

8.0 DETERMINATION OF SIGNIFICANCE

8.1 Methodology for Assigning Significance for Residual Effects

Section 13.1 of the EIS Guidelines (CEAA, 2013) indicates that a determination of significance needs to be completed for the predicted residual effects (including cumulative effects). The EIS Guidelines go on to describe the elements that should be considered when determining environmental significance under CEAA 2012. These include the following:

- Magnitude;
- Geographic extent;
- Timing and duration;
- Frequency;
- Reversibility;
- Ecological and social context; and
- Existence of environmental standards, guidelines or objectives for assessing the impact.

The guidelines indicate that for those where a significant effect is identified, "...the EIS will set out the probability (likelihood) that they will occur". This is consistent with general environmental assessment practice that conservatively assumes that all potential effects, except those related to accidents, will occur (i.e., they have a likelihood of 1).

Each of these individual elements are described in the following sections, while the approach used for combining the effects are described in Section 6.1.

8.1.1 Magnitude

The three general levels of magnitude used in assessing residual effects are:

- Level I – No measurable residual effect.
- Level II – Residual effect is measurable but within range of natural variation
- Level III – Residual effect is outside range of natural variation

Although these levels of magnitude represent reasonable descriptions of the levels of magnitude, they are not specific to a particular component, VC or indicators. In the Round 1 IRs there were multiple questions related to providing specific levels of magnitude by component or VC (e.g., TMI_3-EA(1)-03). To specifically address this IR, and other similar IRs, the following sections describe the levels of magnitude on a component-by-component basis.

8.1.1.1 Terrain and Soils

Section 6.1.3.1 introduced the three VCs used for evaluating the effects of the Project on terrain and soils, namely; natural landscapes, overburden, and soils chemistry. Of these, residual adverse effects were only identified for the natural landscapes VC. Specifically, only the waste rock storage area (WRSA) was considered to represent a residual adverse effects, as this would be the one feature on the site that would be visible from offsite, specifically the WRSA would be visible from Thunder Lake. In assigning levels of magnitude for the residual adverse effects on natural landscapes, considerations was given to the indicators and measures identified in Section 6.1.3.1, and set out in Table 8.1.1.1-1.

Table 8.1.1.1-1: Indicators and Measures for the Natural Landscapes VC

Valued Components (VCs)	Indicators	Measures
Natural Landscapes	Viewscapes	How visible Project features are to offsite observers
		How Project features change the characteristics of viewscapes

The area around the Project is considered to have gently undulating terrain, with elevations ranging between 370 and 430 masl (Appendix M to the EIS). Therefore, tall features, and features with sharply sloping sides could look out of place within the current landscape. For the purposes of assigning levels of magnitude, a feature is considered to be tall if it more than half the variation in the local terrain (i.e., 30 m). A very tall feature would be one that is taller than the variation in the local terrain (i.e., 60 m). The area around the Project is covered with a range of land cover types (see response TMI_145-WL(1)-02), mostly vegetated cover with some small areas of barren rock outcrops. Therefore, features that are vegetated are less likely to appear to stand out from the surrounding areas. Using this information, an approach for assigning the levels of magnitude for natural landscapes was developed, and is provided in Table 8.1.1.1-2.

Table 8.1.1.1-2: Levels of Magnitude for Terrain and Soils

Valued Components (VCs)	Measures	Levels of Magnitude		
		Level I	Level II	Level III
Natural Landscapes	How visible Project features are to offsite observers	The feature altering the viewscape is ≤ 30 m	The feature altering the viewscape 30–60 m high	The feature altering the viewscape is > 60 m high
	How Project features change the characteristics of viewscapes	The feature altering the viewscape has natural slopes and is vegetated	The feature altering the viewscape has natural slopes and is not vegetated, or has unnatural slopes and is vegetated	The feature altering the viewscape has unnatural slopes and is not vegetated

8.1.1.2 Geology and Geochemistry

As described in Section 6.1.3.2, the assessment of geology and geochemistry considered a single VC, pit lake water quality. The following parameters were used as indicators for the pit lake water quality VC:

- Aluminum (Al);
- Antimony (Sb);
- Arsenic (As);
- Beryllium (Be);
- Boron (B);
- Cadmium (Cd);
- Chromium (Cr);
- Cobalt (Co);
- Copper (Cu);
- Iron (Fe);
- Lead (Pb);
- Mercury (Hg);
- Molybdenum (Mo);
- Nickel (Ni);
- Selenium (Se);
- Silver (Ag);
- Thallium (Tl);
- Uranium (U);
- Vanadium (V); and
- Zinc (Zn).

The levels of magnitude for pit lake water quality were determined using regulatory criteria that were developed to provide protections for aquatic life. The specific criteria selected were the Provincial Water Quality Objectives (PWQO) for the protection of aquatic life. These criteria are provided in Table 8.1.1.2-1.

Table 8.1.1.2-1: Assessment Criteria for Pit Water Quality

Indicator	Provincial Water Quality Objectives PWQO (mg/L)
Aluminum	0.075
Antimony	0.020
Arsenic	0.100
Beryllium	0.011
Boron	0.200
Cadmium	0.0002
Chromium	0.0089
Cobalt	0.0009
Copper	0.005
Iron	0.300
Lead	0.020
Mercury	0.0002
Molybdenum	0.040
Nickel	0.025
Selenium	0.100
Silver	0.0001

Table 8.1.1.2-1: Assessment Criteria for Pit Water Quality (continued)

Indicator	Provincial Water Quality Objectives PWQO (mg/L)
Thallium	0.0003
Uranium	0.005
Vanadium	0.006
Zinc	0.030

As a single PWQO criteria is available for each indicator, only two levels of magnitude were assigned. There was no Level II magnitude assigned for pit lake water quality. The general approach for assigning levels of magnitude is provided below:

- Level I: predicted effects were less than or equal to assessment criteria;
- Level II: there was no Level II assigned for the pit water quality VC; and
- Level III: predicted effects were greater than the assessment criteria.

The levels of magnitude for the various pit lake water quality indicators were establishing using the assessment criteria identified in Table 8.1.1.2-2.

Table 8.1.1.2-2: Levels of Magnitude for Pit Lake Water Quality

Valued Component	Indicator	Units	Levels of Magnitude		
			Level I	Level II	Level III
Pit Lake Water Quality	Aluminum	mg/L	PL ≤0.075	NC	PL >0.075
	Antimony	mg/L	PL ≤0.020	NC	PL >0.020
	Arsenic	mg/L	PL ≤0.100	NC	PL >0.100
	Beryllium	mg/L	PL ≤0.011	NC	PL >0.011
	Boron	mg/L	PL ≤0.200	NC	PL >0.200
	Cadmium	mg/L	PL ≤0.002	NC	PL >0.002
	Chromium	mg/L	PL ≤120	NC	PL >120
	Cobalt	mg/L	PL ≤0.0089	NC	PL >0.0089
	Copper	mg/L	PL ≤0.0009	NC	PL >0.0009
	Iron	mg/L	PL ≤0.005	NC	PL >0.005
	Lead	mg/L	PL ≤0.005	NC	PL >0.005
	Mercury	mg/L	PL ≤0.300	NC	PL >0.300
	Molybdenum	mg/L	PL ≤0.020	NC	PL >0.020
	Nickel	mg/L	PL ≤0.0002	NC	PL >0.0002
	Selenium	mg/L	PL ≤0.040	NC	PL >0.040
	Silver	mg/L	PL ≤0.025	NC	PL >0.025
	Thallium	mg/L	PL ≤13	NC	PL >13
	Uranium	mg/L	PL ≤0.030	NC	PL >0.030
Vanadium	mg/L	PL ≤0.100	NC	PL >0.100	
Zinc	mg/L	PL ≤0.0001	NC	PL >0.0001	

Notes:

- (1) In the above table, "PL" represents the pit lake discharge water quality that will discharge to Blackwater Creek
- (2) NC indicates 'no criteria' was assigned to assess magnitude

8.1.1.3 Noise

As described in Section 6.1.3.3, the assessment of noise effects from the Project considers the following four VCs:

- Environmental noise levels;
- Noise disturbance to wildlife (including SAR);
- Blasting noise levels; and
- Noise related health effects.

To the extent possible, the levels of magnitude for Project noise effects were determined with consideration for established regulatory criteria when possible. The general approach for assigning levels of magnitude were as follows:

- Level I: predicted noise effects were at, or below, background;
- Level II: predicted noise effects exceed background but less than established criteria; and
- Level III: predicted noise effects exceed established criteria.

For the environmental noise VC, the criteria selected were those provided by the Ministry of Environment and Climate Change “Stationary Source” guidelines set out in MOE Publication NPC-300 (Ontario MOE, 2013) for Class 3 areas (rural or recreational). These guidelines state that one-hour sound exposures (A-Weighted hourly L_{EQ} values) from stationary noise shall not exceed that of the background, where the background is defined as the sound level present in the environment produced by noise sources other than those associated with the Project under assessment. The MOE Publication NPC-300 sound level limits at the façade (or plane of window) are outlined as follows:

- The higher of 45 dBA or background noise, during the daytime hours (0700 to 1900h);
- The higher of 40 dBA or background noise, during the evening hours (1900 to 2300h); and
- The higher of 40 dBA or background noise, during the night-time hours (2300 to 0700h).

The MOE Publication NPC-300 sound level limits at an outdoor point of reception (POR) are applicable during the daytime and evening hours only. These limits are summarized as follows:

- The higher of 45 dBA or background sound, during the daytime hours (0700 to 1900h); and
- The higher of 40 dBA or background sound, during the evening hours (1900 to 2300h).

For simplicity, the most stringent of these criteria (i.e., 40 dBA) were selected for use in assigning magnitude for this VC.

High levels of environmental noise can also affect wildlife, including species at risk (SAR), causing changes in behaviour or avoidance of affected areas, for at least temporary periods of time. For the “noise effects to wildlife” VC, it was necessary to turn to literature to identify suitable criteria for use in the noise assessment. The assessment of effects of the Project on the “noise effects to wildlife” VC focused on determining whether the predicted noise levels were above the identified criteria or not. For understanding how the predicted noise effects to affect wildlife the reader is referred to the information presented in the wildlife and wildlife habitat components in Section 6.12.

One criteria that was considered was the value suggested in the Round 1 information requests, specifically TMI_192-AE(1)-30. The question indicates that Environment Canada’s ‘Incidental Take of Migratory Birds in Canada’ website identifies that migratory birds are typically disturbed by sound levels exceeding 50 dBA. Such disturbance could contribute to adverse effects on migratory birds and SAR. However, this is not the only literature relevant to the subject, with recent projects evaluated by CEAA have also considered the subject.

The recent Rainy River Project EIS (newgold, 2013) described the types of effects noise could have on wildlife, particularly birds. The most common effect they identified was masking of important communication signals. The EIS went on to indicate that “...sound masking has been shown to occur at sound emissions levels of 50 to 60 dBA (Dooling and Popper 2007)”. A threshold of 50 dBA was used to determining areas that could potentially represent reductions in habitat suitability.

An extensive literature search was also made as part of the recent regulatory process for the Deep Geologic Repository (DGR) project. The findings (OPG, 2013) identified 27 separate publicly available studies and reports dealing with issues related to noise effects on livestock and wildlife, but found that “...species-specific information on the response to increases in background noise for SAR in Ontario was not readily available.” The findings (OPG, 2013) went on to indicate that “the literature review relied on information regarding species that can be considered comparable to the SAR of interest”. Some other findings include the following:

- Exposure to constant noise has been documented to lead to habituation even if the levels are high (54 dB);
- Birds adapt to relatively noisy environments by changing their vocalization (Brumm 2004);
- Birds can acclimatize to relatively high background noise (54 dB) (GOLDER 2012);
- Birds are often more disturbed by sporadic activities than continuous noise (GOLDER 2012);
- American bullfrog have been documented to modify their call structure by altering the call frequency level and increasing call bandwidth (Wilson 2012); and

- Literature suggest species respond to increased noise through avoidance or habituation.

Based on the above, the criteria selected for evaluating the “noise effects on wildlife” VC was 50 dBA, which is consistent with the value recommended in the Round 1 IRs (AE-(1)-30), and the value used in the Rainy River Project EIS (newgold, 2013). However, the effects of noise on wildlife often relate to displacement. To capture potential displacement, the predicted effects of the Project to the noise effects on wildlife VC, are described using the areal extent with predicted noise levels in excess of the 50 dBA threshold.

In evaluating the effects on the “blasting noise” VC, criteria established by the MOECC were available for use. Guidance for noise from blasting is taken mainly from two publications, NPC-119 (MOE, 1978) and Guidelines on Information Required for the Assessment of Blasting Noise and Vibration (MOE, 1985).

Blasting noise is assessed using the peak sound pressure level measured in linear (un-weighted) decibels (dB). The MOECC publication NPC-119 introduces two limits, the cautionary limit, and the peek pressure level limit. The cautionary limit is 120 dB and can be applied in cases where there is no monitoring of sound levels from blasting. The peek pressure limit is 128 dB, and can only be used when sound level monitoring is conducted during blasting. The cautionary limit of 120 dB is used in defining magnitude of the peak sound pressure level indicator.

Blasting vibration is assessed using the peak particle velocity indicator, measured in cm/s. The MOECC publication NPC-119 limits vibration from blasting to 1.00 cm/s at a sensitive receptor location. This value was used for determining levels of magnitude for the peak particle velocity indicator.

In identifying appropriate criteria for evaluating the “noise related health effects” VC, guidance was taken from Health Canada publications.

The framework for assigning levels of magnitude for noise are set out in Table 8.1.1.3-1.

Table 8.1.1.3-1: Levels of Magnitude for Noise

Valued Components (VCs)	Indicators	Measures	Levels of Magnitude		
			Level I	Level II	Level III
Environmental noise levels	Equivalent noise, L_{EQ}	dBA	$L_{EQ} < \text{background}$	$\text{background} < L_{EQ} \leq 45$	$L_{EQ} > 45$
Noise disturbance to wildlife (including SAR)	Equivalent noise, L_{EQ}	dBA	$L_{EQ} < \text{background}$	$\text{background} < L_{EQ} \leq 50$	$L_{EQ} > 50$
Blasting noise levels	Peak sound pressure, PSP	dB	$PSP = 0$	$0 < PSP \leq 120$	$PSP > 120$
	Peak particle velocity, PPV	cm/s	$PPV = 0$	$0 < PPV \leq 1$	$PPV > 1$
Noise related health effects	Absolute sound pressure, L_{DN}	dBA	$L_{DN} < \text{background}$	$\text{background} < L_{DN} \leq 75$	$L_{DN} > 75$
	Change in percent highly annoyed	Δ in %HA	No change	$0\% < \Delta \leq 6.5\%$	$\Delta > 6.5\%$

8.1.1.4 Light

As described in Section 6.1.3.4, the effects of the Project on light were evaluated using a single VC, light trespass. The prediction of the effects of the Project on light trespass were detailed in Section 6.5 where it was demonstrated that there would be no adverse effect of the Project on light. As there were no predicted adverse effects, there will be no residual adverse effects or cumulative effects to carry forward for consideration of significance, and no need to establish a framework for assigning magnitude.

8.1.1.5 Air Quality

As described in Section 6.1.3.5, the assessment of air quality effects from the Project considers the following single VC:

- Air quality.

To the extent possible, the levels of magnitude for Project air quality effects were determined with consideration for established regulatory criteria. The general approach for assigning levels of magnitude were as follows:

- Level I: predicted air quality effects were indistinguishable from background;
- Level II: predicted air quality effects were above background values, but less than or equal to the assessment criteria; and
- Level III: predicted air quality effects exceed the assessment criteria.

Section 4 of the Environmental Air Quality Assessment (RWDI, 2014e) identifies that the following regulatory criteria were considered when identifying the assessment criteria used when assigning the levels of magnitude for air quality:

- Canadian Ambient Air Quality Standards (CAAQS);
- National Ambient Air Quality Objectives (NAAQO); and
- Ontario Ambient Air Quality Criteria (AAQC).

In selecting the assessment criteria used for assigning the levels of magnitude for air quality, the most stringent of the available regulatory criteria were chosen (Section 4.4 of Appendix J-2). The available criteria are listed in Table 8.1.1.5-1, with the relevant criteria selected as the assessment criteria highlighted in the table. These include the following:

- **AAQC:** TSP (24-hour, annual), PM₁₀ (24-hour), dustfall (30-day, annual), NO₂ (1-hour, 24-hour), airborne metals (24-hour)
- **CAAQS:** PM_{2.5} (24-hour, annual); and

- **NAAQS:** SO₂ (1-hour, 24-hour, annual) CO (1-hour, 8-hour), TSP (24-hour, annual), NO₂ (1-hour, 24-hour).

Table 8.1.1.5-1: Criteria Considered in Evaluating Effects for Air Quality

Compound	Averaging Period	Federal Ambient Air Quality Objectives			Canadian Ambient Air Quality Standards	Ontario Ambient Air Quality Objectives	Assessment Criteria
		Desirable	Acceptable	Tolerable			
TSP	24-hour	—	120	400	—	120	120
	Annual	60	70	—	—	60	60
PM ₁₀	24-hour	—	—	—	—	50	50
PM _{2.5}	24-hour	—	—	—	28, 27 ⁽¹⁾	—	27
	Annual	—	—	—	10, 8.8 ⁽¹⁾	—	8.8
Dustfall ⁽²⁾	30 day	—	—	—	—	7	7
	Annual	—	—	—	—	4.6	4.6
CO	1-hour	15,000	35,000	—	—	36,200	15,000
	8-hour ⁽⁴⁾	6,000	15,000	20,000	—	15,700	6,000
NO ₂	1-hour	—	400	1000	—	400	400
	24-hour	—	200	300	—	200	200
SO ₂	1-hour	450	900	—	—	690	450
	24-hour	150	300	800	—	275	150
	Annual	30	60	—	—	55	30
Arsenic	24-hour	—	—	—	—	0.3	0.3
Barium	24-hour	—	—	—	—	10	10
Beryllium	24-hour	—	—	—	—	0.1	0.1
Cadmium	24-hour	—	—	—	—	0.025	0.025
Chromium	24-hour	—	—	—	—	0.1	0.1
Cobalt	24-hour	—	—	—	—	0.5	0.5
Lead	24-hour	—	—	—	—	0.5	0.5
Manganese	24-hour	—	—	—	—	0.4	0.4
Nickel	24-hour	—	—	—	—	0.2	0.2
	Annual	—	—	—	—	0.04	0.04
Phosphorous	24-hour	—	—	—	—	0.35 ⁽²⁾	0.35
Platinum	24-hour	—	—	—	—	0.03	0.03
Rhodium	24-hour	—	—	—	—	2	2
Thallium	24-hour	—	—	—	—	0.4 ⁽²⁾	0.4
Titanium	24-hour	—	—	—	—	0.2	0.2
Uranium	24-hour	—	—	—	—	0.3	0.3
	Annual	—	—	—	—	0.06	0.06
Vanadium	24-hour	—	—	—	—	0.24	0.24

Notes:

- (1) The Canadian Ambient Air Quality Standards for PM_{2.5} will be reduced to 27 (24-hour) and 8.8 (annual) after 2020. For the purposes of assessing air quality effects, the more stringent levels were used as the assessment criteria.
- (2) These values correspond with the Jurisdictional Screening Level (JSL) values.

The levels of magnitude for the various air quality indicators were established using the assessment criteria identified in Table 8.1.1.5-1. Table 8.1.1.5-2 sets out these levels of magnitude for each of the air quality indicators and averaging periods. These were applied to the maximum predictions at the sensitive receptor locations (Section 6.6), which correspond to the

“community-oriented locations” identified by CCME (2000) as the location where ambient air regulations should be applied.

Table 8.1.1.5-2: Levels of Magnitude for Air Quality

Valued Component	Indicator (averaging period)	Measure	Levels of Magnitude		
			Level I	Level II	Level III
Air Quality	TSP (24-hour)	µg/m ³	P ⁽¹⁾ ≤ 33	33 < P ≤ 120	120 < P
	TSP (annual)	µg/m ³	P ≤ 14	14 < P ≤ 60	60 < P
	PM ₁₀ (24-hour)	µg/m ³	P ≤ 15	15 < P ≤ 50	50 < P
	PM _{2.5} (24-hour)	µg/m ³	P ≤ 10	10 < P ≤ 27	27 < P
	PM _{2.5} (annual)	µg/m ³	P ≤ 4.3	4.3 < P ≤ 8.8	8.8 < P
	Dustfall (30 day)	g/m ² /30-day ⁽²⁾	P = 0 ⁽³⁾	0 < P ≤ 7.0	7.0 < P
	Dustfall (annual)	g/m ² /30-day ⁽²⁾	P = 0	0 < P ≤ 4.6	4.6 < P
	CO (1-hour)	µg/m ³	P ≤ 1,248.0	1,248 < P ≤ 15,000	15,000 < P
	CO (8-hour)	µg/m ³	P ≤ 1,248.0	1,248 < P ≤ 6,000	6,000 < P
	NO ₂ (1-hour)	µg/m ³	P ≤ 33	33 < P ≤ 400	400 < P
	NO ₂ (24-hour)	µg/m ³	P ≤ 33	33 < P ≤ 200	200 < P
	SO ₂ (1-hour)	µg/m ³	P ≤ 4	4 < P ≤ 450	450 < P
	SO ₂ (24-hour)	µg/m ³	P ≤ 4	4 < P ≤ 150	150 < P
	SO ₂ (annual)	µg/m ³	P ≤ 1	1 < P ≤ 30	30 < P
	Arsenic (24-hour)	µg/m ³	P ≤ 0.005	0.005 < P ≤ 0.300	0.300 < P
	Barium (24-hour)	µg/m ³	P = 0	0 < P ≤ 10	10 < P
	Beryllium (24-hour)	µg/m ³	P = 0	0 < P ≤ 0.100	0.100 < P
	Cadmium (24-hour)	µg/m ³	P = 0	0 < P ≤ 0.025	0.025 < P
	Chromium (24-hour)	µg/m ³	P = 0	0 < P ≤ 0.100	0.100 < P
	Cobalt (24-hour)	µg/m ³	P = 0	0 < P ≤ 0.500	0.500 < P
	Lead (24-hour)	µg/m ³	P ≤ 0.005	0.005 < P ≤ 0.500	0.500 < P
	Manganese (24-hour)	µg/m ³	P ≤ 0.019	0.019 < P ≤ 0.400	0.400 < P
	Nickel (24-hour)	µg/m ³	P = 0	0 < P ≤ 0.2	0.2 < P
	Nickel (annual)	µg/m ³	P = 0	0 < P ≤ 0.04	0.04 < P
	Phosphorous (24-hour)	µg/m ³	P = 0	0 < P ≤ 0.350	0.350 < P
	Platinum (24-hour)	µg/m ³	P = 0	0 < P ≤ 0.030	0.030 < P
	Rhodium (24-hour)	µg/m ³	P = 0	0 < P ≤ 2	2.000 < P
	Thallium (24-hour)	µg/m ³	P = 0	0 < P ≤ 0.400	0.400 < P
	Titanium (24-hour)	µg/m ³	P = 0	0 < P ≤ 0.200	0.200 < P
	Uranium (24-hour)	µg/m ³	P = 0	0 < P ≤ 0.3	0.3 < P
Uranium (annual)	µg/m ³	P = 0	0 < P ≤ 0.06	0.06 < P	
Vanadium (24-hour)	µg/m ³	P = 0	0 < P ≤ 0.240	0.240 < P	

Notes:

- (1) In the above table, “P” represents the maximum cumulative prediction at the sensitive receptor locations.
- (2) The measure for both dustfall (30-day) and dustfall (annual) is g/m²/30 days. In the case of dustfall (annual) the values are averaged over the period of 1 year.
- (3) Where no background value was available, a value of zero (0) was assumed.

8.1.1.6 Climate

Section 6.1.3.5 describes the two VCs used for evaluating the effects of the Project on climate, namely; Project GHG emissions, and changes in climate due to the Project. Residual adverse effects were identified for the Project GHG emissions VC in Section 6.7.7. There were no residual adverse effects for the changes in climate due to the Project VC. In defining the levels of magnitude for the Project GHG emissions, consideration was given to the established regulatory frameworks for managing GHG emissions. Under Section 46 of the Canadian Environmental Protection Act, facilities are required to report their GHG emissions federally if the total emissions of equivalent carbon dioxide (eCO₂) exceed 10,000 tonnes per year (t/y). In Ontario, under the Ontario Cap and Trade Program (O.Reg. 144/16), facilities that emit more than 10,000 t/y of eCO₂ from stationary sources are required to report. Table 8.1.1.6-1 lists the approach for assigning levels of magnitude for Project GHG emissions, which combines the Federal and Provincial requirements for reporting GHG emissions.

Table 8.1.1.6-1: Levels of Magnitude for Climate

Valued Components (VCs)	Levels of Magnitude		
	Level I	Level II	Level III
Project GHG emissions	Total GHG emissions ≤ 10,000 t/y eCO ₂	Total GHG emissions > 10,000 t/y eCO ₂ and Stationary GHG emissions ≤ 10,000 t/y eCO ₂	Stationary GHG emissions > 10,000 t/y eCO ₂

8.1.1.7 Surface Water Quality

As described in Section 6.1.3.7, the assessment of surface water quality effects from the Project considers surface water quality as the single VC. The following parameters were used as indicators for the surface water quality VC:

- Aluminum (Al);
- Antimony (Sb);
- Arsenic (As);
- Beryllium (Be);
- Boron (B);
- Cadmium (Cd);
- Chloride (Cl);
- Chromium (Cr);
- Cobalt (Co);
- Copper (Cu);
- Cyanide (CN);
- Iron (Fe);
- Lead (Pb);
- Mercury (Hg);
- Molybdenum (Mo);
- Nickel (Ni);

- Nitrate (NO₃);
- Phosphorus (P);
- Selenium (Se);
- Silver (Ag);
- Thallium (Tl);
- Uranium (U);
- Vanadium (V); and
- Zinc (Zn).

The levels of magnitude for surface water quality effects of the Project were determined with consideration for established regulatory criteria for the protection of aquatic life. The selection of assessment criteria Provincial Water Quality Objectives (PWQO) for the protection of aquatic life. In the case of indicators where no PWQO were available (i.e., chloride and nitrate), the Canadian Water Quality Guidelines (CWQG) were used as the assessment criteria.

The assessment criteria for evaluating effects on surface water quality are provided in Table 8.1.1.7-1.

Table 8.1.1.7-1: Criteria Considered in Evaluating Effects for Surface Water Quality

Indicator	PWQO (mg/L)	CWQG (mg/L)	Assessment Criteria (mg/L)
Aluminum	0.075	—	0.075
Antimony	0.020	—	0.020
Arsenic	0.100	—	0.100
Beryllium	0.011	—	0.011
Boron	0.200	—	0.200
Cadmium	0.0002	—	0.0002
Chloride ⁽¹⁾	—	120	120
Chromium	0.0089	—	0.0089
Cobalt	0.0009	—	0.0009
Copper	0.005	—	0.005
Cyanide	0.005	—	0.005
Iron	0.300	—	0.300
Lead	0.020	—	0.020
Mercury	0.0002	—	0.0002
Molybdenum	0.040	—	0.040
Nickel	0.025	—	0.025
Nitrate ⁽¹⁾	—	13	13
Phosphorus	0.030	—	0.030
Selenium	0.100	—	0.100
Silver	0.0001	—	0.0001
Thallium	0.0003	—	0.0003
Uranium	0.005	—	0.005
Vanadium	0.006	—	0.006
Zinc	0.030	—	0.030

Notes: ⁽¹⁾ No PWQO criteria for chloride and nitrate. These parameters were evaluated against CWQG

As a single criteria is available for each parameter, only two levels of magnitude were assigned. There were no Level II magnitudes used for surface water quality. The general approach for assigning levels of magnitude were as follows:

- Level I: predicted effects were greater than existing conditions but less than relevant criteria;
- Level II: there was no Level II assigned for the surface water quality VC; and
- Level III: predicted effects were greater than the relevant criteria.

The levels of magnitude for the various surface water quality indicators were established using the assessment criteria identified in Table 8.1.1.7-2.

Table 8.1.1.7-2: Levels of Magnitude for Surface Water Quality

Valued Component	Indicator	Units	Levels of Magnitude		
			Level I	Level II	Level III
Surface water quality	Aluminum	mg/L	$E < P \leq 0.075$	NC	$P > 0.075$
	Antimony	mg/L	$E < P \leq 0.020$	NC	$P > 0.020$
	Arsenic	mg/L	$E < P \leq 0.100$	NC	$P > 0.100$
	Beryllium	mg/L	$E < P \leq 0.011$	NC	$P > 0.011$
	Boron	mg/L	$E < P \leq 0.200$	NC	$P > 0.200$
	Cadmium	mg/L	$E < P \leq 0.002$	NC	$P > 0.002$
	Chloride	mg/L	$E < P \leq 120$	NC	$P > 120$
	Chromium	mg/L	$E < P \leq 0.0089$	NC	$P > 0.0089$
	Cobalt	mg/L	$E < P \leq 0.0009$	NC	$P > 0.0009$
	Copper	mg/L	$E < P \leq 0.005$	NC	$P > 0.005$
	Cyanide	mg/L	$E < P \leq 0.005$	NC	$P > 0.005$
	Iron	mg/L	$E < P \leq 0.300$	NC	$P > 0.300$
	Lead	mg/L	$E < P \leq 0.020$	NC	$P > 0.020$
	Mercury	mg/L	$E < P \leq 0.0002$	NC	$P > 0.0002$
	Molybdenum	mg/L	$E < P \leq 0.040$	NC	$P > 0.040$
	Nickel	mg/L	$E < P \leq 0.025$	NC	$P > 0.025$
	Nitrate	mg/L	$E < P \leq 13$	NC	$P > 13$
	Phosphorus	mg/L	$E < P \leq 0.30$	NC	$P > 0.30$
	Selenium	mg/L	$E < P \leq 0.100$	NC	$P > 0.100$
	Silver	mg/L	$E < P \leq 0.0001$	NC	$P > 0.0001$
Thallium	mg/L	$E < P \leq 0.0003$	NC	$P > 0.0003$	
Uranium	mg/L	$E < P \leq 0.005$	NC	$P > 0.005$	
Vanadium	mg/L	$E < P \leq 0.006$	NC	$P > 0.006$	
Zinc	mg/L	$E < P \leq 0.030$	NC	$P > 0.030$	

Notes:

- (1) In the above table, "P" represents the surface water quality prediction at a location (i.e., node) modelled in the receiving environment
- (2) E indicates existing surface water quality in the receiving environment
- (3) NC indicates 'no criteria' was assigned to assess magnitude

8.1.1.8 Surface Water Quantity

Residual adverse effects of the Project on surface water quantity were predicted for two of the three indicators used for evaluating the effects of the Project (Section 6.1.3.8), specifically increase in surface water flows and decrease in surface water flows. No residual adverse effects were predicted for the change in lake levels indicator. Table 8.1.1.8-1 lists the approach for assigning levels of magnitude for the VC surface water quantity.

Table 8.1.1.8-1: Levels of Magnitude for Surface Water Quantity

Valued Components (VCs)	Indicator	Levels of Magnitude		
		Level I	Level II	Level III
Surface water quantity	Increase in surface water flows	≤15% change in annual flows	> 15% and ≤ 30% change in annual flows	>30% change in annual flows
	Decrease in surface water flows	≤15% change in monthly flows	> 15% and ≤ 30% change in monthly flows	>30% change in monthly flows

The levels of magnitude for evaluating surface water quantity effects of the Project were determined with consideration for the hydrology of the Project and did not consider the effects of aquatic habitat, which would be captured as part of the assessment of effects on fish and fish habitat.

8.1.1.9 Groundwater Quality

As described in Section 6.1.3.9, a single VC, groundwater quality, was used for evaluating the effects on groundwater quality. As described in Section 6.10.6, there were no residual adverse effects predicted for groundwater quality, when all of the mitigation measures associated with the Project are considered. As there were no predicted residual adverse effects to carry forward for consideration of significance, and no need to establish a framework for assigning magnitude.

8.1.1.10 Groundwater Quantity

As described in Section 6.1.3.10, the potential effects of the Project on the groundwater quantity VC considered a single indicator, namely; decreasing elevations in private water wells. As described in Section 6.11.6, there were no residual adverse effects for groundwater quantity once the planned mitigation is considered. The potential effects predicted for private water wells can be fully mitigated by deepening those wells, where appropriate. Treasury Metals would provide financial assurances as required and applicable under the regular permitting processes to ensure maintenance and provision of neighboring residential wells.

Although not identified as an indicator for groundwater quantity, there is the potential that the dewatering activities associated with the Project could have an effect on the surface water flows

in the vicinity of the Project. Changes in groundwater discharge to surface waterbodies was predicted as part of the description of the effect of the Project on groundwater quantity (Section 6.11), and the predicted changes in groundwater discharge incorporated in the description of the effects of the Project on surface water quantities (Section 6.9).

8.1.1.11 Wildlife and Wildlife Habitat

As described in Section 6.1.3.11, the effects of the Project on wildlife and wildlife habitat were described using eight valued components (VCs), namely; Wildlife Species at Risk, Ungulates, Furbearers, Upland Birds, Wetland Birds, Small Mammals, Reptiles and Amphibians, and Invertebrates. In order to assign a level of magnitude to the residual adverse wildlife and wildlife habitat effects, the total area of the habitat removed or altered/disrupted was compared to the amount of habitat available throughout the wildlife LSA. A comparison to the RSA was not conducted for most species, as the percentages of habitat lost or altered/disrupted would be negligible at that scale. The one exception to this was the ungulate VC. Moose utilize habitat at a landscape scale, as opposed to the other species used as indicators, who utilize habitat at the stand level or smaller. Therefore, affected moose habitat was compared to moose habitat in the RSA. A loss of 10% was classified as a Level I because the boreal forest is constantly undergoing changes due to succession, wildfire and other natural disturbances. Therefore, a change in habitat of 10% at the LSA scale would be well within the natural range of variation. Greater than 25% loss of habitat was ranked as Level III because habitat loss of that magnitude at the LSA scale would be outside the natural range of variation and could have serious implications for species at that scale. A loss of habitat between these two levels was classified as Level II, as it would be approaching the upper end of the natural range of variation in habitat availability. The levels of magnitude are set out in Table 8.1.1.11-1.

Table 8.1.1.11-1: Levels of Magnitude for Wildlife and Wildlife Habitat

Valued Components (VCs)	Indicators	Levels of Magnitude (as a % of the potential habitat)		
		Level I	Level II	Level III
Wildlife Species at Risk	Common Nighthawk	<10% in LSA	10% to 25% in LSA	>25% in LSA
	Northern Myotis/Little Brown Myotis	<10% in LSA	10% to 25% in LSA	>25% in LSA
	Barn Swallow	<10% in LSA	10% to 25% in LSA	>25% in LSA
Ungulates	Moose	<10% in RSA	10% to 25% in RSA	>25% in RSA
Furbearers	American Marten	<10% in LSA	10% to 25% in LSA	>25% in LSA
	American Beaver	<10% in LSA	10% to 25% in LSA	>25% in LSA
Upland Birds	Upland Birds	<10% in LSA	10% to 25% in LSA	>25% in LSA
Wetland Birds	Marsh Birds	<10% in LSA	10% to 25% in LSA	>25% in LSA
Small Mammals	Small Mammals	<10% in LSA	10% to 25% in LSA	>25% in LSA
Reptiles and Amphibians	Reptiles and amphibians	<10% in LSA	10% to 25% in LSA	>25% in LSA
Invertebrates	Invertebrates	<10% in LSA	10% to 25% in LSA	>25% in LSA

Table 8.1.1.11-2 provides a summary of the existing habitat within the relevant study areas for each of the VCs and indicators in the above table.

Table 8.1.1.11-2: Existing Habitat Areas for Wildlife and Wildlife Habitat VCs and Indicators

Valued Components (VCs)	Indicators	Existing Potential Habitat (ha)	
		LSA	RSA
Wildlife Species at Risk	Common Nighthawk ⁽¹⁾	874	48,724
	Northern Myotis/Little Brown Myotis	852	81,174
	Barn Swallow ⁽²⁾	111 structures	7,326 structures
Ungulates	Moose	220	22,632
Furbearers	American Marten ⁽³⁾	1,297	30,552
	American Beaver	1,439	41,603
Upland Birds	Upland Birds	448	34,710
Wetland Birds	Marsh Birds ⁽³⁾	1,439	41,603
Small Mammals	Small Mammals	4,401	226,164
Reptiles and Amphibians	Reptiles and amphibians	3,538	216,568
Invertebrates	Invertebrates	4,401	226,164

Notes:

- (1) The Common Nighthawk habitat was calculated on the basis of non-wetland, treeless habitat.
- (2) The potential Barn Swallow habitat was calculated on the basis of the number of available structures.
- (3) The habitat for American Beaver and marsh birds was calculated as the total wetland areas.

8.1.1.12 Migratory Birds

As described in Section 6.1.3.12, the effects of the Project on migratory birds were described using two valued components (VCs), namely Upland Birds and Wetland Birds. In order to assign a level of magnitude to the residual adverse migratory bird effects, the total area of the habitat removed or altered/disrupted was compared to the amount of habitat available throughout the wildlife LSA. A comparison to the RSA was not conducted, as the percentages of habitat lost or altered/disrupted would be negligible at that scale. A loss of 10% was classified as a Level I because the boreal forest is constantly undergoing changes due to succession, wildfire and other natural disturbances. Therefore, a change in habitat of 10% at the LSA scale would be well within the natural range of variation. Greater than 25% loss of habitat was ranked as Level III because habitat loss of that magnitude at the LSA scale would be outside the natural range of variation and could have serious implications for species at that scale. A loss of habitat between these two levels was classified as Level II, as it would be approaching the upper end of the natural range of variation in habitat availability. The levels of magnitude are set out in Table 8.1.1.12-1.

Table 8.1.1.12-1: Levels of Magnitude for Migratory Birds

Valued Components (VCs)	Indicators	Levels of Magnitude (as a % of the potential habitat)		
		Level I	Level II	Level III
Upland Birds	Upland Birds	<10% in LSA	10% to 25% in LSA	>25% in LSA
Wetland Birds	Marsh Birds	<10% in LSA	10% to 25% in LSA	>25% in LSA

Table 8.1.1.12-2 provides a summary of the existing habitat within the relevant study areas for both of the VCs and indicators in the above table.

Table 8.1.1.11-2: Existing Habitat Areas for Wildlife and Wildlife Habitat VCs and Indicators

Valued Components (VCs)	Indicators	Existing Potential Habitat (ha)	
		LSA	RSA
Upland Birds	Upland Birds	448	34,710
Wetland Birds	Marsh Birds ⁽¹⁾	1,439	41,603

Note:

(1) The habitat for marsh birds was calculate as the total wetland areas.

8.1.1.13 Fish and Fish Habitat

As described in Section 6.1.3.13, the assessment of the effects of the Project on fish and fish habitat considers the following four VCs:

- Stream-resident fish populations;
- Migratory fish populations;
- Lake-resident fish populations; and
- Fish species-at-risk.

Given the effects avoidance measures incorporated into the Project, no adverse effects were predicted for the lake-resident fish populations (see Section 6.14.5). Additionally, there are no at-risk fish species present in the RSA so there will be no adverse effects on them. Predicted adverse effects due to changes in flows were predicted for the stream-resident fish populations and the migratory fish populations. Adverse effects to stream-based fish were also predicted due to the loss of habitat due to the overprinting of portions of Blackwater Creek Tributary 1 due to open pit development, and the portions of Blackwater Creek Tributary 2 overprinted by TSF development. These losses of habitat will not affect the migratory fish populations, as these fish were not found to use the overprinted sections of stream. The losses of habitat and alteration of habitat for stream-resident and migratory fish will be mitigated by offsetting that will be required under the *Fisheries Act*. Therefore, as indicated in Table 6.14.6-1 the only residual effect on fish

and fish habitat is mortality of stream-resident fish. The principle applied to determine the levels for mortality relate to the ability of populations to recover to in a reasonable period of time (i.e., 10 years) to previous levels and thus vary among species.

The stream-resident fish communities in the watercourses where mortality will occur are primarily short-lived, small-bodied species such as Northern Redbelly Dace, Finescale Dace, Brook Stickleback and Pearl Dace. Significant portions of these populations die each year of natural causes that include age and predation. These species mature at an early age and most can produce multiple broods of offspring in a year, traits that allow their populations to rapidly increase in numbers after significant mortality or when new habitat becomes available (for example when a beaver dam is built). For the stream-resident fish populations in Blackwater Creek Tributary 1 and Tributary 2, where fish mortality will occur, the levels of magnitude for mortality stream-resident fish were as follows.

- Level I: mortality rate of stream-resident fish is 90% or less;
- Level II: mortality rate of stream-resident fish is more than 90% and less than 100%; and
- Level III: the mortality rate of stream-resident fish is 100%.

For migratory fishes such as White Sucker the levels for fish mortality would be lower. Migratory White Sucker mature at 3 to 4 years of age and can have a maximum age of over 30 years (C. Portt, personal observation). Consequently, the levels of migratory fish are lower than for the stream-resident species. For migratory fish populations the levels of magnitude for mortality were as follows.

- Level I: mortality rates of migratory fish is 10% or less;
- Level II: mortality rate of migratory fish is more than 10% and less than 25%; and
- Level III: the mortality rate of migratory fish is 25% or greater.

Many lake-resident fishes are similar to migratory White Sucker in terms of age at maturity and life-span. Therefore, for lake-resident fish populations the levels of magnitude for mortality were the same as for migratory fish populations.

For species-at-risk, the levels for mortality may be quite low, depending on the species life-history and whether or not mortality is contributing to the at-risk status. For those species, the levels would often be assessed using a population model. As there are no fish species-at-risk affected by the Project no levels are provided.

8.1.1.14 Wetlands and Vegetation

As described in Section 6.1.3.14, wetlands and vegetation were evaluated using the VCs, indicators and measures listed in Table 8.1.1.4-1.

Table 8.1.1.4-1: Wetlands and Vegetation VCs, Indicators and Measures

Valued Components (VCs)	Indicators	Measures
Wetlands	Wetland extent	Change in area (ha)
	Wild rice	Loss of identified habitat (ha)
		Changes in water level (m)
		Changes in water quality
Floating Marsh Marigold (<i>Caltha natans</i>)	Change in potential habitat (ha)	
Vegetation communities	Predominantly coniferous forest	Change in area (ha)
	Predominantly coniferous forest	Change in area (ha)
	Successional areas	Change in area (ha)
	Potential berry harvesting areas	Change in area (ha)

As detailed in Section 6.15.6, the only residual adverse effects predicted for the wetlands VC were those related to the extent of wetland lost through overprinting or draining during the site preparation and construction phase, in addition to wetlands potentially drained during operations as a result of changes to groundwater levels caused by the dewatering activities. No adverse effects were predicted for the “Wild Rice” or “Floating Marsh Marigold” indicators.

In order to assign a level of magnitude to the residual effects on the “wetland extent” indicator, the total area of wetlands removed or degraded was compared to the amount of wetlands available throughout the LSA. A comparison to the RSA was not conducted for this indicator as the amount of habitat lost or degraded would be negligible at a regional scale. A loss of 1.0% was classified as a Level I as wetlands within the boreal forest tend to undergo alterations only over very long time periods (100’s to 1000’s of years). Therefore, a change in wetlands of 1.0 % at the LSA scale would be within the natural range of variation. Greater than 3.0% loss of wetlands was ranked as Level III because habitat loss of that magnitude at the LSA scale would be outside the natural range of variation, even over long time periods and could have serious implications for the ecosystem. A loss of wetlands between these two levels was classified as Level II, as it would be approaching the upper end of the natural range of variation. The levels of magnitude for the vegetation community are set out in Table 8.1.1.14-2.

Table 8.1.1.14-2: Levels of Magnitude for Wetlands and Vegetation

Valued Components (VCs)	Indicators	Levels of Magnitude (as a % of the potential habitat)		
		Level I	Level II	Level III
Wetlands	Wetland extent	<1% in LSA	1% to 3% in LSA	>3% in LSA
Vegetation communities	Predominantly coniferous forest	<10% in LSA	10% to 25% in LSA	>25% in LSA
	Predominantly deciduous forest	<10% in LSA	10% to 25% in LSA	>25% in LSA

Table 8.1.1.14-2: Levels of Magnitude for Wetlands and Vegetation (continued)

Valued Components (VCs)	Indicators	Levels of Magnitude (as a % of the potential habitat)		
		Level I	Level II	Level III
Vegetation communities (continued)	Successional areas	<10% in LSA	10% to 25% in LSA	>25% in LSA
	Potential berry harvesting areas	<10% in LSA	10% to 25% in LSA	>25% in LSA

Table 8.1.1.14-3 provides a summary of the existing habitat within the terrestrial LSA for the wetland and vegetation VCs and indicators for which residual adverse effects were predicted.

Table 8.1.1.11-2: Existing Habitat Areas for Wetland and Vegetation VCs and Indicators

Valued Components (VCs)	Indicators	Existing Potential Habitat (ha)
		LSA
Wetlands	Wetland extent	1,439
Vegetation communities	Predominantly coniferous forest	1,610
	Predominantly deciduous forest	730
	Successional areas	320
	Potential berry harvesting areas	3,003

8.1.1.15 Land Use

Land and resource use valued components that could be affected by the Project include land use plans and policies, aggregate operations, forestry, mineral exploration, fishing, hunting, trapping, cottagers and outfitters, and other recreation users. Section 6.16.6 describes the predicted residual adverse effects were predicted for several of the VCs and indicators used for describing the effects of the Project on land use. These adverse effects (and the associated cumulative effects described in Section 7.5.10) have been summarized in Table 8.1.1.15-1. The table highlights those VCs and indicators for which residual adverse effects were predicted.

Table 8.1.1.15-1: Summary of Residual Adverse Effects for Land Use

Valued Components (VCs)	Indicators	Residual Adverse Effects
Land Use Planning and Policies	Conflict with accepted land uses as stipulated in approved land use plans.	—
	Overlap with protected areas.	—
Aggregate Operations	Change in access to aggregate resources.	—
	Change in demand of aggregate resources extraction.	—
Forestry	Change in access to forestry resources.	—
	Loss of forestry resources.	Yes

Table 8.1.1.15-1: Summary of Residual Adverse Effects for Land Use (continued)

Valued Components (VCs)	Indicators	Residual Adverse Effects
Mineral Exploration	Change in access to mineral claims for exploration and production.	—
Fishing - Recreational and Commercial	Change in access to fisheries resources.	—
	Change in the abundance of fisheries resources.	—
	Change in contaminant levels in fish	—
	Diminished experience of being on the land.	Yes
Hunting	Change in access to wildlife resources.	Yes
	Change in abundance of wildlife resources.	Yes
	Diminished experience of being on the land	Yes
Trapping	Change in access to wildlife resources.	Yes
	Change in abundance of wildlife resources.	Yes
	Diminished experience of being on the land	Yes
Cottagers and Outfitters	Diminished experience of being on the land.	Yes
	Change in access to cottage and/or outfitter areas.	—
	Changes in clientele for outfitters with lodges located near the Project.	Yes
Other Recreational Uses	Change in access for residents and visitors to public lands for non-consumptive purposes	—
	Change in access for residents and visitors to public lands for consumptive purposes.	Yes
	Change in abundance of berries, mushrooms and/or other vegetation used for consumption	Yes
	Diminished experience of being on the land.	Yes

Note:

- (1) The “—” symbol indicates where no residual adverse effects were predicted for the discipline, VC and indicator. This could represent situations where no adverse effects were predicted, or where predicted adverse effects were fully mitigated, as detailed in Section 6.16.

The levels of magnitude used for land use generally rely of the levels of magnitudes established for the physical or biological disciplines. Table 8.1.1.15-2 summarizes the levels of magnitude for the land use VCs, indicators and measures.

8.1.1.16 Social

As described in Section 6.1.3.16, the assessment of potential Project-related social effects considers the following VCs:

- Population demographics;
- Education;

Table 8.1.1.15-2: Levels of Magnitude for Land Use

Valued Components (VCs)	Indicators	Measure or Description	Levels of Magnitude		
			Level I	Level II	Level III
Forestry	Loss of forestry resources ⁽¹⁾	Areas that will not be available following closure	<10% in LSA	10% to 25% in LSA	>25% in LSA
Fishing - Recreational and Commercial	Diminished on the land experience ⁽²⁾	Viewscapes on Thunder Lake	The feature altering the viewscape is ≤ 30 m high and not fully vegetated, or ≤ 60 m high and fully vegetated	The feature altering the viewscape 30–60 m high and not fully vegetated	The feature altering the viewscape is > 60 m high
Hunting	Change in access to wildlife ⁽³⁾	Are where access is no longer available	<10% in LSA	10% to 25% in LSA	>25% in LSA
	Change in abundance of wildlife ⁽⁴⁾	Moose	<10% in LSA	10% to 25% in LSA	>25% in LSA
		American marten	<10% in LSA	10% to 25% in LSA	>25% in LSA
		American beaver	<10% in LSA	10% to 25% in LSA	>25% in LSA
		Upland birds	<10% in LSA	10% to 25% in LSA	>25% in LSA
		Marsh birds	<10% in LSA	10% to 25% in LSA	>25% in LSA
Diminished on the land experience	Area where noise levels are >40 dBA	<10% in LSA	10% to 25% in LSA	>25% in LSA	
Trapping	Change in access to wildlife ⁽³⁾	Are where access is no longer available	<10% in LSA	10% to 25% in LSA	>25% in LSA
	Change in abundance of wildlife	American marten	<10% in LSA	10% to 25% in LSA	>25% in LSA
		American beaver	<10% in LSA	10% to 25% in LSA	>25% in LSA
	Diminished on the land experience	Area where noise levels are >40 dBA	<10% in LSA	10% to 25% in LSA	>25% in LSA
Cottagers and Outfitters	Diminished on the land experience	Area where noise levels are >40 dBA	<10% in LSA	10% to 25% in LSA	>25% in LSA

Table 8.1.1.15-2: Levels of Magnitude for Land Use (continued)

Valued Components (VCs)	Indicators	Measure or Description	Levels of Magnitude		
			Level I	Level II	Level III
	Changes in clientele for outfitters with lodges located near the Project.	Change in demand for accommodations at local outfitters	effects that are within the normal range of variability	effects can be managed with existing resources	Effects cannot be managed with existing resources
Other Recreational Uses	Change in access to public lands for consumptive purposes ⁽⁵⁾	Are where access is no longer available	<10% in LSA	10% to 25% in LSA	>25% in LSA
	Change in abundance of berries, mushrooms and/or other vegetation used for consumption ⁽⁶⁾	Wetland extent	<1% in LSA	1% to 3% in LSA	>3% in LSA
		Predominantly coniferous forest	<10% in LSA	10% to 25% in LSA	>25% in LSA
		Predominantly deciduous forest	<10% in LSA	10% to 25% in LSA	>25% in LSA
		Successional areas	<10% in LSA	10% to 25% in LSA	>25% in LSA
		Potential berry harvesting areas	<10% in LSA	10% to 25% in LSA	>25% in LSA
	Diminished on the land experience	Area where noise levels are >40 dBA	<10% in LSA	10% to 25% in LSA	>25% in LSA

Note:

- (1) The levels of magnitude for forestry are based on the combined areas of “predominantly coniferous forest” and “predominantly deciduous forest”. The levels are consistent with the levels for wetlands and vegetation (see Table 8.1.1.14-1).
- (2) The diminished “on-the-land” experience for fishing uses the levels of magnitude for the natural landscapes VC in terrain and soils discipline (Table 8.1.1.1-1).
- (3) The change in access to wildlife indicator uses the same levels of magnitude as wildlife and wildlife habitat (Table 8.1.1.11-1).
- (4) The change in abundance of wildlife indicator uses the same levels of magnitude as wildlife and wildlife habitat (Table 8.1.1.11-1).
- (5) The change in access to public lands for consumptive purposes uses the same levels of magnitude as wetlands and vegetation (Table 8.1.1.14-1).
- (6) The change in abundance of berries, mushrooms and/or other vegetation uses the same levels of magnitude as wetlands and vegetation (Table 8.1.1.14-1).

- Infrastructure and services; Housing and property values;
- Public safety; and
- Transportation and traffic.

The general approach to assigning levels of magnitude used to assess residual social effects are:

- Level I – No noticeable change; effects are within the normal range of variability and are manageable within the existing social environment;
- Level II – Noticeable change that can be managed by existing resources and/or through reasonable investments by communities or governments; and
- Level III – Noticeable change that cannot be managed by existing resources and will result in a strain on existing services to the extent that interventions, including investments, would be required to meet Project demands.

8.1.1.17 Economic

The Project could affect the economic valued components through the creation of jobs and the purchase of goods and services. Impacts could be observed in changes to the labour participation and employment, income, cost of living, real estate, economic development, existing business and government revenues. The levels of magnitude for Economic valued components are:

- Level I – No noticeable change; effects are within the normal range of variability and are manageable;
- Level II – Noticeable change that does not pose a risk to the valued component or does not create a management challenge using existing resources; and
- Level III – Effect that poses a serious risk to the valued component or represents a management challenge.

8.1.1.18 Human Health

As described in Section 6.1.3.18, the effects of the Project on human health were evaluated using human health as the single VC. The predicted effects of the Project on human health were presented in Section 6.19.4. As described in Sections 6.17.6, there are no predicted adverse effects of the Project on human health. As there were no residual adverse effects predicted to carry forward for consideration of significance, there is no requirement to establish a framework for assigning magnitude.

8.1.1.19 Heritage Resources

As described in Section 6.1.3.19, the effects of the Project on heritage resources were evaluated using two VCs, namely; archaeological sites, and historic heritage sites. The prediction of the effects of the Project on the heritage resources VCs was described in Section 6.20.4. The mitigation for heritage resources were described in Section 6.20.5, and the residual effects described in Section 6.20.6. There were no residual adverse effects predicted to carry forward for consideration of significance, and therefore no requirement to establish a framework for assigning magnitude.

8.1.1.20 Aboriginal Peoples

Project effects on Aboriginal Peoples are the result of changes in the quantity or quality of a resource gathered for use, change in access to an area traditionally used, changes in the socio-economic environment due to Project spending and in-migration of Project workers and the associated demands on community resources. The valued components that can be impacted are human health, use of resources for traditional practices (plant gathering, hunting, trapping, fishing, and cultural activities), and social and economic conditions. The levels of magnitude for impacts on Aboriginal Peoples are:

- Level 1 – Project does not impact or overlap with traditionally-used resources and has no or low level socio-economic effects that are within the normal range of variability;
- Level II - The Project impacts or overlaps with traditionally-used resources but does not impede the ability to use those resources or a socio-economic change that can be managed with existing resources; and
- Level III - The Project impacts or overlaps traditionally-used resources and limits the ability to use that resource or a socio-economic change that cannot be managed with existing resources.

In evaluating potential effects of the Project on Aboriginal peoples, an emphasis has been placed on describing how changes in the environment, as a result of the Project, could affect the resources traditionally relied on by members of Indigenous communities, or how the Project could affect the ability of Aboriginal peoples to practice their current or historic use of lands and resources for traditional purposes. In addition, how the Project might affect the health or social wellbeing of members of Indigenous communities were also evaluated.

Section 6.21.6 describes the predicted residual adverse effects of the Project on Aboriginal peoples, which have been summarized in Table 8.1.1.20-1. The table highlights those VCs and indicators for which residual adverse effects were predicted.

Table 8.1.1.20-1: Summary of Residual Adverse Effects for Aboriginal Peoples

Valued Components (VCs)	Indicators	Residual Adverse Effects
Human Health	Risk Assessment for Indigenous Human Health	—
Harvesting and gathering of plant material	Wild rice	—
	Berry Harvesting	Yes
	Medicinal plant harvesting	Yes
	Changes in access	Yes
	Diminished on-the-land experience	Yes
Hunting	Ungulates	Yes
	Furbearers	Yes
	Waterfowl	Yes
	Changes in access	Yes
Hunting (continued)	Diminished on-the-land experience	Yes
Trapping	Furbearers	Yes
	Changes in access	Yes
	Diminished on-the-land experience	Yes
Fishing	Sport fish	—
	Baitfish	—
	Commercial fishing	—
	Changes in access	—
	Diminished on-the-land experience	Yes
Cultural and spiritual	Cultural or spiritual sites	—
	Traditional Travel routes	—
	Diminished on-the-land experience	Yes
Socio-economic factors	Economic effects	Yes
	Social effects	Yes

Note:

- (1) The “—” symbol indicates where no residual adverse effects were predicted for the discipline, VC and indicator. This could represent situations where no adverse effects were predicted, or where predicted adverse effects were fully mitigated, as detailed in Section 6.16.

The levels of magnitude used for Aboriginal peoples generally rely of the levels of magnitudes established for the physical or biological disciplines. These disciplines describe the changes in the environment as a result of the Project that could affect ability of Aboriginal peoples to practice their current or historic use of lands and resources for traditional purposes. Table 8.1.1.20-2 summarizes the levels of magnitude for the Aboriginal peoples VCs, indicators and measures.

Table 8.1.1.20-2: Levels of Magnitude for Aboriginal Peoples

Valued Components (VCs)	Indicators	Measure or Description	Levels of Magnitude		
			Level I	Level II	Level III
Harvesting and gathering of plant material	Berry Harvesting ⁽¹⁾	Loss of potential berry harvesting areas	<10% in LSA	10% to 25% in LSA	>25% in LSA
	Medicinal plant harvesting ⁽¹⁾	Loss of forest and wetlands	<10% in LSA	10% to 25% in LSA	>25% in LSA
	Changes in access ⁽²⁾	Are where access is no longer available	<10% in LSA	10% to 25% in LSA	>25% in LSA
	Diminished on-the-land experience	Area where noise levels are >40 dBA	<10% in LSA	10% to 25% in LSA	>25% in LSA
Hunting	Change in access ⁽³⁾	Are where access is no longer available	<10% in LSA	10% to 25% in LSA	>25% in LSA
	Ungulates ⁽⁴⁾	Loss or alteration of habitat for moose	<10% in RSA	10% to 25% in RSA	>25% in RSA
	Furbearers ⁽⁴⁾	Loss or alteration of habitat for marten and beaver	<10% in LSA	10% to 25% in LSA	>25% in LSA
	Waterfowl ⁽⁴⁾	Loss or alteration of habitat for marsh birds	<10% in LSA	10% to 25% in LSA	>25% in LSA
	Diminished on-the-land experience	Area where noise levels are >40 dBA	<10% in LSA	10% to 25% in LSA	>25% in LSA
Trapping	Furbearers ⁽⁴⁾	Loss or alteration of habitat for marten and beaver	<10% in LSA	10% to 25% in LSA	>25% in LSA
	Changes in access ⁽³⁾	Are where access is no longer available	<10% in LSA	10% to 25% in LSA	>25% in LSA
	Diminished on-the-land experience	Area where noise levels are >40 dBA	<10% in LSA	10% to 25% in LSA	>25% in LSA

Table 8.1.1.20-2: Levels of Magnitude for Aboriginal Peoples (continued)

Valued Components (VCs)	Indicators	Measure or Description	Levels of Magnitude		
			Level I	Level II	Level III
Fishing	Diminished on-the-land experience ⁽⁵⁾	Viewscapes on Thunder Lake	The feature altering the viewscape is ≤ 30 m high and not fully vegetated, or ≤ 60 m high and fully vegetated	The feature altering the viewscape 30–60 m high and not fully vegetated	The feature altering the viewscape is > 60 m high
Spiritual and cultural	Diminished on-the-land experience	Viewscapes on Thunder Lake	The feature altering the viewscape is ≤ 30 m high and not fully vegetated, or ≤ 60 m high and fully vegetated	The feature altering the viewscape 30–60 m high and not fully vegetated	The feature altering the viewscape is > 60 m high
		Area where noise levels are >40 dBA	<10% in LSA	10% to 25% in LSA	>25% in LSA
Socio-economic factors	Economic effects	All measures	effects that are within the normal range of variability	effects can be managed with existing resources	Effects cannot be managed with existing resources
	Social effects	All measures	effects that are within the normal range of variability	effects can be managed with existing resources	Effects cannot be managed with existing resources

Note:

- (1) The levels of magnitude for berry and medicinal plant harvesting are consistent with the levels for wetlands and vegetation (see Table 8.1.1.14-1).
- (2) The change in access for the harvesting or gathering of plant materials uses the same levels of magnitude as wetlands and vegetation (Table 8.1.1.14-1).
- (3) The change in access for hunting and trapping uses the same levels of magnitude as wildlife and wildlife habitat (Table 8.1.1.11-1).
- (4) The ungulates, furbearers and waterfowl indicators use the same levels of magnitude as wildlife and wildlife habitat (Table 8.1.1.11-1).
- (5) The diminished “on-the-land” experience for fishing uses the levels of magnitude for the natural landscapes VC in terrain and soils discipline (Table 8.1.1.1-1).

8.1.2 Geographic Extent

The three general levels of geographic extent used in assessing residual effects are:

- Level I – Residual effect restricted to Project footprint;
- Level II – Residual effect extends into LSA; and
- Level III – Residual effect extends into RSA.

The geographic extents refer study areas that may vary by component or VC. Therefore, this approach to assigning geographic extent is consistent with the Round 1 questions related to providing specific special extents by component or VC (e.g., TMI_3-EA(1)-03). The description of the study areas used is provided in Section 6.1.4. The following common levels of geographic extent will be used for all components:

- Level I – Residual effects are restricted to Project Site;
- Level II – Residual effect are restricted to the LSA for the component or VC; and
- Level III – Residual effect extends into the RSA for the component or VC.

8.1.3 Timing

The original EIS for the Project did not explicitly consider timing when evaluating the significance of the effects of the Project. According to the Agency (CEAA, 2015b) timing should be considered “...when it is important in the evaluation of the environmental effect (e.g., when the environmental effect could occur during breeding season, or during a period of species migration through the area). It may also be relevant to discuss variation in timing of project activities, such as reservoir level fluctuations, and how that may cause varying environmental effects.” How timing has been established for the various components is described below.

8.1.3.1 Terrain and Soils

A single residual adverse effect was predicted for terrain and soils. This effect was for the natural landscapes VC, and related to the waste rock storage area (WRSA). The WRSA will be constructed as part of the mining activities during the construction phase. Although portions of the WRSA will be re-vegetated during operations, and the entire WRSA will be remediated during closure, the WRSA will remain as a permanent feature on the landscape. Therefore, timing of the effects will conservatively be assigned a timing as Level III.

8.1.3.2 Geology and Geochemistry

A residual adverse effect for geology and geochemistry was predicted to occur as a result of the formation of the pit lake, with the flooding of the open pit following closure. During the post-closure

phase, the pit lake will be allowed to passively drain through a spillway into Blackwater Creek. Since Treasury Metals will not be actively managing the pit lake discharge during this phase, the assessment has conservatively assumed to have a timing of Level III.

8.1.3.3 Noise

The assessment of potential noise effects of the Project generally focused on the predicted effects at sensitive receptor locations, as defined by the MOECC. The identified sensitive noise receptors correspond, for the most part, to residential structures. For such locations, timing will be tied to the time of day, and correspond to the time periods used by MOECC, as shown in Table 8.1.3.3-1.

Table 8.1.3.3-1: Levels of Timing for Noise

Description	Time Period	Timing Level
Daytime hours	07:00 to 19:00	Level I
Evening hours	19:00 to 23:00	Level II
Night-time hours	23:00 to 07:00	Level III

For certain VCs related to noise (e.g., noise disturbance to wildlife), the above levels of timing would not be relevant. However, assigning significance to this VC has been deferred to the evaluation of effects of the Project on wildlife (Section 6.12) and the determination of significance of residual adverse effects to wildlife (Section 8.12).

8.1.3.4 Light

As there were no predicted residual adverse effects of the Project on light, there is no need to establish a framework for assigning timing.

8.1.3.5 Air Quality

The assessment of potential air quality effect of the Project made use of AERMOD dispersion model identified as the preferred dispersion model in Ontario by MOECC for assessing air quality effects. The model was run using 5 years of hourly dispersion meteorological data provided for use in the region of the Project by the MOECC. The effects assessment made use of the maximum predicted values from the model for the various averaging periods considered (i.e., 1-hour, 8-hour, 24-hour, 30-day, annual). Because the maximum concentrations were used, regardless of the time of day (in the case of the 1-hour and 8-hour predictions), or the time of year, the element of timing does not get considered. Although air quality effects are likely to be most noticeable during the daylight hours on the warmer months of the year when there is the greatest likelihood of people being active and outdoors, the air quality assessment effectively assumes that the maximum predicted values will occur at the worst time of day and at the worst period of the year (i.e., Level III).

8.1.3.6 Climate

While there were predicted residual adverse effect of the Project on climate, specifically for the Project GHG emissions VC, the concept of timing is not relevant for this component. Project GHG emission will be tracked and reported on an annual basis. Therefore, no timing will be assigned.

8.1.3.7 Surface Water Quality

The assessment of potential surface water quality effects as a result of the Project was done using a numerical model, based upon mass-balance equations. The model uses flow data and various surface water quality inputs as a result of the Project (e.g., treated effluent discharged to Blackwater Creek, seepage from on-site mine structures to the receiving environment) to determine water quality in the receiving environment at various locations. Surface water quality for each node was evaluated on an annual average, as there was not sufficient baseline data to support modelling monthly variability in surface water quality. Treasury Metals do have some capacity to manage the discharges during the operations; therefore, the timing has been assigned as Level II for the operations phase. Treasury Metals will not be actively managing discharges from the pit lake during the post-closure phase, as water from the pit lake will be allowed to passively release through the spillway. Therefore, the assessment has conservatively assumed that the predicted effects of the Project could occur during sensitive times of the year following closure, and the timing will be assessed as Level III.

8.1.3.8 Surface Water Quantity

The assessment of potential surface water quantity effects from the Project was done using a numerical hydrologic model, which was based on long-term flow statistics from a representative, regional Water Survey of Canada (WSC) station. The hydrologic model predicted flow rates during the operations and post-closure phases of the Project at various waterbodies. These predicted surface water flows were compared to existing conditions to quantify the changes in flows as a result of the Project during the operations and post-closure phases. Treasury Metals do have some capacity to manage the discharges during the operations; therefore, the timing has been assigned as Level II for the operations phase. Treasury Metals will not be actively managing discharges from the pit lake during the post-closure phase, as water from the pit lake will be allowed to passively release through the spillway. Since these changes in flows during post-closure could occur during sensitive times of the year throughout the life of the Project, timing will be assessed as Level III.

8.1.3.9 Groundwater Quality

As there were no predicted residual adverse effects of the Project on groundwater quality, there is no need to establish a framework for assigning timing.

8.1.3.10 Groundwater Quantity

As there were no predicted residual adverse effects of the Project on groundwater quantity, there is no need to establish a framework for assigning timing.

8.1.3.11 Wildlife and Wildlife Habitat

The vulnerability of many wildlife species can increase or decrease during specific times of the year due to factors such as breeding, migration and vocalization. The specific critical times for the wildlife and wildlife habitat VCs are as follows:

- May to August for breeding and nesting birds;
- May until August for calling amphibians;
- June and July for nesting reptiles;
- Spring and fall dispersions for small mammal; and
- Spring and early summer for flying invertebrates.

In the characterization of residual effects to wildlife and wildlife habitat, the timing of activities was considered as follows:

- Level I – Project activities can be scheduled to avoid negative impacts to species or species habitat;
- Level II – Project activities can be scheduled to reduce negative impacts to species or species habitat, but will still have some negative impact to the species or the species habitat; and
- Level III – Project activities cannot be scheduled to reduce negative impacts to species or species habitat, and will have a negative impact to the species or species habitat.

8.1.3.12 Migratory Birds

The vulnerability of many migratory bird species can increase or decrease during specific times of the year due to factors such as breeding, migration and vocalization. The specific critical times for the migratory bird VCs are as follows:

- May to August for breeding and nesting birds.

In the characterization of residual effects to migratory birds, the timing of activities was considered as follows:

- Level I – Project activities can be scheduled to avoid negative impacts to species or species habitat;
- Level II – Project activities can be scheduled to reduce negative impacts to species or species habitat, but will still have some negative impact to the species or the species habitat; and
- Level III – Project activities cannot be scheduled to reduce negative impacts to species or species habitat, and will have a negative impact to the species or species habitat.

8.1.3.13 Fish and Fish Habitat

Timing was a consideration in the mitigation of impacts to fish and fish habitat. For example, in-stream works will be restricted to the timing windows that have been put in place to prevent the mortality of spawning fish and developing embryos. However, the only residual adverse effect predicted for fish and fish habitat relates to the mortality of the stream-resident fish populations living in the portions of Blackwater Creek Tributary 1 and Tributary 2 overprinted by the Project. Although timing can be used to prevent mortality, if mortality does occur, its timing is immaterial. Therefore, it is assigned Level 1.

8.1.3.14 Wetlands and Vegetation

Many ecosystems and vegetative communities can be more susceptible to damage or degradation during specific times of the year. In the characterization of residual effects to wetlands and vegetation communities, the timing of activities was considered as follows:

- Level 1 – Project activities can be scheduled to avoid any negative impacts to wetlands or vegetation communities;
- Level II – Project activities can be scheduled to reduce negative impacts to wetlands or vegetation communities, but will still have some negative impact to the wetlands or vegetation communities; and
- Level III – Project activities cannot be scheduled to reduce negative impacts to wetlands or vegetation communities, and will have a negative impact to the wetlands or vegetation communities.

8.1.3.15 Land Use

The application of timing in the assessment of potential Project-related land and resource use effects is not applicable in the context of the Agency's (CEAA, 2015b) description of when timing should be considered. However, timing has been considered when determining the significance of the changes to the environment, where relevant, that could affect the land use VCs.

8.1.3.16 Social

The application of timing in the assessment of potential Project-related social effects is not applicable in the context of the Agency's (CEAA, 2015b) description of when timing should be considered.

8.1.3.17 Economic

The application of timing in the assessment of potential Project-related economic effects is not applicable in the context of the Agency's (CEAA, 2015b) description of when timing should be considered.

8.1.3.18 Human Health

As there were no predicted residual adverse effects of the Project on human health, there is no need to establish a framework for assigning timing.

8.1.3.19 Heritage Resources

As there were no predicted residual adverse effects of the Project on heritage resources, there is no need to establish a framework for assigning timing.

8.1.3.20 Aboriginal Peoples

The application of timing in the assessment of potential Project-related Aboriginal Peoples effects is not applicable in the context of the Agency's (CEAA, 2015b) description of when timing should be considered. However, timing has been considered when determining the significance of the changes to the environment, where relevant, that could affect the Aboriginal peoples VCs.

8.1.4 Duration

The following common levels of duration will be used when evaluating the residual effects for all components:

- Level I – Residual effect is temporary or not measurable beyond given Project phase (e.g., site preparation and construction);
- Level II – Residual effect would persist through the majority of the Project life (i.e., the effects would persist through the operations phase, up to 10 years after Project initiation; and
- Level III – Residual effect would persist beyond the life of the Project (i.e., the effects would remain into the post- closure phase).

8.1.5 Frequency

The three levels for frequency are:

- Level I – Residual effect is expected to occur infrequently;
- Level II – Residual effect is expected to occur intermittently; and
- Level III – Residual effects occurs frequently or continuously.

The definitions for frequency vary by component, as described in the following sections.

8.1.5.1 Terrain and Soils

A single residual adverse effect was predicted for terrain and soils. This effect was for the natural landscapes VC, and related to the waste rock storage area (WRSA). The WRSA will be constructed as part of the mining activities during the construction phase. Although the WRSA will only be constructed once, the frequency of the effect is assumed to be Level III as the WRSA will remain as a permanent feature on the landscape.

8.1.5.2 Geology and Geochemistry

A residual adverse effect for geology and geochemistry was predicted to occur as a result of the formation of the pit lake, with the flooding of the open pit following closure. The pit lake will remain a permanent feature on the landscape and will passively drain through a spillway into Blackwater Creek whenever there is sufficient water flowing into the pit lake as a result of runoff and the inflow of groundwater. The frequency of this effect was assumed to be continuous and assigned as Level III.

8.1.5.3 Noise

In assessing the effects of the Project on noise, the assessment assumes a conservative approach for assigning the levels for frequency. For assessing ambient noise levels, the emphasis is on the maximum hourly equivalent noise level. For this VC, the frequency is assumed to be continuous (Level III). The same approach is used for assigning the frequency for noise related health effects. In the case of blasting, these effects are intermittent, happening no more than once per day, and typically less than 5 days per week. The effects related to blasting have been classified as Level II for frequency.

8.1.5.4 Light

As there were no predicted residual adverse effects of the Project on light, there is no need to establish a framework for assigning frequency.

8.1.5.5 Air Quality

In assessing the effects of the Project on air quality, the assessment assumes a conservative approach was used. This approach used the maximum prediction from the dispersion model. While the maximum model prediction may only occur once during the period modelled, the frequency for air quality refers to how often the model predictions were at a certain level of magnitude. For example, if the maximum 1-hour SO₂ concentration was predicted to exceed the assessment criteria (i.e., Level III as described in Section 8.1.1.5), the frequency of the effects would be based on how often the effects was a Level III magnitude.

When assigning the levels of frequency for the predicted air quality effects of the Project, the following approach was used:

- For indicators with an averaging period less than 1 year (i.e., 1-hour, 8-hour, 24-hour and 30-days), the frequency of the effect was classified as either infrequent (Level I) or intermittent (Level II), according to the following:
 - If the effects is predicted to be at a magnitude level up to 2% of the time (e.g., up to 2% of the 1-hour predictions) then the effect was considered to be infrequent (Level I);
 - If the effects is predicted to be at a magnitude level more than 2% of the time (e.g., more than 2% of the 1-hour predictions) then the effect was considered to be intermittent (Level II); and
- For indicators with annual averaging periods (e.g., annual TSP), the predicted effects of the Project were considered to be continuous, and the frequency was classified as Level III.

The threshold for an infrequent effect was based upon the approach used in the process for establishing the Canada-Wide Standards (CCME, 2000), where compliance is based on the 98th percentile of the ambient air quality data.

8.1.5.6 Climate

There were predicted residual adverse effects of the Project on climate, specifically for the Project GHG emissions VC. The GHG emissions from the Project are assumed to be continuous, and the effects assigned as Level III for frequency.

8.1.5.7 Surface Water Quality

The assessment of potential surface water quality effects of the Project was done by modelling the annual water quality in the receiving waters surrounding the Project. The modelling looked at a range of hydrologic conditions, including an average hydrologic year, a dry year (defined by the 1:20 year dry, or 5th percentile annual flow), and a wet hydrologic year (defined by the 1:20 year

wet, or 95th percentile flow). If an effect of a particular magnitude is only predicted in either the wet year or dry year scenarios, the frequency of the effect will be assigned as Level I. If an effect of a particular magnitude is predicted for the average year, the effect was assigned as Level II. If the effect was predicted for all scenarios, the effects was assigned a frequency of Level III.

8.1.5.8 Surface Water Quantity

Surface water quantity predictions were made for three climatic conditions, namely: average year; wet year; and dry year. If an effect of a certain magnitude were predicted under all three climatic conditions, the frequency was assigned as Level III, if predicted under just two of the climatic conditions, the frequency was assigned as Level II, and if under only a single condition, the frequency was assigned as Level I.

8.1.5.9 Groundwater Quality

As there were no predicted residual adverse effects of the Project on groundwater quality, there is no need to establish a framework for assigning timing.

8.1.5.10 Groundwater Quantity

As there were no predicted residual adverse effects of the Project on groundwater quantity, there is no need to establish a framework for assigning timing.

8.1.5.11 Wildlife and Wildlife Habitat

The frequency of economic effects will vary depending on the Project phase. In assessing potential effects of the Project on land use, frequency levels have been assigned based upon professional experience and knowledge. Where appropriate, a conservative approach was taken to assigning frequency levels. The following general frequency descriptions have been used:

- Level I – Residual effect is expected to occur infrequently;
- Level II – Residual effect is expected to occur intermittently; and
- Level III – Residual effects occurs frequently or continuously.

8.1.5.12 Migratory Birds

The frequency of economic effects will vary depending on the Project phase. In assessing potential effects of the Project on land use, frequency levels have been assigned based upon professional experience and knowledge. Where appropriate, a conservative approach was taken to assigning frequency levels. The following general frequency descriptions has been used:

- Level I – Residual effect is expected to occur infrequently;

- Level II – Residual effect is expected to occur intermittently; and
- Level III – Residual effects occurs frequently or continuously.

8.1.5.13 Fish and Fish Habitat

There was one residual adverse effect that remains after the application of mitigation measures, namely the mortality of fish in those watercourses overprinted by the Project. Fish mortality will occur once, when portions of Blackwater Creek Tributary 1 and Blackwater Creek Tributary 2 are overprinted. Therefore, it is Level I.

8.1.5.14 Wetlands and Vegetation

The frequency of economic effects will vary depending on the Project phase. In assessing potential effects of the Project on land use, frequency levels have been assigned based upon professional experience and knowledge. Where appropriate, a conservative approach was taken to assigning frequency levels. The following general frequency descriptions has been used:

- Level I – Residual effect is expected to occur infrequently;
- Level II – Residual effect is expected to occur intermittently; and
- Level III – Residual effects occurs frequently or continuously.

8.1.5.15 Land Use

The frequency of land use effects will vary depending on the Project phase. In assessing potential effects of the Project on land use, frequency levels have been assigned based upon professional experience and knowledge. Where appropriate, a conservative approach was taken to assigning frequency levels. The following general frequency descriptions has been used:

- Level I – Residual effect is expected to occur infrequently;
- Level II – Residual effect is expected to occur intermittently; and
- Level III – Residual effects occurs frequently or continuously.

8.1.5.16 Social

In assessing potential Project-related social effects, frequency levels vary depending on the Project phase. The frequency for which potential Project-related social effects occur is largely dependent upon personal decision-making (e.g., decision to move to a community to seek employment, decision to return to or leave school to support gaining employment) and as such, the assessment of frequency is based upon professional experience and knowledge. Where appropriate, a conservative approach was taken to assigning frequency levels.

8.1.5.17 Economic

The frequency of economic effects will vary depending on the Project phase. In assessing potential effects of the Project on land use, frequency levels have been assigned based upon professional experience and knowledge. Where appropriate, a conservative approach was taken to assigning frequency levels. The following general frequency descriptions has been used:

- Level I – Residual effect is expected to occur infrequently;
- Level II – Residual effect is expected to occur intermittently; and
- Level III – Residual effects occurs frequently or continuously.

8.1.5.18 Human Health

As there were no predicted residual adverse effects of the Project on human health, there is no need to establish a framework for assigning frequency.

8.1.5.19 Heritage Resources

As there were no predicted residual adverse effects of the Project on heritage resources, there is no need to establish a framework for assigning frequency.

8.1.5.20 Aboriginal Peoples

The frequency of effects on Aboriginal peoples will vary depending on VC and the Project phase. In assessing potential effects of the Project on land use, frequency levels have been assigned based upon professional experience and knowledge. Where appropriate, a conservative approach was taken to assigning frequency levels. The following general frequency descriptions has been used:

- Level I – Residual effect is expected to occur infrequently;
- Level II – Residual effect is expected to occur intermittently; and
- Level III – Residual effects occurs frequently or continuously.

8.1.6 Reversibility

Section 6.1.3 of the original EIS introduced the three levels of used in assessing residual effects, namely:

- Level I – Residual effect is readily reversible over a relative short time period;
- Level II – Residual effect is partially reversible (i.e., mitigation cannot guarantee a return to pre-disturbance conditions); and

- Level III – Residual effect is not reversible.

According to the Agency (CEAA, 2015b), a reversible effect is defined as follows:

A reversible environmental effect is one where the VC is expected to recover from the environmental effects caused by the project. This would correspond to a return to baseline conditions or other target (e.g., a population management objective, remediation target), through mitigation or natural recovery within a reasonable timescale.

For this revised EIS, a common set of reversibility levels will be used. These have been modified as follows:

- Level I – Residual effect is readily reversible once the activity causing the effect ends;
- Level II – Residual effect is expected to recover (i.e., to baseline conditions or a remediation target) within a reasonable timescale; and
- Level III – Residual effect is not reversible.

8.1.7 Likelihood

Section 6.1.4 of the original EIS introduced the following three levels likelihood, which were determined once significance was established:

- Level I – Residual effect is unlikely to occur;
- Level II – Residual effect could reasonably be expected to occur; and
- Level III – Residual effect will occur.

The determination of likelihood will be done in accordance with the guidance from the Agency (CEAA, 2015b), which provides the following guidance for likelihood above:

The determination of likelihood is based on consideration of probability and uncertainty, and is considered only when it is established through stage 2 that one or more predicted residual adverse effects are significant.

The probability of an environmental effect occurring may be based on knowledge and experience with similar past environmental effects. The full life cycle of a project, including its various stages and lifespan, should also be considered in determining the probability of occurrence of an effect.

8.1.8 Determination of Significance

A common decision tree was applied to the predicted residual adverse effects (including cumulative effects) for all of the VCs. Once the levels for the various elements described in Section 8.1 were established for each of the residual effects, the significance could be determined by tracing the effects along the branches of the decision tree. The “timing” element was not explicitly considered in the decision tree. The decision tree, presented in Figure 8.1.8-1, uses the following logic:

- If the magnitude of the effect is assigned as Level I (i.e., the effect of the Project will be comparable to baseline conditions or would not be noticeable) then irrespective of spatial extent or reversibility, the effect would be classified as “**not significant**”.



Figure 8.1.8-1: Decision Tree for Determining Significance

- If the magnitude of the effect is clearly distinguishable but meets guidelines or is within the environment's adaptive capabilities (magnitude = Level II), then:
 - If the spatial extent of the effect is limited to the Project site or local study area (extent = Level I or II), then:
 - If the effect is reversible, the effect would be classified as “**not significant**”.
 - If the effect is not reversible, the effect would be classified as “**significant**”.
 - If the effect extends far beyond the Project site into the RSA (extent = Level III), then:
 - If the duration of the effects is relatively short-term (duration = Level I) and the effects are infrequent or intermittent (frequency = Level I or II), the effect would be classified as “**not significant**”.
 - If the duration of the effects is relatively short-term (duration = Level I) and the effects are continuous (frequency = Level III), the effect would be classified as “**significant**”.
 - If the duration of the effects extent through the life of the Project (duration = Level II) and the effects are infrequent (frequency = Level I), the effect would be classified as “**not significant**”.
 - If the duration of the effects extent through the life of the Project (duration = Level II) and the effects are intermittent or continuous (frequency = Level II or III), the effect would be classified as “**significant**”.
 - If the duration of the effect extends more than 10 years beyond the life of the Project, the effect would be classified as “**significant**”.
- If the magnitude of the effect exceeds guidelines or is beyond the environment's adaptive capability (magnitude = Level III), then:
 - If the spatial extent of the effect is limited to the Project site (extent = Level I), and the duration of the effects would not persist more than 10 years beyond the life of the Project (duration = Level I or II), the effect would be classified as “**not significant**”.
 - If the spatial extent of the effect is limited to the Project site (extent = Level I), and the duration of the effects extend more than 10 years beyond the Project life (duration = Level III), the effect would be classified as “**significant**”.
 - If the spatial extent of the effect extends into the local study area (extent = Level II), and the effects are reversible, the effect would be classified as “**not significant**”.
 - If the spatial extent of the effect extends into the local study area (extent = Level II), and the effects are not reversible, the effect would be classified as “**significant**”.
 - If the spatial extent of the effect extends into the regional study area (extent = Level III), the effect would be classified as “**significant**”.

While the use of a decision tree for determining significance has been used on other assessments completed in Ontario in recent years (IAMGOLD, 2014; OPG 2011), it is not the only approach available for determining significance. Lawrence (2005) described a range of approaches used, including technical, collaborative, and reasoned argument approaches. All of the approaches would include some aspect of professional judgement (Sippe, 1999), and make use of the concepts of valued ecosystem components (VEC). The VEC are referred to by the Agency as valued components (VC) in their publications (CEAA, 2015a), and in the EIS Guidelines. There is, however, currently no legislative direction on what constitutes a significant adverse environmental effect provided in CEAA 2012, nor in there any specific guidance provided by the Agency (CEAA, 2015b).

For the revised EIS, the significance of residual adverse effects will be determined two ways. The first approach will be a methodical re-application of the decision tree used in the original EIS (Figure 8.1.8-1), using the elements introduced in Section 8.1, namely: magnitude, geographic extent, duration, frequency and reversibility. The second approach will be the adoptions of a “reasoned argument” approach, where a hypothesis of what would constitute significant effects is put forward, and used to test the predicted residual adverse effects of the Project. This approach will vary between components, and will make use of as many of the elements introduced within Section 8.1 as are appropriate for each component.

8.2 Terrain and Soils

8.2.1 Residual Adverse Effects and Cumulative Effects Advanced for Determination of Significance

The residual adverse effects of the Project on terrain and soils were described in Section 6.2.6. A single residual adverse effect was identified for the natural landscapes VC. The effect relates to the waste rock storage area (WRSA), which will be constructed during operations and will remain in perpetuity at the site. Table 8.2.1-1 summarizes the predicted residual adverse effects on terrain and soils.

Table 8.2.1-1: Residual Adverse Effects on Terrain and Soils

Valued Components (VCs)	Site Preparation and Construction	Operations	Closure	Post-closure
Natural landscapes	—	WRSA 30 m tall 3:1 slopes (h:v) West face re-vegetated	WRSA 30 m tall 3:1 slopes (h:v) Fully re-vegetated	WRSA 30 m tall 3:1 slopes (h:v) Fully re-vegetated
Overburden	—	—	—	—
Soil chemistry	—	—	—	—

Note: The “—” symbol indicates where there were no predicted residual adverse effects

As described in Section 7.5.1, there were no predicted cumulative effects for the natural landscapes VC. None of the planned activities in the region were identified as affecting the viewscape from Thunder Lake. Therefore, the magnitude will be assigned using the residual adverse effects of the Project (Table 8.2.1-1).

8.2.2 Description of Significance

As described in Section 6.1.3.1, three VC were used for evaluating the effects of the Project on terrain and soils, namely: natural landscapes, overburden, and soil chemistry. Residual adverse effects were only predicted for the natural landscapes VC (Table 8.2.1-1). The significance of this residual adverse effect was determined using the measures and methodology described in Section 8.1.

8.2.2.1 Magnitude

The predicted residual adverse effects for terrain and soils is associated with the WRSA, which will be constructed to a height of between 25 and 30 m during the operations phase. The west side of the WRSA will be vegetated during operations so it appears more natural when viewed from Thunder Lake. During closure, the WRSA will be covered with a low permeability cover and vegetated. Using the approach outlines in Section 8.1.1.1 and Table 8.1.1.1-1. The resulting levels of magnitude are provided in Table 8.2.2.1-1.

Table 8.2.2.1-1: Levels of Magnitude for Terrain and Soils

Valued Components (VCs)	Measure	Site Preparation and Construction	Operations	Closure	Post-closure
Natural Landscapes	How visible is the feature	—	Level I	Level I	Level I
	Does the feature change the viewscape	—	Level II	Level I	Level I
Overburden	—	—	—	—	—
Soil chemistry	—	—	—	—	—

Note: The “—” symbol indicates where there were no predicted residual adverse effects

8.2.2.2 Geographic Extent

Although the WRSA is constructed within the Project footprint, it is reasonable to assume the effect extends beyond the site because the WRSA would be visible from certain areas on Thunder Lake. Therefore, the geographic extent is classified as Level II.

8.2.2.3 Timing

The WRSA will be a permanent, therefore the timing is classified as Level III.

8.2.2.4 Duration

The WRSA will be constructed during the operations phase, but will remain a permanent feature on the landscape. Therefore, the duration was assigned for the “how visible is the feature” measure will be Level III for all phases. The “does the feature change the viewscapes” measure will be given a duration of Level II during operations as the WRSA will only be partially vegetated until closure. For the closure and post-closure phases the duration will be Level III.

8.2.2.5 Frequency

The WRSA will be present at the site continuously, and has therefore been classified as having a frequency of Level III.

8.2.2.6 Reversibility

The WRSA is a permanent feature. Therefore the level of reversibility is classified as Level III.

8.2.2.7 Determination of Significance

For an adverse effects on natural landscapes to be considered significant, the feature causing the effects would need to appear to be dramatically different than the surrounding landscape and would have to alter the nature of the landscape to a viewer. For this to happen the feature would need to be very tall relative the local topography, and have an appearance of being un-natural when viewed from a distance.

As described in Section 6.2.4, the WRSA will be constructed to a height of between 25 and 30 m, with relatively gently side slopes (3 to 1, horizontal to vertical). The western side of the WRSA will be vegetated during operations to make it look more natural when viewed from Thunder Lake, and the entire WRSA will be covered with a low permeability cover and vegetated as part of the closure activities. Additionally, the WRSA would not be visible for certain areas of Thunder Lake, as illustrated in Figures 6.2.4.1-1 and 6.2.4.1-2, as well as Figure 6.2.6-1. Therefore, the WRSA would not represent a significant adverse effect on natural landscapes.

Table 8.2.2.7-1 lists the various levels assigned for the measures introduced in Section 8.1. The classification of the effects for the elements presented in the table are described in the preceding sections. By applying these assessment measures to the decision tree presented in Figure 8.1.8-1, yields a determination of not significant.

Both the reasoned narrative and the decision tree approach yield the same conclusion, the Project will not result in significant adverse effects for terrain and soils.

Table 8.2.2.7-1: Determination of Significance for Terrain and Soils

Valued Component s (VCs)	Indicator	Measures	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	Significance	Likelihood		
Site Preparation and Construction Phase												
Natural landscapes	Viewscapes	How visible is the feature	No residual adverse effects									
		Does the feature change the viewscape	No residual adverse effects									
Operations Phase												
Natural landscapes	Viewscapes	How visible is the feature	Level I	Level II	Level III	Level III	Level III	Level III	Level III	Not significant	NA ⁽¹⁾	
		Does the feature change the viewscape	Level II	Level II	Level III	Level II	Level III	Level III	Level III	Level III	Not significant	NA ⁽¹⁾
Closure Phase												
Natural landscapes	Viewscapes	How visible is the feature	Level I	Level II	Level III	Level III	Level III	Level III	Level III	Level III	Not significant	NA ⁽¹⁾
		Does the feature change the viewscape	Level I	Level II	Level III	Level III	Level III	Level III	Level III	Level III	Level III	Not significant
Post-closure Phase												
Natural landscapes	Viewscapes	How visible is the feature	Level I	Level II	Level III	Level III	Level III	Level III	Level III	Level III	Not significant	NA ⁽¹⁾
		Does the feature change the viewscape	Level I	Level II	Level III	Level III	Level III	Level III	Level III	Level III	Level III	Not significant

Notes: (1) In accordance with Agency guidance (CEAA, 2015b) likelihood was not determined as none of the effects were classified as significant

8.2.3 Prediction Confidence and Uncertainty

Treasury Metal had made efforts to ensure the Project is designed with a compact footprint, while keeping a minimal profile to avoid effects to its neighbours. The design features to minimize the effects on natural landscapes (e.g., height between 25 to 39 m, side slopes at 3:1, covering and vegetating the surface during closure) are all aspects of the Project that will be implemented as part of the Project.

8.3 Geology and Geochemistry

8.3.1 Residual Adverse Effects and Cumulative Effects Advanced for Determination of Significance

As described in Section 6.3.4, the potential effects of the Project on geology and geochemistry were evaluated with a single VC, pit lake water quality. There were no residual adverse effects predicted on geology and geochemistry during the site preparation and construction, operations, and closure phases of the Project. The residual adverse effects that remain after the application of mitigation, are summarized in Table 8.3.1-1. The residual adverse effects incorporate the mitigation provided by using a wet cover as the closure option for the TSF, as well as any batch treatment required while the open pit is filling with water to ensure the quality of the water in the pit lake meets Provincial Water Quality Objectives (PWQO), or background levels, prior to being passively discharged to a tributary of Blackwater Creek. Treasury Metals expects that the monitoring of the water quality in the pit lake will continue for a period of time to determine whether additional batch treatment may be required to ensure the water released from the pit lake meets effluent release limits.

Table 8.3.1-1: Residual Adverse Effects on Pit Lake Water Quality

Indicator	Pit Lake Water Quality (mg/L)			
	Site Preparation and Construction	Operations	Closure	Post-closure
Sulphate	—	—	—	59
Aluminum	—	—	—	0.08
Antimony	—	—	—	0.0011
Arsenic	—	—	—	0.0014
Beryllium	—	—	—	0.0010
Boron	—	—	—	0.051
Cadmium	—	—	—	0.0001
Chromium	—	—	—	0.00097
Cobalt	—	—	—	0.0009
Copper	—	—	—	0.004
Iron	—	—	—	0.3
Lead	—	—	—	0.003
Mercury	—	—	—	0.00002

Table 8.3.1-1: Residual Adverse Effects on Pit Lake Water Quality (continued)

Indicator	Pit Lake Water Quality (mg/L)			
	Site Preparation and Construction	Operations	Closure	Post-closure
Molybdenum	—	—	—	0.0010
Nickel	—	—	—	0.025
Selenium	—	—	—	0.0010
Silver	—	—	—	0.00010
Thallium	—	—	—	0.00030
Uranium	—	—	—	0.0050
Vanadium	—	—	—	0.0010
Zinc	—	—	—	0.03

Note: The “—” symbol indicates where there were no predicted residual adverse effects

As detailed in Section 7.5.2, there were no predicted cumulative effects for the pit lake quality VC. None of the planned activities in the region were identified as affecting the quality of the water in the pit lake that will be allowed to form in the mined out open pit following the end of mining operations. Therefore, the magnitude will be assigned using the residual adverse effects of the Project (Table 8.3.1-1).

8.3.2 Description of Significance

As described in Section 6.1.3.2, the geology and geochemistry assessment relied on a single VC called pit lake water quality. The results of the assessment determined there would be residual adverse effects on pit lake water quality during the post-closure phase of the Project.

8.3.2.1 Magnitude

Using the approach described in Section 8.1.1.2 and the levels of magnitude criteria presented in Table 8.1.1.2-2, magnitude levels were assigned to the predicted residual adverse pit water quality effects summarized in Table 8.3.1-1. As the pit lake water quality will meet, or be better than, PWQO for all parameters, the resulting levels of magnitude will be Level I for all indicators.

8.3.2.2 Geographic Extent

Geographic extent was assigned using the approach described in Section 8.1.2. The pit lake is located within the Project site, therefore the geographic extent was assigned as Level I. The effects of pit lake water that will be discharged into a tributary of Blackwater Creek, which ultimately flows to Wabigoon Lake, on the receiving water quality are addressed as part of the evaluation of the Project effects on surface water quality. The significance of residual adverse effects on surface water quality are provided in Section 8.8.

8.3.2.3 Timing

As described in Section 8.1.3.2, the assessment has conservatively assumed that the predicted effects of the Project could occur during sensitive times of the year throughout the Project life and timing will be assessed at a Level III.

8.3.2.4 Duration

The pit lake will not form fully until the post-closure phase of the Project, but will remain in perpetuity. Based on the approach described in Section 8.1.4, levels of duration were assigned as Level III for all indicators.

8.3.2.5 Frequency

Once the pit lake is fully flooded, it will remain in perpetuity. At closure the operations area will be graded to direct all runoff to the pit lake. The pit lake will also receive groundwater inflow, even when the pit is fully flooded. As a result, the pit lake is expected to discharge to Blackwater Creek Tributary 1 throughout the year. The one exception predicted was during the month of August during a dry hydrologic year (Table 6.7.2.5-1). Therefore, the level of frequency for all indicators has been assigned as Level III, as described in Section 8.1.5.2.

8.3.2.6 Reversibility

The reversibility of the residual effects of the Project on pit lake water quality were classified as Level III. The pit lake will be permanent, and the expected quality in the lake is expected to remain at similar levels over time. Treasury Metals do, however, expect that monitoring of the water quality in the pit lake will continue for a period of time following flooding to determine whether additional batch treatment may be required to ensure the water released from the pit lake meets effluent release limits.

8.3.2.7 Determination of Significance

For an adverse effect on pit lake quality to be considered significant, the pit lake would need to have quality that would not support aquatic life, even for sensitive aquatic receptors. If pit lake water quality did not support aquatic life for sensitive receptors then it would be unlikely that it would naturally establish itself as a functioning ecosystem.

Table 8.3.2.7-1 lists the various levels assigned for the elements introduced in Section 8.1. The classification of the effects for the elements presented in the table are described in the preceding sections. By applying these assessment measures to the decision tree (Figure 8.1.8-1) yields a determination of not significant for the residual adverse effect predicted for the pit lake water quality VC.

Table 8.3.2.7-1: Determination of Significance for Geology and Geochemistry

Valued Components (VCs)	Indicator ⁽¹⁾	Magnitude ⁽²⁾	Geographic Extent ⁽³⁾	Timing	Duration	Frequency	Reversibility ⁽⁴⁾	Significance	Likelihood
Site Preparation and Construction Phase									
Pit Lake water quality	No residual adverse effects								
Operations Phase									
Pit Lake water quality	No residual adverse effects								
Closure Phase									
Pit Lake water quality	No residual adverse effects								
Post-closure Phase									
Pit Lake water quality	All indicators	Level I	Level I	Level III	Level III	Level III	Level III	Not significant	NA ⁽⁵⁾

Notes:

- (1) The indicators for which residual adverse effects (Table 8.3.1-1) were predicted was for the post-closure phase
- (2) The level of magnitude was assigned as described in Section 8.3.2.1
- (3) The geographic extent was assigned as described in Section 8.3.2.2
- (4) The reversibility was based on the highest assigned for that phase of the Project (Section 8.3.2.6)
- (5) In accordance with Agency guidance (CEAA, 2015b) likelihood was not determined as none of the effects were classified as significant

A review of the predicted residual adverse pit lake water quality effects of the Project on geology and geochemistry (Table 8.2.1-1) show that none of the predicted concentrations in the receiving environment would exceed the Provincial Water Quality Objectives (PWQO) established to be protective of sensitive aquatic receptors. Therefore, the quality of the water in the pit lake should be suitable to support a functioning ecosystem to establish itself in the lake naturally over time. Therefore, the residual adverse effects of the Project on geology and geochemistry, as evaluated using the pit lake water quality VC, as not significant.

Both the reasoned narrative and the decision tree approach yield the same conclusion, the Project will not result in significant adverse effects for geology and geochemistry.

8.3.3 Prediction Confidence and Uncertainty

As part of the process to respond to the Round 1 information requests, a re-evaluation of the available geochemical data was completed using a conservative, or precautionary approach to modelling geochemical reactions and reaction times. There is confidence that the actual geochemical effects of the Project will be no worse than the predictions provided. Additionally, recommendations have been made with regards to additional sampling and analysis that will allow the estimates to be refined with more realistic, less conservative data over time.

8.4 Noise

8.4.1 Residual Adverse Effects and Cumulative Effects Advanced for Determination of Significance

As detailed in Section 6.4.6, residual adverse effects for noise were predicted for each of the four noise VCs. All of these effects were restricted to the LSA, in the immediate vicinity of the Project. A summary of the predicted residual adverse effects of the Project on the noise VCs is provided in Table 8.4.1-1.

Table 8.4.1-1: Residual Adverse Effects for Noise

Valued Components (VCs)	Indicators	Measures	Predicted Noise Effects			
			Site Preparation Construction	Operations	Closure	Post-closure
Environmental noise levels	LEQ	dBA	40	40	39	N/A ⁽²⁾
Noise disturbance to wildlife	Area > 50 dBA	ha	430 within Project Site	199 within Project Site	122 within Project Site	N/A ⁽²⁾
Blasting noise and vibration	Peak sound pressure	dB	78	78	N/A ⁽¹⁾	N/A ⁽²⁾
	Peak particle velocity	cm/s	0.123	0.123	N/A ⁽¹⁾	N/A ⁽²⁾
	L _{DN}	dBA	65	65	65	N/A ⁽²⁾

Table 8.4.1-1: Residual Adverse Effects for Noise (continued)

Valued Components (VCs)	Indicators	Measures	Predicted Noise Effects			
			Site Preparation Construction	Operations	Closure	Post-closure
Noise related health effects	Δ %HA	%HA	2.2	1.8	2.2	N/A ⁽²⁾

Notes: (1) There will be no blasting during the closure phase
 (2) There will be no sources of noise during the post-closure phase

Section 7.5.2 identifies that cumulative noise effects are predicted for the following activities:

- Treasury Metals exploration program;
- The forestry operations by Dryden Forest Management Company; and
- The existing D&D Contracting quarry operations.

However, these activities were not predicted to numerically alter the noise effect levels relied on for assigning the magnitude of the effects. Therefore, the levels of magnitude for noise will be assigned using the residual adverse effects of the Project (Table 8.4.1-1).

8.4.2 Description of Significance

The results of the noise assessment for the Project identified that there would be residual adverse effects related to each of the following noise VCs:

- Environmental noise levels;
- Noise disturbance to wildlife;
- Blasting noise and vibration; and
- Noise related health effects.

As described in Section 8.1.1.3, the determination of the magnitude of the effects on wildlife and wildlife habitat as a result of avoidance or displacement are evaluated elsewhere in this report, using the results of the noise assessment. Specifically, the effects of noise on wildlife are considered as part of the effects predictions for wildlife (Section 6.12) and the determination of significance of wildlife (Section 8.12).

8.4.2.1 Magnitude

Site Preparation and Construction Phase

The following is noted regarding the magnitude of noise effects during site preparation and construction:

- Maximum predicted environmental noise levels at sensitive receptor locations (Table 8.4.1-1) were in excess of the background, but meet the relevant night-time MOECC noise criteria;
- Maximum of the peak sound pressure (blasting noise) and peak particle velocity (blasting vibration) predictions at sensitive receptor locations (Table 8.4.1-1) were greater than zero, but less than the relevant MOECC criteria; and
- Maximum of the absolute sound pressures (L_{DN}) and changes in percent highly annoyed (Table 8.4.1-1) were greater than baseline conditions, but less than the relevant criteria.

As set out in Table 8.1.1.3-1, the levels of magnitude for the above VCs and indicators were all classified as being Level II.

Operations Phase

The following is noted regarding the magnitude of noise effects during the operations phase:

- Maximum predicted environmental noise levels at sensitive receptor locations (Table 8.4.1-1) were in excess of the background, but meet the relevant night-time MOECC noise criteria;
- Maximum the peak sound pressure (blasting noise) and peak particle velocity (blasting vibration) predictions at sensitive receptor locations (Table 8.4.1-1) were greater than zero, but less than the relevant MOECC criteria; and
- Maximum of the absolute sound pressures (L_{DN}) and changes in percent highly annoyed (Table 8.4.1-1) were greater than baseline conditions, but less than the relevant criteria.

As set out in Table 8.1.1.3-1, the levels of magnitude for the above VCs and indicators were all classified as being Level II.

Closure Phase

For the “environmental noise levels” and “noise related health effects” VCs, the following is noted:

- Maximum predicted environmental noise levels at sensitive receptor locations (Table 8.4.1-1) were in excess of the background, but meet the relevant night-time MOECC noise criteria;
- Maximum of the absolute sound pressures (L_{DN}) and changes in percent highly annoyed (Table 8.4.1-1) were greater than baseline conditions, but less than the relevant criteria.

As set out in Table 8.1.1.3-1, the levels of magnitude for the above VCs and indicators were all classified as being Level II.

Post-closure Phase

As described in Section 6.4.1, there are no sources of noise anticipated at the Project during the post-closure phase. As a result, there will be no residual noise effects.

8.4.2.2 Geographic Extent

The sensitive noise receptors, as defined by NPC-300 (MOECC, 2015), are all located beyond the Project site, but within the LSA. Therefore, the geographic extent for all VCs and indicators were classified as Level II (Section 8.1.2). The geographic extent would be the same for the site preparation and construction, operations, and closure phases. There are no predicted residual adverse effects on noise during the post-closure phase.

8.4.2.3 Timing

Although the heavy equipment activities will be conducted between 07:00 and 22:00 (Section 6.4.3), if possible, the assessment conservatively considers that effects could occur 24-hours at certain times during the Project life. Therefore, the timing for the “environmental noise levels” and “noise related health effects” VCs were classified as Level III (Section 8.1.3.3).

Although blasting will be scheduled to reduce disruption to residents (Section 6.4.3), the assessment conservatively considers that effects from blasting could extend into the evening hours during the Project life. The timing is classified as Level II for the site preparation and construction, operations, and closure phases (Section 8.1.3.3). There are no predicted residual adverse effects on noise during the post-closure phase.

8.4.2.4 Duration

Site Preparation and Construction Phase

The duration for the site preparation and construction phase is classified as Level I (Section 8.1.4) for all VCs and indicators.

Operations Phase

The duration for the operations phase is classified as Level II (Section 8.1.4) for all VCs and indicators.

Closure Phase

The duration for the closure phase is classified as Level I (Section 8.1.4) for all VCs and indicators.

Post-closure Phase

There are no predicted residual adverse effects on noise during the post-closure phase.

8.4.2.5 Frequency

For the “environmental noise levels” and “noise related health effects” VCs, the frequency of the effects are conservatively classified as Level III (Section 8.1.5.3). In contrast, blasting will occur no more than once per day, and on as many as five days per week. The frequency of effects for blasting noise and vibration indicators was classified as Level II (Section 8.1.5.3).

The frequency effects would apply for the site preparation and construction, operations, and closure phases (Section 8.1.3.3). However, blasting effects are not predicted to occur during closure. There are no predicted residual adverse effects on noise during the post-closure phase.

8.4.2.6 Reversibility

The reversibility of the residual effects of the Project on the noise VCs and indicators were all classified as Level I. Once the Project activities stop, the noise levels and vibration will return to the pre-disturbance levels almost immediately.

The potential that changes in noise levels may have a longer lasting effect on other components of the environment (e.g., displacement of wildlife, human health) are most appropriately addressed in other sections of this report (e.g., effects assessment for wildlife in Section 6.12).

8.4.2.7 Determination of Significance

Based on the experience on similar projects within Ontario, it is reasonable to conclude for there to be a significant adverse effect to ambient noise, blasting noise and vibration, and noise related health effects if the Project results in levels that exceed the relevant criteria (i.e., magnitude Level III), at sensitive receptor locations (geographic extent Level II), on an occasional or continuous basis (frequency Level II or III). The criteria used to establish magnitude for assessing the effects of the Project on noise have been established by MOECC or Health Canada to provide

adequate protection against adverse impacts. Therefore, meeting these criteria would preclude the possibility of the effects being significant.

Using the characterization of levels for the assessment criteria measures recommended by the Agency (Table 8.4.2.7-1) and applying the above description of what constitutes a significant effect of the Project on noise, yields the following determinations of significance:

- Environmental noise VC: not significant
- Blasting noise and vibration VC: not significant
- Noise related health effects VC: not significant.

For each of these VC, the maximum predicted effects at the sensitive receptor locations met the established criteria. This result matches the determination of significance identified using the decision tree presented in the original EIS (Figure 6.1.1 of the original EIS), and reproduced in Section 8.1.8.

No determination of significance was completed for the noise disturbance to wildlife VC, as the effects of noise disturbance relate to displacement of wildlife that needs to be evaluated as part of the wildlife and wildlife habitat component. The predicted noise effects were incorporated into the wildlife and wildlife habitat assessment of effects (Section 6.12) and determination of significance (Section 8.12).

8.4.3 Prediction Confidence and Uncertainty

The modelling used in this assessment has an overall prediction accuracy that is dependent on two factors: the accuracy of the acoustical source data, and the accuracy of the noise propagation model.

The sound level data used in this assessment is based on manufacturer's data, engineering calculations, or data from similar equipment, and would be expected to have a high degree of accuracy. Efforts should be made when procuring equipment for the Project to verify that equipment sound levels are similar to those modelled.

The ISO 9613 propagation algorithms have a published accuracy of ± 3 dBA over source-receiver distances between 100 and 1,000 m. A similar degree of accuracy would be expected over the distances considered in this assessment. This is considered to be an excellent agreement for an environmental noise model over such a large distance. A 3 dBA increase or decrease would be considered imperceptible to humans.

Table 8.4.2.7-1: Determination of Significance for Noise

Valued Components (VCs)	Indicator	Measures	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	Significance	Likelihood
Site Preparation and Construction Phase										
Environmental noise levels	Equivalent noise levels, L_{EQ}	A-weighted decibels (dBA)	Level II	Level II	Level III	Level I	Level III	Level I	Not significant	NA ⁽³⁾
Noise disturbance to wildlife	Area predicted L_{EQ} above 50 dBA	Area (ha)	Refer to the predicted effects and determination of significance for wildlife and wildlife habitat ⁽¹⁾							
Blasting noise and vibration	Peak sound pressure level	Decibels (dB)	Level II	Level II	Level I	Level I	Level II	Level I	Not significant	NA ⁽³⁾
	Peak particle velocity	Centimetres per second (cm/s)	Level II	Level II	Level I ⁽²⁾	Level I	Level II	Level I	Not significant	NA ⁽³⁾
Noise related health effects	Absolute sound pressure, L_{DN}	A-weighted decibels (dBA)	Level II	Level II	Level III	Level I	Level III	Level I	Not significant	NA ⁽³⁾
	Percent highly annoyed %HA	Change in %HA	Level II	Level II	Level III	Level I	Level III	Level I	Not significant	NA ⁽³⁾
Operations Phase										
Environmental noise levels	Equivalent noise levels, L_{EQ}	A-weighted decibels (dBA)	Level II	Level II	Level III	Level II	Level III	Level I	Not significant	NA ⁽³⁾
Noise disturbance to wildlife	Area predicted L_{EQ} above 50 dBA	Area (ha)	Refer to the predicted effects and determination of significance for wildlife and wildlife habitat ⁽¹⁾							
Blasting noise and vibration	Peak sound pressure level	Decibels (dB)	Level II	Level II	Level I	Level I	Level II	Level I	Not significant	NA ⁽³⁾
	Peak particle velocity	Centimetres per second (cm/s)	Level II	Level II	Level I ⁽²⁾	Level I	Level II	Level I	Not significant	NA ⁽³⁾
Noise related health effects	Absolute sound pressure, L_{DN}	A-weighted decibels (dBA)	Level II	Level II	Level III	Level II	Level III	Level I	Not significant	NA ⁽³⁾
	Percent highly annoyed %HA	Change in %HA	Level II	Level II	Level III	Level II	Level III	Level I	Not significant	NA ⁽³⁾
Closure Phase										
Environmental noise levels	Equivalent noise levels, L_{EQ}	A-weighted decibels (dBA)	Level II	Level II	Level III	Level I	Level III	Level I	Not significant	NA ⁽³⁾
Noise disturbance to wildlife	Area predicted L_{EQ} above 50 dBA	Area (ha)	Refer to the predicted effects and determination of significance for wildlife and wildlife habitat ⁽¹⁾							
Blasting noise and vibration	Peak sound pressure level	Decibels (dB)	NA ⁽⁴⁾	NA ⁽⁴⁾	NA ⁽⁴⁾	NA ⁽⁴⁾	NA ⁽⁴⁾	NA ⁽⁴⁾	NA ⁽⁴⁾	NA ⁽³⁾
	Peak particle velocity	Centimetres per second (cm/s)	NA ⁽⁴⁾	NA ⁽⁴⁾	NA ⁽⁴⁾	NA ⁽⁴⁾	NA ⁽⁴⁾	NA ⁽⁴⁾	NA ⁽⁴⁾	NA ⁽³⁾
Noise related health effects	Absolute sound pressure, L_{DN}	A-weighted decibels (dBA)	Level II	Level II	Level III	Level I	Level III	Level I	Not significant	NA ⁽³⁾
	Percent highly annoyed %HA	Change in %HA	Level II	Level II	Level III	Level I	Level III	Level I	Not significant	NA ⁽³⁾
Post-closure Phase										
There will be no sources of noise during the post-closure phase										

- Notes: (1) The significance of effects of noise disturbance to wildlife has been considered in the determination of significance for wildlife and wildlife habitat (Section 8.12)
(2) The timing for vibration relates to the time of day when blasting may occur. Timing related to potential effects on fish spawning are addresses in determining significance for fish and fish habitat (Section 8.14)
(3) In accordance with Agency guidance (CEAA, 2015b) likelihood was not determined as none of the effects were classified as significant
(4) There will be no blasting during the closure phase of the Project

In addition, the ISO 9613 model produces results that are representative of meteorological conditions favouring sound propagation (e.g., downwind and/or inversion conditions). These conditions do not occur all the time, and therefore, the model predictions will be conservative, and actual sound levels at the receptors may be less than indicated for much of the time. Based on the above, the overall model prediction confidence is expected to be high.

8.5 Light

As described in Section 6.5.4, there are no predicted residual adverse effects of the Project on light. As there were no predicted residual adverse effects, no determination of significance is required.

8.6 Air Quality

8.6.1 Residual Adverse Effects and Cumulative Effects Advanced for Determination of Significance

Residual adverse effects for air quality were predicted for each of the indicators identified for the “air quality” VC. The effects of the Project on air quality were restricted to the areas in the immediate vicinity of the Project, and at the closest sensitive receptors, or community-oriented locations, as defined by CCME (2000). A summary of the predicted residual adverse effects of the Project on the air quality VC is provided in Table 8.6.1-1.

Table 8.6.1-1: Residual Adverse Effects on Air Quality

Compound	Averaging Period	Maximum Cumulative Prediction at Sensitive Receptors ⁽¹⁾			
		Site Preparation ⁽²⁾ and Construction	Operations	Closure ⁽³⁾	Post-closure ⁽⁴⁾
TSP	24-hour	123.1	110.8	114.7	—
	Annual	30.9	28.5	29.1	—
PM ₁₀	24-hour	39.9	36.6	37.2	—
PM _{2.5}	24-hour	13.6	15.1	13.0	—
	Annual	5.0	5.4	4.9	—
Dustfall ⁽²⁾	30 day	4.6	4.2	4.1	—
	Annual	3.7	3.3	3.3	—
CO	1-hour	1,274.0	1,277.6	1,256.8	—
	8-hour ⁽⁴⁾	1,263.6	1,265.7	1,253.3	—
NO ₂	1-hour	136.4	148.5	60.6	—
	24-hour	58.4	89.1	43.9	—
SO ₂	1-hour	6.3	4.3	5.1	—
	24-hour	4.4	4.1	4.2	—
	Annual	1.1	1.0	1.0	—
Arsenic	24-hour	0.0039	0.0035	0.0036	—
Barium	24-hour	0.0423	0.0365	0.0383	—

Table 8.6.1-1: Residual Adverse Effects on Air Quality (continued)

Compound	Averaging Period	Maximum Cumulative Prediction at Sensitive Receptors ⁽¹⁾			
		Site Preparation ⁽²⁾ and Construction	Operations	Closure ⁽³⁾	Post-closure ⁽⁴⁾
Beryllium	24-hour	0.0002	0.0002	0.0002	—
Cadmium	24-hour	0.0003	0.0003	0.0003	—
Chromium	24-hour	0.0179	0.0162	0.0167	—
Cobalt	24-hour	0.0011	0.0009	0.0010	—
Lead	24-hour	0.0150	0.0137	0.0141	—
Manganese	24-hour	0.0697	0.0627	0.0650	—
Nickel	24-hour	0.0035	0.0030	0.0031	—
	Annual	0.0006	0.0006	0.0006	—
Phosphorous	24-hour	0.0456	0.0394	0.0414	—
Platinum	24-hour	0.0018	0.0016	0.0016	—
Rhodium	24-hour	0.0005	0.0005	0.0005	—
Thallium	24-hour	0.0015	0.0013	0.0014	—
Titanium	24-hour	0.1631	0.1408	0.1479	—
Uranium	24-hour	0.0009	0.0008	0.0008	—
	Annual	0.0002	0.0001	0.0002	—
Vanadium	24-hour	0.0043	0.0037	0.0039	—

Notes:

- (1) The air quality effects are presented at the sensitive receptor locations, which correspond to the definition of “community-oriented locations” used by CCME (2000). The cumulative predictions include background air concentrations
- (2) Predicted effects during the site preparation and construction phase are based on the operations phase modelling
- (3) Predicted effects during the closure phase are based on the operations phase modelling
- (4) There are no sources of air emissions during the post-closure phase.

Section 7.5.3 identifies that cumulative air quality effects are predicted for the following activities:

- Major upgrades to Highway 17;
- Ongoing forestry operations by Dryden Forest Management Company; and
- Domtar Corp.’s Dryden Pulp Mill.

However, these activities were not predicted to numerically alter the ambient concentrations relied on for assigning the magnitude of the effects. Therefore, the levels of magnitude for air quality will be assigned using the residual adverse effects of the Project (Table 8.6.1-1).

8.6.2 Description of Significance

As described in Section 6.1.3.4, the air quality assessment relied on a single VC, namely air quality. The results of the air quality assessment for the Project identified that there would be residual adverse effects to the air quality VC.

8.6.2.1 Magnitude

Using the approach described in Section 8.1.1.5, and the levels of magnitude set out in Table 8.1.1.5-1, levels of magnitude were assigned to the predicted residual adverse air quality effects summarized in Table 8.6.1-1. The results are presented in Table 8.6.2.1-1.

Table 8.6.2.1-1: Levels of Magnitude for Residual Adverse Effects on Air Quality

Compound	Averaging Period	Level of Magnitude ⁽¹⁾			
		Site Preparation ⁽²⁾ and Construction	Operations	Closure ⁽³⁾	Post-closure ⁽⁴⁾
TSP	24-hour	Level III	Level II	Level II	—
	Annual	Level II	Level II	Level II	—
PM ₁₀	24-hour	Level II	Level II	Level II	—
PM _{2.5}	24-hour	Level II	Level II	Level II	—
	Annual	Level II	Level II	Level II	—
Dustfall ⁽²⁾	30-day	Level II	Level II	Level II	—
	Annual	Level II	Level II	Level II	—
CO	1-hour	Level II	Level II	Level II	—
	8-hour ⁽⁴⁾	Level II	Level II	Level II	—
NO ₂	1-hour	Level II	Level II	Level II	—
	24-hour	Level II	Level II	Level II	—
SO ₂	1-hour	Level II	Level II	Level II	—
	24-hour	Level II	Level II	Level II	—
	Annual	Level II	Level II	Level II	—
Arsenic	24-hour	Level II	Level II	Level II	—
Barium	24-hour	Level II	Level II	Level II	—
Beryllium	24-hour	Level II	Level II	Level II	—
Cadmium	24-hour	Level II	Level II	Level II	—
Chromium	24-hour	Level II	Level II	Level II	—
Cobalt	24-hour	Level II	Level II	Level II	—
Lead	24-hour	Level II	Level II	Level II	—
Manganese	24-hour	Level II	Level II	Level II	—
Nickel	24-hour	Level II	Level II	Level II	—
	Annual	Level II	Level II	Level II	—
Phosphorous	24-hour	Level II	Level II	Level II	—
Platinum	24-hour	Level II	Level II	Level II	—
Rhodium	24-hour	Level II	Level II	Level II	—
Thallium	24-hour	Level II	Level II	Level II	—
Titanium	24-hour	Level II	Level II	Level II	—

Table 8.6.2.1-1: Levels of Magnitude for Residual Adverse Effects on Air Quality (continued)

Compound	Averaging Period	Level of Magnitude ⁽¹⁾			
		Site Preparation ⁽²⁾ and Construction	Operations	Closure ⁽³⁾	Post-closure ⁽⁴⁾
Uranium	24-hour	Level II	Level II	Level II	—
	Annual	Level II	Level II	Level II	—
Vanadium	24-hour	Level II	Level II	Level II	—

Notes:

- (1) The levels of magnitude for air quality are based on maximum cumulative predictions at the sensitive receptor locations, which correspond to the definition of “community-oriented locations” used by CCME (2000)
- (2) Predicted effects during the site preparation and construction phase are based on the operations phase modelling
- (3) Predicted effects during the closure phase are based on the operations phase modelling
- (4) There are no sources of air emissions during the post-closure phase

8.6.2.2 Geographic Extent

The sensitive receptors, which are consistent with the definitions of “community-oriented locations” identified by CCME (2000) as the location where as ambient air criteria and standards should apply. All of the sensitive receptor locations are located beyond the Project site, but within the LSA. Therefore, the geographic extent for all indicators for the air quality VC were classified as Level II (Section 8.1.2) during the site preparation and construction phase, the operations phase, and the closure phase. Because there are no air emissions sources at the Project during the post-closure phase, there are no residual adverse effects during the post-closure phase.

While it is possible, based on the dispersion model used (i.e., AERMOD), to predict effects at the limits of the LSA and the start of the RSA, such effects would be indistinguishable from background levels (response to TMI_174-AE(1)-12). Therefore, if the geographic extent were to be classified by extending the predictions into the RSA (Level III), the corresponding magnitude of effects (Section 8.6.2.1) would need to be classified as Level I.

8.6.2.3 Timing

As described in Section 6.6.5, the predicted effects of the Project on the air quality VC made use of AERMOD dispersion model and 5-years of hourly dispersion meteorological data. The effects assessment used the maximum predicted values for each indicator and averaging periods considered (i.e., 1-hour, 8-hour, 24-hour, 30-day, annual). Because the maximum predictions are used, without regard for the time of day or season, the predicted effects were assumed to occur at the worst time of day and at the worst period of the year (i.e., Level III). This would apply for the site preparation and construction phase, the operations phase, and the closure phase. Because there are no air emissions sources at the Project during the post-closure phase, there are no residual adverse effects during the post-closure phase.

8.6.2.4 Duration

The duration for the predicted effects of the Project on air quality are as follows:

- Site preparation and construction phase effects are classified as Level I (Section 8.1.4);
- Operations phase effects are classified as Level II (Section 8.1.4); and
- Closure phase effects are classified as Level I (Section 8.1.4);

8.6.2.5 Frequency

As described in Section 8.1.5.5, the frequency of the residual adverse effects depends on the magnitude level and averaging period. As shown in Section 8.6.2.1, the levels of magnitude were determined to be Level II for all indicators and averaging periods. For those indicators with an averaging period less than 1 year (i.e., 1-hour, 8-hour, 24-hour and 30-days), the frequency of the effect was conservatively classified as intermittent (Level II). For those indicators with an annual averaging periods, the frequency of effects were classified as Level III.

8.6.2.6 Reversibility

The reversibility of the residual effects of the Project on air quality were classified as Level I. Once the Project activities stop, the air quality will return to the pre-disturbance levels almost immediately. The potential that changes in air quality may have a longer lasting effect on other components of the environment (e.g., human health) are most appropriately addressed in other sections of this report (e.g., effects assessment for human health [Section 6.19]).

8.6.2.7 Determination of Significance

Based on the experience on similar projects within Ontario, it is reasonable to conclude for there to be a significant adverse effect to air quality, the Project would need to result in cumulative predictions that exceed the relevant criteria, at community-oriented locations more than 10% of the time.

The assessment criteria used to establish magnitude of the effects of the Project on air quality have been established by regulators to provide a level of protection from harm to people and the environment. When establishing ambient air quality criteria in Canada, thresholds are set at levels that inherently provide a level of protection, and set below “no-effects” or “lowest-observed-adverse effects” levels. For example, the “acceptable” national Ambient Air Quality Objectives (NAAQO) for exposures to CO (i.e., 1-hour value of 35,000 µg/m³ and an 8-hour value of 15,000 µg/m³) were set at levels that would result in COHb (Carboxyhemoglobin) levels in adults less than 2%, or below the 2.5% COHb level identified as a conservative “no-effect level” (CEPA/FPAC 1994). For the purposes of this assessment, the more stringent “desirable” NAAQO (i.e., 1-hour value of 15,000 µg/m³ and an 8-hour value of 6,000 µg/m³) were selected. These

desirable NAAQO levels represent long-term goal for air quality, and provide a basis for an anti-degradation policies for unpolluted parts of the country. In a similar manner, the assessment criteria for 1-hour NO₂ (i.e., 400 µg/m³) is considerably lower than the “lowest observed adverse effects levels” (LOAEL) of 940 µg/m³ (FPAC 1987). Finally, some of the indicators (e.g., TSP) have criteria that are based on reasons (MOE 2012) rather than ecological or health thresholds. Therefore, occasionally exceeding the assessment criteria is not likely to result in significant adverse effects.

According to the authors of the Canada-Wide Standards acknowledge that achievement of the ambient air standards were to be based on “community-oriented locations” (CCME 2000), with an emphasis on areas “where people live, work and play” (CCME 2000). This is the appropriate approach used to assess the potential air quality effects of Project. The authors of the Canada-Wide Standards development process has included acceptable frequency for exceeding the criteria value while still achieving the standard.

Ambient air quality will change throughout in response to meteorological conditions and other natural phenomena, as well as a result of human activities. When characterizing existing air quality in an area, it is accepted practice to use the 90% of the available data. The 10% threshold used in determining significance is consistent with accepted practice and has been accepted in previous assessments of air quality in Ontario (OPG, 2014).

Table 8.6.2.7-1 lists the various levels assigned for the elements introduced in Section 8.1. In the table, the only highest levels for each element were presented in the table. For example, the frequency for all of the indicators with averaging periods less 1 year (i.e., 1-hour, 8-hour, 24-hour and 30-days), as described in Section 8.1.5, was classified as Level II. However, the frequency for the indicators with an annual averaging period was classified as Level III. Therefore, Level III is used in Table 8.6.2.7-1 for the frequency element. The classification of the effects for the elements presented in the table are described in these preceding sections:

- Magnitude: Section 8.6.2.1;
- Geographic extent: Section 8.6.2.2;
- Timing: Section 8.6.2.3;
- Duration: Section 8.6.2.4;
- Frequency: Section 8.6.2.5; and
- Reversibility: Section 8.6.2.6.

Applying the decision tree (Figure 8.1.8-1) to the effects levels in Table 8.6.2.7-1 yields a determination that the residual adverse effects on air quality would not be significant. Similarly, the predicted residual adverse effects of the Project on air quality were determined to be not significant when tested against the hypothesis of what would constitute a significant adverse effect for air quality. Both approaches for determining significance yield the same conclusion.

Table 8.6.2.7-1: Determination of Significance for Air Quality

Valued Components (VCs)	Indicator	Averaging Period	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	Significance	Likelihood
Site Preparation and Construction Phase										
Air quality	Total Suspended particulate (TSP)	24-hour	Level III	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
		Annual	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
	Inhalable particulate (PM ₁₀)	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
		Respirable particulate (PM _{2.5})	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant
	Annual		Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
	Particulate deposition (dustfall)	30 day	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
		Annual	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
	Carbon Monoxide (CO)	1-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
		8-hour ⁽⁴⁾	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
	Nitrogen Dioxide (NO ₂)	1-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
		24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
	Sulphur Dioxide (SO ₂)	1-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
		24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
	Arsenic	Annual	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
		24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
	Barium	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
	Beryllium	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
	Cadmium	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
	Chromium	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
	Cobalt	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
	Lead	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
	Manganese	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
	Nickel	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
		Annual	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
Phosphorous	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾	
Platinum	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾	
Rhodium	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾	
Thallium	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾	
Titanium	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾	
Uranium	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾	
	Annual	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾	
Vanadium	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾	
Operations Phase										
Air quality	Total Suspended particulate (TSP)	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
		Annual	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
	Inhalable particulate (PM ₁₀)	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
		Respirable particulate (PM _{2.5})	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant
	Annual		Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
	Particulate deposition (dustfall)	30 day	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
		Annual	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
	Carbon Monoxide (CO)	1-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
8-hour ⁽⁴⁾		Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾	

Table 8.6.2.7-1: Determination of Significance for Air Quality (continued)

Valued Components (VCs)	Indicator	Averaging Period	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	Significance	Likelihood
Operations Phase (continued)										
Air quality (continued)	Nitrogen Dioxide (NO ₂)	1-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
		24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
	Sulphur Dioxide (SO ₂)	1-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
		24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
		Annual	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
	Arsenic	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
	Barium	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
	Beryllium	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
	Cadmium	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
	Chromium	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
	Cobalt	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
	Lead	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
	Manganese	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
		24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
	Nickel	Annual	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
	Phosphorous	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
	Platinum	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
	Rhodium	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
	Thallium	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
Titanium	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾	
Uranium	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾	
	Annual	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾	
Vanadium	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾	
Closure Phase										
Air quality	Total Suspended particulate (TSP)	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
		Annual	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
	Inhalable particulate (PM ₁₀)	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
		24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
	Respirable particulate (PM _{2.5})	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
		Annual	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
	Particulate deposition (dustfall)	30 day	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
		Annual	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
	Carbon Monoxide (CO)	1-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
		8-hour ⁽⁴⁾	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
	Nitrogen Dioxide (NO ₂)	1-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
		24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
	Sulphur Dioxide (SO ₂)	1-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
		24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
		Annual	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
	Arsenic	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
Barium	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾	
Beryllium	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾	
Cadmium	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾	

Table 8.6.2.7-1: Determination of Significance for Air Quality (continued)

Valued Components (VCs)	Indicator	Averaging Period	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	Significance	Likelihood
Post-closure Phase (continued)										
Air quality (continued)	Chromium	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
	Cobalt	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
	Lead	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
	Manganese	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
	Nickel	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
		Annual	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
	Phosphorous	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
	Platinum	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
	Rhodium	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
	Thallium	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
	Titanium	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
	Uranium	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾
Annual		Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾	
Vanadium	24-hour	Level II	Level II	Level III	Level I	Level II	Level I	Not significant	NA ⁽¹⁾	
Post-closure Phase										
Air quality	There will be no sources of air emissions during the post-closure phase.									

Note:

(1) In accordance with Agency guidance (CEAA, 2015b) likelihood was not determined as none of the effects were classified as significant

8.6.3 Prediction Confidence and Uncertainty

The air dispersion model used to predict the effects of the Project on air quality (i.e., AERMOD) is a widely accepted model, and is required to be used for regulatory modelling applications in Ontario. The AERMOD dispersion model is a public-domain model, developed jointly by the United States Environmental Protection Agency (U.S. EPA) and the American Meteorological Society (AMS). While the model has undergone extensive testing and verification, there is always potential for uncertainty with any predictions. To address these uncertainties, a full five years of hourly meteorological data developed by the Ministry of Environment and Climate Change (MOECC) for use with AERMOD were used as inputs. The concentrations used in assessing the effects of the Project were the maximum values from the model, adopting a precautionary approach to address possible uncertainties. The reality is that air concentrations will be less than the maximum values predicted the vast majority of the time.

8.7 Climate

8.7.1 Residual Adverse Effects and Cumulative Effects Advanced for Determination of Significance

As described in Section 6.7.1, the potential effects of the Project on climate were evaluated using the following VCs:

- Project GHG emissions; and
- Changes in climate due to the Project.

Residual adverse effects were predicted for the Project GHG emissions VC during the site preparation and construction, operations and closure phases. There were no residual adverse effects predicted for Project GHG emissions during post closure. There were no residual adverse effects for the changes in climate due to the Project predicted during any phase. A summary of the residual adverse effects of the Project on climate is provided in Table 8.7.1-1.

Table 8.7.1-1: Residual Adverse Effects on Climate

Valued Components (VCs)	Project GHG Emissions (t/y) ⁽¹⁾⁽²⁾			
	Site Preparation and Construction	Operations	Closure	Post-Closure
Project GHG emissions	10,909 (0)	14,405 (2,820)	12,121 (0)	—
Changes in climate due to the Project	—	—	—	—

Notes:

The “—” symbol indicates where no adverse effects were predicted

- (1) The GHG emissions are provided as equivalent carbon dioxide (eCO₂) in units of tonnes per year (106 g/y). The eCO₂ combines the emissions of CO₂, methane (CH₄) and nitrous oxide (N₂O) using equivalency factors described in Section 6.7.2.1.
- (2) The numbers listed in parentheses represent the GHG emissions from the stationary sources at the Project. Under the Ontario Cap and Trade Program (O.Reg. 144/16), emissions from mobile sources are managed as part of the fuel production and distribution sector.

As described in Section 7.4.1, there were no cumulative effects predicted for the Project GHG emissions VC. The residual effects relate to the Project specific emissions and the requirements for regulatory reporting under Section 46 of the Canadian Environmental Protection Act, or under the Ontario Cap and Trade Program Regulation 144/16. Therefore, the magnitude will be assigned using the residual adverse effects of the Project (Table 8.7.1-1).

8.7.2 Description of Significance

As described in Section 6.1.3.6, two VCs were used for evaluating the effects of the Project on climate, namely: Project GHG emissions, and changes in climate due to the Project. Residual adverse effects were only predicted for the Project GHG emissions VC (Table 8.7.1-1). The significance of this residual adverse effect was determined using the measures and methodology described in Section 8.1.

8.7.2.1 Magnitude

The predicted residual adverse for Project GHG emissions were assigned a magnitude level of Level II for the site preparation and construction, operations, and closure phases using the approach outlines in Section 8.1.1.6 and Table 8.1.1.6-1. The total GHG emission from the Project were calculated to exceed the federal reporting threshold; however, the emisisions from the stationary sources were below the threshold for reporting under the Ontario Cap and Trade Program (O.Reg. 144/16).

8.7.2.2 Geographic Extent

The scale used for classifying the magnitude of Project GHG emissions is provincially and nationally, therefore the geographic extent has been assigned a Level II.

8.7.2.3 Timing

No timing level has been applied for Project GHG emission.

8.7.2.4 Duration

The duration of the emissions was assigned as Level II. Emissions will occur during the site preparation and construction, operations, and closure phases of the Project.

8.7.2.5 Frequency

The emission will occur on a near continuous basis, therefore the frequency has been assigned as Level III.

8.7.2.6 Reversibility

Two VCs were used for characterizing the effects of the Project on climate, namely Project GHG emissions, and changes in climate due to the Project. In the case of Project GHG emissions, the VC relates to the quantity of emissions generated by the Project on an annual basis, in relation to the Provincial total and requirements under Ontario Cap and Trade Program (O.Reg. 144/16). As such, the reversibility for this VC is classified as Level I, fully reversible. Once the Project stops emitting GHGs, the effect will stop. However, it is recognized that the effects of GHG emissions with respect to changing climate are long-lived. Therefore, had there been any predicted residual adverse effects, residual adverse effects related to changes in climate due to the Project would have been assigned as Level II.

8.7.2.7 Determination of Significance

For an adverse effects on Project GHG emissions to be considered significant, the Project would have to emit sufficient quantities to be classified as a “large emitter of GHGs” under the Ontario Cap and Trade Program (O.Reg. 144/16), and the intensity of emissions, stated as tonnes of eCO₂ per unit of production, would have to be above the median for the relevant sector of the economy.

The conservatively calculated GHG emissions from the Project show that while the Project emits emissions that are above the reporting levels for the Ontario Cap and Trade Program (O.Reg. 144/16), the Project would not be considered a “large emitter of GHGs” as the annual emissions are below 25,000 tonnes annually. Therefore, the residual adverse effects of the Project on climate would be classified as not significant.

Table 8.7.2.7-1 lists the various levels assigned for the measures introduced in Section 8.1. The classification of the effects for the elements presented in the table are described in the preceding sections. By applying these assessment measures to the decision tree presented in Figure 8.1.8-1, yields a determination of not significant for the predicted adverse effects of the Project GHG emissions.

Both the reasoned narrative and the decision tree approach yield the same conclusion, the Project will not result in significant adverse effects for climate.

8.7.3 Prediction Confidence and Uncertainty

The calculation of Project GHG emissions conservatively assumed that equipment would be operating on a continuous basis throughout the year. This assumption is considered conservative for the following reasons:

- Activities during the site preparation and construction phase are not expected to occur 24-hours a day throughout the year;

Table 8.7.2.7-1: Determination of Significance for Climate

Valued Components (VCs)	Indicator	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	Significance	Likelihood
Site Preparation and Construction Phase									
Project GHG emissions	Annual equivalent carbon dioxide emissions (eCO ₂)	Level II	Level II	NA ⁽¹⁾	Level II	Level III	Level I	Not significant	NA ⁽²⁾
Changes in climate due to the Project	No residual adverse effects								
Operations Phase									
Project GHG emissions	Annual equivalent carbon dioxide emissions (eCO ₂)	Level II	Level II	NA ⁽¹⁾	Level II	Level III	Level I	Not significant	NA ⁽²⁾
Changes in climate due to the Project	No residual adverse effects								
Closure Phase									
Project GHG emissions	Annual equivalent carbon dioxide emissions (eCO ₂)	Level II	Level II	NA ⁽¹⁾	Level II	Level III	Level I	Not significant	NA ⁽²⁾
Changes in climate due to the Project	No residual adverse effects								
Post-closure Phase									
Project GHG emissions	No residual adverse effects								
Changes in climate due to the Project	No residual adverse effects								

Notes:

- (1) As described in Section 8.1.3.7, timing is not applicable for the Project GHG emissions VC
- (2) In accordance with Agency guidance (CEAA, 2015b) likelihood was not determined as none of the effects were classified as significant

- Gas heating for the underground mine may not be required during the summer months; and
- Closure phase activities are not expected to occur 24-hours a day throughout the year;

8.8 Surface Water Quality

8.8.1 Residual Adverse Effects and Cumulative Effects Advanced for Determination of Significance

Section 6.6.6 describes the following residual adverse effects of the Project related to surface water quality:

- There were no residual adverse effects during the site preparation and construction phase as there will be no discharges.
- Numerical modelling has identified residual adverse effects for surface water quality during operations. A residual adverse effect for surface water quality is identified when the predicted effects of the Project, including mitigation, existing the existing conditions. Operations phase residual adverse effects for surface water quality (Table 8.8.1-1) were predicted at the modelling nodes on Blackwater Creek (nodes BW1 and BW2), as well as the downstream node in Wabigoon Lake (WL).
- There were no residual adverse effects predicted during the closure phase as there will be no discharges.
- The numerical modelling of surface water quality during post-closure considered the mitigation provided by a wet cover over the tailings storage facility (TSF). Post-closure phase residual adverse effects for surface water quality (Table 8.8.1-2) were predicted at the modelling nodes in Blackwater Creek (BW1 and BW2), the node on Thunder Lake Tributary 3 (TL2) and the downstream node on Thunder Lake Tributary 3 near Thunder Lake (TL3), Hoffstrom's Bay Tributary (HB1), Thunder Lake (TL) and Wabigoon Lake (WL).

As described in Section 7.5.4, there were no predicted cumulative effects for the surface water quality VC. None of the planned activities in the region were identified as affecting the quality of the water in the waterbodies affected by the Project. Therefore, the magnitude will be assigned using the residual adverse effects of the Project (Tables 8.8.1-1 and 8.8.1-2).

8.8.2 Description of Significance

As described in Section 6.1.3.7, the surface water quality assessment relied on a single VC, namely surface water quality. The results of the assessment determined there would be residual adverse effects on surface water quality as a result of the Project during the operations and post-closure phases.

Table 8.8.1-1: Residual Adverse Effects on Surface Water Quality during Operations

Parameter	BW1: Blackwater Creek (downstream of Project)			BW2: Blackwater Creek (discharge to Wabigoon Lake)			Wabigoon Lake: Wabigoon Lake		
	Avg. Year	Dry Year	Wet Year	Avg. Year	Dry Year	Wet Year	Avg. Year	Dry Year	Wet Year
Aluminum	—	—	—	—	—	—	—	—	—
Antimony	0.0047	0.0039	0.0049	0.0032	0.0027	0.0033	—	—	0.00064
Arsenic	0.022	0.018	0.023	0.014	0.012	0.015	0.0011	—	0.0012
Beryllium	0.0031	0.0027	0.0032	0.0023	0.0021	0.0024	—	—	—
Boron	0.081	0.076	0.083	0.070	0.066	0.071	—	—	—
Cadmium	0.00006	0.00005	0.00006	0.00004	0.00004	0.00004	—	—	—
Chloride(a)	25.9	21.2	27.3	16.7	13.6	17.6	—	—	3.4
Chromium	0.0027	0.0024	0.0028	0.0020	0.0018	0.0021	—	—	—
Cobalt	0.0006	0.0006	0.0007	0.0006	0.0006	0.0006	—	—	—
Copper	0.0020	0.0018	0.0020	0.0017	0.0016	0.0017	—	—	—
Cyanide	0.0026	0.0025	0.0027	0.0024	0.0023	0.0024	—	—	—
Iron	—	—	—	—	—	—	—	—	—
Lead	0.0018	0.0017	0.0019	0.0015	0.0014	0.0016	—	—	—
Mercury	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	—	—	—
Molybdenum	0.0092	0.0077	0.0096	0.0062	0.0052	0.0065	—	—	0.0011
Nickel	0.0068	0.0059	0.0071	0.0051	0.0045	0.0052	—	—	—
Nitrate(a)	2.8	2.2	2.9	1.8	1.4	1.9	0.044	0.033	0.056
Phosphorus	—	—	—	—	—	—	—	—	—
Selenium	0.022	0.018	0.023	0.014	0.012	0.015	0.0011	—	0.0012
Silver	—	—	—	—	—	—	—	—	—
Thallium	—	—	—	—	—	—	—	—	—
Uranium	—	—	—	—	—	—	—	—	—
Vanadium	0.0022	0.0020	0.0023	0.0018	0.0017	0.0019	—	—	—
Zinc	0.0097	0.0087	0.010	0.0078	0.0071	0.0080	—	—	—

Note:

The “—” symbol indicates there were no adverse effects predicted (i.e., predicted effects were less than or equal to existing conditions)

Table 8.8.1-2: Residual Adverse Effects on Surface Water Quality during Post-Closure

Parameter	BW1: Blackwater Creek (downstream of Project)			BW2: Blackwater Creek (discharge to Wabigoon Lake)			HB1: Hoffstrom's Bay Tributary (at Thunder Lake)			TL2: Thunder Lake Tributary 3 (downstream of Tree Nursery Ponds)			TL3: Thunder Lake Tributary 2 (at Thunder Lake)			Thunder Lake: Thunder Lake			Wabigoon Lake: Wabigoon Lake		
	Avg. Year	Dry Year	Wet Year	Avg. Year	Dry Year	Wet Year	Avg. Year	Dry Year	Wet Year	Avg. Year	Dry Year	Wet Year	Avg. Year	Dry Year	Wet Year	Avg. Year	Dry Year	Wet Year	Avg. Year	Dry Year	Wet Year
Aluminum	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.029	0.028	0.029	—	—	—
Antimony	0.00074	0.00079	0.00075	0.00069	0.00073	0.00070	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Arsenic	0.001	0.001	0.001	0.001	0.001	0.001	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Beryllium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Boron	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cadmium	0.00004	0.00005	0.00004	0.00003	0.00004	0.00003	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Chloride(a)	31	43	35	20	29	23	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Chromium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cobalt	0.0007	0.0007	0.0007	0.0006	0.0007	0.0006	—	—	—	—	—	—	—	—	—	0.0005	0.0005	0.0005	—	—	—
Copper	0.002	0.002	0.002	0.002	0.002	0.002	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cyanide	0.003	0.003	0.003	0.002	0.003	0.003	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Iron	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.158	0.160	0.156	—	—	—
Lead	0.002	0.002	0.002	0.001	0.001	0.001	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mercury	0.00001	0.00002	0.00001	0.00001	0.00001	0.00001	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Molybdenum	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Nickel	0.008	0.010	0.009	0.006	0.007	0.006	—	—	—	—	—	—	—	—	—	0.002	0.002	0.002	—	—	—
Nitrate(a)	3.35	4.57	3.78	2.16	3.08	2.49	—	—	—	—	—	—	—	—	—	—	—	—	0.05	0.04	0.07
Phosphorus	†	†	†	†	†	†	†	†	†	†	†	†	†	†	†	†	†	†	†	†	†
Selenium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Silver	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Thallium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Uranium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Vanadium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Zinc	0.011	0.013	0.012	0.009	0.010	0.009	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Notes:
 The numbers table incorporate the mitigation provided by using a wet cover for the closure of the TSF
 The "—" symbol indicates that there was no adverse effect predicted (i.e., predicted effects were less than or equal to the existing conditions)
 The "†" symbol indicates that surface water quality was not modelled due to insufficient source data

8.8.2.1 Magnitude

Using the approach described in Section 8.1.1.7, and the levels of magnitude set out in Table 8.1.1.7-2, levels of magnitude were assigned to the predicted residual adverse surface water quality effects summarized in Tables 8.8.1-1 and 8.8.1-2. For the purposes of assigning magnitude, the highest magnitude of the prediction for each of the indicators has been selected. The results are presented in Table 8.8.2.1-1.

Table 8.8.2.1-1: Levels of Magnitude for Residual Adverse Effects on Surface Water Quality

Parameter	Level of Magnitude ⁽¹⁾			
	Site Preparation and Construction	Operations	Closure	Post-closure
Aluminum	—	—	—	Level I
Antimony	—	Level I	—	Level I
Arsenic	—	Level I	—	Level I
Beryllium	—	Level I	—	—
Boron	—	Level I	—	—
Cadmium	—	Level I	—	Level I
Chloride	—	Level I	—	Level I
Chromium	—	Level I	—	—
Cobalt	—	Level I	—	Level I
Copper	—	Level I	—	Level I
Cyanide	—	Level I	—	Level I
Iron	—	—	—	Level I
Lead	—	Level I	—	Level I
Mercury	—	Level I	—	Level I
Molybdenum	—	Level I	—	—
Nickel	—	Level I	—	Level I
Nitrate	—	Level I	—	Level I
Phosphorus	—	—	—	†
Selenium	—	Level I	—	—
Silver	—	—	—	—
Thallium	—	—	—	—
Uranium	—	—	—	—
Vanadium	—	Level I	—	—
Zinc	—	Level I	—	Level I

Notes:

The “—” symbol indicates that there was no adverse effect predicted (i.e., predicted effects were less than or equal to the existing conditions)
The “†” symbol indicates that surface water quality was not modelled due to insufficient source data

8.8.2.2 Geographic Extent

Geographic extent was assigned using the approach described in Section 8.1.2. The residual adverse surface water quality effects of the Project (Tables 8.8.1-1 and 8.8.1-2) were determined at a series of nodes, described in Section 6.1.4.8, that were located in both the LSA and RSA for surface water quality. In assessing the geographic extent for the residual adverse effects on surface water quality, the largest geographic extent was selected for indicator. That is to say, if

residual adverse effects were predicted for an indicator in only nodes within the LSA, then the geographic extent was assigned as Level II. If the residual effects were predicted for nodes in the LSA and RSA, geographic extent was assessed as Level III. The geographic extents are summarized in Table 8.8.2.2-1.

Table 8.8.2.2-1: Geographic Extent for Residual Adverse Effects on Surface Water Quality

Parameter	Level of Geographic Extent ⁽¹⁾			
	Site Preparation and Construction	Operations	Closure	Post-closure
Aluminum	—	—	—	Level III
Antimony	—	Level III	—	Level II
Arsenic	—	Level III	—	Level II
Beryllium	—	Level II	—	—
Boron	—	Level II	—	—
Cadmium	—	Level II	—	Level II
Chloride(a)	—	Level II	—	Level II
Chromium	—	Level II	—	—
Cobalt	—	Level II	—	Level III
Copper	—	Level II	—	Level II
Cyanide	—	Level II	—	Level II
Iron	—	—	—	Level III
Lead	—	Level II	—	Level II
Mercury	—	Level II	—	Level II
Molybdenum	—	Level III	—	—
Nickel	—	Level III	—	Level III
Nitrate(a)	—	Level II	—	Level II
Phosphorus	—	—	—	†
Selenium	—	Level III	—	—
Silver	—	—	—	—
Thallium	—	—	—	—
Uranium	—	—	—	—
Vanadium	—	Level II	—	—
Zinc	—	Level II	—	Level II

Notes:

The “—” symbol indicates that there was no adverse effect predicted (i.e., predicted effects were less than or equal to the existing conditions)

The “†” symbol indicates that surface water quality was not modelled due to insufficient source data

8.8.2.3 Timing

The predicted effects of the Project on the surface water quality made use of a numerical model to predict annual average surface water quality at various location in the waterbodies surrounding the Project. As described in Section 8.1.3.7, the assessment has conservatively assumed that the predicted effects of the Project could occur during sensitive times of the year throughout the Project life and the timing will be assessed as Level III.

8.8.2.4 Duration

Using the approach described in Section 8.1.4, levels of duration were assigned to the predicted residual adverse surface water quality effects summarized in Tables 8.8.1-1 and 8.8.1-2. The results are presented in Table 8.8.2.4-1.

Table 8.8.2.4-1: Levels of Duration for Residual Adverse Effects on Surface Water Quality

Parameter	Level of Duration ⁽¹⁾			
	Site Preparation and Construction	Operations	Closure	Post-closure
Aluminum	—	—	—	Level III
Antimony	—	Level II	—	Level III
Arsenic	—	Level II	—	Level III
Beryllium	—	Level II	—	—
Boron	—	Level II	—	—
Cadmium	—	Level II	—	Level III
Chloride(a)	—	Level II	—	Level III
Chromium	—	Level II	—	—
Cobalt	—	Level II	—	Level III
Copper	—	Level II	—	Level III
Cyanide	—	Level II	—	Level III
Iron	—	—	—	Level III
Lead	—	Level II	—	Level III
Mercury	—	Level II	—	Level III
Molybdenum	—	Level II	—	—
Nickel	—	Level II	—	Level III
Nitrate(a)	—	Level II	—	Level III
Phosphorus	—	—	—	†
Selenium	—	Level II	—	—
Silver	—	—	—	—
Thallium	—	—	—	—
Uranium	—	—	—	—
Vanadium	—	Level II	—	—
Zinc	—	Level II	—	Level III

Notes:

The "—" symbol indicates that there was no adverse effect predicted (i.e., predicted effects were less than or equal to the existing conditions)
The "†" symbol indicates that surface water quality was not modelled due to insufficient source data

8.8.2.5 Frequency

The predicted effects of the Project on the surface water quality made use of a numerical model to predict annual average surface water quality at various location in the waterbodies surrounding the Project. As described in Section 8.1.5.7, the assessment has conservatively assumed that the predicted effects of the Project could occur continuously, and the frequency will be assessed as Level III.

8.8.2.6 Reversibility

The reversibility of the residual effects of the Project on surface water quality were classified as Level I during operations. During operations, the residual adverse effects of the Project on surface water quality are a result of the treated effluent being discharged to Blackwater Creek. Should the discharges during operations be stopped for any reason, the surface water quality would quickly return to the existing conditions. This meets the definition of a Level I reversibility.

The reversibility of the residual effects of the Project on surface water quality were classified as Level II during the post-closure phase. During post-closure, the residual adverse effects on surface water quality are the result of discharges from the pit lake, and seepage from the TSF and WRSA. Should discharges from the pit lake cease, the surface water quality as a result of those discharges would quickly return to existing conditions. However, should it be possible in the future to eliminate the ongoing seepage from the TSF and WRSA, the effects on surface quality would not immediately return to existing conditions. The reason is that seepage from the TSF and WRSA will take years to reach the surrounding water courses and the effects will continue long after the seepage stops, should that be possible.

8.8.2.7 Determination of Significance

Based on the experience on similar projects within Ontario, it is reasonable to conclude that for there to be a significant adverse effect to surface water quality, the Project would need to result in predicted annual average concentrations that exceed both existing conditions and the relevant criteria during operations, or extending into the post-closure phase.

A review of the predicted residual adverse surface water quality effects of the Project on surface water quality (Tables 8.8.1-1 and 8.8.1-2) show that none of the predicted concentrations in the receiving environment would exceed the relevant criteria used in the assessment. The PWQO assessment criteria used to evaluate the effects of the Project on surface water quality have been established to provide a level of protection from harm to sensitive aquatic receptors. Therefore, the effects of the Project on surface water quality would be classified as not significant.

Table 8.8.2.7-1 lists the various levels assigned for the elements introduced in Section 8.1. The classification of the effects for the elements presented in the table are described in the preceding sections. By applying the decision tree (Figure 8.1.8-1) to the effects levels in Table 8.8.2.7-1 yields a determination that the residual adverse effects on surface water quality would not be significant.

The residual adverse effects of the Project on surface water quality were determined to be not significant using a reasoned narrative approach as well when using the decision tree (Figure 8.1.8-1). Therefore, it is concluded that the Project will not have a significant adverse effect on surface water quality.

Table 8.8.2.7-1: Determination of Significance for Surface Water Quality

Valued Components (VCs)	Indicator ⁽¹⁾	Magnitude ⁽²⁾	Geographic Extent ⁽³⁾	Timing	Duration	Frequency	Reversibility ⁽⁴⁾	Significance	Likelihood	
Site Preparation and Construction Phase										
Surface water quality	No residual adverse effects									
Operations Phase										
Surface water quality	Aluminum (Al)									
	Antimony (Sb)	Level I	Level III	Level III	Level II	Level III	Level I	Not significant	NA ⁽⁵⁾	
	Arsenic (As)	Level I	Level III	Level III	Level II	Level III	Level I	Not significant	NA ⁽⁵⁾	
	Beryllium (Be)	Level I	Level II	Level III	Level II	Level III	Level I	Not significant	NA ⁽⁵⁾	
	Boron (B)	Level I	Level II	Level III	Level II	Level III	Level I	Not significant	NA ⁽⁵⁾	
	Cadmium (Cd)	Level I	Level II	Level III	Level II	Level III	Level I	Not significant	NA ⁽⁵⁾	
	Chloride (Cl)	Level I	Level II	Level III	Level II	Level III	Level I	Not significant	NA ⁽⁵⁾	
	Chromium (Cr)	Level I	Level II	Level III	Level II	Level III	Level I	Not significant	NA ⁽⁵⁾	
	Cobalt (Co)	Level I	Level II	Level III	Level II	Level III	Level I	Not significant	NA ⁽⁵⁾	
	Copper (Cu)	Level I	Level II	Level III	Level II	Level III	Level I	Not significant	NA ⁽⁵⁾	
	Cyanide (CN)	Level I	Level II	Level III	Level II	Level III	Level I	Not significant	NA ⁽⁵⁾	
	Iron (Fe)	No residual adverse effects								
	Lead (Pb)	Level I	Level II	Level III	Level II	Level III	Level I	Not significant	NA ⁽⁵⁾	
	Mercury (Hg)	Level I	Level II	Level III	Level II	Level III	Level I	Not significant	NA ⁽⁵⁾	
	Molybdenum (Mo)	Level I	Level III	Level III	Level II	Level III	Level I	Not significant	NA ⁽⁵⁾	
	Nickel (Ni)	Level I	Level III	Level III	Level II	Level III	Level I	Not significant	NA ⁽⁵⁾	
	Nitrate (NO ₃)	Level I	Level II	Level III	Level II	Level III	Level I	Not significant	NA ⁽⁵⁾	
	Phosphorus (P)	No residual adverse effects								
	Selenium (Se)	Level I	Level III	Level III	Level II	Level III	Level I	Not significant	NA ⁽⁵⁾	
	Silver (Ag)	No residual adverse effects								
	Thallium (Tl)	No residual adverse effects								
Uranium (U)	No residual adverse effects									
Vanadium (V)	Level I	Level II	Level III	Level II	Level III	Level I	Not significant	NA ⁽⁵⁾		
Zinc (Zn)	Level I	Level II	Level III	Level II	Level III	Level I	Not significant	NA ⁽⁵⁾		
Closure Phase										
Surface water quality	No residual adverse effects									
Post-closure Phase										
Surface water quality	Aluminum (Al)	Level I	Level III	Level III	Level III	Level III	Level II	Not significant	NA ⁽⁵⁾	
	Antimony (Sb)	Level I	Level II	Level III	Level III	Level III	Level II	Not significant	NA ⁽⁵⁾	
	Arsenic (As)	Level I	Level II	Level III	Level III	Level III	Level II	Not significant	NA ⁽⁵⁾	
	Beryllium (Be)	No residual adverse effects								
	Boron (B)	No residual adverse effects								
	Cadmium (Cd)	Level I	Level II	Level III	Level III	Level III	Level II	Not significant	NA ⁽⁵⁾	
	Chloride (Cl)	Level I	Level II	Level III	Level III	Level III	Level II	Not significant	NA ⁽⁵⁾	
	Chromium (Cr)	No residual adverse effects								
	Cobalt (Co)	Level I	Level III	Level III	Level III	Level III	Level II	Not significant	NA ⁽⁵⁾	
	Copper (Cu)	Level I	Level II	Level III	Level III	Level III	Level II	Not significant	NA ⁽⁵⁾	

Table 8.8.2.7-1: Determination of Significance for Surface Water Quality (continued)

Valued Components (VCs)	Indicator ⁽¹⁾	Magnitude ⁽²⁾	Geographic Extent ⁽³⁾	Timing	Duration	Frequency	Reversibility ⁽⁴⁾	Significance	Likelihood	
Post-closure Phase (continued)										
Surface water quality (continued)	Cyanide (CN)	Level I	Level II	Level III	Level III	Level III	Level II	Not significant	NA ⁽⁵⁾	
	Iron (Fe)	Level I	Level III	Level III	Level III	Level III	Level II	Not significant	NA ⁽⁵⁾	
	Lead (Pb)	Level I	Level II	Level III	Level III	Level III	Level II	Not significant	NA ⁽⁵⁾	
	Mercury (Hg)	Level I	Level II	Level III	Level III	Level III	Level II	Not significant	NA ⁽⁵⁾	
	Molybdenum (Mo)	No residual adverse effects								
	Nickel (Ni)	Level I	Level III	Level III	Level III	Level III	Level II	Not significant	NA ⁽⁵⁾	
	Nitrate (NO ₃)	Level I	Level II	Level III	Level III	Level III	Level II	Not significant	NA ⁽⁵⁾	
	Phosphorus (P)	†	†	Level III	Level III	Level III	Level II	Not significant	NA ⁽⁵⁾	
	Selenium (Se)	No residual adverse effects								
	Silver (Ag)	No residual adverse effects								
	Thallium (Tl)	No residual adverse effects								
	Uranium (U)	No residual adverse effects								
	Vanadium (V)	No residual adverse effects								
	Zinc (Zn)	Level I	Level II	Level III	Level III	Level III	Level II	Not significant	NA ⁽⁵⁾	

Notes:

- (1) The indicators for which residual adverse effects (Tables 8.8.1-1 and 8.8.1-2) were predicted varied by phase and modelling nodes
- (2) The level of magnitude was based on the highest assigned for that phase of the Project (Table 8.8.2.1-1)
- (3) The geographic extent was based on the highest assigned for that phase of the Project (Table 8.8.2.2-1)
- (4) The reversibility was based on the highest assigned for that phase of the Project (Section 8.8.2.5)
- (5) In accordance with Agency guidance (CEAA, 2015b) likelihood was not determined as none of the effects were classified as significant

8.8.3 Prediction Confidence and Uncertainty

The predictions of the surface water quality effects of the Project made use of a mass balance model described in Section 6.8.2. The theory behind the modelling is straightforward, and certain. The confidence in the results of the modelling is supported by the commitments made by Treasury Metals with regards to the releases to the environment. During operations, the effluent releases from the Project to Blackwater Creek will be treated to meet the Provincial Water Quality Objectives (PWQO), or background levels, prior to discharge into the receiving environment. There will be no reliance on in-stream dilution to achieve these objectives. In the case of the post-closure releases from the pit lake, Treasury Metals will test the pit lake as it is filling and, if required, implement batch treatment to ensure that the PWQO can be achieved in the water to be passively discharged from the pit lake to a tributary of Blackwater Creek. The post-closure modelling also incorporates the effects of seepage from the waste rock storage area (WRSA) and tailings storage facility (TSF) to surface water. It was conservatively assumed that there would be no attenuation to the quality of the seepage as it travelled to the receiving waters.

8.9 Surface Water Quantity

8.9.1 Residual Adverse Effects and Cumulative Effects Advanced for Determination of Significance

As described in Section 6.9.1, the potential effects of the Project on surface water quantity were evaluated with a single VC, surface water quantity. There were no residual adverse effects predicted on surface water quantity during the site preparation and construction or closure phases of the Project. Residual adverse effects associated with surface water flows, after the implementation of mitigation, are predicted to occur during the operations and post-closure phases of the Project are summarized in Tables 8.9.1-1 and 8.9.1-2, respectively.

Section 7.5.5 identifies that cumulative surface water quantity effects are predicted for the following activities:

- Ongoing forestry operations by Dryden Forest Management Company.

However, these activities were not predicted to numerically alter the residual adverse effects predicted for the Project. Therefore, the levels of magnitude for surface water quantity will be assigned using the residual adverse effects of the Project (Tables 8.9.1-1 and 8.9.1-2).

Table 8.9.1-1: Residual Adverse Effects on Surface Water Quantity during Operations

Scenario	Calculated Change in Flows, ΔQ (%)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Year													
TL1	-4.92%	-4.99%	-4.90%	-0.05%	—	—	—	—	—	—	—	-4.91%	-0.55%
TL2	-5.11%	-5.19%	-5.10%	-0.24%	-0.20%	-0.20%	-0.20%	-0.20%	-0.20%	-0.20%	-0.20%	-5.11%	-0.75%
TL3	-5.53%	-5.59%	-5.51%	-1.28%	-1.24%	-1.24%	-1.24%	-1.24%	-1.24%	-1.24%	-1.24%	-5.52%	-1.73%
HB1	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%
LC1	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%
BW1	+6.59%	+22.71%	+39.65%	-4.08%	-20.43%	-9.91%	-11.08%	+9.29%	+18.16%	+3.69%	+8.27%	-6.07%	-3.90%
BW2	+1.09%	+11.25%	+21.93%	-5.65%	-15.96%	-9.32%	-10.06%	+2.78%	+8.38%	-0.74%	+2.14%	-6.90%	-5.53%
Dry year													
TL1	-4.99%	-4.93%	-5.06%	-5.00%	-5.00%	-5.01%	-5.01%	-4.98%	-5.00%	-4.99%	-5.02%	-4.98%	-5.00%
TL2	-5.19%	-5.13%	-5.26%	-5.20%	-5.20%	-5.21%	-5.20%	-5.18%	-5.20%	-5.19%	-5.21%	-5.18%	-5.20%
TL3	-5.59%	-5.54%	-5.66%	-5.60%	-5.60%	-5.61%	-5.61%	-5.59%	-5.60%	-5.59%	-5.62%	-5.58%	-5.60%
HB1	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%
LC1	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%
BW1	+7.45%	+29.96%	+94.79%	+28.87%	-25.30%	-25.30%	-25.30%	-25.30%	-25.30%	-25.30%	+30.65%	-18.80%	-6.66%
BW2	+1.63%	+15.82%	+56.70%	+15.14%	-19.02%	-19.02%	-19.02%	-19.02%	-19.02%	-19.02%	+16.26%	-14.93%	-7.27%
Wet Year													
TL1	—	—	—	—	—	—	—	—	—	—	—	—	—
TL2	-0.20%	-0.20%	-0.20%	-0.20%	-0.20%	-0.20%	-0.20%	-0.20%	-0.20%	-0.20%	-0.20%	-0.20%	-0.20%
TL3	-1.24%	-1.24%	-1.24%	-1.24%	-1.24%	-1.24%	-1.24%	-1.24%	-1.24%	-1.24%	-1.24%	-1.24%	-1.24%
HB1	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%
LC1	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%
BW1	-4.92%	+5.59%	+19.52%	-8.34%	-15.10%	+4.18%	+0.13%	+26.49%	+18.55%	+2.57%	+2.93%	-12.40%	-1.74%
BW2	-5.40%	+1.23%	+10.01%	-7.55%	-11.82%	+0.34%	-2.21%	+14.41%	+9.40%	-0.68%	-0.45%	-10.11%	-3.39%

Notes:

- (1) The “—” symbol indicates where no adverse effects were predicted.
- (2) The “†” symbol indicates predicted decreases in annual flows. Decreases in flows are evaluated with monthly flows
- (3) The “‡” symbol indicates predicted increases in monthly flows. Increases in flows are evaluated with annual flows

Table 8.9.1-2: Residual Adverse Effects on Surface Water Quantity during Post-closure

Scenario	Calculated Change in Flows, ΔQ (%)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Year													
TL1	—	—	—	—	—	—	—	—	—	—	—	—	—
TL2	+0.01%	+0.01%	+0.01%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%
TL3	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%
HB1	-7.20%	-7.20%	-7.20%	-7.22%	-7.22%	-7.22%	-7.22%	-7.21%	-7.21%	-7.22%	-7.21%	-7.21%	-7.22%
LC1	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%
BW1	+13.11%	+15.00%	+13.88%	+17.29%	+7.81%	-3.36%	-5.27%	-18.31%	+0.01%	+5.07%	+9.74%	+10.79%	+5.69%
BW2	+8.27%	+9.46%	+8.75%	+10.90%	+4.93%	-2.12%	-3.32%	-11.54%	+0.01%	+3.20%	+6.15%	+6.81%	+3.59%
Dry year													
TL1	—	—	—	—	—	—	—	—	—	—	—	—	—
TL2	+0.02%	+0.03%	+0.03%	+0.00%	+0.00%	+0.01%	+0.01%	+0.01%	+0.01%	+0.01%	+0.01%	+0.01%	+0.01%
TL3	+0.01%	+0.01%	+0.01%	+0.00%	+0.00%	+0.00%	+0.00%	+0.01%	+0.00%	+0.00%	+0.00%	+0.01%	+0.00%
HB1	-7.16%	-7.14%	-7.15%	-7.21%	-7.21%	-7.21%	-7.21%	-7.18%	-7.20%	-7.20%	-7.20%	-7.18%	-7.20%
LC1	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%
BW1	+91.69%	+98.31%	+94.38%	+67.76%	+12.10%	-16.92%	-20.76%	-20.76%	-20.76%	-3.53%	+41.86%	+45.60%	+19.61%
BW2	+57.82%	+62.00%	+59.52%	+42.73%	+7.63%	-10.67%	-13.09%	-13.09%	-13.09%	-2.23%	+26.40%	+28.76%	+12.37%
Wet Year													
TL1	—	—	—	—	—	—	—	—	—	—	—	—	—
TL2	+0.00%	+0.01%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%
TL3	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%
HB1	-7.21%	-7.21%	-7.21%	-7.22%	-7.22%	-7.22%	-7.22%	-7.21%	-7.22%	-7.22%	-7.22%	-7.21%	-7.22%
LC1	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%
BW1	+21.27%	+22.35%	+21.71%	+17.89%	+11.82%	+3.69%	+1.26%	-3.98%	+3.51%	+10.82%	+19.35%	+19.95%	+11.08%
BW2	+13.41%	+14.10%	+13.69%	+11.28%	+7.46%	+2.33%	+0.80%	-2.51%	+2.21%	+6.83%	+12.20%	+12.58%	+6.99%

Notes:

- (1) The "—" symbol indicates where no adverse effects were predicted
- (2) The "‡" symbol indicates predicted increases in monthly flows. Increases in flows are evaluated with annual flows
- (3) The "†" symbol indicates predicted decreases in annual flows. Decreases in flows are evaluated with monthly flows

8.9.2 Description of Significance

As described in Section 6.1.3.8, the surface water quantity assessment relied on the VC called surface water quantity. The results of the assessment determined there would be residual adverse effects on surface water quantity during the operations and post-closure phases of the Project.

8.9.2.1 Magnitude

The levels of magnitude for predicted residual adverse effects to surface water quantity were assigned based on the approach described in Section 8.1.1.8 and the levels of magnitude presented in Table 8.1.1.8-1. Surface water flow increases were evaluated on an annual basis and surface water flow decreases were evaluated on a monthly basis. The levels of magnitude are set out in Tables 8.9.2.1-1 and 8.9.2.1-2 for the operations and post-closure phases, respectively. There are no residual adverse effects predicted for either the site preparation and construction or closure phases.

8.9.2.2 Geographic Extent

Geographic extent was assigned using the approach described in Section 8.1.2. All of the sub-watersheds for which there were predicted residual adverse effects are within the LSA. Therefore, the geographic extent was assigned a Level II.

8.9.2.3 Timing

The predicted effects of the Project on surface water quantity made use of a numerical model to determine surface water flows at various locations in waterbodies surrounding the Project. As described in Section 8.1.3.8, the assessment has conservatively assumed that the predicted effects of the Project could occur during sensitive times of the year throughout the life of the Project and timing will be assessed as Level III.

8.9.2.4 Duration

Using the approach described in Section 8.1.4, levels of duration were assigned to the predicted residual adverse surface water quantity effects summarized in Tables 8.9.1-1 and 8.9.1-2. The results are presented in Table 8.9.2.4-1.

Table 8.9.2.1-1: Levels of Magnitude for Surface Water Quantity during Operations

Scenario	Calculated Change in Flows, ΔQ (%)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Year													
TL1	Level I	Level I	Level I	Level I	— ⁽¹⁾	—	—	—	—	—	—	Level I	† ⁽²⁾
TL2	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	†
TL3	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	†
HB1	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	†
LC1	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	†
BW1	‡ ⁽³⁾	‡	‡	Level I	Level I	Level I	Level I	‡	‡	‡	‡	Level I	†
BW2	‡	‡	‡	Level I	Level I	Level I	Level I	Level I	‡	Level I	Level I	Level I	†
Dry year													
TL1	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	†
TL2	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	†
TL3	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	†
HB1	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	†
LC1	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	†
BW1	‡	‡	‡	‡	Level II	Level II	Level II	Level II	Level II	Level II	Level II	Level II	†
BW2	‡	‡	‡	‡	Level II	Level II	Level II	Level II	Level II	Level II	Level II	Level I	†
Wet Year													
TL1	—	—	—	—	—	—	—	—	—	—	—	—	—
TL2	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	†
TL3	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	†
HB1	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	†
LC1	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	†
BW1	Level I	‡	‡	Level I	Level I	‡	‡	‡	‡	‡	‡	Level I	†
BW2	Level I	‡	‡	Level I	Level I	‡	Level I	‡	‡	Level I	Level I	Level I	†

Notes:

- (1) The “—” symbol indicates where no adverse effects were predicted
- (2) The “†” symbol indicates predicted decreases in annual flows. Decreases in flows are evaluated with monthly flows
- (3) The “‡” symbol indicates predicted increases in monthly flows. Increases in flows are evaluated with annual flows

Table 8.9.2.1-2: Levels of Magnitude for Surface Water Quantity during Post-closure

Scenario	Calculated Change in Flows, ΔQ (%)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Year													
TL1	— ⁽¹⁾	—	—	—	—	—	—	—	—	—	—	—	—
TL2	‡ ⁽²⁾	‡	‡	‡	‡	‡	‡	‡	‡	‡	‡	‡	Level I
TL3	‡	‡	‡	‡	‡	‡	‡	‡	‡	‡	‡	‡	Level I
HB1	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	† ⁽³⁾
LC1	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	†
BW1	‡	‡	‡	‡	‡	Level I	Level I	Level I	‡	‡	‡	‡	Level I
BW2	‡	‡	‡	‡	‡	Level I	Level I	Level I	‡	‡	‡	‡	Level I
Dry year													
TL1	—	—	—	—	—	—	—	—	—	—	—	—	—
TL2	‡	‡	‡	‡	‡	‡	‡	‡	‡	‡	‡	‡	Level I
TL3	‡	‡	‡	‡	‡	‡	‡	‡	‡	‡	‡	‡	Level I
HB1	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	†
LC1	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	†
BW1	‡	‡	‡	‡	‡	Level I	‡	‡	Level II				
BW2	‡	‡	‡	‡	‡	Level I	‡	‡	Level I				
Wet Year													
TL1	—	—	—	—	—	—	—	—	—	—	—	—	—
TL2	‡	‡	‡	‡	‡	‡	‡	‡	‡	‡	‡	‡	Level I
TL3	‡	‡	‡	‡	‡	‡	‡	‡	‡	‡	‡	‡	Level I
HB1	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	†
LC1	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	Level I	†
BW1	‡	‡	‡	‡	‡	‡	‡	Level I	‡	‡	‡	‡	Level I
BW2	‡	‡	‡	‡	‡	‡	‡	Level I	‡	‡	‡	‡	Level I

Notes:

- (1) The “—” symbol indicates where no adverse effects were predicted
- (2) The “‡” symbol indicates predicted increases in monthly flows. Increases in flows are evaluated with annual flows
- (3) The “†” symbol indicates predicted decreases in annual flows. Decreases in flows are evaluated with monthly flows

Table 8.9.2.4-1: Levels of Duration for Residual Adverse Effects on Surface Water Quantity

Sub-watershed	Level of Geographic Extent			
	Site Preparation and Construction	Operations	Closure	Post-closure
TL1	—	Level II	—	—
TL2	—	Level II	—	Level III
TL3	—	Level II	—	Level III
HB1	—	Level II	—	Level III
LC1	—	Level II	—	Level III
BW1	—	Level II	—	Level III
BW2	—	Level II	—	Level III

Note: The “—” symbol indicates that there was no adverse effect predicted

8.9.2.5 Frequency

The predicted effects of the Project on surface water quantity made use of a numerical model to determine surface water flows at various locations in waterbodies surrounding the Project. The levels of frequency for the residual adverse effects on surface water quantity are summarized in Table 8.9.2.5-1, using the method described in Section 8.1.5.8. The level of frequency was assigned based on the highest magnitude predicted in a particular sub-watershed and time period (i.e., month or annual).

8.9.2.6 Reversibility

The reversibility of the residual effects of the Project on surface water quantity have been classified as a Level II for Thunder Lake Tributary 2 and Thunder Lake Tributary 3 for the operations and post-closure phases. Once water takings cease from the two dug ponds along Thunder Lake Tributary 3 and the pond located on Thunder Lake Tributary 2, surface water flows would return to existing conditions over a period of time. The reversibility of the residual effects of the Project on surface water quantity have been classified as a Level III for Blackwater Creek, Little Creek and Hoffstrom’s Bay Tributary for the operations and post-closure phases of the Project. These effects are considered to be not reversible as these catchment sizes will be affected as a result of the Project. Refer to Table 8.9.2.6-1 for levels of reversibility for residual adverse effects on surface water quantity.

Table 8.9.2.5-1: Levels of Frequency for Surface Water Quantity

Scenario	Levels of Frequency												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Site Preparation and Construction													
No residual adverse effects													
Operations Phase													
TL1	Level II	Level II	Level II	Level II	Level I	Level II	† ⁽¹⁾						
TL2	Level III	Level III	Level III	Level III	Level III	Level III	Level III	Level III	Level III	Level III	Level III	Level III	†
TL3	Level III	Level III	Level III	Level III	Level III	Level III	Level III	Level III	Level III	Level III	Level III	Level III	†
HB1	Level III	Level III	Level III	Level III	Level III	Level III	Level III	Level III	Level III	Level III	Level III	Level III	†
LC1	Level III	Level III	Level III	Level III	Level III	Level III	Level III	Level III	Level III	Level III	Level III	Level III	†
BW1	Level I	‡	‡	Level II	Level I	Level III	Level II						
BW2	Level I	‡	‡	Level II	Level I	Level III	Level II						
Post-closure Phase													
TL1	— ⁽²⁾	—	—	—	—	—	—	—	—	—	—	—	—
TL2	‡ ⁽³⁾	‡	‡	‡	‡	‡	‡	‡	‡	‡	‡	‡	Level III
TL3	‡	‡	‡	‡	‡	‡	‡	‡	‡	‡	‡	‡	Level III
HB1	Level III	Level II	Level III	† ⁽³⁾									
LC1	Level III	Level III	Level III	Level III	Level III	Level III	Level III	Level III	Level III	Level III	Level III	Level III	†
BW1	‡	‡	‡	‡	‡	Level II	Level II	Level III	Level I	Level I	‡	‡	Level III
BW2	‡	‡	‡	‡	‡	Level II	Level II	Level III	Level I	Level I	‡	‡	Level III
Post-closure Phase													
No residual adverse effects													

Notes:

- The frequencies were assigned for the largest magnitude in a particular sub-watershed and time period
- (1) The “†” symbol indicates predicted decreases in annual flows. Decreases in flows are evaluated with monthly flows
- (2) The “—” symbol indicates where no adverse effects were predicted
- (3) The “‡” symbol indicates predicted increases in monthly flows. Increases in flows are evaluated with annual flows

Table 8.9.2.6-1: Levels of Reversibility for Residual Adverse Effects on Surface Water Quantity

Sub-watershed	Level of Reversibility			
	Site Preparation and Construction	Operations	Closure	Post-closure
TL1	—	Level I	—	—
TL2	—	Level I	—	Level II
TL3	—	Level I	—	Level II
HB1	—	Level III	—	Level III
LC1	—	Level III	—	Level III
BW1	—	Level I	—	Level III
BW2	—	Level I	—	Level III

Note: The “—” symbol indicates that there was no adverse effect predicted

8.9.2.7 Determination of Significance

For the effects of the Project on surface water quantity to be considered significant, the predicted residual adverse effects would need to be sufficiently large to permanently change the hydrologic and geomorphologic function of the watercourse. This definition focusses on the hydrologic significance, and does not consider the significance of changes in surface water flows to aquatic life. The evaluation of changes in flows on aquatic life has been incorporated into the assessment of effects on fish and fish habitat (Section 6.14).

Based on this hypothesis, the changes in average flows predicted for surface water quantity would not result in permanent changes that are of sufficient magnitude to alter the hydrologic function of capacity of the watercourses.

Table 8.9.2.7-1 lists the various levels assigned for the elements introduced in Section 8.9. The classification of the effects for the elements presented in the table are described in the preceding sections. By applying the decision tree presented in Figure 8.1.8-1 the assigned assessment levels yields a determination that the residual adverse effects on surface water quantity would be not significant.

The residual adverse effects of the Project on surface water quantity were determined to be not significant using a reasoned narrative approach as well as when using the decision tree (Figure 8.1.8-1). Therefore, it is concluded that the Project will not have a significant adverse effect on surface water quantity.

8.9.3 Prediction Confidence and Uncertainty

The modelling of the effects of the Project on surface water quantities made use of a model developed based on long-term flow statistics from a representative, regional Water Survey of Canada (WSC) station. The confidence in the results were enhanced by conducting the hydrologic modelling for the following range of hydrologic conditions:

Table 8.9.2.7-1: Determination of Significance for Surface Water Quantity

Valued Components (VCs)	Indicator	Node	Magnitude ⁽¹⁾	Geographic Extent ⁽²⁾	Timing	Duration	Frequency ⁽³⁾	Reversibility ⁽⁴⁾	Significance	Likelihood	
Site Preparation and Construction Phase											
Surface water quantity	No residual adverse effects										
Operations Phase											
Surface water quantity	Increase in surface water flows	TL1	† ⁽⁶⁾	†	†	†	†	†	†	†	
		TL2	†	†	†	†	†	†	†	†	
		TL3	†	†	†	†	†	†	†	†	
		HB1	†	†	†	†	†	†	†	†	
		LC1	†	†	†	†	†	†	†	†	
		BW1	†	†	†	†	†	†	†	†	
		BW2	†	†	†	†	†	†	†	†	
	Decrease in surface water flows	TL1	Level I	Level II	Level III	Level II	Level III	Level II	Level II	Not significant	NA ⁽⁵⁾
		TL2	Level I	Level II	Level III	Level II	Level III	Level II	Level II	Not significant	NA ⁽⁵⁾
		TL3	Level I	Level II	Level III	Level II	Level III	Level II	Level II	Not significant	NA ⁽⁵⁾
		HB1	Level I	Level II	Level III	Level II	Level III	Level III	Level III	Not significant	NA ⁽⁵⁾
		LC1	Level I	Level II	Level III	Level II	Level III	Level III	Level III	Not significant	NA ⁽⁵⁾
		BW1	Level II	Level II	Level III	Level II	Level I	Level II	Level II	Not significant	NA ⁽⁵⁾
	BW2	Level II	Level II	Level III	Level II	Level I	Level II	Level II	Not significant	NA ⁽⁵⁾	
Change in lake levels	No residual adverse effects										
Closure Phase											
Surface water quantity	No residual adverse effects										
Post-closure Phase											
Surface water quantity	Increase in surface water flows	TL1	— ⁽⁷⁾	—	—	—	—	—	—	—	
		TL2	Level I	Level II	Level III	Level III	Level III	Level III	Level III	Not significant	NA ⁽⁵⁾
		TL3	Level I	Level II	Level III	Level III	Level III	Level III	Level III	Not significant	NA ⁽⁵⁾
		HB1	†	†	†	†	†	†	†	†	†
		LC1	†	†	†	†	†	†	†	†	†
		BW1	Level I	Level II	Level III	Level III	Level III	Level III	Level III	Not significant	NA ⁽⁵⁾
		BW2	Level I	Level II	Level III	Level III	Level III	Level III	Level III	Not significant	NA ⁽⁵⁾
	Decrease in surface water flows	TL1	—	—	—	—	—	—	—	—	—
		TL2	‡ ⁽⁸⁾	‡	‡	‡	‡	‡	‡	‡	‡
		TL3	‡	‡	‡	‡	‡	‡	‡	‡	‡
		HB1	Level I	Level II	Level III	Level III	Level III	Level III	Level III	Not significant	NA ⁽⁵⁾
		LC1	Level I	Level II	Level III	Level III	Level III	Level III	Level III	Not significant	NA ⁽⁵⁾
		BW1	Level I	Level II	Level III	Level III	Level III	Level III	Level III	Not significant	NA ⁽⁵⁾
	BW2	Level I	Level II	Level III	Level III	Level III	Level III	Level III	Not significant	NA ⁽⁵⁾	
Change in lake levels	No residual adverse effects										

- NOTES: (1) The level of magnitude was based on the highest assigned for each indicator for that phase of the Project.
(2) The geographic extent was based on the extent for the highest magnitude assigned for each indicator for that phase of the Project
(3) The frequency was based on the frequency assigned for the highest magnitude assigned for each indicator that phase of the Project
(4) The reversibility was based on the reversibility for the highest magnitude assigned for each indicator that phase of the Project
(5) In accordance with Agency guidance (CEAA, 2015b) likelihood was not determined as none of the effects were classified as significant
(6) The "†" symbol indicates that there were no predicted increases in the annual flows. Increases in flows were evaluated on an annual basis.
(7) The "—" symbol indicates that there were no predicted residual adverse effects.
(8) The "‡" symbol indicates that there were no predicted decreases in monthly flows. Decreases in flows were evaluated on a monthly basis.

- Average hydrologic year;
- A dry hydrologic year, based on the 1:20 year (5th percentile) low annual flows; and
- A wet hydrologic year, based on the 1:20 year (95th percentile) high annual flows.

8.10 Groundwater Quality

As described in Section 6.10.6, there were no predicted adverse effects of the Project on groundwater quality. Although some of the seepage from the waste rock storage area (WRSA) and tailings storage facility (TSF) is predicted to leave the site during the post-closure phase, after the after the pit lake is filled and the groundwater levels return to near pre-development conditions, the groundwater modelling determined that this seepage would report to surface water courses and would not affect water wells in the area. The effects of seepage during post-closure on surface watercourses was incorporated into the assessment effects on surface water quality.

Because there were no predicted residual adverse effects on groundwater quality, no determination of significance is required.

8.11 Groundwater Quantity

As described in Section 6.11.6, there were no predicted adverse effects of the Project on groundwater quantity. Although the lowering of the groundwater levels as a result of dewatering is predicted to reduce the groundwater discharge to surface waterbodies in the area, the effects associated with these have been evaluated as an integral component of the evaluation of the effects of the Project on surface water quantities (Section 6.9), and the associated determination of significance (Section 8.9).

Because there were no predicted residual adverse effects on groundwater quality, no determination of significance is required.

8.12 Wildlife and Wildlife Habitat

8.12.1 Residual Adverse Effects and Cumulative Effects Advanced for Determination of Significance

Residual adverse effects of the Project on wildlife and wildlife habitat were predicted to occur during the site preparation and construction, operations, and closure phases of the Project. There were no residual adverse effects during the post-closure phase. The predicted residual adverse effects were determined using a combination of numerical GIS models, and qualitative evaluation of the effects as described in Section 6.12.6. The residual adverse effects of the Project on wildlife and wildlife habitat are summarized in Table 8.12.1-1.

Table 8.12.1-1: Residual Adverse Effects on Wildlife and Wildlife Habitat

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction	Operations	Closure	Post-closure
Wildlife SAR	Common Nighthawk	Habitat loss (ha)	300	300	300	—
		Habitat alteration or disruption (ha)	198	122	192	—
		Potential for mortality (%)	Medium	Medium	Medium	—
	Northern Myotis/Little Brown Myotis	Habitat loss (ha)	15.85	15.85	15.85	—
		Habitat alteration or disruption (ha)	—	—	—	—
		Potential for mortality (%)	Low	Low	Low	—
	Barn Swallow	Habitat loss (ha)	—	—	—	—
		Habitat alteration or disruption (ha)	198	122	192	—
		Potential for mortality (%)	Medium	Medium	Medium	—
Ungulates	Moose	Habitat loss (ha)	84	84	84	—
		Habitat alteration or disruption (ha)	57	34	53	—
		Potential for mortality (%)	Medium	Medium	Medium	—
Furbearers	American Marten	Habitat loss (ha)	62	62	62	—
		Habitat alteration or disruption (ha)	14	8	14	—
		Potential for mortality (%)	Low	Low	Low	—
Upland birds	Upland birds	Habitat loss (ha)	95	95	95	—
		Habitat alteration or disruption (ha)	3.21	4.3	2.6	—
		Potential for mortality (%)	Medium	Medium	Medium	—
Wetland birds	Marsh birds	Habitat loss (ha)	33	33	33	—
		Habitat alteration or disruption (ha)	2.9	7.5	0.7	—
		Potential for mortality (%)	Low	Low	Low	—
Small mammals	Small mammals	Habitat loss (ha)	—	—	—	—
		Habitat alteration or disruption (ha)	400	109	172	—
		Potential for mortality (%)	Medium	Medium	Medium	—
Reptiles and Amphibians	Reptiles and amphibians	Habitat loss (ha)	162	162	162	—
		Habitat alteration or disruption (ha)	89	60	88	—
		Potential for mortality (%)	Medium	Medium	Medium	—
Reptiles and amphibians	Reptiles and amphibians	Habitat loss (ha)	162	162	162	—
		Habitat alteration or disruption (ha)	89	60	88	—
		Potential for mortality (%)	Medium	Medium	Medium	—
Invertebrates	Terrestrial invertebrates	Habitat loss (ha)	—	—	—	—
		Habitat alteration or disruption (ha)	400	400	400	—
		Potential for mortality (%)	Medium	Medium	Medium	—

Note: (1) The “—” symbol indicates there were no residual adverse effects.

Section 7.5.6 identifies that cumulative wildlife and wildlife effects are predicted for the following activities:

- Ongoing forestry operations by Dryden Forest Management Company; and
- The 230kV transmission line proposed by Wataynikaneyap Power.

The specific cumulative effects predicted were for the loss of additional habitat. For most of the wildlife VCs and indicators, the residual adverse effects, and thus the cumulative effects, are evaluated on the local scale. At this scale, only the ongoing forestry operations by Dryden Forest Management Company were predicted to have a cumulative effect. However, moose has been used as the indicator for the ungulate VC. Because of the wide range of habitat needed to support the various life stages of moose, the ungulate VC has been evaluated on the regional scale. At that scale, a portion of the proposed by Wataynikaneyap Power transmission line was predicted to cause cumulative effect. The levels of magnitude for wildlife and wildlife habitat have been assigned using the combined residual adverse effects of the Project and the cumulative effects. These effects are summarized in Table 8.12.1-2.

8.12.2 Description of Significance

As described in Section 6.1.3.11, the evaluation of effects of the Project on wildlife and wildlife habitat considered eight VCs; namely wildlife species at risk, ungulates, furbearers, upland birds, wetland birds, small mammals, reptiles and amphibians, invertebrates.

8.12.2.1 Magnitude

The levels of magnitude for the predicted residual adverse effects (including cumulative effects) on wildlife and wildlife habitat (Table 8.12.1-1) were assigned using the approach described in Section 8.1.1.11. The results are summarized in Table 8.12.2.1-1.

8.12.2.2 Geographic Extent

Geographic extent to the residual adverse effects on wildlife and wildlife habitat (Table 8.12.1-1) was assigned using the approach described in Section 8.1.2. The geographic extents are summarized in Table 8.12.2.2-1.

8.12.2.3 Timing

The levels of timing for the residual adverse effects on wildlife and wildlife habitat (Table 8.12.1-1) were assigned using the approach described in Section 8.1.3.11. The results are summarized in Table 8.12.2.3-1.

Table 8.12.1-2: Residual Adverse Effects and Cumulative Effects on Wildlife and Wildlife Habitat

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction				Operations				Closure				Post-closure
			Goliath Gold Project	Dryden Forest Management Company	Wataynikane yap Power	Cumulative Effect	Goliath Gold Project	Dryden Forest Management Company	Wataynikane yap Power	Cumulative Effect	Goliath Gold Project	Dryden Forest Management Company	Wataynikane yap Power	Cumulative Effect	Goliath Gold Project
Wildlife SAR	Common Nighthawk	Habitat loss (ha)	300	0	— ⁽²⁾	300	300	300	0	— ⁽²⁾	300	0	— ⁽²⁾	300	—
		Habitat alteration or disruption (ha)	198	—	—	198	122	—	—	122	192	—	—	192	—
		Potential for Mortality (%)	Medium	—	—	Medium	Medium	—	—	Medium	Medium	—	—	Medium	—
	Northern Myotis/ Little Brown Myotis	Habitat loss (ha)	16	5	—	21	15.85	16	5	—	21	16	5	—	21
		Habitat alteration or disruption (ha)	— ⁽¹⁾	—	—	—	—	—	—	—	—	—	—	—	—
		Potential for Mortality (%)	Low	—	—	Low	Low	—	—	Low	Low	—	—	Low	—
	Barn Swallow	Habitat loss (structures)	Several	0	—	Several	Several	Several	0	—	Several	0	—	Several	—
		Habitat alteration or disruption (ha)	198	—	—	198	122	—	—	122	192	—	—	192	—
		Potential for Mortality (%)	Medium	—	—	Medium	Medium	—	—	Medium	Medium	—	—	Medium	—
Ungulates	Moose	Habitat loss (ha)	84	56	6	146	84	84	56	6	146	84	56	6	146
		Habitat alteration or disruption (ha)	57	—	—	57	34	—	—	34	53	—	—	53	—
		Potential for Mortality (%)	Medium	—	—	Medium	Medium	—	—	Medium	Medium	—	—	Medium	—
Furbearers	American Marten	Habitat loss (ha)	62	36	—	98	62	36	—	98	62	36	—	98	—
		Habitat alteration or disruption (ha)	14	—	—	14	8	—	—	8	14	—	—	14	—
		Potential for Mortality (%)	Low	—	—	Low	Low	—	—	Low	Low	—	—	Low	—
	American Beaver	Habitat loss (ha)	< 4	0	—	<4	< 4	0	—	<4	< 4	0	—	<4	—
		Habitat alteration or disruption (ha)	—	—	—	—	—	—	—	—	—	—	—	—	—
		Potential for Mortality (%)	Low	—	—	Low	Low	—	—	Low	Low	—	—	Low	—
Upland Birds	Upland Birds	Habitat loss (ha)	95	0	—	95	95	0	—	95	95	0	—	95	—
		Habitat alteration or disruption (ha)	3.21	—	—	3.21	4.3	—	—	4.3	2.6	—	—	2.6	—
		Potential for Mortality (%)	Medium	—	—	Medium	Medium	—	—	Medium	Medium	—	—	Medium	—
Wetland Birds	Marsh Birds	Habitat loss (ha)	33	6	—	39	33	6	—	39	33	6	—	39	—
		Habitat alteration or disruption (ha)	2.9	—	—	2.9	7.5	—	—	7.5	0.7	—	—	0.7	—
		Potential for Mortality (%)	Low	—	—	Low	Low	—	—	Low	Low	—	—	Low	—
Small mammals	Small Mammals	Habitat loss (ha)	—	—	—	—	—	—	—	—	—	—	—	—	—
		Habitat alteration or disruption (ha)	400	—	—	400	109	—	—	109	172	—	—	172	—
		Potential for Mortality (%)	Medium	—	—	Medium	Medium	—	—	Medium	Medium	—	—	Medium	—
Reptiles and Amphibians	Reptiles and Amphibians	Habitat loss (ha)	162	35	—	197	162	35	—	197	162	35	—	197	—
		Habitat alteration or disruption (ha)	89	—	—	89	60	—	—	60	88	—	—	88	—

Table 7.5.6.2-1: Residual Adverse Effects and Cumulative Effects on Wildlife and Wildlife Habitat (continued)

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction				Operations				Closure				Post-closure
			Goliath Gold Project	Dryden Forest Management Company	Wataynikaneyap Power	Cumulative Effect	Goliath Gold Project	Dryden Forest Management Company	Wataynikaneyap Power	Cumulative Effect	Goliath Gold Project	Dryden Forest Management Company	Wataynikaneyap Power	Cumulative Effect	Goliath Gold Project
		Potential for Mortality (%)	Medium	—	—	Medium	Medium	—	—	Medium	Medium	—	—	Medium	—
Invertebrates	Terrestrial Invertebrates	Habitat loss (ha)	—	—	—	—	—	—	—	—	—	—	—	—	—
		Habitat alteration or disruption (ha)	400	—	—	400	400	—	—	400	400	—	—	400	—
		Potential for Mortality (%)	Medium	—	—	Medium	Medium	—	—	Medium	Medium	—	—	Medium	—

Note:

- (1) The "—" symbol indicates there were no predicted residual adverse effects, or no cumulative effect.
- (2) Only the ungulate VC is potentially affected by the Wataynikaneyap Power project.

Table 8.12.2.1-1: Levels of Magnitude for Residual Adverse Effects on Wildlife and Wildlife Habitat

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction	Operations	Closure	Post-closure
Wildlife SAR	Common Nighthawk	Habitat loss (ha)	Level I	Level I	Level I	—
		Habitat alteration or disruption (ha)	Level I	Level I	Level I	—
		Potential for mortality (%)	Level II	Level II	Level II	—
	Northern Myotis/Little Brown Myotis	Habitat loss (ha)	Level I	Level I	Level I	—
		Habitat alteration or disruption (ha)	—	—	—	—
		Potential for mortality (%)	Level I	Level I	Level I	—
	Barn Swallow	Habitat loss (ha)	—	—	—	—
		Habitat alteration or disruption (ha)	Level I	Level I	Level I	—
		Potential for mortality (%)	Level II	Level II	Level II	—
Ungulates	Moose	Habitat loss (ha)	Level I	Level I	Level I	—
		Habitat alteration or disruption (ha)	Level I	Level I	Level I	—
		Potential for mortality (%)	Level II	Level II	Level II	—
Furbearers	American Marten	Habitat loss (ha)	Level I	Level I	Level I	—
		Habitat alteration or disruption (ha)	Level I	Level I	Level I	—
		Potential for mortality (%)	Level I	Level I	Level I	—
	American Beaver	Habitat loss (ha)	Level I	Level I	Level I	—
		Habitat alteration or disruption (ha)	Level I	Level I	Level I	—
		Potential for mortality (%)	Level I	Level I	Level I	—
Upland birds	Upland birds	Habitat loss (ha)	Level II	Level I	Level I	—
		Habitat alteration or disruption (ha)	Level I	Level I	Level I	—
		Potential for mortality (%)	Level II	Level II	Level II	—
Wetland birds	Marsh birds	Habitat loss (ha)	Level I	Level I	Level I	—
		Habitat alteration or disruption (ha)	Level I	Level I	Level I	—
		Potential for mortality (%)	Level I	Level I	Level I	—
Small mammals	Small mammals	Habitat loss (ha)	—	—	—	—
		Habitat alteration or disruption (ha)	Level I	Level I	Level I	—
		Potential for mortality (%)	Level II	Level II	Level II	—
Reptiles and amphibians	Reptiles and amphibians	Habitat loss (ha)	Level I	Level I	Level I	—
		Habitat alteration or disruption (ha)	Level I	Level I	Level I	—
		Potential for mortality (%)	Level II	Level II	Level II	—
Invertebrates	Terrestrial invertebrates	Habitat loss (ha)	—	—	—	—
		Habitat alteration or disruption (ha)	Level I	Level I	Level I	—
		Potential for mortality (%)	Level II	Level II	Level II	—

Note: (1) The “—” symbol indicates there were no residual adverse effects

Table 8.12.2.2-1: Levels of Geographic Extent for Residual Adverse Effects on Wildlife and Wildlife Habitat

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction	Operations	Closure	Post-closure
Wildlife SAR	Common Nighthawk	Habitat loss (ha)	Level II	Level II	Level II	—
		Habitat alteration or disruption (ha)	Level II	Level II	Level II	—
		Potential for mortality (%)	Level II	Level II	Level II	—
	Northern Myotis/Little Brown Myotis	Habitat loss (ha)	Level II	Level II	Level II	—
		Habitat alteration or disruption (ha)	—	—	—	—
		Potential for mortality (%)	Level II	Level II	Level II	—
	Barn Swallow	Habitat loss (ha)	—	—	—	—
		Habitat alteration or disruption (ha)	Level II	Level II	Level II	—
		Potential for mortality (%)	Level II	Level II	Level II	—
Ungulates	Moose	Habitat loss (ha)	Level II	Level II	Level II	—
		Habitat alteration or disruption (ha)	Level II	Level II	Level II	—
		Potential for mortality (%)	Level II	Level II	Level II	—
Furbearers	American Marten	Habitat loss (ha)	Level II	Level II	Level II	—
		Habitat alteration or disruption (ha)	Level II	Level II	Level II	—
		Potential for mortality (%)	Level II	Level II	Level II	—
	American Beaver	Habitat loss (ha)	Level II	Level II	Level II	—
		Habitat alteration or disruption (ha)	Level II	Level II	Level II	—
		Potential for mortality (%)	Level II	Level II	Level II	—
Upland Birds	Upland birds	Habitat loss (ha)	Level II	Level II	Level II	—
		Habitat alteration or disruption (ha)	Level II	Level II	Level II	—
		Potential for mortality (%)	Level II	Level II	Level II	—
Wetland birds	Marsh birds	Habitat loss (ha)	Level II	Level II	Level II	—
		Habitat alteration or disruption (ha)	Level II	Level II	Level II	—
		Potential for mortality (%)	Level II	Level II	Level II	—
Small mammals	Small mammals	Habitat loss (ha)	—	—	—	—
		Habitat alteration or disruption (ha)	Level II	Level II	Level II	—
		Potential for mortality (%)	Level II	Level II	Level II	—
Reptiles and amphibians	Reptiles and amphibians	Habitat loss (ha)	Level II	Level II	Level II	—
		Habitat alteration or disruption (ha)	Level II	Level II	Level II	—
		Potential for mortality (%)	Level II	Level II	Level II	—
Invertebrates	Terrestrial invertebrates	Habitat loss (ha)	—	—	—	—
		Habitat alteration or disruption (ha)	Level II	Level II	Level II	—
		Potential for mortality (%)	Level II	Level II	Level II	—

Note: (1) The “—” symbol indicates there were no residual adverse effects

Table 8.12.2.3-1: Levels of Timing for Residual Adverse Effects on Wildlife and Wildlife Habitat

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction	Operations	Closure	Post-closure
Wildlife SAR	Common Nighthawk	Habitat loss (ha)	Level I	Level I	Level I	—
		Habitat alteration or disruption (ha)	Level III	Level III	Level III	—
		Potential for mortality (%)	Level II	Level III	Level III	—
	Northern Myotis/Little Brown Myotis	Habitat loss (ha)	Level I	Level I	Level I	—
		Habitat alteration or disruption (ha)	—	—	—	—
		Potential for mortality (%)	Level II	Level III	Level III	—
	Barn Swallow	Habitat loss (ha)	—	—	—	—
		Habitat alteration or disruption (ha)	Level III	Level III	Level III	—
		Potential for mortality (%)	Level II	Level III	Level III	—
Ungulates	Moose	Habitat loss (ha)	Level III	Level III	Level III	—
		Habitat alteration or disruption (ha)	Level III	Level III	Level III	—
		Potential for mortality (%)	Level III	Level III	Level III	—
Furbearers	American Marten	Habitat loss (ha)	Level III	Level III	Level III	—
		Habitat alteration or disruption (ha)	Level III	Level III	Level III	—
		Potential for mortality (%)	Level III	Level III	Level III	—
	American Beaver	Habitat loss (ha)	Level III	Level III	Level III	—
		Potential for mortality (%)	Level III	Level III	Level III	—
Upland birds	Upland birds	Habitat loss (ha)	Level I	Level I	Level I	—
		Habitat alteration or disruption (ha)	Level III	Level III	Level III	—
		Potential for mortality (%)	Level II	Level III	Level III	—
Wetland birds	Marsh birds	Habitat loss (ha)	Level I	Level I	Level I	—
		Habitat alteration or disruption (ha)	Level III	Level III	Level III	—
		Potential for mortality (%)	Level II	Level III	Level III	—
Small mammals	Small Mammals	Habitat loss (ha)	—	—	—	—
		Habitat alteration or disruption (ha)	Level III	Level III	Level III	—
		Potential for mortality (%)	Level II	Level III	Level III	—
Reptiles and amphibians	Reptiles and amphibians	Habitat loss (ha)	Level I	Level I	Level I	—
		Habitat alteration or disruption (ha)	Level III	Level III	Level III	—
		Potential for mortality (%)	Level II	Level III	Level III	—
Invertebrates	Terrestrial invertebrates	Habitat loss (ha)	—	—	—	—
		Habitat alteration or disruption (ha)	Level III	Level III	Level III	—
		Potential for mortality (%)	Level III	Level III	Level III	—

Note: (1) The “—” symbol indicates there were no residual adverse effects

8.12.2.4 Duration

The levels of duration for the predicted residual effects of the Project on wildlife and wildlife habitat (Table 8.12.1-1) were assigned using the approach described in Section 8.1.4. When assigning the duration (Table 8.12.2.4-1) for “habitat loss”, Level II was assigned as the habitat will remain lost through to post-closure.

8.12.2.5 Frequency

The levels of frequency for the predicted residual effects of the Project on wildlife and wildlife habitat (Table 8.12.1-1) were assigned using the approach described in Section 8.1.5.11. The results are summarized in Table 8.12.2.5-1.

8.12.2.6 Reversibility

The levels of reversibility for the predicted residual effects of the Project on wildlife and wildlife habitat (Table 8.12.1-1) were assigned using the approach described in Section 8.1.6. When assigning the reversibility (Table 8.12.2.6-1) for “habitat loss”, Level II was assigned as the habitat will recover over time. Level I was assigned for the habitat alteration and potential for mortality as those effects will stop once the activities causing the effect stop (e.g., noise from equipment), and will recover as soon as the activity causing the effect stops.

8.12.2.7 Determination of Significance

Based on experience with Projects in the boreal forest region of Ontario, a significant effect to wildlife or wildlife habitat is one that would alter the available habitat to an extent where it would have serious, long-term effects on a species at the local or regional scale. When the predicted residual adverse effects of the Project on wildlife and wildlife habitat are tested against this definition of significance, no significant adverse effects are predicted. The reason is that none of the residual adverse effects were classified with a Level III magnitude, which is the level required for there to be serious long term effects. In this regard, the magnitude can act as a surrogate for significance.

Table 8.12.2.7-1 lists the various levels assigned for the elements introduced in Section 8.1. The classification of the effects for the elements presented in the table are described in these preceding sections:

- Magnitude: Section 8.12.2.1;
- Geographic extent: Section 8.12.2.2;
- Timing: Section 8.12.2.3;
- Duration: Section 8.12.2.4;

Table 8.12.2.4-1: Levels of Duration for Residual Adverse Effects on Wildlife and Wildlife Habitat

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction	Operations	Closure	Post-closure
Wildlife SAR	Common Nighthawk	Habitat loss (ha)	Level II	Level II	Level II	—
		Habitat alteration or disruption (ha)	Level I	Level II	Level I	—
		Potential for mortality (%)	Level I	Level II	Level I	—
	Northern Myotis/Little Brown Myotis	Habitat loss (ha)	Level II	Level II	Level II	—
		Habitat alteration or disruption (ha)	—	—	—	—
		Potential for mortality (%)	Level II	Level II	Level II	—
	Barn Swallow	Habitat loss (ha)	—	—	—	—
		Habitat alteration or disruption (ha)	Level I	Level II	Level I	—
		Potential for mortality (%)	Level I	Level II	Level I	—
Ungulates	Moose	Habitat loss (ha)	Level II	Level II	Level II	—
		Habitat alteration or disruption (ha)	Level I	Level II	Level I	—
		Potential for mortality (%)	Level I	Level II	Level I	—
Furbearers	American Marten	Habitat loss (ha)	Level II	Level II	Level II	—
		Habitat alteration or disruption (ha)	Level I	Level II	Level I	—
		Potential for mortality (%)	Level I	Level II	Level I	—
	American Beaver	Habitat loss (ha)	Level II	Level II	Level II	—
		Habitat alteration or disruption (ha)	Level I	Level II	Level I	—
		Potential for mortality (%)	Level I	Level II	Level I	—
Upland birds	Upland birds	Habitat loss (ha)	Level II	Level II	Level II	—
		Habitat alteration or disruption (ha)	Level I	Level II	Level I	—
		Potential for mortality (%)	Level I	Level II	Level I	—
Wetland birds	Marsh birds	Habitat loss (ha)	Level II	Level II	Level II	—
		Habitat alteration or disruption (ha)	Level I	Level II	Level I	—
		Potential for mortality (%)	Level I	Level II	Level I	—
Small mammals	Small Mammals	Habitat loss (ha)	—	—	—	—
		Habitat alteration or disruption (ha)	Level I	Level II	Level I	—
		Potential for mortality (%)	Level I	Level II	Level I	—
Reptiles and amphibians	Reptiles and amphibians	Habitat loss (ha)	Level II	Level II	Level II	—
		Habitat alteration or disruption (ha)	Level I	Level II	Level I	—
		Potential for mortality (%)	Level I	Level II	Level I	—
Invertebrates	Terrestrial invertebrates	Habitat loss (ha)	—	—	—	—
		Habitat alteration or disruption (ha)	Level I	Level II	Level I	—
		Potential for mortality (%)	Level I	Level II	Level I	—

Note: (1) The “—” symbol indicates there were no residual adverse effects

Table 8.12.2.5-1: Levels of Frequency for Residual Adverse Effects on Wildlife and Wildlife Habitat

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction	Operations	Closure	Post-closure
Wildlife SAR	Common Nighthawk	Habitat loss (ha)	Level III	Level III	Level III	—
		Habitat alteration or disruption (ha)	Level III	Level III	Level III	—
		Potential for mortality (%)	Level III	Level III	Level III	—
	Northern Myotis/Little Brown Myotis	Habitat loss (ha)	Level III	Level III	Level III	—
		Habitat alteration or disruption (ha)	—	—	—	—
		Potential for mortality (%)	Level III	Level III	Level III	—
	Barn Swallow	Habitat loss (ha)	—	—	—	—
		Habitat alteration or disruption (ha)	Level III	Level III	Level III	—
		Potential for mortality (%)	Level III	Level III	Level III	—
Ungulates	Moose	Habitat loss (ha)	Level III	Level III	Level III	—
		Habitat alteration or disruption (ha)	Level III	Level III	Level III	—
		Potential for mortality (%)	Level III	Level III	Level III	—
Furbearers	American Marten	Habitat loss (ha)	Level III	Level III	Level III	—
		Habitat alteration or disruption (ha)	Level III	Level III	Level III	—
		Potential for mortality (%)	Level III	Level III	Level III	—
	American Beaver	Habitat loss (ha)	Level III	Level III	Level III	—
		Habitat alteration or disruption (ha)	Level III	Level III	Level III	—
		Potential for mortality (%)	Level III	Level III	Level III	—
Upland birds	Upland birds	Habitat loss (ha)	Level III	Level III	Level III	—
		Habitat alteration or disruption (ha)	Level III	Level III	Level III	—
		Potential for mortality (%)	Level III	Level III	Level III	—
Wetland birds	Marsh birds	Habitat loss (ha)	Level III	Level III	Level III	—
		Habitat alteration or disruption (ha)	Level III	Level III	Level III	—
		Potential for mortality (%)	Level III	Level III	Level III	—
Small mammals	Small mammals	Habitat loss (ha)	—	—	—	—
		Habitat alteration or disruption (ha)	Level III	Level III	Level III	—
		Potential for mortality (%)	Level III	Level III	Level III	—
Reptiles and amphibians	Reptiles and amphibians	Habitat loss (ha)	Level III	Level III	Level III	—
		Habitat alteration or disruption (ha)	Level III	Level III	Level III	—
		Potential for mortality (%)	Level III	Level III	Level III	—
Invertebrates	Terrestrial invertebrates	Habitat loss (ha)	—	—	—	—
		Habitat alteration or disruption (ha)	Level III	Level III	Level III	—
		Potential for mortality (%)	Level III	Level III	Level III	—

Note: (1) The “—” symbol indicates there were no residual adverse effects

Table 8.12.2.6-1: Levels of Reversibility for Residual Adverse Effects on Wildlife and Wildlife Habitat

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction	Operations	Closure	Post-closure
Wildlife SAR	Common Nighthawk	Habitat loss (ha)	Level II	Level II	Level II	—
		Habitat alteration or disruption (ha)	Level I	Level I	Level I	—
		Potential for mortality (%)	Level I	Level I	Level I	—
	Northern Myotis/Little Brown Myotis	Habitat loss (ha)	Level II	Level II	Level II	—
		Habitat alteration or disruption (ha)	—	—	—	—
		Potential for mortality (%)	Level I	Level I	Level I	—
	Barn Swallow	Habitat loss (ha)	—	—	—	—
		Habitat alteration or disruption (ha)	Level I	Level I	Level I	—
		Potential for mortality (%)	Level I	Level I	Level I	—
Ungulates	Moose	Habitat loss (ha)	Level II	Level II	Level II	—
		Habitat alteration or disruption (ha)	Level I	Level I	Level I	—
		Potential for mortality (%)	Level I	Level I	Level I	—
Furbearers	American Marten	Habitat loss (ha)	Level II	Level II	Level II	—
		Habitat alteration or disruption (ha)	Level I	Level I	Level I	—
		Potential for mortality (%)	Level I	Level I	Level I	—
	American Beaver	Habitat loss (ha)	Level II	Level II	Level II	—
		Habitat alteration or disruption (ha)	Level I	Level I	Level I	—
		Potential for mortality (%)	Level I	Level I	Level I	—
Upland birds	Upland birds	Habitat loss (ha)	Level II	Level II	Level II	—
		Habitat alteration or disruption (ha)	Level I	Level I	Level I	—
		Potential for mortality (%)	Level I	Level I	Level I	—
Wetland birds	Marsh birds	Habitat loss (ha)	Level II	Level II	Level II	—
		Habitat alteration or disruption (ha)	Level I	Level I	Level I	—
		Potential for mortality (%)	Level I	Level I	Level I	—
Small mammals	Small mammals	Habitat loss (ha)	—	—	—	—
		Habitat alteration or disruption (ha)	Level I	Level I	Level I	—
		Potential for mortality (%)	Level I	Level I	Level I	—
Reptiles and amphibians	Reptiles and amphibians	Habitat loss (ha)	Level II	Level II	Level II	—
		Habitat alteration or disruption (ha)	Level I	Level I	Level I	—
		Potential for mortality (%)	Level I	Level I	Level I	—
Invertebrates	Terrestrial Invertebrates	Habitat loss (ha)	—	—	—	—
		Habitat alteration or disruption (ha)	Level I	Level I	Level I	—
		Potential for mortality (%)	Level I	Level I	Level I	—

Note: (1) The “—” symbol indicates there were no residual adverse effects

Table 8.12.2.7-1: Determination of Significance for Wildlife and Wildlife Habitat

Valued Components (VCs)	Indicators	Measure	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	Significance	Likelihood	
Site Preparation and Construction Phase											
Wildlife species at risk (SAR)	Common Nighthawk	Habitat loss (ha)	Level I	Level II	Level I	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
		Habitat alteration or displacement (ha)	Level I	Level II	Level III	Level I	Level III	Level I	Not significant	NA ⁽¹⁾	
		Potential for mortality	Level II	Level II	Level II	Level I	Level III	Level I	Not significant	NA ⁽¹⁾	
	Northern Myotis/Little Brown Myotis	Habitat loss (ha)	Level I	Level II	Level I	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
		Habitat alteration or displacement (ha)	No residual adverse effects								
		Potential for mortality	Level I	Level II	Level II	Level II	Level III	Level I	Not significant	NA ⁽¹⁾	
	Barn Swallow	Habitat loss (ha)	No residual adverse effects								
		Habitat alteration or displacement (ha)	Level I	Level II	Level III	Level I	Level III	Level I	Not significant	NA ⁽¹⁾	
		Potential for mortality	Level II	Level II	Level II	Level I	Level III	Level I	Not significant	NA ⁽¹⁾	
Ungulates	Moose	Habitat loss (ha)	Level I	Level II	Level III	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
		Habitat alteration or displacement (ha)	Level I	Level II	Level III	Level I	Level III	Level I	Not significant	NA ⁽¹⁾	
		Potential for mortality	Level II	Level II	Level III	Level I	Level III	Level I	Not significant	NA ⁽¹⁾	
Furbearers	American Marten	Habitat loss (ha)	Level I	Level II	Level III	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
		Habitat alteration or displacement (ha)	Level I	Level II	Level III	Level I	Level III	Level I	Not significant	NA ⁽¹⁾	
		Potential for mortality	Level I	Level II	Level III	Level I	Level III	Level I	Not significant	NA ⁽¹⁾	
	American Beaver	Habitat loss (ha)	Level I	Level II	Level III	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
		Habitat alteration or displacement (ha)	Level I	Level II	Level III	Level I	Level III	Level I	Not significant	NA ⁽¹⁾	
		Potential for mortality	Level I	Level II	Level III	Level I	Level III	Level I	Not significant	NA ⁽¹⁾	
Upland birds	Upland birds	Habitat loss (ha)	Level II	Level II	Level I	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
		Habitat alteration or displacement (ha)	Level I	Level II	Level III	Level I	Level III	Level I	Not significant	NA ⁽¹⁾	
		Potential for mortality	Level II	Level II	Level II	Level I	Level III	Level I	Not significant	NA ⁽¹⁾	
Wetland bird	Marsh birds	Habitat loss (ha)	Level I	Level II	Level I	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
		Habitat alteration or displacement (ha)	Level I	Level II	Level III	Level I	Level III	Level I	Not significant	NA ⁽¹⁾	
		Potential for mortality	Level I	Level II	Level II	Level I	Level III	Level I	Not significant	NA ⁽¹⁾	
Small mammals	Small mammals	Habitat loss (ha)	No residual adverse effects								
		Habitat alteration or displacement (ha)	Level I	Level II	Level III	Level I	Level III	Level I	Not significant	NA ⁽¹⁾	
		Potential for mortality	Level II	Level II	Level II	Level I	Level III	Level I	Not significant	NA ⁽¹⁾	
Reptiles and amphibian	Reptiles and amphibians	Habitat loss (ha)	Level I	Level II	Level I	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
		Habitat alteration or displacement (ha)	Level I	Level II	Level III	Level I	Level III	Level I	Not significant	NA ⁽¹⁾	
		Potential for mortality	Level II	Level II	Level II	Level I	Level III	Level I	Not significant	NA ⁽¹⁾	
Invertebrates	Terrestrial invertebrates	Habitat loss (ha)	No residual adverse effects								
		Habitat alteration or displacement (ha)	Level I	Level II	Level III	Level I	Level III	Level I	Not significant	NA ⁽¹⁾	
		Potential for mortality	Level II	Level II	Level III	Level I	Level III	Level I	Not significant	NA ⁽¹⁾	
Operations Phase											
Wildlife species at risk (SAR)	Common Nighthawk	Habitat loss (ha)	Level I	Level II	Level I	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
		Habitat alteration or displacement (ha)	Level I	Level II	Level III	Level II	Level III	Level I	Not significant	NA ⁽¹⁾	
		Potential for mortality	Level II	Level II	Level III	Level II	Level III	Level I	Not significant	NA ⁽¹⁾	
	Northern Myotis/Little Brown Myotis	Habitat loss (ha)	Level I	Level II	Level I	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	

Table 8.12.2.7-1: Determination of Significance for Wildlife and Wildlife Habitat (continued)

Valued Components (VCs)	Indicators	Measure	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	Significance	Likelihood	
Ungulates	Barn Swallow	Habitat alteration or displacement (ha)	No residual adverse effects								
		Potential for mortality	Level I	Level II	Level III	Level II	Level III	Level I	Not significant	NA ⁽¹⁾	
		Habitat loss (ha)	No residual adverse effects								
	Moose	Habitat alteration or displacement (ha)	Level I	Level II	Level III	Level II	Level III	Level I	Not significant	NA ⁽¹⁾	
		Potential for mortality	Level II	Level II	Level III	Level II	Level III	Level I	Not significant	NA ⁽¹⁾	
		Habitat loss (ha)	Level I	Level II	Level III	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
Furbearers	American Marten	Habitat alteration or displacement (ha)	Level I	Level II	Level III	Level II	Level III	Level I	Not significant	NA ⁽¹⁾	
		Potential for mortality	Level I	Level II	Level III	Level II	Level III	Level I	Not significant	NA ⁽¹⁾	
		Habitat loss (ha)	Level I	Level II	Level III	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
	American Beaver	Habitat alteration or displacement (ha)	Level I	Level II	Level III	Level II	Level III	Level I	Not significant	NA ⁽¹⁾	
		Potential for mortality	Level I	Level II	Level III	Level II	Level III	Level I	Not significant	NA ⁽¹⁾	
		Habitat loss (ha)	Level I	Level II	Level III	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
Upland birds	Upland birds	Habitat alteration or displacement (ha)	Level I	Level II	Level III	Level II	Level III	Level I	Not significant	NA ⁽¹⁾	
		Potential for mortality	Level II	Level II	Level III	Level II	Level III	Level I	Not significant	NA ⁽¹⁾	
		Habitat loss (ha)	Level I	Level II	Level I	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
Wetland bird	Marsh birds	Habitat alteration or displacement (ha)	Level I	Level II	Level III	Level II	Level III	Level I	Not significant	NA ⁽¹⁾	
		Potential for mortality	Level I	Level II	Level III	Level II	Level III	Level I	Not significant	NA ⁽¹⁾	
		Habitat loss (ha)	Level I	Level II	Level I	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
Small mammals	Small mammals	Habitat alteration or displacement (ha)	Level I	Level II	Level III	Level II	Level III	Level I	Not significant	NA ⁽¹⁾	
		Potential for mortality	Level II	Level II	Level III	Level II	Level III	Level I	Not significant	NA ⁽¹⁾	
		Habitat loss (ha)	Level I	Level II	Level I	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
Reptiles and amphibian	Reptiles and amphibians	Habitat alteration or displacement (ha)	Level I	Level II	Level III	Level II	Level III	Level I	Not significant	NA ⁽¹⁾	
		Potential for mortality	Level II	Level II	Level III	Level II	Level III	Level I	Not significant	NA ⁽¹⁾	
		Habitat loss (ha)	Level I	Level II	Level I	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
Invertebrates	Terrestrial invertebrates	Habitat alteration or displacement (ha)	Level I	Level II	Level III	Level II	Level III	Level I	Not significant	NA ⁽¹⁾	
		Potential for mortality	Level II	Level II	Level III	Level II	Level III	Level I	Not significant	NA ⁽¹⁾	
		Habitat loss (ha)	No residual adverse effects								
Closure Phase											
Wildlife species at risk (SAR)	Common Nighthawk	Habitat alteration or displacement (ha)	Level I	Level II	Level III	Level I	Level II	Level III	Level I	Not significant	NA ⁽¹⁾
		Potential for mortality	Level II	Level II	Level III	Level I	Level III	Level I	Not significant	NA ⁽¹⁾	
		Habitat loss (ha)	Level I	Level II	Level I	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
	Northern Myotis/Little Brown Myotis	Habitat alteration or displacement (ha)	No residual adverse effects								
		Potential for mortality	Level I	Level II	Level III	Level II	Level III	Level I	Not significant	NA ⁽¹⁾	
		Habitat loss (ha)	No residual adverse effects								
	Barn Swallow	Habitat alteration or displacement (ha)	Level I	Level II	Level III	Level I	Level III	Level I	Not significant	NA ⁽¹⁾	
		Potential for mortality	Level II	Level II	Level III	Level I	Level III	Level I	Not significant	NA ⁽¹⁾	

Table 8.12.2.7-1: Determination of Significance for Wildlife and Wildlife Habitat (continued)

Valued Components (VCs)	Indicators	Measure	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	Significance	Likelihood
Ungulates	Moose	Habitat loss (ha)	Level I	Level II	Level III	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
		Habitat alteration or displacement (ha)	Level I	Level II	Level III	Level I	Level III	Level I	Not significant	NA ⁽¹⁾
		Potential for mortality	Level II	Level II	Level III	Level I	Level III	Level I	Not significant	NA ⁽¹⁾
Furbearers	American Marten	Habitat loss (ha)	Level I	Level II	Level III	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
		Habitat alteration or displacement (ha)	Level I	Level II	Level III	Level I	Level III	Level I	Not significant	NA ⁽¹⁾
		Potential for mortality	Level I	Level II	Level III	Level I	Level III	Level I	Not significant	NA ⁽¹⁾
	American Beaver	Habitat loss (ha)	Level I	Level II	Level III	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
		Habitat alteration or displacement (ha)	Level I	Level II	Level III	Level I	Level III	Level I	Not significant	NA ⁽¹⁾
		Potential for mortality	Level I	Level II	Level III	Level I	Level III	Level I	Not significant	NA ⁽¹⁾
Upland birds	Upland birds	Habitat loss (ha)	Level I	Level II	Level I	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
		Habitat alteration or displacement (ha)	Level I	Level II	Level III	Level I	Level III	Level I	Not significant	NA ⁽¹⁾
		Potential for mortality	Level II	Level II	Level III	Level I	Level III	Level I	Not significant	NA ⁽¹⁾
Wetland bird	Marsh birds	Habitat loss (ha)	Level I	Level II	Level I	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
		Habitat alteration or displacement (ha)	Level I	Level II	Level III	Level I	Level III	Level I	Not significant	NA ⁽¹⁾
		Potential for mortality	Level I	Level II	Level III	Level I	Level III	Level I	Not significant	NA ⁽¹⁾
Small mammals	Small mammals	Habitat loss (ha)	No residual adverse effects							
		Habitat alteration or displacement (ha)	Level I	Level II	Level III	Level I	Level III	Level I	Not significant	NA ⁽¹⁾
		Potential for mortality	Level II	Level II	Level III	Level I	Level III	Level I	Not significant	NA ⁽¹⁾
Reptiles and amphibian	Reptiles and amphibians	Habitat loss (ha)	Level I	Level II	Level I	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
		Habitat alteration or displacement (ha)	Level I	Level II	Level III	Level I	Level III	Level I	Not significant	NA ⁽¹⁾
		Potential for mortality	Level II	Level II	Level III	Level I	Level III	Level I	Not significant	NA ⁽¹⁾
Invertebrates	Terrestrial invertebrates	Habitat loss (ha)	No residual adverse effects							
		Habitat alteration or displacement (ha)	Level I	Level II	Level III	Level I	Level III	Level I	Not significant	NA ⁽¹⁾
		Potential for mortality	Level II	Level II	Level III	Level I	Level III	Level I	Not significant	NA ⁽¹⁾
Post-closure Phase										
Wildlife species at risk (SAR)	Common Nighthawk	No residual adverse effects								
	Northern Myotis/Little Brown Myotis	No residual adverse effects								
	Barn Swallow	No residual adverse effects								
Ungulates	Moose	No residual adverse effects								
Furbearers	American Marten	No residual adverse effects								
	American Beaver	No residual adverse effects								
Upland birds	Upland birds	No residual adverse effects								
Wetland bird	Marsh birds	No residual adverse effects								
Small mammals	Small mammals	No residual adverse effects								
Reptiles and amphibian	Reptiles and amphibians	No residual adverse effects								
Invertebrates	Terrestrial invertebrates	No residual adverse effects								

Notes:

The Levels in the Table represent the highest assigned for that VC, indicator and phase of the Project (Tables 8.12.2.1-1 to 8.12.2.6-1)

(1) In accordance with Agency guidance (CEAA, 2015b) likelihood was not determined as none of the effects were classified as significant

- Frequency: Section 8.12.2.5; and
- Reversibility: Section 8.12.2.6.

Applying the decision tree (Figure 8.1.8-1) to the effects levels in Table 8.12.2.7-1 yields a determination that the residual adverse effects on wildlife and wildlife habitat would not be significant.

The conclusions regarding the significance of the residual adverse effects of the Project on wildlife and wildlife habitat are the same whether the reasoned narrative approach or the decision tree approach is used. Therefore, it is concluded that the Project would not have a significant effect on wildlife or wildlife habitat, even when the cumulative effects of other projects and activities in the region are considered.

8.13 Migratory Birds

8.13.1 Residual Adverse Effects and Cumulative Effects Advanced for Determination of Significance

Residual adverse effects of the Project on migratory birds were predicted to occur during the site preparation and construction, operations, and closure phases of the Project. There were no residual adverse effects during the post-closure phase. The predicted residual adverse effects were determined using a combination of numerical GIS models, and qualitative evaluation of the effects as described in Section 6.13.

Section 7.5.7 identifies that cumulative wildlife and wildlife effects are predicted for the following activity:

- Ongoing forestry operations by Dryden Forest Management Company.

The specific cumulative effects predicted were for the loss of additional habitat. The levels of magnitude for migratory birds have been assigned using the combined residual adverse effects of the Project and the cumulative effects. These effects are summarized in Table 8.13.1-1.

8.13.2 Description of Significance

As described in Section 6.1.3.12, the evaluation of effects of the Project on migratory birds considered two VCs; upland birds and wetland birds.

Table 8.13.1-1: Residual Adverse Effects and Cumulative Effects on Migratory Birds

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction			Operations			Closure			Post-closure
			Goliath Gold Project	Dryden Forest Management Company	Cumulative Effect	Goliath Gold Project	Dryden Forest Management Company	Cumulative Effect	Goliath Gold Project	Dryden Forest Management Company	Cumulative Effect	Goliath Gold Project
Upland Birds	Upland Birds	Habitat loss (ha)	95	0	95	95	0	95	95	0	95	—
		Habitat alteration or disruption (ha)	3.21	—	3.21	4.3	—	4.3	2.6	—	2.6	—
		Potential for Mortality (%)	Medium	—	Medium	Medium	—	Medium	Medium	—	Medium	—
Wetland Birds	Marsh Birds	Habitat loss (ha)	33	6	39	33	6	39	33	6	39	—
		Habitat alteration or disruption (ha)	2.9	—	2.9	7.5	—	7.5	0.7	—	0.7	—
		Potential for Mortality (%)	Low	—	Low	Low	—	Low	Low	—	Low	—

Note:

(1) The "—" symbol indicates there were no predicted residual adverse effects, or no cumulative effect.

8.13.2.1 Magnitude

The levels of magnitude for the predicted residual effects of the Project on migratory birds (Table 8.13.1-1) were assigned using the approach described in Section 8.1.1.12. The results are summarized in Table 8.13.2.1-1.

8.13.2.2 Geographic Extent

Geographic extent to the residual adverse effects for migratory birds (Table 8.13.1-1) was assigned using the approach described in Section 8.1.2. The geographic extents are summarized in Table 8.13.2.2-1.

8.13.2.3 Timing

The levels of timing for the predicted residual effects of the Project on migratory birds (Table 8.13.1-1) were assigned using the approach described in Section 8.1.3.12. The results are summarized in Table 8.13.2.3-1.

8.13.2.4 Duration

The levels of duration for the predicted residual effects of the Project on migratory birds (Table 8.13.1-1) were assigned using the approach described in Section 8.1.4. When assigning the duration (Table 8.13.2.4-1) for “habitat loss”, Level II was assigned as the habitat will remain lost through to post-closure.

8.13.2.5 Frequency

The levels of frequency for the predicted residual effects of the Project on migratory birds (Table 8.13.1-1) were assigned using the approach described in Section 8.1.5.12. The results are summarized in Table 8.13.2.5-1

8.13.2.6 Reversibility

The levels of reversibility for the predicted residual effects of the Project on migratory birds (Table 8.13.1-1) were assigned using the approach described in Section 8.1.6. When assigning the reversibility (Table 8.13.2.6-1) for “habitat loss”, Level II was assigned as the habitat will recover over time. Level I was assigned for the habitat alteration and potential for mortality as those effects will stop once the activities causing the effect stop (e.g., noise from equipment), and will recover as soon as the activity causing the effect stops.

Table 8.13.2.1-1: Levels of Magnitude for Residual Adverse Effects on Migratory Birds

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction	Operations	Closure	Post-closure
Upland birds	Upland birds	Habitat loss (ha)	Level I	Level I	Level I	—
		Habitat alteration or disruption (ha)	Level I	Level I	Level I	—
		Potential for mortality (%)	Level II	Level II	Level II	—
Wetland birds	Marsh birds	Habitat loss (ha)	Level I	Level I	Level I	—
		Habitat alteration or disruption (ha)	Level I	Level I	Level I	—
		Potential for mortality (%)	Level I	Level I	Level I	—

Note: (1) The “—” symbol indicates there were no residual adverse effects

Table 8.13.2.2-1: Levels of Geographic Extent for Residual Adverse Effects on Migratory Birds

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction	Operations	Closure	Post-closure
Upland Birds	Upland birds	Habitat loss (ha)	Level II	Level II	Level II	—
		Habitat alteration or disruption (ha)	Level II	Level II	Level II	—
		Potential for mortality (%)	Level II	Level II	Level II	—
Wetland birds	Marsh birds	Habitat loss (ha)	Level II	Level II	Level II	—
		Habitat alteration or disruption (ha)	Level II	Level II	Level II	—
		Potential for mortality (%)	Level II	Level II	Level II	—

Note: (1) The “—” symbol indicates there were no residual adverse effects

Table 8.13.2.3-1: Levels of Timing for Residual Adverse Effects on Migratory Birds

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction	Operations	Closure	Post-closure
Upland birds	Upland birds	Habitat loss (ha)	Level I	Level I	Level I	—
		Habitat alteration or disruption (ha)	Level III	Level III	Level III	—
		Potential for mortality (%)	Level II	Level III	Level III	—
Wetland birds	Marsh birds	Habitat loss (ha)	Level I	Level I	Level I	—
		Habitat alteration or disruption (ha)	Level III	Level III	Level III	—
		Potential for mortality (%)	Level II	Level III	Level III	—

Note: (1) The “—” symbol indicates there were no residual adverse effects

Table 8.12.2.4-1: Levels of Duration for Residual Adverse Effects on Migratory Birds

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction	Operations	Closure	Post-closure
Upland birds	Upland birds	Habitat loss (ha)	Level II	Level II	Level II	—
		Habitat alteration or disruption (ha)	Level I	Level II	Level I	—
		Potential for mortality (%)	Level I	Level II	Level I	—
Wetland birds	Marsh birds	Habitat loss (ha)	Level II	Level II	Level II	—
		Habitat alteration or disruption (ha)	Level I	Level II	Level I	—
		Potential for mortality (%)	Level I	Level II	Level I	—

Note: (1) The “—” symbol indicates there were no residual adverse effects

Table 8.13.2.5-1: Levels of Frequency for Residual Adverse Effects on Migratory Birds

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction	Operations	Closure	Post-closure
Upland birds	Upland birds	Habitat loss (ha)	Level III	Level III	Level III	—
		Habitat alteration or disruption (ha)	Level III	Level III	Level III	—
		Potential for mortality (%)	Level III	Level III	Level III	—
Wetland birds	Marsh birds	Habitat loss (ha)	Level III	Level III	Level III	—
		Habitat alteration or disruption (ha)	Level III	Level III	Level III	—
		Potential for mortality (%)	Level III	Level III	Level III	—

Note: (1) The “—” symbol indicates there were no residual adverse effects

Table 8.13.2.6-1: Levels of Reversibility for Residual Adverse Effects on Migratory Birds

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction	Operations	Closure	Post-closure
Upland birds	Upland birds	Habitat loss (ha)	Level II	Level II	Level II	—
		Habitat alteration or disruption (ha)	Level I	Level I	Level I	—
		Potential for mortality (%)	Level I	Level I	Level I	—
Wetland birds	Marsh birds	Habitat loss (ha)	Level II	Level II	Level II	—
		Habitat alteration or disruption (ha)	Level I	Level I	Level I	—
		Potential for mortality (%)	Level I	Level I	Level I	—

Note: (1) The “—” symbol indicates there were no residual adverse effects

8.13.2.7 Determination of Significance

Based on experience with Projects in the boreal forest region of Ontario, a significant effect to migratory birds is one that would alter the available habitat to an extent where it would have serious, long-term effects on a species at the local scale. When the predicted residual adverse effects of the Project on migratory birds are tested against this definition of significance, no significant adverse effects are predicted. The reason is that none of the residual adverse effects were classified with a Level III magnitude, which is the level required for there to be serious long-term effects. In this regard, the magnitude can act as a surrogate for significance.

Table 8.13.2.7-1 lists the various levels assigned for the elements introduced in Section 8.1. The classification of the effects for the elements presented in the table are described in these preceding sections:

- Magnitude: Section 8.13.2.1;
- Geographic extent: Section 8.13.2.2;
- Timing: Section 8.13.2.3;
- Duration: Section 8.13.2.4;
- Frequency: Section 8.13.2.5; and
- Reversibility: Section 8.13.2.6.

Applying the decision tree (Figure 8.1.8-1) to the effects levels in Table 8.13.2.7-1 yields a determination that the residual adverse effects on migratory birds would not be significant. The conclusions regarding the significance of the residual adverse effects of the Project on migratory birds are the same whether the reasoned narrative approach or the decision tree approach is used. Therefore, it is concluded that the Project would not have a significant effect on migratory birds.

8.14 Fish and Fish Habitat

8.14.1 Residual Adverse Effects and Cumulative Effects Advanced for Determination of Significance

There was one residual adverse effect for fish and fish habitat that remains after the application of mitigation measures. That residual adverse effect is fish mortality for the stream-resident fish populations VC. This residual adverse effect will occur during the site preparation and construction phase, when portions of Blackwater Creek Tributary 1 and Blackwater Creek Tributary 2 are overprinted. Table 8.14.1-1 summarized the residual adverse effects of the Project on fish and fish habitat.

Table 8.13.2.7-1: Determination of Significance for Migratory Birds

Valued Components (VCs)	Indicators	Measures	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	Significance	Likelihood
Site Preparation and Construction Phase										
Upland birds	Upland birds	Habitat loss (ha)	Level I	Level II	Level I	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
		Habitat alteration or displacement (ha)	Level I	Level II	Level III	Level I	Level III	Level I	Not significant	NA ⁽¹⁾
		Potential for mortality	Level II	Level II	Level II	Level I	Level III	Level I	Not significant	NA ⁽¹⁾
Wetland bird	Marsh birds	Habitat loss (ha)	Level I	Level II	Level I	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
		Habitat alteration or displacement (ha)	Level I	Level II	Level III	Level I	Level III	Level I	Not significant	NA ⁽¹⁾
		Potential for mortality	Level I	Level II	Level II	Level I	Level III	Level I	Not significant	NA ⁽¹⁾
Operations Phase										
Upland birds	Upland birds	Habitat loss (ha)	Level I	Level II	Level I	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
		Habitat alteration or displacement (ha)	Level I	Level II	Level III	Level II	Level III	Level I	Not significant	NA ⁽¹⁾
		Potential for mortality	Level II	Level II	Level III	Level II	Level III	Level I	Not significant	NA ⁽¹⁾
Wetland bird	Marsh birds	Habitat loss (ha)	Level I	Level II	Level I	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
		Habitat alteration or displacement (ha)	Level I	Level II	Level III	Level II	Level III	Level I	Not significant	NA ⁽¹⁾
		Potential for mortality	Level I	Level II	Level III	Level II	Level III	Level I	Not significant	NA ⁽¹⁾
Closure Phase										
Upland birds	Upland birds	Habitat loss (ha)	Level I	Level II	Level I	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
		Habitat alteration or displacement (ha)	Level I	Level II	Level III	Level I	Level III	Level I	Not significant	NA ⁽¹⁾
		Potential for mortality	Level II	Level II	Level III	Level I	Level III	Level I	Not significant	NA ⁽¹⁾
Wetland bird	Marsh birds	Habitat loss (ha)	Level I	Level II	Level I	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
		Habitat alteration or displacement (ha)	Level I	Level II	Level III	Level I	Level III	Level I	Not significant	NA ⁽¹⁾
		Potential for mortality	Level I	Level II	Level III	Level I	Level III	Level I	Not significant	NA ⁽¹⁾
Post-closure Phase										
Upland birds	Upland birds	No residual adverse effects								
Wetland bird	Marsh birds	No residual adverse effects								

Notes:

The levels in the table represent the highest assigned for that VC, indicator and phase of the Project (Tables 8.13.2.1-1 to 8.13.2.6-1)

(1) In accordance with Agency guidance (CEAA, 2015b) likelihood was not determined as none of the effects were classified as significant

Table 8.14.1-1: Residual Adverse Effects for Fish and Fish Habitat

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction	Operations	Closure	Post-closure
Stream-resident fish population	Direct loss or alteration of habitat	Stream length (km)	0	0	0	0
		Pond area (ha)	0	0	0	0
		Fish mortality proportion (%)	50% ⁽²⁾	0	0	0
	Changes in flows or water levels	Stream length (km)	0	0	0	0
		Pond area (ha)	0	0	0	0
	Changes in water quality	Stream length (km)	0	0	0	0
		Pond area (ha)	0	0	0	0
		Fish mortality proportion (%)	0	0	0	0
	Blasting	Fish mortality proportion (%)	0	0	0	0
Migratory fish populations	Direct loss or alteration of habitat	Stream length (km)	0	0	0	0
		Pond area (ha)	0	0	0	0
		Fish mortality proportion (%)	0	0	0	0
	Changes in flows or water levels	Stream length (km)	0	0	0	0
		Pond area (ha)	0	0	0	0
	Changes in water quality	Stream length (km)	0	0	0	0
		Pond area (ha)	0	0	0	0
		Fish mortality proportion (%)	0	0	0	0
	Blasting	Fish mortality proportion (%)	0	0	0	0
Lake-resident fish populations	Direct loss or alteration of habitat	Lake area (ha)	0	0	0	0
		Fish mortality proportion (%)	0	0	0	0
	Changes water levels	Lake area (ha)	0	0	0	0
	Changes in water quality	Lake area (ha)	0	0	0	0
		Fish mortality proportion (%)	0	0	0	0
Blasting	Fish mortality proportion (%)	0	0	0	0	

Table 6.14.6-1: Residual Adverse Effects for Fish and Fish Habitat (continued)

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction	Operations	Closure	Post-closure
Fish species-at-risk	Direct loss or alteration of habitat	Stream length (km)	0	0	0	0
		Pond or lake area (ha)	0	0	0	0
		Fish mortality proportion (%)	0	0	0	0
	Changes in flows or water levels	Stream length (km)	0	0	0	0
		Pond or lake area (ha)	0	0	0	0
	Changes in water quality	Stream length (km)	0	0	0	0
		Pond or lake area (ha)	0	0	0	0
		Fish mortality proportion (%)	0	0	0	0
	Blasting	Fish mortality proportion (%)	0	0	0	0

Notes:

- (1) It was predicted that there would be a 50% mortality for those stream-resident fish that remained in the portions of Blackwater Creek Tributary 1 and Blackwater Creek Tributary 2 overprinted as a result of the Project.

As described in Section 7.5.8, there were no predicted cumulative effects for the fish and fish habitat. Therefore, the magnitude will be assigned using the residual adverse effects of the Project (Table 8.14.1-1).

8.14.2 Description of Significance

8.14.2.1 Magnitude

It is estimated that approximately 50% of the fish present in these tributaries will leave as flows diminish, or will be successfully relocated downstream as part of the mitigation measures to be implemented by Treasury Metals. The magnitude level was assigned as Level I in accordance with the procedures described in Section 8.1.1.13.

8.14.2.2 Geographic Extent

For fish mortality, the residual adverse effect extends beyond the footprint of the Project into the LSA. The effects were assigned a magnitude level of Level II, in accordance with the procedures described in Section 8.1.2.

8.14.2.3 Timing

Timing is not a significant consideration when mortality is involved. The level of timing for mortality was assigned as Level I.

8.14.2.4 Duration

Fish mortality will occur during the site preparation and construction phase, when portions of Blackwater Creek Tributary 1 and Blackwater Creek Tributary 2 are overprinted and flows are diminished in the downstream portions. The duration for the effect was assigned a duration of Level I, in accordance with Section 8.1.4.

8.14.2.5 Frequency

Fish mortality will occur once, when portions of Blackwater Creek Tributary 1 and Blackwater Creek Tributary 2 are overprinted and flows are diminished in the downstream portions during the Construction Phase of the Project. Therefore, the frequency is Level I.

8.14.2.6 Reversibility

Fish mortality is not reversible, and was assigned as Level III.

8.14.2.7 Determination of Significance

Based on experience in evaluating similar mining Project, a significant adverse effect for fish mortality would be one that permanently reduces the size or viability of a fish population such that the sustainability of a commercial, recreational or Aboriginal fishery is at risk. When the predicted residual adverse effects of the Project are tested against this hypothesis of what constitutes a significant adverse effect, the effects of the Project would not be significant. This is supported by the nature of fish affected as well as the relative quantity. The stream-resident fish species that will suffer mortality are common species that are widely distributed throughout in Ontario and Canada. This fish community could arguably be considered the most common stream fish community on the Canadian Shield, where it occurs in many, if not most, small stream habitats that are low-gradient with fine substrates and extensive beaver activity as well as small, shallow lakes and ponds.

The effects levels assigned to the residual adverse effects of the Project on fish and fish habitat have been summarized in Table 8.14.2.7-1. By applying the decision tree (Figure 8.1.8-1) to the effects levels in the table yields a determination that the residual adverse effects on fish and fish habitat would not be significant.

Both the application of the decision tree approach and the use of a reasoned argument approach yield the same conclusion, the Project will not result in significant adverse effects to fish or fish habitat.

Table 8.14.2.7-1: Determination of Significance for Fish and Fish Habitat

Valued Components (VCs)	Indicators	Measures	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	Significance	Likelihood
Site Preparation and Construction Phase										
Stream-resident fish populations	Direct loss or alteration of habitat	Stream length (km)	No residual adverse effects							
		Pond area (ha)	No residual adverse effects							
		Fish mortality proportion (%)	Level I	Level II	Level I	Level I	Level I	Level I	Level III	Not significant
	Changes water levels	No residual adverse effects								
	Changes in water quality	No residual adverse effects								
Migratory fish populations	Direct loss or alteration of habitat	No residual adverse effects								
	Changes water levels	No residual adverse effects								
	Changes in water quality	No residual adverse effects								
	Blasting	No residual adverse effects								
Migratory fish populations	Direct loss or alteration of habitat	No residual adverse effects								
	Changes water levels	No residual adverse effects								
	Changes in water quality	No residual adverse effects								
	Blasting	No residual adverse effects								
Fish species-at-risk	Direct loss or alteration of habitat	No residual adverse effects								
	Changes water levels	No residual adverse effects								
	Changes in water quality	No residual adverse effects								
	Blasting	No residual adverse effects								
Operations Phase										
Stream-resident fish populations	Direct loss or alteration of habitat	No residual adverse effects								
	Changes water levels	No residual adverse effects								
	Changes in water quality	No residual adverse effects								
	Blasting	No residual adverse effects								
Migratory fish populations	Direct loss or alteration of habitat	No residual adverse effects								
	Changes water levels	No residual adverse effects								
	Changes in water quality	No residual adverse effects								
	Blasting	No residual adverse effects								
Migratory fish populations	Direct loss or alteration of habitat	No residual adverse effects								
	Changes water levels	No residual adverse effects								
	Changes in water quality	No residual adverse effects								
	Blasting	No residual adverse effects								
Fish species-at-risk	Direct loss or alteration of habitat	No residual adverse effects								
	Changes water levels	No residual adverse effects								
	Changes in water quality	No residual adverse effects								
	Blasting	No residual adverse effects								
Closure Phase										
Stream-resident fish populations	Direct loss or alteration of habitat	No residual adverse effects								
	Changes water levels	No residual adverse effects								

Table 8.14.2.7-1: Determination of Significance for Fish and Fish Habitat (continued)

Valued Components (VCs)	Indicators	Measures	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	Significance	Likelihood
Migratory fish populations	Changes in water quality									No residual adverse effects
	Blasting									No residual adverse effects
	Direct loss or alteration of habitat									No residual adverse effects
	Changes water levels									No residual adverse effects
	Changes in water quality									No residual adverse effects
Migratory fish populations	Blasting									No residual adverse effects
	Direct loss or alteration of habitat									No residual adverse effects
	Changes water levels									No residual adverse effects
	Changes in water quality									No residual adverse effects
Fish species-at-risk	Blasting									No residual adverse effects
	Direct loss or alteration of habitat									No residual adverse effects
	Changes water levels									No residual adverse effects
	Changes in water quality									No residual adverse effects
Post-closure Phase										
Stream-resident fish populations	Direct loss or alteration of habitat									No residual adverse effects
	Changes water levels									No residual adverse effects
	Changes in water quality									No residual adverse effects
	Blasting									No residual adverse effects
Migratory fish populations	Direct loss or alteration of habitat									No residual adverse effects
	Changes water levels									No residual adverse effects
	Changes in water quality									No residual adverse effects
	Blasting									No residual adverse effects
Migratory fish populations	Direct loss or alteration of habitat									No residual adverse effects
	Changes water levels									No residual adverse effects
	Changes in water quality									No residual adverse effects
	Blasting									No residual adverse effects
Fish species-at-risk	Direct loss or alteration of habitat									No residual adverse effects
	Changes water levels									No residual adverse effects
	Changes in water quality									No residual adverse effects
	Blasting									No residual adverse effects

Notes:

(1) In accordance with Agency guidance (CEAA, 2015b) likelihood was not determined as none of the effects were classified as significant.

8.14.3 Prediction Confidence and Uncertainty

Based on professional experience, we are confident that fish mortality will occur when the watercourse portions of Blackwater Creek Tributary 1 and Blackwater Creek Tributary 2 are overprinted during the site preparation and construction phase of the Project. Measures to relocate fish or allow them to leave will not be 100% effective and mortality of 50% has been assumed. This is considered a realistic estimate, but may vary depending on the effectiveness of measures to reduce the number of fish present when the watercourses are isolated. One measure to encourage fish to leave would be removing beaver dams and allowing ponds to draw down the water levels prior to dewatering the watercourse.

8.15 Wetlands and Vegetation

8.15.1 Residual Adverse Effects and Cumulative Effects Advanced for Determination of Significance

As described in Section 6.15.6, the Projected is predicted to result in residual adverse effects to the wetlands and vegetation communities VCs, specifically for the following:

- Wetlands:
 - Wetland extent.
- Vegetation communities
 - Predominantly coniferous forest;
 - Predominantly deciduous forest;
 - Successional areas; and
 - Potential berry harvesting areas.

There were no residual adverse effects predicted for either the wild rice or the Floating Marsh Marigold indicators.

Section 7.5.9 identifies that cumulative effects on wetlands and vegetation are predicted for the following activity:

- Ongoing forestry operations by Dryden Forest Management Company.

The specific cumulative effects predicted were for the change in areas measured for each of the indicators. The levels of magnitude for wetlands and vegetation have been assigned using the combined residual adverse effects of the Project and the cumulative effects. These effects are summarized in Table 8.15.1-1.

Table 8.15.1-1: Residual Adverse Effects and Cumulative Effects on Wetlands and Vegetation

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction			Operations			Closure			Post-closure
			Goliath Gold Project	Dryden Forest Management Company	Cumulative Effect	Goliath Gold Project	Dryden Forest Management Company	Cumulative Effect	Goliath Gold Project	Dryden Forest Management Company	Cumulative Effect	Cumulative Effect
Wetlands	Wetland extent	Change in area (ha)	33	6	39	47 ⁽¹⁾	6	53	47 ⁽²⁾	6	53	— ⁽³⁾
	Wild Rice	Loss of identified habitat (ha)	—	—	—	—	—	—	—	—	—	—
		Changes in water level (m)	—	—	—	—	—	—	—	—	—	—
		Changes in water quality	—	—	—	—	—	—	—	—	—	—
Floating Marsh Marigold (<i>Caltha natans</i>)	Loss of identified habitat (ha)	—	—	—	—	—	—	—	—	—	—	
Vegetation Communities	Predominantly coniferous forest	Change in area (ha)	95	41	136	95 ⁽³⁾	41	136	95 ⁽³⁾	41	136	— ⁽³⁾
	Predominantly deciduous forest	Change in area (ha)	43	5	48	43 ⁽³⁾	5	48	43 ⁽³⁾	5	48	— ⁽³⁾
	Successional areas	Change in area (ha)	70	0	70	70 ⁽³⁾	0	70	70 ⁽³⁾	0	70	— ⁽³⁾
	Potential berry harvesting areas	Change in area (ha)	260	49	309	260 ⁽³⁾	49	309	260 ⁽³⁾	49	309	— ⁽³⁾

Notes:

The “—” symbol indicates there were no predicted adverse effects

(1) The increase in wetland extent reflects the effects of dewatering on WLD5.

(2) The effects due to dewatering are expected to persist until the open pit floods and groundwater returns to near pre-development levels.

(3) The areas lost during the site preparation and construction phase will not recover until post-closure.

8.15.2 Description of Significance

8.15.2.1 Magnitude

The levels of magnitude for the predicted residual effects of the Project on wetlands and vegetation (Table 8.14.1-1) were assigned using the approach described in Section 8.1.1.14. The results are summarized in Table 8.15.2.1-1.

The description of the effects of the Project on land use (Section 6.16.6) identified that the Project would result in residual adverse effects for the following VCs and associated indicators:

8.15.2.2 Geographic Extent

Geographic extent to the residual adverse effects predicted residual effects of the Project on wetlands and vegetation (Table 8.14.1-1) was assigned using the approach described in Section 8.1.2. The geographic extents are summarized in Table 8.15.2.2-1.

8.15.2.3 Timing

The levels of timing for the predicted residual effects of the Project on wetlands and vegetation (Table 8.15.1-1) were assigned as Level II, in accordance with the approach described in Section 8.1.3.14. The results are summarized in Table 8.15.2.3-1.

8.15.2.4 Duration

The levels of duration (Table 8.15.1-1) for the predicted residual effects on wetlands and vegetation were assigned using the approach described in Section 8.1.4. Level II was assigned as the wetlands lost during site preparation and construction will not recover until post-closure.

8.15.2.5 Frequency

The levels of frequency for the predicted residual effects of the Project on wetlands and vegetation habitat (Table 8.15.1-1) were assigned using the approach described in Section 8.1.5.14. The results are summarized in Table 8.15.2.5-1.

8.15.2.6 Reversibility

The levels of reversibility for the predicted residual effects of the Project on wetlands and vegetation (Table 8.15.1-1) were assigned using the approach described in Section 8.1.6. The results are summarized in Table 8.14.2.6-1.

Table 8.15.2.1-1: Levels of Magnitude for Adverse Effects on Wetlands and Vegetation

Valued Components (VCs)	Indicators	Site Preparation and Construction	Operations	Closure	Post-closure
Wetlands	Wetland area	Level II	Level II	Level II	—
	Wild rice	—	—	—	—
	Floating Marsh Marigold (<i>Caltha natans</i>)	—	—	—	—
Vegetation communities	Predominantly coniferous forest	Level I	Level I	Level I	—
	Predominantly deciduous forest	Level I	Level I	Level I	—
	Successional areas	Level I	Level I	Level I	—
	Potential berry harvesting areas	Level I	Level I	Level I	—

Note: (1) The “—” symbol indicates there were no residual adverse effects

Table 8.15.2.2-1: Levels of Geographic Extent for Adverse Effects on Wetlands and Vegetation

Valued Components (VCs)	Indicators	Site Preparation and Construction	Operations	Closure	Post-closure
Wetlands	Wetland area	Level II	Level II	Level II	—
	Wild rice	—	—	—	—
	Floating Marsh Marigold (<i>Caltha natans</i>)	—	—	—	—
Vegetation communities	Predominantly coniferous forest	Level II	Level II	Level II	—
	Predominantly deciduous forest	Level II	Level II	Level II	—
	Successional areas	Level II	Level II	Level II	—
	Potential berry harvesting areas	Level II	Level II	Level II	—

Note: (1) The “—” symbol indicates there were no residual adverse effects

Table 8.15.2.3-1: Levels of Timing for Adverse Effects on Wetlands and Vegetation

Valued Components (VCs)	Indicators	Site Preparation and Construction	Operations	Closure	Post-closure
Wetlands	Wetland area	Level II	Level II	Level II	—
	Wild rice	—	—	—	—
	Floating Marsh Marigold (<i>Caltha natans</i>)	—	—	—	—
Vegetation communities	Predominantly coniferous forest	Level II	Level II	Level II	—
	Predominantly deciduous forest	Level II	Level II	Level II	—
	Successional areas	Level II	Level II	Level II	—
	Potential berry harvesting areas	Level II	Level II	Level II	—

Note: (1) The “—” symbol indicates there were no residual adverse effects

Table 8.14.2.4-1: Levels of Duration for Adverse Effects on Wetlands and Vegetation

Valued Components (VCs)	Indicators	Site Preparation and Construction	Operations	Closure	Post-closure
Wetlands	Wetland area	Level II	Level II	Level II	—
	Wild rice	—	—	—	—
	Floating Marsh Marigold (<i>Caltha natans</i>)	—	—	—	—
Vegetation communities	Predominantly coniferous forest	Level II	Level II	Level II	—
	Predominantly deciduous forest	Level II	Level II	Level II	—
	Successional areas	Level II	Level II	Level II	—
	Potential berry harvesting areas	Level II	Level II	Level II	—

Note: (1) The “—” symbol indicates there were no residual adverse effects

Table 8.15.2.5-1: Levels of Frequency for Adverse Effects on Wetlands and Vegetation

Valued Components (VCs)	Indicators	Site Preparation and Construction	Operations	Closure	Post-closure
Wetlands	Wetland area	Level III	Level III	Level III	—
	Wild rice	—	—	—	—
	Floating Marsh Marigold (<i>Caltha natans</i>)	—	—	—	—
Vegetation communities	Predominantly coniferous forest	Level III	Level III	Level III	—
	Predominantly deciduous forest	Level III	Level III	Level III	—
	Successional areas	Level III	Level III	Level III	—
	Potential berry harvesting areas	Level III	Level III	Level III	—

Note: (1) The “—” symbol indicates there were no residual adverse effects

Table 8.15.2.6-1: Levels of Reversibility for Adverse Effects on Wetlands and Vegetation

Valued Components (VCs)	Indicators	Site Preparation and Construction	Operations	Closure	Post-closure
Wetlands	Wetland area	Level II	Level II	Level II	—
	Wild rice	—	—	—	—
	Floating Marsh Marigold (<i>Caltha natans</i>)	—	—	—	—
Vegetation communities	Predominantly coniferous forest	Level II	Level II	Level II	—
	Predominantly deciduous forest	Level II	Level II	Level II	—
	Successional areas	Level II	Level II	Level II	—
	Potential berry harvesting areas	Level II	Level II	Level II	—

Note: (1) The “—” symbol indicates there were no residual adverse effects

8.15.2.7 Determination of Significance

Based on experience with Projects in the boreal forest region of Ontario, a significant effect to wetlands and vegetation is one that would alter a wetland or vegetative community to an extent where it would have serious, long-term effects at the local or regional scale. When the predicted residual adverse effects of the Project on wetlands and vegetation are tested against this definition of significance, no significant adverse effects are predicted. The reason is that none of the residual adverse effects were classified with a Level III magnitude, which is the level required for there to be serious long-term effects. In this regard, the magnitude can act as a surrogate for significance.

Table 8.14.2.7-1 lists the various levels assigned for the elements introduced in Section 8.1. The classification of the effects for the elements presented in the table are described in these preceding sections:

- Magnitude: Section 8.15.2.1;
- Geographic extent: Section 8.15.2.2;
- Timing: Section 8.15.2.3;
- Duration: Section 8.15.2.4;
- Frequency: Section 8.15.2.5; and
- Reversibility: Section 8.15.2.6.

Applying the decision tree (Figure 8.1.8-1) to the effects levels in Table 8.15.2.7-1 yields a determination that the residual adverse effects on wetlands and vegetation would not be significant.

The conclusions regarding the significance of the residual adverse effects of the Project on wetlands and vegetation are the same whether the reasoned narrative approach or the decision tree approach is used. Therefore, it is concluded that the Project would not have a significant effect on wetlands and vegetation.

8.16 Land Use

8.16.1 Residual Adverse Effects and Cumulative Effects Advanced for Determination of Significance

The predicted residual effects for the land use VCs and indicators included residual adverse effects, beneficial effects and effects that were a combination of both, depending on the phase of the Project, or the level of magnitude.

Table 8.15.2.7-1: Determination of Significance for Wetlands and Vegetation

Valued Components (VCs)	Indicators	Measures	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	Significance	Likelihood
Site Preparation and Construction Phase										
Wetlands	Wetlands extent	Change in area (ha)	Level II	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
	Wild rice		No residual adverse effect							
	Floating March Marigold		No residual adverse effect							
Vegetation Communities	Predominantly coniferous forest	Change in area (ha)	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
	Predominantly deciduous forest	Change in area (ha)	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
	Successional areas	Change in area (ha)	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
	Potential berry harvesting areas	Change in area (ha)	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
Operations Phase										
Wetlands	Wetlands extent	Change in area (ha)	Level II	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
	Wild rice		No residual adverse effect							
	Floating March Marigold		No residual adverse effect							
Vegetation Communities	Predominantly coniferous forest	Change in area (ha)	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
	Predominantly deciduous forest	Change in area (ha)	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
	Successional areas	Change in area (ha)	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
	Potential berry harvesting areas	Change in area (ha)	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
Closure Phase										
Wetlands	Wetlands extent	Change in area (ha)	Level II	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
	Wild rice		No residual adverse effect							
	Floating March Marigold		No residual adverse effect							
Vegetation Communities	Predominantly coniferous forest	Change in area (ha)	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
	Predominantly deciduous forest	Change in area (ha)	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
	Successional areas	Change in area (ha)	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
	Potential berry harvesting areas	Change in area (ha)	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
Post-closure Phase										
Wetlands	Wetlands extent		No residual adverse effect							
	Wild rice		No residual adverse effect							
	Floating March Marigold		No residual adverse effect							
Vegetation Communities	Predominantly coniferous forest		No residual adverse effect							
	Predominantly deciduous forest		No residual adverse effect							
	Successional areas		No residual adverse effect							
	Potential berry harvesting areas		No residual adverse effect							

Notes:

The levels in the table represent the highest assigned for that VC, indicator and phase of the Project (Tables 8.15.2.1-1 to 8.15.2.6-1)
(1) In accordance with Agency guidance (CEAA, 2015b) likelihood was not determined as none of the effects were classified as significant

An example of a beneficial residual effects of the Project (Section 6.16.6) is the change in demand for aggregate resources. If Treasury Metals determines that waste rock will provide insufficient amounts of non-PAG materials for use in construction, local aggregate suppliers that can provide the requisite volumes of suitable aggregate will need to be identified. This would represent an economic boon to the local industry. An adverse effect identified relates to the loss of forestry resources in the long-term. Following the closure of the mine, those portions of the site where the waste rock storage area (WRSA), tailings storage facility (TSF) and the pit lake will no longer be available for sustainable forestry in the region. In accordance with the EIS Guidelines, only residual adverse effects need to be considered when determining significance. Table 8.16.1-1 provides a listing of the predicted residual adverse effects for land use.

Table 8.16.1-1: Summary of Residual Adverse Effects for Land Use

Valued Components (VCs)	Indicators	Residual Adverse Effects
Land Use Planning and Policies	Conflict with accepted land uses as stipulated in approved land use plans.	—
	Overlap with protected areas.	—
Aggregate Operations	Change in access to aggregate resources.	—
	Change in demand of aggregate resources extraction.	—
Forestry	Change in access to forestry resources.	—
	Loss of forestry resources.	Yes
Mineral Exploration	Change in access to mineral claims for exploration and production.	—
Fishing - Recreational and Commercial	Change in access to fisheries resources.	—
	Change in the abundance of fisheries resources.	—
	Change in contaminant levels in fish	—
	Diminished experience of being on the land.	Yes
Hunting	Change in access to wildlife resources.	Yes
	Change in abundance of wildlife resources.	Yes
	Diminished experience of being on the land	Yes
Trapping	Change in access to wildlife resources.	Yes
	Change in abundance of wildlife resources.	Yes
	Diminished experience of being on the land	Yes
Cottagers and Outfitters	Diminished experience of being on the land.	Yes
	Change in access to cottage and/or outfitter areas.	—
	Changes in clientele for outfitters with lodges located near the Project.	Yes
Other Recreational Uses	Change in access for residents and visitors to public lands for non-consumptive purposes	—
	Change in access for residents and visitors to public lands for consumptive purposes.	Yes

Table 8.16.1-1: Summary of Residual Adverse Effects for Land Use (continued)

Valued Components (VCs)	Indicators	Residual Adverse Effects
Other Recreational Uses (continued)	Change in abundance of berries, mushrooms and/or other vegetation used for consumption	Yes
	Diminished experience of being on the land.	Yes
	Diminished experience of being on the land.	Yes

Note:

- (1) The “—” symbol indicates where no residual adverse effects were predicted for the discipline, VC and indicator. This could represent situations where no adverse effects were predicted, or where predicted adverse effects were fully mitigated, as detailed in Section 6.16.

Section 7.5.10 identifies that cumulative effects on land use are predicted for the following activity:

- Ongoing forestry operations by Dryden Forest Management Company;
- Major upgrades to Highway 17; and
- The 230kV transmission line proposed by Wataynikaneyap Power.

In the case of the Dryden Forest Management Company’s ongoing forestry operations in the region, these are predicted to have a quantifiable cumulative effect on the following VCs and indicators:

- Hunting: change in abundance of wildlife resources;
- Trapping: change in abundance of wildlife resources; and
- Other recreational users: change in abundance of berries, mushrooms and/or other vegetation used for consumption.

It was also predicted that both the Highway 17 upgrades and Wataynikaneyap Power transmission line would have cumulative effects on the “change in clientele for outfitters” indicator for the cottagers and outfitters VC. This effect can be both a beneficial (increased business) and adverse (pressure on available accommodations) cumulative effect; however, they are unlikely to change the magnitude of the residual effects for the Project. The levels of magnitude for land use have been assigned using the combined residual adverse effects of the Project and the cumulative effects. These effects are summarized in Table 8.16.1-2.

Table 8.16.2-1: Residual Adverse Effects and Cumulative Effects on Land Use VCs

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction			Operations			Closure			Post-closure
			Goliath Gold Project	Dryden Forest Management Company	Cumulative Effect	Goliath Gold Project	Dryden Forest Management Company	Cumulative Effect	Goliath Gold Project	Dryden Forest Management Company	Cumulative Effect	Goliath Gold Project
Land Use Planning and Policies	Conflict with accepted land uses as stipulated in approved land use plans.	—	—	—	—	—	—	—	—	—	—	—
	Overlap with protected areas.	—	—	—	—	—	—	—	—	—	—	—
Aggregate Operations	Change in access to aggregate resources.	—	—	—	—	—	—	—	—	—	—	—
	Change in demand of aggregate resources extraction.	—	—	—	—	—	—	—	—	—	—	—
Forestry	Change in access to forestry resources.	—	—	—	—	—	—	—	—	—	—	—
	Loss of forestry resources.	Area unavailable (ha)	—	† ⁽⁴⁾	—	138	†	138	138	†	138	168
Mineral Exploration	Change in access to mineral claims for exploration and production.	—	—	—	—	—	—	—	—	—	—	—
Fishing - Recreational and Commercial	Change in access to fisheries resources.	—	—	—	—	—	—	—	—	—	—	—
	Change in the abundance of fisheries resources.	—	—	—	—	—	—	—	—	—	—	—
	Change in contaminant levels in fish	—	—	—	—	—	—	—	—	—	—	—
	Diminished on-the-land experience.	Change to viewscales on Thunder Lake	WRSA visible on Thunder Lake	†	WRSA visible on Thunder Lake	WRSA visible on Thunder Lake	†	WRSA visible on Thunder Lake	WRSA visible on Thunder Lake	†	WRSA visible on Thunder Lake	WRSA visible on Thunder Lake
Hunting	Change in access to wildlife resources.	Area unavailable (ha)	743	†	743	743	†	743	743	†	743	—
	Change in abundance of wildlife resources	Moose	84	56	140	84	56	140	84	56	140	—
		American Marten	62	36	98	62	36	98	62	36	98	—
		American Beaver	< 4	0	<4	< 4	0	<4	< 4	0	<4	—
		Upland Birds	95	0	95	95	0	95	95	0	95	—
		Marsh Birds	33	6	39	33	6	39	33	6	39	—
	Diminished on-the-land experience.	Areas >40 dBA noise	157	†	157	157	†	157	157	†	157	—
Trapping	Change in access to wildlife resources.	Area unavailable (ha)	309	†	309	309	†	309	309	†	309	—
	Change in abundance of wildlife resources	American Marten	62	36	98	62	36	98	62	36	98	—
		American Beaver	< 4	0	<4	< 4	0	<4	< 4	0	<4	—
	Diminished on-the-land experience.	Areas >40 dBA noise	157	†	157	157	†	157	157	†	157	—
Cottagers and Outfitters	Diminished on-the-land experience.	Areas >40 dBA noise	157	†	157	157	†	157	157	†	157	—
	Change in access to cottage and/or outfitter areas.	—	—	—	—	—	—	—	—	—	—	—
	Changes in clientele for outfitters with lodges located near the Project.	Increased demand for local accommodations	effects can be managed with existing resources	‡ ⁽⁵⁾	effects can be managed with existing resources	effects can be managed with existing resources	‡	effects can be managed with existing resources	effects can be managed with existing resources	‡	effects can be managed with existing resources	effects that are within the normal range of variability
Other Recreational Uses	Change in access for residents and visitors to public lands for non-consumptive purposes	—	—	—	—	—	—	—	—	—	—	—

Table 8.16.2-1: Residual Adverse Effects and Cumulative Effects on Land Use VCs (continued)

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction			Operations			Closure			Post-closure
			Goliath Gold Project	Dryden Forest Management Company	Cumulative Effect	Goliath Gold Project	Dryden Forest Management Company	Cumulative Effect	Goliath Gold Project	Dryden Forest Management Company	Cumulative Effect	Goliath Gold Project
Other Recreational Uses (continued)	Change in access for residents and visitors to public lands for consumptive purposes.	Area unavailable (ha)	743	†	743	743	†	743	743	†	743	—
Other Recreational Uses (continued)	Change in abundance of berries, mushrooms and/or other vegetation used for consumption	Wetland extent	33	6	39	47 ⁽¹⁾	6	53	47 ⁽²⁾	6	53	— ⁽³⁾
		Predominantly coniferous forest	95	41	136	95 ⁽³⁾	41	136	95 ⁽³⁾	41	136	— ⁽³⁾
	Change in abundance of berries, mushrooms and/or other vegetation used for consumption (continued)	Predominantly deciduous forest	43	5	48	43 ⁽³⁾	5	48	43 ⁽³⁾	5	48	— ⁽³⁾
		Successional areas	70	0	70	70 ⁽³⁾	0	70	70 ⁽³⁾	0	70	— ⁽³⁾
		Potential berry harvesting areas	260	49	309	260 ⁽³⁾	49	309	260 ⁽³⁾	49	309	— ⁽³⁾
	Diminished on-the-land experience.	Areas >40 dBA noise	157	†	157	157	†	157	157	†	157	—

Note:

The "—" symbol indicates there were no predicted residual adverse effects, or no cumulative effect.

(1) The increase in wetland extent reflects the effects of dewatering on WLD5.

(2) The effects due to dewatering are expected to persist until the open pit floods and groundwater returns to near pre-development levels.

(3) The areas lost during the site preparation and construction phase will not recover until post-closure.

(4) Those disciplines, VCs, and indicators with predicted residual adverse effects, but no predicted cumulative are indicated with the "†" symbol in the table.

(5) Those disciplines, VCs, and indicators for which cumulative effects were predicted but the analysis determined there would be no numeric or material change in magnitude of the residual adverse effects predicted for the Project are indicated with a "‡" symbol in the table.

8.16.2 Description of Significance

8.16.2.1 Magnitude

The levels of magnitude for the predicted residual adverse effects (including cumulative effects) on land use (Table 8.16.1-1) were assigned using the approach described in Section 8.1.1.15, and set out in Table 8.1.1.15-2. The results are summarized in Table 8.16.2.1-1.

8.16.2.2 Geographic Extent

Geographic extent to the residual adverse effects on land use are all restricted to the relevant LSAs, therefore the geographic extent for all VCs and indicators with a residual adverse effect if Level II.

8.16.2.3 Timing

While there will be no specific action to manage the timing of effects from a land use perspective, several of the land use effects (e.g., hunting) rely on the levels of timing assigned for other disciplines, such as wildlife and wildlife habitat. The resulting levels of timing for the land use VCs and indicators are summarized in Table 8.16.2.3-1.

8.16.2.4 Duration

The levels of duration for the predicted residual effects of the Project on land use (Table 8.16.1-1) were assigned using the approach described in Section 8.1.4. The levels of duration for land use are summarized in Table 8.16.2.4-1. When assigning the level of duration for “habitat loss” measures, Level II was assigned as the habitat will remain lost through to post-closure.

8.16.2.5 Frequency

The levels of frequency for the predicted residual effects of the Project on land use (Table 8.16.1-1) were assigned using the approach described in Section 8.1.5.15. The results are summarized in Table 8.16.2.5-1

Table 8.16.2.1-1: Levels of Magnitude for Land Use

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction	Operations	Closure	Post-closure
Land Use Planning and Policies	Conflict with accepted land uses as stipulated in approved land use plans.	—	—	—	—	—
	Overlap with protected areas.	—	—	—	—	—
Aggregate Operations	Change in access to aggregate resources.	—	—	—	—	—
	Change in demand of aggregate resources extraction.	—	—	—	—	—
Forestry	Change in access to forestry resources.	—	—	—	—	—
	Loss of forestry resources.	Area unavailable (ha)	—	Level I	Level I	Level I
Mineral Exploration	Change in access to mineral claims for exploration and production.	—	—	—	—	—
Fishing - Recreational and Commercial	Change in access to fisheries resources.	—	—	—	—	—
	Change in the abundance of fisheries resources.	—	—	—	—	—
	Change in contaminant levels in fish	—	—	—	—	—
	Diminished on-the-land experience.	Change to views on Thunder Lake	—	Level I	Level I	Level I
Hunting	Change in access to wildlife resources.	Area unavailable (ha)	Level I	Level I	Level I	—
	Change in abundance of wildlife resources	Moose	Level I	Level I	Level I	—
		American Marten	Level I	Level I	Level I	—
		American Beaver	Level I	Level I	Level I	—
		Upland Birds	Level I	Level I	Level I	—
		Marsh Birds	Level II	Level II	Level II	—
Diminished on-the-land experience.	Areas >40 dBA noise	Level I	Level I	Level I	—	
Trapping	Change in access to wildlife resources.	Area unavailable (ha)	Level I	Level I	Level I	—
	Change in abundance of wildlife resources	American Marten	Level I	Level I	Level I	—
		American Beaver	Level I	Level I	Level I	—

Table 8.16.2.1-1: Levels of Magnitude for Land Use (continued)

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction	Operations	Closure	Post-closure	
	Diminished on-the-land experience.	Areas >40 dBA noise	Level I	Level I	Level I	—	
Cottagers and Outfitters	Diminished on-the-land experience.	Areas >40 dBA noise	Level I	Level I	Level I	—	
	Change in access to cottage and/or outfitter areas.	—	—	—	—	—	
	Changes in clientele for outfitters with lodges located near the Project.	Increased demand for local accommodations	Level II	Level II	Level II	—	
Other Recreational Uses	Change in access for residents and visitors to public lands for non-consumptive purposes	—	—	—	—	—	
	Change in access for residents and visitors to public lands for consumptive purposes.	Area unavailable (ha)	Level I	Level I	Level I	—	
	Change in abundance of berries, mushrooms and/or other vegetation used for consumption	Wetland extent		Level II	Level II	Level II	—
		Predominantly coniferous forest		Level I	Level I	Level I	—
		Predominantly deciduous forest		Level I	Level I	Level I	—
		Successional areas		Level I	Level I	Level I	—
		Potential berry harvesting areas		Level I	Level I	Level I	—
Diminished on-the-land experience.	Areas >40 dBA noise	Level I	Level I	Level I	—		

Note: The “—” symbol indicates there were no predicted residual adverse effects.

Table 8.16.2.3-1: Levels of Timing for Land Use

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction	Operations	Closure	Post-closure
Land Use Planning and Policies	Conflict with accepted land uses as stipulated in approved land use plans.	—	—	—	—	—
	Overlap with protected areas.	—	—	—	—	—
Aggregate Operations	Change in access to aggregate resources.	—	—	—	—	—
	Change in demand of aggregate resources extraction.	—	—	—	—	—
Forestry	Change in access to forestry resources.	—	—	—	—	—
	Loss of forestry resources.	Area unavailable (ha)	—	Level II	Level II	Level II
Mineral Exploration	Change in access to mineral claims for exploration and production.	—	—	—	—	—
Fishing - Recreational and Commercial	Change in access to fisheries resources.	—	—	—	—	—
	Change in the abundance of fisheries resources.	—	—	—	—	—
	Change in contaminant levels in fish	—	—	—	—	—
	Diminished on-the-land experience.	Change to views on Thunder Lake	—	Level II	Level II	Level II
Hunting	Change in access to wildlife resources.	Area unavailable (ha)	Level II	Level II	Level II	—
		Moose	Level III	Level III	Level III	—
	Change in abundance of wildlife resources	American Marten	Level III	Level III	Level III	—
		American Beaver	Level III	Level III	Level III	—
		Upland Birds	Level I	Level I	Level I	—
	Marsh Birds	Level I	Level I	Level I	—	
Diminished on-the-land experience.	Areas >40 dBA noise	Level II	Level II	Level II	—	
Trapping	Change in access to wildlife resources.	Area unavailable (ha)	Level II	Level II	Level II	—
		American Marten	Level III	Level III	Level III	—
	Change in abundance of wildlife resources	American Beaver	Level III	Level III	Level III	—
		Diminished on-the-land experience.	Areas >40 dBA noise	Level II	Level II	Level II

Table 8.16.2.3-1: Levels of Timing for Land Use (continued)

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction	Operations	Closure	Post-closure	
Cottagers and Outfitters	Diminished on-the-land experience.	Areas >40 dBA noise	Level II	Level II	Level II	—	
	Change in access to cottage and/or outfitter areas.	—	—	—	—	—	
	Changes in clientele for outfitters with lodges located near the Project.	Increased demand for local accommodations	Level II	Level II	Level II	—	
Other Recreational Uses	Change in access for residents and visitors to public lands for non-consumptive purposes	—	—	—	—	—	
	Change in access for residents and visitors to public lands for consumptive purposes.	Area unavailable (ha)	Level II	Level II	Level II	—	
	Change in abundance of berries, mushrooms and/or other vegetation used for consumption	Wetland extent	Level II	Level II	Level II	Level II	—
		Predominantly coniferous forest	Level II	Level II	Level II	Level II	—
		Predominantly deciduous forest	Level II	Level II	Level II	Level II	—
		Successional areas	Level II	Level II	Level II	Level II	—
		Potential berry harvesting areas	Level II	Level II	Level II	Level II	—
Diminished on-the-land experience.	Areas >40 dBA noise	Level II	Level II	Level II	—		

Note: The “—” symbol indicates there were no predicted residual adverse effects.

Table 8.16.2.4-1: Levels of Duration for Land Use

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction	Operations	Closure	Post-closure
Land Use Planning and Policies	Conflict with accepted land uses as stipulated in approved land use plans.	—	—	—	—	—
	Overlap with protected areas.	—	—	—	—	—
Aggregate Operations	Change in access to aggregate resources.	—	—	—	—	—
	Change in demand of aggregate resources extraction.	—	—	—	—	—
Forestry	Change in access to forestry resources.	—	—	—	—	—
	Loss of forestry resources.	Area unavailable (ha)	—	Level II	Level II	Level III
Mineral Exploration	Change in access to mineral claims for exploration and production.	—	—	—	—	—
Fishing - Recreational and Commercial	Change in access to fisheries resources.	—	—	—	—	—
	Change in the abundance of fisheries resources.	—	—	—	—	—
	Change in contaminant levels in fish	—	—	—	—	—
	Diminished on-the-land experience.	Change to views on Thunder Lake	—	Level II	Level III	Level III
Hunting	Change in access to wildlife resources.	Area unavailable (ha)	Level II	Level II	Level II	—
		Moose	Level II	Level II	Level II	—
	Change in abundance of wildlife resources	American Marten	Level II	Level II	Level II	—
		American Beaver	Level II	Level II	Level II	—
		Upland Birds	Level II	Level II	Level II	—
	Marsh Birds	Level II	Level II	Level II	—	
Diminished on-the-land experience.	Areas >40 dBA noise	Level I	Level I	Level I	—	
Trapping	Change in access to wildlife resources.	Area unavailable (ha)	Level II	Level II	Level II	—
		American Marten	Level II	Level II	Level II	—
	Change in abundance of wildlife resources	American Beaver	Level II	Level II	Level II	—
		Diminished on-the-land experience.	Areas >40 dBA noise	Level I	Level II	Level I

Table 8.16.2.4-1: Levels of Duration for Land Use (continued)

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction	Operations	Closure	Post-closure	
Cottagers and Outfitters	Diminished on-the-land experience.	Areas >40 dBA noise	Level I	Level II	Level I	—	
	Change in access to cottage and/or outfitter areas.	—	—	—	—	—	
	Changes in clientele for outfitters with lodges located near the Project.	Increased demand for local accommodations	Level I	Level II	Level I	—	
Other Recreational Uses	Change in access for residents and visitors to public lands for non-consumptive purposes	—	—	—	—	—	
	Change in access for residents and visitors to public lands for consumptive purposes.	Area unavailable (ha)	Level I	Level II	Level I	—	
	Change in abundance of berries, mushrooms and/or other vegetation used for consumption	Wetland extent	Level II	Level II	Level II	Level II	—
		Predominantly coniferous forest	Level II	Level II	Level II	Level II	—
		Predominantly deciduous forest	Level II	Level II	Level II	Level II	—
		Successional areas	Level II	Level II	Level II	Level II	—
		Potential berry harvesting areas	Level II	Level II	Level II	Level II	—
Diminished on-the-land experience.	Areas >40 dBA noise	Level I	Level I	Level I	—		

Note: The “—” symbol indicates there were no predicted residual adverse effects.

Table 8.16.2.5-1: Levels of Frequency for Land Use

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction	Operations	Closure	Post-closure
Land Use Planning and Policies	Conflict with accepted land uses as stipulated in approved land use plans.	—	—	—	—	—
	Overlap with protected areas.	—	—	—	—	—
Aggregate Operations	Change in access to aggregate resources.	—	—	—	—	—
	Change in demand of aggregate resources extraction.	—	—	—	—	—
Forestry	Change in access to forestry resources.	—	—	—	—	—
	Loss of forestry resources.	Area unavailable (ha)	—	Level III	Level III	Level III
Mineral Exploration	Change in access to mineral claims for exploration and production.	—	—	—	—	—
Fishing - Recreational and Commercial	Change in access to fisheries resources.	—	—	—	—	—
	Change in the abundance of fisheries resources.	—	—	—	—	—
	Change in contaminant levels in fish	—	—	—	—	—
	Diminished on-the-land experience.	Change to views on Thunder Lake	—	Level III	Level III	Level III
Hunting	Change in access to wildlife resources.	Area unavailable (ha)	—	—	—	—
		Moose	Level III	Level III	Level III	—
	Change in abundance of wildlife resources	American Marten	Level III	Level III	Level III	—
		American Beaver	Level III	Level III	Level III	—
		Upland Birds	Level III	Level III	Level III	—
	Marsh Birds	Level III	Level III	Level III	—	
Diminished on-the-land experience.	Areas >40 dBA noise	Level III	Level III	Level III	—	
Trapping	Change in access to wildlife resources.	Area unavailable (ha)	Level III	Level III	Level III	—
		American Marten	Level III	Level III	Level III	—
	Change in abundance of wildlife resources	American Beaver	Level III	Level III	Level III	—
		Diminished on-the-land experience.	Areas >40 dBA noise	Level III	Level III	Level III

Table 8.16.2.5-1: Levels of Frequency for Land Use (continued)

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction	Operations	Closure	Post-closure	
Cottagers and Outfitters	Diminished on-the-land experience.	Areas >40 dBA noise	Level III	Level III	Level III	—	
	Change in access to cottage and/or outfitter areas.	—	—	—	—	—	
	Changes in clientele for outfitters with lodges located near the Project.	Increased demand for local accommodations	Level II	Level II	Level II	—	
Other Recreational Uses	Change in access for residents and visitors to public lands for non-consumptive purposes	—	—	—	—	—	
	Change in access for residents and visitors to public lands for consumptive purposes.	Area unavailable (ha)	Level III	Level III	Level III	—	
	Change in abundance of berries, mushrooms and/or other vegetation used for consumption	Wetland extent	Level III	Level III	Level III	Level III	—
		Predominantly coniferous forest	Level III	Level III	Level III	Level III	—
		Predominantly deciduous forest	Level III	Level III	Level III	Level III	—
		Successional areas	Level III	Level III	Level III	Level III	—
		Potential berry harvesting areas	Level III	Level III	Level III	Level III	—
Diminished on-the-land experience.	Areas >40 dBA noise	Level III	Level III	Level III	Level III	—	

Note: The “—” symbol indicates there were no predicted residual adverse effects.

8.16.2.6 Reversibility

The levels of reversibility for the predicted residual effects of the Project on land use (Table 8.16.1-1) were assigned using the approach described in Section 8.1.6. The levels of reversibility are summarized in Table 8.16.2.6-1. When assigning the level of reversibility for “habitat loss” measures, Level II was assigned as the habitat will remain lost through to post-closure. When assigning the level of reversibility to effects associated with “noise”, Level I was assigned as those effects will stop once the activities causing the effect (e.g., noise from equipment) stops.

8.16.2.7 Determination of Significance

The determination of significance for each valued component and potential effect is presented in Table 8.16.2.5-1. The table lists the various levels assigned for the elements introduced in Section 8.1. Applying the decision tree (Figure 8.1.8-1) to the effects levels in the table yields a determination that the effects of the Project on land use would not be significant. In addition to those elements, the table indicates the direction of the effect (adverse, neutral, or positive).

8.16.2.8 Prediction Confidence and Uncertainty

The prediction confidence regarding land and resource uses is moderate. Possible existing gaps in information will be addressed by completion of additional land and resource use baseline. Treasury Metals is committed to continue to engage with area users to gather Project-specific land and resource use information.

Table 8.16.2.6-1: Levels of Reversibility for Land Use

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction	Operations	Closure	Post-closure
Land Use Planning and Policies	Conflict with accepted land uses as stipulated in approved land use plans.	—	—	—	—	—
	Overlap with protected areas.	—	—	—	—	—
Aggregate Operations	Change in access to aggregate resources.	—	—	—	—	—
	Change in demand of aggregate resources extraction.	—	—	—	—	—
Forestry	Change in access to forestry resources.	—	—	—	—	—
	Loss of forestry resources.	Area unavailable (ha)	—	Level III	Level III	Level III
Mineral Exploration	Change in access to mineral claims for exploration and production.	—	—	—	—	—
Fishing - Recreational and Commercial	Change in access to fisheries resources.	—	—	—	—	—
	Change in the abundance of fisheries resources.	—	—	—	—	—
	Change in contaminant levels in fish	—	—	—	—	—
	Diminished on-the-land experience.	Change to views on Thunder Lake	—	Level III	Level III	Level III
Hunting	Change in access to wildlife resources.	Area unavailable (ha)	Level II	Level II	Level II	—
		Moose	Level II	Level II	Level II	—
	Change in abundance of wildlife resources	American Marten	Level II	Level II	Level II	—
		American Beaver	Level II	Level II	Level II	—
		Upland Birds	Level II	Level II	Level II	—
	Marsh Birds	Level II	Level II	Level II	—	
Diminished on-the-land experience.	Areas >40 dBA noise	Level I	Level I	Level I	—	
Trapping	Change in access to wildlife resources.	Area unavailable (ha)	Level II	Level II	Level II	—
		American Marten	Level II	Level II	Level II	—
	Change in abundance of wildlife resources	American Beaver	Level II	Level II	Level II	—
		Diminished on-the-land experience.	Areas >40 dBA noise	Level I	Level I	Level I

Table 8.16.2.6-1: Levels of Reversibility for Land Use (continued)

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction	Operations	Closure	Post-closure	
Cottagers and Outfitters	Diminished on-the-land experience.	Areas >40 dBA noise	Level I	Level I	Level I	—	
	Change in access to cottage and/or outfitter areas.	—	—	—	—	—	
	Changes in clientele for outfitters with lodges located near the Project.	Increased demand for local accommodations	Level II	Level II	Level II	—	
Other Recreational Uses	Change in access for residents and visitors to public lands for non-consumptive purposes	—	—	—	—	—	
	Change in access for residents and visitors to public lands for consumptive purposes.	Area unavailable (ha)	Level II	Level II	Level II	—	
	Change in abundance of berries, mushrooms and/or other vegetation used for consumption	Wetland extent	Level II	Level II	Level II	Level II	—
		Predominantly coniferous forest	Level II	Level II	Level II	Level II	—
		Predominantly deciduous forest	Level II	Level II	Level II	Level II	—
		Successional areas	Level II	Level II	Level II	Level II	—
		Potential berry harvesting areas	Level II	Level II	Level II	Level II	—
Diminished on-the-land experience.	Areas >40 dBA noise	Level I	Level I	Level I	—		

Note: The “—” symbol indicates there were no predicted residual adverse effects.

Table 8.16.2.5-1: Determination of Significance for Land and Resource Use

Valued Components (VCs)	Indicator	Measure	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	Significance	Likelihood
Site Preparation and Construction Phase										
Land Use Planning and Policies	Conflict with accepted land uses as stipulated in approved land use plans.								No residual adverse effects	
	Overlap with protected areas.								No residual adverse effects	
Aggregate operations	Change in access to aggregate resources.								No residual adverse effects	
	Change in demand of aggregate resources extraction.								No residual adverse effects	
Forestry	Change in access to forestry resources.								No residual adverse effects	
	Loss of forestry resources.	Area unavailable (ha)	—	—	—	—	—	—	—	—
Mineral Exploration	Change in access to mineral claims for exploration and production.								No residual adverse effects	
Fishing - recreational and commercial	Change in access to fisheries resources.								No residual adverse effects	
	Change in the abundance of fisheries resources.								No residual adverse effects	
	Change in contaminant levels in fish								No residual adverse effects	
	Diminished on-the-land experience.	Change to views on Thunder Lake	—	—	—	—	—	—	—	—
Hunting	Change in access to wildlife resources.	Area unavailable (ha)	Level I	Level II	Level II	Level II	—	Level II	Not significant	NA ⁽¹⁾
	Change in abundance of wildlife resources	Moose	Level I	Level II	Level III	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
		American Marten	Level I	Level II	Level III	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
		American Beaver	Level I	Level II	Level III	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
		Upland Birds	Level I	Level II	Level I	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
		Marsh Birds	Level II	Level II	Level I	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
Diminished on-the-land experience.	Areas >40 dBA noise	Level I	Level II	Level II	Level I	Level III	Level I	Not significant	NA ⁽¹⁾	
Trapping	Change in access to wildlife resources.	Area unavailable (ha)	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
	Change in abundance of wildlife resources	American Marten	Level I	Level II	Level III	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
		American Beaver	Level I	Level II	Level III	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
	Diminished on-the-land experience.	Areas >40 dBA noise	Level I	Level II	Level II	Level I	Level III	Level I	Not significant	NA ⁽¹⁾
Cottagers and outfitters	Diminished on-the-land experience.	Areas >40 dBA noise	Level I	Level II	Level II	Level I	Level III	Level I	Not significant	NA ⁽¹⁾
	Change in access to cottage and/or outfitter areas.								No residual adverse effects	
Other recreational uses	Changes in clientele for outfitters with lodges located near the Project.	Increased demand for local accommodations	Level II	Level II	Level II	Level I	Level II	Level II	Not significant	NA ⁽¹⁾
	Change in access for residents and visitors to public lands for non-consumptive purposes								No residual adverse effects	
	Change in access for residents and visitors to public lands for consumptive purposes.	Area unavailable (ha)	Level I	Level II	Level II	Level I	Level III	Level II	Not significant	NA ⁽¹⁾
	Change in abundance of berries, mushrooms and/or other vegetation used for consumption	Wetland extent	Level II	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
		Predominantly coniferous forest	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
		Predominantly deciduous forest	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
		Successional areas	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
Potential berry harvesting areas	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾		
Diminished experience of being on the land.	Areas >40 dBA noise	Level I	Level II	Level II	Level I	Level III	Level I	Not significant	NA ⁽¹⁾	

Table 8.16.2.5-1: Determination of Significance for Land and Resource Use (continued)

Valued Components (VCs)	Indicator	Measure	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	Significance	Likelihood
Operations Phase										
Land Use Planning and Policies	Conflict with accepted land uses as stipulated in approved land use plans.	No residual adverse effects								
	Overlap with protected areas.	No residual adverse effects								
Aggregate operations	Change in access to aggregate resources.	No residual adverse effects								
	Change in demand of aggregate resources extraction.	No residual adverse effects								
Forestry	Change in access to forestry resources.	No residual adverse effects								
	Loss of forestry resources.	Area unavailable (ha)	Level I	Level II	Level II	Level II	Level III	Level III	Not significant	NA ⁽¹⁾
Mineral Exploration	Change in access to mineral claims for exploration and production.	No residual adverse effects								
Fishing - recreational and commercial	Change in access to fisheries resources.	No residual adverse effects								
	Change in the abundance of fisheries resources.	No residual adverse effects								
	Change in contaminant levels in fish	No residual adverse effects								
	Diminished on-the-land experience.	Change to views on Thunder Lake	Level I	Level II	Level II	Level II	Level III	Level III	Not significant	NA ⁽¹⁾
Hunting	Change in access to wildlife resources.	Area unavailable (ha)	Level I	Level II	Level II	Level II	—	Level II	Not significant	NA ⁽¹⁾
		Moose	Level I	Level II	Level III	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
		American Marten	Level I	Level II	Level III	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
		American Beaver	Level I	Level II	Level III	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
		Upland Birds	Level I	Level II	Level I	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
	Marsh Birds	Level II	Level II	Level I	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
Diminished on-the-land experience.	Areas >40 dBA noise	Level I	Level II	Level II	Level I	Level III	Level I	Not significant	NA ⁽¹⁾	
Trapping	Change in access to wildlife resources.	Area unavailable (ha)	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
		American Marten	Level I	Level II	Level III	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
	Change in abundance of wildlife resources	American Beaver	Level I	Level II	Level III	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
		Diminished on-the-land experience.	Areas >40 dBA noise	Level I	Level II	Level II	Level II	Level III	Level I	Not significant
Cottagers and outfitters	Diminished on-the-land experience.	Areas >40 dBA noise	Level I	Level II	Level II	Level II	Level III	Level I	Not significant	NA ⁽¹⁾
	Change in access to cottage and/or outfitter areas.	No residual adverse effects								
Other recreational uses	Changes in clientele for outfitters with lodges located near the Project.	Increased demand for local accommodations	Level II	Level II	Level II	Level II	Level II	Level II	Not significant	NA ⁽¹⁾
	Change in access for residents and visitors to public lands for non-consumptive purposes	No residual adverse effects								
		Change in access for residents and visitors to public lands for consumptive purposes.	Area unavailable (ha)	Level I	Level II	Level II	Level II	Level III	Level II	Not significant
	Change in abundance of berries, mushrooms and/or other vegetation used for consumption		Wetland extent	Level II	Level II	Level II	Level II	Level III	Level II	Not significant
		Predominantly coniferous forest	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
		Predominantly deciduous forest	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
		Successional areas	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
Potential berry harvesting areas	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾		
Diminished experience of being on the land.	Areas >40 dBA noise	Level I	Level II	Level II	Level I	Level III	Level I	Not significant	NA ⁽¹⁾	

Table 8.16.2.5-1: Determination of Significance for Land and Resource Use (continued)

Valued Components (VCs)	Indicator	Measure	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	Significance	Likelihood
Closure Phase										
Land Use Planning and Policies	Conflict with accepted land uses as stipulated in approved land use plans.	No residual adverse effects								
	Overlap with protected areas.	No residual adverse effects								
Aggregate operations	Change in access to aggregate resources.	No residual adverse effects								
	Change in demand of aggregate resources extraction.	No residual adverse effects								
Forestry	Change in access to forestry resources.	No residual adverse effects								
	Loss of forestry resources.	Area unavailable (ha)	Level I	Level II	Level II	Level II	Level III	Level III	Not significant	NA ⁽¹⁾
Mineral Exploration	Change in access to mineral claims for exploration and production.	No residual adverse effects								
Fishing - recreational and commercial	Change in access to fisheries resources.	No residual adverse effects								
	Change in the abundance of fisheries resources.	No residual adverse effects								
	Change in contaminant levels in fish	No residual adverse effects								
	Diminished on-the-land experience.	Change to views on Thunder Lake	Level I	Level II	Level II	Level III	Level III	Level III	Not significant	NA ⁽¹⁾
Hunting	Change in access to wildlife resources.	Area unavailable (ha)	Level I	Level II	Level II	Level II	—	Level II	Not significant	NA ⁽¹⁾
		Moose	Level I	Level II	Level III	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
		American Marten	Level I	Level II	Level III	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
		American Beaver	Level I	Level II	Level III	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
		Upland Birds	Level I	Level II	Level I	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
	Marsh Birds	Level II	Level II	Level I	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
Diminished on-the-land experience.	Areas >40 dBA noise	Level I	Level II	Level II	Level I	Level III	Level I	Not significant	NA ⁽¹⁾	
Trapping	Change in access to wildlife resources.	Area unavailable (ha)	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
		American Marten	Level I	Level II	Level III	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
	Change in abundance of wildlife resources	American Beaver	Level I	Level II	Level III	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
		Diminished on-the-land experience.	Areas >40 dBA noise	Level I	Level II	Level II	Level I	Level III	Level I	Not significant
Cottagers and outfitters	Diminished on-the-land experience.	Areas >40 dBA noise	Level I	Level II	Level II	Level I	Level III	Level I	Not significant	NA ⁽¹⁾
	Change in access to cottage and/or outfitter areas.	No residual adverse effects								
Other recreational uses	Changes in clientele for outfitters with lodges located near the Project.	Increased demand for local accommodations	Level II	Level II	Level II	Level I	Level II	Level II	Not significant	NA ⁽¹⁾
	Change in access for residents and visitors to public lands for non-consumptive purposes	No residual adverse effects								
		Change in access for residents and visitors to public lands for consumptive purposes.	Area unavailable (ha)	Level I	Level II	Level II	Level I	Level III	Level II	Not significant
	Change in abundance of berries, mushrooms and/or other vegetation used for consumption		Wetland extent	Level II	Level II	Level II	Level II	Level III	Level II	Not significant
		Predominantly coniferous forest	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
		Predominantly deciduous forest	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
		Successional areas	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
	Potential berry harvesting areas	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
Diminished experience of being on the land.	Areas >40 dBA noise	Level I	Level II	Level II	Level I	Level III	Level I	Not significant	NA ⁽¹⁾	

Table 8.16.2.5-1: Determination of Significance for Land and Resource Use (continued)

Valued Components (VCs)	Indicator	Measure	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	Significance	Likelihood	
Post-closure Phase											
Land Use Planning and Policies	Conflict with accepted land uses as stipulated in approved land use plans.									No residual adverse effects	
	Overlap with protected areas.									No residual adverse effects	
Aggregate operations	Change in access to aggregate resources.									No residual adverse effects	
	Change in demand of aggregate resources extraction.									No residual adverse effects	
Forestry	Change in access to forestry resources.									No residual adverse effects	
	Loss of forestry resources.	Area unavailable (ha)	Level I	Level II	Level II	Level III	Level III	Level III	Not significant	NA ⁽¹⁾	
Mineral Exploration	Change in access to mineral claims for exploration and production.									No residual adverse effects	
Fishing - recreational and commercial	Change in access to fisheries resources.									No residual adverse effects	
	Change in the abundance of fisheries resources.									No residual adverse effects	
	Change in contaminant levels in fish									No residual adverse effects	
	Diminished on-the-land experience.	Change to views on Thunder Lake	Level I	Level II	Level II	Level III	Level III	Level III	Not significant	NA ⁽¹⁾	
Hunting	Change in access to wildlife resources.	Area unavailable (ha)								No residual adverse effects	
	Change in abundance of wildlife resources	Moose								No residual adverse effects	
		American Marten								No residual adverse effects	
		American Beaver								No residual adverse effects	
		Upland Birds								No residual adverse effects	
		Marsh Birds								No residual adverse effects	
	Diminished on-the-land experience.	Areas >40 dBA noise								No residual adverse effects	
Trapping	Change in access to wildlife resources.	Area unavailable (ha)								No residual adverse effects	
	Change in abundance of wildlife resources	American Marten								No residual adverse effects	
		American Beaver								No residual adverse effects	
	Diminished on-the-land experience.	Areas >40 dBA noise								No residual adverse effects	
Cottagers and outfitters	Diminished on-the-land experience.	Areas >40 dBA noise								No residual adverse effects	
	Change in access to cottage and/or outfitter areas.									No residual adverse effects	
	Changes in clientele for outfitters with lodges located near the Project.	Increased demand for local accommodations								No residual adverse effects	
Other recreational uses	Change in access for residents and visitors to public lands for non-consumptive purposes									No residual adverse effects	
	Change in access for residents and visitors to public lands for consumptive purposes.	Area unavailable (ha)								No residual adverse effects	
	Change in abundance of berries, mushrooms and/or other vegetation used for consumption.	Wetland extent									No residual adverse effects
		Predominantly coniferous forest									No residual adverse effects
		Predominantly deciduous forest									No residual adverse effects
		Successional areas									No residual adverse effects
	Potential berry harvesting areas									No residual adverse effects	
Diminished experience of being on the land.	Areas >40 dBA noise								No residual adverse effects		

Notes: (1) In accordance with Agency guidance (CEAA, 2015b) likelihood was not determined as none of the effects were classified as significant

8.17 Social

8.17.1 Residual Adverse Effects and Cumulative Effects Advanced for Determination of Significance

Residual Project-related social effects were predicted for each of the social VCs. The effects are expected to occur primarily within the communities in closest proximity to the Project, namely Village of Wabigoon, City of Dryden, and local Indigenous communities of Wabigoon Lake Ojibway Nation, and Eagle Lake First Nation. A summary of the predicted residual effects of the Project on the social VCs is provided in Table 8.17.1-1. The residual effects for social have been classified as either adverse or positive, depending on the VC, indicator and phase of the Project. In accordance with the EIS Guidelines, only the residual adverse effects will be carried forward through the determination of significance.

Section 7.5.9 identifies that cumulative effects are predicted for the following VCs. This listing of VCs also identifies which projects or activities were associated with the cumulative effects:

- Population demographics (population change):
 - Josephine Cone Mine Project.
- Education (capacity of education services):
 - Josephine Cone Mine Project.
- Education (education attainment):
 - Josephine Cone Mine Project.
- Infrastructure and services (municipal services):
 - Josephine Cone Mine Project.
- Infrastructure and services (community services):
 - Josephine Cone Mine Project.
- Housing and property values (housing availability):
 - Major upgrades to Highway 17;
 - Josephine Cone Mine Project; and
 - Wataynikaneyap Power Project.
- Housing and property values (property values):
 - Josephine Cone Mine Project.
- Public safety (crime rate):
 - Josephine Cone Mine Project.



- Public safety (capacity of emergency services):

Table 8.17.1-1: Residual Effects of the Project on Social VCs

Valued Components (VCs)	Indicators	Residual Effect	Site Preparation and Construction	Operations	Closure	Post-closure
Population demographics	Population change	Potential increased demand on existing community housing, infrastructure and services. A noticeable change may result but it is expected that the current infrastructure within the communities most likely to be affected (City of Dryden and Village of Wabigoon) would be able to accommodate increased population. Population levels may decline to pre-Project conditions during Closure and Post-closure.	Adverse	Adverse	Positive	Positive
Education	Capacity of education services	Potential increased demand on education services. It is anticipated that any increase in enrollments could be accommodated within existing education system.	Adverse	Adverse	Positive	Positive
	Education attainment	Increased opportunities would encourage individuals to achieve higher levels of education.	Adverse	Adverse	Positive	Positive
	Project-specific Training	Increased training and education opportunities for unemployed and under-employed residents and non-resident workers	Positive	Positive	Adverse	Adverse
Infrastructure and services	Municipal Services	Potential increased demand on infrastructure and services may be noticeable but are anticipated to be within the current capacity.	Adverse	Adverse	Positive	—
	Community services such as recreation, health and social services	Potential increased demand on infrastructure and services may be noticeable but are anticipated to be within the current capacity.	Adverse	Adverse	Positive	—
Housing and property values	Housing availability	Potential for demand to limit supply or lead to price increases for temporary accommodations.	Adverse	—	—	—
	Property values	Real and perceived effects of Project-related activities (e.g., traffic, blasting) could negatively affect the value of houses that are closest to the Project's property boundary.	Adverse	Adverse	Adverse	Positive
		Increased demand for housing because of in-migration to the area may lead to an increase in real estate values.	Positive	Positive	Adverse	Adverse
Public safety	Crime rate	Personal decision-making related to spending Project-related income may positively or negatively affect public safety within the affected communities. Although potential out-migration of population following mine closure may occur, decreases in income levels due to mine closure and personal decision-making and behaviours could negatively affect the crime rate within the affected socio-economic study area communities.	Adverse	Adverse	Adverse	Adverse
	Capacity of emergency services	Higher populations may have a noticeable effect on the demand for emergency services.	Adverse	Adverse	Adverse	—
	Requests for emergency services initiated by the Project	Project-related requests may have a noticeable effect on the demand for emergency services.	Adverse	Adverse	Adverse	—
Transportation and traffic	Road network capacity and conditions	The existing levels of service will be maintained on both Highway 17 and Anderson Road with additional anticipated Project-related traffic.	Adverse	Adverse	Positive	Positive

- Major upgrades to Highway 17;
- Josephine Cone Mine Project; and
- Wataynikaneyap Power Project.
- Transportation and traffic (road network capacity and conditions):
 - Major upgrades to Highway 17;
 - Josephine Cone Mine Project; and
 - Wataynikaneyap Power Project.

The above predicted cumulative effects were determined to be unlikely to numerically alter the magnitude of the predicted residual adverse effects for the Project. Therefore, the levels of magnitude for the social VCs have been assigned using the residual adverse effects of the Project (Table 8.17.1-1).

8.17.2 Description of Significance

8.17.2.1 Magnitude

The levels of magnitude for the predicted residual adverse effects of the Project on the social VCs were assigned using the approach described in Section 8.1.1.16. The results are summarized in Table 8.17.2.1-1.

Table 8.17.1-1: Levels of Magnitude for the Social VCs

Valued Components (VCs)	Indicators	Site Preparation and Construction	Operations	Closure	Post-closure
Population demographics	Population change	Level I	Level I	— ⁽¹⁾	—
Education	Capacity of education services	Level I	Level I	—	—
	Education attainment	Level I	Level I	—	—
	Project-specific Training	—	—	Level I	Level I
Infrastructure and services	Municipal Services	Level I	Level I	—	—
	Community services	Level I	Level I	—	—
Housing and property values	Housing availability	Level I	—	—	—
	Property values	Level I	Level I	Level I	—
		—	—	Level I	Level I
Public safety	Crime rate	Level I	Level I	Level I	Level I

Table 8.17.1-1: Levels of Magnitude for the Social VCs (continued)

Valued Components (VCs)	Indicators	Site Preparation and Construction	Operations	Closure	Post-closure
Public safety (continued)	Capacity of emergency services	Level I	Level I	Level I	—
	Project requests for emergency services	Level I	Level I	Level I	—
Transportation and traffic	Road network capacity and conditions	Level I	Level I	—	—

Note:

- (1) The “—” symbol indicates where no residual adverse effects were predicted for the discipline, VC and indicator. This could represent situations where no adverse effects were predicted, where the predicted effects were positive, or where predicted adverse effects were fully mitigated, as detailed in Section 6.17.

8.17.2.2 Geographic Extent

Geographic extent of the predicted residual adverse effects on the social VCs is the socio-economic study area. Therefore, the levels of geographic extent were assigned as Level II.

8.17.2.3 Timing

The levels of timing for the predicted residual adverse effects of the Project on the social VCs were assigned as Level II, in accordance with the approach described in Section 8.1.3.16.

8.17.2.4 Duration

The levels of duration (Table 8.15.1-1) for the predicted residual effects on the social VCs were assigned using the approach described in Section 8.1.4.

8.17.2.5 Frequency

The levels of frequency for the predicted residual effects of the Project on the social VCs were assigned as Level II, using the approach described in Section 8.1.5.16.

8.17.2.6 Reversibility

The levels of reversibility for the predicted residual effects of the Project on the social VCs were assigned as Level II using the approach described in Section 8.1.6.

8.17.2.7 Determination of Significance

Table 8.17.2.5-1 lists the levels assigned for the various assessment criteria described in Sections 8.17.2.1 through 8.17.2.6. Applying the decision tree (Figure 8.1.8-1) to the effects levels in the table yields a determination that the effects of the Project on social factors would not be significant.

8.18 Economic

8.18.1 Residual Adverse Effects and Cumulative Effects Advanced for Determination of Significance

Residual effects of the Project were predicted for each of the economic VCs. A summary of the predicted residual effects of the Project on the economic VCs was provided in Table 6.18.6-1. The predicted residual economic effects are classified as either adverse or positive, depending on the VC, indicator and phase of the Project. For the “changes in house prices” indicator, the direction is classified as adverse and positive, depending on whether viewed from the position of the seller or the buyer.

Section 7.5.10 identifies that cumulative effects are predicted for the economic VCs. The following lists the economic VCs for which cumulative effects were predicted, along with the Projects or activities that were associated with the cumulative effects:

- Labour force, labour participation and employment (labour income employment):
 - Major upgrades to Highway 17;
 - Josephine Cone Mine Project; and
 - Wataynikaneyap Power Project.
- Income levels (income levels and categories):
 - Josephine Cone Mine Project.
- Cost of living (current prevailing cost of living):
 - Josephine Cone Mine Project.
- Real estate (housing prices and affordability)
 - Josephine Cone Mine Project.
- Economic development (municipal taxes and contribution to economic development projects):
 - Josephine Cone Mine Project.

Table 8.17.2.5-1: Determination of Significance for Social Valued Components

Valued Components (VCs)	Indicator	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	Significance	Likelihood
Site Preparation and Construction Phase									
Population demographics	Population change	Level I	Level II	Level II	Level I	Level II	Level II	Not significant	NA ⁽¹⁾
Education	Capacity of education services	Level I	Level II	Level II	Level I	Level II	Level II	Not significant	NA ⁽¹⁾
	Education attainment	Level I	Level II	Level II	Level I	Level II	Level II	Not significant	NA ⁽¹⁾
	Project-specific Training	No residual adverse effects							
Infrastructure and services	Municipal Services	Level I	Level II	Level II	Level I	Level II	Level II	Not significant	NA ⁽¹⁾
	Community services	Level I	Level II	Level II	Level I	Level II	Level II	Not significant	NA ⁽¹⁾
Housing and property values	Housing availability	Level I	Level II	Level II	Level I	Level II	Level II	Not significant	NA ⁽¹⁾
	Property values	Level I	Level II	Level II	Level I	Level II	Level II	Not significant	NA ⁽¹⁾
No residual adverse effects									
Public safety	Crime rate	Level I	Level II	Level II	Level I	Level II	Level II	Not significant	NA ⁽¹⁾
	Capacity of emergency services	Level I	Level II	Level II	Level I	Level II	Level II	Not significant	NA ⁽¹⁾
	Project requests for emergency services	Level I	Level II	Level II	Level I	Level II	Level II	Not significant	NA ⁽¹⁾
Transportation and traffic	Road network capacity and conditions	Level I	Level II	Level II	Level I	Level II	Level II	Not significant	NA ⁽¹⁾
Operations Phase									
Population demographics	Population change	Level I	Level II	Level II	Level I	Level II	Level II	Not significant	NA ⁽¹⁾
Education	Capacity of education services	Level I	Level II	Level II	Level I	Level II	Level II	Not significant	NA ⁽¹⁾
	Education attainment	Level I	Level II	Level II	Level I	Level II	Level II	Not significant	NA ⁽¹⁾
	Project-specific Training	No residual adverse effects							
Infrastructure and services	Municipal Services	Level I	Level II	Level II	Level I	Level II	Level II	Not significant	NA ⁽¹⁾
	Community services	Level I	Level II	Level II	Level I	Level II	Level II	Not significant	NA ⁽¹⁾
Housing and property values	Housing availability	No residual adverse effects							
	Property values	Level I	Level II	Level II	Level I	Level II	Level II	Not significant	NA ⁽¹⁾
No residual adverse effects									
Public safety	Crime rate	Level I	Level II	Level II	Level I	Level II	Level II	Not significant	NA ⁽¹⁾
	Capacity of emergency services	Level I	Level II	Level II	Level I	Level II	Level II	Not significant	NA ⁽¹⁾
	Project requests for emergency services	Level I	Level II	Level II	Level I	Level II	Level II	Not significant	NA ⁽¹⁾
Transportation and traffic	Road network capacity and conditions	Level I	Level II	Level II	Level I	Level II	Level II	Not significant	NA ⁽¹⁾
Closure Phase									
Population demographics	Population change	No residual adverse effects							
Education	Capacity of education services	No residual adverse effects							
	Education attainment	No residual adverse effects							
	Project-specific Training	Level I	Level II	Level II	Level I	Level II	Level II	Not significant	NA ⁽¹⁾
Infrastructure and services	Municipal Services	No residual adverse effects							
	Community services	No residual adverse effects							

Table 8.17.2.5-1: Determination of Significance for Social Valued Components (continued)

Valued Components (VCs)	Indicator	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	Significance	Likelihood
Housing and property values	Housing availability	No residual adverse effects							
	Property values	Level I	Level II	Level II	Level I	Level II	Level II	Not significant	NA ⁽¹⁾
Public safety	Crime rate	Level I	Level II	Level II	Level I	Level II	Level II	Not significant	NA ⁽¹⁾
	Capacity of emergency services	Level I	Level II	Level II	Level I	Level II	Level II	Not significant	NA ⁽¹⁾
	Project requests for emergency services	Level I	Level II	Level II	Level I	Level II	Level II	Not significant	NA ⁽¹⁾
Transportation and traffic	Road network capacity and conditions	No residual adverse effects							
Post-closure Phase									
Population demographics	Population change	No residual adverse effects							
Education	Capacity of education services	No residual adverse effects							
	Education attainment	No residual adverse effects							
	Project-specific Training	Level I	Level II	Level II	Level I	Level II	Level II	Not significant	NA ⁽¹⁾
Infrastructure and services	Municipal Services	No residual adverse effects							
	Community services	No residual adverse effects							
Housing and property values	Housing availability	No residual adverse effects							
	Property values	Level I	Level II	Level II	Level I	Level II	Level II	Not significant	NA ⁽¹⁾
Public safety	Crime rate	Level I	Level II	Level II	Level I	Level II	Level II	Not significant	NA ⁽¹⁾
	Capacity of emergency services	No residual adverse effects							
	Project requests for emergency services	No residual adverse effects							
Transportation and traffic	Road network capacity and conditions	No residual adverse effects							

Notes:

(1) In accordance with Agency guidance (CEAA, 2015b) likelihood was not determined as none of the effects were classified as significant.

- Existing businesses (local business availability):
 - Major upgrades to Highway 17;
 - Josephine Cone Mine Project; and
 - Wataynikaneyap Power Project.
- Government revenues (taxes and revenues):
 - Josephine Cone Mine Project.
 - Wataynikaneyap Power Project.

The above predicted cumulative effects were determined to be unlikely to numerically alter the magnitude of the predicted residual adverse effects of the Project on the economic VCs. Therefore, the levels of magnitude for the economic VCs have been assigned using the residual adverse effects of the Project. Table 8.18.1-1 provides a summary of the residual effects of the Project on the economic VCs. In accordance with the EIS Guidelines, only the residual adverse effects will be carried forward through the determination of significance.

8.18.2 Description of Significance

8.18.2.1 Magnitude

The levels of magnitude for the predicted residual adverse effects of the Project on the economic VCs were assigned using the approach described in Section 8.1.1.17. The results are summarized in Table 8.18.2.1-1.

8.18.2.2 Geographic Extent

Geographic extent of the predicted residual adverse effects on the economic VCs is the socio-economic study area. Therefore, the levels of geographic extent were assigned as Level II.

8.18.2.3 Timing

The levels of timing for the predicted residual adverse effects of the Project on the economic VCs were assigned as Level II, in accordance with the approach described in Section 8.1.3.16.

8.18.2.4 Duration

The levels of duration (Table 8.15.1-1) for the predicted residual effects on the economic VCs were assigned using the approach described in Section 8.1.4.

Table 8.18.1-1: Residual Effects of the Project on the Economic VCs

Valued Components (VCs)	Indicators	Residual Effect	Site Preparation and Construction	Operations	Closure	Post-closure
Labour force, labour participation and employment	Labour income employment	The Project will affect labour income, change labour participation and change employment opportunities in the region.	Positive	Positive	Adverse	Adverse
Income levels	Income levels and categories	The Project will affect income levels in the region.	Positive	Positive	Adverse	Adverse
Cost of living	Current prevailing cost of living	The Project through employment and contacting opportunities will affect cost of living	Positive	Positive	Adverse	—
Real estate	Housing prices and affordability	The Project through employment and contacting opportunities will affect real estate prices	Positive	Positive	Adverse	—
Economic development	Municipal taxes and contribution to economic development projects	The Project will change government taxes which will affect economic development in the region	Positive	Positive	Adverse	Adverse
Existing businesses	Local business availability	The Project, through employment and contacting opportunities, will affect existing businesses	Positive	Positive	Adverse	Adverse
Government revenues	Taxes and revenues	The project through expenditures and employment will affect government revenues	Positive	Positive	Adverse	Adverse

Table 8.17.1-1: Levels of Magnitude for the Social VCs

Valued Components (VCs)	Indicators	Site Preparation and Construction	Operations	Closure	Post-closure
Labour force, labour participation and employment	Labour income employment	—	—	Level I	Level I
Income levels	Income levels and categories	—	—	Level I	Level I
Cost of living	Current prevailing cost of living	—	—	Level I	—
Real estate	Housing prices and affordability	—	—	Level I	—
Economic development	Municipal taxes and contribution to economic development projects	—	—	Level I	Level I
Existing businesses	Local business availability	—	—	Level I	Level I
Government revenues	Taxes and revenues	—	—	Level I	Level I

Note:

- (1) The “—” symbol indicates where no residual adverse effects were predicted for the discipline, VC and indicator. This could represent situations where no adverse effects were predicted, where the predicted effects were positive, or where predicted adverse effects were fully mitigated, as detailed in Section 6.18.

8.18.2.5 Frequency

The levels of frequency for the predicted residual effects of the Project on the economic VCs were assigned as Level II, using the approach described in Section 8.1.5.16.

8.18.2.6 Reversibility

The levels of reversibility for the predicted residual effects of the Project on the economic VCs were assigned as Level II using the approach described in Section 8.1.6.

8.18.2.7 Determination of Significance

Table 8.17.2.5-1 lists the levels assigned for the various assessment criteria described in Sections 8.17.2.1 through 8.17.2.6. Applying the decision tree (Figure 8.1.8-1) to the effects levels in the table yields a determination that the effects of the Project on social factors would not be significant.

Table 8.18.2.5-1 lists the various assessment levels for economic factors using the criteria listed in Section 8.1. Applying the decision tree (Figure 8.1.8-1) to the effects levels in the table yields a determination of significance. There were no significant residual economic effects identified during the site preparation and construction, closure, or post-closure phases. Significant economic effects were identified during operations. However, these significant effects were positive in direction, with the exception of changes in house prices. The direction for this effect was classified as neutral as the effects would be considered as negative for the buyers, but positive for the sellers.

8.19 Human Health

As described in Section 6.19.6, there were no predicted adverse effects of the Project on human health. Because there were no predicted residual adverse effects on human health, no determination of significance is required.

8.20 Heritage Resources

As described in Section 6.20.6, there were no predicted adverse effects of the Project on heritage resources. Because there were no predicted residual adverse effects on heritage resources, no determination of significance is required.

Table 8.18.2.5-1: Determination of Significance for Economic

Valued Components	Indicator	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	Significance	Likelihood
Site Preparation and Construction Phase									
Labour force, labour participation and employment	Labour income employment							No residual adverse effects	
Income levels	Changes in employment income							No residual adverse effects	
Cost of living	Changes in cost of living							No residual adverse effects	
Real estate	Changes in housing prices							No residual adverse effects	
Economic development	Changes in economic development							No residual adverse effects	
Existing businesses	Changes in demands for existing businesses							No residual adverse effects	
Government revenues	Changes in government revenues							No residual adverse effects	
Operations Phase									
Labour force, labour participation and employment	Labour income employment							No residual adverse effects	
Income levels	Changes in employment income							No residual adverse effects	
Cost of living	Changes in cost of living							No residual adverse effects	
Real estate	Changes in housing prices							No residual adverse effects	
Economic development	Changes in economic development							No residual adverse effects	
Existing businesses	Changes in demands for existing businesses							No residual adverse effects	
Government revenues	Changes in government revenues							No residual adverse effects	
Closure Phase									
Labour force, labour Participation and employment	Labour income employment	Level I	Level II	Level II	Level I	Level II	Level II	Not Significant	NA ⁽²⁾
Income levels	Changes in employment income	Level I	Level II	Level II	Level I	Level II	Level II	Not Significant	NA ⁽²⁾
Cost of living	Changes in cost of living	Level I	Level II	Level II	Level I	Level II	Level II	Not Significant	NA ⁽²⁾
Real estate	Changes in housing prices	Level I	Level II	Level II	Level I	Level II	Level II	Not Significant	NA ⁽²⁾
Economic development	Changes in economic development	Level I	Level II	Level II	Level I	Level II	Level II	Not Significant	NA ⁽²⁾
Existing businesses	Changes in demands for existing businesses	Level I	Level II	Level II	Level I	Level II	Level II	Not Significant	NA ⁽²⁾
Government revenues	Changes in government revenues	Level I	Level II	Level II	Level I	Level II	Level II	Not Significant	NA ⁽²⁾
Post-closure Phase									
Labour force, labour participation and employment	Labour income employment	Level I	Level II	Level II	Level II	Level II	Level II	Not Significant	NA ⁽²⁾
Income levels	Changes in employment income	Level I	Level II	Level II	Level II	Level II	Level II	Not Significant	NA ⁽²⁾
Cost of living	Changes in cost of living							No residual adverse effects	
Real estate	Changes in housing prices							No residual adverse effects	
Economic development	Changes in economic development	Level I	Level II	Level II	Level II	Level II	Level II	Not Significant	NA ⁽²⁾
Existing businesses	Changes in demands for existing businesses	Level I	Level II	Level II	Level II	Level II	Level II	Not Significant	NA ⁽²⁾
Government revenues	Changes in government revenues	Level I	Level II	Level II	Level II	Level II	Level II	Not Significant	NA ⁽²⁾

Notes:

- (1) Timing in not In accordance with Agency guidance (CEAA, 2015b) likelihood was not determined as none of the effects were classified as significant
- (2) In accordance with Agency guidance (CEAA, 2015b) likelihood was not determined as none of the effects were classified as significant
- (3) The magnitude for cost of living cost of living was classified as Level I, as the change from the Project would not be distinguishable from the current conditions.

8.21 Aboriginal Peoples

8.21.1 Residual Adverse Effects and Cumulative Effects Advanced for Determination of Significance

The description of the effects of the Project on the Aboriginal peoples VCs identified residual effects that were adverse, beneficial, and a combination of both, depending on the specific VC, indicator and phase of the Project. In accordance with the EIS Guidelines, only residual adverse effects need to be considered when determining significance. Table 8.21.1-1 provides a listing of the predicted residual adverse effects for the Aboriginal peoples VCs.

Table 8.21.1-1: Summary of Residual Adverse Effects for Aboriginal Peoples

Valued Components (VCs)	Indicators	Residual Adverse Effects
Human Health	Risk Assessment for Indigenous Human Health	—
Harvesting and gathering of plant material	Wild rice	—
	Berry Harvesting	Yes
	Medicinal plant harvesting	Yes
	Changes in access	Yes
	Diminished on-the-land experience	Yes
Hunting	Ungulates	Yes
	Furbearers	Yes
	Waterfowl	Yes
	Changes in access	Yes
	Diminished on-the-land experience	Yes
Trapping	Furbearers	Yes
	Changes in access	Yes
	Diminished on-the-land experience	Yes
Fishing	Sport fish	—
	Baitfish	—
	Commercial fishing	—
	Changes in access	Yes
	Diminished on-the-land experience	Yes
Cultural and spiritual	Cultural or spiritual sites	—
	Traditional Travel routes	—
	Diminished on-the-land experience	Yes
Socio-economic factors	Economic effects	Yes
	Social effects	Yes

Note:

- (1) The “—” symbol indicates where no residual adverse effects were predicted for the discipline, VC and indicator. This could represent situations where no adverse effects were predicted, or where predicted adverse effects were fully mitigated, as detailed in Section 6.16.

Section 7.5.13 identifies that cumulative effects were predicted for Aboriginal peoples VCs. The following lists the Aboriginal peoples VCs for which cumulative effects were predicted, along with the Projects or activities that were associated with the cumulative effects:

- Harvesting and gathering of plant materials (berry harvesting):
 - Ongoing forestry operations by Dryden Forest Management Company.
- Harvesting and gathering of plant materials (medicinal plant harvesting):
 - Ongoing forestry operations by Dryden Forest Management Company.
- Hunting (ungulates):
 - Josephine Cone Mine Project; and
 - Wataynikaneyap Power Project.
- Hunting (furbearers):
 - Ongoing forestry operations by Dryden Forest Management Company.
- Hunting (waterfowl):
 - Ongoing forestry operations by Dryden Forest Management Company.
- Trapping (furbearers):
 - Ongoing forestry operations by Dryden Forest Management Company.
- Socio-economic factors (economic effects):
 - Major upgrades to Highway 17;
 - Josephine Cone Mine Project; and
 - Wataynikaneyap Power Project.
- Socio-economic factors (social effects):
 - Major upgrades to Highway 17;
 - Josephine Cone Mine Project; and
 - Wataynikaneyap Power Project.

It was also predicted that cumulative effects on the “economic effects” and “social” effects indicators for the socio-economic factors are unlikely to change the magnitude of the residual effects for the Project. The levels of magnitude for Aboriginal peoples have been assigned using the combined residual adverse effects of the Project and the cumulative effects. These effects are summarized in Table 8.21.1-2.

Table 8.21.1-2: Residual Adverse Effects and Cumulative Effects on Aboriginal Peoples VCs

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction				Operations				Closure				Post-closure
			Goliath Gold Project	Dryden Forest Management Company	Watayni-kaneyap Power	Cumulative Effect	Goliath Gold Project	Dryden Forest Management Company	Watayni-kaneyap Power	Cumulative Effect	Goliath Gold Project	Dryden Forest Management Company	Watayni-kaneyap Power	Cumulative Effect	Goliath Gold Project
Human Health	Risk Assessment for Indigenous Human Health		No residual adverse effects												
Harvesting and gathering of plant materials	Wild rice		No residual adverse effects												
	Berry harvesting	Loss of potential harvest areas (ha)	260	49	— ⁽¹⁾	309	260	49	— ⁽¹⁾	309	260	49	— ⁽¹⁾	309	— ⁽⁸⁾
		Quality for consumption	No residual adverse effects												
	Medicinal plant harvesting	Loss of forest (ha)	138 ⁽²⁾	45	—	183	138	45	—	183	138	45	—	183	—
		Loss of wetlands (ha)	33	6	—	39	47 ⁽³⁾	6	—	53	33	6	—	39	—
	Changes in access	Quality for consumption	No residual adverse effects												
		Area where access is controlled (ha)	379	—	—	379	379	—	—	379	379	—	—	379	—
	Diminished on-the-land experience	Area removed from access (ha)	364	—	—	364	364	—	—	364	364	—	—	364	—
		Change to viewscales on Thunder Lake	—	—	—	—	WRSA visible on Thunder Lake	†	—	WRSA visible on Thunder Lake	WRSA visible on Thunder Lake	†	—	WRSA visible on Thunder Lake	WRSA visible on Thunder Lake
	Hunting	Ungulates	Areas >40 dBA noise	171	—	—	171	171	—	—	171	171	—	—	171
Habitat loss (ha)			141 ^(4, 5)	56	6 ⁽⁶⁾	203	118 ⁽⁷⁾	56	6 ⁽⁶⁾	180	137	56	6 ⁽⁶⁾	199	—
Furbearers		Quality for consumption	No residual adverse effects												
		Habitat loss (ha)	80	42	—	122	74	42	—	136	80	42	—	122	—
Waterfowl		Habitat loss (ha)	36	0	—	36	41	0	—	41	34	0	—	34	—
		Quality for consumption	No residual adverse effects												
Changes in access		Area where access is controlled (ha)	379	—	—	379	379	—	—	379	379	—	—	379	—
		Area removed from access (ha)	364	—	—	364	364	—	—	364	364	—	—	364	—
Diminished on-the-land experience		Areas >40 dBA noise	171	—	—	171	171	—	—	171	171	—	—	171	—
Trapping		Furbearers	Habitat loss (ha)	80	36	—	116	74	36	—	116	80	36	—	116
	Changes in access	Area where access is controlled (ha)	379	—	—	379	379	—	—	379	379	—	—	379	—
		Area removed from access (ha)	364	—	—	364	364	—	—	364	364	—	—	364	—
	Diminished on-the-land experience	Areas >40 dBA noise	171	—	—	171	171	—	—	171	171	—	—	171	—
Fishing	Sport fish		No residual adverse effects												
	Baitfish		No residual adverse effects												
	Commercial fishing		No residual adverse effects												
	Changes in access	Area where access is controlled (ha)	379	—	—	379	379	—	—	379	379	—	—	379	—

Table 8.21.1-2: Residual Adverse Effects and Cumulative Effects on Aboriginal Peoples VCs (continued)

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction				Operations				Closure				Post-closure
			Goliath Gold Project	Dryden Forest Management Company	Watayni-kaneyap Power	Cumulative Effect	Goliath Gold Project	Dryden Forest Management Company	Watayni-kaneyap Power	Cumulative Effect	Goliath Gold Project	Dryden Forest Management Company	Watayni-kaneyap Power	Cumulative Effect	Goliath Gold Project
Fishing (continued)	Changes in access (continued)	Area removed from access (ha)	364	—	—	364	364	—	—	364	364	—	—	364	—
	Diminished on-the-land experience	Change to viewscapes on Thunder Lake	—	—	—	—	WRSA visible on Thunder Lake	†	—	WRSA visible on Thunder Lake	WRSA visible on Thunder Lake	†	—	WRSA visible on Thunder Lake	WRSA visible on Thunder Lake
Cultural and spiritual	Cultural or spiritual sites	No residual adverse effects													
	Traditional Travel routes	No residual adverse effects													
	Diminished on-the-land experience	Change to viewscapes on Thunder Lake	—	—	—	—	WRSA visible on Thunder Lake	†	—	WRSA visible on Thunder Lake	WRSA visible on Thunder Lake	†	—	WRSA visible on Thunder Lake	WRSA visible on Thunder Lake
Areas >40 dBA noise		171	—	—	171	171	—	—	171	171	—	—	171	—	
Socio-economic factors	Economic effects	Aboriginal employment opportunities	Positive	—	‡	Positive	Positive	—	‡	Positive	Adverse	—	‡	Adverse	Adverse
		Cost of living	Positive	Positive	‡	Positive	Positive	Positive	‡	Positive	Positive	—	‡	Adverse	—
		Project purchases from Aboriginal businesses	Positive	—	‡	Positive	Positive	—	‡	Positive	Positive	—	‡	Adverse	Adverse
	Social effects	In- and out-migration	Adverse	—	‡	Adverse	Adverse	—	‡	Adverse	Positive	—	‡	Positive	Positive
		Capacity of education services	Adverse	—	‡	Adverse	Adverse	—	‡	Adverse	Positive	—	‡	Positive	Positive
		Education attainment	Adverse	—	‡	Adverse	Adverse	—	‡	Adverse	Positive	—	‡	Positive	Positive
		Project-specific training	Positive	—	‡	Positive	Positive	—	‡	Positive	Adverse	—	‡	Adverse	Adverse
		Housing availability	Adverse	—	‡	Adverse	—	—	—	—	—	—	—	—	—
		Property values (off-reserve)	Adverse	—	‡	Adverse	Adverse	—	‡	Adverse	Adverse	—	‡	Adverse	Positive
		Capacity of emergency services	Adverse	—	‡	Adverse	Adverse	—	‡	Adverse	Adverse	—	‡	Adverse	—
Project requests for emergency services	Adverse	—	‡	Adverse	Adverse	—	‡	Adverse	Adverse	—	‡	Adverse	—		
Road network capacity and conditions	Adverse	—	‡	Adverse	Adverse	—	‡	Adverse	Positive	—	‡	Positive	Positive		

Note:

- (1) The “—” symbol indicates there were no predicted residual adverse effects, or no cumulative effect.
- (2) The loss of forests is calculated as the sum of the “predominantly coniferous forest” and “predominantly deciduous forest” cleared as a result of the Project.
- (3) The increase in wetlands areas lost during operations reflects the effects of groundwater drawdown on WLD5.
- (4) The wildlife habitat lost as a result of the Project is a combination of the direct clearing as a result of the Project, and the alteration of habitat as a result of Project noise levels exceeding 50 dBA.
- (5) The areas for ungulates are determined for the wildlife and wildlife habitat RSA.
- (6) Only the ungulate VC was determined to have potential cumulative effects with the Wataynikaneyap Power project.
- (7) The habitat loss varies between Project phases because the areas of habitat predicted to have noise levels above 50 dBA vary.
- (8) The areas lost during the site preparation and construction phase will not recover until post-closure.

8.21.2 Description of Significance

8.21.2.1 Magnitude

The levels of magnitude for the predicted residual adverse effects, including cumulative effects, on the Aboriginal peoples VCs were assigned using the approach described in Section 8.1.1.20. The results are summarized in Table 8.21.2.1-1.

8.21.2.2 Geographic Extent

Geographic extent of the predicted residual adverse effects of the Project on the Aboriginal peoples VCs were assigned using the approach described in Section 8.1.2. The geographic extents are summarized in Table 8.21.2.2-1.

8.21.2.3 Timing

The levels of timing for the predicted residual adverse effects to Aboriginal peoples were assigned in accordance with the approach described in Section 8.1.3.20. The results are summarized in Table 8.21.3.2-1.

8.21.2.4 Duration

The levels of duration (Table 8.15.1-1) for the predicted residual effects on the Aboriginal peoples VCs were assigned using the approach described in Section 8.1.4.

8.21.2.5 Frequency

The levels of frequency for the predicted residual effects of the Project on Aboriginal peoples were assigned as Level II, using the approach described in Section 8.1.5.20.

8.21.2.6 Reversibility

The levels of reversibility for the predicted residual effects of the Project on Aboriginal peoples were assigned using the approach described in Section 8.1.6.

8.21.2.7 Determination of Significance

Table 8.21.2.7-1 lists the levels assigned for the various assessment criteria described in Sections 8.21.2.1 through 8.21.2.6. Applying the decision tree (Figure 8.1.8-1) to the effects levels in the table yields a determination that the effects of the Project on Aboriginal peoples would not be significant.

Table 8.21.2.1-1: Levels of Magnitude Aboriginal Peoples

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction	Operations	Closure	Post-closure	
Human Health	Risk Assessment for Indigenous Human Health	No residual adverse effects	—	—	—	—	
Harvesting and gathering of plant materials	Wild rice	No residual adverse effects	—	—	—	—	
	Berry harvesting	Loss of potential harvest areas (ha)	Level I	Level I	Level I	—	
		Quality for consumption	—	—	—	—	
	Medicinal plant harvesting	Loss of forest (ha)	Level I	Level I	Level I	—	
		Loss of wetlands (ha)	Level II	Level II	Level II	—	
		Quality for consumption	—	—	—	—	
	Changes in access	Area where access is controlled (ha)	Level I	Level I	Level I	—	
		Area removed from access (ha)	Level I	Level I	Level I	—	
	Diminished on-the-land experience	Change to viewscales on Thunder Lake	—	—	Level I	Level I	Level I
		Areas >40 dBA noise	Level I	Level I	Level I	Level I	—
Hunting	Ungulates	Habitat loss (ha)	Level I	Level I	Level I	—	
		Quality for consumption	—	—	—	—	
	Furbearers	Habitat loss (ha)	Level I	Level I	Level I	—	
	Waterfowl	Habitat loss (ha)	Level I	Level I	Level I	—	
		Quality for consumption	—	—	—	—	
	Changes in access	Area where access is controlled (ha)	Level I	Level I	Level I	—	
		Area removed from access (ha)	Level I	Level I	Level I	—	
	Diminished on-the-land experience	Areas >40 dBA noise	Level I	Level I	Level I	—	

Table 8.21.1-1: Levels of Magnitude for the Aboriginal Peoples (continued)

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction	Operations	Closure	Post-closure
Trapping	Furbearers	Habitat loss (ha)	Level I	Level I	Level I	—
	Changes in access	Area where access is controlled (ha)	Level I	Level I	Level I	—
		Area removed from access (ha)	Level I	Level I	Level I	—
	Diminished on-the-land experience	Areas >40 dBA noise	Level I	Level I	Level I	—
Fishing	Sport fish	No residual adverse effects	—	—	—	—
	Baitfish	No residual adverse effects	—	—	—	—
	Commercial fishing	No residual adverse effects	—	—	—	—
	Changes in access	Area where access is controlled (ha)	Level I	Level I	Level I	—
		Area removed from access (ha)	Level I	Level I	Level I	—
	Diminished on-the-land experience	Change to viewscales on Thunder Lake	—	Level I	Level I	Level I
Cultural and spiritual	Cultural or spiritual sites	No residual adverse effects	—	—	—	—
	Traditional Travel routes	No residual adverse effects	—	—	—	—
	Diminished on-the-land experience	Change to viewscales on Thunder Lake	—	Level I	Level I	Level I
		Areas >40 dBA noise	Level I	Level I	Level I	—
Socio-economic factors	Economic effects	Aboriginal employment opportunities	—	—	Level I	Level I
		Cost of living	—	—	Level I	—

Table 8.21.1-1: Levels of Magnitude for the Aboriginal Peoples (continued)

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction	Operations	Closure	Post-closure
Socio-economic factors (continued)	Economic effects (continued)	Project purchases from Aboriginal businesses	—	—	Level I	Level I
	Social effects	In- and out-migration	Level I	Level I	—	—
		Capacity of education services	Level I	Level I	—	—
		Education attainment	Level I	Level I	—	—
		Project-specific training	—	—	Level I	Level I
		Housing availability	Level I	—	—	—
		Property values (off-reserve)	Level I	Level I	Level I	—
		Capacity of emergency services	Level I	Level I	Level I	—
		Project requests for emergency services	Level I	Level I	Level I	—
		Road network capacity and conditions	Level I	Level I	—	—

Note: (1) The “—” symbol indicates where no residual adverse effects were predicted for the discipline, VC and indicator. This could represent situations where no adverse effects were predicted, where the predicted effects were positive, or where predicted adverse effects were fully mitigated, as detailed in Section 6.21.

Table 8.21.2.2-1: Geographic Extents for Residual Adverse Effects to Aboriginal Peoples

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction	Operations	Closure	Post-closure	
Human Health	Risk Assessment for Indigenous Human Health	No residual adverse effects	—	—	—	—	
Harvesting and gathering of plant materials	Wild rice	No residual adverse effects	—	—	—	—	
	Berry harvesting	Loss of potential harvest areas (ha)	Level II	Level II	Level II	—	
		Quality for consumption	—	—	—	—	
	Medicinal plant harvesting	Loss of forest (ha)	Level II	Level II	Level II	—	
		Loss of wetlands (ha)	Level II	Level II	Level II	—	
		Quality for consumption	—	—	—	—	
	Changes in access	Area where access is controlled (ha)	Level II	Level II	Level II	—	
		Area removed from access (ha)	Level II	Level II	Level II	—	
	Diminished on-the-land experience	Change to viewscapes on Thunder Lake	—	—	Level II	Level II	Level II
		Areas >40 dBA noise	Level II	Level II	Level II	Level II	—
Hunting	Ungulates	Habitat loss (ha)	Level III	Level III	Level III	—	
		Quality for consumption	—	—	—	—	
	Furbearers	Habitat loss (ha)	Level II	Level II	Level II	—	
	Waterfowl	Habitat loss (ha)	Level II	Level II	Level II	—	
		Quality for consumption	—	—	—	—	
	Changes in access	Area where access is controlled (ha)	Level II	Level II	Level II	—	
		Area removed from access (ha)	Level II	Level II	Level II	—	
	Diminished on-the-land experience	Areas >40 dBA noise	Level II	Level II	Level II	—	

Table 8.21.2.2-1: Geographic Extents for Residual Adverse Effects to Aboriginal Peoples (continued)

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction	Operations	Closure	Post-closure
Trapping	Furbearers	Habitat loss (ha)	Level II	Level II	Level II	—
	Changes in access	Area where access is controlled (ha)	Level II	Level II	Level II	—
		Area removed from access (ha)	Level II	Level II	Level II	—
	Diminished on-the-land experience	Areas >40 dBA noise	Level II	Level II	Level II	—
Fishing	Sport fish	No residual adverse effects	—	—	—	—
	Baitfish	No residual adverse effects	—	—	—	—
	Commercial fishing	No residual adverse effects	—	—	—	—
	Changes in access	Area where access is controlled (ha)	Level II	Level II	Level II	—
		Area removed from access (ha)	Level II	Level II	Level II	—
	Diminished on-the-land experience	Change to viewscales on Thunder Lake	—	Level II	Level II	Level II
Cultural and spiritual	Cultural or spiritual sites	No residual adverse effects	—	—	—	—
	Traditional Travel routes	No residual adverse effects	—	—	—	—
	Diminished on-the-land experience	Change to viewscales on Thunder Lake	—	Level II	Level II	Level II
		Areas >40 dBA noise	Level II	Level II	Level II	—
Socio-economic factors	Economic effects	Aboriginal employment opportunities	—	—	Level II	Level II
		Cost of living	—	—	Level II	—

Table 8.21.2.2-1: Geographic Extents for Residual Adverse Effects to Aboriginal Peoples (continued)

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction	Operations	Closure	Post-closure
Socio-economic factors (continued)	Economic effects (continued)	Project purchases from Aboriginal businesses	—	—	Level II	Level II
	Social effects	In- and out-migration	Level II	Level II	—	—
		Capacity of education services	Level II	Level II	—	—
		Education attainment	Level II	Level II	—	—
		Project-specific training	—	—	Level II	Level II
		Housing availability	Level II	—	—	—
		Property values (off-reserve)	Level II	Level II	Level II	—
		Capacity of emergency services	Level II	Level II	Level II	—
		Project requests for emergency services	Level II	Level II	Level II	—
		Road network capacity and conditions	Level II	Level II	—	—

Note: (1) The “—” symbol indicates where no residual adverse effects were predicted for the discipline, VC and indicator. This could represent situations where no adverse effects were predicted, where the predicted effects were positive, or where predicted adverse effects were fully mitigated, as detailed in Section 6.21.

Table 8.21.2.3-1: Levels of Timing for Aboriginal Peoples

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction	Operations	Closure	Post-closure	
Human Health	Risk Assessment for Indigenous Human Health	No residual adverse effects	—	—	—	—	
Harvesting and gathering of plant materials	Wild rice	No residual adverse effects	—	—	—	—	
	Berry harvesting	Loss of potential harvest areas (ha)	Level III	Level III	Level III	—	
		Quality for consumption	—	—	—	—	
	Medicinal plant harvesting	Loss of forest (ha)	Level III	Level III	Level III	—	
		Loss of wetlands (ha)	Level III	Level III	Level III	—	
		Quality for consumption	—	—	—	—	
	Changes in access	Area where access is controlled (ha)	Level II	Level II	Level II	—	
		Area removed from access (ha)	Level II	Level II	Level II	—	
	Diminished on-the-land experience	Change to viewscales on Thunder Lake	—	—	Level II	Level II	Level II
		Areas >40 dBA noise	Level II	Level II	Level II	Level II	—
Hunting	Ungulates	Habitat loss (ha)	Level III	Level III	Level III	—	
		Quality for consumption	—	—	—	—	
	Furbearers	Habitat loss (ha)	Level III	Level III	Level III	—	
	Waterfowl	Habitat loss (ha)	Level III	Level III	Level III	—	
		Quality for consumption	—	—	—	—	
	Changes in access	Area where access is controlled (ha)	Level II	Level II	Level II	—	
		Area removed from access (ha)	Level II	Level II	Level II	—	
	Diminished on-the-land experience	Areas >40 dBA noise	Level II	Level II	Level II	—	

Table 8.21.2.3-1: Levels of Timing for Aboriginal Peoples (continued)

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction	Operations	Closure	Post-closure
Trapping	Furbearers	Habitat loss (ha)	Level III	Level III	Level III	—
	Changes in access	Area where access is controlled (ha)	Level II	Level II	Level II	—
		Area removed from access (ha)	Level II	Level II	Level II	—
	Diminished on-the-land experience	Areas >40 dBA noise	Level II	Level II	Level II	—
Fishing	Sport fish	No residual adverse effects	—	—	—	—
	Baitfish	No residual adverse effects	—	—	—	—
	Commercial fishing	No residual adverse effects	—	—	—	—
	Changes in access	Area where access is controlled (ha)	Level II	Level II	Level II	—
		Area removed from access (ha)	Level II	Level II	Level II	—
	Diminished on-the-land experience	Change to viewscales on Thunder Lake	—	Level II	Level II	Level II
Cultural and spiritual	Cultural or spiritual sites	No residual adverse effects	—	—	—	—
	Traditional Travel routes	No residual adverse effects	—	—	—	—
	Diminished on-the-land experience	Change to viewscales on Thunder Lake	—	Level II	Level II	Level II
		Areas >40 dBA noise	Level II	Level II	Level II	—
Socio-economic factors	Economic effects	Aboriginal employment opportunities	—	—	Level II	Level II
		Cost of living	—	—	Level II	—

Table 8.21.2.3-1: Levels of Timing for Aboriginal Peoples (continued)

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction	Operations	Closure	Post-closure
Socio-economic factors (continued)	Economic effects (continued)	Project purchases from Aboriginal businesses	—	—	Level II	Level II
	Social effects	In- and out-migration	Level II	Level II	—	—
		Capacity of education services	Level II	Level II	—	—
		Education attainment	Level II	Level II	—	—
		Project-specific training	—	—	Level II	Level II
		Housing availability	Level II	—	—	—
		Property values (off-reserve)	Level II	Level II	Level II	—
		Capacity of emergency services	Level II	Level II	Level II	—
		Project requests for emergency services	Level II	Level II	Level II	—
		Road network capacity and conditions	Level II	Level II	—	—

Note: (1) The “—” symbol indicates where no residual adverse effects were predicted for the discipline, VC and indicator. This could represent situations where no adverse effects were predicted, where the predicted effects were positive, or where predicted adverse effects were fully mitigated, as detailed in Section 6.21.

Table 8.21.2.5-1: Determination of Significance for Aboriginal Peoples

Valued Components	Indicator	Measure	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	Significance	Likelihood
Site Preparation and Construction Phase										
Human Health	Risk Assessment for Indigenous Human Health	No residual adverse effects								
Harvesting and gathering of plant materials	Wild rice	No residual adverse effects								
	Berry harvesting	Loss of potential harvest areas (ha)	Level I	Level II	Level III	Level II	Level III	Level III	Not significant	NA ⁽¹⁾
		Quality for consumption	No residual adverse effects							
	Medicinal plant harvesting	Loss of forest (ha)	Level I	Level II	Level III	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
		Loss of wetlands (ha)	Level II	Level II	Level III	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
		Quality for consumption	No residual adverse effects							
	Changes in access	Area where access is controlled (ha)	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
		Area removed from access (ha)	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
Diminished on-the-land experience	Change to viewscales on Thunder Lake	No residual adverse effects								
	Areas >40 dBA noise	Level I	Level II	Level II	Level II	Level III	Level I	Not significant	NA ⁽¹⁾	
Hunting	Ungulates	Habitat loss (ha)	Level I	Level III	Level III	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
		Quality for consumption	No residual adverse effects							
	Furbearers	Habitat loss (ha)	Level I	Level II	Level III	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
	Waterfowl	Habitat loss (ha)	Level I	Level II	Level III	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
		Quality for consumption	No residual adverse effects							
	Changes in access	Area where access is controlled (ha)	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
		Area removed from access (ha)	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
Diminished on-the-land experience	Areas >40 dBA noise	Level I	Level II	Level II	Level II	Level III	Level I	Not significant	NA ⁽¹⁾	
Trapping	Furbearers	Habitat loss (ha)	Level I	Level II	Level III	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
	Changes in access	Area where access is controlled (ha)	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
		Area removed from access (ha)	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
	Diminished on-the-land experience	Areas >40 dBA noise	Level I	Level II	Level II	Level II	Level III	Level I	Not significant	NA ⁽¹⁾
Fishing	Sport fish	No residual adverse effects								
	Baitfish	No residual adverse effects								
	Commercial fishing	No residual adverse effects								
	Changes in access	Area where access is controlled (ha)	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
		Area removed from access (ha)	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾
Diminished on-the-land experience	Change to viewscales on Thunder Lake	No residual adverse effects								
Cultural and spiritual	Cultural or spiritual sites	No residual adverse effects								
	Traditional Travel routes	No residual adverse effects								
	Diminished on-the-land experience	Change to viewscales on Thunder Lake	No residual adverse effects							
Areas >40 dBA noise		Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
Socio-economic factors	Economic effects	Aboriginal employment opportunities	No residual adverse effects							
		Cost of living	No residual adverse effects							

Table 8.21.2.5-1: Determination of Significance for Aboriginal Peoples (continued)

Valued Components	Indicator	Measure	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	Significance	Likelihood	
		Project purchases from Aboriginal businesses	No residual adverse effects								
Socio-economic factors (continued)	Social effects	In- and out-migration	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
		Capacity of education services	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
		Education attainment	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
		Project-specific training	No residual adverse effects								
		Housing availability	Level I	Level II	Level II	Level I	Level III	Level II	Not significant	NA ⁽¹⁾	
		Property values (off-reserve)	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
		Capacity of emergency services	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
		Project requests for emergency services	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
		Road network capacity and conditions	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
Operations Phase											
Human Health	Risk Assessment for Indigenous Human Health	No residual adverse effects									
Harvesting and gathering of plant materials	Wild rice	No residual adverse effects									
	Berry harvesting	Loss of potential harvest areas (ha)	Level I	Level II	Level III	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
		Quality for consumption	No residual adverse effects								
	Medicinal plant harvesting	Loss of forest (ha)	Level I	Level II	Level III	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
		Loss of wetlands (ha)	Level II	Level II	Level III	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
		Quality for consumption	No residual adverse effects								
	Changes in access	Area where access is controlled (ha)	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
		Area removed from access (ha)	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
Diminished on-the-land experience	Change to viewscales on Thunder Lake	Level I	Level II	Level II	Level III	Level III	Level III	Not significant	NA ⁽¹⁾		
	Areas >40 dBA noise	Level I	Level II	Level II	Level II	Level III	Level I	Not significant	NA ⁽¹⁾		
Hunting	Ungulates	Habitat loss (ha)	Level I	Level III	Level III	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
		Quality for consumption	No residual adverse effects								
	Furbearers	Habitat loss (ha)	Level I	Level II	Level III	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
	Waterfowl	Habitat loss (ha)	Level I	Level II	Level III	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
		Quality for consumption	No residual adverse effects								
	Changes in access	Area where access is controlled (ha)	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
		Area removed from access (ha)	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
Diminished on-the-land experience	Areas >40 dBA noise	Level I	Level II	Level II	Level II	Level III	Level I	Not significant	NA ⁽¹⁾		
Trapping	Furbearers	Habitat loss (ha)	Level I	Level II	Level III	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
	Changes in access	Area where access is controlled (ha)	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
		Area removed from access (ha)	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
	Diminished on-the-land experience	Areas >40 dBA noise	Level I	Level II	Level II	Level II	Level III	Level I	Not significant	NA ⁽¹⁾	
Fishing	Sport fish	No residual adverse effects									
	Baitfish	No residual adverse effects									

Table 8.21.2.5-1: Determination of Significance for Aboriginal Peoples (continued)

Valued Components	Indicator	Measure	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	Significance	Likelihood	
Fishing (continued)	Commercial fishing	No residual adverse effects									
	Changes in access	Area where access is controlled (ha)	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
		Area removed from access (ha)	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
Diminished on-the-land experience	Change to viewscales on Thunder Lake	Level I	Level II	Level II	Level III	Level III	Level III	Not significant	NA ⁽¹⁾		
Cultural and spiritual	Cultural or spiritual sites	No residual adverse effects									
	Traditional Travel routes	No residual adverse effects									
	Diminished on-the-land experience	Change to viewscales on Thunder Lake	Level I	Level II	Level II	Level II	Level III	Level III	Not significant	NA ⁽¹⁾	
Areas >40 dBA noise		Level I	Level II	Level II	Level II	Level III	Level I	Not significant	NA ⁽¹⁾		
Socio-economic factors	Economic effects	Aboriginal employment opportunities	No residual adverse effects								
		Cost of living	No residual adverse effects								
		Project purchases from Aboriginal businesses	No residual adverse effects								
	Social effects	In- and out-migration	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
		Capacity of education services	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
		Education attainment	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
		Project-specific training	No residual adverse effects								
		Housing availability	No residual adverse effects								
		Property values (off-reserve)	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
		Capacity of emergency services	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
Project requests for emergency services	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾			
Road network capacity and conditions	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾			
Closure Phase											
Human Health	Risk Assessment for Indigenous Human Health	No residual adverse effects									
Harvesting and gathering of plant materials	Wild rice	No residual adverse effects									
	Berry harvesting	Loss of potential harvest areas (ha)	Level I	Level II	Level III	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
		Quality for consumption	No residual adverse effects								
	Medicinal plant harvesting	Loss of forest (ha)	Level I	Level II	Level III	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
		Loss of wetlands (ha)	Level II	Level II	Level III	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
		Quality for consumption	No residual adverse effects								
	Changes in access	Area where access is controlled (ha)	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
Area removed from access (ha)		Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾		
Diminished on-the-land experience	Change to viewscales on Thunder Lake	Level I	Level II	Level II	Level III	Level III	Level III	Not significant	NA ⁽¹⁾		
	Areas >40 dBA noise	Level I	Level II	Level II	Level II	Level III	Level I	Not significant	NA ⁽¹⁾		
Hunting	Ungulates	Habitat loss (ha)	Level I	Level III	Level III	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
		Quality for consumption	No residual adverse effects								
	Furbearers	Habitat loss (ha)	Level I	Level II	Level III	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
	Waterfowl	Habitat loss (ha)	Level I	Level II	Level III	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
Quality for consumption		No residual adverse effects									

Table 8.21.2.5-1: Determination of Significance for Aboriginal Peoples (continued)

Valued Components	Indicator	Measure	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	Significance	Likelihood	
	Changes in access	Area where access is controlled (ha)	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
		Area removed from access (ha)	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
Hunting (continued)	Diminished on-the-land experience	Areas >40 dBA noise	Level I	Level II	Level II	Level II	Level III	Level I	Not significant	NA ⁽¹⁾	
Trapping	Furbearers	Habitat loss (ha)	Level I	Level II	Level III	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
	Changes in access	Area where access is controlled (ha)	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
		Area removed from access (ha)	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
	Diminished on-the-land experience	Areas >40 dBA noise	Level I	Level II	Level II	Level II	Level III	Level I	Not significant	NA ⁽¹⁾	
Fishing	Sport fish	No residual adverse effects									
	Baitfish	No residual adverse effects									
	Commercial fishing	No residual adverse effects									
	Changes in access	Area where access is controlled (ha)	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
		Area removed from access (ha)	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
	Diminished on-the-land experience	Change to viewscales on Thunder Lake	Level I	Level II	Level II	Level III	Level III	Level III	Not significant	NA ⁽¹⁾	
Cultural and spiritual	Cultural or spiritual sites	No residual adverse effects									
	Traditional Travel routes	No residual adverse effects									
	Diminished on-the-land experience	Change to viewscales on Thunder Lake	Level I	Level II	Level II	Level II	Level III	Level III	Not significant	NA ⁽¹⁾	
Areas >40 dBA noise		Level I	Level II	Level II	Level II	Level III	Level I	Not significant	NA ⁽¹⁾		
Socio-economic factors	Economic effects	Aboriginal employment opportunities	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
		Cost of living	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
		Project purchases from Aboriginal businesses	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
	Social effects	In- and out-migration	No residual adverse effects								
		Capacity of education services	No residual adverse effects								
		Education attainment	No residual adverse effects								
		Project-specific training	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
		Housing availability	No residual adverse effects								
		Property values (off-reserve)	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
		Capacity of emergency services	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
Project requests for emergency services	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾			
	Road network capacity and conditions	No residual adverse effects									
Post-closure Phase											
Human Health	Risk Assessment for Indigenous Human Health	No residual adverse effects			No residual adverse effects						
Harvesting and gathering of plant materials	Wild rice	No residual adverse effects			No residual adverse effects						
	Berry harvesting	Loss of potential harvest areas (ha)				No residual adverse effects					
		Quality for consumption				No residual adverse effects					

Table 8.21.2.5-1: Determination of Significance for Aboriginal Peoples (continued)

Valued Components	Indicator	Measure	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	Significance	Likelihood	
	Medicinal plant harvesting	Loss of forest (ha)	No residual adverse effects								
		Loss of wetlands (ha)	No residual adverse effects								
		Quality for consumption	No residual adverse effects								
Harvesting and gathering of plant materials	Changes in access	Area where access is controlled (ha)	No residual adverse effects								
		Area removed from access (ha)	No residual adverse effects								
	Diminished on-the-land experience	Change to viewscales on Thunder Lake	Level I	Level II	Level II	Level III	Level III	Level III	Not significant	NA ⁽¹⁾	
Hunting	Ungulates	Habitat loss (ha)	No residual adverse effects								
		Quality for consumption	No residual adverse effects								
	Furbearers	Habitat loss (ha)	No residual adverse effects								
		Waterfowl	Habitat loss (ha)	No residual adverse effects							
	Changes in access		Area where access is controlled (ha)	No residual adverse effects							
		Area removed from access (ha)	No residual adverse effects								
	Diminished on-the-land experience	Areas >40 dBA noise	No residual adverse effects								
	Trapping	Furbearers	Habitat loss (ha)	No residual adverse effects							
Changes in access		Area where access is controlled (ha)	No residual adverse effects								
		Area removed from access (ha)	No residual adverse effects								
Diminished on-the-land experience		Areas >40 dBA noise	No residual adverse effects								
Fishing	Sport fish	No residual adverse effects									
	Baitfish	No residual adverse effects									
	Commercial fishing	No residual adverse effects									
	Changes in access	No residual adverse effects									
	Diminished on-the-land experience	Change to viewscales on Thunder Lake	Level I	Level II	Level II	Level III	Level III	Level III	Not significant	NA ⁽¹⁾	
Cultural and spiritual	Cultural or spiritual sites	No residual adverse effects									
	Traditional Travel routes	No residual adverse effects									
	Diminished on-the-land experience	Change to viewscales on Thunder Lake	Level I	Level II	Level II	Level III	Level III	Level III	Not significant	NA ⁽¹⁾	
		Areas >40 dBA noise	No residual adverse effects								
Socio-economic factors	Economic effects	Aboriginal employment opportunities	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
		Cost of living	No residual adverse effects								
		Project purchases from Aboriginal businesses	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	
	Social effects	In- and out-migration	No residual adverse effects								
		Capacity of education services	No residual adverse effects								
		Education attainment	No residual adverse effects								
		Project-specific training	Level I	Level II	Level II	Level II	Level III	Level II	Not significant	NA ⁽¹⁾	

Table 8.21.2.5-1: Determination of Significance for Aboriginal Peoples (continued)

Valued Components	Indicator	Measure	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	Significance	Likelihood
		Housing availability	No residual adverse effects							
		Property values (off-reserve)	No residual adverse effects							
Socio-economic factors (continued)	Social effects (continued)	Capacity of emergency services	No residual adverse effects							
		Project requests for emergency services	No residual adverse effects							
		Road network capacity and conditions	No residual adverse effects							

Notes:

- (1) In accordance with Agency guidance (CEAA, 2015b) likelihood was not determined as none of the effects were classified as significant