

**HARDROCK PROJECT  
Final Environmental Impact  
Statement / Environmental  
Assessment**

Chapter 20.0:  
Cumulative Effects Assessment

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## 20.0 CUMULATIVE EFFECTS ASSESSMENT

### 20.1 INTRODUCTION

Section 19(1)(a) of the *Canadian Environmental Assessment Act, 2012* requires that an environmental assessment (EA) of a designated project “*must take into account cumulative environmental effects that are likely to result from the designated project in combination with other physical activities that have been or will be carried out*”. Activities that will be carried out (future physical activities) include those that are certain and those that are considered to be reasonably foreseeable (e.g., the proponent has publicly disclosed its intention to seek the necessary authorizations to proceed [i.e., proponent has filed regulatory applications.])

This chapter presents the methods and approach used in the cumulative effects assessment aligned with the EA methodology (Chapter 6.0) used to assess the effects of the Project. This includes: valued component (VC) identification, identification of spatial and temporal boundaries, the identification of other physical activities and the overall assessment approach and significance determination.

### 20.2 METHODS

The cumulative effects assessment uses the approach and guidance outlined in the Canadian Environmental Assessment Agency's (CEA Agency) Operational Policy Statement *Assessing Cumulative effects under the Canadian Environmental Assessment Act, 2012* (Operational Policy Statement; CEA Agency 2015), *Technical Guidance for Assessing Cumulative effects under the Canadian Environmental Assessment Act, 2012* (CEA Agency 2014) and *Cumulative Effects Assessment Practitioners Guide, 1999* (Hegmann et al. 1999). It also meets the information requirements of section 6.6.3 of the “Guidelines for the Preparation of an Environmental Impact Statement pursuant to the *Canadian Environmental Assessment Act, 2012* – Hardrock Deposit Project: Premier Gold Mines Hardrock Inc.” (EIS Guidelines; Appendix A1) and section 6.5 of the “Hardrock Project Terms of Reference – Editorial Amendment” (ToR; Appendix A2).

Two conditions must be met to initiate an assessment of cumulative effects on a VC:

- the Project is assessed as having adverse residual environmental effects on a VC; and
- the adverse residual effects from the Project overlap spatially and/or temporally with residual effects of other physical activities on a VC.

If these conditions are not met, there is no expectation that the Project will contribute cumulatively to residual effects of other physical activities on the VC and further assessment is not warranted. If the two conditions are met, then an assessment of cumulative effects on the VC is initiated.

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To determine if these two conditions are met, the following steps are completed:

- Selection of VCs for the cumulative effects assessment based on the identification of Project-specific residual effects in the VC Chapters (Chapters 7.0 to 19.0).
- Determination of spatial and temporal boundaries for the assessment.
- Identification of other physical activities within the determined boundaries.
- Where there is an spatial or temporal overlap, initiate a cumulative effects assessment by:
  - identification/estimation of potential cumulative environmental effects
  - identification of additional mitigation measures, if required
  - determination of significance of potential adverse residual cumulative environmental effects
  - identification of follow-up, if required.

### **20.2.1 Selection of VCs for Cumulative Effects Assessment**

The cumulative effects assessment builds on the Project-specific residual effects assessments presented in Chapters 7.0 to 19.0 (VC chapters). This information is necessary to identify potential effects on VCs that might act cumulatively with the effects of other physical activities.

In accordance with the federal EIS Guidelines (Appendix A1), a cumulative effects assessment is only required for VCs upon which the Project may result in adverse residual effects. VCs that would not be affected by the Project or would be affected positively may be omitted from the cumulative effects assessment. The Project was identified to have adverse residual effects upon a number of VCs. All adverse residual effects were determined to be not significant; however, they were carried forward to a cumulative effects assessment in accordance with the federal EIS Guidelines.

The Project-specific VCs for which adverse residual effects (condition 1 for the initiation of a cumulative effects assessment) are anticipated are:

- atmospheric environment (Chapter 7.0)
  - change in ambient air quality
  - climate change (as measured by change in greenhouse gases [GHGs])
  - change in lighting
- groundwater (Chapter 9.0)
  - change in groundwater quantity

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- surface water (Chapter 10.0)
  - change in surface water quantity
- fish and fish habitat (Chapter 11.0)
  - permanent alteration of fish habitat
  - lethal and sub-lethal effects on fish
- vegetation communities (Chapter 12.0)
  - change in abundance of vegetation communities
  - change in function, connectivity and quality of vegetation communities
  - change in abundance of plant species of interest
- wildlife and wildlife habitat (Chapter 13.0)
  - change in habitat
  - change in mortality risk
  - change in movement
- labour and economy (Chapter 14.0)
  - change in labour
  - change in economy
- community services and infrastructure (Chapter 15.0)
  - change in capacity of housing and accommodations
  - change in capacity of provincial and municipal services and infrastructure
  - change in capacity of transportation services and infrastructure
- land and resource use (LRU; Chapter 16.0)
  - change in recreational LRU
  - change in commercially-based LRU
- traditional land and resource use (TRLU; Chapter 18.0)
  - change to availability of plant species and access to plant harvesting sites and activities
  - change to availability of fish species and access to fishing areas and activities
  - change to availability of hunted and trapped species and access to hunting and trapping areas and activities
  - change in cultural or spiritual practices, sites or areas



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Those VCs which have not been carried forward for a cumulative effects assessment are detailed below with an explanation as to why a cumulative effects assessment was not undertaken.

**Human and Ecological Health (Chapter 19.0):** the assessment of potential Project effects on human and ecological health concluded that residual effects would be low in magnitude. The human and ecological health risk assessment identified negligible health risks from the inhalation and low risks from the ingestion of surface water and the consumption of fish based on predicted concentrations of chemicals of potential concern in the atmosphere, water and fish tissue that were modelled to represent the operation phase of the Project. Overall, although a low level of risk was identified as a result of predicted Project-specific changes to surface water quality and fish tissue concentrations, with appropriate monitoring to confirm both surface water and fish tissue concentrations, the Project will likely not result in a change to human or ecological health. In the absence of measurable residual effects, there is no pathway through which to result in cumulative effects and therefore, no cumulative effects assessment is warranted.

**Acoustic Environment (Chapter 8.0):** Cumulative effects from other projects and physical activities interacting with the Project were included in the residual effects assessment and determination of significance in Chapter 8.0 (acoustic environment). The Project will result in an increase in noise and vibration levels. The predicted noise and vibration levels at each point of reception will be within the quantitative limits as prescribed by the applicable guidelines. With the application of mitigation measures incorporated in the acoustic models, the Project-specific residual effects on the acoustic environment for all phases of the Project are predicted to be not significant. None of the future physical activities identified in Table 20-1 are located within the regional assessment area (RAA) for the acoustic environment, and therefore no spatial overlap could occur and therefore is no pathway through which to result in cumulative effects. Therefore, no cumulative effects assessment is warranted.

**Heritage Resources (Chapter 17.0):** With the proposed mitigation (creation of buffer zones, documentation and salvage, and commemoration) no adverse residual environmental effects on heritage resources are anticipated. In the absence of measurable residual effects, there is no pathway through which to result in cumulative effects and therefore, no cumulative effects assessment is warranted.

### **20.2.2 Spatial and Temporal Boundaries**

Identified adverse residual environmental effects on VCs are reviewed for potential spatial and temporal boundary overlap with similar environmental effects from other physical activities. Only physical activities with potential effects that overlap with the residual effects of the Project (spatially and/or temporally) are included in the assessment of potential cumulative effects (condition 2 for the initiation of a cumulative effects assessment).

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The spatial and temporal boundaries used in this cumulative effects assessment encompass the areas and time-frames within which the Project may measurably contribute to cumulative environmental effects.

The spatial boundaries of the cumulative effects assessment are determined on a VC-specific basis with the selection of a RAA for each VC. The RAA is considered to be the area within which adverse residual effects of the Project have the potential to act in a cumulative manner with the effects of other past, current and reasonably foreseeable projects. The RAA encompasses the Project development area (PDA) and the local assessment area (LAA). A description of each RAA is provided in each VC section (Sections 20.3 to 20.12).

The temporal boundaries for the assessment are defined based on the anticipated timing and duration of effects in relation to each VC. Temporal boundaries are established by determining the period (phase) over which Project-specific and cumulative effects are to be considered.

### **20.2.3 Identification of Other Physical Activities**

The cumulative effects assessment considers the baseline effects that have resulted or are resulting from existing or past physical activities. Then, the contribution of the residual environmental effects of the proposed Project is considered. Finally, the cumulative contribution of other existing or future physical activities (certain and reasonably foreseeable) is considered.

The CEA Agency's Operational Policy Statement for assessing cumulative effects acknowledges that "present-day conditions reflect the cumulative effects of many past and existing physical activities" (CEA Agency 2015). Therefore, this cumulative effects assessment focuses on the combination of the Project-specific residual effects with the residual effects of future physical activities.

#### **20.2.3.1 Past and Existing Physical Activities**

Past and existing physical activities are identified to provide an understanding of how the current environmental conditions have arisen, and how past and existing activities may have or currently are affecting VCs. Existing environmental conditions reflect cumulative effects from past and existing physical activities and are accounted for within the residual Project effects assessment.

Past and existing physical activities are identified based on government sources, local knowledge, industry contacts and desktop research. They are listed in detail in Table 20-1, combined under the following categories for the potential interactions table within each VC section: Mining, Community Development, Forestry, Aggregate Extraction, Transportation, and Energy. Specific physical activities are discussed in more detail in the VC sections (Sections 20.3 to 20.12) if warranted (i.e., they are in close proximity to the Project or contribute to baseline conditions).

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**20.2.3.2 Future Physical Activities**

The list of future physical activities (i.e., development applications within regulatory approval processes) is based on information available up to February 2017.

Certain and future planned physical activities considered in the cumulative effects assessment are restricted to those that meet one or more of the following criteria:

- are currently undertaking site preparation or are under construction
- have received regulatory approval
- have been publicly announced with applications filed and defined project execution period and with sufficient project details for consideration
- are currently undergoing an EA
- are in a permitting process
- are identified in an approved development plan.

Table 20-1 lists the physical activities identified with the potential to act in a cumulative manner with the residual effects of the Project. The identification and selection of specific physical activities was based on a conservative assumption that a potential interaction may exist due to the nature of that activity, the surrounding environment and the VCs assessed. Table 20-1 lists physical activities within the District of Thunder Bay which represents the largest RAA (labour and economy VC). Due to the large geographic extent of the District of Thunder Bay not all the physical activities in Table 20-1 will be relevant to all VCs. Therefore, each VC will determine which physical activities have the potential to contribute to Project-specific residual effects resulting in a cumulative effect on that VC.

The locations of the physical activities listed in Table 20-1 are presented in Figure 20-1.

A number of mineral development projects, ranging from exploration to mining, are currently in regulatory review or have been approved for the region, some of these Projects are a significant distance from the Project but are still within the RAA. Those closest to the Project include: Thunder Bay District Mining Exploration (approximately 60 kilometres [km] northwest of the Project), Ishkoday Exploration (approximately 65 km west of the Project), Junior Lake Exploration (approximately 100 km northwest of the Project), Brookbank Deposit Exploration (approximately 36 km west of the Project), Viper Exploration (approximately 23 km east of the Project) and Bankfield West Mineral Exploration (approximately 10 km west of the Project).

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In addition to potential exploration activities there are two run-of-the-river hydroelectric developments proposed for the Namewaminikan River (two generation stations with a combined production capacity of 10 megawatts), one hydroelectric development on the Little Jackfish River (78 megawatts), two pipeline projects (a natural gas pipeline project and another project to convert a natural gas pipeline to an oil transportation pipeline) and a transmission line project. Municipal development plans include a potential new landfill site and a new residential subdivision for Geraldton.

**Table 20-1: Physical Activity Potential Inclusion List**

Proponent	Project Name or Physical Activity	Description	Status/Timing	Approximate Location relative to Project
<b>PAST AND PRESENT PHYSICAL ACTIVITIES</b>				
<b>Mining</b>				
Greenstone Gold Mines	Hardrock Mine Shaft and Discovery Point	Underground gold and silver mine that operated during 1934 – 1951.	Closed	<1 km east
Roxmark Mines Ltd.	Bankfield Consolidated Mine	Underground gold and silver mine that operated during 1937- 1947.	Closed	10 km northwest
Tombill Gold Mines Ltd.	Tombill Mine	Underground gold and silver mine that operated during 1938 – 1942, and was decommissioned in 1955.	Closed	10 km northwest
Whitehorse Gold Mines Ltd. & Jellicoe Gold Mining Company Ltd.	Jellicoe Mine	Surface and underground gold and silver mine. Operated between 1939 and 1949.	Closed	13 km northwest
Elmos Gold Mines Ltd.	Talmora Long Lac Mine	Primarily a gold mine with secondary mining of silver, tungsten, tin and copper. Operated between 1942 and 1948.	Closed	2 km northwest
Little Long Lac Gold Mines Ltd.	Little Long Lac Mine	Primarily a gold mine with secondary mining of silver and tungsten. Operated between 1934 and 1956.	Closed	2.5 km northwest

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**Table 20-1: Physical Activity Potential Inclusion List**

Proponent	Project Name or Physical Activity	Description	Status/Timing	Approximate Location relative to Project
Lake Shore Mines	Macleod – Cockshutt Mine	Underground gold mine with secondary production of zinc, lead and silver. Operated between 1938 and 1970.	Closed	<1 km west
Barrick Gold Corp.	Hemlo Mine	Underground and open pit gold mine.	Operating	132 km southeast
Wesdome Gold Mines Ltd.	Mishi Gold Mine	Gold mine, initially a seasonal open pit mine, began year-round operations in 2011.	Operating	208 km southeast
Wesdome Gold Mines Ltd.	Eagle River Mine	Primarily a gold mine with secondary mining of silver.	Operating	217 km southeast
Wesdome Gold Mines Ltd.	Eagle River Mill	Processes ore from the Eagle River Mine.	Operating	207 southeast
North American Palladium Ltd.	Lac des Iles Mine	Palladium mine. Commenced as an open pit operation but then extended underground.	Operating	202 km southwest
Richmont Mines Inc.	Island Gold Mine	Underground gold mine that commenced production in 2007.	Operating	238 km southeast
Greenstone Gold Mines	Brookbank Mineral Exploration	The Brookbank Project consists of 686 mining leases and staked claims. The exploration permit concludes activities in December 2016.	Exploration	36 km west
Greenstone Gold Mines	Viper Mineral Exploration	The Viper Project is a contiguous block of 17 mining claims. The exploration permit concludes activities in April 2016.	Exploration	23 km east

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**Table 20-1: Physical Activity Potential Inclusion List**

Proponent	Project Name or Physical Activity	Description	Status/Timing	Approximate Location relative to Project
<b>Community Development</b>				
Municipality of Greenstone	Municipality of Greenstone	Includes the Ward of Geraldton, the Ward of Longlac, the Ward of Nakina and the Ward of Beardmore. Aboriginal communities within the municipal boundaries are: Animibiigoo Zaagi'igan Anishinaabek (AZA), Aroland First Nation (AFN), Biinjitiwaabik Zaaging Anishinaabek (BZA), Ginoogaming First Nation (GFN) and Long Lake #58 First Nation (LLFN).	N/A	2 km
Municipality of Greenstone	Beardmore Landfill (A7249502)	Landfill for waste disposal located in the Municipality of Greenstone.	Open	65 km east
Municipality of Greenstone	Geraldton Landfill (A7004401)	Landfill for waste disposal located in the Municipality of Greenstone.	Open	3 km southeast
Municipality of Greenstone	Longlac Landfill (5968-5ZRM25)	Landfill for waste disposal located in the Municipality of Greenstone.	Open	32 km northeast
Municipality of Greenstone	Nakina Ward Waste Disposal Site (A591901)	Landfill for waste disposal located in the Municipality of Greenstone.	Open	56 km north
Municipality of Greenstone	Nakina Ward Waste Disposal Site (A591902)	Landfill for waste disposal located in the Municipality of Greenstone.	Open	60 km north
Kenogami Industries Incorporated	Kenogami Industries Inc. (A590601)	Wood Waste Disposal Site.	Open	32 km northeast

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Proponent	Project Name or Physical Activity	Description	Status/Timing	Approximate Location relative to Project
Ministry of Natural Resources and Forestry (MNRF)	Pamela Lake Landfill (A590006)	Landfill for waste disposal located in the Municipality of Greenstone.	Open	45 km east
MNRF	Macdiarmid Landfill (A7372901)	Landfill for waste disposal located in the Municipality of Greenstone.	Open	75 km west
Unknown	Wood Waste Site (CL 13109)	Landfill for wood waste disposal located in the Municipality of Greenstone.	Open	33 km east
MNRF	Caramat Waste Disposal Site (A590031)	Landfill for waste disposal located in the Municipality of Greenstone.	Open	57 km east
MNRF	Camp 25 (Yak Lake) Landfill (A7198201)	Landfill for waste disposal located in the Municipality of Greenstone.	Open	12 km east
MNRF	Wildgoose Waste Disposal Site (A7088402)	Landfill for waste disposal located in the Municipality of Greenstone.	Open	12 km west
MNRF	Jellicoe Landfill (A7086801)	Landfill for waste disposal located in the Municipality of Greenstone.	Open	35 km east
Various	Approximately 100 other open landfills throughout the District of Thunder Bay	Landfill for waste disposal located in the District of Thunder Bay.	Open	N/A
Municipality of Greenstone	Geraldton Sewage Treatment Plant	Sewage Treatment Plant for the Municipality of Greenstone – Geraldton Ward, District. The effluent is released to Hardrock Creek and Kenogamisis Lake.	Operating	4 km north

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Proponent	Project Name or Physical Activity	Description	Status/Timing	Approximate Location relative to Project
<b>Forestry</b>				
Kenogami Industries	Longlac Wood Industries waferboard and plywood mills	Plywood and waferboard mills	Closed	29 km northeast
Longlac Lumber Inc.	Longlac Lumber Mill	Sawmill	Operating	29km northeast
Nakina Lumber Inc.	Nakina Lumber Mill	Sawmill	Unknown	56 km northeast
AV Terrace Bay Inc.	Terrace Bay Mill	Pulp and paper mill	Operating	93 km south
Lake Nipigon Forest Management Inc. and the Crown	MNRF - FMU 815 - Lake Nipigon Forest	Encompasses 1,263,186 hectares (ha) of Crown managed land. The Forest is situated in the Boreal Forest Region.	Active	10 km west
Ne-Daa-Kii-Me-Naan Inc. and the Crown	MNRF - MU 350 - Kenogami Forest	Encompasses 1.9 million ha of northern Ontario boreal forest.	Active	Project is within the MU 350
<b>Aggregate Extraction</b>				
S. Leduchowski Trucking	Ashmore Township Pit	Aggregate extraction	Unknown	6 km north
Municipality of Greenstone	Dafoe Lake Pit	Aggregate extraction	Unknown	8 km northwest
Various	Fulford Creek Pit	Aggregate extraction	Unknown	15 km north
C. Villeneuve Construction Company Ltd.	Geraldton Quarry	Aggregate extraction	Operating	15 km north
S. Leduchowski Trucking	McQuesten Township Pit	Aggregate extraction	Operating	15 km north
Ministry of Transportation (MTO)	Wildgoose Lake #27 Pit	Aggregate extraction	Operating	12 km southwest
MTO	Geraldton #07 Pit/Quarry	Aggregate extraction	Operating	3 km northeast



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**Table 20-1: Physical Activity Potential Inclusion List**

Proponent	Project Name or Physical Activity	Description	Status/Timing	Approximate Location relative to Project
<b>Transportation</b>				
Municipality of Greenstone	Greenstone Regional Airport	Constructed in 1978. Facility consists of a 5,000 foot runway terminal building and fueling amenities.	Operating	7 km north
Municipality of Greenstone	Elmer Ruddick Nakina Airport	Constructed in the 1930s. Facility consists of a 3,500 foot runway, terminal building and fueling amenities.	Operating	56 km north
MTO	Highway 11	TransCanada Highway	Operating	<1 km north
Canadian National Railway Company	Rail line	Rail line between Longlac and Thunder Bay.	Operating	24 km east
MTO	Highway 11/17 Widening and Upgrade	Highway widening to 4 lanes and bridge installation on Nipigon River.	Under Construction	Varied
<b>Energy</b>				
TransCanada	TransCanada Pipeline	Natural gas pipeline within the Highway 11 right-of-way (ROW).	Operating	< 1 km north
Various	Hydroelectric Transmission	Numerous linear transmission line projects.	Operating	
Ontario Power Generation	Long Lake Diversion Dam	In 1937-1938, the Hydro-Electric Power Commission of Ontario, now Ontario Power Generation, built the Kenogami Lake Dam and Long Lake Diversion Dam to divert the flow from the Kenogamis Subwatershed through Long Lake into Lake Superior.	Operating	40 km northeast

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**Table 20-1: Physical Activity Potential Inclusion List**

Proponent	Project Name or Physical Activity	Description	Status/Timing	Approximate Location relative to Project
Ontario Power Generation	Kenogamisis Dam	The Kenogami Lake Dam and Long Lake Diversion Dam divert water flow from the Kenogamisis Sub-watershed through Long Lake into Lake Superior.	Operating	19 km northeast
Namewaminikan Hydro Inc.	Namewaminikan River Waterpower Project	Two run-of-the-river hydroelectric facilities proposed for construction on the Namewaminikan River. Associated infrastructure includes access roads, storage/staging areas, two bridges, an aerial power line and substation.	EA complete. Commissioning planned for December 2015.	69 km west
<b>FUTURE PHYSICAL ACTIVITIES (CERTAIN AND REASONABLY FORESEEABLE)</b>				
<b>Mining</b>				
Treasury Metals Inc.	Goliath Gold Mine	Construction, operation, decommissioning, and abandonment of an open-pit and underground gold mine and associated infrastructure.	EA in progress. Environmental Impact Statement (EIS) submitted April 9, 2015.	410 km west
Prodigy Gold Inc.	Magino Gold Mine	Redevelopment of the Magino Gold Mine. Construction, operation, decommissioning, and abandonment of an open-pit mine and metal mill, and associated infrastructure.	EA in progress.	239 km southeast

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**Table 20-1: Physical Activity Potential Inclusion List**

Proponent	Project Name or Physical Activity	Description	Status/Timing	Approximate Location relative to Project
Canadian Malartic General Partnership	Hammond Reef Gold Mine	Construction, operation, and decommissioning of a new open-pit gold mine and onsite metal mill, and associated infrastructure.	EA in progress. EIS/EA submitted to the Ministry of the Environment and Climate Change (MOECC) in January 2014. EIS/EA submitted to CEA Agency in December 2014.	339 km southwest
Bending Lake Iron Group Ltd.	Josephine Cone Mine	Construction, operation and decommissioning of an iron ore mine and associated infrastructure.	EA in progress.	388 km west
<b>Exploration</b>				
Greenstone Gold Mines	Bankfield West Mineral Exploration	An exploration drill program, in the Bankfield West target area, to confirm the occurrence of mineralization.	Exploration	10 km southwest
GoldON Resources Ltd.	Pickle Lake Mining Exploration	Mapping, detailed sampling of historical trenches in the Fault Creek area and drill testing along strike.	Exploration	300 km northwest
Landore Resources Ltd.	Junior Lake Mining Exploration	Winter exploration the Junior Lake Nickel-Copper-PGE Property.	Exploration	104 km northwest
Laurion Mineral Exploration Inc.	Ishkoday Mining Exploration	Proponent is reviewing data to focus future drill programs.	Exploration	64 km west
Pierre Gagne	McCaul Twp Mining Exploration	Exploration permit issued in January 2017 for mechanized drilling, mechanized stripping, pitting and trenching of bedrock.	Exploration	338 km southwest

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**Table 20-1: Physical Activity Potential Inclusion List**

Proponent	Project Name or Physical Activity	Description	Status/Timing	Approximate Location relative to Project
Sage Gold Inc.	Thunder Bay District Mining Exploration	Exploration permit issued in January 2017 for mechanized drilling, mechanized stripping, pitting and trenching of bedrock and line cutting.	Exploration	60 km northwest
Metalcorp Ltd.	Hemlo East Project Mining Exploration	Exploration permit issued in January 2017 for mechanized drilling, mechanized stripping, pitting and trenching of bedrock.	Exploration	134 km southeast
<b>Community Development</b>				
Municipality of Geraldton	Geraldton Subdivision	Development for a rural residential subdivision on the south shore of Kenogamisis Lake (Barton Bay) west of Little Longlac.	Proposed	2 km northwest
Corporation of the Municipality of Greenstone	Municipality of Greenstone Landfill	The Municipality's landfill site in Geraldton Ward is approaching capacity and a review of alternative options for municipal solid waste management within the Municipality is being undertaken.	EA ToR approved 2014.	Exact location undetermined, would be located within the Municipality of Greenstone boundary.
MNRF	Black Sturgeon River Camp 43 Dam Project	A dam safety upgrade deemed necessary to avoid potential environmental liabilities as a result of dam failure in the future. In addition, rehabilitation objectives of native walleye and lake sturgeon populations in Black Bay will be completed.	Draft Environmental Study Report published November 2016	136 km southwest

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**Table 20-1: Physical Activity Potential Inclusion List**

Proponent	Project Name or Physical Activity	Description	Status/Timing	Approximate Location relative to Project
<b>Forestry</b>				
Lake Nipigon Forest Management Inc. and the Crown	MNRF – Forest Management Unit (FMU) 815 - Lake Nipigon Forest	Encompasses 1,263,186 ha of Crown managed land. The Forest is situated in the Boreal Forest Region.	Active	10 km west
Crown	MNRF - FMU 350 - Kenogami Forest	Encompasses 1.9 million ha of Northern Ontario boreal forest.	Active	Project is within FMU 350
<b>Aggregate Extraction</b>				
McTavish Township	Aggregate	Permit application submitted to excavate aggregate from a new quarry of 32.94 ha in size.	Application submitted January 16, 2017.	160 km southwest
<b>Energy</b>				
Ontario Power Generation	Little Jackfish Hydroelectric Development	New hydroelectric generating station on Little Jackfish River. Associated facilities include access roads, borrow areas for construction materials, and a large temporary construction camp.	Proposed	127 km northwest
Ontario Power Generation	Little Jackfish Transmission Line	Associated with the Little Jackfish Hydroelectric Development. Construction of a new 230 kilovolt (kV) transmission line from an existing Hydro One Networks Inc. (Hydro One) 230 kV transmission line located near Kama Bay to the Little Jackfish Hydroelectric Development plus construction of a 44 kV transmission line from the Jackfish Hydroelectric Development (Lower Site) to the Summit Control Dam.	Proposed	51 km northwest

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**Table 20-1: Physical Activity Potential Inclusion List**

Proponent	Project Name or Physical Activity	Description	Status/Timing	Approximate Location relative to Project
TransCanada	TransCanada Energy East Project	From Alberta to New Brunswick, through northern Ontario the 4,600 km pipeline passes 10 km north of the Project.  In northern Ontario, the segment will require converting an existing natural gas pipeline to an oil transportation pipeline and constructing the associated facilities and pump stations.	EA in progress	10 km north
Union Gas Limited	Union Gas Pipeline	Construction of approximately 10 km of new natural gas pipeline from a TransCanada main line, located north of Geraldton, to the Project.	Preliminary planning	<5 km north
NextBridge Infrastructure	East-West Tie Transmission Project	Construction of approximately 400 km double-circuit 230 kV transmission line generally paralleling the existing double-circuit 230 kV transmission corridor connecting the Wawa Transformer Station to the Lakehead Transformer Station near Thunder Bay.	Draft EA submitted December 5, 2016	70 km south

NOTE:

N/A not applicable

## **20.2.4 Assessment Approach**

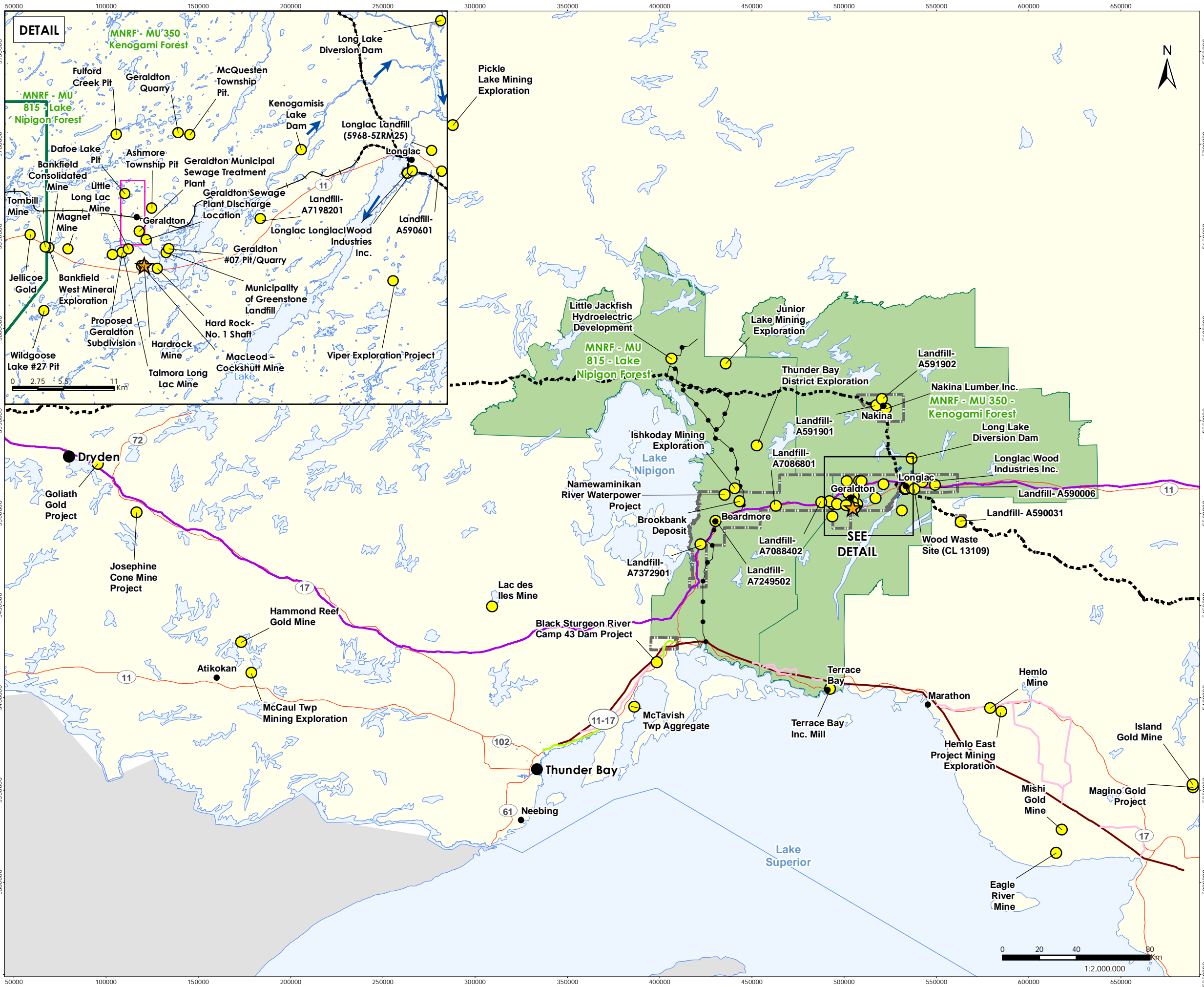
### **20.2.4.1 Cumulative Effects Mechanisms**

Cumulative effects are considered for each VC predicted to have adverse residual effects. The residual cumulative effects are characterized and evaluated using the same criteria and significance thresholds established for the Project-specific residual effects.

Not all adverse residual effects will contribute to measurable cumulative effects. For each VC with adverse residual effects, only those residual effects with a spatial or temporal overlap with the residual effects of physical activities identified in Table 20-1 are assessed.

The assessment of each cumulative effect begins with a description of the effect and the mechanisms whereby the effects from the Project might interact with other projects and activities in the VC defined spatial boundary. Existing environmental conditions reflect the cumulative effects from past and existing physical activities. The assessment of cumulative effects focuses on future conditions, which includes ongoing and future effects of existing and past physical activities.





- Legend**
- Project Location
  - City
  - Direction of Flow (Kenogami River Diversion Project)
  - Highway
  - CN Railway
  - East-West Tie Transmission Project Preferred Route
  - East-West Tie Transmission Project Alternate Route
  - Little Jackfish Transmission Line
  - Highway 17 Widening (Manitoba Border Easterly)
  - Highway 17 Widening (Thunder Bay to Nipigon)
  - TransCanada Energy East Project
  - Forest Areas
  - General Union Gas Pipeline Area
  - Municipality of Greenstone

- Notes**
1. Coordinate System: NAD 1983 UTM Zone 16N
  2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2014.

Client/Project  
 Greenstone Gold Mines GP Inc. (GGM)  
 Hardrock Project

Figure No.  
**20-1**

Title  
**Physical Activities for  
 Cumulative Effects Assessment**

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 Revised: 2017-06-30 By: dhanvey



#### **20.2.4.2 Mitigation for Cumulative Effects**

If required, mitigation measures to reduce identified potentially adverse cumulative effects are described for each effect.

#### **20.2.4.3 Residual Cumulative Effects**

Residual cumulative effects are described, taking into account how the proposed mitigation would alter or change the cumulative effect. When possible, cumulative effects are characterized in terms of the direction, magnitude, geographic extent, timing, frequency, duration, reversibility and ecological or socio-economic context.

#### **20.2.4.4 Determination of Significance of Residual Cumulative Effect**

A determination of significance of the adverse residual cumulative effects is made using the standards or thresholds established for the residual Project effects on individual VCs.

#### **20.2.4.5 Project Contribution to Cumulative Effects**

Once the residual cumulative effect on the VC has been determined, a description of the Project's contribution to that total residual cumulative effect (i.e., how much of the total residual cumulative effect on the VC can be attributed to the Project) is provided. This includes, where appropriate a discussion as to whether the Project contribution will cause a change in the cumulative effect to an extent that could affect the sustainability of the VC.

#### **20.2.4.6 Prediction Confidence**

The purpose of a cumulative effects assessment is to predict environmental conditions that may result from the Project, in conjunction with approved and planned physical activities or developments that are already operational. The predictive nature of the assessment means there is a level of confidence that needs to be considered.

A discussion of prediction confidence is provided for each VC.

### **20.2.5 Influence of Consultation and Consideration of Aboriginal Information and Traditional Knowledge**

Consultation has been ongoing prior to and throughout the EA process, and will continue with government agencies, local Aboriginal communities, and stakeholders through the life of the Project. Chapter 3.0 (community and stakeholder consultation) provides more detail on the consultation process covering open houses, site visits, targeted meetings, newsletters, questionnaires, presentations, and capacity funding for technical reviews and community-based studies among other consultation activities. The Record of Consultation (Appendix C) includes comments received during the development of the Draft EIS/EA and responses provided.

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Consultation feedback related to follow-up and monitoring has been addressed through direct responses (in writing and follow-up meetings) and in the Final EIS/EA, as appropriate. Information received has been considered by the Project team. An overview of the key comments that influenced cumulative effects between the Draft EIS/EA and the Final EIS/EA is summarized below.

The CEA Agency as well as Aboriginal communities noted the importance of updating the cumulative effects assessment to reflect changes to baseline data or effects analysis. Additional baseline information, including the incorporation of traditional knowledge (TK), was used to determine residual effects on VCs and was incorporated into the cumulative effects assessment as appropriate.

### **Historical Mining**

AFN and Biigtigong Nishnaabeg requested the cumulative effects assessment to be revised in order to acknowledge the importance and contribution of historical mining to the existing environment. The Ministry of Northern Development and Mines noted that cumulative effects related to past mining activities (i.e., historical tailings) in combination with the Project need to be more clearly defined. LLFN noted the importance of not only considering what is occurring today, but also what will occur in the future and what future generations should have the right to do in the area.

A summary of historical mining and other influences on surface water quality is provided in Chapter 10.0 (surface water VC), Section 10.2.2.8 and assessed in detail in the "Environmental Conditions: Hardrock Project - Historical Mining and Lake Water Quality" report (Appendix L). The assessment provides updated overall loadings and water quality predictions for Kenogamisis Lake under existing, operational and closure conditions and incorporates the existing conditions assessment, further historical to future condition arsenic modelling in the Lake, as well as parameter mass balance assessment. The lake arsenic modelling (STELLA) specifically addresses comments received from MOECC, LLFN, and Métis Nation of Ontario (MNO) regarding sediment quality and cycling suspension and redeposition within the Lake. The Project results in an improvement in water quality within Barton Bay, having a positive effect on arsenic and iron concentrations (Section 10.4.3.3). The reduction in these parameters is related to decreases in loading from the historical MacLeod tailings. The potential effects of historical tailings excavation and removal to the tailings management facility (TMF) have been incorporated into geochemical and groundwater modelling and predictions of TMF seepage quality to Kenogamisis Lake during operation and closure. It is predicted that there will be a net improvement to surface water quality in Kenogamisis Lake and therefore there are no downstream effects.

The CEA Agency's Operational Policy Statement for assessing cumulative effects acknowledges that "present-day conditions reflect the cumulative effects of many past and existing physical activities" (CEA Agency 2015). Existing environmental conditions, that reflect cumulative effects from past and existing physical activities, are accounted for within the Project-specific residual

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effects assessment, and are therefore not repeated specifically within the cumulative effects assessment. The cumulative effects assessment focuses on the combination of the Project-specific residual effects (which by definition include the cumulative effects of past and present mining activities) with the potential effects of future physical activities.

### **Spatial Boundaries**

Biigtigong Nishnaabeg requested the extension of the RAA for fish and fish habitat downstream to the confluence of the Aguasabon River at Lake Superior due to a risk of potential cumulative effects.

Based on the information sharing to date and results of the assessment on the fish and fish habitat VC (Chapter 11.0), the Project will not have an effect on the downstream environment and Biigtigong Nishnaabeg areas of interest. Cumulative effects are only assessed when two conditions are met; the Project is assessed as having adverse residual environmental effect on a VC; and the adverse residual effects from the Project overlap spatially or temporally with residual effects of other physical activities on the same VC. Cumulative effects on fish and downstream water quantity and quality are not anticipated based on the Project having an overall positive effect on long-term water quality compared to existing conditions.

### **Cumulative Effects Methodology**

The CEA Agency, AZA and MNO requested clarification for listing the Brookbank and Viper projects as "past and present activities" instead of "future activities" in Table 23-1 (now Table 20-1 in this Final EIS/EA).

The Project inclusion list was updated in February 2017 for the Final EIS/EA. The update to the list resulted in the addition of four future activities: two mineral exploration permits, one aggregate extraction project and one dam safety upgrade project. Both the Brookbank and Viper Projects were listed under "past and present activities" because they are existing exploration projects with no current plans to develop the resources. Existing environmental conditions reflect cumulative effects from past and existing physical activities and are accounted for within the Project effects assessment. Therefore, the effects of both the Brookbank and Viper projects are considered within the residual effects assessment which then forms the basis of the cumulative effects assessment.

The CEA Agency and MNRF requested confirmation of why Levesque Plywood (operating as Columbia Forest Products) in Hearst and Lecours Lumber Co. Ltd. in Calstock were excluded from the cumulative effects assessment.

Levesque Plywood (operating as Columbia Forest Products) in Hearst and Lecours Lumber Co. in Calstock were not listed within Table 23-1 (now Table 20-1 in this Final EIS/EA) because those locations are based in the District of Cochrane which lies outside the largest RAA for the

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cumulative effects assessment (i.e., the District of Thunder Bay). It is recognized that these proponents receive timber from the Kenogami Forest. Forestry activities within MNRF FMU 350 - Kenogami Forest and FMU 815 - Lake Nipigon Forest are listed within Table 20-1 (Table 23-1 in the Draft EIS/EA) and as such are captured within the cumulative effects assessment. The information sourced for future activities within the Kenogami Forest is the *Kenogami Forest Management Plan 2011–2021* (Terrace Bay Pulp 2011).

MNRF also requested that the status of Longlac Lumber Inc. is updated to operating and the addition of the proponent Ne-Daa-Kii-Me-Naan Inc. for the Kenogami Forest as well as additional clarifications in Table 23-1 (now Table 20-1 in this Final EIS/EA).

As a result, the status of Longlac Lumber Inc. has been updated to operating and Ne-Daa-Kii-Me-Naan Inc. has been added to Table 20-1 (Table 23-1 in the Draft EIS/EA) as a proponent for the Kenogami Forest as a forest manager. The Kenogamisis FMU has been included in Table 20-1, as FMU 350. In addition, the reversibility of the "Cumulative Effect with the Project" on economy (tourism and forestry) in Table 20-20 has been clarified.

### **20.3 ATMOSPHERIC ENVIRONMENT**

As detailed in Chapter 7.0 (atmospheric environment VC), while not found to be significant, the Project is anticipated to have adverse residual effects on air quality, GHG emissions and lighting. Residual effects identified are: an increase in ambient levels of particulate, criteria air contaminants and other parameters of potential concern (PoPC), during construction, operation and closure; an increase in GHG emissions during construction, operation and closure; and an increase in ambient lighting levels during construction, operation and closure. As such there is potential for the residual effects of the Project to act cumulatively with residual effects of other future physical activities.

#### **20.3.1 Regional Assessment Area**

As noted in Section 7.1.5.1, the RAA for the atmospheric environment is used to provide regional context for the significance of residual effects and is also the area within which potential for cumulative effects of the Project in combination with other past, present or reasonably foreseeable projects or activities are considered. The RAA has been defined separately for air quality/lighting and GHGs:

- For a change in ambient air quality, the RAA extends 50 km in all directions from the PDA, which is considered the maximum extent that other projects or activities may have a measurable cumulative effect on air quality in the LAA based on types of emission sources anticipated for this Project.

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- For a change in lighting, the RAA also extends 50 km in all directions from the PDA, which is considered the maximum extent that other projects or activities may have a measurable cumulative effect on lighting.
- For a change in GHG emissions, since GHG releases act cumulatively in the atmosphere globally, the environmental effect of GHG on the environment is a global concern. The spatial boundary is provincial and national in geographic extent.

**20.3.2 Identification of Project Effects Likely to Interact Cumulatively**

Where residual environmental effects from the Project have the potential to act cumulatively with those from other projects and physical activities (Table 20-2), a cumulative effects assessment is undertaken to determine significance.

**Table 20-2: Potential Cumulative Effects on Atmospheric Environment**

Other Projects and Physical Activities with Potential for Cumulative Environmental Effects	Potential Cumulative Environmental Effects		
	Air Quality	GHG Emissions	Lighting
<b>FUTURE PHYSICAL ACTIVITIES (CERTAIN AND REASONABLY FORESEEABLE)</b>			
Goliath Gold Mine	-	-	-
Magino Mine	-	-	-
Hammond Reef Gold Mine	-	-	-
Josephine Cone Mine	-	-	-
Bankfield West Mineral Exploration	✓	✓	-
Pickle Lake Mining Exploration	-	-	-
Junior Lake Mining Exploration	-	-	-
Ishkoday Mining Exploration	-	-	-
McCaul Twp Mining Exploration	-	-	-
Thunder Bay District Mining Exploration	-	-	-
Hemlo East Project Mining Exploration	-	-	-
McTavish Twp Aggregate	-	-	-
Proposed Geraldton Subdivision	✓	✓	✓
Municipality of Greenstone Landfill	✓	✓	-
Little Jackfish Hydroelectric Development	-	-	-
Little Jackfish Transmission Line	-	-	-

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**Table 20-2: Potential Cumulative Effects on Atmospheric Environment**

Other Projects and Physical Activities with Potential for Cumulative Environmental Effects	Potential Cumulative Environmental Effects		
	Air Quality	GHG Emissions	Lighting
TransCanada Energy East Project	-	-	-
Union Gas Pipeline	-	-	-
East-West Tie Transmission Project	-	-	-
Black Sturgeon River Camp 43 Dam Project	-	-	-
MNRF – FMU815 Lake Nipigon Forest	-	-	-
MNRF – FMU350 Kenogami Forest	-	-	-

NOTES:

- ✓ those "other projects and physical activities" whose residual effects are likely to interact cumulatively with Project-specific residual environmental effects.
- interactions between the adverse residual effects of other projects and the Project-specific adverse residual effects are not expected

Those future activities listed but not checked off in Table 20-2 represent activities that are unlikely to interact cumulatively with the Project; e.g., are either one or a combination of the following: 1) substantially geographically removed from the Project; 2) by definition their operations do not represent a potential cumulative effect pathway to the VC; 3) would be considered to have a potential spatial or temporal overlap; however, due to the known success of current best management and design mitigation for such projects residual effects are unlikely.

**20.3.3 Residual Cumulative Environmental Effects Description Criteria**

The residual cumulative environmental effects are characterised using the same terms and definitions as those of the residual environmental effects. Table 20-3 provides those terms and definitions as previously detailed in Section 7.1.6.

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**Table 20-3: Characterization of Residual Environmental Effects on Atmospheric Environment**

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Direction	The relative change compared to baseline conditions.	<b>Positive</b> — a decrease in air PoPC concentrations, GHG emissions or lighting levels compared to baseline conditions. <b>Adverse</b> — an increase in air PoPC concentrations, GHG emissions or lighting levels compared to baseline conditions.
Magnitude	The amount of change in measurable parameters or the VC relative to baseline conditions.	<b>Low</b> — a measurable change is expected but of comparable magnitude to baseline conditions. For GHG emissions, an annual release less than 1 percent (%) of provincial or federal annual GHG emissions. <b>Moderate</b> — a measurable change or effect but less than regulatory limits or standards. For GHG emissions, an annual release of 1% -5% of provincial or federal annual GHG emissions. <b>High</b> — a measurable change that causes exceedance of objectives or standards beyond the Project boundaries. For GHG emissions, annual release greater than 5% of provincial or federal annual GHG emissions.
Geographic Extent	The geographic area in which the residual environmental effect occurs.	<b>Modelled Property Boundary</b> — the residual environmental effect is limited to properties owned or leased by Greenstone Gold Mines GP Inc. (GGM). <b>LAA</b> — the residual environmental effect extends into the LAA. <b>RAA</b> — the residual environmental effect extends into the RAA. <b>Global (for GHG)</b> — the residual environmental effect for GHGs is provincial, federal and ultimately global in extent.
Timing	Considers when the residual environmental effect is expected to occur. Timing considerations are noted in the evaluation of the residual environmental effect, where applicable or relevant.	<b>Not Applicable (N/A)</b> — seasonal aspects are unlikely to affect the atmospheric environment. <b>Applicable</b> — seasonal aspects may affect the atmospheric environment

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**Table 20-3: Characterization of Residual Environmental Effects on Atmospheric Environment**

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Frequency	Identifies how often the residual environmental effect occurs within a given time.	<p><b>Single event</b> — the residual environmental effect occurs only once.</p> <p><b>Multiple irregular event (no set schedule)</b> — the residual environmental effect occurs sporadically, at irregular intervals, without a predictable pattern.</p> <p><b>Multiple regular event</b> — the residual environmental effect occurs on a regular basis and at regular intervals.</p> <p><b>Continuous</b> — the residual environmental effect occurs continuously.</p>
Duration	The length of time required until the residual environmental effect can no longer be measured or otherwise perceived.	<p><b>Short-term</b> — the residual environmental effect is limited to construction or active closure or for periods of less than 1 year during operation.</p> <p><b>Medium-term</b> — the residual environmental effect extends throughout construction, operation and active closure.</p> <p><b>Long-term</b> — the residual environmental effect extends beyond active closure.</p>
Reversibility	Pertains to whether a measurable parameter or the VC can return to its baseline condition or other target after the Project activity ceases.	<p><b>Reversible</b> — the residual environmental effect is likely to be reversed and the VC or measurable parameter is likely to return to its existing condition or other target after activity completion.</p> <p><b>Irreversible</b> — the residual environmental effect is permanent and the VC or measurable parameter is unlikely to return to its existing condition or other target.</p>
Ecological and Socio-economic Context	Considers uncommon characteristics of the area, a community and/or ecosystems that may be affected by the Project and/or whether the VC or measurable parameter is important to the functioning of an ecosystem or community of people.	<p><b>Typical</b> — the airshed is typical of a rural area in northern Ontario. The lighting environment is typical of a rural environment with low night-time brightness.</p> <p><b>Atypical</b> — the airshed is considered compromised or stressed and is not typical of a rural area in northern Ontario. The lighting environment is not typical of a rural environment with high night-time brightness.</p> <p>This characterization is not applicable to GHG, since GHG releases have a global effect and ecological and socio-economic context is highly variable globally.</p>



## **20.3.4 Cumulative Effects Assessment for Ambient Air Quality**

### **20.3.4.1 Cumulative Effect Mechanisms for Ambient Air Quality**

In association with the Project-specific residual effects, an assessment of the potential cumulative effects was conducted for other future physical activities that have potential to interact with the Project.

Emissions from a source emitting into the atmosphere will disperse as they are carried downwind, with the ambient concentration in the plume decreasing with increasing distance from the source, until eventually it will reach a level at which the concentration of the chemical in the plume is indistinguishable from the ambient background level. Therefore, the potential for emissions sources to interact cumulatively will decrease with increasing distance between the two sources. Generally, based on a conservative estimate and previous experience, it would be expected that most emissions sources located greater than 50 km apart would be unlikely to have cumulative effects. This distance was therefore chosen as the extent of the RAA for Ambient Air Quality.

The proposed Bankfield West Mineral Exploration and Municipality of Greenstone Landfill would result in emissions (equipment exhaust emissions and dust) that could overlap cumulatively with emissions from the operation of the Project. Both proposed activities are located within the LAA which encompasses the area where Project-specific residual effects are predicted. The extent of the overlap would be dependent on the magnitude of their emissions as well as location with the LAA being considered relative to both the distance from the Project and the other future projects. Both of these proposed activities will be required to operate under provincial permits and within regulatory limits. The Project will also be required to operate under provincial permits and within regulatory limits. The proposed Geraldton Subdivision would also result in emissions of PoPC that could overlap cumulatively with emissions from the Project, but would be expected to be of lower magnitudes than those associated with the proposed industrial activities.

Two other future activities, the Union Gas Pipeline and the TransCanada Energy East Project, while in close proximity to the Project, were not checked in Table 20-2. The Project is not expected to have a cumulative effect with the proposed Union Gas or TransCanada Energy East pipelines as neither pipeline would have emissions during operation, and construction emissions of pipelines are typically minor, localized and of short duration.

### **20.3.4.2 Mitigation for Cumulative Effects on Ambient Air Quality**

Measures for mitigating air contaminant concentrations from the Project will also mitigate cumulative ambient air quality effects, no additional mitigation specific to cumulative effects is proposed. Other industrial activities in the RAA will be operating under environmental approvals including mitigation measures for ambient air quality. A comprehensive listing of Project-specific mitigation measures for ambient air quality is provided in Section 7.4.2.2.

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**20.3.4.3 Residual Cumulative Effects on Ambient Air Quality**

With mitigation, the maximum predicted concentrations of all PoPCs were below applicable criteria during operation at all off assessed property modelling locations with the exception of infrequent 24-hour average particulate matter less than 10 micrometres in diameter ( $PM_{10}$ ) and fine particulate matter less than 2.5 micrometres in diameter ( $PM_{2.5}$ ) close to the modelled property boundary. Given the proximity and description of future physical activities (Table 20-2), Project-specific residual environmental effects will likely act cumulatively with those of other physical activities, but the resulting cumulative effects are unlikely to exceed acceptable levels with the application of management practices and proposed mitigation measures at each project. The residual cumulative effect (i.e., the effect of all future foreseeable activities) on ambient air quality are anticipated to be adverse in direction, moderate in magnitude (a measurable change but less than regulatory limits or standards), limited to the LAA, medium-term in duration, continuous and reversible within an airshed that is typical of a rural area in northern Ontario. Timing will be applicable as the increase in ambient levels of particulates and metals may be affected by seasonal variations in haul route control efficiencies and daily/weekly construction schedules. The Project contribution to the overall cumulative environmental effect is discussed in Section 20.3.8.1.

**20.3.4.4 Cumulative Effects Assessment for Climate Change  
(as Measured by Change in GHGs)**

Scientific consensus has been established that it is very likely that GHG emissions from anthropogenic sources are altering the global climate (Intergovernmental Panel on Climate Change 2013). As concentrations of GHGs in the atmosphere increase, there has been corresponding warming of the atmosphere, oceans, and related systems. A multitude of GHG sources, sinks, and reservoirs around the world contribute to the global cumulative effect. The contribution of the Project or future activities will be small in a global context and would not contribute measurably to climate change.

As noted in Chapter 7.0 (atmospheric environment VC), the incremental contribution of Project construction to total Ontario annual GHG emissions would be a maximum of 0.06% over the construction phase (based on Ontario's 2014 GHG emission level). The incremental contribution of Project construction to total Canadian annual GHG emissions would be a maximum of 0.01% over the construction phase. During construction, releases of GHGs from the Project are expected to be very small in comparison to provincial, national and global emissions.

The incremental contribution from the operation of the Project to total Ontario annual GHG emissions would be 0.1% for the Mill Phase 1 operating scenario, and 0.2% for the Mill Phase 2 scenario. The incremental contribution of the Project to total Canadian annual GHG emissions would be 0.03% for the Mill Phase 1 scenario, and 0.04% for the Mill Phase 2 scenario occurring annually over the lifetime of the Project. During operation, releases of GHGs from the Project are expected to be very small in comparison to provincial, national and global emissions.

## **20.3.5 Cumulative Effects Assessment for Change in Lighting**

### **20.3.5.1 Cumulative Effect Mechanisms for Change in Lighting**

Due to the proximity of the proposed Geraldton Subdivision in the vicinity of the PDA, there is potential for a cumulative effect for increased sky glow due to the combination of these light sources. Light emissions from the proposed subdivision would be expected to occur from street lighting and residential lights.

Project construction and operation will require night-time lighting, however, interactions with the Project and other future industrial activities in the RAA are not anticipated. Lighting effects, including sky glow, will not overlap with these other projects due to the distances between these projects within the RAA and as a result there is no cumulative effect pathway and assessment is not required.

### **20.3.5.2 Mitigation for Cumulative Effects on Change in Lighting**

Exterior lighting will be designed to reduce the amount of light trespass, sky glow and glare. Design and use of exterior of lighting systems for Project will be based on widely accepted standards and guidelines as discussed in detail in Section 7.4.4.2. It is assumed that similar design considerations, management practices and proposed mitigation measures would be in place for the proposed Geraldton Subdivision.

### **20.3.5.3 Residual Cumulative Effects on Change in Lighting**

With the proposed mitigation for the Geraldton Subdivision and the Project, a residual cumulative effect on lighting is anticipated to be adverse in direction, low in magnitude, confined to the LAA, medium-term in duration, continuous, reversible and occur within a lighting environment that is typical of a rural environment with low night-time brightness. Timing is not considered applicable as light emissions are not likely to be substantially affected by seasonality.

## **20.3.6 Summary of Cumulative Effects on the Atmospheric Environment**

A summary of the characterization of the overall cumulative environmental effects (i.e., the effect of all future foreseeable activities within the RAA) on the atmospheric environment is presented in Table 20-4. The Project contribution to the overall cumulative environmental effect is discussed in Section 20.3.8.1.

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**Table 20-4: Summary of Cumulative Effects on the Atmospheric Environment**

Case	Residual Cumulative Effects Characterization							
	Direction	Magnitude	Geographic Extent	Timing	Frequency	Duration	Reversibility	Ecological and Socio-economic Context
<b>Cumulative Change in Air Quality</b>								
Cumulative environmental effect with the Project	Adverse	Moderate <sup>1</sup>	LAA	Applicable	Continuous <sup>1</sup>	Medium-term	Reversible	Typical
<b>Cumulative Change in Lighting</b>								
Cumulative environmental effect with the Project	Adverse	Low	LAA	N/A	Continuous	Medium-term	Reversible	Typical

NOTES:

<sup>1</sup> With reference to infrequent PM<sub>10</sub> and PM<sub>2.5</sub> air quality levels in close proximity to the GGM property boundary. See Table 20-3 for detailed definitions.

### 20.3.7 Significance of Residual Cumulative Effects

#### Air Quality

The residual cumulative effects of a change in ambient air quality during Project operation were assessed to result in an increase in PoPC ambient concentrations above baseline conditions but to be not significant. With the proposed mitigation and environmental protection measures incorporated into the Project and future activities, the residual cumulative environmental effect of a change in air quality is predicted as not significant.

#### GHGs

It is generally recognized that additions to global emissions of GHGs and consequent changes to global climate change represents a significant cumulative effect. However, according to the Federal-Provincial-Territorial Committee on Climate Change and Environmental Assessment (2003) the environmental effect of a contribution of GHG emissions of an individual Project to climate change cannot be measured.

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### **Lighting**

The Project's effect on ambient lighting is predicted to be below the relevant Commission Internationale de L'Éclairage Guideline levels at all the assessed receptors.

With the proposed mitigation for the Geraldton Subdivision and the Project, the residual cumulative environmental effect of a change in lighting is predicted as not significant.

### **20.3.7.1 Project Contribution to Cumulative Effects**

#### **Air Quality**

In relation to the other future physical activities identified with the potential to act cumulatively with the Project (e.g., Bankfield West Mineral Exploration, proposed Geraldton Subdivision and Municipality of Greenstone Landfill), and due to the nature and duration of Project operation, the Project is anticipated to contribute more to the cumulative effect on air quality than the other physical activities. The Project's contribution will be above baseline conditions but be within regulatory limits and objectives for all PoPCs except infrequently for PM<sub>10</sub> (no more than 2-days in 5-years, or 0.1% of the time) and PM<sub>2.5</sub>, and to be restricted to the LAA.

#### **GHGs**

As noted above, Project emissions of GHGs will contribute to these cumulative effects, but the contribution will be small in a global context. Details of predicted GHG emissions for all phases of the Project are provided in Chapter 7.0 (atmospheric environment VC) and in "Technical Data Report: Hardrock Project – Atmospheric Environment" (Appendix F1).

### **Lighting**

In relation to the other future physical activities identified with the potential to act cumulatively with the Project (i.e., the Geraldton Subdivision, it is considered that overall the Project will contribute more to the cumulative effect on lighting). The relative contribution of light from other sources will vary dependent upon the Project's phase (construction or operation) and the time of day.

### **20.3.7.2 Prediction Confidence for Cumulative Effects**

The effects of Project releases of air PoPCs are based on calculated emission rates, modelling completed using the United States Environmental Protection Agency's AERMOD air dispersion model, and measured background air quality levels. Prediction confidence is high because emission rates used in the modelling were estimated based on a combination of emission factors, engineering estimates and maximum emission levels. Background concentrations used for assessing the Project-specific residual effects were conservatively determined by taking the median of the 90<sup>th</sup> percentile concentrations of each PoPC from the available data sources. The

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Project is located in northern Ontario and air quality is primarily influenced by the Ward of Geraldton and traffic on Highway 11. Baseline air concentrations established in this Final EIS/EA are primarily based on National Air Pollution Surveillance stations which are located in residential, commercial and industrial areas which are expected to have higher background concentrations relative to the LAA, or site specific data. Because of the nature of this approach, there is a high degree of confidence that existing conditions cumulative air quality levels are overestimated.

Prediction confidence relative to GHG emissions is high because, although the methods used for estimates are approximate and based on preliminary design information, the estimates are considered accurate enough to evaluate and define the magnitude of GHG emissions from the Project.

The effect of lighting from the Project and cumulative effects were evaluated based on the location and site condition of the Project and nearby receptors. With proper design and mitigation of the Project and future development lighting sources, the prediction confidence for the cumulative assessment of lighting is high.

### **20.4 GROUNDWATER**

As detailed in Chapter 9.0 (groundwater VC), while found not significant, the Project is anticipated to have adverse residual effects on groundwater quantity. The primary effect on groundwater quantity is during operation with the lowering of water levels through dewatering of historical underground workings and open pit, aggregate sources S1 and T2 and the Goldfield Creek diversion. Therefore, there is potential for the adverse residual effects of the Project to act cumulatively with residual effects of other future physical activities.

The anticipated residual effects of the Project on groundwater quality are considered to be positive and therefore are not included in the cumulative effects assessment.

#### **20.4.1 Regional Assessment Area**

As noted in Section 9.1.5.1, the RAA for groundwater is based on the likely extent of drawdown from open pit dewatering and changes to flow or groundwater quality due to recharge from the TMF and waste rock storage areas (WRSAs). The RAA boundary (Figure 9-1) is based on the study area described in "Environmental Baseline Data Report – Hardrock Project: Hydrogeology" (Appendix E3.2) and "Supplemental 2015 Hydrogeology Characterization Data Report – Hardrock Project" (Appendix E3.1) and results of groundwater modelling presented in the "Technical Data Report – Hardrock Project: Hydrogeology Modelling" (Appendix F4). The RAA and the LAA are the same geographical area due to the localized nature of potential Project effects. The western boundary of the RAA is the drainage divide for Magnet Creek and Kenogamisis Lake. South of Longacre Lake, the RAA boundary follows the drainage divide to the west side of Goldfield Lake. The southern RAA boundary includes the southern divide of the

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drainage area for Goldfield Lake and follows the northern drainage divide for Parent Creek toward the southern tip of the Southwest Arm of Kenogamisis Lake. The eastern boundary follows the eastern shore of the Southwest Arm of Kenogamisis Lake and turns eastward north of Puppy and Pussy Lakes to follow the eastern shore of the Central Basin of Kenogamisis Lake. The northern boundary follows the northern drainage divide of Hardrock Creek. The RAA is used to provide regional context for the significance of residual effects and is also the area within which potential for cumulative effects of the Project in combination with other past, present, or reasonably foreseeable projects or activities are considered. The RAA is approximately 14,900 ha in size.

**20.4.2 Identification of Project Effects Likely to Interact Cumulatively**

Where residual environmental effects from the Project have the potential to act cumulatively with those from other projects and physical activities (Table 20-5), a cumulative effects assessment is undertaken to determine significance.

Groundwater effects from other future activities located in different sub-watersheds than the Project and occur at a distance of more than 2 km from the boundaries of the RAA are not expected to have measurable cumulative effects on groundwater quantity or quality and are not considered further.

**Table 20-5: Potential Cumulative Effects on Groundwater**

Other Projects and Physical Activities with Potential for Cumulative Environmental Effects	Potential Cumulative Environmental Effects
	Change in Groundwater Quantity
<b>Future Physical Activities (certain and reasonably foreseeable)</b>	
Goliath Gold Mine	-
Magino Mine	-
Hammond Reef Gold Mine	-
Josephine Cone Mine	-
Bankfield West Mineral Exploration	-
Pickle Lake Mining Exploration	-
Junior Lake Mining Exploration	-
Ishkoday Mining Exploration	-
McCaul Twp Mining Exploration	-
Thunder Bay District Mining Exploration	-
Hemlo East Project Mining Exploration	-
McTavish Twp Aggregate	-
Proposed Geraldton Subdivision	-
Municipality of Greenstone Landfill	-



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**Table 20-5: Potential Cumulative Effects on Groundwater**

Other Projects and Physical Activities with Potential for Cumulative Environmental Effects	Potential Cumulative Environmental Effects
	Change in Groundwater Quantity
Little Jackfish Hydroelectric Development	-
Little Jackfish Transmission Line	-
TransCanada Energy East Project	-
Union Gas Pipeline	-
East-West Tie Transmission Project	-
Black Sturgeon River Camp 43 Dam Project	-
MNRF – FMU815 Lake Nipigon Forest	-
MNRF – FMU350 Kenogami Forest	-

NOTES:

- ✓ those "other projects and physical activities" whose residual effects are likely to interact cumulatively with Project-specific residual environmental effects.
- interactions between the adverse residual effects of other projects and the Project-specific adverse residual effects are not expected.

Those future activities listed but not checked off in Table 20-5 represent activities that are unlikely to interact cumulatively with the Project (i.e., are either one or a combination of the following: 1) substantially geographically removed from the Project; 2) by definition their operations do not represent a potential cumulative effect pathway to the VC; 3) would be considered to have a potential spatial or temporal overlap however due to the known success of current best management and design mitigation for such projects residual effects are unlikely).

Two potential future projects, the Union Gas Pipeline and the proposed Geraldton Subdivision, may have a potential spatial and temporal overlap with the Project, however as noted under condition 3 above, with the implementation of current best management and design mitigation measures neither project is anticipated to result in residual effects on groundwater quantity and therefore cumulative effects with the Project are not anticipated. Effects on groundwater quantity from the Union Gas Pipeline or the proposed Geraldton Subdivision would be restricted to possible temporary dewatering required during construction only. The magnitude of drawdown is anticipated to be low due to the limited depths that these types of infrastructure are typically installed. The effect of drawdown would be confined to the area directly around the infrastructure, and is considered short term as it will only occur during construction. Given this, no cumulative effects assessment is considered warranted.



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**20.5 SURFACE WATER**

As detailed in Chapter 10.0 (surface water VC), while not found to be significant, the Project is anticipated to have adverse residual effects on surface water quantity and quality. As such there is potential for the residual effects of the Project to act cumulatively with residual effects of other future physical activities.

**20.5.1 Regional Assessment Area**

As noted in Section 10.1.5.1, the RAA for surface water is based on the contributing area to the LAA and extends downstream from the Kenogamisis Lake Dam to the discharge point of the Kenogami River to Long Lake at Crib Road and northeast to the Kenogami Diversion Dam. The Kenogami Diversion Dam was selected as the northeastern boundary of the RAA as a relatively small flow volume (2 cubic metres per second [m<sup>3</sup>/s]) is routed by this dam from the Saturday before Victoria Day until Labor Day to continue to flow toward the Albany River. The Kenogami River at Crib Road was selected as the downstream RAA boundary because it facilitates the determination of Project-specific residual effects in the RAA upstream of Long Lake. Long Lake has been identified as the water supply source for the community of Longlac, GFN, and LFN, as well as an important Aboriginal fishery, transportation route and recreational waterbody. The downstream RAA boundary is used to provide regional context for the significance of residual effects and is also the area within which the potential for cumulative effects of the Project in combination with other past, present or reasonably foreseeable projects or activities are considered. The determination of the RAA also takes into consideration comments from Aboriginal communities and government agencies. The RAA is approximately 133,700 ha in size.

**20.5.2 Identification of Project Effects Likely to Interact Cumulatively**

The residual effects of the Project on surface water quantity and quality are expected to be confined within the LAA. Where residual environmental effects from the Project have the potential to act cumulatively with those from other projects and physical activities (Table 20-6), a cumulative effects assessment is undertaken to determine significance.

**Table 20-6: Potential Cumulative Effects on Surface Water**

Other Projects and Physical Activities with Potential for Cumulative Environmental Effects	Potential Cumulative Environmental Effects	
	Change in Surface Water Quantity	Change in Surface Water Quality
<b>Future Physical Activities (certain and reasonably foreseeable)</b>		
Goliath Gold Mine	-	-
Magino Mine	-	-
Hammond Reef Gold Mine	-	-

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**Table 20-6: Potential Cumulative Effects on Surface Water**

Other Projects and Physical Activities with Potential for Cumulative Environmental Effects	Potential Cumulative Environmental Effects	
	Change in Surface Water Quantity	Change in Surface Water Quality
Josephine Cone Mine	-	-
Bankfield West Mineral Exploration	-	-
Pickle Lake Mining Exploration	-	-
Junior Lake Mining Exploration	-	-
Ishkoday Mining Exploration	-	-
McCaul Twp Mining Exploration	-	-
Thunder Bay District Mining Exploration	-	-
Hemlo East Project Mining Exploration	-	-
McTavish Twp Aggregate	-	-
Proposed Geraldton Subdivision	-	-
Municipality of Greenstone Landfill	-	-
Little Jackfish Hydroelectric Development	-	-
Little Jackfish Transmission Line	-	-
TransCanada Energy East Project	-	-
Union Gas Pipeline	-	-
East-West Tie Transmission Project	-	-
Black Sturgeon River Camp 43 Dam Project	-	-
MNRF – FMU815 Lake Nipigon Forest	-	-
MNRF – FMU350 Kenogami Forest	-	-

NOTES:

- ✓ those "other projects and physical activities" whose residual effects are likely to interact cumulatively with Project-specific residual environmental effects.
- interactions between the adverse residual effects of other projects and the Project-specific adverse residual effects are not expected

Those future activities listed but not checked off in Table 20-6 represent activities that are unlikely to interact cumulatively with the Project (i.e., are either one or a combination of the following: 1) substantially geographically removed from the Project; 2) by definition their operations do not represent a potential cumulative effect pathway to the VC; 3) would be considered to have a potential spatial or temporal overlap however due to the known success of current best management and design mitigation for such projects residual effects are unlikely).

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None of the future physical activities listed in Table 20-6 are considered to have a potential to act cumulatively with the residual effects of the Project and therefore a cumulative effects assessment is not warranted.

One future project, the Bankfield West Mineral Exploration, may have a potential spatial and temporal overlap with the Project; however, as noted under condition 3 above, with the implementation of mitigation this project is not anticipated to result in residual effects on surface water quality and therefore cumulative effects with the Project are not anticipated.

The Bankfield West Mineral Exploration Project would involve exploration drilling approximately 10 km west of the PDA. It is assumed that no temporary camp will be required for the exploration project and no Environmental Compliance Approval for discharge will be required. As such residual effects on water quality are not anticipated and no cumulative effect would occur. Given this, no cumulative effects assessment is considered warranted.

## **20.6 FISH AND FISH HABITAT**

As detailed in Chapter 11.0 (fish and fish habitat VC), while found not significant, the Project is anticipated to have adverse residual effects on fish and fish habitat in the form of the permanent alteration of fish habitat and sub-lethal effects on fish due to PoPC inputs from treated effluent and non-point sources. As such there is potential for the residual effects of the Project to act cumulatively with residual effects of other future physical activities.

### **20.6.1 Regional Assessment Area**

As noted in Section 11.1.5.1, the RAA for fish and fish habitat encompasses the LAA, the upstream drainage area of Barton Bay and the upstream drainage area of the Southwest Arm of Kenogamisis Lake. It also includes all of Kenogamisis Lake and extends downstream along the Kenogamisis River to the reservoir created by the Kenogami Control Dam. To consider potential cumulative effects on water quality, the RAA boundary was extended southward along the Kenogamisis River (which now flows south as a result of historical water diversions) to Crib Road. Compared to the LAA, the RAA boundary was further extended to the Kenogami Diversion Reservoir, which is approximately 30 km downstream of the LAA. The RAA includes the drainages of the LAA, plus the Burrows River and some smaller, unnamed tributaries to the Kenogami River downstream of Kenogamisis Lake. The RAA is used to provide regional context for the significance of residual effects and is also the area within which potential for cumulative effects of the Project in combination with other past, present or reasonably foreseeable projects or activities are considered. The RAA is approximately 133,800 ha in size.

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**20.6.1 Identification of Project Effects Likely to Interact Cumulatively**

Table 20-7 provides a summary of interactions resulting from other physical activities with fish and fish habitat. Not checked are those that lack a physical connection via surface water (e.g., quarries, aggregate pits), or are outside of the Kenogamisis watershed boundaries and lack potential interaction with fish and fish habitat affected by the Project.

**Table 20-7: Potential Cumulative effects on Fish and Fish Habitat**

Other Projects and Physical Activities with Potential for Cumulative Environmental Effects	Potential Cumulative Environmental Effects
	Permanent Alteration of Fish Habitat
<b>Future Physical Activities (certain and reasonably foreseeable)</b>	
Goliath Gold Mine	-
Magino Mine	-
Hammond Reef Gold Mine	-
Josephine Cone Mine	-
Bankfield West Mineral Exploration	-
Pickle Lake Mining Exploration	-
Junior Lake Mining Exploration	-
Ishkoday Mining Exploration	-
McCaul Twp Mining Exploration	-
Thunder Bay District Mining Exploration	-
Hemlo East Project Mining Exploration	-
McTavish Twp Aggregate	-
Proposed Geraldton Subdivision	-
Municipality of Greenstone Landfill	-
Little Jackfish Hydroelectric Development	-
Little Jackfish Transmission Line	-
TransCanada Energy East Project	-
Union Gas Pipeline	-
East-West Tie Transmission Project	-
Black Sturgeon River Camp 43 Dam Project	-
MNRF – FMU815 Lake Nipigon Forest	-
MNRF – FMU350 Kenogami Forest	-

NOTES:

- ✓ those "other projects and physical activities" whose residual effects are likely to interact cumulatively with Project-specific residual environmental effects.
- interactions between the adverse residual effects of other projects and the Project-specific adverse residual effects are not expected.

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Those future activities listed but not checked off in Table 20-7 represent activities that are unlikely to interact cumulatively with the Project (i.e., are either one or a combination of the following: 1) substantially geographically removed from the Project; 2) by definition their operations do not represent a potential cumulative effect pathway to the VC; 3) would be considered to have a potential spatial or temporal overlap however due to the known success of current best management and design mitigation for such projects residual effects are unlikely).

None of the future physical activities listed in Table 20-7 are considered to have a potential to act cumulatively with the residual effects of the Project and therefore a cumulative effects assessment is not warranted.

One future project, the Bankfield West Mineral Exploration, may have a potential spatial and temporal overlap with the Project; however, as noted under condition 3 above, with the implementation of mitigation this project is not anticipated to result in residual effects on fish and fish habitat, due to changes in water quality, and therefore cumulative effects with the Project are not anticipated.

The Bankfield West Mineral Exploration Project would involve exploration drilling approximately 10 km west of the PDA. It is assumed that no temporary camp will be required for the exploration project and no Environmental Compliance Approval for discharge will be required. As such residual effects on fish and fish habitat due to changes in water quality are not anticipated and no cumulative effect would occur. Given this, no cumulative effects assessment with the Project is considered warranted.

### **20.7 VEGETATION COMMUNITIES**

As detailed in Chapter 12.0 (vegetation communities VC), the Project is anticipated to result in the following localized adverse residual effects on vegetation communities:

- change in abundance of vegetation communities
- change in function, connectivity and quality of vegetation communities.
- change in abundance of plant species of interest.

Although all residual effects were found to be not significant, there is potential for the residual effects of the Project to act cumulatively with residual effects of other future physical activities.

No rare vegetation communities (ecosites) have been identified in the LAA through ecosite confirmation surveys or background review and therefore the change in abundance of vegetation communities includes the assessment of direct loss of only common vegetation communities (upland and wetland).

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The assessment of change in function, connectivity and quality of vegetation communities includes indirect loss or alteration of wetland and upland communities through changes in groundwater and surface water flow, fragmentation, fugitive dust emissions and introduction of invasive species.

No provincially or federally listed plant Species at Risk (SAR) or Species of Conservation Concern (SOCC) were encountered in the LAA or identified through background review, so the assessment of change in abundance of plant species of interest includes only effects on plant species of interest to Aboriginal communities (see Chapter 12.0 [vegetation communities VC] for more detail).

**20.7.1 Regional Assessment Area**

As noted in Section 12.1.5.1, the RAA for vegetation communities was selected using natural ecological boundaries, specifically the Burrows River, Kenogamisis River and Kenogamisis Lake watersheds. The RAA contains similar ecosystem and habitat types to those found within the LAA and is used to provide regional context for the significance of residual effects and is also the area within which potential for cumulative effects of the Project in combination with other past, present or reasonably foreseeable projects or activities are considered. The total area of the RAA is approximately 1 68,300 ha. The RAA includes the LAA and PDA, and is consistent with the RAA for the wildlife and wildlife habitat VC (Chapter 13.0).

**20.7.2 Identification of Project Effects Likely to Interact Cumulatively**

Where residual environmental effects from the Project have the potential to act cumulatively with those from other projects and physical activities (Table 20-8), a cumulative effects assessment is undertaken to determine significance.

**Table 20-8: Potential Cumulative Effects on Vegetation Communities**

Other Projects and Physical Activities with Potential for Cumulative Environmental Effects	Potential Cumulative Environmental Effects		
	Change in abundance of plant species of interest	Change in abundance of vegetation communities	Change in function, connectivity, and quality of vegetation communities
<b>Future Physical Activities (certain and reasonably foreseeable)</b>			
Goliath Gold Mine	-	-	-
Magino Mine	-	-	-
Hammond Reef Gold Mine	-	-	-

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**Table 20-8: Potential Cumulative Effects on Vegetation Communities**

Other Projects and Physical Activities with Potential for Cumulative Environmental Effects	Potential Cumulative Environmental Effects		
	Change in abundance of plant species of interest	Change in abundance of vegetation communities	Change in function, connectivity, and quality of vegetation communities
Josephine Cone Mine	-	-	-
Bankfield West Mineral Exploration	✓	✓	✓
Pickle Lake Mining Exploration	-	-	-
Junior Lake Mining Exploration	-	-	-
Ishkoday Mining Exploration	-	-	-
McCaul Twp Mining Exploration	-	-	-
Thunder Bay District Mining Exploration	-	-	-
Hemlo East Project Mining Exploration	-	-	-
McTavish Twp Aggregate	-	-	-
Proposed Geraldton Subdivision	✓	✓	✓
Municipality of Greenstone Landfill	-	-	-
Little Jackfish Hydroelectric Development	-	-	-
Little Jackfish Transmission Line	-	-	-
TransCanada Energy East Project	✓	✓	✓
Union Gas Pipeline	✓	✓	✓
East-West Tie Transmission Project	-	-	-
Black Sturgeon River Camp 43 Dam Project	-	-	-
MNRF – FMU815 Lake Nipigon Forest	✓	✓	✓
MNRF – FMU350 Kenogami Forest	✓	✓	✓

NOTES:

- ✓ those "other projects and physical activities" whose residual effects are likely to interact cumulatively with Project-specific residual environmental effects.
- interactions between the adverse residual effects of other projects and the Project-specific adverse residual effects are not expected

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Those future physical activities listed but not checked off in Table 20-8 represent activities that are unlikely to interact cumulatively with the Project because they do not overlap spatially; i.e., they are located outside the RAA; and by definition their operations do not represent a potential cumulative effect pathway to the VC.

The RAA for vegetation communities was selected using natural ecological boundaries, specifically the Burrows River, Kenogamisis River and Kenogamisis Lake watersheds. As presented in Table 20-9, the baseline condition of vegetation communities in the RAA is a landscape mosaic of upland forests and treed and open wetlands, with existing anthropogenic disturbances dispersed throughout. Disturbances include timber harvesting and production activities, residential areas, and other industrial developments. These disturbances have removed or altered vegetation communities.

The PDA includes a similar land cover mosaic as that of the RAA (Chapter 12.0; vegetation communities VC). The Project and other future physical activities in the RAA, will result in direct loss of vegetation communities and may contribute to indirect effects on vegetation communities including changes in surface water and groundwater dynamics, community fragmentation, dust emissions, invasive species introduction and change in species composition due to changes in light and moisture availability. The residual effects assessment (Chapter 12.0; vegetation communities VC) concluded that no indirect residual effects from fragmentation, invasive plants or dust were expected (see Section 12.4.4). However, the effects from direct loss of vegetation communities in the PDA could interact with future physical activities to result in cumulative effects on vegetation communities in the RAA.

The Project will result in a loss of plant species of interest to Aboriginal communities in the PDA (Section 12.4.2). As a conservative approach to estimating the Project's contribution to cumulative effects, the loss of plant species of interest to Aboriginal communities in the PDA has been considered permanent loss, even though a portion of the PDA will be rehabilitated at closure (Section 12.4.3).

There are five future physical activities which could contribute to cumulative effects on vegetation communities in the RAA (Table 20-8). One of these future activities is ongoing timber harvest activities in FMUs 815 and 350. The ongoing forest harvesting activities will potentially affect approximately 13,406 ha of vegetation. The proposed TransCanada Energy East Project will require an increase in existing footprint, resulting in a total approximate footprint size of approximately 210 ha within the RAA (TransCanada Corporation 2015) and therefore a contribution to cumulative effects on vegetation communities in the RAA.



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The remaining three future physical activities will each require new, but relatively small areas of disturbance, and will result in only correspondingly small contributions to cumulative effects on vegetation communities:

- The Geraldton Subdivision is a planned project that would occupy approximately 24 ha of land near Kenogamisis Lake (Municipality of Greenstone 2015).
- The proposed Union Gas Pipeline would be a narrow corridor approximately 13 km in length from north of Geraldton to the Hardrock Mine. A 50 m wide corridor is assumed for this project equating to approximately 66 ha of disturbance area. A portion of the Union Gas Pipeline would overlap the Project's vegetation communities VC LAA.
- Bankfield West Mineral Exploration is planning drilling and other exploration activities that could be carried out over approximately 17 ha (Premier Gold Mines Limited 2014).

The cumulative effects assessment considers the Project-specific residual effects combined with the effects of other future physical activities on vegetation communities. Ecosite mapping was used to quantitatively assess cumulative effects on vegetation communities similar to the assessment of residual effects provided in Chapter 12.0, Figure 12-2. Ecosite mapping was developed from MNRF's Forest Resource Inventory (FRI) for the Kenogami and Lake Nipigon forests. The FRI classification scheme was converted to equivalent ecosites presented in the *Ecological Land Classification field manual – operational draft* (MNR 2009a) to be consistent with the classification scheme used for the LAA. Ecosite code conversions were done using an approved provincial protocol (i.e., MNR 2012).

The RAA is comprised primarily of undisturbed vegetated communities (137,545 ha; 88%), including upland (60%) and wetland (28%) ecosites. The remaining area (18,600 ha; 12%) is comprised of non-vegetated areas (11%) which include open water and exposed rock (barren); and disturbed areas (1%) which include anthropogenic non-vegetated disturbed regenerating vegetation. An area of 12,270 ha of the RAA comprise unmapped ecosites, where FRI data was not available; this area has not been included in the % cover in the RAA.

Four upland groups of ecosites occur in the RAA: coniferous forest, deciduous forest (here-in referred to as hardwood forest), mixedwood forest and meadow, and four wetland ecosite classes occur in the RAA: bog, fen, marsh, and swamp. These ecosite classes are broken down into ecosite types as shown in Table 20-9.

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**Table 20-9: Ecosites in the RAA**

Ecosite Code	Ecosite Name	Area in RAA (ha)	Proportion (%) of the RAA
<b>UPLAND VEGETATION</b>			
<b>Conifer Forest</b>			
B012	Very Shallow, Dry to Fresh: Pine - Black Spruce Conifer	750	0.5
B033	Dry, Sandy: Red Pine - White Pine Conifer	10	<0.1
B034	Dry, Sandy: Jack Pine- Black Spruce Dominated	4680	3
B035	Dry, Sandy: Pine - Black Spruce Conifer	3130	2
B037	Dry, Sandy: Pine-Black Spruce Conifer	10	<0.1
B049	Dry to Fresh, Coarse Loamy: Jack Pine - Black Spruce Dominated	21,670	14
B050	Dry to Fresh, Coarse Loamy: Jack Pine - Black Spruce Conifer	1,740	1
B051	Dry to Fresh, Coarse Loamy: Hemlock-Cedar Conifer	20	<0.1
B052	Dry to Fresh, Coarse Loamy: Spruce-Fir Conifer	19,590	13
B053	Dry to Fresh, Coarse: Conifer	20	<0.1
B065	Moist, Coarse Loamy: Pine - Black Spruce Conifer	10,800	7
B066	Moist, Coarse Loamy: Hemlock - Cedar Conifer	120	0.1
B068	Moist, Course: Conifer	40	<0.1
B082	Fresh, Clayey: Jack Pine - Black Spruce Dominated	2,080	1
B098	Fresh, Silty to Fine Loamy: Jack Pine - Black Spruce	690	0.4
B099	Fresh, Silty to Fine Loamy: Pine - Black Spruce	60	<0.1
B101	Fresh, Silty to Fine Loamy: Spruce - Fir Conifer	110	0.1
B102	Fresh, Silty to Fine Loamy: Conifer	20	<0.1
B114	Moist, Fine Loamy: Pine - Black Spruce Conifer	590	0.4
B115	Moist, Fine: Hemlock - Cedar Conifer	20	<0.1
B116	Moist, Fine: Spruce - Fir Conifer	100	0.1
B117	Moist, Fine: Conifer	10	<0.1
<b>Conifer Forest Subtotal</b>		<b>66,260</b>	<b>42</b>
<b>Hardwood Forest</b>			
B040	Dry, Sandy: Aspen - Birch Hardwood	2,390	2
B055	Dry to Fresh, Coarse Loamy: Aspen - Birch Hardwood	23,980	15
B070	Moist, Coarse Loamy: Aspen - Birch Hardwood	1,000	0.6
B088	Fresh, Clayey: Aspen - Birch Hardwood	220	0.1
B104	Fresh, Silty to Fine Loamy: Aspen - Birch Hardwood	670	0.4

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**Table 20-9: Ecosites in the RAA**

Ecosite Code	Ecosite Name	Area in RAA (ha)	Proportion (%) of the RAA
B119	Moist, Fine Loamy: Aspen - Birch Hardwood	50	<0.1
<b>Hardwood Forest Subtotal</b>		<b>28,310</b>	<b>18</b>
<b>Mixedwood Forest</b>			
B059	Dry to Fresh, Coarse Loamy: Aspen-Birch	5	<0.1
B076	Moist, Coarse: Mixedwood	60	<0.1
B125	Moist, Fine: Mixedwood	40	<0.1
<b>Mixedwood Forest Subtotal</b>		<b>105</b>	<b>&lt;0.1</b>
<b>Meadow</b>			
B030	Dry, Sandy: Meadow	30	<0.1
B110	Moist, Fine: Meadow	20	<0.1
<b>Meadow Subtotal</b>		<b>50</b>	<b>&lt;0.1</b>
<b>Upland Vegetation Subtotal</b>		<b>94,725</b>	<b>60</b>
<b>WETLAND</b>			
<b>Bog</b>			
B126	Low Treed Bog	280	0.2
B137	Sparse Treed Bog	10	<0.1
B138	Open Bog	10	<0.1
<b>Bog Subtotal</b>		<b>300</b>	<b>0.2</b>
<b>Fen</b>			
B136	Sparse Treed Fen	2,850	2
B139	Poor Fen	150	0.1
B140	Open Moderately Rich Fen	1,340	1
B141	Open Extremely Rich Fen	60	<0.1
B146	Open Shore Fen	1,170	0.7
<b>Fen Subtotal</b>		<b>5,570</b>	<b>4</b>
<b>Marsh</b>			
B142	Mineral Meadow Marsh	1,430	0.9
B144	Organic Meadow Swamp	240	0.2
B148	Mineral Shallow Marsh	10	<0.1
B149	Organic Shallow Marsh	20	<0.1
<b>Marsh Subtotal</b>		<b>1,700</b>	<b>1</b>
<b>Swamp</b>			

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**Table 20-9: Ecosites in the RAA**

Ecosite Code	Ecosite Name	Area in RAA (ha)	Proportion (%) of the RAA
B127	Poor Conifer Swamp	4,980	3
B128	Intermediate Conifer Swamp	24,280	16
B129	Rich Conifer Swamp	5,110	3
B130	Intolerant Hardwood Swamp	10	<0.1
B134	Mineral Thicket Swamp	610	0.4
B135	Organic Thicket Swamp	80	0.1
B223	Mineral Intermediate Conifer Swamp: Peaty Phase	170	0.1
B224	Mineral Rich Conifer Swamp: Peaty Phase:	10	<0.1
<b>Swamp Subtotal</b>		<b>35,250</b>	<b>23</b>
<b>Wetland Subtotal</b>		<b>42,820</b>	<b>28</b>
<b>Vegetated (Upland Vegetation and Wetland) Subtotal</b>		<b>137,545</b>	<b>88</b>
<b>NON-VEGETATED AND DISTURBED AREAS</b>			
<b>Non-Vegetated Natural</b>			
B007	Active Mineral Barren	110	0.1
Water	Water	16,490	11
<b>Non-Vegetated Natural Subtotal</b>		<b>16,600</b>	<b>11</b>
<b>Disturbed Ecosites</b>			
B194	Early Successional Forest-Disturbed – Coarse Clean Fill	130	0.1
B196	Early Successional Forest - Disturbed - Fine Clean Fill	<10	<0.1
B197	Early Successional Forest - Disturbed - Pavement/Concrete	40	<0.1
B198	Early Successional Forest - Disturbed - Compact Graveled Surface	1,820	1
B200	Early Successional Forest -Disturbed - Other Materials	<10	<0.1
<b>Disturbed Ecosites Subtotal</b>		<b>2,000</b>	<b>1</b>
<b>Non-Vegetated and Disturbed Areas Subtotal</b>		<b>18,600</b>	<b>12</b>
<b>Mapped Ecosite Subtotal</b>		<b>156,180</b>	<b>100.0</b>
Unmapped	Ecosites unmapped	12,155	N/A
<b>RAA Total</b>		<b>168,300</b>	<b>N/A</b>

NOTE:

N/A refers to 'not applicable' for the unmapped and RAA total proportions because the proportions in that column are within the total area mapped with ecosites.

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**20.7.3 Residual Cumulative Environmental Effects Description Criteria**

The residual cumulative environmental effects are characterised using the same terms and definitions as those of the residual environmental effects. Table 20-10 provides those terms and definitions as previously detailed in Section 12.1.6.

**Table 20-10: Characterization of Residual Environmental Effects on Vegetation Communities**

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Direction	The relative change compared to baseline conditions.	<b>Positive</b> — an increase in the count, area or quality of vegetation communities (upland and wetland), including habitat for species of interest. <b>Adverse</b> — a decrease in the count, area or quality of vegetation communities (upland or wetland), including habitat for species of interest.
Magnitude	The amount of change (ha) in either the measurable parameters or the VC relative to baseline conditions.	<b>Low</b> — a measurable change in the count, area (ha) or quality of vegetation communities (upland or wetland), where the change does not threaten long-term viability of that vegetation community type in the RAA. <b>Moderate</b> — a measurable change in the count, area (ha) or quality of vegetation communities (upland and wetland), where the change may affect the resiliency to future changes of that vegetation community type in the RAA. <b>High</b> — a measurable change in the count, area (ha) or quality of vegetation communities (upland and wetland), compared to baseline conditions, where the change is likely to threaten long-term viability of that vegetation community type in the RAA.
Geographic Extent	The geographic area in which the residual environmental effect occurs.	<b>PDA</b> — the residual environmental effect is restricted to the PDA. <b>LAA</b> — the residual environmental effect extends into the LAA. <b>RAA</b> — the residual environmental effect extends into the RAA.

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**Table 20-10: Characterization of Residual Environmental Effects on Vegetation Communities**

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Timing	Considers when the residual environmental effect is expected to occur. Timing considerations are noted in the evaluation of the residual environmental effect, where applicable or relevant.	<b>Not Applicable (N/A)</b> — seasonal aspects are unlikely to affect the residual environmental effect on vegetation communities. <b>Applicable</b> — seasonal aspects may affect the residual environmental effect on vegetation communities.
Frequency	Identifies how often the residual environmental effect occurs within a given time.	<b>Single event</b> — the residual environmental effect occurs once during the Project. <b>Multiple irregular events (no set schedule)</b> — the residual environmental effect occurs sporadically, at an irregular interval, and is not predictable. <b>Multiple regular events</b> — the residual environmental effect occurs regularly, and may be at predictable intervals or specific times. <b>Continuous</b> — the residual environmental effect occurs continuously.
Duration	The length of time required until the residual environmental effect can no longer be measured or otherwise perceived.	<b>Short-term</b> — the residual environmental effect is restricted to construction or active closure. <b>Medium-term</b> — the residual environmental effect extends throughout construction, operation and active closure. <b>Long-term</b> — the residual environmental effect extends beyond active closure.
Reversibility	Pertains to whether a measurable parameter or the VC can return to its existing baseline condition after the Project activity ceases.	<b>Reversible</b> — the residual environmental effect is likely to be reversed after activity the ceases. <b>Irreversible</b> — the residual environmental effect is permanent and either the measurable parameter or the VC is unlikely to return to baseline conditions, prior to the creation of the pit lake.
Ecological and Socio-economic Context	Considers uncommon characteristics of the area, a community and/or ecosystems that may be affected by the Project and or whether the VC or measurable parameter is important to the functioning of an ecosystem or community of people.	<b>Typical</b> — the VC or measurable parameter is considered common and/or is considered not important to the functioning of the ecosystem. <b>Atypical</b> — the VC or measurable parameter is considered uncommon and/or is considered important to the functioning of the ecosystem.

## **20.7.4 Cumulative Effects Assessment for Change in Abundance of Vegetation Communities**

### **20.7.4.1 Cumulative Effect Mechanisms for Change in Abundance of Vegetation Communities**

No rare vegetation communities were identified in the LAA and none are predicted to be affected by the Project (Section 12.4.3); therefore, they are not considered or discussed further in this assessment.

The residual change in abundance of vegetation communities from other projects and activities in the RAA will act cumulatively with that from the Project. Vegetation removal will result in cumulative loss of vegetation communities. These effects on vegetation communities have already occurred from many past and present projects and activities.

The maximum area of vegetation change as a result of the Project and future physical activities is assumed, although much of the area can be expected to return to near pre-Project/activity conditions over time (in particular areas altered by forestry activities). Table 20-9 presented the baseline existing conditions by ecosite, which incorporates past and present project effects.

The removal of additional areas containing vegetation communities is expected to occur as a result of other future physical activities in the RAA through land clearing and therefore would act cumulatively with this effect from the Project.

### **20.7.4.2 Mitigation for Cumulative Effects on Change in Abundance of Vegetation Communities**

Project mitigation measures presented in Section 12.4.2.2 for a change in abundance of vegetation communities are predicted to reduce and mitigate the Project's contribution to the cumulative loss of vegetation communities. No additional mitigation measures are considered necessary to mitigate for cumulative change in abundance of vegetation communities.

### **20.7.4.3 Residual Cumulative Effects for Change in Abundance of Vegetation Communities**

The total area of vegetation communities that is expected to be removed from the PDA plus other future physical activities is 15,923 ha which is a 11.6% reduction from baseline. The loss of upland vegetation communities from the PDA contributing to this cumulative effect is 1,133 ha (< 1 % reduction from baseline) (Table 20-11 and Section 12.4.1 for assumptions used in the assessment). The coniferous forest ecosites collectively in the RAA (66,260 ha) would have the greatest approximate change in areal extent (8,122 ha, or a -12.3% change from baseline). However, hardwood forest ecosites collectively in the RAA (28,310 ha) would have the greatest approximate percent change from baseline (4,151 ha, or -14.7% change from baseline).

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Mixedwood communities are not common to the RAA, as these community types are considered transition communities between hardwood and conifer communities, and were likely under represented in the FRI data. Of the 105 ha of mixedwood communities identified in the RAA, 19 ha will be removed as a result of forestry activity outside the PDA, and 55 ha removed as a result of vegetation clearing in the PDA. The removal of these communities result in a -70.5% reduction.

Wetland communities lost as a result of the Project include 810 ha (< 1% reduction from baseline) (Table 20-11 and Section 12.4.1 for assumptions used in the assessment). The loss of swamp ecosites would have the greatest approximate change in areal extent (1,822 ha, or -5.2% change from baseline). However, the loss of bog communities would have the greatest approximate percent change from baseline (23 ha, or -7.7% change from baseline), which is due to the limited bog ecosites identified across the RAA. Rationale for the limited bog ecosite mapped across the RAA is discussed in Section 12.2.2.5.

Of the total estimated loss of vegetation communities from the Project, plus future physical activities in the RAA, the majority of change is due to the forest harvesting; 11.6% change of vegetation communities from baseline is attributed to planned forest harvesting, leaving 1.6% change from baseline being attributed to the Project combined with the remaining future physical activities. It is assumed that this cumulative loss would occur from the start of Project construction to closure, which is a conservative approach in the assessment because the cumulative loss would not occur for the full extent of each future physical activity footprint for the full duration of these activities or permanently (see Section 20.7.1 for the assumption of permanent loss in this assessment).

**Table 20-11: Cumulative Change in Vegetation Communities**

Ecosite Code	Ecosite Name	Area (ha) in the RAA at Baseline	Area (ha) Changed			Area (ha) Remaining <sup>2</sup>	Percent (%) Change from Baseline <sup>3</sup>
			the Project	Reasonably Foreseeable Future Activities in the RAA	Total (Project Plus Future <sup>1</sup> )		
<b>UPLAND VEGETATION</b>							
<b>Conifer Forest</b>							
B012	Very Shallow, Dry to Fresh: Pine - Black Spruce Conifer	750	13	94	107	643	-14.2
B033	Dry, Sandy: Red Pine - White Pine Conifer	10	-	-	-	10	0.0
B034	Dry, Sandy: Jack Pine- Black Spruce Dominated	4,680	155	606	761	3,919	-16.2
B035	Dry, Sandy: Pine - Black Spruce Conifer	3,130	115	180	295	2,835	-9.4
B037	Dry, Sandy: Spruce – Fir Conifer	10	10	10	10*	0*	-100



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**Table 20-11: Cumulative Change in Vegetation Communities**

Ecosite Code	Ecosite Name	Area (ha) in the RAA at Baseline	Area (ha) Changed			Area (ha) Remaining <sup>2</sup>	Percent (%) Change from Baseline <sup>3</sup>
			the Project	Reasonably Foreseeable Future Activities in the RAA	Total (Project Plus Future <sup>1</sup> )		
B049	Dry to Fresh, Coarse Loamy: Jack Pine - Black Spruce Dominated	21,670	180	2399	2,579	19,091	-11.9
B050	Dry to Fresh, Coarse Loamy: Jack Pine - Black Spruce Conifer	1,740	120	319	439	1,301	-25.2
B051	Dry to Fresh, Coarse Loamy: Hemlock-Cedar Conifer	20	-	8	8	12	-40.0
B052	Dry to Fresh, Coarse Loamy: Spruce-Fir Conifer	19,590	5	2291	2,296	17,294	-11.7
B053	Dry to Fresh, Coarse: Conifer	20	-	-	-	20	0.0
B065	Moist, Coarse Loamy: Pine - Black Spruce Conifer	10,800	265	868	1,133	9,667	-10.5
B066	Moist, Coarse Loamy: Hemlock - Cedar Conifer	120	5	4	9	111	-7.5
B068	Moist, Course: Conifer	40	-	-	-	40	0.0
B082	Fresh, Clayey: Jack Pine - Black Spruce Dominated	2,808	-	276	276	2,532	-9.8
B098	Fresh, Silty to Fine Loamy: Jack Pine - Black Spruce	690	-	89	89	601	-12.9
B099	Fresh, Silty to Fine Loamy: Pine - Black Spruce	60	-	1	1	59	-1.6
B101	Fresh, Silty to Fine Loamy: Spruce - Fir conifer	110	-	40	40	70	-36.3
B102	Fresh, Silty to Fine Loamy: Conifer	20	-	-	-	20	0.0
B114	Moist, Fine Loamy: Pine - Black Spruce Conifer	590	1	60	61	529	-10.3
B115	Moist, Fine: Hemlock - Cedar Conifer	20	-	4	4	16	-20.0
B116	Moist, Fine: Spruce - Fir Conifer	100	-	-	-	100	0.0
B117	Moist, Fine: Conifer	10	-	4	4	6	-40.0
<b>Conifer Forest Subtotal</b>		<b>66,260</b>	<b>869</b>	<b>7,253</b>	<b>8,122</b>	<b>58,138</b>	<b>-12.3</b>

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**Table 20-11: Cumulative Change in Vegetation Communities**

Ecosite Code	Ecosite Name	Area (ha) in the RAA at Baseline	Area (ha) Changed			Area (ha) Remaining <sup>2</sup>	Percent (%) Change from Baseline <sup>3</sup>
			the Project	Reasonably Foreseeable Future Activities in the RAA	Total (Project Plus Future <sup>1</sup> )		
<b>Hardwood Forest</b>							
B040	Dry, Sandy: Aspen - Birch Hardwood	2,390	2	225	227	2,163	-9.5
B055	Dry to Fresh, Coarse Loamy: Aspen - Birch Hardwood	23,980	90	3,409	3,499	20,481	-14.6
B070	Moist, Coarse Loamy: Aspen - Birch Hardwood	1000	7	81	88	912	-8.8
B088	Fresh, Clayey: Aspen - Birch Hardwood	220	-	36	36	184	-16.4
B104	Fresh, Silty to Fine Loamy: Aspen - Birch Hardwood	670	110	189	299	371	-44.6
B119	Moist, Fine: Aspen - Birch Hardwood	50	-	2	2	48	-4.0
<b>Hardwood Forest Subtotal</b>		<b>28,310</b>	<b>209</b>	<b>3,942</b>	<b>4,151</b>	<b>24,159</b>	<b>-14.7</b>
<b>Mixedwood Forest</b>							
B059	Dry to Fresh, Coarse: Mixedwood	5	5	0	5	0	-100
B076	Moist, Course: Mixedwood	60	40	0	40	20	-66.7
B125	Moist, Fine: Mixedwood	40	10	19	29	11	-72.5
<b>Mixedwood Forest Subtotal</b>		<b>105</b>	<b>55</b>	<b>19</b>	<b>74</b>	<b>31</b>	<b>-70.5</b>
<b>Meadow</b>							
B030	Dry, Sandy: Meadow	30	-	1	1	29	-3.3
B110	Moist, Fine: Meadow	20	-	<1	<1	20	0.0
<b>Meadow Subtotal</b>		<b>50</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>49</b>	<b>-2.0</b>
<b>Upland Vegetation Subtotal</b>		<b>94,725</b>	<b>1,133</b>	<b>11,269</b>	<b>12,402</b>	<b>82,323</b>	<b>-13.1</b>
<b>WETLAND</b>							
<b>Bog</b>							
B126	Low Treed Bog	280	-	18	18	262	-6.4
B137	Sparse Treed Bog	10	5	-	5	5	-50.0
B138	Open Bog	10	-	-	-	10	0.0
<b>Bog Subtotal</b>		<b>300</b>	<b>5</b>	<b>18</b>	<b>23</b>	<b>277</b>	<b>-7.7</b>

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**Table 20-11: Cumulative Change in Vegetation Communities**

Ecosite Code	Ecosite Name	Area (ha) in the RAA at Baseline	Area (ha) Changed			Area (ha) Remaining <sup>2</sup>	Percent (%) Change from Baseline <sup>3</sup>
			the Project	Reasonably Foreseeable Future Activities in the RAA	Total (Project Plus Future <sup>1</sup> )		
<b>Fen</b>							
B136	Sparse Treed Fen	2,850	10	33	43	2,807	-1.5
B139	Poor Fen	150	-	-	-	150	0.0
B140	Open Moderately Rich Fen	1,340	-	15	15	1,325	-1.1
B141	Open Extremely Rich Fen	60	5	-	5	55	-8.3
B146	Open Shore Fen	1,170	6	7	13	1,157	-1.1
<b>Fen Subtotal</b>		<b>5,570</b>	<b>21</b>	<b>55</b>	<b>76</b>	<b>5,494</b>	<b>-1.4</b>
<b>Marsh</b>							
B142	Mineral Meadow Marsh	1,430	-	18	18	1,412	-1.3
B144	Organic Meadow Marsh	240	55	<1	55	185	-22.9
B148	Mineral Shallow Marsh	10	-	-	-	10	0.0
B149	Organic Shallow Marsh	20	10	1	11	9	-55
<b>Marsh Subtotal</b>		<b>1,700</b>	<b>65</b>	<b>20</b>	<b>74</b>	<b>1,626</b>	<b>-4.4</b>
<b>Swamp</b>							
B127	Poor Conifer Swamp	4,980	57	148	205	4,775	-4.1
B128	Intermediate Conifer Swamp	24,280	410	748	1158	23,122	-4.8
B129	Rich Conifer Swamp	5,110	82	193	275	4,835	-5.4
B130	Intolerant Hardwood Swamp	10	-	-	0	10	0.0
B134	Mineral Thicket Swamp	610	5	12	17	593	-2.8
B135	Organic Thicket Swamp	80	50	1	51	29	-63.8
B223	Mineral Intermediate Conifer Swamp: Peaty Phase	170	115	1	116	54	-68.2
B224	Mineral Rich Conifer Swamp: Peaty Phase	10	-	-	0	10	0.0
<b>Swamp Subtotal</b>		<b>35,250</b>	<b>719</b>	<b>1,103</b>	<b>1,822</b>	<b>33,428</b>	<b>-5.2</b>
<b>Wetland Subtotal</b>		<b>42,820</b>	<b>810</b>	<b>1,196</b>	<b>1,995</b>	<b>40,825</b>	<b>-4.7</b>

NOTES:

Total sums might not add up precisely due to rounding.

<sup>1</sup> Future refers to future physical activities.

<sup>2</sup> Area remaining refers to the area of land cover remaining if the PDA and future physical activities are implemented.

<sup>3</sup> % change from baseline is calculated by dividing total area loss by the baseline area per land cover class and multiplying by 100.

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The cumulative change (i.e., the effect of all future foreseeable activities within the RAA) in abundance of vegetation communities will be adverse in direction and low in magnitude because the total change of upland vegetation from baseline is -13.1%, and the total change of wetland vegetation from baseline is -4.7%. A large proportion of the potential total cumulative change in abundance of vegetation communities within the RAA is expected to revegetate in the years after disturbance because much of the area lost is due to forest harvesting activities. The effect occurs in the RAA, is long-term for the Project and some future projects and activities, and occurs as an irregular event throughout the RAA because the effect will occur more than once with the various projects and activities occurring at different times throughout the RAA. The effect is considered primarily reversible, where natural regrowth or rehabilitation occurs. Permanent loss of vegetation communities has occurred in some areas of the RAA and is expected to continue to occur elsewhere in the RAA. In those areas, the effect is predicted to be irreversible. The ecological context is considered typical in the RAA, as the vegetation communities (ecosites) are considered common to the landscape. Timing is considered to be not applicable as seasonal aspects are unlikely to affect the removal of vegetation. The Project contribution to the overall cumulative environmental effect is discussed in Section 20.7.8.1.

**20.7.5 Cumulative Effects Assessment for Change in Function, Connectivity, and Quality of Vegetation Communities**

**20.7.5.1 Cumulative Effect Mechanisms for Change in Function, Connectivity, and Quality of Vegetation Communities**

Other future physical activities in addition to the Project are predicted to affect function, connectivity, and quality of vegetation communities through indirect interactions, such as changes in groundwater and surface water levels, landscape fragmentation and edge effects (as defined in Section 12.4.4), increase in dust emissions and the introduction of invasive species.

Wetland drawdown is anticipated to occur when the water table is lowered during open pit dewatering, which will change water availability to wetlands that are currently supported by groundwater. Changes in groundwater levels in such wetland communities can result in community changes from one type of wetland to another or from wetland to upland communities over time. There are no reasonably foreseeable future projects anticipated in the RAA during the duration of the Project that would result in groundwater drawdown in the RAA. Therefore, there are no anticipated cumulative effects on groundwater drawdown as it affects the function(s) of wetlands in the RAA.

Given the Projects effects on catchment areas and changes in surface water (as discussed in Section 12.4.3) in the LAA, there are no anticipated changes in surface water extending outside the LAA into the RAA; however, it is unknown what activities may occur in the subwatersheds outside of the LAA as a result of other projects. Other projects in the RAA are not anticipated to interact with changes to surface water flows in the PDA. As such, there are no anticipated cumulative effects on surface water as it affects the function(s) of wetlands in the RAA.

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Wetlands that rely on surface water will be changed, where some wetland communities are predicted to experience a decrease in surface water (drier). Mitigation will be applied to areas surrounding the Project (e.g., creek diversion channel), to reduce effects on vegetation communities. As such, no major shifts in surface water flow are predicted in the RAA (Section 12.4.3).

Treed communities (both upland forests and treed wetlands) have historically been affected by timber harvesting activities (Sections 12.2.2.1) across the RAA, resulting in vegetation community fragmentation, creating areas susceptible to increased dust emissions and invasive species. With the implementation of the Project mitigation, residual Project-specific edge effects on vegetation communities from fragmentation, invasive species spread or establishment or from dust are considered to be of low magnitude and limited to the LAA (Table 12-12).

Present and future activities in the RAA will likely increase fragmentation, edge effects, dust deposition, and possibly increase the introduction of invasive species; forestry activities are anticipated to have the greatest effect on fragmentation, as the activity will occur over the greatest amount of area in the RAA (13,406 ha).

### **20.7.5.2 Mitigation for Cumulative Effects on Change in Function, Connectivity, and Quality of Vegetation Communities**

Project mitigation measures outlined in Section 12.4.3.2 are expected to reduce and mitigate the Project's contribution to the cumulative changes in function, connectivity, and quality of vegetation communities. No additional measures are proposed to mitigate for cumulative effects on change in function, connectivity, and quality of vegetation communities.

### **20.7.5.3 Residual Cumulative Effects for Change in Function, Connectivity, and Quality of Vegetation Communities**

Cumulative changes (i.e., the effect of all future foreseeable activities within the RAA) in fragmentation, edge effects, dust deposition and the introduction of invasive species would be considered to be low in magnitude, the geographic extent would be the RAA, long-term and mostly reversible, because the majority of these effects will be the result of forestry activities, and most areas will revegetate over time. The ecological context of cumulative effects is considered typical, since the community types predicted to be affected are generally common and widespread in the RAA. The Project contribution to the overall cumulative environmental effect is discussed in Section 20.7.8.1.

## **20.7.6 Cumulative Effects Assessment for Change in Abundance of Plant Species of Interest**

### **20.7.6.1 Cumulative Effect Mechanisms for Change in Abundance of Plant Species of Interest**

There are no predicted residual effects of the Project to plant SAR or SOCC (Section 12.4.4.1); therefore, cumulative effects for plant SAR or SOCC are not discussed further. The cumulative effects assessment deals only with plant species of interest to Aboriginal communities.

Potential suitable habitat for 32 plants of interest to Aboriginal communities identified through Aboriginal consultation (Section 12.2.2.3 and Table 12-4) occurs in the PDA, and will be removed as part of the Project.

Change in plant species of interest to Aboriginal communities is assumed to have occurred in the RAA from past and present projects or activities because the Aboriginal species of interest are relatively common and widespread in the RAA and suitable habitats have been extensively affected by past activities.

Vegetation has been removed and replaced with infrastructure in several of the past and present projects listed above, resulting in long-term or permanent loss of plant species of interest to Aboriginal communities, while other activities (e.g., forestry, pipeline or transmission cutlines) have resulted in temporary losses.

The permanent removal of additional areas containing some of these species of interest to Aboriginal communities is expected to occur as a result of future physical activities in the RAA involving land clearing. Future activities involving vegetation removal (TransCanada Energy East Project, Geraldton Subdivision, Union Gas Pipeline and Bankfield West Mineral Exploration) affect habitat for plant species of interest to Aboriginal communities. Forestry activities will temporarily affect habitat suitability for these plants and may increase or decrease the availability of these plants in the RAA. These effects from future activities will act cumulatively with the effect from the removal of vegetation communities associated with the Project.

### **20.7.6.2 Mitigation for Cumulative Effects on Change in Abundance of Plant Species of Interest**

Project mitigation measures outlined in Section 12.4.4.2 for residual effects are predicted to reduce or mitigate the Project's contribution to the cumulative change in abundance of plant species of interest. This will include incorporating plant species of interest to Aboriginal communities into rehabilitation plans where technically feasible.

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**20.7.6.3 Residual Cumulative Effects for Change in Abundance of Plant Species of Interest**

Occurrence data for species of interest to Aboriginal communities are not publicly available. A list of species of interest to Aboriginal communities was received through Aboriginal consultation (Chapter 3.0; community and stakeholder consultation) and compared to the list of plant species recorded during field surveys. Many of the plant species of interest to Aboriginal communities were encountered during field work, but some were not encountered. Given the presence of suitable habitat, it is assumed that most of the species, even those not found during fieldwork, may occur in the RAA. The vegetation communities that support these plant species are commonly found within the RAA.

These plants are considered relatively common in the RAA (Section 12.4.4.3) and distributed among a wide range of habitat types. Therefore, the extent of vegetated area that will be affected by the Project as well as future physical activities is used as an estimate of the extent of disturbance or removal of potential habitat for these species.

Approximately 137,545 ha of natural vegetation communities (i.e., upland and wetland ecosites) currently exist in the RAA (Table 20-12). With the Project, existing development, and future physical activities, approximately 15,923 ha of vegetation is anticipated to be removed or altered, which includes: forestry management (13,406 ha), existing development (210 ha) and proposed development (107 ha) and the Project (2,200 ha). These activities are anticipated to reduce the total area of natural vegetation communities that provide suitable habitat for species of interest to Aboriginal communities to approximately 121,622 ha in the RAA (a 11.6% change in potential habitat from baseline). The Project contribution to this effect is 2,200 ha (1.6 %). Changes in vegetation community types due to forestry activities will result in temporary loss of vegetation communities as well as some plants of interest to Aboriginal communities. These timber harvesting areas will also increase the amount of growth for early successional species, such as poplar. As such, the level of disturbance is considered to affect vegetation communities to a lesser extent when compared to areas that will experience permanent loss as a result of other project activities. The cumulative removal of plant species of interest to Aboriginal communities is not anticipated to affect the viability of populations of these species in the RAA.

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**Table 20-12: Cumulative Loss of Habitat for Plant Species of Interest**

Land Cover	Area (ha) in the RAA at Baseline	Potential Habitat (ha) Lost or Altered			Area (ha) Remaining <sup>2</sup>	Percent (%) Change from Baseline <sup>3</sup>
		Project	Reasonably Foreseeable Future Activities in the RAA, Excluding the Project	Total (the Project Plus Future <sup>1</sup> )		
Total Vegetation	137,545	2,200	13,723	15,923	121,622	-11.6

NOTES:

Total sums might not add up precisely due to rounding.

<sup>1</sup> Future refers to future physical activities

<sup>2</sup> Area remaining refers to the area of vegetation remaining intact if the Project and future physical activities are implemented.

<sup>3</sup> % change from baseline is calculated by dividing total area loss by the baseline area and multiplying by 100.

The magnitude of the residual cumulative effect (i.e., the effect of all future foreseeable activities within the RAA) on plant species of interest to Aboriginal communities is predicted to be low due to the relatively common occurrence of these species in the RAA. The cumulative change in habitat potential is -11.6% from the existing baseline conditions to the cumulative case effects, which considers the Project (-1.6%) and the future physical activities. The majority of this cumulative change is attributed to planned future forest harvesting which is predicted to affect 13,406 ha, or a -10% change from baseline conditions of the vegetated area. The removal of these plants and the alteration of habitat will occur in multiple irregular events and the duration of effects be long-term. Given their wide distribution, these species are expected to re-establish through natural ingress and rehabilitation activities in areas of temporary losses. Ecological context is typical because the community types that predicted to be affected are generally common and widespread in the RAA. Timing is considered to be not applicable as seasonal aspects are unlikely to affect the removal of plant species of interest. The Project contribution to the overall cumulative environmental effect is discussed in Section 20.7.8.1.

**20.7.7 Summary of Cumulative Effects on Vegetation Communities**

A summary of the characterization of the overall cumulative environmental effects (i.e., the effect of all future foreseeable activities within the RAA) on vegetation communities is presented in Table 20-17. The Project contribution to the overall cumulative environmental effect is discussed in Section 20.7.8.1.



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**Table 20-13: Summary of Cumulative Effects on Vegetation Communities**

Case	Residual Cumulative Effects Characterization							
	Direction	Magnitude	Geographic Extent	Timing	Frequency	Duration	Reversibility <sup>1</sup>	Ecological and Socio-economic Context
<b>Cumulative Change in Abundance of Vegetation Communities</b>								
Cumulative environmental effect with the Project	Adverse	Low	RAA	N/A	Multiple irregular	Long-term	Irreversible	Typical
<b>Cumulative Change in Function, Connectivity, and Quality of Vegetation Communities</b>								
Cumulative environmental effect with the Project	Adverse	Low	RAA	Applicable	Multiple irregular	Long-term	Irreversible	Typical
<b>Cumulative Change in Abundance of Plant Species of Interest</b>								
Cumulative environmental effect with the Project	Adverse	Low	RAA	N/A	Multiple irregular	Long-term	Reversible	Typical

NOTES:

<sup>1</sup> For change in abundance of vegetation, the effect can be reversible or irreversible dependent upon the specific location of the vegetation removal and the ability for natural revegetation. For change in function, connectivity and quality of vegetation communities the effect can be reversible or irreversible dependent upon the specifics of the pathway of the effect.

See Table 20-10 for detailed definitions.

### 20.7.8 Significance of Residual Cumulative Effects

The Project plus future physical activities are cumulatively quantified by ecosite types to provide an estimated cumulative case for each ecosite.

There is a low level of disturbance at baseline within the mapped RAA (1.0%; Table 20-9) which consists of existing roads, urban development, mining, and forest harvesting. The cumulative losses of plant species of interest to Aboriginal communities and vegetation communities, represent less than 15% of the total resource base for each measurable parameter within the RAA, the majority of which as attributable to forestry. Specifically, the cumulative change from existing disturbance to cumulative case disturbance (i.e., including the Project and future physical activities) is:

- -11.6% change for habitat for vegetation species of interest (of which 10.0% is from forest harvesting following which vegetation will regrow)
- -13.1% change for upland, and -4.7% change in wetland vegetation communities, across the RAA

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- no anticipated effects on wetland communities from groundwater drawdown or surface water flow as a result of Project activities. Fragmentation, edge effects, dust deposition and introduction of invasive species may occur as a result of present and future projects in the RAA.

No predicted cumulative effect in abundance of SAR or SOCC will occur as a result of the Project because none have been identified in the PDA. A change in abundance of species of interest to Aboriginal communities is predicted. The maximum area of cumulative changes in potential habitat for species of interest to Aboriginal communities was quantified. Potential habitats for the plant species of interest to Aboriginal communities are common and widespread in the RAA (Section 12.2.2.3) and the viability and distribution of populations of these species are not expected to be adversely affected in the RAA.

The adverse residual cumulative effects on vegetated ecosites supporting vegetation species of interest, vegetation communities, and function, connectivity and quality of vegetation communities are not predicted to affect the long-term sustainability of vegetation communities identified in this assessment in the RAA and are therefore predicted to be not significant.

### **20.7.8.1 Project Contribution to Cumulative Effects**

The Project's contribution to cumulative effects is predicted to be a relatively small (1.6%) contribution to the cumulative loss in the RAA. A conservative case was considered in the assessment, and the actual effects may be less than what was considered in the assessment.

### **20.7.8.2 Prediction Confidence for Cumulative Effects**

Although there are limitations in the available information of the effects from other present, past and future physical activities, a conservative approach was taken to estimate the cumulative effects (e.g., permanent loss of PDA and footprints of future physical activities, including planned forestry activities). The predicted effects are similar to those which have occurred during other mining operations and forestry activities, thereby increasing the confidence in the assessment. The level of confidence is high in the conclusions of the cumulative effects assessment for the vegetation communities VC.

## **20.8 WILDLIFE AND WILDLIFE HABITAT**

As detailed in Chapter 13.0 (wildlife and wildlife habitat VC), while found not significant, the Project is anticipated to have adverse residual environmental effects on wildlife and wildlife habitat. As such there is potential for the residual environmental effects of the Project to act cumulatively with residual environmental effects of other future physical activities.

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The Project-specific residual environmental effects on wildlife and wildlife habitat described in Section 13.4 that are likely to interact cumulatively with the residual environmental effects of other physical activities (past, existing, and certain and reasonably foreseeable) are identified in this section and the resulting cumulative environmental effects are assessed. This is followed by an analysis of the Project contribution to the overall cumulative environmental effects on wildlife and wildlife habitat.

**20.8.1 Regional Assessment Area**

As noted in Section 13.1.5.1, the RAA applied for wildlife and wildlife habitat is used to provide regional context for the significance of residual effects and is also the area within which potential for cumulative effects of the Project in combination with other past, present or reasonably foreseeable projects or activities are considered. The RAA also reflects the large home ranges of landscape-level species, such as caribou, moose and black bear, which may potentially interact with the Project. The RAA applied for wildlife and wildlife habitat and vegetation communities is the same, emphasizing the direct linkage between these VCs. As described in Section 12.1.5.1, the RAA was selected using natural ecological boundaries, specifically the Burrows River, Kenogamisis River and Kenogamisis Lake watersheds. The range of habitat types found within the LAA is represented within the RAA. The total area of the RAA is approximately 168,300 ha and includes the LAA.

**20.8.2 Identification of Project Effects Likely to Interact Cumulatively**

The reasonably foreseeable future physical activities that are within the RAA for wildlife are listed in Table 20-14. The Project is predicted to have an adverse residual environmental effect on change in habitat, change in mortality risk, and change in movement (Section 13.4.5). Table 20-14 identifies where these Project-specific residual environmental effects are likely to interact cumulatively with the residual environmental effects from other physical activities within the RAA. On the basis of the information presented in Table 20-14, a cumulative environmental effects assessment is required for the three adverse residual environmental effects on wildlife and wildlife habitat.

**Table 20-14: Potential Cumulative Environmental Effects on Wildlife and Wildlife Habitat**

Other Projects and Physical Activities with Potential for Cumulative Environmental Effects	Potential Cumulative Environmental Effects		
	Change in Habitat	Change in Mortality Risk	Change in Movement
<b>Future Physical Activities (certain and reasonably foreseeable)</b>			
Goliath Gold Mine	-	-	-
Magino Mine	-	-	-

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**Table 20-14: Potential Cumulative Environmental Effects on Wildlife and Wildlife Habitat**

Other Projects and Physical Activities with Potential for Cumulative Environmental Effects	Potential Cumulative Environmental Effects		
	Change in Habitat	Change in Mortality Risk	Change in Movement
Hammond Reef Gold Mine	-	-	-
Josephine Cone Mine	-	-	-
Bankfield West Mineral Exploration	✓	✓	✓
Pickle Lake Mining Exploration	-	-	-
Junior Lake Mining Exploration	-	-	-
Ishkoday Mining Exploration	-	-	-
McCaul Twp Mining Exploration	-	-	-
Thunder Bay District Mining Exploration	-	-	-
Hemlo East Project Mining Exploration	-	-	-
McTavish Twp Aggregate	-	-	-
Proposed Geraldton Subdivision	✓	✓	✓
Municipality of Greenstone Landfill	-	-	-
Little Jackfish Hydroelectric Development	-	-	-
Little Jackfish Transmission Line	-	-	-
TransCanada Energy East Project	✓	✓	✓
Union Gas Pipeline	✓	✓	✓
East-West Tie Transmission Project	-	-	-
Black Sturgeon River Camp 43 Dam Project	-	-	-
MNRF – FMU815 Lake Nipigon Forest	✓	✓	✓
MNRF – FMU350 Kenogami Forest	✓	✓	✓

NOTES:

- ✓ those "other projects and physical activities" whose residual effects are likely to interact cumulatively with Project-specific residual environmental effects.
- interactions between the adverse residual effects of other projects and the Project-specific adverse residual effects are not expected

Those future activities listed but not checked off in Table 20-14 represent activities that are unlikely to interact cumulatively with the Project (i.e., are either one or a combination of the following: 1) substantially geographically removed from the Project; 2) by definition their operations do not represent a potential cumulative effect pathway to the VC; 3) would be considered to have a potential spatial or temporal overlap however due to the known success of current best management and design mitigation for such projects residual effects are unlikely).

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The cumulative environmental effects assessment is focused on future conditions which reflect the addition of the Project's residual environmental effects and those of other certain and reasonably foreseeable future physical activities to the existing conditions for wildlife and wildlife habitat. Existing conditions reflect the cumulative environmental effects from past and existing physical activities. The following is a brief discussion of the existing conditions within the RAA and whether or not these conditions have already affected the sustainability of wildlife and wildlife habitat.

Past and existing human development within the RAA has resulted in habitat loss and alteration. This development includes disturbed areas associated with human settlement and industrial development (2,000 ha [1% of the mapped area<sup>1</sup>], Table 20-9, Section 20.6) and regenerating harvested areas (63,797 ha<sup>2</sup>, 41% of the mapped area). These latter areas retain some value as wildlife habitat, particularly for early seral and shrub-associated species. While habitat loss and alteration within the RAA has adversely affected wildlife, the existing condition is at a level unlikely to have affected the sustainability of wildlife species within the RAA. The RAA is, however, part of a broader region that has experienced declines in caribou, wolverine, and moose numbers, as discussed later in this section.

Existing sources of mortality risk for wildlife within the RAA are vehicle traffic, urban development, and backcountry access development (e.g., logging roads). There have also been past but short-term activities, such as forest harvesting, that have intermittently affected wildlife mortality risk over time within the RAA. Regarding bats, white-nose syndrome was first confirmed in Ontario in 2010 and continues to spread throughout the province (MNR 2015). There are confirmed cases in the MNR district where the RAA is located (i.e., MNR's Nipigon District; see Figure 1 in MNR 2015). Considering the sources collectively, while there is an elevated level of mortality risk within the RAA, particularly in the north half where Highway 11 and Geraldton are located, the current condition is unlikely to have affected the sustainability of wildlife species within the RAA. Bats are the one exception, however, as the effect of white-nose syndrome on the sustainability of local and regional populations in Ontario is unknown at present.

Past and existing human development within the RAA has resulted in habitat fragmentation and an associated disruption and alteration of wildlife movement patterns (Section 13.2.2.4). In the north half of the RAA, urban and industrial development and Highway 11 are the major drivers of change in wildlife movement. Elsewhere in the RAA, forest harvesting and associated road development have also contributed to change in wildlife movement. However, most wildlife species are highly mobile and are able to adjust their movement patterns in response to changes in habitat configuration. On this basis, while disruption of movement within the RAA has affected wildlife, the current condition has not affected the sustainability of wildlife species within the RAA.

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<sup>1</sup> A portion of the RAA, along the southwestern boundary, is unmapped (see Section 13.4.2.1)

<sup>2</sup> This is the area logged from 1984 onwards

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The decline in caribou and wolverine populations in Ontario is well documented (e.g., Environment Canada 2012; Ontario Wolverine Recovery Team 2013). These declines have been attributed to multiple inter-related factors including human settlement and land clearing, logging, altered predator-prey dynamics, harvest (wolverine), and landscape fragmentation (Environment Canada 2012; Ontario Wolverine Recovery Team 2013). In this context, and considering the existing conditions described above for the RAA, the occurrence of these species within the RAA is unlikely (caribou)<sup>3</sup> to very unlikely (wolverine) at present (see Section 13.2.2.1). This condition is not expected to improve for wolverine as the RAA is not within a recognized recovery zone (Ontario Wolverine Recovery Team 2013). However, in the case of caribou, this condition may improve or at least be maintained as the RAA overlaps an area of discontinuous caribou distribution (Lake Superior Uplands Linkage zone) and two caribou ranges (Nipigon and Pagwachuan), all of which are addressed under the provincial Caribou Conservation Plan (MNR 2009b).

Moose populations are declining in parts of Ontario, including some wildlife management units within the Nipigon District where the Project is located (MNRF 2014a). Concerns about moose were also raised during Aboriginal and government agency consultation (see Section 13.1.2). Moose population demographics are affected by a number of factors including hunter harvest, predation, parasites, and habitat condition (MNRF 2014a; MNRF 2016). For the two wildlife management units that overlap the RAA, calf recruitment has been below the level for population maintenance since 2003 in 21A (MNRF 2014b), and above this level since surveys began (1982) in the other, 19 (MNRF 2014c).

**20.8.3 Residual Cumulative Environmental Effects Description Criteria**

The residual cumulative environmental effects are characterised using the same terms and definitions as those of the residual environmental effects. Table 20-15 provides those terms and definitions as previously detailed in Section 13.1.6.

**Table 20-15: Characterization of Residual Environmental Effects on Wildlife and Wildlife Habitat**

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Direction	The relative change compared to baseline conditions.	<p><b>Positive</b> — an increase in area (ha) of wildlife habitat, a decrease in wildlife mortality risk, an increase in wildlife movement.</p> <p><b>Adverse</b> — a decrease in area (ha) of wildlife habitat, an increase in wildlife mortality risk, a decrease in wildlife movement.</p>

<sup>3</sup> Telemetry data provided by MNRF for the period 2011 to 2013 show no caribou locations within the RAA

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**Table 20-15: Characterization of Residual Environmental Effects on Wildlife and Wildlife Habitat**

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Magnitude	The amount of change in measurable parameters or the VC relative to baseline conditions.	<p><b>Low</b> — a measurable change in area (ha) of wildlife habitat or mortality risk that is within the range of normal variability of baseline conditions and will not affect the long-term persistence or viability of wildlife within the RAA; or creation of a semi-permeable barrier<sup>1</sup> that will not affect wildlife movement.</p> <p><b>Moderate</b> — a measurable change in area (ha) of wildlife habitat or mortality risk that is unlikely to affect the long-term persistence or viability of wildlife within the RAA; or creation of a semi-permeable barrier that is unlikely to affect wildlife movement.</p> <p><b>High</b> — a measurable change in area (ha) of wildlife habitat or mortality risk that might affect the long-term persistence or viability of wildlife within the RAA; or creation of an impermeable barrier that will affect wildlife movement.</p>
Geographic Extent	The geographic area in which a residual environmental effect occurs.	<p><b>PDA</b> — the residual environmental effect is restricted to the PDA.</p> <p><b>LAA</b> — the residual environmental effect extends into the LAA.</p> <p><b>RAA</b> — the residual environmental effect extends into the RAA.</p>
Timing	Considers when the residual environmental effect is expected to occur. Timing considerations are noted in the evaluation of the residual environmental effect, where applicable or relevant.	<p><b>Not Applicable (N/A)</b> — seasonal aspects are unlikely to affect wildlife habitat, mortality risk, or movement.</p> <p><b>Applicable</b> — seasonal aspects may affect wildlife habitat, mortality risk, or movement.</p>



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**Table 20-15: Characterization of Residual Environmental Effects on Wildlife and Wildlife Habitat**

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Frequency	Identifies how often the residual environmental effect occurs within a given time.	<p><b>Single event</b> — the residual environmental effect occurs once.</p> <p><b>Multiple irregular event (no set schedule)</b> — the residual environmental effect occurs sporadically, at an irregular interval, and is not predictable.</p> <p><b>Multiple regular event</b> — the residual environmental effect occurs regularly, and may be at predictable intervals or specific times.</p> <p><b>Continuous</b> — the residual environmental effect occurs continuously.</p>
Duration	The length of time required until the residual environmental effect can no longer be measured or otherwise perceived.	<p><b>Short-term</b> — the residual environmental effect is limited to construction or active closure.</p> <p><b>Medium-term</b> — the residual effect extends throughout construction, operation and active closure.</p> <p><b>Long-term</b> — the residual environmental effect extends beyond active closure.</p>
Reversibility	Pertains to whether a measurable parameter or the VC can return to its baseline condition after the Project activity ceases.	<p><b>Reversible</b> — the residual environmental effect is likely to be reversed after activity completion and rehabilitation.</p> <p><b>Irreversible</b> — the residual environmental effect is permanent and is unlikely to return to its existing condition after activity completion and rehabilitation.</p>
Ecological and Socio-economic Context	Considers uncommon characteristics of the area, a community and/or ecosystems that may be affected by the Project and/or whether the VC or measurable parameter is important to the functioning of an ecosystem or community of people.	<p><b>Typical</b> — the VC or measurable parameter is considered common and/or is considered not important to the functioning of an ecosystem.</p> <p><b>Atypical</b> — the VC or measurable parameter is considered uncommon and/or is considered important to the functioning of an ecosystem.</p>

NOTE:

<sup>1</sup> a semi-permeable barrier in relation to wildlife movement is a barrier which may prevent the movement of certain species or individuals but allow the passage of others. For example, small mammals may be reluctant to cross an opening with minimal overhead cover (e.g., a pipeline ROW), while birds and large mammals may readily cross such a feature.



## **20.8.4 Cumulative Environmental Effects Assessment for Change in Habitat**

This section describes the cumulative environmental effect mechanisms, mitigation measures, and residual cumulative environmental effects characterization for change in habitat. Ecosite mapping was used to quantitatively assess cumulative environmental effects on the measurable parameters for wildlife habitat (see Section 13.1.4, Table 13-1) in a similar manner as residual direct environmental effects were determined for these parameters (see Section 13.4.1.2). The development of the ecosite mapping for the RAA is described in Section 12.2.1, and the methods for identifying habitat within the RAA are described in Section 13.2.1.3 (Table 13-4).

While the focus of the cumulative environmental effects assessment for change in habitat is the measurable parameters and the species represented by those parameters (e.g., Canada warbler, moose), the cumulative environmental effects of the Project on habitat for other wildlife species and species groups (e.g., snowshoe hare, mink) can be inferred from the predictions for the species assessed based on the associations identified in Section 13.4.1.1 (Table 13-8) and, where relevant, the cumulative environmental effects assessment for other VCs (e.g., vegetation communities [Section 20.7]).

### **20.8.4.1 Cumulative Environmental Effect Mechanisms for Change in Habitat**

The primary cumulative environmental effect mechanism for change in habitat within the RAA is vegetation removal. The Project-specific residual environmental effect on habitat will interact cumulatively with five future physical activities (Table 20-14) through this mechanism, as follows:

- Bankfield West Mineral Exploration – drilling and other exploration activities within a 17 ha area located 10 km west of the PDA.
- Forestry activity<sup>4</sup> – planned cutblocks (13,427 ha)<sup>5</sup> and logging roads throughout the RAA.
- Geraldton Subdivision – 24 ha development near Kenogamisis Lake, just north of the PDA.
- TransCanada Energy East Project – 210 ha of ROW through north half of the RAA, approximately 10 km north of the PDA.
- Union Gas Pipeline – 67 ha of ROW originating approximately 3 km north of Geraldton and running to the PDA.

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<sup>4</sup> The area of future forest harvest within the RAA was determined from operations maps provided in the Lake Nipigon Forest 2011–2021 Forest Management Plan (Lake Nipigon Forest Management Inc. 2011) and the Kenogami Forest 2011–2021 Forest Management Plan (Terrace Bay Pulp 2011). The maps applicable to the RAA were georeferenced in ArcGIS and all planned regular harvest and contingency harvest areas were manually digitized.

<sup>5</sup> This is a potential overestimate of planned future harvest as some of the planned cutblocks may have been logged as early as 2011.

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### **20.8.4.2 Mitigation for Cumulative Environmental Effects on Change in Habitat**

Mitigation measures and regional initiatives applicable to limiting cumulative environmental effects on habitat within the RAA include, but are not limited to, the following:

- The Project's Environmental Management and Monitoring Plans (EMMPs; Appendix M).
- MNR's and industry's active management of forest harvest in the two FMUs that overlap the RAA (FMU 815 [Lake Nipigon Forest] and FMU 350 [Kenogami Forest]).
- The Ontario Caribou Conservation Plan, which has as one of its goals to develop a management strategy for the Lake Superior Uplands Linkage zone to enhance connectivity between the northern continuous caribou ranges and the Coast Range (MNR 2009b).
- Direction provided by the Provincial Policy Statement, in conjunction with the *Natural Heritage Reference Manual* (MNR 2010a), for the protection of natural heritage features, which include significant wildlife habitats such as seasonal concentration areas and habitats of SOCC.
- Designation of provincially significant habitat by the Province; including but not limited to, within the RAA, waterfowl nesting areas, waterfowl stopover and staging areas, wetlands, moose aquatic feeding areas, and moose wintering areas.
- MNR's *Cervid Ecological Framework* (MNR 2009c) and *Moose Management Policy* (MNR 2009d) which provide specific direction on the province-wide management of moose.
- Identification and protection of critical habitat as part of existing and future federal SAR recovery strategies.
- Protection of SAR and their habitats under the *Endangered Species Act* and implementation of existing and future provincial recovery strategies.

### **20.8.4.3 Residual Cumulative Environmental Effects for Change in Habitat**

The residual cumulative environmental effects for change in habitat are characterized for the species assessed in the following sections. There is predicted to be no Project-related residual environmental effect on barn swallow breeding habitat (see Section 13.5); therefore, this species is not addressed in this cumulative environmental effects assessment. In addition, no critical habitat as defined by the *Species at Risk Act* is affected by the Project (see Section 13.5); therefore, critical habitat is also not addressed in this cumulative environmental effects assessment.

The Project results in the direct loss of potential anthropogenic bat maternity roosting habitat (i.e., buildings); however, as discussed in Section 13.2.2.2, the amount of anthropogenic bat roosting habitat within the RAA is difficult to determine so a cumulative environmental effects assessment for this measurable parameter was not undertaken. As long as there are buildings within the RAA there will be some potential for bats to roost in them and it is most likely that future activities will contribute more buildings over time rather than fewer.

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In the assessment of Project-related residual environmental effects, caribou habitat within the LAA was identified as Category 3 habitat (see Section 13.2.2) and the change in the area of Category 3 habitat was the measurable parameter (see Section 13.4.1, Table 13-8). The distribution of Category 1, 2 and 3 habitats within the RAA is unknown, so for the cumulative environmental effects assessment the measurable parameter was "potential woodland caribou habitat" which was identified as the total undisturbed area within the RAA, undifferentiated as to category type, but assumed to have some value to caribou for functions including foraging, resting, and travel.

**Migratory Bird Habitat**

The Project plus five future physical activities (Bankfield West Mineral Exploration, forestry activity, Geraldton Subdivision, TransCanada Energy East Project, Union Gas Pipeline) will result in the direct loss of 11% (14,223 ha) of the Canada warbler breeding habitat within the RAA (Table 20-16). The Project's contribution to this direct loss is 13% (1,853) (Table 20-16). The majority of this direct loss (86%) is attributable to forest harvesting (Table 20-16). It is predicted that suitable breeding habitat will reestablish over time as post-logging succession and mine rehabilitation progresses. While Canada warbler may use younger seral stages, it is more likely to use older stands (Environment Canada 2015a) so this reestablishment will take decades. Some of the cumulative loss of Canada warbler breeding habitat within the RAA will be irreversible (i.e., Geraldton Subdivision [23 ha] and portions of the PDA<sup>6</sup> [994 ha, Section 13.4.2.3, Table 13-11]).

**Table 20-16: Predicted Cumulative Change in Wildlife Habitat within the Regional Assessment Area**

Measurable Parameter	Existing Conditions	Future Conditions					Other Contributions to Loss (%)
	Total Area (ha)	Total Area (ha)	Area (ha) Loss Relative to Existing Conditions	Percentage (%) Loss Relative to Existing Conditions	Project Contribution to Loss <sup>1</sup>		
					ha	%	
<b>Migratory Bird Habitat</b>							
Canada warbler breeding habitat	129,941	115,718	14,223	11	1,853	13	Forestry: 86 Miscellaneous: 1
Eastern wood-pewee breeding habitat	29,135	24,778	4,357	15	328	8	Forestry: 92 Miscellaneous: 1

<sup>6</sup> The following areas of rehabilitation within the PDA are considered to have limited value to wildlife upon closure: WRSAs, disturbed areas, exposed rock (associated with the TMF dam), open water (e.g., the open pit, TMF pond), and permanent infrastructure (e.g., Hydro One substation, MTO patrol yard, Highway 11 corridor) (see Section 13.4.2.4).

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**Table 20-16: Predicted Cumulative Change in Wildlife Habitat within the Regional Assessment Area**

Measurable Parameter	Existing Conditions	Future Conditions					Other Contributions to Loss (%)
	Total Area (ha)	Total Area (ha)	Area (ha) Loss Relative to Existing Conditions	Percentage (%) Loss Relative to Existing Conditions	Project Contribution to Loss <sup>1</sup>		
					ha	%	
Common nighthawk breeding habitat	1,867	1,255	612	33	321	52	Pipelines: 32 Miscellaneous: 16
Non-treed wetland bird habitat	7,571	7,391	180	2	87	48	Forestry: 46 Miscellaneous: 6
Waterfowl nesting habitat	10,104	9,648	456	5	208	46	Forestry: 51 Miscellaneous: 3
<b>Additional Bird Habitat</b>							
Bald eagle nesting habitat	129,941	115,717	14,224	11	1,854	13	Forestry: 86 Miscellaneous: 1
American white pelican stopover and foraging habitat	4,250	4,247	3	<1	2	69	Pipelines: 31 Miscellaneous: 0
<b>Mammal Habitat</b>							
Moose foraging habitat	89,044	81,594	7,450	8	1,184	16	Forestry: 84 Miscellaneous: 1
Moose late winter cover habitat	57,670	50,731	6,938	12	576	8	Forestry: 91 Miscellaneous: <1
Potential woodland caribou habitat	85,443 <sup>2</sup>	69,750	15,693	18	1,949 <sup>3</sup>	12	Forestry: 86 Miscellaneous: 2
Northern myotis and little brown myotis maternity roosting habitat – natural	28,423	24,139	4,284	15	268	6	Forestry: 93 Miscellaneous: 1

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**Table 20-16: Predicted Cumulative Change in Wildlife Habitat within the Regional Assessment Area**

Measurable Parameter	Existing Conditions	Future Conditions					Other Contributions to Loss (%)
	Total Area (ha)	Total Area (ha)	Area (ha) Loss Relative to Existing Conditions	Percentage (%) Loss Relative to Existing Conditions	Project Contribution to Loss <sup>1</sup>		
					ha	%	
<b>Amphibian and Reptile Habitat</b>							
Western painted turtle overwintering habitat	22,280	22,111	169	1	79	47	Forestry: 46 Miscellaneous: 7
Amphibian breeding habitat	46,660	43,009	3,651	8	1,379	38	Forestry: 61 Miscellaneous: 1
<b>Insect Habitat</b>							
Taiga alpine butterfly habitat	35,116	32,746	2,371	7	803	34	Forestry: 66 Miscellaneous: 1

NOTES:

- <sup>1</sup> Peak residual environmental effect from Section 13.4.2.4 (i.e., the maximum direct loss of habitat during construction and operation [see Table 13-9]) with one exception (caribou – see Note c).
- <sup>2</sup> Total undisturbed area within RAA calculated by subtracting the areas of open water, disturbed ecosites, and regenerating harvested areas (i.e., area logged from 1984 onwards) from the total area of the RAA.
- <sup>3</sup> Total area of PDA minus existing disturbance.

The Project plus five future physical activities (Bankfield West Mineral Exploration, forestry activity, Geraldton Subdivision, TransCanada Energy East Project, Union Gas Pipeline) will result in the direct loss of 15% (4,357 ha) of the eastern wood-pewee breeding habitat within the RAA (Table 20-16). The Project's contribution to this direct loss is 8% (328 ha) (Table 20-16). The majority of this direct loss (92%) is attributable to forest harvesting (Table 20-16). It is predicted that suitable breeding habitat will reestablish over time as post-logging succession and mine rehabilitation progresses. Eastern wood-pewee is more likely to use older stands (Committee on the Status of Endangered Wildlife in Canada 2012) so this reestablishment will take decades. Some of the cumulative loss of eastern wood-pewee breeding habitat within the RAA will be irreversible (i.e., Geraldton Subdivision [16 ha] and portions of the PDA [167 ha, Section 13.4.2.4, Table 13-10]).

The Project plus four future physical activities (Bankfield West Mineral Exploration, forestry activity, TransCanada Energy East Project, Union Gas Pipeline) will result in the direct loss of 33% (612 ha) of the common nighthawk breeding habitat within the RAA (Table 20-16). The majority of this direct loss is attributable to the Project (52%, Table 20-16) plus the two pipeline developments (32%, Table 20-16). Common nighthawk nest in a wide range of open, sparsely vegetated habitats, including beaches, grasslands, wetlands, burns, cutblocks, gravel roads and mine

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features (Environment Canada 2015b), not all of which are reflected in the ecosite mapping (e.g., existing cutblocks, burns). Therefore, breeding habitat for this species is more prevalent within the RAA than represented by the ecosite mapping and, consequently, the 33% direct loss from future activities is likely an overestimate. Further, it is predicted that future activities within the RAA will actually create suitable nesting habitat for this species over the short, medium, and, in the case of the Project (see Section 13.4.2.3, Table 13-11), the long-term.

The Project plus four future physical activities (Bankfield West Mineral Exploration, forestry activity, TransCanada Energy East Project, Union Gas Pipeline) will result in the direct loss of 2% (180 ha) of the non-treed wetland bird breeding habitat within the RAA (Table 20-16). The majority of this direct loss is attributable to the Project (48%, Table 20-16) plus forestry (46%, Table 20-16), although the forestry loss is likely to be less than predicted because of the application of standards and guidelines that limit operational activities in and around non-treed wetlands (i.e., MNR 2010b). It is predicted that suitable non-treed wetland bird breeding habitat will reestablish over time as Project rehabilitation progresses. Some of the cumulative loss of non-treed wetland bird breeding habitat within the RAA will be irreversible (i.e., portions of the PDA [42 ha, Section 13.4.2.3, Table 13-11]).

The Project plus four future physical activities (Bankfield West Mineral Exploration, forestry activity, TransCanada Energy East Project, Union Gas Pipeline) will result in the direct loss of 5% (456 ha) of the waterfowl nesting habitat within the RAA (Table 20-16). The majority of this direct loss is attributable to forest harvesting (51%, Table 20-16) plus the Project (46%, Table 20-16). Similar to non-treed wetland bird breeding habitat, the forestry loss is likely to be less than predicted because of the application of standards and guidelines that limit operational activities in and around wetlands (i.e., MNR 2010b). It is predicted that suitable waterfowl nesting habitat will reestablish over time, particularly as post-logging succession progresses. Some of the cumulative loss of waterfowl nesting habitat within the RAA will be irreversible (i.e., portions of the PDA [163 ha, Section 13.4.2.3, Table 13-11]).

### **Additional Bird Habitat**

The Project plus five future physical activities (Bankfield West Mineral Exploration, forestry activity, Geraldton Subdivision, TransCanada Energy East Project, Union Gas Pipeline) will result in the direct loss of 11% (14,224 ha) of the bald eagle nesting habitat<sup>7</sup> within the RAA (Table 20-16). The Project's contribution to this direct loss is 13% (1,854 ha) (Table 20-16). The majority of this direct loss (86%) is attributable to forest harvesting (Table 20-16). It is predicted that suitable nesting habitat will reestablish over time as post-logging succession and mine rehabilitation progresses. Bald eagles require mature trees for nesting so this reestablishment will take decades. Some of the cumulative loss of bald eagle nesting habitat within the RAA will be irreversible (i.e., Geraldton Subdivision [23 ha] and portions of the PDA [1,615 ha, Section 13.4.2.3, Table 13-11]).

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<sup>7</sup> As discussed in Section 13.4.2.4, the predictions related to bald eagle nesting habitat loss are conservative as all treed ecosites within the RAA are considered potential nesting habitat but bald eagle prefer nesting sites located along lake shores and rivers.

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The overall cumulative environmental effect on American white pelican stopover and foraging habitat is low. The Project plus one future physical activity (Union Gas Pipeline) will result in the direct loss of <1% (3 ha) of the American white pelican stopover and foraging habitat within the RAA (Table 20-16). The majority of this direct loss (69%, 2 ha) is attributable to the Project (Table 20-16). However, as discussed in Section 13.4.2.3, this is a conservative prediction related to the installation of intake and treated effluent discharge pipelines into Kenogamisis Lake; the presence of the pipes is not expected to alter the lake's function as American white pelican stopover and foraging habitat and the pipelines will be removed at closure.

### **Mammal Habitat**

The Project plus five future physical activities (Bankfield West mineral exploration, forestry activity, Geraldton Subdivision, TransCanada Energy East Project, Union Gas Pipeline) will result in the direct loss of 8% (7,450 ha) of the moose foraging habitat within the RAA (Table 20-16). The Project's contribution to this direct loss is 16% (1,184 ha) (Table 20-16). The majority of this direct loss (84%) is attributable to forest harvesting (Table 20-16). As moose may use younger seral stages for foraging, it is predicted that suitable moose foraging habitat will begin to reestablish relatively soon following logging and the initiation of Project rehabilitation (i.e., within 20 years). Some of the cumulative loss of moose foraging habitat within the RAA will be irreversible (i.e., Geraldton Subdivision [5 ha] and portions of the PDA [780 ha, Section 13.4.2.3, Table 13-11]).

The Project plus five future physical activities (Bankfield West mineral exploration, forestry activity, Geraldton Subdivision, TransCanada Energy East Project, Union Gas Pipeline) will result in the direct loss of 12% (6,938 ha) of the moose late winter cover within the RAA (Table 20-16). The Project's contribution to this direct loss is 8% (576 ha) (Table 20-16). The majority of this direct loss (91%) is attributable to forest harvesting (Table 20-16). It is predicted that suitable late winter cover will reestablish over time as post-logging succession and mine rehabilitation progresses. As dense, mature conifer stands are preferable as late winter cover for moose (MNRF 2014b), this reestablishment will take decades. Some of the cumulative loss of moose late winter cover within the RAA will be irreversible (i.e., Geraldton Subdivision [7 ha] and portions of the PDA [347 ha, Section 13.4.2.3, Table 13-11]).

The Project plus four future physical activities (forestry activity, Geraldton Subdivision, TransCanada Energy East Project, Union Gas Pipeline) will result in the direct loss of 18% (15,693 ha) of the potential woodland caribou habitat within the RAA (Table 20-16). The Project's contribution to this direct loss is 12% (1,949 ha) (Table 20-16). The majority of this direct loss (86%) is attributable to forest harvesting (Table 20-16). It is predicted that suitable caribou habitat will reestablish over time as post-logging succession and mine rehabilitation progresses, and that caribou use of habitat within the RAA in the future may increase relative to current conditions. Some of the cumulative loss of potential woodland caribou habitat within the RAA will be irreversible (i.e., Geraldton Subdivision [24 ha], portions of the PDA [1,951 ha, Section 13.4.2.3, Table 13-11]).



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The Project plus five future physical activities (Bankfield West mineral exploration, forestry activity, Geraldton Subdivision, TransCanada Energy East Project, Union Gas Pipeline) will result in the direct loss of 15% (4,284 ha) of natural bat maternity roosting habitat within the RAA (Table 20-16). The Project's contribution to this direct loss is 6% (268 ha) (Table 20-16). The majority of this direct loss (93%) is attributable to forest harvesting (Table 20-16). It is predicted that suitable bat maternity roosting habitat will reestablish over time as post-logging succession and mine rehabilitation progresses. Northern myotis and little brown myotis require larger diameter trees for roosting (Environmental Baseline Data Reports – Hardrock Project: Terrestrial; Appendix E8) so this reestablishment will take decades. Some of the cumulative loss of natural bat maternity roosting habitat within the RAA will be irreversible (i.e., Geraldton Subdivision [16 ha], portions of the PDA [29 ha, Section 13.4.2.3, Table 13-11]).

### **Amphibian and Reptile Habitat**

The Project plus four future physical activities (Bankfield West mineral exploration, forestry activity, TransCanada Energy East Project, Union Gas Pipeline) will result in the direct loss of 1% (169 ha) of western painted turtle overwintering habitat within the RAA (Table 20-16). The majority of this direct loss is attributable to the Project (47%, Table 20-16) plus forestry (46%, Table 20-16). Similar to non-treed wetland bird breeding habitat, the forestry loss is likely to be less than predicted because of the application of standards and guidelines that limit operational activities in wetlands (i.e., MNR 2010b). It is predicted that suitable western painted turtle overwintering habitat will reestablish over time as mine rehabilitation progresses. Some of the cumulative loss of western painted overwintering habitat within the RAA will be irreversible (i.e., portions of the PDA [42 ha, Section 13.4.2.3, Table 13-11]).

The Project plus five future physical activities (Bankfield West mineral exploration, forestry activity, Geraldton Subdivision, TransCanada Energy East Project, Union Gas Pipeline) will result in the direct loss of 8% (3,651 ha) of amphibian breeding habitat within the RAA (Table 20-16). The Project's contribution to this direct loss is 38% (1,379 ha) (Table 20-16). The majority of this direct loss (61%) is attributable to forestry (Table 20-16). It is predicted that suitable amphibian breeding habitat will reestablish over time as post-logging succession and mine rehabilitation progresses. Some of the cumulative loss of amphibian breeding habitat within the RAA will be irreversible (i.e., Geraldton Subdivision [11 ha], portions of the PDA [1,265 ha, Section 13.4.2.4, Table 13-10]).

### **Insect Habitat**

The Project plus four future physical activities (forestry activity, Geraldton Subdivision, TransCanada Energy East Project, Union Gas Pipeline) will result in the direct loss of 7% (2,371 ha) of the taiga alpine butterfly breeding habitat within the RAA (Table 20-16). The Project's contribution to this loss is 34% (803 ha) (Table 20-16). The majority of this direct loss (66%) is attributable to forest harvesting (Table 20-16). It is predicted that suitable taiga alpine butterfly breeding habitat will reestablish over time as post-logging succession and Project rehabilitation progresses. Some of the cumulative loss of taiga alpine butterfly breeding habitat within the RAA will be irreversible (i.e., Geraldton Subdivision [ $< 1$  ha], portions of the PDA [718 ha, Section 13.4.2.3, Table 13-11]).



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### **Summary**

In summary, with the implementation of the mitigation measures and existing regional initiatives (Section 20.8.4.2), the overall cumulative environmental effect (i.e., the effect of all future foreseeable activities within the RAA) on wildlife habitat is characterized as adverse, moderate magnitude (a measurable change in area of wildlife habitat that is unlikely to affect the long-term persistence or viability of wildlife within the RAA ), long-term and irreversible in the RAA. Timing is applicable given that wildlife habitat use patterns vary with time of year and the ecological context for the overall cumulative environmental effect is typical because the wildlife habitats identified are generally common and widespread in the RAA. The Project contribution to the overall cumulative environmental effect is discussed in Section 20.8.8.1.

### **20.8.5 Cumulative Environmental Effects Assessment for Change in Mortality Risk**

This section describes the cumulative environmental effect mechanisms, mitigation measures, and residual cumulative environmental effects characterization for change in mortality risk. Cumulative environmental effects on mortality risk are assessed qualitatively through a review of the literature, consideration of the factors that can contribute to the susceptibility of a species or species group to the cumulative environmental effect mechanisms, and professional judgment.

#### **20.8.5.1 Cumulative Environmental Effect Mechanisms for Change in Mortality Risk**

The primary cumulative environmental effect mechanisms for change in mortality risk within the RAA are vegetation and overburden clearing, traffic, and adverse human-wildlife encounters. The Project-specific residual environmental effect on mortality risk will interact cumulatively with five future physical activities (Table 20-14) through one or more of these mechanisms, as follows:

- Bankfield West Mineral Exploration – bird and other wildlife mortality may occur during site clearing and active exploration (machinery, vehicles).
- Forestry activity (planned cutblocks and logging roads) – bird and other wildlife mortality may occur during active logging (from tree felling and vehicles); creation of new access may increase human and predator access throughout the RAA.
- Geraldton Subdivision – bird and other wildlife mortality may occur during site clearing and construction; mortality risk from sources such as vehicles, cats, window strikes are expected for the life of the development.
- TransCanada Energy East Project – bird and other wildlife mortality may occur during site clearing and construction.
- Union Gas Pipeline – bird and other wildlife mortality may occur during site clearing and construction; creation of a new ROW may increase human and predator access within the north half of the RAA.

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**20.8.5.2 Mitigation for Cumulative Environmental Effects on Change in Mortality Risk**

Mitigation measures and regional initiatives applicable to limiting cumulative environmental effects on mortality risk within the RAA include, but are not limited to, the following:

- the Project's EMMPs (Appendix M)
- MNRF's active management of wildlife harvest (hunting and trapping) within the two wildlife management units that overlap the RAA (19 and 21a)
- *Ontario's White-nose Syndrome Response Plan* (MNRF 2015).

**20.8.5.3 Residual Cumulative Environmental Effects on Change in Mortality Risk**

Section 20.8.2 describes the existing conditions for change in mortality risk within the RAA considering all sources collectively. Given that a) there is already an elevated level of mortality risk (relative to an undeveloped landscape) within the RAA, particularly in the north half where Highway 11 and Geraldton are located; and b) with the exception of forest harvesting, future physical activities are also within the north half of the RAA, the contributions of future physical activities to change in mortality risk are predicted to be minor relative to the existing condition.

With respect to the relative contribution of future activities to the overall cumulative increase in mortality risk, the increase in mortality risk is expected to be minor and short-term for mining exploration and the Project, as it will be associated primarily with site clearing and related activities (e.g., exploration, construction). The two pipeline ROWs may act as access routes for humans and predators although neither ROW will be creating new access into previously undisturbed tracts of wilderness. The greatest increase in mortality risk associated with the pipelines will be short-term, resulting from site clearing and construction. Mortality risk associated with forestry activity will also peak during site clearing (i.e., logging) but some risk will remain from the logging roads (i.e., traffic and access). It is possible that some of the new logging roads may create access into previously undisturbed areas within the RAA. The Geraldton Subdivision is likely to be the most persistent new contributor to mortality risk within the RAA, primarily for birds (i.e., cat predation, window strikes).

As described in Section 13.4.3, there are multiple Project-related interactions that result in increased mortality risk but they are clearly associated with specific, finite, Project phases and particular activities for which mitigation measures exist. This is also generally considered to be the case for other future physical activities within the RAA, with the exception of the Geraldton Subdivision and most roads which are permanent features contributing to mortality risk.

In summary, with the implementation of the mitigation measures and regional initiatives described above, the overall cumulative environmental effect (i.e., the effect of all future foreseeable activities within the RAA) on mortality risk is characterized as adverse, moderate magnitude (a measurable change in mortality risk that is unlikely to affect the long-term

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persistence or viability of wildlife within the RAA), regional (RAA), long-term, continuous, and irreversible<sup>8</sup>. Also, timing is applicable (i.e., wildlife susceptibility to mortality effect mechanisms varies with time of year)) and the ecological context for the overall cumulative environmental effect on mortality risk is typical because the wildlife habitats identified are generally common and widespread in the RAA. The Project contribution to the overall cumulative environmental effect is discussed in Section 20.8.8.1.

## **20.8.6 Cumulative Environmental Effects Assessment for Change in Movement**

This section describes the cumulative environmental effect mechanisms, mitigation measures, and residual cumulative environmental effects characterization for change in movement. Cumulative environmental effects on movement are assessed qualitatively using professional judgment, including consideration of species' sensitivity to human disturbance, seasonal movements, and the potential for movement corridors and dispersal routes within the RAA.

### **20.8.6.1 Cumulative Environmental Effect Mechanisms for Change in Movement**

The primary cumulative environmental effect mechanisms for change in movement within the RAA are the presence of the open pit, WRSAs, ditches, access roads, and power line corridors. These features may act as semi-permeable barriers to wildlife movement for some species or individuals (e.g., small mammals, females with young) because of high levels of human activity, sensory disturbance, or physical constraints (e.g., height or width of the feature) while other species may be unaffected (e.g., birds, bats). The Project-specific residual environmental effect on movement will interact cumulatively with five future physical activities (Table 20-14) through one or more of these mechanisms, as follows:

- Bankfield West Mineral Exploration – access roads and an area of concentrated, short-term human activity 10 km west of the PDA.
- Forestry activity – planned cutblocks and logging roads throughout the RAA (habitat fragmentation).
- Geraldton Subdivision – area of concentrated, long-term human activity near Kenogamis Lake, just north of the PDA.
- TransCanada Energy East Project – ROW through north half of the RAA, approximately 10 km north of the PDA.
- Union Gas Pipeline – ROW originating approximately 3 km north of Geraldton and running to the PDA.

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<sup>8</sup> Based on the assumption that the town and most roads within the RAA are permanent features contributing to mortality risk

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**20.8.6.2 Mitigation for Cumulative Environmental Effects on Change in Movement**

Mitigation measures and regional initiatives applicable to limiting cumulative environmental effects on movement within the RAA include, but are not limited to, the following:

- The Project's EMMPs (Appendix M).
- MNRF's and industry's active management of forest harvest in the two FMUs that overlap the RAA (FMU 815 [Lake Nipigon Forest] and FMU 350 [Kenogami Forest]).
- The *Ontario Caribou Conservation Plan* (MNR 2009b), which has as one of its goals to develop a management strategy for the Lake Superior Uplands Linkage zone to enhance connectivity between the northern continuous caribou ranges and the Coast Range.
- Direction provided by the *Provincial Policy Statement*, in conjunction with the *Natural Heritage Reference Manual* (MNR 2010a), for the protection of natural heritage features, which include significant wildlife habitats such as animal movement corridors.

**20.8.6.3 Residual Cumulative Environmental Effects on Change in Movement**

Section 20.8.2 describes the existing conditions for change in movement within the RAA, where past and existing human development has resulted in habitat fragmentation and an associated disruption and alteration of movement patterns. With the exception of forest harvesting, future physical activities are within the relatively well-developed north half of the RAA. Given this condition, the contributions of future physical activities to change in movement are predicted to be minor.

With respect to the relative contribution of future activities to the overall cumulative change in movement, the Bankfield West Mineral Exploration activity will be located along Highway 11, already an influence on movement, and is likely to be relatively short-lived. The Geraldton Subdivision and Project will be long-term point source disturbances located within or near existing urban and industrial development. The two pipeline ROWs will act as semi-permeable permeable barriers to wildlife movement, depending on the species (e.g., large mammals may be more likely to cross a ROW than small animals like amphibians). However, both ROWs traverse areas that are already affected by linear development and the longest of these, the TransCanada Energy East Project ROW, follows an existing pipeline ROW through the RAA. Forestry activity will continue to create openings and roads that alter movement in the south half of the RAA.

As described in Section 13.4.4, the Project may have some localized effects on the movements of terrestrial species but is not anticipated to affect the regional movement patterns of large mammals such as moose or black bear or affect the connectivity function of the Lake Superior Uplands Linkage zone for caribou. This is also considered to be the case for the other future physical activities within the RAA. It is anticipated that new local movement patterns will be established in response to the future physical activities, particularly in cases where sensory disturbance abates or revegetation occurs.

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In summary, with the implementation of the mitigation measures and regional initiatives described above, the overall cumulative environmental effect on movement is characterized as adverse, moderate in magnitude, regional (RAA), long-term, continuous, and irreversible<sup>9</sup>. Also, timing is applicable (i.e., wildlife movement patterns vary with the time of year) and the ecological context for the overall cumulative environmental effect on movement is typical because wildlife habitats identified are generally common and widespread in the RAA. The Project contribution to the overall cumulative environmental effect is discussed in Section 20.8.8.1.

**20.8.7 Summary of Cumulative Effects on Wildlife and Wildlife Habitat**

A summary of the characterization of the overall cumulative environmental effects (i.e., the effect of all future foreseeable activities within the RAA) on wildlife and wildlife habitat is presented in Table 20-17. The Project contribution to the overall cumulative environmental effect is discussed in Section 20.8.8.1.

**Table 20-17: Summary of Cumulative Effects on Wildlife and Wildlife Habitat**

Case	Residual Cumulative Environmental Effects Characterization							
	Direction	Magnitude	Geographic Extent	Timing	Frequency	Duration	Reversibility	Ecological and Socio-economic Context
<b>Cumulative Change in Habitat</b>								
Cumulative environmental effect with the Project	Adverse	Moderate	RAA	Applicable	Continuous	Long-term	Irreversible	Typical
<b>Cumulative Change in Mortality Risk</b>								
Cumulative environmental effect with the Project	Adverse	Moderate	RAA	Applicable	Continuous	Long-term	Irreversible	Typical
<b>Cumulative Change in Movement</b>								
Cumulative environmental effect with the Project	Adverse	Moderate	RAA	Applicable	Continuous	Long-term	Irreversible	Typical

NOTE:  
See Table 20-15 for detailed definitions.

<sup>9</sup>Based on the assumption that the town and most roads within the RAA are permanent features that affect wildlife movement patterns.

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### **20.8.8 Significance of Residual Cumulative Environmental Effects**

The residual cumulative environmental effects from the Project and other future physical activities on wildlife and wildlife habitat are determined to be not significant because they do not threaten the long-term persistence or viability of a wildlife species (including SAR, SOCC, and species of interest to Aboriginal communities) within the RAA. Evidence to support this determination is:

- Canada warbler is ranked S4B (apparently secure–uncommon, not rare) in Ontario (Section 13.2.2.1) and under future conditions suitable breeding habitat is predicted to be common within the RAA (74% of the mapped area). Birds displaced by future activities are likely to find breeding habitat elsewhere within the RAA.
- Eastern wood-pewee is ranked S4B (apparently secure–uncommon, not rare) in Ontario (Section 13.2.2.1) and under future conditions suitable breeding habitat is predicted to be common within the RAA (16% of the mapped area). Birds displaced by future activities are likely to find breeding habitat elsewhere within the RAA.
- Common nighthawk is ranked S4B (apparently secure–uncommon, not rare) in Ontario (Section 13.2.2.1). Given this species' affinity for open, sparsely vegetated areas for nesting, it is predicted that future activities within the RAA will actually create suitable nesting habitat over the short, medium, and long-term (Section 20.8.4.3). Birds displaced by future activities are likely to find breeding habitat elsewhere within the RAA.
- Some loss of non-treed wetland bird breeding habitat and waterfowl nesting habitat will result from future activities. These habitats are wetlands that are generally small and dispersed throughout the RAA so even under existing conditions suitable habitat is uncommon within the RAA: non-treed wetland bird breeding habitat is 5% of the mapped area (i.e., 7,571 ha, see Section 13.4.2.3, Table 13-10) and waterfowl nesting habitat is 6% of the mapped area (i.e., 10,104 ha, see Section 13.4.2.3, Table 13-10). However, wetland-associated birds displaced by future activities are still likely to find breeding habitat elsewhere within the RAA.
- Bald eagle is ranked S4B (apparently secure–uncommon, not rare) in Ontario (Section 13.2.2.1) and under future conditions suitable nesting habitat is predicted to be common within the RAA. Specifically, 74% of the mapped area is identified as potential nesting habitat, a subset of which will be preferred for nesting (i.e., near large waterbodies) (see Section 20.8.4.3). Birds displaced by future activities are likely to find nesting habitat elsewhere within the RAA.
- American white pelican is ranked S2B (imperiled) in Ontario (Section 13.2.2.1); however, the effect of future activities on this species' stopover and foraging habitat is low and reversed at closure.

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- Some loss of moose foraging habitat and late winter cover will result from future activities; however, even under future conditions these habitats are common within the RAA (52% and 32% of the mapped area, respectively). Moose displaced by future activities are likely to find foraging habitat and late winter cover elsewhere within the RAA.
- Northern myotis and little brown myotis are ranked S3 (vulnerable) and S4 (apparently secure–uncommon, not rare), respectively, in Ontario, but are designated as Endangered in Canada (Section 13.2.2.1). Some loss of these species' maternity roosting habitat will result from future activities; however, even under future conditions suitable natural bat maternity roosting habitat is common within the RAA (15% of the mapped area). Anthropogenic bat maternity roosting habitat will also continue to be present within the RAA, although at a much lower and less predictable level than the natural habitat. Bats displaced by future activities are likely to find roosting habitat elsewhere within the RAA.
- Some loss of potential woodland caribou habitat will result from future activities; however, because the RAA is within an area where caribou are unlikely to occur (Section 20.8.2) future activities are not expected to alter caribou presence within the RAA.
- Some loss of western painted turtle overwintering habitat will result from future activities; however, even under future conditions this habitat is common within the RAA (14% of the mapped area). Turtles displaced by future activities are likely to find foraging habitat and late winter cover elsewhere within the RAA.
- Some loss of amphibian breeding habitat will result from future activities; however, even under future conditions this habitat is common within the RAA (28% of the mapped area).
- Taiga alpine butterfly is ranked S3 (vulnerable) in Ontario (Section 13.2.2.1); however, even under future conditions suitable breeding habitat is predicted to be common within the RAA (21% of the mapped area). In recognition of the taiga alpine butterfly's conservation status, the TMF was refined to avoid a large fen within the LAA where this species was recorded during baseline surveys (Section 13.4.2.4).
- Post-logging forest succession and mine rehabilitation will restore some wildlife habitat value over time. However, the Project and other future physical activities do result in the irreversible loss of habitat from the RAA. However, this irreversible loss of habitat is small relative to what is available within the RAA:
  - The Geraldton Subdivision (24 ha) and portions of the PDA<sup>10</sup> (1,034 ha) will result in the irreversible loss of wildlife habitat from the RAA; this total area of irreversible loss (1058 ha) is 1% of the RAA.

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<sup>10</sup> The following areas of rehabilitation within the PDA are considered to have limited value to wildlife upon closure: WRSAs, disturbed areas, exposed rock (associated with the TMF dam), open water (e.g., the open pit, TMF pond), and permanent infrastructure (e.g., Hydro One substation, MTO patrol yard, Highway 11 corridor) (see Section 13.4.2.4)



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- The irreversible loss of Canada warbler breeding habitat is 1,017 ha (Section 20.8.4.3) which is 1% of what is identified as this habitat within the RAA.
- The irreversible loss of eastern wood-pewee breeding habitat is 183 ha (Section 20.8.4.3) which is 1% of what is identified as this habitat within the RAA.
- The irreversible loss of non-treed wetland breeding bird habitat is 42 ha (Section 20.8.4.3) which is 1% of what is identified as this habitat within the RAA.
- The irreversible loss of waterfowl nesting habitat is 163 ha (Section 20.8.4.3) which is 2% of what is identified as this habitat within the RAA.
- The irreversible loss of bald eagle nesting habitat is 1,638 ha (Section 20.8.4.3) which is 1% of what is identified as this habitat within the RAA.
- The irreversible loss of potential woodland caribou habitat is 1,975 ha (Section 20.8.4.3) which is 1% of the RAA; this loss is entirely within the Lake Superior Uplands Linkage zone, an area of discontinuous caribou distribution (Section 20.8.2).
- The irreversible loss of natural bat maternity roosting habitat is 45 ha (Section 20.8.4.3) which is <1% of what is identified as this habitat within the RAA.
- The irreversible loss of moose foraging habitat is 785 ha (Section 20.8.4.3) which is 1% of what is identified as this habitat within the RAA.
- The irreversible loss of moose late winter cover is 354 ha (Section 20.8.4.3) which is 1% of what is identified as this habitat within the RAA.
- The irreversible loss of turtle wintering area is 42 ha (Section 20.8.4.3), which is <1% of what is identified as this habitat within the RAA.
- The irreversible loss of amphibian breeding habitat is 1,276 ha (Section 20.8.4.3), which is 3% of what is identified as this habitat within the RAA.
- The irreversible loss of taiga alpine butterfly breeding habitat is 719 ha (Section 20.8.4.3) which is 2% of what is identified as this habitat within the RAA.
- The overall cumulative environmental effect on mortality risk within the RAA is expected to have a similar profile to the existing condition (see Section 20.8.2)— persistent sources of mortality risk (e.g., highway vehicle traffic) combined with short-term, intermittent increases in mortality risk (e.g., forest harvesting, site clearing for the Project and other future physical activities) that are primarily confined to the north half of the RAA, and not predicted to have an effect on the long-term persistence or viability of wildlife species within the RAA.
- The overall cumulative environmental effect on movement within the RAA is also expected to have a similar profile to the existing condition (see Section 20.8.2)— disruption of wildlife movement from Highway 11 and urban and industrial development (now including the Project and other future physical activities) in the north half of the RAA that is not predicted to have an effect the long-term persistence or viability of wildlife species within the RAA.



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### **20.8.8.1 Project Contribution to Cumulative Environmental Effects**

The Project's contribution to the overall cumulative environmental effect on wildlife habitat within the RAA varies with species. This contribution will be partially reversed through mine rehabilitation, but there will be some irreversible loss of habitat within the PDA (see Section 13.4.2.3, Table 13-11).

As described in Section 20.8.5.3, the contributions of future activities to the overall cumulative increase in mortality risk range from short-term effects related to site clearing to longer term effects related to increased human and predator access, particularly within the south part of the RAA, wildlife-vehicle collision risk, and the risks to birds associated with the Geraldton Subdivision (i.e., cat predation and window strikes). The Project's contribution to the overall cumulative environmental effect on mortality risk within the RAA is at the lower end of this range (i.e., primarily related to site clearing) and will be reversed following closure.

As described in Section 20.8.6.3, the contributions of future activities to the overall cumulative change in movement range from short-term (Bankfield West mineral exploration) to long-term effects (Geraldton Subdivision, the Project) within the well-developed north half of the RAA to the ongoing alteration of wildlife movements as the result of the creation of openings and roads (forestry activity) within the relatively undeveloped south half of the RAA. The Project's contribution to the overall cumulative environmental effect on movement within the RAA is considered to be low because it will create a permeable barrier that will not affect wildlife movement.

Collectively, these contributions do not cause a change in the overall cumulative environmental effect that could affect the long-term persistence or viability of wildlife species within the RAA.

### **20.8.8.2 Prediction Confidence for Cumulative Environmental Effects**

Overall confidence in the cumulative environmental effects and significance predictions for wildlife and wildlife habitat is moderate. This prediction confidence assignment was based on professional judgment and the consideration of multiple factors:

- Confidence in the residual environmental effects and significance predictions for wildlife and wildlife habitat is high (see Section 13.6).
- The potential effects and effect mechanisms (pathways) for cumulative environmental effects on wildlife and wildlife habitat within the RAA are generally well understood.
- The assessment used conservative assumptions and methods to increase the level of confidence, specifically:
  - A conservative case scenario was used for the quantitative prediction of cumulative environmental effects on habitat, that is, the entire area directly affected by future physical activities was assumed to have no value as habitat, although in reality over time some of this area will function again as wildlife habitat (e.g., regenerating cutblocks).

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- If there was reasonable doubt about whether or not a cumulative interaction might occur, the interaction is discussed.
- The area of planned future forest harvesting is likely overestimated (see Section 20.8.4.1).
- The cumulative environmental effects on habitat are quantified using geographic information system (GIS).

The factors contributing to lower than high confidence are:

- Indirect effects on habitat from sensory disturbance are not considered.
- Development footprints of future physical activities are based on available information and may not reflect final design.
- The characterization of existing and past cumulative environmental effects on habitat has some uncertainty due to the scale and quality of the FRI products used to develop the ecosite mapping for the RAA.
- The mortality risk and movement cumulative environmental effects assessments are qualitative rather than quantitative.
- The relationship between the long-term persistence or viability of a wildlife species at a regional level and cumulative environmental effects is moderately understood and qualitative.

### **20.9 LABOUR AND ECONOMY**

As detailed in Chapter 14.0 (labour and economy VC), while not found to be significant, the Project is anticipated to have adverse residual effects on labour and economy. As such there is potential for the residual effects of the Project to act cumulatively with residual effects of other future physical activities.

#### **20.9.1 Regional Assessment Area**

As noted in Section 14.1.5.1, the RAA for labour and economy consists of three Census Subdivisions, which includes rural and urban residents of the District of Thunder Bay. The RAA is comprised of the Thunder Bay census subdivision, the Pic River 50 IR census subdivision (associated with the Biigtigong Nishnaabeg reserve) and the Pays Plat 51 IR census subdivision (associated with the Pays Plat First Nation [PPFN] reserve). This area includes the LAA and represents the region in which Project employment and expenditures can be reasonably expected to interact with those of other projects and cause effects on the regional economy. The RAA is used to provide regional context for the significance of residual effects and is also the area within which potential for cumulative effects of the Project in combination with other past, present or reasonably foreseeable projects or activities are considered.

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**20.9.2 Identification of Project Effects Likely to Interact Cumulatively**

Current and past projects in the RAA (see Table 20-1) are generating or have generated changes in demands for labour, goods and services from sources in the RAA. These include mining projects (including aggregate production), forestry projects, infrastructure projects (transportation, water and energy transmission projects) and residential development. As noted in Section 14.2.2.5, economic development in the region has been and continues to be centered around mining and mineral development and, to a lesser extent, forestry, and this is reflected in the size and composition of the regional labour force, as presented in the description of baseline labour force and economic conditions in Section 14.2.2. With the effects of Project demands for labour, goods and services having been assessed in the context of baseline economic conditions, the Project's cumulative effects in terms of past and present projects and activities have already been assessed.

Table 20-18 lists future physical activities that have been proposed for the RAA. Although three of these projects are currently on hold, and the others are in various stages of planning and approval, it is expected that, if and when these other future projects occur, there could be competition for labour, goods and services in the RAA.

**Table 20-18: Potential Cumulative Effects on Labour and Economy**

Other Projects and Physical Activities with Potential for Cumulative Environmental Effects	Potential Cumulative Environmental Effects	
	Change in Labour	Change in Economy
<b>Future Physical Activities (certain and reasonably foreseeable)</b>		
Goliath Gold Mine	-	-
Magino Mine	-	-
Hammond Reef Gold Mine	-	-
Josephine Cone Mine	-	-
Bankfield West Mineral Exploration	✓	✓
Pickle Lake Mining Exploration	-	-
Junior Lake Mining Exploration	✓	✓
Ishkoday Mining Exploration	✓	✓
McCaul Twp Mining Exploration	-	-
Thunder Bay District Mining Exploration	-	-
Hemlo East Project Mining Exploration	-	-
McTavish Twp Aggregate	-	-
Proposed Geraldton Subdivision	✓	✓
Municipality of Greenstone Landfill	✓	✓

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**Table 20-18: Potential Cumulative Effects on Labour and Economy**

Other Projects and Physical Activities with Potential for Cumulative Environmental Effects	Potential Cumulative Environmental Effects	
	Change in Labour	Change in Economy
Little Jackfish Hydroelectric Development	✓	✓
Little Jackfish Transmission Line	✓	✓
TransCanada Energy East Project	✓	✓
Union Gas Pipeline	✓	✓
East-West Tie Transmission Project	✓	✓
Black Sturgeon River Camp 43 Dam Project	-	-
MNRF – FMU815 Lake Nipigon Forest	✓	✓
MNRF – FMU350 Kenogami Forest	✓	✓

NOTES:

- ✓ those "other projects and physical activities" whose residual effects are likely to interact cumulatively with Project-specific residual environmental effects.
- interactions between the adverse residual effects of other projects and the Project-specific adverse residual effects are not expected

Those future activities listed but not checked off in Table 20-18 represent activities that are unlikely to interact cumulatively with the Project (i.e., are either one or a combination of the following: 1) substantially geographically removed from the Project; 2) by definition their operations do not represent a potential cumulative effect pathway to the VC; 3) would be considered to have a potential spatial or temporal overlap however due to the known success of current best management and design mitigation for such projects residual effects are unlikely).

Descriptions for the physical activities checked in Table 20-18, in terms of labour and economy, are provided below:

- Bankfield West Mineral Exploration – although estimates of the cost of future exploration in this area are not available, information from Premier Gold Mines Limited (2014) indicates that it spent \$3.7 million on exploration activities in 2014 at all of its Ontario properties (other than the Hardrock property).
- Junior Lake Mining Exploration – although estimates of the cost of future exploration in this area are not available, information from Landore Resources (2015) indicates that it spent \$2.3 million on exploration activities in 2014 at the Junior Lake property.
- Ishkoday Mining Exploration – although estimates of the cost of future exploration in this area are not available, information from Laurion Mineral Exploration Inc. (2015), it had deferred exploration expenses on its properties of about \$3 million per year in 2013 and 2014.

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- Geraldton Subdivision –while there is no capital cost available for this development, the establishment of the subdivision would provide the basis for new residential construction on 33 lots. Based on average value of dwellings in the Municipality of Greenstone in 2011 (Statistics Canada 2013), this represents new construction valued at \$3.3 million.
- Municipality of Greenstone Landfill –while there is no capital cost information available for this project, the annual budget for Environmental Services in the Municipality of Greenstone (Grant Thornton 2014) is about \$4 million.
- Namewaminikan River Waterpower Project – according to information presented at open houses, Namewaminikan Hydro Inc. (2011), the project will cost \$45.6 million, will create 60 person years of employment during construction, and create two operations positions.
- Little Jackfish Hydroelectric Development and Little Jackfish Transmission Line – according to information presented at open houses, Ontario Power Generation (2012) indicates that construction of the dam will require 250 workers for three years and transmission line construction will require 80 workers for 1.5 years.
- TransCanada Energy East Project – according to the project description (TransCanada PipeLines Limited Energy East Pipeline 2014), the Ontario West segment of the project will involve converting 730 km of existing pipeline to carry oil instead of natural gas with construction of only 1 km of new pipeline in Western Ontario. Consequently, construction labour requirements would be very small and there would be no additional requirements for operating labour.
- Union Gas Pipeline – this would involve construction of a new natural gas distribution line for the Hardrock Project that would be about 10 km in length. While there is no information on the cost of constructing this pipeline, it is expected that total costs and labour requirements to construct such a short length of pipeline would be relatively small.
- East-West Tie Transmission Project –according to Nexbridge Infrastructure (2015), project construction will cost \$22.2 million with an expected 2020 in-service date.
- Highway 11/17 Widening –according to BOT Construction Group (2010), project construction will employ 75 people per year.

### **20.9.3 Residual Cumulative Environmental Effects Description Criteria**

The residual cumulative environmental effects are characterised using the same terms and definitions as those of the residual environmental effects. Table 20-19 provides those terms and definitions as previously detailed in Section 14.1.6.

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**Table 20-19: Characterization of Residual Effects on Labour and Economy**

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Direction	The relative change compared to baseline conditions.	<b>Positive</b> — the measurable parameter is improving or is more desirable compared to baseline conditions. <b>Adverse</b> — the measurable parameter is worsening or less desirable compared to baseline conditions.
Magnitude	The amount of change in either the measurable parameters or the VC relative to baseline conditions.	<b>Low</b> — the measurable parameter is at or near baseline conditions. <b>Moderate</b> — a measurable change but it is unlikely to pose a serious risk or benefit to the VC or if adverse, to represent a management challenge <sup>1</sup> . <b>High</b> — a measurable change that is likely to pose a serious risk or benefit to the VC, and if adverse, represents a management challenge.
Geographic extent	The geographic area in which the residual environmental effect occurs.	<b>PDA</b> — the residual environmental effect is restricted to the PDA. <b>LAA</b> — the residual environmental effect extends into the LAA. <b>RAA</b> — the residual environmental effect extends into the RAA.
Timing	Considers when the residual environmental effect is expected to occur. Timing considerations are noted in the evaluation of the residual environmental effect, where applicable or relevant.	<b>Not Applicable (N/A)</b> — seasonal aspects are unlikely to affect economic conditions. <b>Applicable</b> — seasonal aspects may affect economic conditions.
Frequency	Identifies how often the residual environmental effect occurs within a given time.	<b>Single event</b> — the residual environmental effect occurs once. <b>Multiple irregular events (no set schedule)</b> — the residual environmental effect occurs sporadically, at an irregular interval, and is not predictable. <b>Multiple regular events</b> — the residual environmental effect occurs regularly, and may be at predictable intervals or specific times. <b>Continuous</b> — the residual effect occurs continuously.

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**Table 20-19: Characterization of Residual Effects on Labour and Economy**

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Duration	The length of time required until the residual environmental effect can no longer be measured or otherwise perceived.	<p><b>Short-term</b> — the residual environmental effect is limited to construction or active closure (0-5 years).</p> <p><b>Medium-term</b> — the residual environmental effect extends through the operating life of the Project.</p> <p><b>Long-term</b> — the residual effect extends beyond closure.</p>
Reversibility	Pertains to whether a measurable parameter or the VC can return to its existing condition after the Project activity ceases.	<p><b>Reversible</b> — the residual environmental effect is likely to be reversed after activity completion.</p> <p><b>Irreversible</b> — the residual environmental effect is permanent and is unlikely to return to its existing condition.</p>
Ecological and Socio-economic context <sup>A</sup>	Considers uncommon characteristics of the area and/or a community and/or ecosystems that may be affected by the Project and/or whether the VC is important to the functioning of an ecosystem or community of people.	<p><b>Low diversity</b> — a fragile economy where the labour force has limited diversity, has been declining in size, and has limited capacity to accommodate the demands of a new large project.</p> <p><b>Moderate diversity</b> — a stable economy where the labour force has moderate diversity, has been slowly increasing or decreasing in size, and can accommodate many of the demands of a new large project.</p> <p><b>High diversity</b> — a diverse, dynamic, and rapidly growing economy where the labour force has enough capacity to accommodate all demands of a new large project.</p> <p><b>Unknown</b> — effect occurs in the future. The diversity of the economy and labour force to accommodate change is unknown.</p>

NOTE:

<sup>1</sup> A management challenge means that there may be difficulty in addressing effects through management measures, such as implementation of policies or plans, human resource planning, or financial investment.



## **20.9.4 Cumulative Effects Assessment for Labour**

### **20.9.4.1 Cumulative Effect Mechanisms for Labour**

Construction and operation of the future projects listed in Table 20-18 will result in increased demands for labour in the RAA and, as such, they may compete with current employers in the LAA for these resources. The exact details of when these projects would be constructed and their hiring and procurement strategies are presently unknown and will only be revealed when those projects undergo regulatory review or become operational. However, on the assumption that they all do proceed as proposed, the construction, operation and closure of the Project would serve to have a cumulative demand on labour in the RAA.

The extent of potential cumulative demands on labour will depend on the demand for and supply of labour with appropriate qualifications within the RAA. As noted in Chapter 14.0 (labour and economy VC), Table 14-5, the RAA has a very large construction labour force (3,535 workers in 2011, compared to only 125 construction workers in the LAA) and also has a very large number of workers in the mining, quarrying, and oil and gas extraction industry (850 workers in 2011, with 135 of them residing in the LAA). Also, as noted in Chapter 14.0 (labour and economy VC), Table 14-4, the RAA had a relatively large number of unemployed workers (4,910 in 2011, with an unemployment rate of 8.5%).

Most of the future projects listed in Table 20-18 have relatively lower costs or would involve relatively low numbers of construction workers within the RAA; only the Marathon Platinum Group Metals and Copper Mine (currently on hold) and the Little Jackfish Hydroelectric Development have requirements for construction labour that are as large as those of the Project. For this reason, it is unlikely that the additional labour demands of the Project during construction (short term) will result in shortages that could adversely affect labour conditions in the RAA. Based on labour force conditions in the RAA, the cumulative effects associated with construction employment opportunities provided by future projects, including the Project, would likely be positive.

Similarly, most of the other future projects have low operation labour requirements. During operation, Project demands for labour with mining experience may only be competing with one other large future project, the Marathon Platinum Group Metals and Copper Mine (currently on hold) and, as noted in Chapter 14.0 (labour and economy VC), Section 14.4.2.3, it is expected that as many as 255 Project workers needed to operate the Project could be RAA residents outside the LAA. It is expected that the Marathon Platinum Group Metals and Copper Mine, if it were to proceed, would also adopt an employment strategy where operational workers who could not be supplied locally would be brought in from elsewhere in the RAA or from outside the RAA. Thus, the additional Project demands for labour during operation (long-term) are also unlikely to result in labour shortages that could adversely affect economic conditions in the RAA. However, based on labour force conditions in the RAA, the cumulative effects associated with operation employment opportunities provided by future projects, including the Project, would likely be positive.



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It is not possible to predict the exact cumulative effects of Project closure on labour in the RAA because this will depend on labour conditions, especially for the mining industry, at the time of closure, 20 years into the future. If other mines are closing at the same time, the adverse cumulative effects of Project closure could be large. However, if new mines begin operating in the RAA at the same time the Project is ceasing operation, some of the adverse cumulative effects could be offset because former Project workers could be employed by the new mines. The magnitude of potential adverse cumulative effects would further be reduced to the extent that skills and experience acquired by Project workers are transferable to other projects and they are able to find employment in other sectors.

### **20.9.4.2 Mitigation for Cumulative Effects on Labour**

Given that there are unlikely to be adverse cumulative effects on labour in the RAA as a result of Project construction and operation, no mitigation is required. In addition, it is expected that each of the future projects will adopt hiring and procurement strategies similar to those of the Project (see Section 14.4.2.2) such that workers in the RAA will have the ability to choose their preferred projects of employment.

Although the exact cumulative effects of Project closure on labour conditions in the RAA cannot be predicted, it is expected that mine projects would be working with their employees and nearby communities to develop a strategy for mine closure that would reduce potential adverse effects at the time of closure. The nature of the closure strategies will be revised over time to reflect changing economic conditions, and it is possible that final closure strategy for each operation will be as effective as possible in limiting the adverse effects of closure on employment.

### **20.9.4.3 Residual Cumulative Effects on Labour**

The cumulative demands of the Project, in combination with all other future foreseeable activities, will not result in an adverse effect on labour in the RAA during construction (short-term) or operation (long-term). However, as previously noted, the exact cumulative effects of Project closure on labour conditions in the RAA are difficult to accurately predict. To be conservative, it is assumed that some residual cumulative effects in the RAA at closure are possible and that with mitigation, those cumulative effects will be adverse, low in magnitude, long-term, continuous and irreversible. Long-term effects are considered irreversible because job opportunities associated within mining projects may not be replaced after those mines close down. Seasonal aspects are unlikely to affect employment conditions and because the effect occurs in the future, the diversity of the economy and labour force to accommodate change is unknown. The Project contribution to the overall cumulative environmental effect is discussed in Section 20.9.7.1.

## **20.9.5 Cumulative Effects Assessment for Economy**

### **20.9.5.1 Cumulative Effect Mechanisms for Economy**

Construction and operation of the future projects listed in Table 20-18 will result in increased opportunities for businesses in the RAA and may generate municipal government revenues, affect the land base that supports forestry operations, and may affect businesses that are dependent on tourism. As such, Project effects may interact cumulatively with the effects of these other future projects.

The extent of potential cumulative demands on businesses will depend on their capacity to provide the labour, goods and services required by current and future projects in the RAA. As shown in Chapter 14.0 (labour and economy VC), Table 14-5, the RAA has a very large labour force in non-basic (service) industries that supply and would supply current and future projects. As of 2011, there were 43,530 workers who had experience in the service industries and the RAA had an unemployment rate of 8.5%. Given that most of the future projects listed in Table 20-18 are relatively small in terms of their requirements for goods and services during construction and operation, it is unlikely that Project purchases of goods and services from regional businesses will adversely affect business conditions in the RAA. Based on labour force conditions in the RAA, it is expected that the cumulative effects on the RAA economy of constructing and operating future projects, including the Project, would likely be positive direction. For example, the indirect and induced employment that would result from Project and consumer spending will result in 10,480 PYs of indirect and induced employment in businesses in the RAA during construction, operation, and active closure (Section 14.4.3.3).

In terms of potential cumulative effects on municipal government revenues, project-related taxes are collected either by the appropriate local government or the provincial government, and these revenues are then distributed to regional governments as required. This means that it is necessary to consider potential cumulative effects on municipal revenues for the LAA (the Municipality of Greenstone) instead of the RAA. Seven of the future projects listed in Table 20-18 are located in the LAA, and only two of these (the proposed subdivision and the new gas pipeline) are likely to be a long-term sources of municipal government revenues. Municipal taxes paid during Project operation, in combination with taxes paid by the other projects, will result in positive cumulative effects on municipal government revenues. While Project closure will have a moderate adverse effect on municipal government revenues after closure, the tax assessment base provided by the other future projects will provide the Municipality of Greenstone with increased flexibility in terms of how it can manage its collection of revenues to buffer the effects of the loss of Project revenues.

The geographical basis for assessing potential cumulative effects on the forest industry is the RAA, which contains most of the businesses that are directly and indirectly affected by harvesting activities in the Kenogami FMU. The FMU is 1,977,684 ha in area and, of this, there are plans to harvest timber on 149,586 ha during the period from 2011–2021 (MNR 2011). While the

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Project will remove 342 ha (0.2%) of this planned harvest area, the only other future projects in Table 20-18 that could also adversely affect the forestry land base include construction of the Union Gas Pipeline, and possibly the construction of the Geraldton Subdivision and the Municipality of Greenstone Landfill. The other future projects in the LAA are located outside the Kenogami FMU. While losses of timber during site preparation and the potential long-term loss of forested land based associated with each of these future projects is unknown, it is expected affected merchantable timber would be salvaged in accordance with provincial requirements and that project proponents will consult with the MNRF and the enhanced Forest Resource Licence holder to develop mitigation strategies that would reduce potential cumulative adverse effects on the forest land base. Thus, there would be limited adverse effects on businesses that directly or indirectly rely on timber harvesting in the FMU.

Project construction, in combination with the construction of the other future projects, could result in cumulative land use disturbances that could adversely affect the development of the tourism industry in the RAA. However, given that these projects would be required to implement mitigation measures to reduce these effects and that these projects would have a small cumulative footprint in the RAA, these effects would be small and could be offset if some of the projects, such as the Marathon Copper Mine and the hydroelectric projects, are actively promoted as tourism attractions.

### **20.9.5.2 Mitigation for Cumulative Effects on Economy**

As the adverse effects of the Project on regional businesses in combination with the effects of other future projects are expected to be limited, no Project specific mitigation is required. In relation to potential cumulative effects on the forest industry there are mechanisms in place (forest management planning) to guide industry in operating on a sustainable basis. In relation to potential adverse effects of Project closure on municipal government revenues; municipal governments have various mechanisms by which they can balance revenues and costs. There are mechanisms in place to address the potential cumulative adverse effects of multiple future projects on the tourist industry in the LAA through tourism planning undertaken by the Municipality of Greenstone and by the North of Superior Tourism Association in the RAA.

### **20.9.5.3 Residual Cumulative Effects on Economy**

It is anticipated that the cumulative adverse effects of the Project in combination with the effects of other future projects will be of low magnitude on businesses in the RAA, on the forest industry that relies on timber harvests from the Kenogami FMU, and on tourism in the RAA. In terms of cumulative adverse effects of local government revenues, the overall cumulative effect of Project closure in combination with the effects of other future projects will reduce the magnitude of adverse effects associated with closure from moderate to low. Adverse cumulative effects that can be attributed to the Project will be long-term, continuous, and irreversible.

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Seasonal aspects are unlikely to affect the reduction in economic activities associated with forestry; however, seasonal aspects are likely to affect the loss of revenue and employment for the tourism industry, because tourism and recreation are seasonal industries. The socio-economic context is predicted to be moderate diversity because of the existing stable economy where the labour force has moderate diversity, has been slowly increasing or decreasing in size, and can accommodate many project demands.

**20.9.6 Summary of Cumulative Effects on Labour and Economy**

A summary of the characterization of the overall cumulative environmental effects (i.e., the effect of all future foreseeable activities within the RAA) on labour and economy is presented in Table 20-17. The Project contribution to the overall cumulative environmental effect is discussed in Section 20.9.7.1.

**Table 20-20: Summary of Cumulative Effects on Labour and Economy**

Case	Residual Cumulative Effects Characterization							
	Direction	Magnitude	Geographic Extent	Timing	Frequency	Duration	Reversibility	Ecological and Socio-economic Context
<b>Cumulative Change in Labour</b>								
Cumulative environmental effect with the Project	Adverse	Low	RAA	N/A	Continuous	Long-term	Irreversible	Unknown
<b>Cumulative Change in Economy</b>								
Cumulative environmental effect with the Project	Adverse	Low	RAA	Applicable	Continuous	Long-term	Irreversible	Moderate Diversity

NOTE:  
See Table 20-19 for detailed definitions.

**20.9.7 Significance of Residual Cumulative Effects**

As defined in Section 14.1.6, a significant effect on labour and economy is one that is highly distinguishable from recent or anticipated trends and variability in the measurable parameters and is usually of high in magnitude and long-term in duration. Significant residual effects cannot be managed or mitigated using current or planned programs, services or infrastructure.

Based on the characterization of the adverse residual cumulative effects of the Project in combination with the effects associated with other future projects in the RAA, the adverse residual cumulative effects on labour and economy are predicted to be not significant.

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**20.9.7.1 Project Contribution to Cumulative Effects**

The Project's contributions to adverse cumulative effects on labour and economy are limited to the long-term effects of closure in terms of effects on labour and on regional businesses and to construction and operation in terms of effects on tourism and forestry. Given the overall magnitude of the labour force and the economy of the RAA and the expectation that, with mitigation, the cumulative effects of future projects, including the Project, will be low, the Project's overall contribution to overall cumulative effects on labour and economy will also be low.

**20.9.7.2 Prediction Confidence for Cumulative Effects**

There is a high degree of confidence in the predictions of the Project-specific and cumulative effects on labour and economy. The economy of the RAA is very large and dynamic, with a long history of mining and other types of resource development. Consequently, the regional economy has evolved to anticipate and adapt to changes that will be caused by the Project and by the other types of future projects that are identified in Table 20-23.

**20.10 COMMUNITY SERVICES AND INFRASTRUCTURE**

As detailed in Chapter 15.0 (community services and infrastructure VC), while found to be not significant, the Project is anticipated to have an adverse residual effect on community services and infrastructure in terms of change in capacity of housing and accommodations, change in capacity of municipal and provincial services and infrastructure and change in capacity of transportation services and infrastructure. As such there is potential for the residual effects of the Project to act cumulatively with residual effects of other future physical activities.

**20.10.1 Regional Assessment Area**

As noted in Section 15.1.5.1, the RAA for community services and infrastructure was selected to include the communities which may experience increased demand as a result of the Project. The RAA and LAA are the same geographically because both potential residual and cumulative effects may affect the same communities. The communities in question are mostly located within the Municipality of Greenstone, an amalgamated municipality that includes the former municipalities of the Town of Geraldton, Town of Longlac, the Township of Nakina and the Township of Beardmore, and an extensive area of unincorporated territory including settlement areas such as Caramat, Jellicoe and MacDiarmid. The RAA is used to provide regional context for the significance of residual effects and is also the area within which potential for cumulative effects of the Project in combination with other past, present or reasonably foreseeable projects or activities are considered.

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The RAA also includes the following First Nation reserves, which are located within Greenstone municipal boundaries:

- AZA
- BZA
- Bingwi Neyaashi Anishinaabek
- LLFN

The following First Nation reserves are near the Greenstone municipal boundaries and have also been included in the RAA:

- AFN
- GFN

**20.10.2 Identification of Project Effects Likely to Interact Cumulatively**

An assessment of potential cumulative effects resulting from the Project in combination with other past, present and reasonably foreseeable projects and activities has been undertaken. Table 20-21 lists the other projects and physical activities that might act cumulatively with the Project.

The population of the Municipality of Greenstone decreased by 4% between 2006 and 2011, and projections indicate that the municipality will continue to see population decline, with an estimated 4,618 residents in 2018 and 4,480 residents in 2023 (Invest in Greenstone 2014; Statistics Canada 2012).

**Table 20-21: Potential Cumulative Effects on Community Services and Infrastructure**

Other Projects and Physical Activities with Potential for Cumulative Environmental Effects	Potential Cumulative Environmental Effects		
	Change in Capacity of Housing and Accommodations	Change in Capacity of Municipal and Provincial Services and Infrastructure	Change in Capacity of Transportation Services and Infrastructure
<b>Future Physical Activities (certain and reasonably foreseeable)</b>			
Goliath Gold Mine	-	-	-
Magino Mine	-	-	-
Hammond Reef Gold Mine	-	-	-
Josephine Cone Mine	-	-	-
Bankfield West Mineral Exploration	-	-	-
Pickle Lake Mining Exploration	-	-	-

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**Table 20-21: Potential Cumulative Effects on Community Services and Infrastructure**

Other Projects and Physical Activities with Potential for Cumulative Environmental Effects	Potential Cumulative Environmental Effects		
	Change in Capacity of Housing and Accommodations	Change in Capacity of Municipal and Provincial Services and Infrastructure	Change in Capacity of Transportation Services and Infrastructure
Junior Lake Mining Exploration	-	-	-
Ishkoday Mining Exploration	-	-	-
McCaul Twp Mining Exploration	-	-	-
Thunder Bay District Mining Exploration	-	-	-
Hemlo East Project Mining Exploration	-	-	-
McTavish Twp Aggregate	-	-	-
Proposed Geraldton Subdivision	✓	-	-
Municipality of Greenstone Landfill	-	-	-
Little Jackfish Hydroelectric Development	-	-	-
Little Jackfish Transmission Line	-	-	-
TransCanada Energy East Project	-	-	-
Union Gas Pipeline	-	-	-
East-West Tie Transmission Project	-	-	-
Black Sturgeon River Camp 43 Dam Project	-	-	-
MNRF – FMU815 Lake Nipigon Forest	-	-	-
MNRF – FMU350 Kenogami Forest	-	-	-

NOTES:

- ✓ those "other projects and physical activities" whose residual effects are likely to interact cumulatively with Project-specific residual environmental effects.
- interactions between the adverse residual effects of other projects and the Project-specific adverse residual effects are not expected.

Those future activities listed but not checked off in Table 20-21 represent activities that are unlikely to interact cumulatively with the Project (i.e., are either one or a combination of the following: 1) substantially geographically removed from the Project; 2) by definition their operations do not represent a potential cumulative effect pathway to the VC; 3) would be considered to have a potential spatial or temporal overlap however due to the known success of current best management and design mitigation for such projects residual effects are unlikely).

Other projects will act cumulatively with the Project to create effects on community services and infrastructure if they are occurring at the same time as the Project and require the temporary relocation of workers into the RAA communities. Additional workers from other projects may place additional demands on community services and infrastructure, possibly beyond their



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capacity. However, the labour requirements for residential development and landfill construction will likely be small and contributions to cumulative effects on community services and infrastructure from those projects will be minimal.

The construction of a new landfill and the widening and upgrade of Highway 11/17 will improve and increase the capacity of municipal and provincial services and infrastructure and transportation services and infrastructure in the RAA.

**20.10.3 Residual Cumulative Environmental Effects Description Criteria**

The residual cumulative environmental effects are characterised using the same terms and definitions as those of the residual environmental effects. Table 20-22 provides those terms and definitions as previously detailed in Section 15.1.6.

**Table 20-22: Characterization of Residual Environmental Effects on Community Services and Infrastructure**

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Direction	The relative change compared to baseline conditions.	<b>Positive</b> — an increase in capacity of community services and infrastructure. <b>Adverse</b> — a decrease in capacity of community services and infrastructure.
Magnitude	The amount of change in either the measurable parameters or the VC relative to baseline conditions.	<b>Low</b> — a change in capacity of community services and infrastructure will be at or near to baseline conditions. <b>Moderate</b> — a change in capacity of community services and infrastructure approaches current capacity, standard or threshold but will not result in a reduction in standards of service. <b>High</b> — a change in capacity of community services and infrastructure exceeds current capacity, standard or thresholds that result in a reduction in standards of service.
Geographic Extent	The geographic area in which the residual environmental effect occurs.	<b>PDA</b> — the residual environmental effect is restricted to the PDA. <b>LAA/RAA</b> — the residual environmental effect extends into the LAA/RAA.
Timing	Considers when the residual environmental effect is expected to occur. Timing considerations are noted in the evaluation of the residual environmental effect, where applicable or relevant.	<b>Not Applicable (N/A)</b> — seasonal aspects are unlikely to affect capacity of community services and infrastructure. <b>Applicable</b> — seasonal aspects may affect capacity of community services and infrastructure.



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**Table 20-22: Characterization of Residual Environmental Effects on Community Services and Infrastructure**

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Frequency	Identifies how often the residual environmental effect occurs within a given time.	<p><b>Single event</b> — the residual environmental effect occurs once.</p> <p><b>Multiple irregular events (no set schedule)</b> — the residual environmental effect occurs sporadically, at an irregular interval, and is not predictable.</p> <p><b>Multiple regular events</b> — the residual environmental effect occurs regularly, and may be at predictable intervals or specific times.</p> <p><b>Continuous</b> — the residual environmental effect occurs continuously.</p>
Duration	The length of time required until the residual environmental effect can no longer be measured or perceived.	<p><b>Short-term</b> — the residual environmental effect is limited to construction or active closure (0 to 5 years).</p> <p><b>Medium-term</b> — the residual environmental effect extends through the operating life of the Project.</p> <p><b>Long-term</b> — the residual environmental effect extends beyond closure.</p>
Reversibility	Pertains to whether a measurable parameter or the VC can return to its baseline condition after the Project activity ceases.	<p><b>Reversible</b> — the residual environmental effect is likely to be reversed after activity completion.</p> <p><b>Irreversible</b> — the residual environmental effect is permanent and the VC is unlikely to return to its baseline condition.</p>
Ecological and Socio-economic Context	Considers uncommon characteristics of the area, a community and/or ecosystems that may be affected by the Project and/or whether the VC is important to the functioning of an ecosystem or community of people.	<p><b>Low Capacity</b> — infrastructure and services have limited capacity to accommodate increased demand.</p> <p><b>Moderate Capacity</b> — infrastructure and services can accommodate some levels of increased demand.</p> <p><b>High Capacity</b> — infrastructure and services have capacity to accommodate increased demand.</p>

#### **20.10.4 Cumulative Effects Assessment for Change in Capacity of Housing and Accommodations**

##### **20.10.4.1 Cumulative Effect Mechanisms for Change in Capacity of Housing and Accommodations**

Cumulative effects on housing and accommodation are primarily a result of increases in the population of an area because new residents may require housing and place additional demands on existing housing and accommodations.

It is expected that the majority of non-local construction workers will be housed in the temporary camp and will not affect housing demand. The Municipality has an adequate number of temporary accommodations to absorb additional demand from workers that may live outside of the temporary camp.

Project operation will directly employ an average of 450 people per year. Labour demand/supply matching according to the skill requirements suggests that about 64% of Project workers (approximately 350 workers) will be in-migrants to the LAA/RAA from other areas. As a result, operation employees will require housing within the LAA/RAA communities and it is expected that there are enough homes within the LAA/RAA to accommodate these workers. However, with the surplus in vacant housing due to trending population declines, the Municipality is expected to be able to absorb the increase in workers without putting pressure on housing and accommodations.

The result of the potential Geraldton Subdivision construction would be an increase in the capacity of housing in the RAA. No other projects are expected to increase demand on housing and accommodations.

##### **20.10.4.2 Mitigation for Cumulative Effects on Change in Capacity of Housing and Accommodations**

A temporary camp will be in place for construction, and potentially early operation when some construction activities may be ongoing to house Project workers and will be the main mitigation for reducing additional demands on local available housing. Construction workers will be bussed to and from the temporary camp. No additional mitigation is required for housing operation or closure workers due to the availability of vacant housing in the LAA/RAA.

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**20.10.4.3 Residual Cumulative Effects for Change in Capacity of Housing and Accommodations**

Future residential developments are unlikely to lead to an increase in the population of the RAA as they are planned to address current housing needs, and thus an increase in the demand on community services and infrastructure. Furthermore, Project operation employees may move into new residential developments, which would reduce the total demand on the existing housing market. Residential development will add to the supply of housing in the RAA within the lifespan of the Project such that the cumulative effects of the Project in combination with other projects and activities on housing and accommodations are conservatively predicted to be adverse, low in magnitude, long-term, continuous and reversible. Seasonal aspects are unlikely to affect capacity of housing and accommodations. Housing and accommodations can accommodate moderate levels of increased demand.

**20.10.5 Summary of Cumulative Effects on Community Services and Infrastructure**

A summary of the characterization of the overall cumulative environmental effects (i.e., the effect of all future foreseeable activities within the RAA) on community services and infrastructure is presented in Table 20-23. The Project contribution to the overall cumulative environmental effect is discussed in Section 20.10.6.1.

**Table 20-23: Summary of Cumulative Effects on Community Services and Infrastructure**

Case	Residual Cumulative Effects Characterization							
	Direction	Magnitude	Geographic Extent	Timing	Frequency	Duration	Reversibility	Ecological and Socio-economic Context
<b>Cumulative Change in Capacity of Housing and Accommodations</b>								
Cumulative environmental effect with the Project	Adverse	Low	RAA	N/A	Continuous	Long-term	Reversible	Moderate Diversity

NOTE:  
See Table 20-22 for detailed definitions.

**20.10.6 Significance of Residual Cumulative Environmental Effects**

Effects on community services and infrastructure are primarily a result of increases in the population of an area. Because the projects and activities listed in Table 20-21 are not anticipated to cause a permanent increase in the population of the RAA, the cumulative effects of the Project in combination with future activities on a change in capacity of community services and infrastructure are considered to be not significant.

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**20.10.6.1 Project Contribution to Cumulative Environmental Effects**

The potential contribution of the Project to cumulative effects on community services and infrastructure will be mitigated through the use of a temporary camp and work rotation schedules that will limit the amount of time that Project construction employees spend in the RAA communities and their use of services and infrastructure. GGM will use management plans, to promote positive effects and limit adverse effects of Project and employee activities on community services and infrastructure. GGM will maintain communication with the relevant agencies and organizations, including municipal authorities, health agencies and school boards, to provide Project information, to identify and address potential Project-related implications for services and infrastructure, and to support responsible organizations in planning for, adapting to, or benefitting from changing demand as a result of the Project.

Based on the potential for increased demand on services and infrastructure, and the proposed mitigation measures, it is expected that the Project contribution to cumulative effects on community services and infrastructure will be low.

**20.10.6.2 Prediction Confidence for Cumulative Effects**

Because specific information about the timing and labour requirements of the relevant projects in the RAA is not available, the extent of cumulative effects on community services and infrastructure can be made with a moderate level of confidence.

**20.11 LAND AND RESOURCE USE**

As detailed in Chapter 16.0 (LRU VC), while found not significant, the Project is anticipated to have adverse residual effects on recreational land and resource use, commercially-based LRU, and navigation. The Project is expected to result in changes in areas and access for recreational LRU as a result of the removal of trails, the imposition of access restrictions to the PDA and changes in access to recreational facilities and areas outside the PDA. Project construction will lead to a loss of area for harvesting tenure holders in the PDA and changes in access to areas located outside the PDA, such as the Crown land campsite. Changes to the Goldfield Creek channel alignment, construction of watercourse crossings and the freshwater intake and treated effluent discharge locations in Kenogamisis Lake will adversely affect navigation. Additionally, the construction of watercourse crossings, within the Southwest Arm tributary and Goldfield Creek Tributary – North Branch (downstream of Lake A-322) will introduce impediments to navigation.

As such there is potential for the residual effects of the Project to act cumulatively with residual effects of other future physical activities.

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**20.11.1 Regional Assessment Area**

As noted in Section 16.1.5.1, the RAA for LRU encompasses the LAA, and includes the RAA for surface water, fish and fish habitat, wildlife and wildlife habitat, and TLRU. The RAA is used to provide regional context for the significance of residual effects and is also the area within which potential for cumulative effects of the Project in combination with other past, present or reasonably foreseeable projects or activities are considered. The RAA is approximately 170,990 ha.

**20.11.2 Identification of Project Effects Likely to Interact Cumulatively**

Where residual environmental effects from the Project have the potential to act cumulatively with those from other projects and physical activities (Table 20-24), a cumulative effects assessment is undertaken to determine significance.

**Table 20-24: Potential Cumulative Effects on Land and Resource Use**

Other Projects and Physical Activities with Potential for Cumulative Environmental Effects	Potential Cumulative Environmental Effects		
	Change in Recreational Land and Resource Use	Change in Commercially-Based Land and Resource Use	Change in Navigation
<b>Future Physical Activities (certain and reasonably foreseeable)</b>			
Goliath Gold Mine	-	-	-
Magino Mine	-	-	-
Hammond Reef Gold Mine	-	-	-
Josephine Cone Mine	-	-	-
Bankfield West Mineral Exploration	✓	✓	-
Pickle Lake Mining Exploration	-	-	-
Junior Lake Mining Exploration	-	-	-
Ishkoday Mining Exploration	-	-	-
McCaul Twp Mining Exploration	-	-	-
Thunder Bay District Mining Exploration	-	-	-
Hemlo East Project Mining Exploration	-	-	-
McTavish Twp Aggregate	-	-	-
Proposed Geraldton Subdivision	✓	✓	-
Municipality of Greenstone Landfill	✓	✓	-
Little Jackfish Hydroelectric Development	-	-	-
Little Jackfish Transmission Line	-	-	-
TransCanada Energy East Project	✓	✓	-

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**Table 20-24: Potential Cumulative Effects on Land and Resource Use**

Other Projects and Physical Activities with Potential for Cumulative Environmental Effects	Potential Cumulative Environmental Effects		
	Change in Recreational Land and Resource Use	Change in Commercially-Based Land and Resource Use	Change in Navigation
Union Gas Pipeline	✓	✓	-
East-West Tie Transmission Project	-	-	-
Black Sturgeon River Camp 43 Dam Project	-	-	-
MNRF – FMU815 Lake Nipigon Forest	✓	✓	-
MNRF – FMU350 Kenogami Forest	✓	✓	-

NOTES:

- ✓ those "other projects and physical activities" whose residual effects are likely to interact cumulatively with Project-specific residual environmental effects.
- interactions between the adverse residual effects of other projects and the Project-specific adverse residual effects are not expected

Those future physical activities listed but not checked off in Table 20-24 represent activities that are unlikely to interact cumulatively with the Project (i.e., are either one or a combination of the following: 1) substantially geographically removed from the Project; 2) by definition their operations do not represent a potential cumulative effect pathway to the VC; 3) would be considered to have a potential spatial or temporal overlap however due to the known success of current best management and design mitigation for such projects residual effects are unlikely).

**20.11.3 Residual Cumulative Environmental Effects Description Criteria**

The residual cumulative environmental effects are characterised using the same terms and definitions as those of the residual environmental effects. Table 20-25 provides those terms and definitions as previously detailed in Section 16.1.6.

**Table 20-25: Characterization of Residual Effects on Land and Resource Use**

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Direction	The relative change compared to baseline conditions.	<b>Positive</b> — an increase in the number or extent (ha) of the areas associated with the given LRU. <b>Adverse</b> — a decrease in the number or extent (ha) of the areas associated with the given LRU.

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**Table 20-25: Characterization of Residual Effects on Land and Resource Use**

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Magnitude	The amount of change in either the measurable parameter or the VC relative to baseline conditions.	<p><b>Low</b> — the residual environmental effect will not reduce the ability to undertake the activities.</p> <p><b>Moderate</b> — the residual environmental effect will reduce the ability to undertake the activities.</p> <p><b>High</b> — the residual environmental effect will eliminate the ability to undertake the activities.</p>
Geographic Extent	The geographic area in which the residual environmental effect occurs.	<p><b>PDA</b> — the residual environmental effect is restricted to the PDA.</p> <p><b>LAA</b> — the residual environmental effect extends into the LAA.</p> <p><b>RAA</b> — the residual environmental effect extends into the RAA.</p>
Timing	Considers when the residual environmental effect is expected to occur. Timing considerations are noted in the evaluation of the residual environmental effect, where applicable or relevant.	<p><b>Not applicable (N/A)</b> — seasonal aspects are unlikely to alter the residual environmental effect on LRU.</p> <p><b>Applicable</b> — seasonal aspects may affect the residual effect on LRU.</p>
Duration	The length of time required until the residual environmental effect can no longer be measured or otherwise perceived.	<p><b>Short-term</b> — the residual environmental effect is limited to construction or active closure.</p> <p><b>Medium-term</b> — the residual environmental effect extends throughout construction, operation, and active closure.</p> <p><b>Long-term</b> — the residual environmental effect extends beyond active closure.</p>
Frequency	Identifies how often the residual environmental effect occurs within a given time.	<p><b>Single event</b> — the residual environmental effect occurs once during the Project.</p> <p><b>Multiple irregular event (no set schedule)</b> — the residual environmental effect occurs sporadically, at irregular intervals, without a predictable pattern.</p> <p><b>Multiple regular event</b> — the residual environmental effect occurs on a regular basis, and at regular intervals.</p> <p><b>Continuous</b> — the residual environmental effect occurs continuously.</p>



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**Table 20-25: Characterization of Residual Effects on Land and Resource Use**

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Reversibility	Pertains to whether a measurable parameter or the VC can return to its existing condition after the Project activity ceases.	<b>Reversible</b> — the residual environmental effect is likely to be reversed after activity ceases. <b>Irreversible</b> — the residual environmental effect is permanent and either the measurable parameter or the VC is unlikely to return to existing conditions after the activity ceases.
Ecological and Socio-economic Context	Considers uncommon characteristics or value of the area, a community and/or ecosystems that may be affected by the Project and/or whether the VC is important to the functioning of an ecosystem or community of people.	<b>Typical</b> — the VC or measurable parameter is considered common and widely available to the community. <b>Atypical</b> — the VC or measurable parameter is considered rare and is considered important to the community.

**20.11.4 Cumulative Effects Assessment for Change in Recreational Land and Resource Use**

**20.11.4.1 Cumulative Effects Mechanisms for Change in Recreational Land and Resource Use**

Cumulative effects on recreational LRU may occur as a result of a combination of both the Project and future projects. As with the Project, the future projects listed in Table 20-24 may affect recreational land and resources due to: loss or change to access to areas and sites for recreational use, loss or disruption of recreational trails, sensory disturbance, or a decrease in availability of wildlife resources.

Table 20-26 lists the potential loss of area for recreational purposes posed by the Project, the identified future projects and the combination of the Project with the future projects. While the future projects will not spatially overlap the Project, each will potentially contribute to a reduction in the availability of recreational areas in the RAA.

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**Table 20-26: Potential Cumulative Loss of Areas for Recreational Purposes in the RAA**

Project or Future Physical Activity	Regional Assessment Area (168,381 ha)
Project footprint	2,200 ha
Proportion of assessment area affected	1.3%
<b>Other Future Physical Activities</b>	
Municipality of Greenstone Landfill	4 ha
Geraldton Subdivision	24 ha
Union Gas Pipeline	72 ha
Bankfield West Mineral Exploration	17 ha
TransCanada Pipeline	209 ha
<b>Total Area for which access will be removed (including Project)</b>	2,526 ha
<b>Proportion of assessment area affected (including Project)</b>	1.5%

The area to which access for recreational activities could be either lost or interrupted, as a result of the Project in combination with future physical activities, is estimated at 2,526 ha (1.5%) of the RAA. This estimate is considered low because it excludes the area that will be used for future forestry activity during harvesting and planting. These exact areas for future forestry activities are unknown. Although forestry activity is planned at one to ten-year intervals, harvest areas often deviate from plans due to economic and biophysical factors.

Based on the nature of the future physical activities, much of the area lost in the LAA will be long-term (e.g., Municipality of Greenstone Landfill, Geraldton Subdivision) and will occur in areas that have been subject to previous disturbance from mining, forestry and development. Loss or interruption of access to areas in the RAA for recreational use will generally affect areas with lower levels of previous disturbance, with the exception of the area associated with the TransCanada Pipeline, which will occur along an existing ROW.

The Project and other future physical activities will remove areas from recreational use, and will also change access across and around these areas. This includes the removal of recreational trails. The total length of trails in the RAA that could be removed or interrupted as a result of the Project and other future physical activities (e.g., TransCanada Pipeline and Union Gas Pipeline) is 10.6 km of snowmobile trails and 1.4 km of hiking trails, which may be used for recreational uses, including snowmobiling. Forestry activity may also cause temporary disruption to the use of existing trails. The TransCanada Pipeline would overlap about 170 m of canoe portage trails.

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Cumulative effects on wildlife and wildlife habitat consist of cumulative effects on habitat and wildlife movement (Section 20.8), and have the potential to result in cumulative effects on recreational land use by decreasing the availability of wildlife resources upon which the activity depends in the RAA. Future activities interacting with the availability of wildlife resources are the Bankfield West Mineral Exploration, Municipality of Greenstone Landfill, Geraldton Subdivision, TransCanada Energy East Pipeline, Union Gas Pipeline and forestry activity. Direct losses of wildlife habitat associated with the footprints of these other future physical activities are quantified in Section 20.8.

Cumulative effects on fish habitat in Kenogamisis Lake are not anticipated (Section 20.6) and therefore the availability of fish for fishing activities is not anticipated to change. Although there may be some minor shifts in movement of fish species based on small changes in habitat, fish availability in Kenogamisis Lake will not be affected.

Cumulative effects on recreational LRU may also result from sensory disturbance to land and resource users as a result of atmospheric emissions and changes to the visual landscape. As per Section 20.3, cumulative effects on ambient air quality will result from interactions with the Geraldton Subdivision, Municipality of Greenstone Landfill and Bankfield West Mineral Exploration. The cumulative effect will result in an increase in off-property PoPC concentrations during operation; however, only total suspended particulate matter, PM<sub>10</sub> and PM<sub>2.5</sub> will exceed applicable air quality criteria, and the exceedances will be limited to areas near the modelled property boundary and will be infrequent. Section 20.3 concludes that residual cumulative effects on lighting are predicted to be not significant and confined to the LAA. Although the spatial overlap of residual effects on lighting and ambient air quality will be limited to the LAA, the sensory disturbance generated by each project separately has the potential to redistribute recreational LRU in the LAA and into the RAA. The existing visual landscape will be permanently altered to varying degrees from the Project and other future physical activities. The PDA and LAA for land and resource use include areas disturbed from previous human activity and development that have had existing effects on the viewscape. As a result, recreational land and resource users may already be accustomed to disturbed conditions, although some users may relocate to other areas in the RAA for land and resource use.

Potential cumulative effects on recreational LRU could also result from increased competition for fish and wildlife species and recreational trails. Depending on the timing of future physical activities, increased local labour demand may drive a need to hire more workers from outside the region (i.e., in-migrant workers). Potential cumulative effects are possible if the out-of-region hires for future physical activities are present at the same time as the in-migrant workers hired for Project operation (no Project-specific residual effects from competition are anticipated during construction).

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Much of the PDA and LAA overlap areas that have been subject to disturbance from previous mining and forestry activity, and current development related to Geraldton and transportation infrastructure (e.g., Highway 11). Cumulative effects would therefore largely occur in an environmental and socio-economic context with existing access constraints, potential lower abundance of wildlife resources in the LAA (due to displacement), and higher background levels of sensory disturbance to recreational land and resource users than other areas in the RAA. Recreational land and resource users may be used to practicing their activities under these disturbed conditions; however, the cumulative effects may encourage some users to seek out areas with less disturbance and more opportunities for recreational LRU outside the LAA.

### **20.11.4.2 Mitigation for Cumulative Effects of Change in Recreational Land and Resource Use**

The residual effects of the Project on recreational LRU will be managed through mitigation measures described in Section 16.4.2.2. With the application of Project mitigation and mitigation implemented by the proponents of future physical activities, foreseeable cumulative effects are expected to be effectively managed.

Cumulative effects resulting from the interaction between the Project and future physical activities will be largely managed through existing management frameworks for mineral exploration, industrial development, forestry activities, and fish and wildlife harvesting and regulations.

The Bankfield West Mineral Exploration, Municipality of Greenstone Landfill, Union Gas Pipeline and TransCanada Pipeline are subject to federal and/or provincial environmental approvals. As such these future physical activities will be required to meet regulatory criteria and apply mitigation measures to manage the adverse effects on LRU in order to receive approval. The MNRF's hunting and fishing regulations summaries and frameworks, such as the *Black Bear Management Framework* (MNR 2009e), will be the primary mechanisms to manage pressure on preferred species of fish and wildlife within the RAA, which will help to manage effects on opportunities for fishing and hunting.

It is also expected that other future physical activities will apply standard operating procedures such as limiting the extent of site clearing to the footprint of each future physical activity, implementing setbacks from sensitive fish and wildlife habitat to avoid sensory disturbance to species and reduce the loss of habitat and harvest areas, and employing standard operating procedures for heavy equipment to limit atmospheric emissions.

### **20.11.4.3 Residual Cumulative Effects for Change in Recreational Land and Resource Use**

With the mitigation described above, the residual cumulative effects (i.e., the effect of all future foreseeable activities within the RAA) on recreational LRU will include a decrease in the area of land available for hunting, loss, relocation or interruption of the use of recreational trails, displacement of wildlife in the LAA in the vicinity of the different projects and sensory disturbance to recreational land and resource users. Through provincial licensing requirements for hunters, competition for recreational LRU would be managed to acceptable levels.

These residual cumulative effects are characterized as adverse and moderate in magnitude because of the number of recreational land and resource users who may be affected. The residual cumulative effects will be long-term and irreversible due to removal of trails, loss of area associated with the Project's open pit and the establishment of the proposed Geraldton Subdivision. The frequency is expected to range from irregular (for sensory disturbance) to continuous (for loss of access to areas). Generally, the residual cumulative effects will be reversible since most residual effects of the Project and other future physical activities will cease with the end of operation and closure; however, some portion of the residual cumulative effect will also be irreversible because of the permanence of various structures. For the most part timing is not considered applicable in relation to recreational LRU, with the exception of hunting and fishing for which timing is applicable as there are specific time restrictions at certain times of the year. The ecological and socio-economic context is considered typical because hunting areas, fishing areas, recreational areas and snowmobile and hiking trails are considered common and widely available in the RAA. The Project contribution to cumulative effects is discussed in Section 20.11.7.1.

### **20.11.5 Cumulative Effects Assessment for Change in Commercially-based Land and Resource Use**

#### **20.11.5.1 Cumulative Effect Mechanisms for Change in Commercially-based Land and Resource Use**

Cumulative effects on commercially-based LRU (i.e., trapping, guide outfitting, bait harvesting and timber harvesting) may occur as a result of a combination of both the Project and future projects. As with the Project, the future projects listed in Table 20-24 may affect commercially-based LRU due to: loss of access to tenure areas for trapping, bait harvesting, guide outfitting and timber harvesting, sensory disturbance, change in availability of wildlife resources of value to commercial harvesters, and increased competition for fish and wildlife species of value.

Cumulative effects on trapping, guide outfitting and bait harvesting are related to the availability of preferred fish and wildlife species. However, these cumulative effects may affect different tenure holders differently. For example, trappers, some guide outfitters and bait harvesters cannot easily shift their harvesting areas to less disturbed areas because title must first be secured to harvest in new tenure areas. Furthermore, title to less disturbed tenure areas may not be available for purchase.

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Cumulative effects related to timber harvesting are related to the removal of planned harvest areas identified within the *Kenogami Forest Management Plan 2011-2021* (Terrace Bay Pulp 2011). Crown timber will be removed from future forest management activity and alter the sequence of planned forest management activities in the Kenogami FMU.

Table 20-27 lists the harvest tenures in the RAA that will be overlapped by both the Project and future physical activities. Although the footprints of the Project and future physical activities will not necessarily overlap, their residual effects are considered to interact cumulatively because the identified future physical activities will remove access to portions of tenure areas affected by the Project.

Potential cumulative effects are expected in trapline areas GE021 and GE022 and bear management areas GE-19-027 and GE-21A-032. The cumulative loss of accessible area will represent about 15% of trapline area GE022, 1% of bear management area GE-21A-032 and less than 1% for the other two affected tenures. These estimates exclude potential loss of area associated with future forestry activity and do not account for areas that may already be off-limits for harvesting due to existing development and access rights.

The Project and other future physical activities overlap approximately 344 ha of planned harvesting area within the Kenogami FMU for the period from 2011 to 2021. This represents less than 1% of the total planned harvest area within the FMU.

**Table 20-27: Potential Cumulative Loss of Accessible Area by Affected Tenure Area**

Project or Future Physical Activity	Area of Overlap with Trapline Areas (ha)		Area of Overlap with Bear Management Areas (ha)		Area of Overlap with Planned Forest Harvest Areas
	GE021 (15,845 ha)	GE022 (13,583 ha)	GE-19-027 (26,757 ha)	GE-21A-032 (92,285 ha)	Kenogami FMU – Planned Forest Harvest Areas 2011-2021 (149,586 ha)
Hardrock Project	20	2,173	15	1,583	342
Municipality of Greenstone Landfill	-	4	-	-	-
Geraldton Subdivision	-	24	-	-	-
Bankfield West Mineral Exploration	17	-	-	-	-
Union Gas Pipeline	-	50	-	12	-
TransCanada Pipeline*	22	-	24	-	2

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**Table 20-27: Potential Cumulative Loss of Accessible Area by Affected Tenure Area**

Project or Future Physical Activity	Area of Overlap with Trapline Areas (ha)		Area of Overlap with Bear Management Areas (ha)		Area of Overlap with Planned Forest Harvest Areas
	GE021 (15,845 ha)	GE022 (13,583 ha)	GE-19-027 (26,757 ha)	GE-21A-032 (92,285 ha)	Kenogami FMU – Planned Forest Harvest Areas 2011-2021 (149,586 ha)
Total area overlapped by tenure area (ha)	41	2,017	49	1,349	-
Proportion of tenure area affected (%) in RAA	< 1	15	<1	1	-

NOTES:

- Not present within spatial boundary
- \* Only considers the area within the LRU RAA.

The Project will remove the existing Goldfield Creek from baitfish harvesting areas NI5027 and NI5035, although the Goldfield Creek diversion will potentially add new harvesting area to NI5035. Other future physical activities will not directly remove areas of watercourses within bait harvesting areas; however, residual effects of future physical activities may interact cumulatively with those of the Project to change access to areas for harvesting. Potential cumulative effects on access may occur in bait harvesting areas NI5036, NI5035, NI5027 and NI5028.

**20.11.5.2 Mitigation for Cumulative Effects on Change in Commercially-based Land and Resource Use**

Potential cumulative effects related to changes in the availability of wildlife resources for trapping and guide outfitting, and sensory disturbance to users will be managed in much the same way as potential cumulative effects on recreational LRU.

Like the Project, future physical activities will be required to obtain the necessary approvals and permits for construction and operation from local authorities be it the MNRF, Ministry of Municipal Affairs and Housing or Municipality of Greenstone, and meeting the conditions of approvals and permits will likely require that the proponents of future physical activities implement mitigation measures to manage disturbance to other resource users. Similarly, forestry activities will be managed through existing regulations and management frameworks for forest resource tenure holders.

Project effects related to loss of access to areas within harvesting and other tenures will be managed by communicating Project activities to tenure holders and entering into negotiations with affected tenure holders. It is reasonably expected that proponents of future physical activities would also communicate activities to local stakeholders and to enter into negotiations, as appropriate. In so doing, the cumulative effects on loss of access to tenure areas will be mitigated.



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**20.11.5.3 Residual Cumulative Effects on Change in Commercially-based Land and Resource Use**

Based on past experience, the anticipated interactions between the Project and future physical activities, the small number of tenure holders affected and the effectiveness of standard mitigation measures and existing regulations and policies, the residual cumulative effect (i.e., the effect of all future foreseeable activities within the RAA) on commercially-based LRU is expected to be adverse in direction and moderate in magnitude. The frequency ranges from irregular (for sensory disturbance) and continuous (change in access). The duration is conservatively characterized as long-term (due to the Project's open pit). The residual cumulative effect is considered reversible since most effects will cease upon closure. The exception to this is change in access associated with the open pit and Goldfield Creek diversion, which are irreversible. Timing is considered applicable to a change in commercially based LRU as hunting only occurs at specific times of the year.

The residual cumulative effects will occur in an ecological and socio-economic context that is marked by a high level of development, including mining activity, forestry, residential development and transportation. The Project contribution to cumulative effects is discussed in Section 20.11.7.1.

**20.11.6 Summary of Cumulative Effects on Land and Resource Use**

A summary of the characterization of the overall cumulative environmental effects (i.e., the effect of all future foreseeable activities within the RAA) on LRU is presented in Table 20-28. The Project contribution to the overall cumulative environmental effect is discussed in Section 20.11.7.1.

**Table 20-28: Summary of Cumulative Environmental Effects on Land and Resource Use**

Case	Residual Cumulative Environmental Effects Characterization							
	Direction	Magnitude	Geographic Extent	Timing	Frequency	Duration	Reversibility	Ecological and Socio-economic Context
<b>Cumulative Change in Recreational Land and Resource Use</b>								
Cumulative environmental effect with the Project	Adverse	Moderate	RAA	N/A	Continuous	Long-term	Irreversible	Typical
<b>Cumulative Change in Commercially-Based Land and Resource Use</b>								
Cumulative environmental effect with the Project	Adverse	Moderate	RAA	Applicable	Continuous	Long-term	Irreversible	Typical

NOTE:

See Table 20-25 for detailed definitions.

### **20.11.7 Significance of Residual Cumulative Effects**

The residual cumulative effects on recreational LRU are expected to be moderate in magnitude and will result in a loss of area for recreational use that is equivalent to 1.5% of the RAA. The residual cumulative effects consist of loss of accessible area, interruptions to trail use, changes in the availability of wildlife resources and sensory disturbance to resource users. Recreational LRU may be degraded in the LAA as a result. However, as a result of previous mining, forestry and urban and infrastructure development, recreational users are already accustomed to the types of disturbance that will result from the interaction of the Project and the identified future physical activities. Given the existing level of disturbance in the LAA, the abundance of wildlife resources and recreational opportunities in the RAA, the residual cumulative effects are not anticipated to affect the long-term viability of recreational LRU and therefore are predicted to be not significant.

Residual cumulative effects will remove area and change access to trapping, guide outfitting and bait harvesting areas. They will also affect harvesting activity through changes as a result of the displacement of wildlife resources and sensory disturbance to users, similarly to the cumulative effects on recreational LRU. The residual cumulative effects will affect a small number of commercially-based land and resource users differently. Considering the mitigation discussed above, the existing levels of disturbance, the size of tenure areas and access options, and the relatively low level of disturbance to harvesting activities in the RAA, the residual cumulative effects are not anticipated to affect the long-term viability of commercially-based LRU and are therefore are predicted to be not significant.

#### **20.11.7.1 Project Contribution to Cumulative Effects**

As discussed in Chapter 16.0 (LRU VC), the Project's residual effects will range from low to moderate in magnitude, mainly as a function of the relative number of land and resource users who will be affected. The residual effects will range from a single event to continuous in frequency and many will occur over the long-term, extending beyond closure. In most areas, effects will be reversible, with the exception of areas around the open pit and Goldfield Creek diversion, where effects will be long-term and irreversible. The Project's contribution to residual cumulative effects will be limited to the PDA and LAA. The residual effects of the Project will largely occur in an area that has been disturbed by previous mining, forestry and development activity and the continued presence of Geraldton and Highway 11.

As indicated in Table 20-27 the Project will account for most of the loss of access to areas for recreational use in the LAA and RAA. Only future forestry activity may account for a larger area; however, data are unavailable and forestry activity is not included in estimates of the cumulative effect. Compared to the TransCanada Pipeline, which would also affect access over a large area, the changes in area and access associated with the Project would be mainly long-term. The Project will contribute to the loss of recreational trails, primarily snowmobile trails within the RAA. However, as noted in Section 16.4.2.3, the snowmobile trails in question have not been used or maintained in recent years.

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The Project will also drive the cumulative effect related to the loss of access to areas in trapline area GE022 and in bear management area GE-21A-032. In trapline area GE022 the Project will account for 2,173 ha of the area removed cumulatively, leaving approximately 11,410 ha available for use. In Bear Management Area GE-21A-032, the Project will account for 1,583 ha of the area removed cumulatively, leaving approximately 90,702 ha available for use. Again, this estimate excludes the potential contribution of future forestry activity. Although the Project contributes most to the cumulative change in the trapline and Bear Management Area in relation to other future activities, there will be a cumulative reduction of 15% for the trapline and 1% for the Bear Management Area.

### **20.11.7.2 Prediction Confidence for Cumulative Effects**

The level of confidence for predicted cumulative effects on LRU is considered moderate based on the available information describing baseline conditions, the assessment team's thorough understanding of Project effects, the effects of future physical activities and the current and future application of statutory requirements and/or management objectives to mitigate effects of the Project and future physical activities.

## **20.12 TRADITIONAL LAND AND RESOURCE USE**

As detailed in Chapter 18.0 (TLRU VC), while found not significant, the Project is anticipated to have a localized adverse residual effect on: plant species and plant harvesting sites and activities; fish species and fishing areas and activities; hunted and trapped species and hunting and trapping areas and activities; and cultural or spiritual practices, sites or areas. As such there is potential for the residual effects of the Project to act cumulatively with residual effects of other future physical activities.

### **20.12.1 Regional Assessment Area**

As noted in Section 18.1.5.1 the RAA aligns with the RAA selected for the surface water assessment due to Aboriginal use and reliance on waterways in the area as described by LLFN in the "Traditional Knowledge Assessment Related to the Premier Gold Mines Hardrock Project: prepared for Long Lake #58 First Nation" (LLFN TK Assessment; Appendix J1), MNO in "Métis Nation of Ontario - Traditional Knowledge and Land Use Study for the Hardrock Project: Lakehead/Nipigon/Michipicoten Traditional Territories" (MNO TKLU Study; Appendix J3) and PPFN (Toupee Lake) in "Pays Plat First Nation Watershed Study for Greenstone Gold Mines" (PPFN Watershed Study; Appendix J4). The RAA extends downstream from the Kenogamis Lake Dam to the discharge point of the Kenogami River to Long Lake at Crib Road and northeast to the Kenogami Diversion Dam. This drainage area forms the basis for the assessment of the terrestrial area of current use. The RAA is used to provide regional context for the significance of residual effects and is also the area within which potential for cumulative effects of the Project in combination with other past, present, or reasonably foreseeable projects or activities are considered. The RAA is approximately 133,780 ha in size.

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Where site-specific TLRU information is available, TLRU sites that fall within the spatial boundaries of the TLRU assessment are identified.

**20.12.2 Identification of Project Effects Likely to Interact Cumulatively**

Two conditions were used to determine which VCs would be carried forward for an assessment of cumulative effects in the Final EIS/EA: 1) that there are adverse residual effects identified for the VC in question; and 2) that the residual environmental effects of the Project are likely to interact cumulatively with the residual environmental effects from other reasonably foreseeable future projects or activities. Based on these criteria, the other VCs that have linkages to TLRU are identified in Table 20-29. Information from those assessments has been used to inform this assessment of cumulative effects on TLRU.

**Table 20-29: VCs that have Linkages to Traditional Land and Resource Use**

Potential Effect	Valued Component			
	Wildlife and Wildlife Habitat	Vegetation Communities	Atmospheric Environment	Land and Resource Use
Change to Availability of Plant Species and Access to Plant Harvesting Sites and Activities	-	✓	✓	✓
Change to Availability of Fish Species and Access to Fishing Areas and Activities	-	-	✓	✓
Change to Availability of Hunted and Trapped Species and Access to Hunting and Trapping Areas and Activities	✓	-	✓	✓
Change to Availability of and Access to Cultural or Spiritual Practices, Sites or Areas	-	-	✓	✓

NOTES:

- ✓ VCs that have a linkage to the potential effect.
- VCs that do not have a linkage to the potential effect

Table 20-1 presents the Project and physical activities inclusion list, which identifies other projects and physical activities that have the potential to act cumulatively with the Project. Where residual environmental effects of the Project on TLRU act cumulatively with those from other projects and physical activities (Table 20-30), a cumulative effects assessment has been undertaken to determine their residual effects and significance.

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**Table 20-30: Potential Cumulative Effects Traditional Land and Resource Use**

Other Projects and Physical Activities with Potential for Cumulative Environmental Effects	Potential Cumulative Environmental Effects			
	Change to Availability of Plant Species and Access to Plant Harvesting Sites and Activities	Change to Availability of Fish Species and Access to Fishing Areas and Activities	Change to Availability of Hunted and Trapped Species and Access to Hunting and Trapping Areas and Activities	Change to Availability of and Access to Cultural or Spiritual Practices, Sites or Areas
<b>Future Physical Activities (certain and reasonably foreseeable)</b>				
Goliath Gold Mine	-	-	-	-
Magino Mine	-	-	-	-
Hammond Reef Gold Mine	-	-	-	-
Josephine Cone Mine	-	-	-	-
Bankfield West Mineral Exploration	✓	✓	✓	✓
Pickle Lake Mining Exploration	-	-	-	-
Junior Lake Mining Exploration	-	-	-	-
Ishkoday Mining Exploration	-	-	-	-
McCaul Twp Mining Exploration	-	-	-	-
Thunder Bay District Mining Exploration	-	-	-	-
Hemlo East Project Mining Exploration	-	-	-	-
McTavish Twp Aggregate	-	-	-	-
Proposed Geraldton Subdivision	✓	✓	✓	✓
Municipality of Greenstone Landfill	-	-	-	-
Little Jackfish Hydroelectric Development	-	-	-	-
Little Jackfish Transmission Line	-	-	-	-
TransCanada Energy East Project	✓	✓	✓	✓
Union Gas Pipeline	✓	✓	✓	✓
East-West Tie Transmission Project	✓	✓	✓	✓
Black Sturgeon River Camp 43 Dam Project	-	-	-	-
MNRF – FMU815 Lake Nipigon Forest	✓	✓	✓	✓
MNRF – FMU350 Kenogami Forest	✓	✓	✓	✓

NOTES:

- ✓ those "other projects and physical activities" whose residual effects are likely to interact cumulatively with Project-specific residual environmental effects.
- interactions between the adverse residual effects of other projects and the Project-specific adverse residual effects are not expected

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Those future physical activities listed but not checked off in Table 20-30 represent activities that are unlikely to interact cumulatively with the Project (i.e., are either one or a combination of the following: 1) substantially geographically removed from the Project; 2) by definition their operations do not represent a potential cumulative effect pathway to the VC; 3) would be considered to have a potential spatial or temporal overlap; however, due to the known success of conventional mitigation for such projects residual effects are unlikely).

**20.12.3 Residual Cumulative Environmental Effects Description Criteria**

The residual cumulative environmental effects are characterised using the same terms and definitions as those of the residual environmental effects. Table 20-31 provides those terms and definitions as previously detailed in Section 18.1.6.

**Table 20-31: Characterization of Residual Environmental Effects on Traditional Land and Resource Use**

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Direction	The relative change compared to baseline conditions.	<b>Positive</b> — an increase in availability of and access to TLRU relative to baseline conditions. <b>Adverse</b> — a decrease in availability of and access to TLRU relative to baseline conditions.
Magnitude	The amount of change in either the measurable parameters or the VC relative to baseline conditions.	<b>Low</b> — the residual environmental effect will not reduce the ability to undertake the activities. <b>Moderate</b> — the residual environmental effect will reduce the ability to undertake TLRU activities. <b>High</b> — the residual environmental effect will eliminate TLRU.
Geographic Extent	The geographic area in which the residual environmental effect occurs.	<b>PDA</b> — the residual environmental effect is restricted to the PDA. <b>LAA</b> — the residual environmental effect extends into the LAA. <b>RAA</b> — the residual environmental effect extends into the RAA.
Timing	Considers when the residual environmental effect is expected to occur. Timing considerations are noted in the evaluation of the environmental effect, where applicable or relevant.	<b>Not applicable (N/A)</b> — seasonal aspects are unlikely to alter the residual environmental effect on TLRU. <b>Applicable</b> — seasonal aspects may alter the residual environmental effect on TLRU.

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**Table 20-31: Characterization of Residual Environmental Effects on Traditional Land and Resource Use**

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Frequency	Identifies how often the residual environmental effect occurs within a given time.	<p><b>Single event</b> — the residual environmental effect occurs once during the Project.</p> <p><b>Multiple irregular event (no set schedule)</b> — the residual environmental effect occurs at irregular intervals throughout the life of Project.</p> <p><b>Multiple regular event</b> — the residual environmental effect occurs on a regular basis and at regular intervals throughout the life of Project.</p> <p><b>Continuous</b> — the residual environmental effect occurs continuously throughout the life of the Project.</p>
Duration	The length of time required until the residual environmental effect can no longer be measured or otherwise perceived.	<p><b>Short-term</b> — the residual environmental effect is limited to construction or active closure).</p> <p><b>Medium-term</b> — the residual environmental effect extends throughout construction, operation, and active closure.</p> <p><b>Long-term</b> — the residual environmental effect extends beyond active closure</p>
Reversibility	Pertains to whether a measurable parameter or the VC can return to its baseline condition after the Project activity ceases	<p><b>Reversible</b> — the residual environmental effect is likely to be reversed after the activity ceases.</p> <p><b>Irreversible</b> — the residual environmental effect is permanent and either the measurable parameter of the VC is unlikely to return to baseline conditions after the activity ceases.</p>
Ecological and Socio-economic Context	Considers uncommon characteristics of the area, a community and/or ecosystems that may be affected by the Project and/or whether the VC or measurable parameter is important to the functioning of an ecosystem or community of people.	<p><b>Typical</b> — the VC or measurable parameter is considered common and/or is considered not important to the functioning of the community.</p> <p><b>Atypical</b> — the VC or measurable parameter is considered uncommon and/or is considered important to the functioning of the community.</p>



## **20.12.4 Cumulative Effect Assessment for Change in Traditional Land and Resource Use**

### **20.12.4.1 Cumulative Effect Mechanisms for Change in Traditional Land and Resource Use**

The Project has the potential to contribute to cumulative effects on the distribution, abundance and health of the resources and access to the sites and locations that are relied upon for activities related to TLRU. For the purposes of this assessment, potential cumulative Project effects have been considered collectively as cumulative effects on TLRU for: availability of plant species and access to plant harvesting sites and activities; availability of fish species and access to fishing areas; availability of hunted and trapped species and access to hunting and trapping areas; and availability of and access to cultural or spiritual practices, sites or areas. This approach has been taken because the cumulative effects are predicted to be similar for each of the Project effects identified in Chapter 18.0 (TLRU VC). For instance, the effects of development on the ability to access TLRU sites is similar for plant harvesting as it is for fishing, hunting, and trapping.

TLRU activities and practices associated with plant harvesting, fishing, hunting and trapping, and cultural or spiritual sites or areas within the RAA were identified through the project-specific studies and other relevant sources of information. Additional information has been shared during Project consultation activities. Various TLRU sites and areas were acknowledged to be within the PDA, LAA, and RAA, although specific locations were not disclosed for all TLRU activities. Cumulative effects on TLRU areas may occur where Aboriginal people move across the landscape.

Assessment of the cumulative effects identified for the VCs related to TLRU are provided in Sections 20.3, 20.7, 20.8 and 20.11:

- The atmospheric environment cumulative effects assessment (Section 20.3) determined that Project-specific residual effects are likely to interact with environmental effects from other projects. Cumulative residual environmental effects are anticipated on air quality, GHG emissions, and lighting.
- The vegetation communities cumulative effects assessment (Section 20.7) concluded that in considering the full extent of vegetated area as potential habitat for species of interest to Aboriginal communities, the cumulative loss of vegetation is 1% from cumulative effects attributable to the Project and the reasonably foreseeable future projects. The area of land disturbed by the Project will therefore be relatively small compared to the amount of available undisturbed land within the RAA.

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- The wildlife and wildlife habitat cumulative effects assessment (Section 20.8) identified cumulative effects for change in habitat, change in mortality risk, and change in wildlife movement within the RAA. While the Project and future activities will contribute to change in habitat within the RAA, primarily through vegetation clearing, the overall cumulative effect on habitat loss within the RAA is considered to be not significant. With respect to change in mortality risk, the primary cumulative environmental effect mechanisms are vegetation and overburden clearing, traffic, and adverse human-wildlife encounters. However, the contributions of future physical activities to change in mortality risk are predicted to be minor relative to the existing condition. For change in wildlife movement, human development within the RAA has resulted in habitat fragmentation and an associated disruption and alteration of movement patterns. There may be localized effects on the movements of some species, but hunted and trapped wildlife species are highly mobile and are able to adjust their movement patterns in response to changes in habitat configuration. Overall, the Project and future activities are not anticipated to contribute substantially to change in habitat, change in mortality risk, and change in movement and is not predicted to compromise the sustainability of wildlife and wildlife habitat within the RAA.
- The LRU cumulative effects assessment (Section 20.11) determined that there are Project-specific residual effects that are likely to interact with environmental effects from other projects. Residual effects for change in recreational land include loss or change to access to areas and sites for recreational use, sensory disturbance, decrease in availability of wildlife resources. This assessment notes that the PDA and LAA are sites of previous activity and development that have had existing effects on access, wildlife resources, and sensory disturbance. As a result, recreational land and resource users may already be accustomed to disturbed conditions although some users may relocate to other areas in the RAA. With respect to residual cumulative effects on change in commercially-based LRU, these are related to access, availability and competition for wildlife resources, and sensory disturbance. Overall, both recreational and commercially-based LRU is predicted to be adversely affected within the RAA. However, given the existing disturbance within the LAA and the abundance and diversity of wildlife populations within the RAA, the effects on recreational land users are not significant.

### **20.12.4.2 Mitigation for Cumulative Effects Change in Traditional Land and Resource Use**

Several mitigation measures have been incorporated in the Project, to reduce or eliminate effects on VCs that are relied upon for TLRU activities. Detailed descriptions of the relevant mitigation measures are provided in Chapter 7.0 (atmospheric environment VC), Chapter 11.0 (fish and fish habitat VC), Chapter 12.0 (vegetation communities VC), Chapter 13.0 (wildlife and wildlife habitat VC), and Chapter 16.0 (LRU VC). In addition to these mitigation measures, GGM will incorporate plant species of interest to Aboriginal communities into the Closure Plan as feasible and where there is interest, GGM will provide opportunities to local communities for harvesting of plants for traditional purposes prior to construction. GGM will implement detailed recording and mapping of spiritual or cultural sites in partnership with Aboriginal community

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representatives, a decision is then made about the relative importance of the site and, if warranted, how to maintain and control access. Also, a Pipe Ceremony will be held prior to commencement of construction under the direction of local Aboriginal communities.

**20.12.4.3 Residual Cumulative Effects for Change in Traditional Land and Resource Use**

Lands within the RAA have experienced disturbances as a result of mining, forestry, and human settlement. The Project is located on both brownfield and relatively undisturbed land, and existing land uses in and around the PDA include urban, rural and recreational uses.

Taking the conservative approach, the movement by Aboriginal harvesters will effectively tie together effects on TLRU sites across the RAA and therefore cumulative effects can be assumed to occur throughout the assessment area. For example, Aboriginal harvesters who travel through the RAA on traplines or to berry picking sites may be displaced from preferred sites and areas within the LAA to sites and areas within the RAA that may be affected by future and planned activities.

This assessment relies on Project-specific TLRU information and the cumulative effects assessments of other VCs that have linkages to TLRU. Although assessed as not significant, adverse cumulative effects were identified for the VCs on which the activities of TLRU rely. As a result, resources and TLRU areas that are not anticipated to experience residual effects may be subject to increased usage:

- Effects on air quality and lighting may result in indirect sensory disturbance to Aboriginal land users; however, residual environmental effects and the overall effect on atmospheric environment within the RAA is considered to be not significant because the adverse residual cumulative effects on atmospheric environment are not predicted to compromise the sustainability of TLRU within the RAA.
- Clearing of vegetation from past, present, and future projects combined with the Project's clearing during construction will result in an incremental loss of plant species of interest to Aboriginal communities. These species, however, are widely distributed and the viability and distribution of populations of these species are not expected to be adversely affected in the RAA. The Project will act cumulatively with other reasonably foreseeable future projects to result in a loss of vegetation communities. However, these losses represent a small proportion of each resource within the RAA and are not predicted to compromise the sustainability of TLRU within the RAA.
- While the Project and future activities will contribute to change in wildlife and wildlife habitat within the RAA, overall, the Project and future activities are not anticipated to contribute substantially to change in habitat, change in mortality risk, and change in movement and is not predicted to compromise the sustainability of wildlife and wildlife habitat within the RAA. Changes to wildlife and wildlife habitat in the RAA will result in effects on wildlife species of interest to Aboriginal communities, but are not predicted to compromise the sustainability of TLRU within the RAA.

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- Residual cumulative effects on recreation and commercially-based LRU are related to access, availability and competition for fishing, hunting, and trapping sites and areas, and sensory disturbance to users. Overall, both recreational and commercially-based LRU is predicted to be adversely affected within the RAA. However, given the existing disturbance within the LAA and the abundance and diversity of wildlife populations within the RAA, the effects on land users are not significant. Change in land and resource use applicable to TLRU include effects on hunting, fishing, trapping, and navigation. Changes to the availability and access to areas used for these activities are not predicted to compromise the sustainability of TLRU within the RAA.

The removal of traditional resources within the RAA, or the decrease in access to these resources, subsequently causes greater pressure on nearby harvesting areas as people move elsewhere to hunt, trap, fish, gather plants or participate in cultural or spiritual practices. As a result, TLRU sites and resources may be subject to more intensive use by Aboriginal and recreational users.

Overall, the cumulative effects on TLRU are predicted to be adverse in direction, extend to the RAA, be continuous in frequency and be both long-term and irreversible, as several of the VCs that influence TLRU will also experience adverse local effects that are continuous and long-term in duration. The overall cumulative effect with the Project will be moderate in magnitude because the residual environmental effects will reduce the ability to undertake TLRU activities. Timing is considered not applicable as seasonal aspects are unlikely to alter the residual cumulative effect on TLRU. The ecological and socio-economic context is considered typical for hunting and trapping, fishing, plant species of interest to Aboriginal communities and/or plant harvesting sites are considered to be abundant within the LAA and RAA. The context for cultural or spiritual sites or areas is considered atypical, as these sites are valued and important to the functioning of the community.

### **20.12.5 Summary of Cumulative Effects on Traditional Land and Resource Use**

A summary of the characterization of the overall cumulative environmental effect (i.e., the effect of all future foreseeable activities within the RAA) on TLRU is presented in Table 20-32. The Project contribution to the overall cumulative environmental effect is discussed in Section 20.12.6.1.

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**Table 20-32: Summary of Cumulative effects on Traditional Land and Resource Use**

Case	Residual Cumulative Effects Characterization							
	Direction	Magnitude	Geographic Extent	Timing	Frequency	Duration	Reversibility	Ecological and Socio-economic Context
<b>Cumulative Change In TLRU</b>								
Cumulative environmental effect with the Project	Adverse	Moderate	RAA	N/A	Continuous	Long-term	Irreversible	Atypical

NOTE:  
See Table 20-31 for detailed definitions.

**20.12.6 Significance of Residual Cumulative Effects**

When future project effects on the landscape are considered, the Project's contributions to cumulative effects on TLRU are not anticipated to reduce the ability of Aboriginal peoples to pursue TLRU activities within the RAA. Considering the cumulative effects assessments for VCs related to TLRU and the characterization of residual effects, the cumulative effects on TLRU will be not significant.

**20.12.6.1 Project Contribution to Cumulative Effects**

Adverse cumulative effects were identified for the VCs on which TLRU activities rely. However, in each of these instances, the Project's contribution to cumulative effects was predicted to be manageable with the application of mitigation. Therefore, when future project effects on the landscape are considered, the Project's contributions to cumulative effects on TLRU are anticipated to be low.

**20.12.6.2 Prediction Confidence for Cumulative Effects**

Using the results of other VC assessments and the findings of TK studies submitted for the Project and in keeping with the conservative approach to assessment, confidence in the assessment of effects on TLRU is moderate, reflecting the project specific TLRU information available at the time of application submission. GGM will review the results of TK information received from local Aboriginal communities after submission of the Final EIS/EA against the conclusions of the Final EIS/EA to determine whether additional mitigation is required with respect to Project design and EMMPs.

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## **20.13 REFERENCES**

- BOT Construction Group. 2010. Highway Contract MTO 2010 – 6003 Thunder Bay. Available at [http://www.botconstruction.ca/pdf\\_projects/BPP\\_2010-6003.pdf](http://www.botconstruction.ca/pdf_projects/BPP_2010-6003.pdf). Accessed: June 23, 2015.
- Canadian Environmental Assessment Agency (CEA Agency). 2014. Technical Guidance for Assessing Cumulative effects under the Canadian Environmental Assessment Act, 2012. Available at: <http://www.ceaa.gc.ca>.
- Canadian Environmental Assessment Agency (CEA Agency). 2015. Assessing Cumulative effects under the Canadian Environmental Assessment Act, 2012. Available at: <http://www.ceaa.gc.ca>.
- Committee on the Status of Endangered Wildlife in Canada. 2012. COSEWIC Assessment and Status Report on the Eastern Wood-pewee *Contopus virens* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. x + 39 pp.
- Environment Canada. 2012. Recovery Strategy for the Woodland Caribou (*Rangifer tarandus caribou*), Boreal population, in Canada. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa. xi + 138 pp.
- Environment Canada. 2015a. Recovery Strategy for Canada Warbler (*Cardellina canadensis*) in Canada [Proposed]. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa. vi + 55 pp.
- Environment Canada. 2015b. Recovery Strategy for the Common Nighthawk (*Chordeiles minor*) in Canada [Proposed]. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa. vi + 48 pp.
- Federal-Provincial-Territorial Committee on Climate Change and Environmental Assessment. 2003. Incorporating Climate Change Considerations in Environmental Assessment: General Guidance for Practitioners. November 2003.
- Grant Thornton. 2014. Consolidated Financial Statements The Corporation of the Municipality of Greenstone. December 31, 2013. Available at: <http://www.greenstone.ca/sites/greenstone.civicwebcms.com/files/media/2013%20FINAL%20Greenstone%20FS.pdf>. Accessed May 28, 2015.
- Hegmann, G., Cocklin, C., Creasey, R., Dupuis, S., Kennedy, A., Kingsley, L., Ross, W., Spaling, H., and Stalker, D. 1999. Cumulative Effects Assessment Practitioners Guide. Prepared by AXYS Environmental Consulting Ltd, and the CEA Working Group for the Canadian Environmental Assessment Agency, Hull. Quebec.

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Intergovernmental Panel on Climate Change. 2013. Climate Change 2013: The Physical Science Basis. Available at: <http://www.ipcc.ch/report/ar5/wg1/>.

Invest in Greenstone. 2014. Demographics. Available at:  
<http://www.investingreenstone.ca/demographics-c15.php>. Accessed: January 27, 2014.

Lake Nipigon Forest Management Inc. 2011. Lake Nipigon Forest 2011–2021 Forest Management Plan. Available at:  
<http://www.efmp.lrc.gov.on.ca/eFMP/viewFmuPlan.do?fmu=815&fid=100100&type=CURRENT&pid=100100&sid=8806&pn=FP&ppyf=2011&ppyt=2021&ptyf=2011&ptyt=2016&phase=P1>.

Landore Resources. 2015. Annual Report 2014. Available at: [http://www.landore.com/pdf/AR-2014-Landore\\_Resources\\_Annual\\_Report.pdf](http://www.landore.com/pdf/AR-2014-Landore_Resources_Annual_Report.pdf).

Laurion Mineral Exploration Inc. 2015. Financial Statements for Years Ended December 31, 2014 and 2013. Available at: <http://www.laurion.ca/i/pdf/2014-YE-FS.pdf>.

Ministry of Natural Resources (MNR). 2009a. Ecological Land Classification field manual – operational draft, April 20, 2009. Ecological Land Classification Working Group, Ontario. Unpublished manual.

Ministry of Natural Resources (MNR). 2009b. Ontario's Woodland Caribou Conservation Plan. 24 pp.

Ministry of Natural Resources (MNR). 2009c. Cervid Ecological Framework. Available at:  
<https://dr6j45jk9xcmk.cloudfront.net/documents/3086/263997.pdf>.

Ministry of Natural Resources (MNR). 2009d. Moose Management Policy. Available at:  
<https://dr6j45jk9xcmk.cloudfront.net/documents/3083/263991.pdf>.

Ministry of Natural Resources (MNR). 2009e. Black Bear Management Framework. Available at:  
<https://dr6j45jk9xcmk.cloudfront.net/documents/3087/274504.pdf>.

Ministry of Natural Resources (MNR). 2010a. Natural Heritage Reference Manual for Natural Heritage Policies of the Provincial Policy Statement, 2005. Second Edition. Toronto: Queens Printer for Ontario. 233 pp.

Ministry of Natural Resources (MNR). 2010b. Forest Management Guide for Conserving Biodiversity at the Stand and Site Scales. Toronto: Queen's Printer for Ontario. 211 pp.

Ministry of Natural Resources (MNR). 2012. A guide to translate northwestern Ontario ecosites into "Ecosites of Ontario". Science and Information Services Division, Science and Information Branch. NWSI Tech. Note TN-48.



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Ministry of Natural Resources and Forestry (MNRF). 2014a. Moose Survey Results by Region. News Release, April 16, 2014, 1:45 PM. Available at:  
<https://news.ontario.ca/mnr/en/2014/04/moose-survey-results-by-region.html>.

Ministry of Natural Resources and Forestry (MNRF). 2014b. Moose Resource Report Wildlife Management Unit 21A. Available at: [http://files.ontario.ca/environment-and-energy/fish-and-wildlife/Moose-Resource-Report-WMU-21A\\_2014.pdf](http://files.ontario.ca/environment-and-energy/fish-and-wildlife/Moose-Resource-Report-WMU-21A_2014.pdf).

Ministry of Natural Resources and Forestry (MNRF). 2014c. Moose Resource Report Wildlife Management Unit 19. Available at: [http://files.ontario.ca/environment-and-energy/fish-and-wildlife/Moose-Resource-Report-WMU-19\\_2014.pdf](http://files.ontario.ca/environment-and-energy/fish-and-wildlife/Moose-Resource-Report-WMU-19_2014.pdf).

Ministry of Natural Resources and Forestry (MNRF). 2015. Ontario's White-nose Syndrome Response Plan. 22 pp. Available at:  
<https://dr6j45jk9xcmk.cloudfront.net/documents/4614/ontario-wns-response-plan-final-april-14-2015.pdf>.

Municipality of Greenstone. 2015. Public Meeting Agenda – Council Meeting held on April 13, 2015. Available at:  
<https://greenstone.civicweb.net/document/12704/Public%20Meeting%20-%2013%20Apr%202015.pdf?handle=926ED98FDFC84DDAB3DA524EEB037370>.

Namewaminikan Hydro Inc. 2011. Poster 31\_Socio-Economic Benefits. Available at:  
[http://namewaminikanhydro.com/POSTER%2031\\_SOCIO-COMMUNITY%20BENEFITS.pdf](http://namewaminikanhydro.com/POSTER%2031_SOCIO-COMMUNITY%20BENEFITS.pdf).

Natural Heritage Information Centre (NHIC). 2014. Natural Areas and Species records search. Available at: <http://www.ontario.ca/environment-and-energy/get-natural-heritage-information>.

Nexbridge Infrastructure. 2015. Letter to Ontario Energy Board dated May 15, 2015, Available at:  
[http://www.nextbridge.ca/files/NextBridge\\_EWT\\_Response%20to%2020150122%20Decision%20and%20Order\\_20150515.pdf](http://www.nextbridge.ca/files/NextBridge_EWT_Response%20to%2020150122%20Decision%20and%20Order_20150515.pdf).

Ontario Power Generation. 2012. Little Jackfish River Hydroelectric Project Purpose of this Open House. Available at: [http://www.opg.com/generating-power/hydro/projects/little-jackfish/Documents/LJF\\_Open\\_House%20Panels\\_2012.pdf](http://www.opg.com/generating-power/hydro/projects/little-jackfish/Documents/LJF_Open_House%20Panels_2012.pdf). Accessed: June 23, 2015.

Ontario Wolverine Recovery Team. 2013. Recovery Strategy for the Wolverine (*Gulo gulo*) in Ontario. Ontario Recovery Strategy Series. Prepared for the Ontario Ministry of Natural Resources, Peterborough, Ontario. vi + 66 pp.

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Premier Gold Mines Limited. 2014. Premier Gold Identifies Prospective Open Pit Target Near Hardrock. Press release, April 23, 2014. Available at:  
<http://www.premiergoldmines.com/news/press-releases/00-00-premier-gold-identifies-prospective-open-pit-targets-near-hardrock-648961>.

Statistics Canada. 2012. 2011 Census Profiles. Available at: <http://www12.statcan.gc.ca/census-recensement/2011/dp-pd/prof/index.cfm?Lang=E>. Accessed: January 27, 2014.

Statistics Canada. 2013. National Household Survey Profiles, 2011. Available at:  
<http://www12.statcan.gc.ca/nhs-enm/2011/dp-pd/prof/index.cfm?Lang=E>. Accessed: March 24, 2015.

Terrace Bay Pulp. 2011. Kenogami Forest 2011–2021 Forest Management Plan. Available at:  
<http://www.efmp.lrc.gov.on.ca/eFMP/viewFmuPlan.do?fmu=350&fid=58916&type=CURRENT&pid=58916&sid=11118&pn=FP&ppyf=2011&ppyt=2021&ptyf=2011&ptyt=2016&phase=P1>.

TransCanada Corporation. 2015. TransCanada Energy East Pipeline. Available at:  
<http://www.energyeastpipeline.com/>.