KGHM

Victoria Mine Project – Project Description Report

47VP-047700-003-RPT-0001

May 1, 2019

Table of Contents

1. General Information and Contact(s) 7

1.1 Project Overview 7
1.2 Proponent Information 13
1.2.1 Project Name 13
1.2.2 Proponent Name 13
1.2.3 Proponent Address 13
1.2.4 President and Chief Executive Office (or equivalent) 13
1.2.5 Victoria Project Manager 14
1.2.6 Principal Contact 14
1.3 Project Consultation Overview 14
1.4 Environmental Assessment and Regulatory Requirements 16
1.5 Regional Environmental Studies 22
1.6 References 22

2. Project Information 23

2.1 Project Description 23
2.1.1 Location, Land Tenure and Mineral Rights 26
2.1.2 General Arrangement of Facilities and Related Infrastructure (Other Proponents) 26
2.2 Designated Physical Activities 31
2.3 Components and Activities 31
2.3.1 Physical Works 31
2.3.1.1 Use of Offsite Existing Infrastructure/Facilities 34
2.3.1.2 Proposed Facilities and Infrastructure 35
2.3.2 Production Capacity 36
2.3.3 Expansion Scope 36
2.3.4 Description of Project Activities 36
2.3.5 Mining Method 36
2.3.5.1 Drilling and Blasting 37
2.3.5.2 Hoisting 37
2.3.5.3 Mine Product and Waste Rock Crushing, Handling and Transportation 38
2.3.5.4 Labour 38
2.3.5.5 Procurement of Goods and Services 38
2.4 Emissions, Discharges and Waste 38
2.4.1 Atmospheric Emissions 38
2.4.1.1 Point Source and Fugitive Emissions 38
2.4.1.2 Greenhouse Gas Emissions 40
2.4.1.3 Noise Emissions 44
2.4.2 Liquid Discharges 44
2.4.2.1 Water Management and Treatment 44
2.4.2.2 Sewage Treatment and Disposal 44
2.4.3 Waste Management 45
2.4.3.1 Non-Hazardous and Hazardous 45

2.4.3.2 Waste Rock 45
2.5 Project Phases and Scheduling 46
2.5.1 Scheduling 46
2.5.2 Main Activities 46
2.6 Alternatives 48
2.6.1 Alternatives to the Project 48
2.6.2 The "No Project" Alternative 48
2.6.3 Approach to Project Planning 49
2.6.4 Alternative Means of Carrying Out the Project 49
2.7 References 49

3. Project Location 50

3.1 Description of Project Location 50
3.1.1 Project Coordinates 50
3.1.2 Site Plan 50
3.1.3 Maps of Project Components in Relation to Existing Features 50
3.1.4 Proximity to Other Features 56
3.2 Land and Water Use 57
3.2.1 Zoning Designations 57
3.2.2 Legal Description 57
3.2.3 Relevant Land and Resources Management Plans 59
3.2.4 Use of Traditional Indigenous Lands 62
3.3 References 64

4. Federal Involvement 65

4.1 Federal Financial Support 65
4.2 Federal Lands 65
4.3 Federal Approvals and Authorizations 65

5. Environmental Effects 66

5.1 Environmental Effects Analysis 66
5.1.1 Existing Conditions 66
5.1.1.1 Atmospheric Environment 66
5.1.1.2 Surface Water Quality 67
5.1.1.3 Groundwater Quantity 68
5.1.1.4 Fish and Fish Habitat 69
5.1.1.5 Terrestrial Habitat 69
5.1.1.6 Archaeological Resources 70
5.1.1.7 Residential and Recreational Land Use 71
5.1.1.8 Community Services and Infrastructure 72
5.1.1.9 Employment and Business 73
5.2 Effects Assessment 74
5.3 Key Adverse Environmental Effects, Mitigations and Key Benefits 79
5.3.1 Atmospheric Environment 79
5.3.1.1 Regulatory Oversight 79

5.3.1.2 Adverse Environmental Effects 80
5.3.1.3 Environmental Design, Mitigation and Optimization 81
5.3.1.4 Key Benefits 85
5.3.2 Surface Water Quality 85
5.3.2.1 Regulatory Oversight 85
5.3.2.2 Adverse Environmental Effects 86
5.3.2.3 Environmental Design, Mitigation and Optimization 88
5.3.2.4 Key Benefits 90
5.3.3 Groundwater Quantity 90
5.3.3.1 Regulatory Oversight 90
5.3.3.2 Adverse Environmental Effects 90
5.3.3.3 Environmental Design, Mitigation and Optimization 91
5.3.3.4 Key Benefits 93
5.3.4 Fish and Fish Habitat 93
5.3.4.1 Regulatory Oversight 93
5.3.4.2 Adverse Environmental Effects 95
5.3.4.3 Environmental Design, Mitigation and Optimization 97
5.3.4.4 Key Benefits 99
5.3.5 Terrestrial Habitat 99
5.3.5.1 Regulatory Oversight 99
5.3.5.2 Adverse Environmental Effects 100
5.3.5.3 Environmental Design, Mitigation and Optimization 103
5.4 Key Environmental Effects within the Legislative Authority of Parliament 104
5.5 Environmental Effects on Federal Lands, Other Provinces and Other Countries 109
5.6 Environmental Effects on Indigenous Peoples 109
5.7 Other Indigenous Groups 114
5.8 References 114

6. Proponent Engagement and Consultation with Indigenous Groups 115

6.1 Consultation on the Project Description Report 117

7. Public Consultation 134

Appendix A - Victoria Mine Project Environmental Effects Analysis: A Report Supporting Basic Engineering and Overall Project Planning and Permitting 139

List of Figures

Figure 1-1: Project Location 10
Figure 2-1: Victoria Mine Project Process Block Flow Diagram 24
Figure 2-2: Victoria Mine Project Water Block Flow Diagram 25
Figure 2-3: Victoria Mine Project General Arrangement of Site Facilities 27
Figure 2-4: Victoria Mine Project General Arrangement of Overall Site 28
Figure 2-5: Expected Site Disturbance Comparison 29
Figure 2-6: Blasthole Stoping – Over-Hand Transverse Method (Hanging Wall Access) 37
Figure 2-7: Point Source Emissions during the Victoria Mine Project 39

Figure 3-1: Project Location 51
Figure 3-2: Topographical Features 52
Figure 3-3: Aerial Photo of the Victoria Site Taken in Q2 2014 Showing Proposed Future Location of Project Facilities and Infrastructure 53
Figure 3-4: Aerial Photo of the Victoria Site Taken in Q4 2015 Showing Proposed Future Location of Project Facilities and Infrastructure 54
Figure 3-5: Fairbank Creek (Receiving Environment) 55
Figure 3-6: Location of Existing Historical Dam and Proposed Control Structure 55
Figure 3-7: Location of Existing Historical Dam, Looking Downstream from Ethel Lake 56
Figure 3-8: Land Tenure Map 58
Figure 5-1: Upstream Face of the Existing Ethel Lake Concrete Dam 112
Figure 5-2: 1970s Air Photo Illustrating Historical Flooding of Ethel Lake 113
Figure 6-1: Key Comments from Indigenous Groups 130
Figure 6-2: Sagamok Anishnawbek First Nation Letter of Support 131

List of Tables

Table 1-1: Physical Works and Activities Associated with Advanced Exploration 8
Table 1-2: Physical Works and Activities Associated with the Mine Project 9
Table 1-3: Victoria Mine Project - Overall Project Schedule 11
Table 1-4: Authorizations and Permits for Advanced Exploration 18
Table 1-5: Authorizations and Permits for Mine Production 20
Table 2-1: Infrastructure and Building Sizes – Exploration and Advanced Exploration 30
Table 2-2: Proposed Infrastructure and Building Sizes – Victoria Mine Project 30
Table 2-3: Point Source Emissions and Emission Rates – Operations 40
Table 2-4: Emission Factors 41
Table 2-5: Construction Phase GHG Emissions Estimate 41
Table 2-6: Operations Phase GHG Emissions Estimate 42
Table 3-1: Victoria Property – Mining Rights 57
Table 3-2: Victoria Property – Surface Rights 59
Table 4-1: Anticipated Federal Environmental Approvals and Authorizations 65
Table 5-1: Valid Hours AQI in Range - Sudbury 67
Table 5-2: Definitions for Probability of Occurrence, Effect on Ecosystem Function and Integrity and Sustainable Use of Renewable Resources for Residual Adverse Environmental Effects 75
Table 5-3: Potential Environmental Effects of the Proposed Mine Project Compared to Cumulative Effects of the Project in Combination with Other Projects 77
Table 5-4: Project Environmental Effects Associated with Key Areas of Parliamentary Legislative Authority (*Canadian Environmental Assessment Act* Section 5 and Sections 17 to 19 of the *Prescribed Information for the* 105
Table 6-1: Victoria Mine Project and Site Exploration Activities – Summary of Consultation and Engagement with Atikameksheng Anishnawbek First Nation (AAFN) 118
Table 6-2: Victoria Mine Project and Site Exploration Activities: Summary of Consultation and Engagement with Sagamok First Nation (SFN) 122

Table 6-3: Victoria Mine Project and Site Exploration Activities: Summary of Consultation and Engagement with Métis Nation of Ontario (MNO) 127
Table 7-1: Victoria Mine Project and Site Exploration Activities – Summary of Consultation and Engagement with the Public 135
Table 7-2: Victoria Mine Project and Site Exploration Activities: Summary of Consultation and Engagement with Government Agencies 137

1. General Information and Contact(s)

1.1 Project Overview

FNX Mining Company Inc. (FNX), a wholly owned subsidiary of KGHM International Ltd. (KGHM) is proposing to develop the Victoria Mine Project (46°25'N latitude, 81°23'W longitude) which is located approximately 35 kilometres west from the City of Greater Sudbury, within the Sudbury Basin, in northeastern Ontario (Figure 1-1). The Victoria Mine Project (the Project) comprises a copper-nickel mine with recoverable platinum group elements (PGEs) and is located in the City of Greater Sudbury. The Project is very similar to the numerous exploration, mining and minerals processing operations in the Sudbury Basin that have been part of the socioeconomic fabric of the region and Province since sulphide ores containing nickel and copper were discovered in the 1880s. Primary access to the Project site is by Municipal Road #4 that runs north from Highway 17. The mineral rights for the Victoria property were acquired by FNX from Inco Ltd. (now Vale Canada Limited, or Vale) in 2002 to allow exploration, development and mining operations to be conducted on the property. Although exploitation of Nickel contact orebodies in other locations within the Victoria Property Mineral Rights boundary has occurred in the past (Mond 1890s-1920s; and Inco Ltd.: 1970s), the newly identified Cu-Ni-PGE zone is within an offset environment and several kilometers away from the historical mine and as such FNX is approaching the Project as a new mine.

The development of the Victoria site will occur in two phases; an advanced exploration phase followed by the production phase depending on the results of the advanced exploration activities. Advanced Exploration activities were initiated in 2013, with bulk sample collection expected to occur in 2023. Extraction of the bulk sample is included in the Advanced Exploration phase. The bulk sample will be extracted at a rate of 330 tonnes per day via ore silling using development jumbo drills. This will be followed by production in 2031 based on the results of the bulk sample (refer to the Project schedule in Table 1-3).

Physical works and activities associated with each phase of the Project are presented in Table 1-1 and Table 1-2. The scope of the Project for consideration by CEAA in conducting a screening and deciding whether an environmental assessment is required comprises operation of some advanced exploration infrastructure (during mine production) that will be in place in advance of the Mine Project, as well as construction and operation of infrastructure associated with the producing mine as described in Table 1-2.

Table 1-1: Physical Works and Activities Associated with Advanced Exploration

Infrastructure, Facility or Activity	Ongoing Use During Mine Project	Change in Building Size or Footprint Area
Site Access Road	Yes	No
Temporary Utilities (power, water)	No	N/A
Natural Gas pipeline	Yes	No
Potable Water Treatment Plant	Yes	No
Water Distribution Pumphouse and Service/Fire Water Tank	Yes	No
Waste Water Treatment Plant	Yes	No
Mine Water Pond	Yes	No
Sewage Treatment System	Yes	No
Ventilation Shaft Headworks and Hoisting Facilities	Yes	No
Shaft Development (sinking of Ventilation Shaft) to 1860 Level	Yes	No
Adit Portal	Yes	No
Fuel and Lubricant Storage and Distribution Buildings	Yes	Yes, increase of 250 m^2
Gatehouse and Security (Entrance) Fencing	Yes	No
230 kV Substation, Transmission line and E-House	Yes	No
Site Administration and Construction Trailers	No	N/A
Overburden Storage Areas	Yes	No
Construction and Operation of Potentially Acid Generating Waste Rock Storage Area #1 (PAG1)	Yes[1]	No
Laydown/Staging Area/Parking Lot	Yes	No
Lateral Development along 1400 Level Required for Delineation Drilling and Extraction of Bulk Sample	Yes	No
Extraction of Bulk Sample (rate of 330 tonnes/day)	No	N/A

[1] Waste rock will only be added to PAG 1 during the Advanced Exploration phase. No waste rock will be added to PAG 1 (and its dimensions and capacity will not increase) during the mine project. Removing rock from PAG 1 for use as backfill and reclamation of the PAG 1 footprint will occur during the production phase of the Project.

Table 1-2: Physical Works and Activities Associated with the Mine Project

Infrastructure, Facility or Activity
Operation (during mine production), decommissioning and abandonment of components constructed during Advanced Exploration including: Site Access Road, Natural Gas Pipeline, Potable Water Treatment Plant, Water Distribution Pumphouse and Service/Fire Water Tank, Waste Water Treatment Plant, Mine Water Pond, Sewage Treatment System, Ventilation Shaft Headworks and Hoisting Facilities, Adit Portal, Fuel and Lubricant Storage and Distribution Buildings, Gatehouse and Security (Entrance) Fencing, 230 kV Substation and E-House, Overburden Storage Areas and Laydown/Staging Area/Parking Lot.
Construction and operation of the Potentially Acid Generating Waste Rock Storage Area #2 (PAG2) and Access Road
Construction and Operation of the Ethel Lake Water Control Structure and Pumphouse and Access Road
Underground Mine Development
Main Shaft Development
Underground Ventilation
Main Shaft Headworks and Hoisting Facilities
Mine Product Hauling by Third Party Owned and Operated Trucks to Vale's Clarabelle Mill
Rock Crushing and Handling Facilities
Office, Warehousing, Maintenance Buildings
Removal of rock from PAG 1, crushing and grinding of rock for use in paste backfill process
Operation of Paste Backfill Plant, distribution of backfill underground
Removal of PAG 1 waste rock pad, reclamation of pad footprint including grading and revegetation
Physical decommissioning including demolition of buildings, removal of the headframe, removal of the Ethel Lake Control Structure, removal of gatehouse and fencing
Dismantling of surface equipment, Removal of machinery and equipment
Post closure monitoring including groundwater monitoring, surface water monitoring, biological monitoring, physical stability monitoring and any other monitoring as required by the filed Victoria Mine Production Closure Plan.

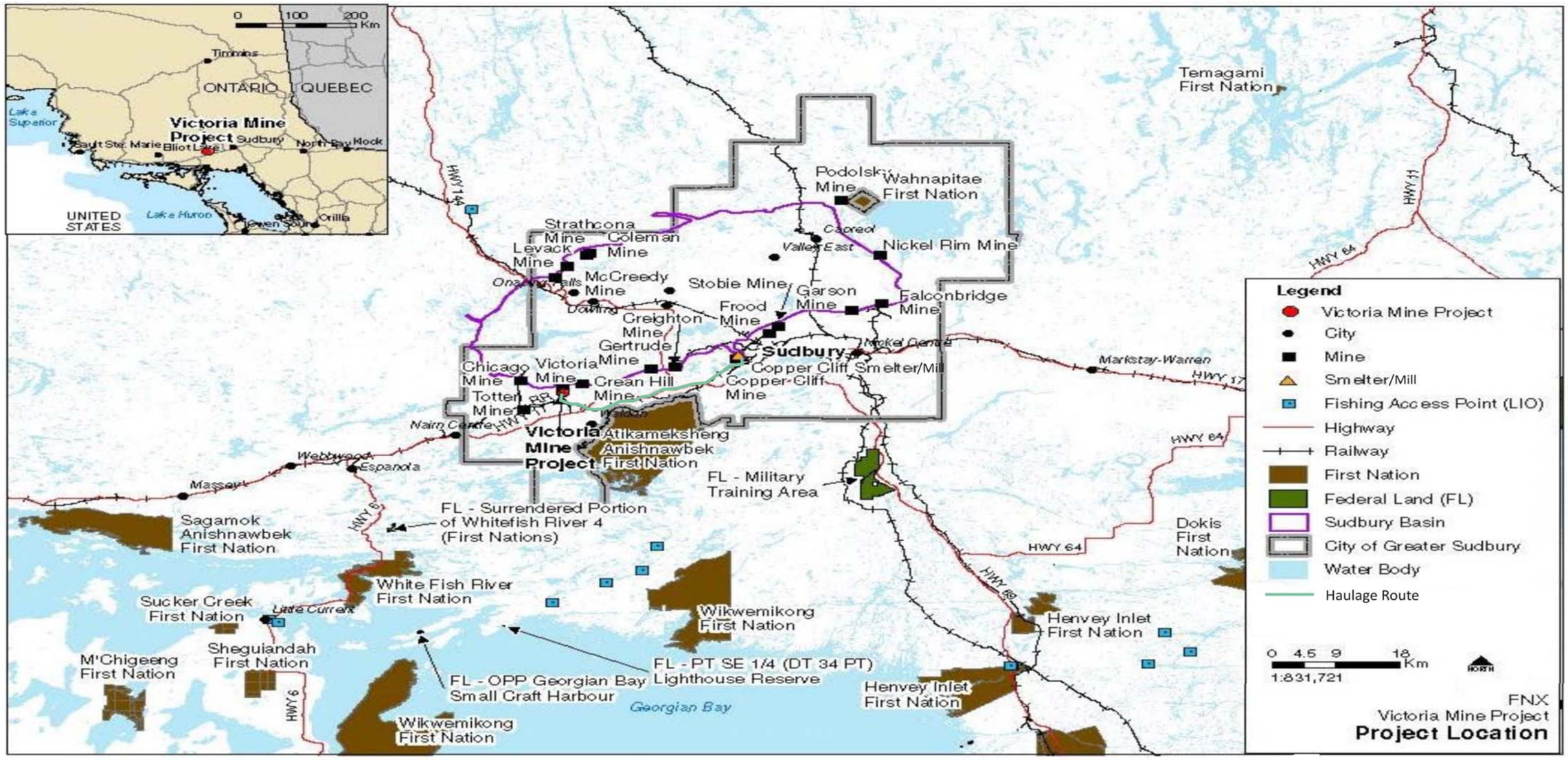

Figure 1-1: Project Location

Table 1-3: Victoria Mine Project - Overall Project Schedule

Activity	Start Date	Finish Date
Exploration Activities	April 2008	December 2012
Indigenous Consultation for/During Advanced Exploration	November 2009	July 2024
Engineering for Advanced Exploration	March 2011	March 2012
Provincial Permitting for Advanced Exploration	March 2012	October 2014
Advanced Exploration Phase	May 2013	July 2024
Basic Engineering for Mine Infrastructure	April 2014	December 2015
Federal Environmental Assessment (EA):		
Initial Submission of Project Description Report	April 2017	June 2017
Revised Submission of Project Description Report	May 2019	July 2019
Determination if a Formal EA is Required	July 2019	
Detailed Engineering for Mine Infrastructure	January 2017	July 2019
Indigenous Consultation for Mine Production	January 2016	January 2031
Provincial Permitting for Mine Production	January 2016	October 2023
Mine Construction	July 2024	
Commercial Production	February 2031	
Indigenous Consultation during Life of Mine	February 2031	October 2042
Life of Mine	February 2031	October 2042
Indigenous Consultation during Mine Closure	October 2042	October 2045
Mine Closure	October 2042	October 2045

Advanced Exploration construction is scheduled to be completed in 2024. The collection of the bulk sample is scheduled for 2023, followed by full mine construction in 2024 with full mine (commercial) production expected to begin in 2031, depending on results from the bulk sample extraction and metallurgical testwork. Once operational (February 2031), the mine life will extend to late 2042. The Project comprises a mine to develop the ore body comprising approximately 12.8 million tonnes of mine product grading at 2.2% copper (Cu) and 2.1% nickel (Ni) with approximately 6.9 grams per tonne (g/t) platinum group elements (PGEs). The Project is being designed and evaluated based on a maximum ore (mine product) production rate of 3,500 tonnes per day (t/d) of mine product. The mining method and inferred resource characteristics will also result in a

peak of 2,000 t/d of waste rock produced for an overall material movement rate of 5,500 t/d. Based on various factors of safety designed into hoisting equipment and its operations, the maximum overall potential mine production capacity for the Project is thus considered to be 5,500 t/d (ore plus waste rock).

The Project is currently in the advanced exploration phase, which includes the development of specific surface and underground infrastructure required to support both surface and underground drilling and sampling. These investigations help support the engineering maturation process for the Project and also help ascertain project viability. Engineering studies are ongoing to ensure optimization of the ore body and to a complete Basic Engineering level of design. Environmental planning including consultation and issue scoping, environmental baseline studies and ongoing monitoring for surface water, groundwater, terrestrial ecology, aquatic ecology, climatology, noise, and geochemistry have been ongoing since 2002 and continue to be an integral component of the overall project engineering design and planning process. Permits and approvals have been obtained to allow for exploration and advanced exploration activities as well as site environmental management. Indigenous and public consultation in support of the Project was initiated in 2009 and ongoing dialogue with the potentially affected Indigenous groups will continue throughout the life of the Project, and beyond into the Operations phase (refer to the Project Schedule outlined in Table 1-3).

The proposed project comprises activities that are largely a continuation of activities that have occurred since 2002 at the Victoria property under a high level of regulatory scrutiny as well as scrutiny and involvement from Indigenous groups and community stakeholders. FNX uses contemporary environmental assessment and evaluation methods in its project planning and, as a result, has a high degree of certainty on:

- Potential project-environment interactions, including the Project in combination with other projects and activities that may act in combination to result in cumulative environmental effects;
- Valued components of the environment that are considered;
- Engineering design and mitigation measures to reduce residual adverse environmental effects on Valued Components to acceptable levels;
- The significance of residual adverse environmental effects of Valued Components as well as the likelihood of occurrence of any residual adverse environmental effects considered significant; and
- Potential requirements for compliance, surveillance monitoring and follow-up.

The nature of mineral resource development and the need for information obtained from exploration inevitably results in some surface disturbances and infrastructure established well before the potential project can be contemplated. FNX will ensure that site activities that support exploration, such as areas of physical disturbance and the establishment of existing infrastructure including underground access, are optimized

such that any future disturbances as a result of the Project going forward will be minimized.

FNX is committed to conducting appropriate reclamation throughout the mining life cycle to return the mine site to a diverse and viable ecosystems that will serve the need of post-mining land use. The objectives of site reclamation includes re-establishing conditions which permit the land to return to a similar pre-mining land use. For each project component, reclamation plans will address potential environmental effects, the final end use of the land and the long term physical and chemical stability of the reclaimed component.

It is important to acknowledge that certain elements, typical of many mining projects, are not part of the Project. These include:

- No camp and associated support facilities - Labour force requirements are expected to be available locally and thus housed locally;
- No mill - The City of Greater Sudbury has ample existing mine product milling capacity and the Project is part of the Vale life of facility production plan. FNX has a life of mine take off agreement with Vale for the Victoria mine product. No material modifications are required to existing off-site facilities (including tailing storage facilities) for the purpose of receiving and processing ore (mine product) or waste rock from the proposed Victoria Mine Project;
- No tailings and tailings management - FNX considers avoiding local permanent tailings placement as a major contributor to avoiding potential significant residual adverse environmental effects; and
- No mineral processing such as smelting and refining.

1.2 Proponent Information

1.2.1 Project Name

Victoria Mine Project

1.2.2 Proponent Name

FNX Mining Company Inc.

1.2.3 Proponent Address

1010 Lorne Street, Unit 2

Sudbury, ON P3C 4R9

1.2.4 President and Chief Executive Office (or equivalent)

Michal Holaczuk

President and CEO

KGHM International

1.2.5 Victoria Project Manager

Neil Milner

1.2.6 Principal Contact

Vanessa Felix

Environmental Coordinator

Vanessa.Felix@ca.kghm.com

705-885-1535 x2009

1.3 Project Consultation Overview

Consultation on the initial Project development began in November 2009, with formal Public Information Sessions commencing in December 2010, in association with Closure Planning requirements under the *Ontario Mining Act* and permitting requirements for water taking and discharge under the *Ontario Environmental Protection Act* and *Ontario Water Resources Act*, to inform the stakeholders, public and Indigenous groups of Advanced Exploration activities and the Project overall. An open and transparent dialogue with communities continues today and will continue over the life of the Project.

FNX has been actively engaged in consultation, information sharing and issue scoping process with the Project's Indigenous Communities including:

- Indigenous Communities:
  - Atikameksheng Anishnawbek First Nation;
  - Sagamok Anishnawbek First Nation;
  - Métis Nation of Ontario (Region 5);
  - Whitefish River First Nation;
  - Wikwemikong First Nation;
  - Serpent River First Nation; and
  - Wahnapitae First Nation.

The Project stakeholders that have been consulted to date include:

- Special Interest Stakeholders:
  - Vermilion River Stewardship Committee;
  - Fairbank Lake Cottagers Association;
  - Walden Sno Runners;
  - Randolph Street Residents; and
  - The town of Copper Cliff.

- Local Industry:
  - Vale Canada Limited; and
  - Vale Totten Mine and Sudbury Integrated Nickel Operations (A Glencore Company).
- Federal Government Agencies:
  - Canadian Environmental Assessment Agency (CEAA);
  - Ministry of Environment and Climate Change Canada (MOECC); and
  - Fisheries and Oceans Canada (DFO).
- Provincial Government Agencies:
  - Ministry of Northern Development and Mines (MNDM);
  - Ministry of Environmental and Climate Change (MOECC);
  - Ministry of Natural Resources and Forestry (MNRF); and
  - Ministry of Transportation Ontario (MTO).
- Municipal Government Agencies:
  - City of Greater Sudbury; and
  - Ward 2 Walden (Whitefish, Naughton, Lively, Worthington, Copper Cliff).

Public Information Sessions were held on December 1, 2010, October 12, 2011, August 20, 2013 and September 4, 2014 in accordance with the requirements of Section 8 of the *Ontario Mining Act* (*O. Reg. 240/00* - as amended). Specific public consultation activities initiated in 2009 were focused on the Fairbank Lake Cottagers Association and the Walden Sno Runners Snowmobile Association.

FNX has been actively engaged in extensive consultation, information sharing and issue scoping process with Atikameksheng Anishnawbek First Nation, Sagamok Anishnawbek First Nation, and the Métis Nation of Ontario (Region 5). FNX has also initiated an information sharing exercise with four additional Indigenous groups as identified in discussions with the federal government; Whitefish River First Nation, Wikwemikong First Nation, Wahnapitae First Nation and Serpent River First Nation.

Consultation with Indigenous groups has been undertaken with the guidance and direction of the MNDM and the federal government (Canadian Environmental Assessment Agency). The Project is situated at the overlapping traditional territory of Atikameksheng Anishnawbek (Whitefish Lake) and Sagamok First Nations and therefore FNX initiated on-going dialogue and consultation with the affected Indigenous communities in November 2009. These discussions focused on formalizing an understanding of cooperation and joint participation during the pending advanced exploration and feasibility study stages of the Project. Sagamok First Nation and FNX signed a Memorandum of Understanding (MOU) in December 2011, followed with the

signing of an Advanced Exploration Impact Benefits Agreement (IBA) in October 2014. Atikameksheng Anishnawbek First Nation and FNX signed a MOU in December 2011, renewed the MOU in December 2012, and followed with the signing of an Advanced Exploration Agreement, with a community signing in November 2014. These agreements define the working relationships between the parties which will meet the needs and interests of both parties. An MOU between the Métis Nation of Ontario and FNX was signed in April 2015.

Consultation with government stakeholders has been a key component of the process to obtain the required permits, approvals and authorizations for the Project.

A detailed description of consultation activities undertaken for the Project is provided in Section 6 – Proponent Engagement and Consultation with Indigenous Groups and Section 7 – Public Consultation.

1.4 Environmental Assessment and Regulatory Requirements

Several environmental assessments have been conducted to date on elements of the Project. These include:

- FNX - Diesel generation facilities (electrical facilities) 2014: Ontario Environmental Approval (Category B Project) by Ontario Ministry of Environment and Climate Change under the *Ontario Environmental Assessment Act*. Assessment concluded no significant residual adverse environmental effects and included Indigenous and public consultation;
- Hydro One - Installation of 230 kV tapping structures (electricity projects) 2015: A screen-out prepared in accordance with the Class Environmental Assessment for minor transmission facilities by Ontario Ministry of Environment and Climate Change under the *Ontario Environmental Assessment Act*;
- Union Gas - Installation of a 2.3 kilometre natural gas pipeline (Sudbury Expansion project) 2015: Ontario Energy Board. Included review of environmentally sensitive areas, species at risk and areas of natural or scientific areas. Consultation with MNRF, local municipalities, Sagamok Anishnawbek and Atikameksheng Anishnawbek First Nations, and Métis Nation of Ontario were completed. Environmental Protection Plan provided. Conclusion: no significant environmental impacts associated with the construction; and
- City of Greater Sudbury – Crean Hill road improvements (complete): The City of Greater Sudbury has completed preliminary Species at Risk Habitat Screening in consultation with the local MNRF district office to determine if the road improvements are likely to require an authorization under the Provincial *Endangered Species Act (ESA)*. It was determined that an *ESA* permit was required to cover these activities. The permit was issued to the City of Greater Sudbury in September 2017 and applies to Blanding's Turtle and Eastern Whip-poor-will.

A number of provincial permits and authorizations are in place to support advanced exploration activities (Table 1-4). Key permits, authorizations and approvals obtained include the following:

- Victoria Advanced Exploration Closure Plan, September 2013 under Part VII of the *Mining Act, R.S.O. 1990*;
- Victoria Advanced Exploration Closure Plan Amendment, November 2014 under Part VII of the *Mining Act, R.S.O. 1990*;
- Environmental Compliance Approval (ECA) - Air No 8794-8VFJ7B (July 2014) under Section 20.2 of Part II.1 of the *Environmental Protection Act (EPA), R.S.O. 1990*;
- Amended Environmental Compliance Approval (ECA) – Sewage Works No 9557-AP5FSQ (August 2017) under Section 20.2 of Part II.1 *EPA, R.S.O. 1990*;
- Species At Risk (SAR) Permit number SU-C-001-12 (May 2012) under Clause 17(2) of the *Endangered Species Act (ESA), 2007*; and
- Permit to Take Water (Dewatering) 5450-95GQY3 (July 2014) under Section 34 of the *Ontario Water Resource Act, R.S.O. 1990*.

Additional authorizations and permits will be required for the producing mine as listed in Table 1-5. Preparation of permit and approval applications was initiated in early 2016 for these additional authorizations to ensure all permits are obtained prior to construction of infrastructure associated with the producing mine. The Species At Risk (SAR) Permit number SU-C-001-12 (May 2012) under Clause 17(2) of the *Endangered Species Act (ESA) 2007* is included in Table 1-5 as it is valid for the life of the Project and will apply to activities associated with the producing mine. Ongoing consultation with the responsible government agencies will occur in a timely manner to facilitate receipt of the required permits and approvals. FNX considers that the potential environmental effects of the Project can be adequately managed through existing legislative and regulatory processes.

Table 1-4: Authorizations and Permits for Advanced Exploration

Authorization or Permit	Responsible Ministry	Applicable Act/ Regulation	Associated Facility, Infrastructure or Activities	Approval Date
Environmental Compliance Approval (Air)	Ministry of the Environment and Climate Change (Provincial)	*Environmental Protection Act, R.S.O. 1990*, Section 20.2 of Part II.1	Air emissions and dust	2014
Environmental Compliance Approval (Industrial Sewage)	Ministry of the Environment and Climate Change (Provincial)	*Environmental Protection Act, R.S.O. 1990*, Section 20.2 of Part II.1	PAG 1, mine water pond, sewage, water treatment plant (permanent and temporary) and discharge	Original ECA – 2014; Amendment – 2015; Amendment- 2017
Permit to Take Water	Ministry of the Environment and Climate Change (Provincial)	*Ontario Water Resources Act, R.S.O. 1990*, Section 34.1	Groundwater supply well, dewatering shaft	Original permit 2014; Amendment - 2017
Hazardous Waste Generator Registration	Ministry of Environment and Climate Change (Provincial)	*Environmental Protection Act, R.R.O. 1990, Regulation 347: General – Waste Management*	Generation and shipment of hazardous wastes	2014
17(2)(c) Permit	Ministry of Natural Resources (Provincial)	*Endangered Species Act, 2007*	Disturbance of Whip-poor-will habitat	2012

Authorization or Permit	Responsible Ministry	Applicable Act/ Regulation	Associated Facility, Infrastructure or Activities	Approval Date
Advanced Exploration Closure Plan Amendment and associated Notice of Material Change	Ministry of Northern Development and Mines (Provincial)	*Mining Act, R.S.O. 1990, c.M.14, O. Regulation 240/00 – Mine Development and Closure Under Part VII of the Act*	Surface development and construction for advanced exploration, definition drilling, construction of ventilation shaft hoist house and headframe, water management and treatment	Advanced Exploration Closure Plan – 2013; Amendment – 2015; Notice of Material Change – 2015; Notice of Material Change - 2017

Table 1-5: Authorizations and Permits for Mine Production

Authorization or Permit	Responsible Ministry	Applicable Act/Regulation	Associated Facility, Infrastructure or Activities	Target Date to Obtain Approval
Mine Production Closure Plan	Ministry of Northern Development and Mines (Provincial)	*Mining Act, R.S.O. 1990, c.M.14, O. Regulation 240/00 – Mine Development and Closure Under Part VII of the Act*	Lateral underground development, PAG 2, Ethel Lake, backfill plant, construction of main shaft including hoist house and headframe, all additional permanent surface infrastructure to support mine production.	January 2022
Environmental Compliance Approval for Industrial Sewage - Amendment	Ministry of the Environment and Climate Change (Provincial)	*Environmental Protection Act, R.S.O. 1990*, Section 20.2 of Part II.1	Amendment required for any additional regulated infrastructure, (Ethel Lake, PAG 2) that is not currently approved for advanced exploration	September 2022
Environmental Compliance Approval for Air - Amendment	Ministry of the Environment and Climate Change (Provincial)	*Environmental Protection Act, R.S.O. 1990*, Section 20.2 of Part II.1	Amendment for production and update emission sources and rates to ensure air shed boundary is sufficient	September 2022
Permit to Take Water	Ministry of the Environment and Climate Change (Provincial)	*Ontario Water Resources Act, R.S.O. 1990*, Section 34.1	Required for Ethel Lake water taking	September 2023

Authorization or Permit	Responsible Ministry	Applicable Act/Regulation	Associated Facility, Infrastructure or Activities	Target Date to Obtain Approval
17(2)(c) Permit	Ministry of Natural Resources (Provincial)	*Endangered Species Act, 2007*	Disturbance of Whip-poor-will habitat	Obtained in 2012
Work Permit	Ministry of Natural Resources (Provincial)	*Lakes and Rivers Improvement Act, R.S.O. 1990, c.L.3*	Required for construction of Ethel Lake water control structure	September 2023
Shoreline Alteration/Development Permit	Conservation Sudbury [Nickel District Conservation Authority] (Municipal)	*Conservation Authorities Act, R.S.O. 1990, c. C.27, Section 28, Ontario Regulation 156/06 Nickel District Conservation Authority: Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses*	Required prior to construction of Ethel Lake water control structure and pumphouse	October 2023

1.5 Regional Environmental Studies

The region recently underwent a thorough regional ecological and human health risk assessment into the 100+ years of mining and minerals processing that has occurred in the Sudbury Basin, the Sudbury Soils Study or Sudbury Area Risk Assessment (SARA 2001, 2008). The study was a comprehensive scientific and technical investigation into a 40,000 km^2 area of former and current mining and minerals processing areas to evaluate the state of the ecological conditions and risks to human health, plants and wildlife. It is one of the largest and most comprehensive regional environmental studies conducted to date in North America. The study area included the Victoria properties area where mining has occurred (Mond and Inco Ltd.) as well as minerals processing (Mond: open roast smelting and refining).

The Sudbury Soils Study was initiated by the Ontario Ministry of Environment (2001) and was completed in 2008. The study involved a Technical Committee (TC) for oversight as well as independent expert reviewers of the science and findings. The TC included membership from the Ministry of Environment, the City of Greater Sudbury, the Sudbury District Health Unit, Health Canada (First Nations & Inuit Health Branch) as well as Vale and Xstrata Nickel. The study focused on Chemicals of Concern (CoCs) that included nickel and copper, and concluded generally that while there are elevated levels of CoCs in plant communities they are not at levels of concern in the Project area and area wildlife populations are not likely to be directly affected by elevated levels of CoCs now or in the future. The study predicted little risk of health effects on Sudbury area residents associated with metals in the environment. Anglers, hunters and Indigenous people who may consume more local fish and wild game are at no greater risk of health effects due to metals in the environment than the general population.

Metals released to the environment as a result of the Project (e.g., dust, exhaust, return air and drainage) are expected to be a *di minimis* contribution to overall metals in the environment in the region. The principle sources of metals in the environment in the region are associated with smelting and refining processes (located in Copper Cliff and Falconbridge) and modern smelter technology minerals processing practices greatly reduce metals in the environment compared to the practices of decades ago.

1.6 References

- SARA, 2001. Sudbury Area Risk Assessment Volume I: Background, Study Organization and 2001 Soils Survey. The 2001 Soil Survey. Available at: http://www.sudburysoilsstudy.com.
- SARA, 2008. Sudbury Area Risk Assessment Volume II: Human Health Risk Assessment – Final Report. Available at: http://www.sudburysoilsstudy.com.

2. Project Information

The scope of the Mine Project includes the use of existing Advanced Exploration phase infrastructure, as well as proposed new infrastructure and activities for mine production. The shaft, hoisting and ventilation infrastructure, as well as waste storage, various building and key processes like sewage treatment and wastewater collection and treatment are all permitted and construction started in 2013 to support the removal of a 33,000 tonnes bulk sample. The bulk sample will be extracted at a rate of 330 tonnes/day via ore silling using development jumbo drills.

The phases of the Mine Project include a mine construction phase starting in 2024, production from 2031 to 2042, followed by a three year physical decommissioning phase to late 2045, and another five years of monitoring to the end of 2050.

2.1 Project Description

The Project includes the development of the underground mine including both above ground and below ground supporting infrastructure to enable the extraction of a maximum of 3,500 tonnes per day of mine product and 2,000 t/d of waste rock. Project activities include waste water treatment and discharge, construction of a second waste rock storage pad (PAG 2), stockpiling of waste rock and construction of the Ethel Lake control structure and Ethel Lake water taking infrastructure. Figure 2-1 and Figure 2-2 provide the Process Block Flow Diagram and Water Block Flow Diagram for the Project, respectively.

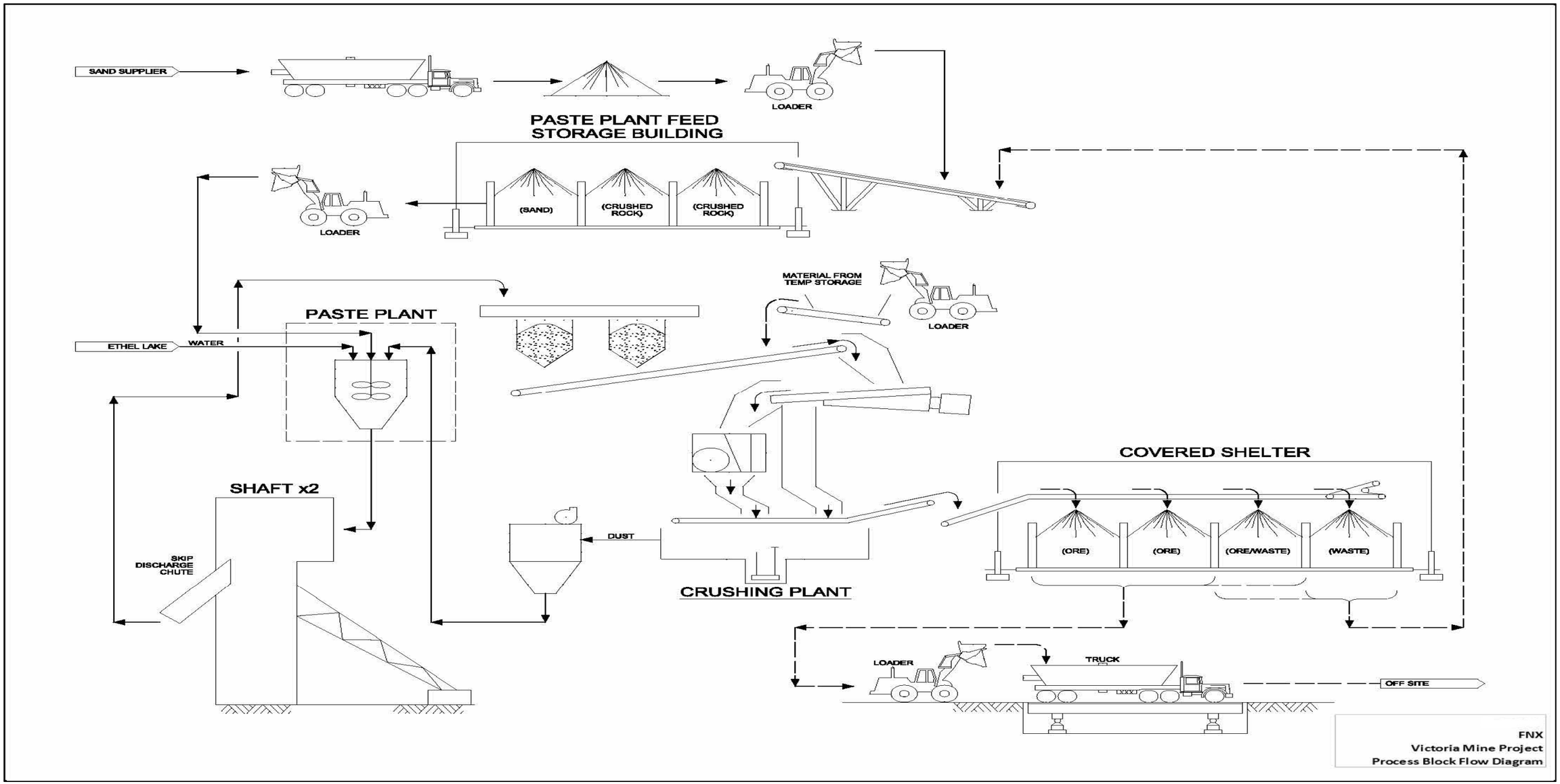

Figure 2-1: Victoria Mine Project Process Block Flow Diagram

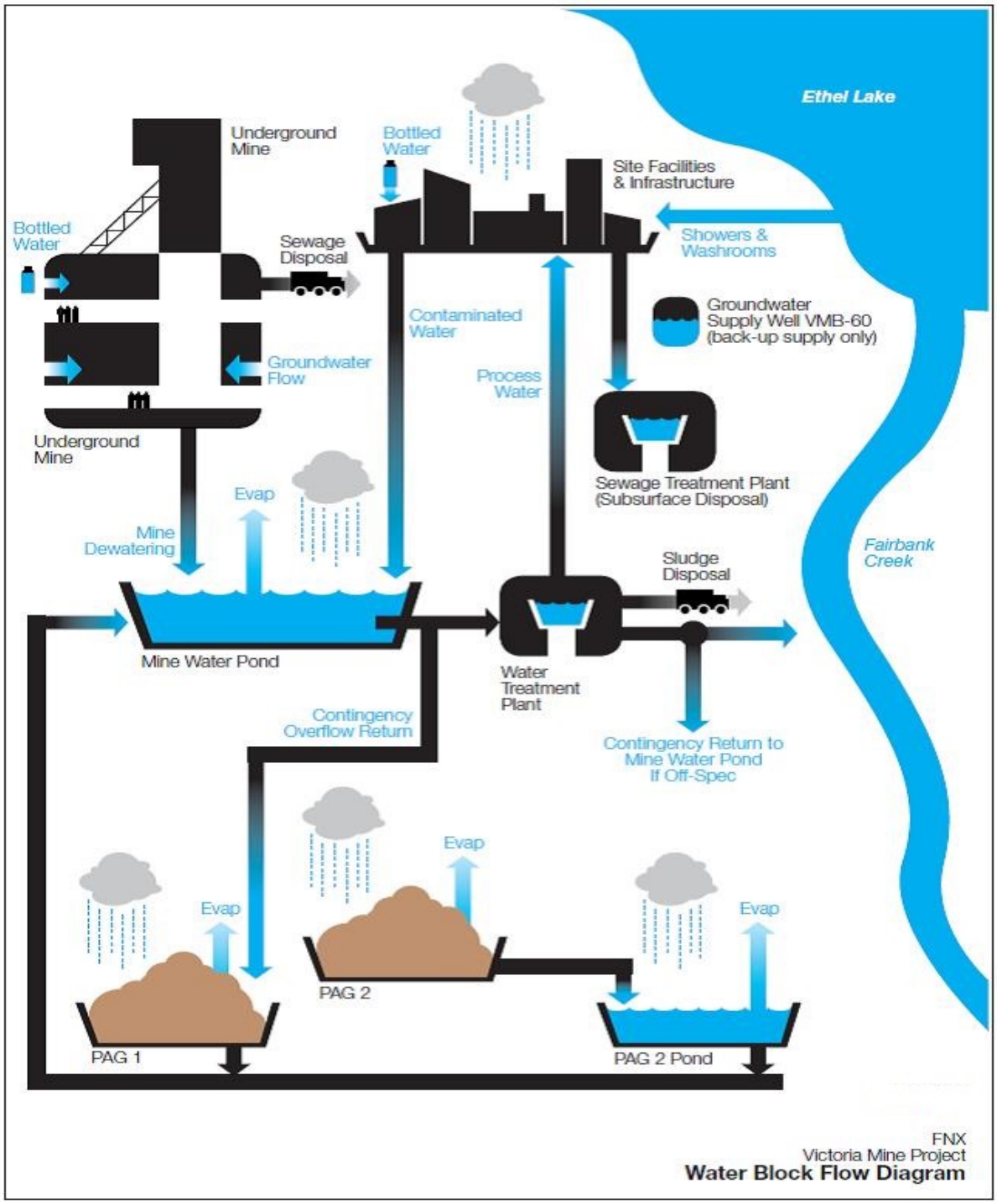

Figure 2-2: Victoria Mine Project Water Block Flow Diagram

2.1.1 Location, Land Tenure and Mineral Rights

The Project is located in northern Ontario on privately owned land within the City of Greater Sudbury, within Denison Township, and approximately 400 kilometres north of Toronto, Ontario. The main access to the area is provided by Municipal Road #4 (formerly Hwy 658), which runs north from Highway 17. Vale, and to a minor extent Carman Construction, own the surface rights of the Victoria Property (Figure 3-8). The five patented mining rights dispositions associated with the Project and held by FNX encompass the entire Property and are contiguous over the area.

2.1.2 General Arrangement of Facilities and Related Infrastructure (Other Proponents)

Figure 2-3 and Figure 2-4 provide the proposed layout of the Project development including Advanced Exploration and Project phase facilities and infrastructure. The shaft, hoisting and ventilation infrastructure, as well as waste storage, various building and key processes like sewage treatment and wastewater collection and treatment plants will be in place and functioning in advance of commencing production. A section of fencing was installed at the site entrance during the Advanced Exploration Stage. This fencing runs parallel to Fairbank East Road and extends along a portion of the Northeastern boundary of the Victoria Project Site. This fencing will remain in place during the Mine Project. The amount of fencing will not change during the Mine Project. Figure 2-3 illustrates the location of the fencing. Figure 2-5, Table 2-1 and Table 2-2 provide a comparison of the proposed site disturbance during exploration and advanced exploration activities, and the expected site disturbance associated with the Victoria Mine Project.

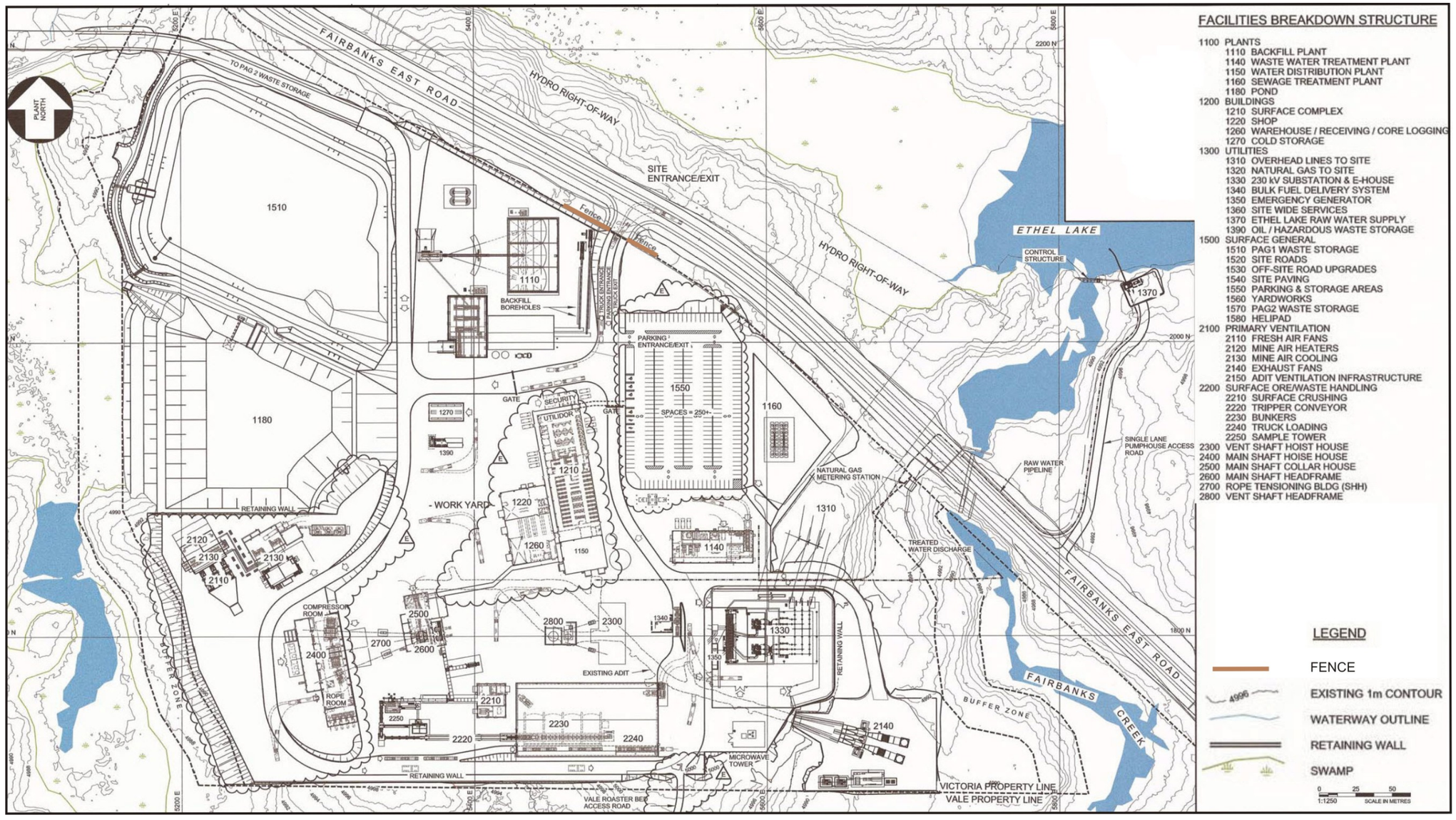

Figure 2-3: Victoria Mine Project General Arrangement of Site Facilities

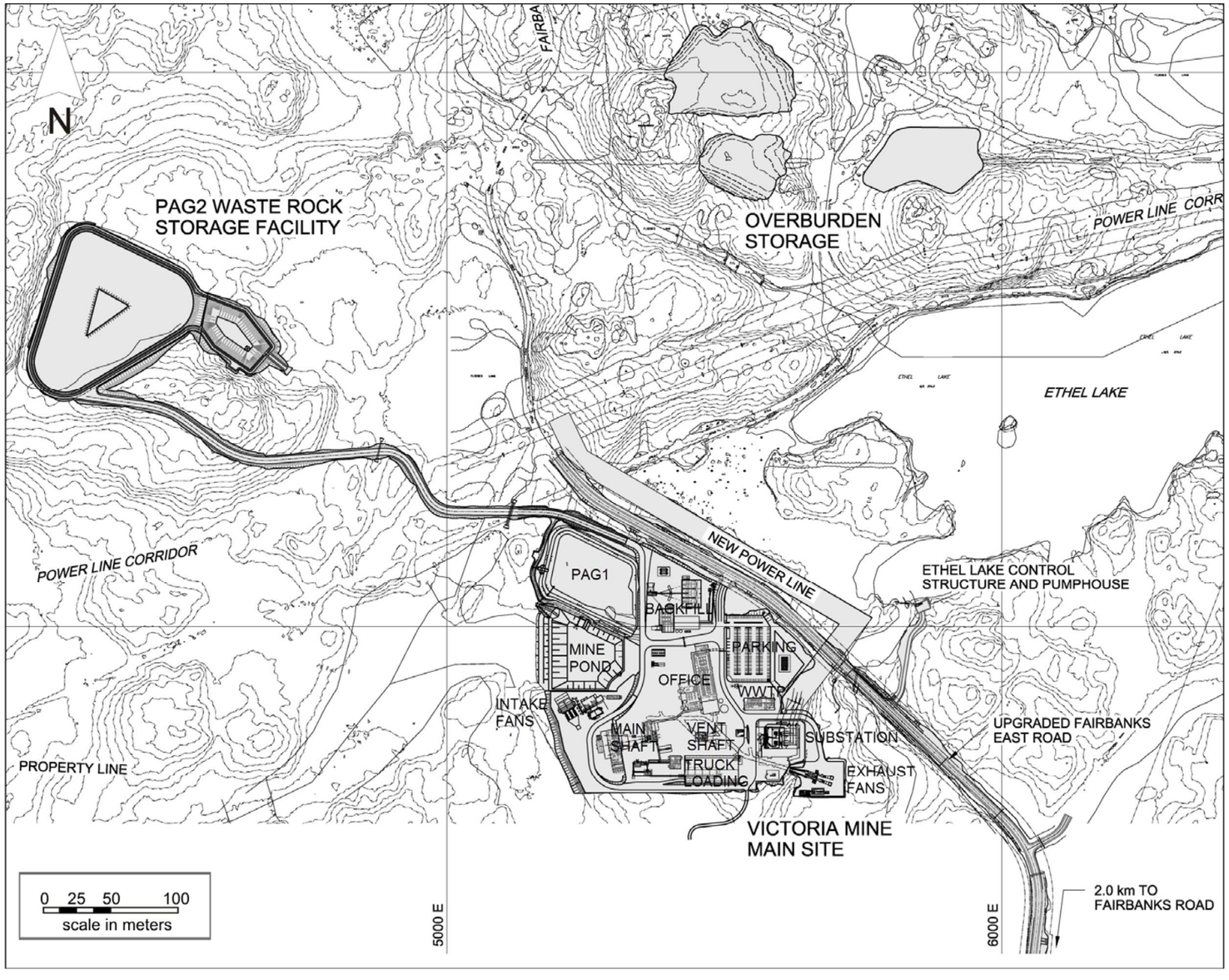

Figure 2-4: Victoria Mine Project General Arrangement of Overall Site

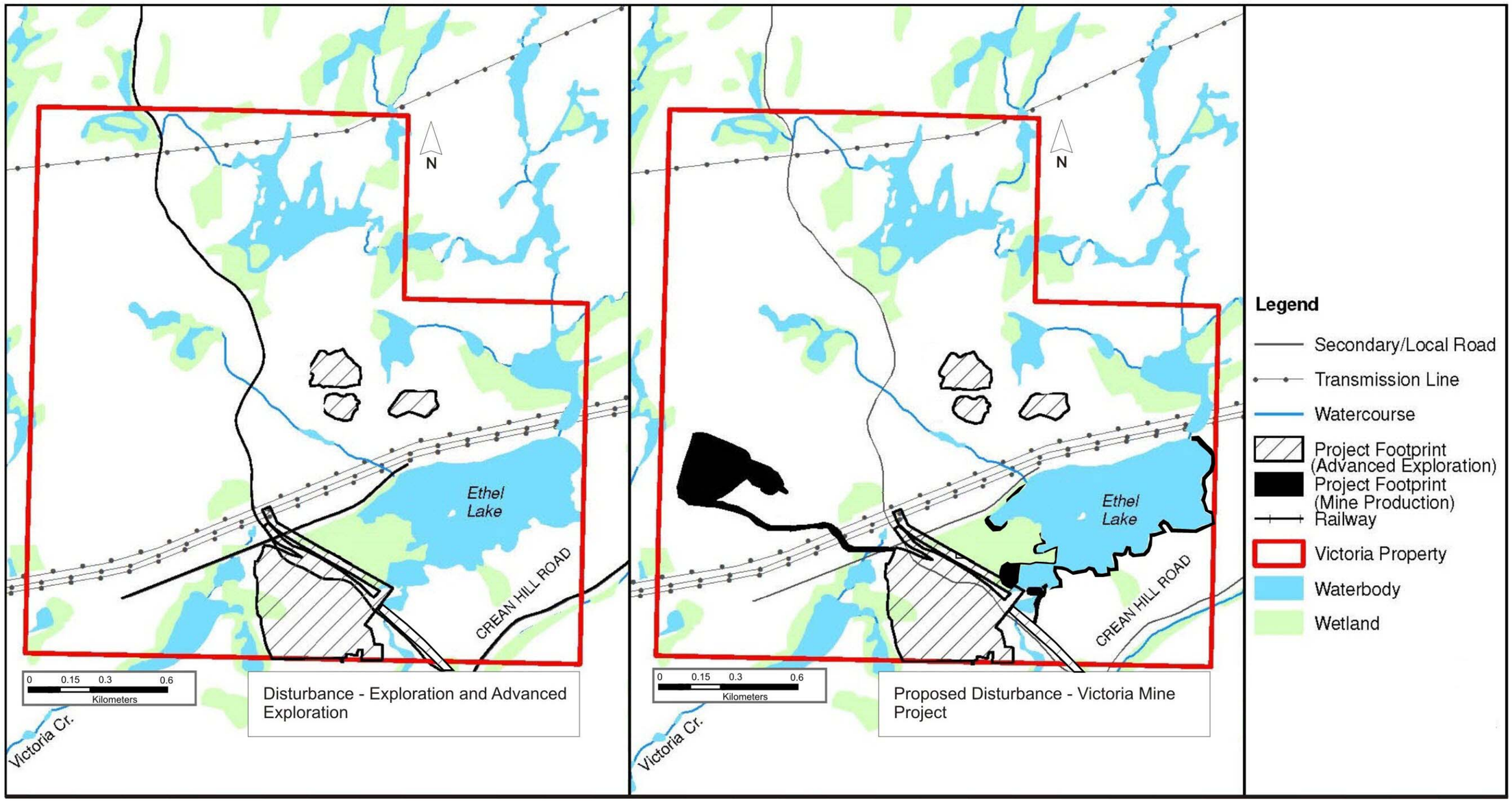

Figure 2-5: Expected Site Disturbance Comparison

Table 2-1: Infrastructure and Building Sizes – Exploration and Advanced Exploration

Development Area	Approximate Building Size (m^2)	Approximate Area (ha)	Capacity (m^3)
Overburden Storage Areas		6.5	
Site Access Road		2.5	
230 kV Transmission Line		3	
230kV Substation	150		
Natural Gas pipeline			
General Site Area:		22	
Ventilation Shaft Headworks and Hoisting Facilities	1,394		
Gatehouse and Security (Entrance) Fencing			
Crushing and Loading	300		
Mine Water Pond	22,720		43,400
PAG 1 Waste Rock Storage Area		2.4	195,000
Offices and Storage	0		
Dry	225		
Fuel and Storage	250		
Core Shack			
Miscellaneous	200		
Total "Footprint" (ha)		**36**	

Table 2-2: Proposed Infrastructure and Building Sizes – Victoria Mine Project

Development Area	Approximate Building Size (m^2)	Approximate Area (ha)	Capacity (m^3)
Ethel Lake Flooded Area		2.5	
PAG 2		8.71	673,000
Main Shaft Headworks and Hoisting Facilities	3,289		

Development Area	Approximate Building Size (m^2)	Approximate Area (ha)	Capacity (m^3)
Crushing and Loading	5,500		
Mine Water Pond	22,720		43,400
Offices and Storage	7,000		
Dry	1,400		
Fuel and Storage	500		
Core Shack	961		
Miscellaneous	200		
Backfill Plant	2,000		
Ethel Lake Control Structure Road and Pumphouse Pad		3	
Total Additional Footprint (ha)		**14.2**	

1. *The PAG 2 Area of 8.7 ha includes the haulage road which has an area of 1.2 ha. The area of the PAG 2 waste rock storage pad (not including the road) is 7.5 ha.*

The proposed Mine Project will result in an increase of 14.2 hectares of disturbed area. The increase of 14.2 hectares represents the increase required by the following: Ethel Lake Flooded Area (2.5 ha), Ethel Lake Control Structure Road and Pumphouse Pad (3 ha), PAG 2 Pad and access road (8.7 ha) as shown in Figure 2-5.

2.2 Designated Physical Activities

The designated physical activity that is proposed to be carried out as part of the designated project is Provision 16 in the schedule to the *Regulations Designating Physical Activities: "The construction, operation, decommissioning and abandonment of a new (a) metal mine, other than a rare earth element mine or gold mine, with an ore production capacity of 3 000 t/day or more."*

2.3 Components and Activities

2.3.1 Physical Works

The proposed Project is an underground mine with supporting surface infrastructure. There will be no mill or processing facilities at the site. Mine product (ore) extracted from the Victoria Mine will be part of the integrated mining operations in the Sudbury basin and will be hauled to Vale's centralized offsite milling, smelting, refining and material handling facilities. No material modifications are required to existing off-site facilities (including tailing storage facilities) for the purpose of receiving and processing ore (mine product) or waste rock from the proposed Victoria Mine Project.

The main physical works associated with the Mine Project include:

- Operation (during mine production), decommissioning and abandonment of components constructed during Advanced Exploration including: Site Access Road, Natural Gas Pipeline, Potable Water Treatment Plant, Water Distribution Pumphouse and Service/Fire Water Tank, Waste Water Treatment Plant, Mine Water Pond, Sewage Treatment System, Ventilation Shaft Headworks and Hoisting Facilities, Adit Portal, Fuel and Lubricant Storage and Distribution Buildings, Gatehouse and Security (Entrance) Fencing, 230 kV Substation and E-House, Overburden Storage Areas and Laydown/Staging Area/Parking Lot;
- Construction and operation of a second rock storage area approximately 7.5 hectares in size for mineralized (PAG) rock referred to as PAG 2. The PAG 2 waste rock storage area will be located 1.5 kilometres northwest of the main Project site and will consist of a waste rock storage pad and water collection pond to collect runoff from the footprint of the potentially acid generating waste rock stockpile. Collected water will flow to the adjacent collection pond and ultimately be piped to the Waste Water Treatment Plant for treatment, prior to release to the environment or re-used as process water. Prior to construction of PAG 2 waste rock pad, a haulage road to the pad will be required. The total area of the haulage road from the site to the PAG 2 storage area is 1.2 hectares. Construction of the haulage road includes land clearing, grubbing, and rough grading with clean fill. Construction of PAG 2 includes land clearing and grubbing the PAG 2 footprint, importing clean fill, placing and compacting fill in the PAG 2 area to form the base of the pad and the berms, creating sumps to collect water, installation of piping along haulage road to pipe water from sumps to the Mine Water Pond and installation of a geomembrane liner to create a watertight containment area; Construction of a plant to manufacture paste backfill ground support material for placement underground in mined out areas. The plant will be situated in the area already disturbed by exploration and PAG rock will be used to manufacture backfill. Rock will be removed from PAG 1 and 2 to be used in the paste backfill process;
- Construction of a plant to produce paste backfill ground support material for placement in mined out areas. The plant will be situated in the area already disturbed by exploration and PAG rock from PAG Pad 1 and 2 will be used to produce backfill to provide additional support to the mine workings;
- Removal of waste rock from PAG 1 for use as backfill underground. Once all rock has been remove from PAG 1, the waste rock pad liner will be removed and reclamation of the pad footprint including grading and re-vegetation of the area will take place;
- Construction and Operation of the Ethel Lake control structure and a pump house for water supply. The Ethel Lake control structure and pumphouse will be located east of Fairbanks East Road, at Ethel Lake on the eastern side of the Victoria Property. The Project will require supplementary water to support shaft sinking and production activities, and maintain flow requirements in Fairbank Creek. The control structure will be installed in order to raise the level of Ethel Lake by approximately 0.5 metres.

Outflow to Fairbank Creek will be controlled to ensure minimum flow requirements are achieved. The pumphouse will be installed to supply raw water via pipeline to the main Victoria Site;

- Underground mine development utilizing existing ventilation shaft and surface infrastructure for mine product and rock movement including hoisting;
- Underground ventilation and dewatering of work areas as key elements of mitigating potential workplace hazards;
- Mine product hauling by truck to Vale's Clarabelle Mill in Copper Cliff;
- Various enclosed facilities for mine product and rock crushing and handling. The crushing system will be located in an enclosed area east of PAG 1 and immediately northwest of the backfill plant. It will include three portable crushers (one jaw crusher and two cone crushers) working in series to reduce the mine waste rock from PAG 1 to 6-millimetre aggregate to feed the grinding circuit located inside the backfill plant. The 6-millimetre product will be transferred into a storage bunker having a total storage capacity of 13,000 tonnes. The crushers will be enclosed in an unheated, sound insulated building. Dust containment enclosures along with a 64,000-cubic metre per hour (m^3/h) bag house dust collector will help to minimize the dust effects. On average, 1,800 tonnes of material will be processed by this system on a daily basis;
- Use of existing temporary stockpile locations for soil and overburden. These stockpiles were established during exploration and will be used for site remediation activities to meet closure plan expectations;
- Various office, administration, warehousing, maintenance, general storage and employee parking facilities;
- Fuel storage facilities: The fuel storage system is comprised of diesel fuel oil and gasoline storage on surface and diesel fuel oil storage underground. The primary purpose of the diesel fuel distribution system will be to transfer fuel in a batching process from surface to underground fuel bays, while also dispensing fuel on surface with a local dispensing pump;
- The Surface Fuel System will consist of one Diesel Fuel Delivery System, comprising one 50,000-litre storage tank and 1,475-litre batch tank equipped with two distribution pumps each; and one Gasoline Fuel Dispensing System comprising one 1200-litre Gasoline Fuel Tank equipped with one dispensing pump;
- The Underground Fuel System will consist of one shaft pipeline routed from the surface 50,000-litre storage tank through the existing adit and down the Main Shaft; four intermediate transfer stations comprising 475-litre storage tank equipped with fire suppression and one transfer pump each; four 6,000-litre diesel fuel storage tanks located within the main levels fuel bays; one 2,275-litre permanent satellite fuel station and two 2,275-litre temporary satellite fuel stations to be relocated as required to support development;

- Sewage treatment facilities designed to accommodate up to 250 people working on site or 30 m^3 of waste per day. The sewage treatment system will process all sewage-related waste generated on site. The system will be approximately 4,000 m^2 in size and will consist of an equalization tank, septic tanks, effluent tank, biofilters, septic bed, and odour control units. The approximate footprint of the facility will be 30 metres by 20 metres. The system will not tie into the municipal sanitary sewage system operated and maintained by the City of Greater Sudbury. Sewage will be directed from washrooms and shower facilities on site to a passive septic system near the parking lot. It will then be pumped through a series of peat moss filters into a prepared subsurface tile bed;
- Water management and treatment of site and mine water/effluent using the Wastewater Treatment Plant;
- The procurement of goods and services;
- A construction labour force of approximately 72 direct hires, plus approximately 200 to 300 indirect contractor employees;
- An operations labour force of 397 direct hires;
- Physical decommissioning including demolition of buildings, removal of the headframe and removal of the Ethel Lake Control Structure, removal of gatehouse and fencing;
- Removal of PAG Pad 2 liner and reclamation of the pad footprint including grading and re-vegetation of the area;
- Removal of all machinery and equipment not essential for compliance or the enhancement of environmental security. Surface equipment will be dismantled and removed for possible salvage or reuse;
- Post closure monitoring including groundwater monitoring, surface water monitoring, biological monitoring, physical stability monitoring and all other monitoring as required by the filed Victoria Mine Production Closure Plan.

2.3.1.1 Use of Offsite Existing Infrastructure/Facilities

The Ventilation Shaft, extending to a nominal depth of approximately 1860 metres will be in place at the completion of advanced exploration. Off-shaft lateral development is considered part of the Project and will include the exploration shaft access adit and diamond drill drifts. Development waste and the bulk sample will be trucked to surface from an adit dump underground. Each round of development rock will be identified according to rock type and managed following a waste rock management plan.

A return air ventilation adit will be collared, during Advanced Exploration, from the southeast side of the site and will be developed from surface to 40 metres below the collar of the exploration shaft. A pilot raise will be driven from this drift to surface and then slashed to full diameter to facilitate the construction of the collar. The galloway used for sinking the exploration shaft will be constructed and suspended in the shaft

prior to headframe erection and the completion of the remaining headworks and hoist arrangements. The adit will also be utilized for the Mine Project to connect to the Main Shaft and the fresh air fans at the west side of the Victoria Site. The adit will be separated by physical barrier into two sides, a fresh air side connecting the fresh air fans to the Main Shaft and a return air side to exhaust air from the Exploration Shaft via return air fans at the adit collar.

2.3.1.2 Proposed Facilities and Infrastructure

2.3.1.2.1 Potentially Acid Generating (PAG) 2 Storage Area

The PAG 2 Storage Area (PAG 2) will be located 1.5 kilometres northwest of the mine site and will be comprised of a waste rock storage pad, and water collection pond. The PAG 2 rock storage containment pad will be lined with a geomembrane with non-woven geotextile placed directly above and below the geomembrane. The geomembrane will be contained within sand bedding layers above and below the geomembrane and surrounded by perimeter berms. The waste rock to be stored at PAG 2 is considered potentially acid generating and therefore runoff from the footprint of the waste rock stockpile shall be collected and treated. The water collected within PAG 2 will flow to the PAG 2 collection pond where it will then be pumped through a decant structure and a heat traced discharge pipeline to the Mine Water Pond (MWP). Ultimately, the water will be sent to the Waste Water Treatment Plant (WWTP) for treatment prior to release to the environment or re-used as process water.

2.3.1.2.2 Ethel Lake Water Levels and Associated Control Structures

The Project requires additional water, supplementary to water obtained via the on-site groundwater wells, to support shaft sinking, production activities, and meet water quality objectives. Supplementary requirements will be met through the installation of a control structure and pumphouse, situated where Ethel Lake flows into Fairbank Creek, to raise the lake level approximately 0.5 metres. A control valve will allow the outflow to Fairbank Creek to ensure the minimum flow requirements are achieved and a spillway will be sized to ensure the Inflow Design Flood may be safely passed. A pumphouse will be constructed to supply raw water via pipeline to the raw water tank situated at the mine site.

2.3.1.2.3 Paste Backfill Plant

The crushing system will include three portable crushers in series to reduce the mine waste rock to six millimetre aggregate. This aggregate will feed the grinding circuit located inside the backfill plant where the grinding circuit will further reduce the aggregate to at least 20% passing 20 micron.

2.3.1.2.4 Physical Activities Incidental to the Designated Project

There are no physical activities incidental to the designated project.

2.3.2 Production Capacity

The Project includes, after the cessation of Advanced Exploration phase activities, the development of the underground mine including both above ground and below ground supporting infrastructure to enable the extraction of a maximum of 3,500 t/d of mine product (ore). This amount exceeds the threshold set out in Provision 16 in the *Regulations Designating Physical Activities: "The construction, operation, decommissioning and abandonment of a new (a) metal mine, other than a rare earth element mine or gold mine, with an " production capacity of 3 000 t/day or more."*

A description of the production processes to be used, associated infrastructure, and permanent or temporary structures is provided in Sections 2.3.1 – Physical Works and 2.3.4 – Description of Project Activities.

2.3.3 Expansion Scope

This is a new Project, and does not meet the criteria of an expansion project.

2.3.4 Description of Project Activities

The underground mine will consist of a main shaft, a ventilation shaft and an adit and underground supporting infrastructure including, but not be limited to, maintenance facilities, refuge stations, ballast and shotcrete delivery systems, and explosive and detonator magazines. Mine product (ore) and waste will be moved from the shaft to the load out building via crushing and sampling processes prior to being shipped off site. Surface infrastructure to support mine production includes a backfill plant, crusher, maintenance facilities, stormwater management infrastructure, administration facilities, mine dry facilities, and hygienic water, sewage and wastewater treatment plants.

The Project components located outside of the main Project site, but within the Victoria Property boundaries, include the overburden stockpiles, 230 kV transmission line, PAG 2 (waste rock stockpile), natural gas line, and the Ethel Lake water control structure and pumphouse.

2.3.5 Mining Method

The attributes of the Victoria deposit support the selection of an underground, transverse over-hand blasthole stoping, which is a bulk mining method, as the most appropriate method for the proposed mine. Blasthole stoping is a commonly used method in the Sudbury area and is inherently safe, as workers are typically remote from the working face. Figure 2-6 demonstrates a typical multi-panel overhand transverse blasthole stope. In this case, the illustration shows that there are two panels in each of the individual stopes. Victoria Mine varies from one to three panels thick.

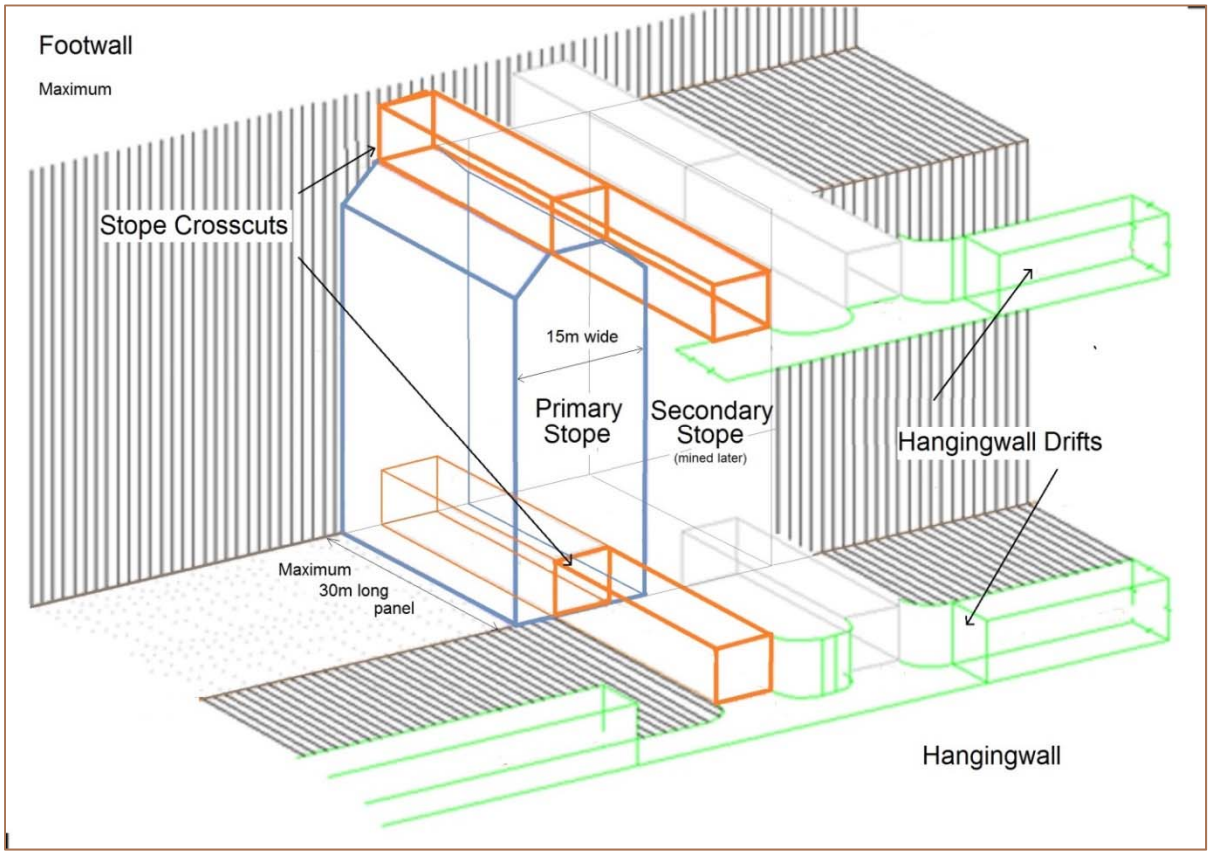

Figure 2-6: Blasthole Stoping – Over-Hand Transverse Method (Hanging Wall Access)

2.3.5.1 Drilling and Blasting

The transverse over-hand blasthole stoping method has the advantage of good mining recovery with moderate dilution from waste rock or backfill and is inherently safe. Drilling and blasting operations will progress until the stope is completely mined out. The stope void will then be backfilled using backfill.

2.3.5.2 Hoisting

The facilities that are involved in the mine product handling on surface are essentially related to the shaft and hoisting processes and the mine product transport and waste transport system processes, which move the broken mine product and associated waste rock to surface and off-site. The flow of all material, personnel, and equipment into and out of the mine will be through the main shaft headframe complex. The ventilation shaft headframe complex will be an integral structure which consists of the ventilation shaft

headframe, collar, sub-collar, hoist room with the secondary egress hoist, and associated facilities.

2.3.5.3 Mine Product and Waste Rock Crushing, Handling and Transportation

Mine product (ore) and waste rock material handling on surface will start at the discharge of the vibratory feeders below the two headframe bins. Vibratory feeders will be used as primary flow control devices, controlled by the rock level in the bins, to transfer material from the bins to conveyors. Conveyors will transfer the mine product and waste rock to the crusher building. After the crusher, both the fines and crushed material will drop onto the crusher discharge conveyor and will be transferred to the primary sampler where a cutter will divert 85% of the mine product and 100% of the waste to a bypass of the sampling process. A total of 15% of the mine product will go into the sample system to be further crushed, sampled, packaged and sent for analysis.

Third party owned and operated trucks will deliver the mine product (ore) via truck to the Clarabelle Mill. All mine product will be processed by Vale. Waste rock will be loaded to trucks and transferred to the PAG 2 storage area.

2.3.5.4 Labour

While the workforce will fluctuate over the course of construction, the total Project workforce will range from 252 to 437 over the life of mine. Management, supervision and technical staff positions are planned to a total of 70 employees. The maintenance crew varies from 66 to 98 people over the life of mine. The mine operations crew varies from 66 to 162 employees over the life of mine.

2.3.5.5 Procurement of Goods and Services

Project purchasing must be carried out ethically and professionally in the best interests of the Project, in compliance with applicable laws and without bias towards suppliers. The following conditions will be satisfied in conducting purchasing activities: compliance with the FNX policies; compliance with any arrangements or agreements between FNX and Indigenous Communities; compliance with Project criteria and specifications: within Project quality standards; within the Project budget; within the Project time schedule and within the framework of the Project systems.

2.4 Emissions, Discharges and Waste

2.4.1 Atmospheric Emissions

2.4.1.1 Point Source and Fugitive Emissions

The primary point source air emissions are expected to be generated by the fuel fired equipment, including heaters, generators, and mine ventilation equipment. The Project does not include a process plant, hence primary process air emissions are expected to be much lower than fuel combustion emissions. More specifically, the Project will consume natural gas for heating, diesel for surface and underground activities, and

gasoline for surface vehicles and equipment. Secondarily, upstream emissions will also be generated from grid electricity production.

Fugitive dust emissions (the main fugitive emission source) will be produced by a number of Project activities during both the construction and production phases including movement of equipment and vehicles on site roads; mine product and waste rock handling and processing activities; dust from mine product, waste rock, topsoil and overburden stockpiles and movement of mine product and waste rock offsite. Fugitive dust emissions will be produced during the decommissioning and abandonment phase due to physical decommissioning and equipment removal.

Air emissions from underground, site buildings and surface equipment activity have been modeled using an Emission Summary and Dispersion Model (ESDM) prescribed by the MOECC to demonstrate compliance with the requisite environmental approvals.

Figure 2-7 and Table 2-3 provide an illustration of point source emissions during the Victoria Mine Project operations phase.

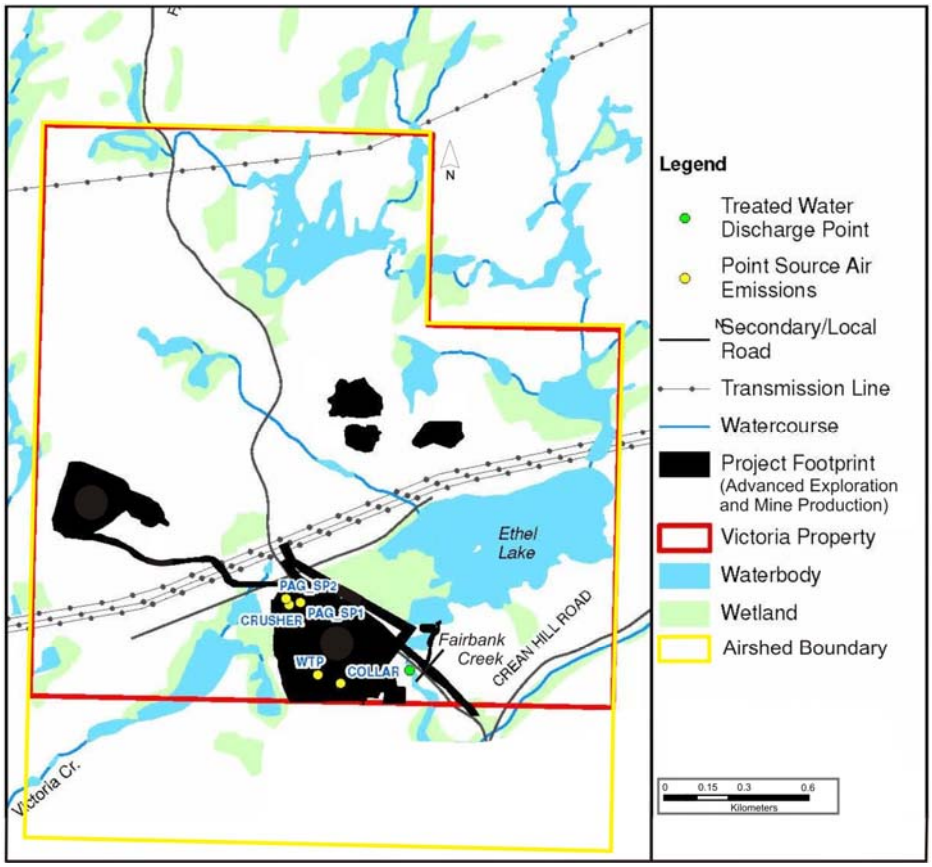

Figure 2-7: Point Source Emissions during the Victoria Mine Project

Table 2-3: Point Source Emissions and Emission Rates – Operations

ID	Source Description	Contaminate	Maximum Emission Rate [1]	Unit
COLLAR	Mine Ventilation	PM	1.65E+00	g/s
		CO	1.29E+01	g/s
		NOx	2.84E+00	g/s
		SO_2	1.93E-02	g/s
WTP	Water Treatment Plant	NOx	2.15E-02	g/s
		Ammonia	2.22E+00	g/s
IDGEN1 – IDGEN3, IDGEN5 – IDGEN7	Diesel Generators	CO	Emergency backup only	g/s
		NOx		g/s
		PM		g/s
		SO_2		g/s
CRUSHER	PAG Stockpile Area Crusher	CO	1.08E+00	g/s
		NOx	2.04E+00	g/s
		PM	2.65E-01	g/s
		SO_2	3.86E-01	g/s
PAG_SP1	PAG Material Handling 1	PM	3.63E-02	g/s
PAG_SP2	PAG Material Handling 2	PM	3.63E-02	g/s

Note 1: Assumed emissions from COLLAR, CRUSHER, PAG_SP1 and PAG_SP2 are proportional to Advanced Exploration emissions based on maximum extraction rates for respective phases (1,100 tpd vs. 5,500 tpd).

2.4.1.2 Greenhouse Gas Emissions

Greenhouse gas emissions (GHG) associated with diesel fuel and other fuel sources are anticipated to be minimal as the principal stationary power source for both construction and production is by transmission line. The greatest potential for the generation of greenhouse gases is through the use of heavy equipment, generators, or vehicles fuelled by diesel, gasoline or propane during the construction phase, and by trucks transporting the mine product during production.

The calculation of GHG emissions from energy sources is based on established Canadian emission factors associated with the combustion of fuels and the generation of grid electricity. The emissions factors used in this calculation, along with the source of the data, are summarized in Table 2-4 below.

Table 2-4: Emission Factors

Energy Source	Natural Gas[1]		Diesel[1]		Gasoline[1]		Electrical Power[2]	
GHG	Quantity	Unit	Quantity	Unit	Quantity	Unit	Quantity	Unit
CO_2	1,888	g/m^3	2,690	g/L	2,316	g/L	N/A	N/A
CH_4	0.037	g/m^3	0.15	g/L	2.7	g/L	N/A	N/A
N_2O	0.035	g/m^3	1	g/L	0.05	g/L	N/A	N/A
CO_2eq_3	1,899	g/m^3	2,992	g/L	2,398	g/L	50	g/kWh

[1] *National Inventory Report 1990-2014: Greenhouse Gas Sources and Sinks in Canada, Part 2 Annex 6, Environment and Climate Change Canada.*
[2] *National Inventory Report 1990-2014: Greenhouse Gas Sources and Sinks in Canada, Part 3 Annex 13, Environment and Climate Change Canada.*

Construction Phase

During the construction phase, the Project will consume natural gas for heating, diesel for surface and underground activities, and gasoline for surface vehicles and equipment. In addition, the Project will consume electrical power from the existing regional grid as a connection has been stablished for the construction phase.

The consumption and associated GHG emissions during the construction phase are summarized in Table 2-5 below. Energy source consumption data was estimated from first principals using the planned equipment fleet, facilities and construction schedule.

Table 2-5: Construction Phase GHG Emissions Estimate

	Annual Energy Consumption		Annual Greenhouse Gas Emissions	
Energy source	Quantity	Unit	Quantity	Unit
Natural gas	2,336,280	m^3	4,437	tCO_2eq/yr
Diesel	1,540,557	L	4,609	tCO_2eq/yr
Gasoline	62,400	L	150	tCO_2eq/yr
Electrical power	221,000	MWh	11,050	tCO_2eq/yr
		Total	**20,246**	**tCO_2eq/yr**

Primary greenhouse gas emissions from fuel combustion (natural gas, diesel and gasoline) during construction are estimated to be 9 $ktCO_2eq/yr$. In addition, secondary upstream emissions from grid electricity production are estimated at 11 $ktCO_2eq/yr$.

Operations Phase

During the operation phase, the Project will consume natural gas for heating, diesel for surface and underground activities and trucks transporting the mine product, gasoline for surface vehicles and equipment, as well as electrical power from the regional grid.

The consumption and associated GHG emissions during the operations phase are summarized in Table 2-6 below. Energy source consumption data was estimated from first principals using the planned equipment fleet, facilities and mine operations plan.

Table 2-6: Operations Phase GHG Emissions Estimate

	Annual Energy Consumption		Annual Greenhouse Gas Emissions	
Energy source	**Quantity**	**Unit**	**Quantity**	**Unit**
Natural gas	3,700,695	m^3	7,029	tCO_2eq/yr
Diesel	4,379,812	L	13,103	tCO_2eq/yr
Gasoline	31,200	L	75	tCO_2eq/yr
Electrical power	221,000	MWh	11,050	tCO_2eq/yr
	Total		**31,257**	**tCO_2eq/yr**
			26	**$kgCO_2eq/t$ mine product**

Primary greenhouse gas emissions from fuel combustion (natural gas, diesel and gasoline) during the operations phase are estimated to be 20.1 $ktCO_2eq/yr$. In addition, secondary upstream emissions from grid electricity production are estimated at 11 $ktCO_2eq/yr$. This corresponds to 26 $kgCO_2eq/t$ of mine product extracted, based on 3,500 tonnes of mine product extracted per day.

These estimates are very small (<0.05%) compared to province of Ontario and Canada-wide totals and future targets.

Decommissioning and Abandonment Phase

Greenhouse gases generated during the decommissioning and abandonment phase are expected to derive from heavy equipment used during the demolition of buildings and removal of the headframe. The consumption and associated GHG emissions during the decommissioning and abandonment phase are summarized in Table 2-7 below. Primary

greenhouse gas emissions from fuel combustion (natural gas, diesel and gasoline) during the decommissioning and abandonment phase are estimated to be 5.6 $ktCO_2eq/yr$. In addition, secondary upstream emissions from grid electricity production are estimated at 0.11 $ktCO_2eq/yr$. Energy source consumption data was estimated from first principals using the planned equipment fleet, facilities and mine closure plan.

Table 2-7: Decommissioning and Abandonment Phase GHG Emissions Estimate

	Annual Energy Consumption		Annual Greenhouse Gas Emissions	
Energy source	**Quantity**	**Unit**	**Quantity**	**Unit**
Natural gas	29,932	m^3	56.85	tCO_2eq/yr
Diesel	1,841.594	L	5,509.59	tCO_2eq/yr
Gasoline	15,600	L	37	tCO_2eq/yr
Electrical power	2,204	MWh	110	tCO_2eq/yr
Total			**5,713**	**tCO_2eq/yr**

Comparison to Provincial and National Emission Totals and Targets

As demonstrated in Table 2-8, GHG emissions from the construction, operation and decommissioning and abandonment phase activities at Victoria Mine are expected to be very small (<0.05%) compared to province of Ontario and Canada-wide totals and future targets.

Table 2-8 Comparison to Provincial and National Emission Totals and Targets

		Construction	Operation	Decommissioning and Abandonment
	GHG emissions ($ktCO_2eq/yr$)	**20.2**	**25.5**	**5.7**
Emissions-Intensive and Trade-Exposed Industries [1]	76,000	0.026%	0.034%	0.0075%
Ontario Provincial Total [1]	170,000	0.011%	0.015%	0.0034%
Canadian National Total [1]	732,000	0.003%	0.004%	0.0008%
Canadian 2020 Target [1]	620,000	0.003%	0.0035%	0.0009%
Canadian 2030 Target [1]	522,000	0.004%	0.0049%	0.0011%

[1] *National Inventory Report 1990-2014: Greenhouse Gas Sources and Sinks in Canada, Part 1 Executive Summary, Environment and Climate Change Canada.*

2.4.1.3 Noise Emissions

The primary sources of noise emissions during construction would include open air heavy equipment operation and blasting. Noise emissions will be generated by the mine ventilation fans, materials handling and blasting and other process facilities during the production phase.

The mine ventilation fans, compressor plant, refrigeration plant, backfill plant, crusher, and vacuum truck were identified as the major source of noise emissions during operations.

The major source of noise emissions during operations will be abated to reduce the potential adverse effects to local residents, cottagers and the public.

Noise sources during the decommissioning and abandonment phases will are expected to derive from heavy equipment operation related to demolition of buildings and removal of the headframe, removal of the Ethel Lake control structure and post closure activities.

2.4.2 Liquid Discharges

2.4.2.1 Water Management and Treatment

The Water treatment Plant provides process water for mine operations, water containment and water treatment. The Project has proactively planned to limit the number of water discharge points to ensure minimal effects on the receiving aquatic environment. The single effluent discharge location is shown on Figure 2-3.

Potentially contaminated and process water includes water pumped from the underground workings and precipitation in the site area, all of which are considered potential sources of contamination. In addition, wash water and other water used on site for operational reasons is considered to be potentially contaminated. Potentially contaminated water requires collection, isolation and treatment prior to discharge into the environment or before being reused as process water in Project construction and operations. The Water Distribution Plant will be one of the last facilities constructed, therefore a separate system will be provided for construction water demands.

The Mine Water Pond is a water retention area located on the west side of the property. It is sized to accommodate a 1-in-100-year, 24-hour storm event, or 43,400 cubic metres of water. If this amount is exceeded, a spillway is included to protect dam integrity. Water from the Mine Water Pond is delivered to the WWTP for treatment so that it can be reused in underground operations.

2.4.2.2 Sewage Treatment and Disposal

The sewage treatment facilities on site are designed to accommodate up to 250 people working on site or 30 m^3 of waste per day. The sewage treatment system will process all sewage-related waste generated on site. The system will be approximately 4,000 m^2 in

size and will consist of an equalization tank, septic tanks, effluent tank, biofilters, septic bed, and odour control units. The approximate footprint of the facility will be 30 metres by 20 metres. The system will not tie into the municipal sanitary sewage system operated and maintained by the City of Greater Sudbury. Sewage will be directed from washrooms and shower facilities on site to a passive septic system near the parking lot. It will then be pumped through a series of peat moss filters into a prepared subsurface tile bed.

The system described above will be supplied as a pre-engineered turn-key system and will be installed by either the vendor or a contractor. Installation is to be completed in a single stage.

2.4.3 Waste Management

Wastes generated by the Project include non-hazardous, hazardous, and liquid wastes as well as waste rock generated by mining activities. Tailings will not be generated on-site as the processing of all ore will be conducted off site. Therefore, no on-site tailing storage will be required.

2.4.3.1 Non-Hazardous and Hazardous

Solid, non-hazardous waste will be deposited in dedicated bins that are supplied and transported by a licensed carrier and disposed of at an approved off-site facility. Bulk products such as water treatment reagents and petroleum products will be obtained in returnable containers to the extent possible and material will be recycled to the extent possible. All non-hazardous and recycling wastes will be managed according to waste management procedures.

All hazardous and liquid industrial wastes will be stored, managed and disposed of as detailed in the FNX hazardous and liquid industrial waste management procedure.

2.4.3.2 Waste Rock

Waste rock produced by the Project will be separated into non-acid generating (NAG) and PAG rock. The NAG rock will be used as construction material on site and may also be used for surface backfill material. The PAG rock will be stored on site in two lined, bermed areas (PAG 1 and PAG 2 waste rock storage areas) to be used for underground backfill material. PAG 1 is located on the northwest corner of the Property and will receive waste rock generated during the Advanced Exploration phase only. No waste rock will be added to PAG 1 and its dimensions and capacity will not increase during the mine project. PAG 2 waste rock storage area will be used to store waste rock produced throughout the production phase only.

Once all rock has been removed from PAG 1 for use as backfill, the liner will be removed and the area will be graded and revegetated. Removing rock from PAG 1 for use as backfill and reclamation of the PAG 1 footprint will occur during the production phase of the Project.

The entire volume of waste rock stockpiled in both PAG facilities is expected to be utilized by the backfill plant and returned underground as fill to the mined out areas during the life-of-mine operation. No PAG waste rock will remain on surface at mine closure.

2.5 Project Phases and Scheduling

2.5.1 Scheduling

Full mine construction is expected to commence in 2024. Commercial production will begin in 2031 and the mine life will extend to October 2042. Physical decommissioning will take place from 2042 to 2045.

2.5.2 Main Activities

Construction Phase

The Victoria Project will utilize existing infrastructure and facilities associated with the advanced exploration program as much as practical. Main activities associated with the development and construction phase include:

- Procurement of materials and equipment;
- Development and implementation of environmental protection and monitoring plans for construction (continuing through all project phases);
- Movement of construction materials to laydown areas on site;
- Construction labour, vegetation clearing; earthworks (excavation and piling of earth), dewatering, grubbing and disposal, infilling with suitable clean granular material to provide sufficient drainage; final grading;
- Paving of main site footprint to minimize dust and efficiently direct all runoff to designated low points for collection and storage in existing mine water pond;
- Atmospheric emissions from noise and dust;
- Construction of paste backfill plant and systems and other buildings;
- Construction of the Ethel Lake control structure;
- Construction of main shaft headworks and hoisting facility and development of main shaft;
- Construction of PAG 2 waste rock storage area including:
  - Land clearing and grubbing haulage road to PAG 2, rough grading with clean fill;
  - Land clearing and grubbing of PAG 2 footprint area;
  - Importing clean fill, placing and compacting clean fill into the PAG 2 area to form the base of the pad and berms;

  - Installation of a geomembrane liner in the PAG 2 area to create a watertight containment area;
  - Creation of sumps to collect water, installation of piping along the haulage road to pipe water to connect to the Mine Water Pond;
- Rock storage and handling;
- Fuel and hazardous materials storage and handling;
- Water use, collection, treatment and discharge;
- Underground ventilation;
- Vehicle and equipment use;
- Solid waste disposal;
- Sewage treatment and disposal; and
- Progressive reclamation.

Construction activities will be sequenced according to manpower and equipment availability and site conditions. Sequencing of activities will consider environmental aspects such as fish spawning windows and bird breeding seasons.

Operations Phase

Main activities associated with the operations phase include:

- Operations labour;
- Vehicle and equipment use;
- Water management including dewatering, collection, use of water, treatment and discharge;
- Mine product extraction, crushing and movement of mine product and waste rock, waste rock and mine product hauling to Vale Copper Cliff facilities;
- Underground ventilation;
- Underground backfill (ground support);
- PAG waste rock storage and handling; rock and mine product hauling to Vale Copper Cliff facilities;
- Transferring of runoff from PAG2 to the Mine Water Pond;
- Fuel and hazardous materials storage and handling;
- Environmental monitoring and reporting;
- Air quality and noise management;
- Solid waste disposal and sewage treatment and disposal; and

- Progressive site reclamation, where practical.

Decommissioning and Abandonment

All project components will be decommissioned and all land will be reclaimed. Main activities associated with the decommissioning and abandonment phase include:

- Progressive rehabilitation;
- Physical decommissioning including demolition of buildings, removal of the headframe and removal of the Ethel Lake Control Structure;
- Removal and rehabilitation of PAG 2 Storage Area;
- Removal of all machinery and equipment not essential for compliance or the enhancement of environmental security. Surface equipment will be dismantled and removed for possible salvage or reuse;
- Post closure monitoring including groundwater monitoring, surface water monitoring, biological monitoring, physical stability monitoring and all other monitoring as required by the filed Victoria Mine Production Closure Plan.

Closure of the Victoria Project site will occur on completion of production mining. Closure and post closure activities will occur in accordance with the Victoria Mine Production Closure Plan which will meet the *Ontario Mining Act* and its associated regulations and will be filed before the production phase begins. Financial assurance will be provided by FNX with the closure plan at the time of filing.

Closure activities will be governed by the *Ontario Mining Act* and its associated Regulations and codes, and are expected to include:

- Openings to underground will be sealed with engineered caps; and
- Revegetation consisting of grading, spreading of seed and hydroseeding.

2.6 Alternatives

2.6.1 Alternatives to the Project

FNX views alternatives to the Project as different ways to achieve the same objective, which is producing metals for its customers. FNX has spread development risk amongst a group of projects that offer some potential for viable mine development. Potential risks to business development projects are constantly evaluated to ensure that capital can be optimized between projects to best meet overall objectives.

2.6.2 The “No Project” Alternative

If the Project does not proceed, the mineral resource will not be developed and the potential residual adverse environmental effects and the benefits described in this environmental effects assessment will not be realized.

2.6.3 Approach to Project Planning

FNX's overall approach to Project planning includes a practical respect for the precautionary principle in the scope and scale of the Project. The following aspects of the Project help protect the environment, avoid or reduce pollution and the creation of potential legacy issues. The Project is situated in the City of Greater Sudbury avoiding the need for construction camp facilities; milling/ore processing; site tailing storage; smelting and refining facilities and extensive upgrades to infrastructure.

The underground mining method will result in a reduction and minimization of surface "footprint"; Project related buildings able to fit within the area of disturbance from past exploration activities; the need for ventilation as mitigation against unsafe working conditions; and reduced and simplified decommissioning and abandonment needs.

2.6.4 Alternative Means of Carrying Out the Project

A variety of considerations where investigated with the purposes of bringing forward an acceptable Project and avoiding significant residual adverse environmental effects. Such alternatives included:

- Collecting and recycling of mine and site water to the extent practical to reduce demand on other sources rather than the continuous use of fresh water, and to minimize the discharge to the natural environment;
- Preferentially focus any surface water source needs on Ethel Lake as it is already considered an altered water body due to historical mining and water management activities in the area rather than create or affect another surface water body;
- Engineered impervious rock storage pads for mineralized (PAG) rock and fully consider developing a mine method (blasthole stoping) that can utilize mine rock for backfill for ground support. The manufacturing of backfill will use PAG rock thus PAG rock storage on site is considered temporary; and
- Alternatives for excessive mineralized (PAG) rock storage or mine rock disposal until engineered pads are ready for site storage includes trucking to Vale properties for use in tailings area dam construction and water management.

2.7 References

- KGHM International. 2014. Amendment to the Victoria Project Advances Exploration Closure Plan filed by MNDM on October 21, 2013. Addressed to Gordon MacKay, Director of Mine Rehabilitation. November 26, 2014.

3. Project Location

3.1 Description of Project Location

3.1.1 Project Coordinates

The Project is situated in Denison Township (46°25'N latitude, 81°23'W longitude) in the Sudbury Basin of northeastern Ontario within the City of Greater Sudbury (Figure 3-1). Primary access is provided by Municipal Road #4 that runs north from Highway 17.

3.1.2 Site Plan

The general arrangement of Project facilities and infrastructure is provided in Figure 2-3 and Figure 2-4, including facilities and infrastructure constructed for Advanced Exploration. As previously stated, much of the infrastructure required for the Project will be in place as a result of more than a decade of exploration activities. The ventilation shaft, hoisting and underground ventilation infrastructure, as well as waste storage, various building and key processes like sewage treatment and wastewater collection and treatment plants will be in place and functioning. Aerial photos taken of the site in 2014 and 2015, showing the proposed future location of facilities and infrastructure are presented in Figure 3-3, Figure 3-4 and Figure 3-5 display photos of Fairbank Creek (receiving water), and Figure 3-6 and Figure 3-7 display the existing historical dam at Ethel Lake.

3.1.3 Maps of Project Components in Relation to Existing Features

The proximity of the Project to indigenous groups, settlement land, traditional territory, federal lands, fisheries and fishing areas, environmentally sensitive areas, provincial and international boundaries are provided in Figure 3-1 and Figure 3-2.

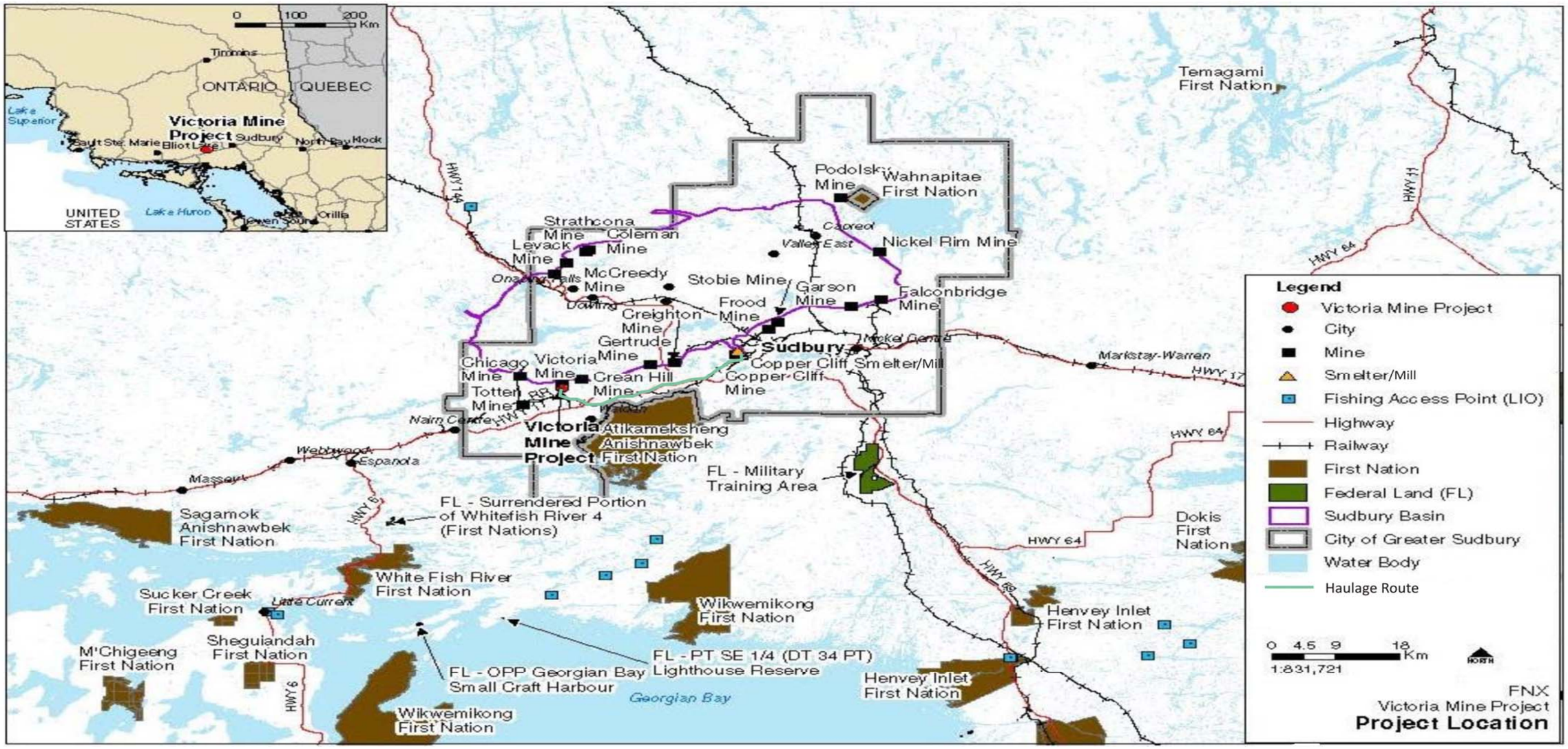

Figure 3-1: Project Location

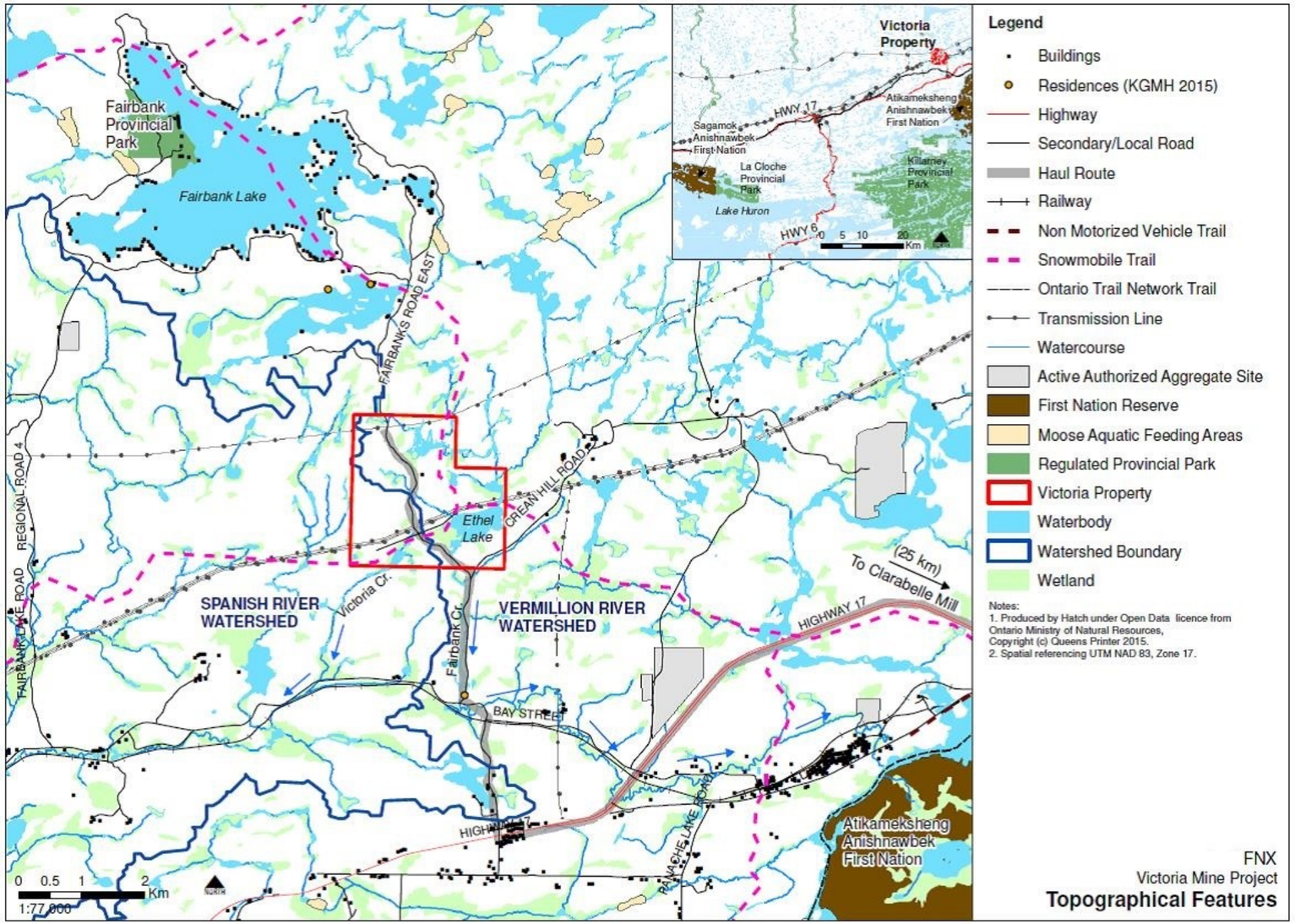

Figure 3-2: Topographical Features

Figure 3-3: Aerial Photo of the Victoria Site Taken in Q2 2014 Showing Proposed Future Location of Project Facilities and Infrastructure

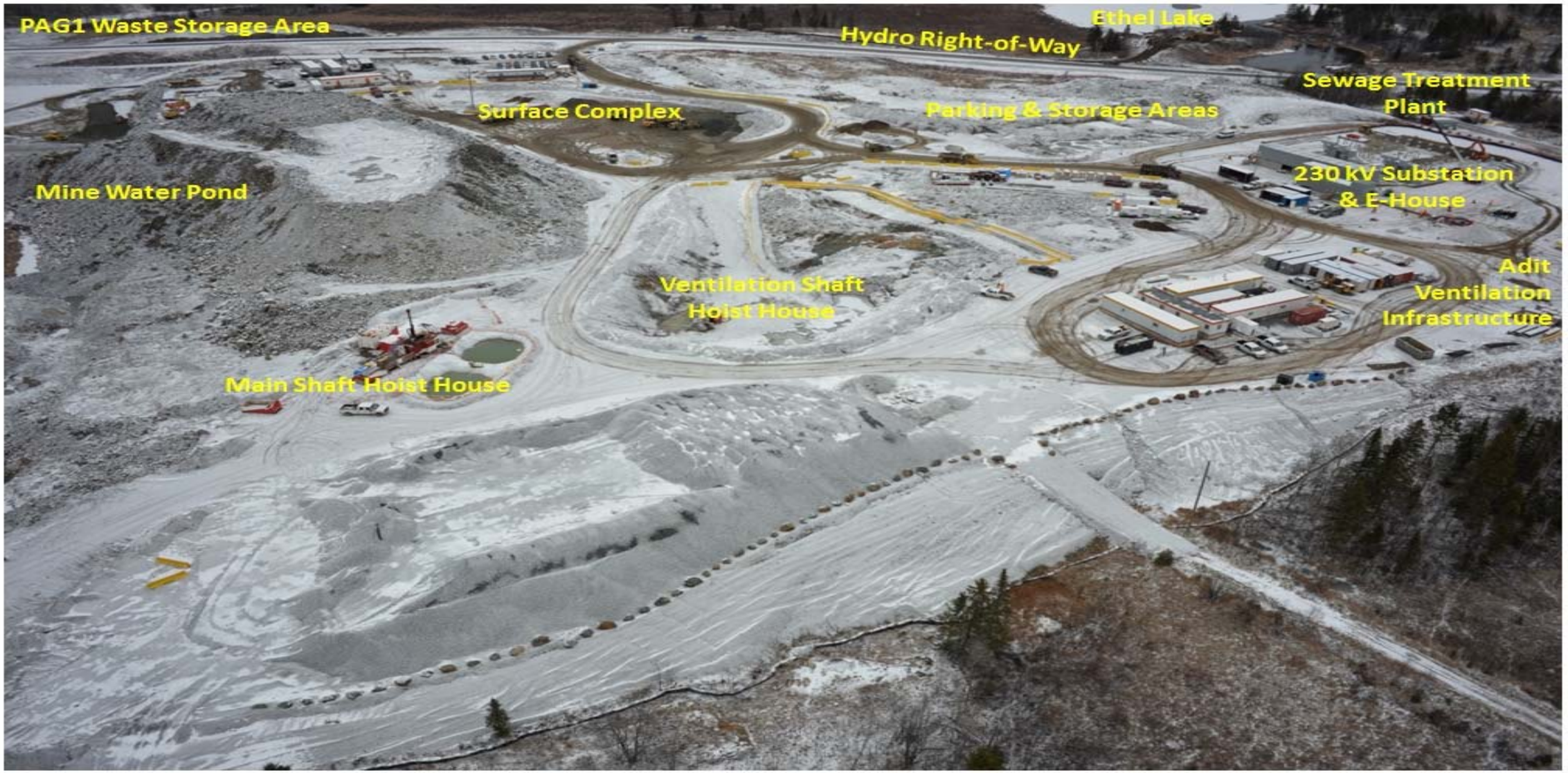

Figure 3-4: Aerial Photo of the Victoria Site Taken in Q4 2015 Showing Proposed Future Location of Project Facilities and Infrastructure

Figure 3-5: Fairbank Creek (Receiving Environment)

Figure 3-6: Location of Existing Historical Dam and Proposed Control Structure

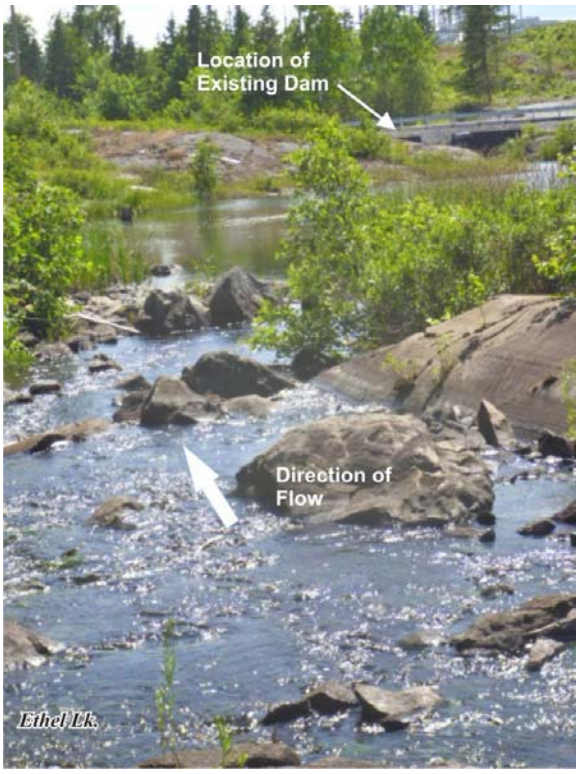

Figure 3-7: Location of Existing Historical Dam, Looking Downstream from Ethel Lake

3.1.4 Proximity to Other Features

The Project is situated within proximity to a number of other features, as shown on Figure 1-1, Figure 3-1 and Figure 3-2. Natural features in proximity to the Project include watercourses within the Vermilion River and Spanish River watersheds, forests, wetlands and associated wildlife habitat.

There are no planned facilities or activities associated with the Victoria Project on:

- Federal lands of any type, including First Nations Reserve lands;
- Provincial Parks or Conservation Reserves;
- Areas of Natural and Scientific Interest;
- Provincially Significant Wetlands;
- Provincial Forest Reserves; or other
- Provincially-protected lands.

There are no residences on the Victoria Project Site.

Features located within the Victoria Property include an existing transmission line corridor, Ontario Federation of Snowmobile Club trails, Fairbanks Road East and Crean Hill Road. Other features situated beyond the Victoria Property but within proximity to the Project include:

- Atikameksheng Anishnawbek First Nation Reserve (7.6 kilometres southeast);
- Sagamok First Nation Reserve (45 kilometres west);
- Fairbank Provincial Park (7.2 kilometres northwest);
- Highway 17 (4.6 kilometres south);
- Various seasonal and/or permanent buildings (approximately two kilometres north and south); and
- Town of Whitefish (6.2 kilometres southeast).

3.2 Land and Water Use

3.2.1 Zoning Designations

The Project is situated within an area of approximately 519 hectares of mining rights comprising five registered parcels. The area is zoned M4 – Mining Industrial by the City of Greater Sudbury.

The Project area is located in the City of Greater Sudbury in the western portion of the Sudbury Basin that also provides recreational land use opportunities such as fishing, hunting, berry picking and snowmobiling.

3.2.2 Legal Description

The mineral rights tenure for the Victoria property is comprised of five contiguous registered parcels of land, namely PIN's 73382-0346(LT), 73382-0791(LT), 73382-0793(LT), 73382-0795(LT), 73382-0801(LT), each of which were granted by Letters Patent through the Province of Ontario (Table 3-1). The five parcels cover a total area of 519.18 ha. The mineral rights boundary (i.e. the outer perimeter of these parcels) is indicated on the land tenure map presented as Figure 3-8.

Table 3-1: Victoria Property – Mining Rights

PIN Number	Parcel Number or Deed of Land	Area (ha)
Pt of PIN 73382-0791 (LT)	Pt of Parcel 19824 "A" SWS	252.08
PIN 73382-0346 (LT)	Parcel 1240 SWS	1.64
PIN 73382-0793 (LT)	Parcel 483 SWS	91.44
PIN 73382-0795 (LT)	Parcel 8283 SWS	42.90
PIN 73382-0801 (LT)	Deed-Instrument 151	131.12
Total	**5**	**519.18**

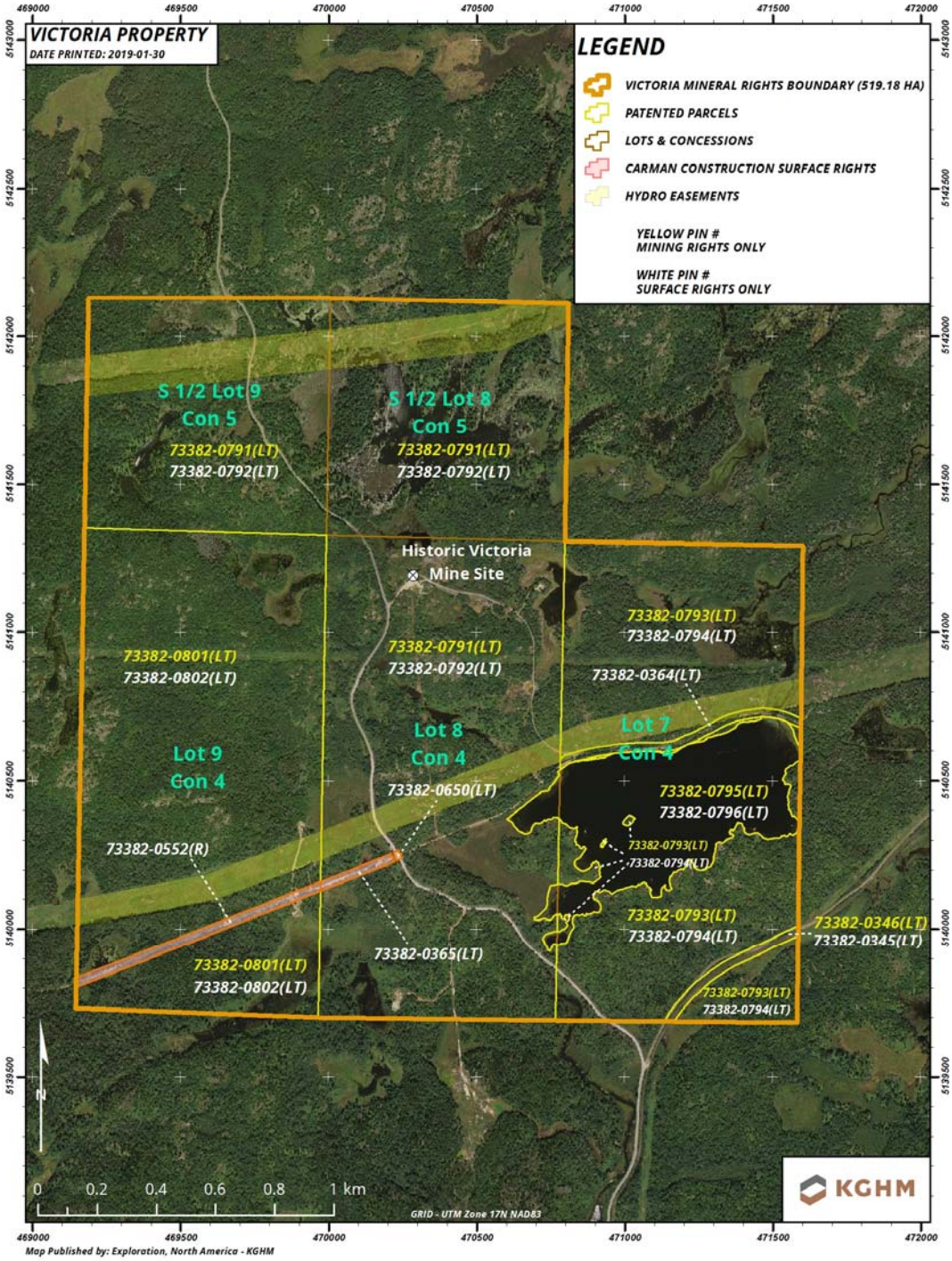

Figure 3-8: Land Tenure Map

On January 10, 2002, FNX entered into an Option Agreement with Vale (at the time, Inco Ltd.) whereby FNX may acquire an interest in five properties in the Sudbury District, including the Victoria property. FNX owns the minerals rights to the Victoria property. In 2013, FNX and Vale agreed to proceed with exploration and Project studies and executed an off-take agreement whereby mine product (ore) will be processed at Vale's Clarabelle Mill in Copper Cliff. Under the arrangement, FNX will be the sole Owner and build and operate the Project and Vale will receive a royalty and off-take on all future production from the Project.

The surface rights tenure for the Victoria property comprises six contiguous registered parcels of land as shown in Table 3-2. Vale, and to a minor extent Carman Construction, own the surface rights of the Victoria Property (Figure 3-8).

Table 3-2: Victoria Property – Surface Rights

PIN Number	Parcel Number or Deed of Land	Owner	Area (ha)
Pt of PIN 73382-0792 (LT)	Pt of Parcel 19824 "A" SWS	Vale	251.17
PIN 73382-0345 (LT)	Parcel 1239 SWS	Vale	1.64
PIN 73382-0364 (LT)	Parcel 4949 SWS	Vale	2.57
PIN 73382-0794 (LT)	Parcel 483 SWS	Vale	88.87
PIN 73382-0796 (LT)	Parcel 8283 SWS	Vale	42.90
PIN 73382-0802 (LT)	Deed-Instrument 151	Vale	128.47
PIN 73382-0552 (RA)	Deed-Instrument 141	CCI	2.65
PIN 73382-0365 (LT)	Pt of Parcel 4951 SWS	CCI	0.85
PIN 73382-0650	Pt of Parcel 4951 SWS	CCI	0.06
Total			**519.18**

3.2.3 Relevant Land and Resources Management Plans

The Victoria property and the Project are part of the Sudbury igneous geological complex (the "Sudbury Basin") and situated within the boundary limits of the City of Greater Sudbury. Mining is a highly compatible and desirable land use practice in the city of Greater Sudbury and as a result has appropriate emphasis in the Master Plan. Several key excerpts associated with mineral resources development are provided here (italic emphasis added):

The following are excerpts from the City of Greater Sudbury Master Plan (2006):

"1.3.2 Economic Development[1]

Economic development is essential to the future of this community and an important building block of a Healthy Community.

The Official Plan must provide a policy framework which supports economic development initiatives and facilitates the implementation of the Economic Development Strategic Plan.

Quality of place has been identified as a main factor in attracting and retaining community talent. The Official Plan plays an important role in influencing and improving the natural, cultural and lifestyle amenities of Greater Sudbury. Among other matters, this Plan establishes land use policies that will protect and enhance the City's natural environmental assets, as well as urban design guidelines that are intended to improve the quality of our built environment.

The City's economic development strategy focuses on five engines for growth:

The best mining and supply services in the world;

A city of the creative, curious and adventuresome (providing a quality of life to attract a diverse population);

One of Ontario's top four destinations (capitalizing on our natural assets and history to attract residents and visitors);

A leader in health innovation and biotechnology; and

A model for eco-industry and renewable energy.

1.3.3 Sustainable Development

A healthy and prosperous future depends on Greater Sudbury being a sustainable community.

Our Common Future, the landmark U.N. report presented by the Bruntland Commission in 1987, defines sustainable development as "meeting the needs of the present generation without compromising the ability of future generations to meet their needs."

Becoming a sustainable community involves adopting a long-term view in assessing options and making choices. It also means recognizing the value of healthy ecosystems, using resources efficiently, and enhancing a locally based economy. Bringing all parts of the community together to meet the goal of sustainability can be accomplished by encouraging and facilitating partnerships among the government, private and non-profit sectors.

[1] City of Greater Sudbury, 2006. The City of Greater Sudbury Master Plan (as amended through to September 2015). Prepared by Planning Services Division, Growth and Development Department, City of Greater Sudbury. pp 279.

The Official Plan recognizes the interdependencies that exist in the natural environment and introduces a watershed-based approach to planning. It provides land use policies which protect our natural resources to support long-term economic growth, including mining, aggregate and agricultural lands.

1.3.4 Focus on Opportunities

Greater Sudbury must build upon its strengths and recognize where opportunities exist to improve our community.

…"The Economic Development strategic plan identifies several economic engines as the focus of potential growth. The mining and supply services cluster in particular offers tremendous potential for the development of products, services and expertise that can be exported globally."…

4.6.1 Mining/Mineral Reserve

Lands designated Mining/Mineral Reserve are considered to have significant mineral potential including areas forming the Sudbury Igneous Complex, as well as current producing mines, past producing mines, ore processing plants, major tailings areas, and other mineral deposits.

Policies

1. *Mining/Mineral Reserve areas will be protected from development that would preclude or hinder the establishment of new operations or access to the resource unless:*
    - *i) The resource use would not be feasible; or*
    - *ii) The proposed land use or development serves a greater long-term public interest; and*
    - *iii) Issues of public health, public safety and environmental impact are addressed.*
2. *Lands designated Mining/Mineral Reserve may be used for a variety of uses related to the extraction of minerals. Permitted uses may include mining and mining-related uses, mineral aggregate uses, smelting and refining uses, pits and quarries and related uses, and accessory uses and structures associated with mining.*
3. *For land in the Mining/Mineral Reserve to be used for mining purposes, an amendment to the Zoning By-law must occur where such lands are not pre- zoned. In considering an amendment to the Zoning By-law to permit a mining or mining-related use or the expansion of an existing use in the Mining/Mineral Reserve area, Council will consider:*
    - *i) The impact on the environment, particularly new mining operations which must be located where there will be little or no impact on natural heritage features and functions;*
    - *ii) Indirect impacts on the utilities and services provided by the City;*
    - *iii) The impact on surrounding land uses;*

iv) The aesthetic appearance of the proposed development; and

v) The benefit of the mining or mining-related use to the City.

4. *Other uses such as forestry and other resource-related compatible uses, recreation, parks and open space, and wildlife management may be permitted provided they do not preclude future extraction. Other industrial uses that will not preclude future mining activities may be permitted subject to zoning permission and site plan control.*
5. *New lot creation for rural residential development is not permitted on lands designated as Mining/Mineral Reserve (see Section 5.2.2).*
6. *Past producing mining operations or active mining operations are subject to the provisions of the Mining Act with respect to rehabilitation and/or closure."*

3.2.4 Use of Traditional Indigenous Lands

A well-established and practiced information sharing and confidential consultation process exists between FNX and each of the three Indigenous groups potentially affected by the Project. Because of the extensive consultation efforts over the past ten years, FNX has a comprehensive understanding of key concerns of these groups (as shown in the consultation logs presented in the preceding Tables 6-1 through 6-3). The key issues that FNX has engaged the three Indigenous groups about are:

1. Awareness of the traditional use of lands and resources that may be of concern;
2. Awareness of the use of Aboriginal cultural and sensitive areas;
3. Establishment of potential Aboriginal employment, business opportunities, skills development and training; and where practicable; and
4. The use and incorporation of any traditional knowledge provided to improve overall sustainability performance for ongoing exploration activities and the future Victoria Mine.

FNX has considered the concerns associated with; potential adverse environmental effects on potential or established Aboriginal or treaty rights into the Project design and planning of the environmental effects analysis that has been conducted for the Project.

The selection of Valued Components in the environmental effects analysis takes into consideration the key issues identified by the Indigenous groups through the consultation process. Valued components have been carefully and respectfully considered to reflect environmental protection and pollution prevention issues associated with concerns and key issues identified by Indigenous groups in Tables 6-1 through 6-3 above, in the Design of the Project while respecting existing confidential agreements. The Valued Components used in this analysis include: Atmospheric Environment, Surface Water Quality, Groundwater Quantity, Fish and Fish Habitat, Terrestrial Habitat, Archaeological Resources, Residents and Recreational Land Use, Community Services and Infrastructure, and Employment and Business. Results of the

detailed environmental analysis indicate that residual adverse environmental effects for each of these VCs have been determined to be not significant. Furthermore, the Project will generate considerable local and regional economic activity during the Construction and Operation phases, resulting in positive benefits from potential economic opportunities including employment opportunities, business and contracting opportunities, and training and skills development. The Project and Indigenous communities have consulted extensively since 2010, including: Atikameksheng Anishnawbek First Nation, Sagamok First Nation, and Métis Nation of Ontario (refer to Section 6 – Proponent Engagement and Consultation with Indigenous Groups). Consultation and engagement efforts have included detailed discussions regarding the potential effects of the Project on the Indigenous communities, including concerns of impacts to traditional territory and Indigenous and treaty rights. Concerns raised by each community are addressed through various outreach initiatives, which are led by FNX management and Indigenous community leadership. Outreach initiatives have included, but are not limited to information sharing; implementation meetings, site visits and tours, establishment of subcommittees (e.g. Environmental subcommittee), provision of project updates to communities, site ceremonial blessings, participation in Fall harvest events and traditional celebrations, provision of financial support for capacity funding, funding of traditional knowledge and land use studies (according to our existing agreements), and archaeology studies for Ethel Lake.

FNX has reached formal agreements for the Advanced Exploration phase of the Project with the Indigenous communities above which includes provision for addressing any issues or concerns with traditional land use and traditional knowledge and to identify opportunities for traditional knowledge to be incorporated into the design of the Project. The contents of these agreements are confidential and are not discussed herein. A traditional knowledge and land use study was undertaken by one of the Indigenous communities with funding provided by FNX. We expect to receive TKLU information from the other two communities over the course of the next few years. If any new infringement on land use is identified in the course of the studies, FNX is committed to working with the affected communities to address any concerns. The results of the study as well as traditional land usage information received to-date from Indigenous Communities have been fully considered in the relevant aspects of the Project's policies and procedures.

Indigenous Communities have reported traditional usage of the lands in the region around the Victoria Project for hunting large and small game, fish harvesting, plant gathering, road access, trapping and occupancy, while the lands closely surrounding the Project area itself have also been used for bird harvesting, harvesting of plants and natural materials, cultural practices and camping.

To accommodate Indigenous Groups' traditional use of the lands and resources surrounding the Victoria Project Area, FNX will provide conditional access to these areas for traditional activities throughout the life of the mine. Access will be conditional upon the area to be accessed being deemed safe.

An Access Management Plan will be developed in consultation with Indigenous Groups to facilitate safe access to areas in and surrounding the Victoria Project Site for traditional usage during the life cycle of the mine (including advanced exploration, construction, operation, decommissioning and abandonment). The Access Management Plan will be developed and in use by the end of 2019. The Plan will protect the health and safety of those practicing traditional gathering activities, the public and Victoria Project personnel. Our closure plan objectives were also developed in alignment with indigenous communities Traditional Usage values.

FNX understands the importance of collecting and considering Traditional Knowledge and Traditional Land Use (TLU) information. Individuals and families most dependent on local resources for spiritual, cultural, and basic needs are best positioned to articulate the importance of places, areas, and activities but also to share the knowledge that is grounded in learned experience. With this in mind, FNX will continue to meet with Indigenous Groups to update the Access Management Plan as information changes or new information is acquired to ensure that traditional use needs of Indigenous Groups are accommodated.

3.3 References

- City of Greater Sudbury, 2006. The City of Greater Sudbury Master Plan (as amended through to September 2015). Prepared by Planning Services Division, Growth and Development Department, City of Greater Sudbury. pp 279.

4. Federal Involvement

4.1 Federal Financial Support

FNX does not require Federal financial support for the Project. There is no proposed or anticipated Federal financial support associated with the Victoria Project development, operation or closure.

4.2 Federal Lands

There are no federal lands required for the Project. There are no planned facilities or activities associated with the Victoria Project on Federal lands of any type, including First Nations Reserve lands.

There are no Federal lands in the vicinity of the Victoria Project Site. No changes to Federal lands inside or outside of Ontario, nor inside or outside of Canada, are expected as a result of the Victoria Project.

4.3 Federal Approvals and Authorizations

The Project may be required to obtain the Federal Approvals identified in Table 4-1.

Table 4-1: Anticipated Federal Environmental Approvals and Authorizations

Approval/Authorization	Responsible Agency	Applicable Project Component
Federal Environmental Assessment	*Canadian Environmental Assessment Act (2012)* – Canadian Environmental Assessment Agency	*Regulations Designating Physical Activities SOR/2012-147* (March 31, 2015) Section 16a – " The construction, operation, decommissioning and abandonment of a new (a) metal mine, other than a rare earth element mine or gold mine, with an ore production capacity of 3,000 t/day or more."
Explosives Manufacture	*Explosives Act* - Natural Resources Canada	A license or certificate under Section 7 of the *Explosives Act* activity related to the temporary use, storage of explosives.
Transportation of Dangerous Goods	*Transportation of Dangerous Goods Act, 1992* - Transport Canada	All personnel transporting hazardous goods will be trained and registered according to the federal *Transportation of Dangerous Goods Act, 1992*.

5. Environmental Effects

FNX has a good understanding of potential adverse environmental effects associated with the Project. FNX also has a good understanding of important engineering design, site selection and mitigation measures as part of science based approaches to avoid residual adverse environmental effects, or reduce residual adverse environmental effects on the site to levels considered not significant which are analogous to "minor" environmental effects (CEA Agency, 2015 - page 2). FNX has completed a detailed description of the Project and its potential environmental effects including cumulative environmental effects in the area (Appendix A – Victoria Mine Project Environmental Effects Analysis: A Report Supporting Basic Engineering and Overall Project Planning and Permitting).

This section summarizes findings in Appendix A associated with differences between the cumulative effects of the mine Project in combination with past, present and likely future activities, namely exploration and advanced exploration activities at the Project site, and those of the proposed mine Project itself. As well, this section includes an evaluation of the key environmental effects of the Project on specific legislative areas of Parliament in accordance with the *Canadian Environmental Assessment Act*, Section 5.

5.1 Environmental Effects Analysis

5.1.1 Existing Conditions

5.1.1.1 Atmospheric Environment

Air Quality

As an indicative measure of existing air quality conditions, the results of the Air Quality Index (AQI) established by the MOECC was reviewed for the Greater Sudbury area. The AQI is an indicator of air quality which is based on air pollutants that have adverse effects on human health and the environment. The pollutants considered are ozone (O_3), Particulate Matter (PM), Nitrogen Dioxide (NO_2), Carbon Monoxide (CO), Sulphur Dioxide (SO_2) and total reduced sulphur compounds. As shown in Table 5-1, Sudbury AQI results from 2009 to 2013 show the Greater Sudbury area local air quality is in the 'Very Good' to 'Good' range 95.8% to 97.3% of the time. Local air quality in the 'Very Good' to 'Good' range is not expected to have adverse health effects in healthy people (MOECC, 2015). Review of recent air quality monitoring data from the Greater Sudbury area shows comparable air quality to other cities in Northern Ontario with specific contaminants (e.g. SO_2) showing an overall 62% decrease provincially from 1994 to 2013 (MOECC, 2015). Ambient air quality concentrations are generally low and within federal and provincial AAQOs. The Sudbury air shed is subject to transboundary flow influences from the United States of America which can account for approximately half of Ontario's smog during an air quality episode (MOECC, 2015).

Table 5-1: Valid Hours AQI in Range - Sudbury

AQI Range	Percentage of Valid Hours AQI in Range				
	2013	2012	2011	2010	2009
Very Good	32.4	32.5	31.9	30.7	40.9
Good	63.5	63.3	65.7	66	56.4
Moderate	4.1	4.1	2.4	3.3	2.6
Poor	0	0.1	0	0.1	0.1
Very Poor	0	0	0	0	0

Source: MOECC, Air Quality in Ontario Report, 2009-2013. http://www.airqualityontario.com/press/publications.php

Noise

Although the Project Site and surrounding area is zoned industrial (2010, Schedule A Bylaw and Figure 4 in the Emission Summary and Dispersion Modelling Report, 2015 attached in Appendix A), the existing noise levels in the vicinity of the Project reflect a rural sound environment with generally low background noise emissions, characterized by sounds of nature with little road traffic. Background noise levels in the surrounding area can drop into the 20 dBA range and it is noted some mines in the region have received noise complaints below the MOECC limit of 40 dBA as people tend to judge a new sound in comparison to existing sounds.

5.1.1.2 Surface Water Quality

The Victoria Property is bisected by two major watersheds; the Vermilion River watershed to the east and the Spanish River watershed to the west. The Fairbank Creek watershed, which includes Ethel Lake, is located immediately east of the site, with Fairbank Creek flowing southward and eastward into the Vermilion River. To the northwest are wetland complexes that flow south into an unnamed wetland and stream that drains southwest to Victoria Creek and ultimately to the Spanish River.

Approximately 66% of the Project footprint lies within the Spanish River watershed, which is approximately 150 hectares in size upstream from the Project. The main feature of this watershed is a beaver impoundment immediately adjacent to the western boundary of the Project site. Water from this impoundment flows through a series of wetland complexes that drains southwest to Victoria Creek and the Spanish River, The Spanish River is located approximately 11 kilometres downstream from the Project site.

The remainder of the Project site (approximately 34%) is in the Fairbank Creek watershed, which is approximately 5,000 hectares in surface area upstream from the Project site and includes Fairbank Lake. From Fairbank Lake, Fairbank Creek flows approximately six kilometres before draining into Ethel Lake. The outflow from Ethel Lake flows south for approximately five kilometres, before turning east to flow for an

additional seven kilometres before draining into the Vermilion River in the Town of Whitefish. The proposed discharge location for treated mine effluent is on Fairbank Creek, approximately 250 metres downstream from the Ethel Lake outflow.

FNX has conducted extensive baseline environmental investigations in the area surrounding the project site. A surface water sampling program was initiated in 2002, providing several years of baseline data prior to initiation of Advanced Exploration construction activities in 2013.

Surface water quality in Ethel Lake is generally good with some exceedances of nickel, copper, cobalt, and zinc PWQO's at various depths. Monitoring indicates fairly low metal concentrations in Fairbank Creek relative to the PWQO's, with results generally equivalent to the upstream control sites. Baseline surface water quality in Fairbank Creek is good with infrequent exceedances for copper and nickel. Monitoring sites downstream experience more frequent exceedances of copper, nickel and aluminum.

Victoria Creek typically has higher concentrations of metals than Fairbank Creek and drains into the Spanish River.

Water quality is also influenced by variable seasonal flows causing erosion and sedimentation during spring and fall freshet periods and storm events (Kilgour & Associates Ltd and Denison Environmental Services, 2014).

5.1.1.3 Groundwater Quantity

Groundwater Quantity has previously been evaluated at 21 groundwater monitoring wells at locations within the Victoria Property. A hydrogeological assessment (WESA, 2012) of the monitoring results was completed to determine baseline Groundwater Quantity conditions related to the elevation of the water table, groundwater flow and hydraulic conductivities.

Ground surface elevations through the Project area range from 270 metres near Fairbank Creek in the southeast corner of the Victoria Property to approximately 317 metres in the northwest corner of the Victoria Property. On a regional level, the hilly topography creates a complex groundwater subsystem whereby groundwater entering an area via a recharge site may be discharged at the nearest topographic low (typically a watercourse or wetland system) or flow further to be discharged at a regional discharge location in the bottom of a major valley. Regional groundwater flow direction in the vicinity of the Project is generally expected to be southeast towards the Vermilion River (Richards, 2002; cited in WESA, 2013).

Based on local monitoring results, inferred local groundwater flow vectors at the Project site are primarily towards adjacent surface water features including Ethel Lake, Fairbank Creek and Victoria Creek. WESA's 2013 report notes that shallow overburden groundwater is inferred to primarily flow through a thin zone of glacial outwash and till deposits in bedrock valleys and that the bedrock topography controls the direction of

this groundwater flow in the overburden. The thin overburden in the area of the Project encourages groundwater discharge to local surface water features or into bedrock valleys with thicker unconsolidated materials. Flow velocities in the shallow overburden were calculated to range from one m/yr (in the southcentral portion of the Project site, flowing towards Victoria Creek) to 100 m/yr (in the western portion of the site, also flowing towards Victoria Creek) (WESA, 2013).

The 2013 WESA report also indicates that the inferred direction of groundwater flow in bedrock is east-northeast, with average flow velocities of 0.3 m/yr. Hydraulic conductivity in the bedrock aquifers ranges from $1x10^{-7}$ to $3x10^{-4}$ (WESA, 2012b). The vertical gradient of groundwater flow throughout the Project site is typically downward from the overburden to the bedrock (WESA, 2013).

5.1.1.4 Fish and Fish Habitat

Baseline Fish and Fish Habitat studies have been conducted in both watersheds and both have been identified as containing fish that are part of, or support, commercial, recreational or Indigenous fisheries. Northern Pike (*Esox Lucius*) are the top predator and one of two sportfish species found in the environmental assessment area within the Fairbank Creek watershed. Smallmouth Bass (*Micropterus Dolomieui*), the other sportfish species captured in the environmental assessment area, are present in Fairbank Creek upstream and downstream from Ethel Lake, but not within the lake itself. The remainder of the fish community in the portion of the Fairbank Creek watershed within the study area consists of a variety of coarse fish (e.g. White Sucker (*Catostomus commersonii*) and Silver Redhorse (*Moxostoma anisurum*)) and baitfish, predominantly cyprinids (minnow species). Watercourses that have been sampled in the Victoria Creek watershed within the environmental assessment area were found to only contain a variety of baitfish species with no large-bodied fish present.

5.1.1.5 Terrestrial Habitat

Terrestrial Habitat considers both wildlife and wildlife habitat within the Project site and takes into account the species of special conservation status found on and in the vicinity of the property. The Project is located in the Ontario Shield Ecozone and Georgian Bay Ecoregion, and within Wildlife Management Unit 39. The Project is located approximately five kilometres from the nearest protected area; Fairbanks Provincial Park. Forest communities in the environmental assessment area are typical of the Great Lakes/St. Lawrence forest region. The dominant community types include poplar-white birch and poplar-white birch-white spruce-balsam fir mixed wood stands. There are no rare plant communities or wildlife concentration areas within the environmental assessment area based on data obtained from the MNRF Land Information Ontario (LIO) environmental datasets.

The area of the Project includes a mix of natural and disturbed areas comprising wetlands, forests, meadows and rock barren communities. The diversity of vegetation

communities throughout the environmental assessment area provides suitable habitat for a variety of upland and semi-terrestrial aquatic wildlife species.

Wetlands within the environmental assessment area are predominately shallow or meadow marsh communities, although swamp communities and to a lesser extent, fens, have also been documented. Beaver activity throughout the environmental assessment area is high and appears to have influenced the creation of most of the wetlands in the environmental assessment area. All wetland communities within the environmental assessment area are common and no provincially significant wetlands (PSWs) have been identified.

Wildlife in the area is typical of Northern Ontario and includes common mammal species such as Moose, Black Bear, Whitetail Deer, Marten, Mink, Long-Tailed Weasel, Snowshoe Hare, Raccoon, Red Fox, Lynx, Wolf and Beaver.

A total of 75 bird species have been identified in the area of the Project. Common birds include the Canada Goose, Great Blue Heron, Common Loon and American Crow.

One bird species, the Eastern Whip-poor, designated as Threatened under the *Endangered Species Act* was identified on the Victoria Project's footprint during the early exploration phase, resulting in the Project obtaining an Overall Benefit Permit (SU-C-001) which is valid for the life of the Mine Project.

Snapping Turtle, a species designated as Special Concern by the *Endangered Species Act*, was identified on the proposed Victoria Mine Project footprint. Two snapping turtles were documented along the northern shoreline of Ethel Lake during a 2013 survey (EcoTec 2013).

During a regional survey, five species designated as Special Concern by the *Endangered Species Act* (Eastern Milksnake, Bald Eagle, Golden-Winged Warbler, Canada Warbler and Common Nighthawk) and one species identified as Threatened (Blanding's Turtle) were identified outside of the proposed Victoria Mine Project Footprint.

DFO has determined that there are no federal species at risk or their habitats present in the Project area, therefore no additional approvals are required for the Project under the federal *Species at Risk Act*.

5.1.1.6 Archaeological Resources

The majority of the Victoria Property (beyond the historic site of Mond) has relatively low archaeological potential. While it is near permanent water features, the area is observed to have few suitable sandy beaches being mostly rough and steep bedrock. Additionally, there is no evidence of eskers or similar sand or gravel features. The area does not contain any locations of known useable tool stones which contribute to the characterization of archaeological potential. There are some well-drained locations of moderate archaeological potential within the shorelines and 300 metre zone around

Ethel and Mond Lakes, and Fairbank Creek. Further archaeological assessment has been recommended in these areas. According to the Stage 1 Archaeological Assessment of the Victoria Property there are no known archaeological sites found within 250 metres of the property boundary (Julig, St. Jean and Hawkins, 2010).

Lands required for water taking activities around Ethel Lake are located within a soil complex which includes well-drained sandy soils in some locations. Historic mapping indicates that these lands are located in proximity to historic transportation routes, features and settlement. In addition, a review of the geography and history of the environmental assessment area suggests potential for the identification of Indigenous and Euro-Canadian Archaeological Resources. Accordingly, further archaeological assessment is required in some areas (ASI, 2015).

5.1.1.7 Residential and Recreational Land Use

The Victoria Property is comprised of over 500 hectares of mining rights contained in four contiguous patented parcels and one patented instrument. The surface rights tenure for the Victoria property is comprised of five contiguous registered parcels. All surface rights are owned by Vale Canada Ltd. The property is zoned M4 – Mining Industrial by the City of Greater Sudbury.

The Victoria Property is located in a very accessible and active area. MR4 and Fairbank East Road are all-weather roads that provide access to the community of Worthington, and to the temporary and permanent residents at Fairbank Lake.

Fairbank Lake is not serviced by city water or sewage (City of Greater Sudbury, undated). The Victoria Property hosts wilderness areas that may be used for recreational purposes such as fishing, hunting, berry picking and snowmobiling. Nearly all of the land within the Project site (including along the proposed haul route) is held under private ownership.

The Fairbank Lake area is located approximately two kilometres north of the Victoria property. Access to the area is obtained via two road routes, one of which is Fairbanks East Road. The other route is located west of the property, via MR4 (Fairbank Lake Road).

An Ontario Federation of Snowmobile Clubs (OFSC) snowmobile trail bisects the Victoria Property. This trail is part of the Sudbury Trail Plan which is operated with the City of Greater Sudbury and has eight associated clubs that support the trail system. The trails within the Victoria Property are maintained by the Walden Sno Runners, located in Lively, Whitefish, Worthington and Naughton (Sudbury Trail Plan, Undated).

Since there are no municipal water supply systems within the environmental assessment area, groundwater and major surface water bodies (i.e. Fairbank Lake) provide the only source of potable water (WESA, 2013). The Project area has several industrial and domestic groundwater users including Ellen Pit 1 (which has a PTTW in place and is valid from 2010 to 2020) within five kilometres of the Project, as well as three domestic water

wells located within 2.5 kilometres of the Project (WESA, 2012a). The depth of these three domestic wells ranges from approximately 25 to 82 metres (WESA, 2013).

Residents and Nearby Cottagers

There are no residences or cottages located within or in the immediate vicinity of the Victoria Property. The nearest residences or cottages are located approximately two kilometres south and one kilometre east of the Property on Crean Hill Road, approximately two kilometres north of the Property on Fairbanks Road East.

The Fairbank Lake area has approximately 94 permanent and 323 seasonal residents with approximately 57 permanent and 180 seasonal dwellings. Fairbank Provincial Park is located on the west side of Fairbank Lake hosting campsites, a boat launch and beaches. The Fairbank Lake Resort is also located on the lake, and is accessible via Fairbank East Road (City of Greater Sudbury, Undated).

Local Use of Regional Roads

As described in Section 2.10 – Community Services and Infrastructure in Appendix A, the City of Greater Sudbury's Transportation Master Plan indicates that the daily traffic volume on major highways such as Highway 17 are in the order of 10,000 to 50,000 trips per day, while roads such as MR4 see 1,000 to 12,000 trips per day.

Within the vicinity of the Project site, the Average Annual Daily Traffic (AADT) on Fairbank Lake Road, north of Highway 17 was estimated to be 1,478 in July 2014, while the AADT on Fairbank Lake Road west of Bay Street, was estimated to be 1,616 (MR4 Traffic Volumes, 2014). According to the Design Criteria for the Crean Hill Road and Fairbank East Road improvements, traffic for the 3.3 kilometre length of road including Crean Hill Road from Fairbank Lake Road (MR4) to Fairbank East Road, and Fairbank East Road from Crean Hill Road to Victoria Mine, had an AADT of 470 in 2011 and a projected AADT of 1,000 to 1,500 trips per day for 2021 (Unknown source, 2015).

5.1.1.8 Community Services and Infrastructure

The City of Greater Sudbury is composed of a mix of urban, suburban, rural and natural environments (City of Greater Sudbury, Undated), and as such there is an extensive network of existing community services and infrastructure. The city is divided into the following zones: residential, commercial, industrial, rural, other (e.g. park, conservation, private, etc.), and overlay (e.g. airport height restriction, flood plain, etc.). Greater Sudbury is 3,267 square kilometres in area, making it geographically, the largest municipality in Ontario and second largest in Canada. There are a number of small communities in proximity to the Project. The Fairbanks area is located approximately two kilometres northwest of the Property, containing both seasonal and permanent residents. Approximately 5 kilometres south of the Property, at the junction of Fairbank Lake Road and Highway 17, along the proposed haul route, is the community of Denlou.

A complex infrastructure system extends across the municipality, including water and sewage treatment facilities, electrical and telecommunications utility networks, modern airport, public transit services, and district energy plants. There is also an existing waste management program, which includes sewage waste disposal sites and solid waste landfills.

The City of Greater Sudbury has an extensive emergency preparedness program, which includes an Emergency Services Strategic Plan, Emergency Management Program, Comprehensive Fire Services, Training Programs, and other plans and programs to ensure appropriate response of police, fire, paramedic, and other emergency services to the community. The City of Greater Sudbury is home to a variety of institutions, including health research centers and initiatives such as Health Sciences North, the Northern Ontario School of Medicine and the Centre of Rural and Northern Health Research.

The City of Greater Sudbury recently completed a Transportation Master Plan, which was be presented to City Council in May 2016. The existing transportation conditions from the plan indicate that trips to the southwest of Sudbury are distributed between MR [Municipal Road] 55 and Highway 17, both of which have been determined to be operating at an acceptable level of service. According to the Transportation Master Plan, daily traffic volumes on “major highways” (such as Highway 17) is in the order of 10,000 to 50,000 trips per day, and on “collectors” (such as MR4) is in the order of 1,000 to 12,000 trips per day (City of Greater Sudbury and MMM Group, 2015).

5.1.1.9 Employment and Business

The City of Greater Sudbury is approximately 3,227 km^2 in area with a population of 160,274 people according to the 2011 census (Statistics Canada, 2011). According to the City of Greater Sudbury, the mining industry directly employs approximately 6,000 people and is reported to indirectly support a mining supply and service sector cluster of 300 companies, who employ an additional 10,000 people. Sudbury is a regional centre for Northeastern Ontario in financial and business services, tourism, health care and research, education and government. The regional centre extends from the Quebec border west to the eastern shore of Lake Superior and north to the James and Hudson’s Bay coastlines, which serves a market of 555,000 (City of Greater Sudbury, Undated).

The City of Greater Sudbury functions as the regional centre of learning and applied research for Northeastern Ontario. According to the 2011 census, there is strong enrollment in programs such as security services, mechanical and repair technologies, engineering, engineering and mechanical trade certificates, and construction (Statistics Canada, 2011). According to the January 2016 labour force characteristics for the Greater Sudbury census metropolitan area, the current unemployment rate is 8.6%, which is up 0.2% from December 2015. Since January 2014, the portion of the labour force which is currently unemployed has risen from 6.8% to 8.6% (a difference of 1.8%). This data suggests that there is an available labour force within Greater Sudbury currently seeking

work, with a skill and education base that is compatible with the Project's needs (City of Greater Sudbury, 2016).

Sudbury's mining supply and services sector was founded in the provision of tools, parts and professional services to local mining companies. As new technology and innovation led to new products and processes, these home-grown companies found eager national and international mining markets looking to improve their productivity. With a strong history of mining, and a commitment to promoting investment and continued economic diversification, the City of Greater Sudbury has a wide range of businesses available to the mining sector for the procurement of various goods and services. FNX's Exploration and Advanced Exploration activities have been ongoing over the past decade and accordingly, there are established relationships and contributions to the local economy as a result of these activities.

5.2 Effects Assessment

FNX has completed a detailed environmental effects analysis on its proposed producing mine Project (Appendix A). The methodology used in conducting the environmental assessment is complete in that it address Construction, Operations, Decommissioning and Abandonment phases as well as Accidents, Malfunctions and Unplanned Events (see Appendix A; Chapter 8).

The existing regulatory and legislative processes enabled FNX to fully consider the potential for adverse environmental effects by performing an analysis on Project Valued Components (VCs). The VCs used in this analysis included: Atmospheric Environment, Surface Water Quality, Groundwater Quantity, Fish and Fish Habitat, Terrestrial Habitat, Archaeological Resources, Residents and Recreational Land Use, Community Services and Infrastructure, and Employment and Business. For each VC where residual adverse environmental effects are predicted, the adverse environmental effect is further described in terms of some fundamental indicators of sustainability including: probability of occurrence (likelihood); effect on ecosystem function and integrity; and the sustainable use (capacity) of renewable resources to meet present and future needs. Definitions for these sustainability ratings are shown in Table 5-2. This approach is consistent with the three steps outlined for determining whether environmental effects are adverse, significant and likely (CEA Agency 2015). The residual adverse environmental effects summary table for each VC also includes a cross-reference to key federal legislation as appropriate.

Table 5-3 provides a brief summary of the potential environmental effects of the proposed mine Project compared to the broader environmental effects of the proposed mine Project in combination with past, present, and likely future activities at the Project site, namely exploration and advanced exploration activities (i.e. cumulative effects).

Table 5-2: Definitions for Probability of Occurrence, Effect on Ecosystem Function and Integrity and Sustainable Use of Renewable Resources for Residual Adverse Environmental Effects

Rating	Probability of Occurrence	Effect on Ecosystem Function and Integrity	Sustainable Use (Capacity) of Renewable Resources to Meet Present and Future Needs
High	An environmental effect is probable and there is no uncertainty based on previous scientific research/experience.	Residual adverse environmental effects may result in severe ecosystem changes that result in large scale changes in resource management practices/ planning and land use.	Previous research/experience indicates that the environmental effect on the VC would not reduce biodiversity or the capacity of resources to meet present and future needs.
Moderate	An environmental effect may occur but there is some uncertainty based on previous scientific research/experience.	Residual adverse environmental effects may result in temporary changes resource management practices and land use.	Previous research/experience indicates that the environmental effect on the VC may, to a certain extent, reduce biodiversity or the capacity of resources to meet present and future needs.
Low	An environmental effect has a small probability of occurring and there is little uncertainty based on previous scientific research/experience.	Residual adverse environmental effects will not result in noticeable change to ecosystem components. Changes may be similar to natural variability.	Previous research/experience indicates that the environmental effect on the VC would reduce biodiversity or the capacity of resources to meet present and future needs.
Nil	An environmental effect has no probability of occurring and there is no uncertainty based on previous scientific research/experience.	Anticipated adverse environmental effects area small and may not be detectable.	Previous research/ experience indicates that the environmental effect on the VC would eliminate biodiversity or the capacity of resources to meet present and future needs.

Rating	Probability of Occurrence	Effect on Ecosystem Function and Integrity	Sustainable Use (Capacity) of Renewable Resources to Meet Present and Future Needs
Unknown	There is insufficient research, experience, Indigenous knowledge to predict the likelihood of an environmental effect occurring.	There is insufficient knowledge to predict an ecosystem effect.	There is insufficient research/experience to indicate whether the environmental effect on the VC would reduce biodiversity or the capacity of resources to meet present and future needs.

Table 5-3: Potential Environmental Effects of the Proposed Mine Project Compared to Cumulative Effects of the Project in Combination with Other Projects

Valued Component	Residual Environmental Effect	Significance[1]	Probability of Occurrence (Likelihood)[2]	Effect on Ecosystem Function and Integrity[2]	Sustainable (Capacity) Use of Renewable Resources[2]	Relevant Legislation[3]
Project Effects						
Atmospheric Environment	Reduced air quality and increased noise levels.	Not Significant	Moderate	Low	High	Canadian Ambient Air Quality Standards
Surface Water Quality	Overall increase in turbidity, nutrients and metals, above background concentrations but remaining within regulatory criteria.	Not significant	High	Moderate	Moderate	N/A
Groundwater Quantity	Reductions in Groundwater Quantity due to groundwater extraction for supply water and dewatering.	Not significant	High	Low	Moderate	N/A
Fish and Fish Habitat	Alterations to Fish and Fish Habitat utilization due to habitat changes associated with Ethel Lake Control structure and water taking.	Not Significant	High	Low	High	*Fisheries Act, Section 35(2)(b)*
Terrestrial Habitat	Wildlife disturbance and mortality (e.g., avoidance of area, changes in behaviour and movement, vehicle collisions, human-wildlife interactions) and habitat loss and alteration.	Not significant	High	Low	High	*ESA, 2007, SARA, MBCA, FWCA*
Archaeological Resources	Potential disturbance or destruction of Archaeological Resources through chance finds or unplanned events.	Not Significant	Low	Unknown	Unknown	*Ontario Heritage Act, CEAA 2012*
Residents and Recreational Land Use	Risk to public safety as a result of increased traffic on local roadways Effects to the use and enjoyment of residential and recreational properties due to changes in the atmospheric environment; the availability of surface water and groundwater resources (including potential increases in contaminants, such as mercury being released into the water bodies).	Not significant	Moderate	Low	High	N/A
Community Services and Infrastructure	Traffic alters established traffic patterns and volumes and may result in delays in traffic on regional public roads. Increased demands on fire response and emergency medical services due to vehicle and general traffic accidents, forest fire, fall of ground or mine rescue.	Not significant	High	Low	High	N/A
Cumulative Effects						
Atmospheric Environment	Overall reduced air quality and increased noise levels.	Not Significant	Moderate	Low	High	Canadian Ambient Air Quality Standards
Surface Water Quality	Overall increased degradation of Surface Water Quality for potential downstream water users from increases in turbidity, nutrients and other contaminants.	Not significant	High	Moderate	Moderate	N/A
Groundwater Quantity	Overall increased groundwater takings in the immediate area may reduce the total amount of groundwater available to other users.	Low	Low	Moderate	N/A	

Valued Component	Residual Environmental Effect	Significance[1]	Probability of Occurrence (Likelihood)[2]	Effect on Ecosystem Function and Integrity[2]	Sustainable (Capacity) Use of Renewable Resources[2]	Relevant Legislation[3]
Fish and Fish Habitat	The Project, when combined with recreational fishing in Ethel Lake or Fairbank Creek may result in an increase in fish mortality.	Not Significant	Low	Low	High	*Fisheries Act, Section 35(2)(b)*
Terrestrial Habitat	Increased instances of wildlife disturbance and mortality (e.g., avoidance of area, changes in behaviour and movement, vehicle collisions, human-wildlife interactions) and habitat loss and alteration.	Not significant	High	Low	High	*ESA, 2007, SARA, MBCA, FWCA*
Archaeological Resources	The Project, in combination with other projects and activities causing ground disturbance, may result in increased potential disturbance or destruction of Archaeological Resources through chance finds or unplanned events.	Not Significant	Low	Unknown	Unknown	*Ontario Heritage Act, CEAA 2012*
Residents and Recreational Land Use	The Project in combination with other projects in the area may contribute to increased access restrictions to local recreational areas; compound the reduction in the use and enjoyment of lands in the vicinity of the Project due to emissions (air and noise) to the atmospheric environment; and further increase the volume of traffic on local roadways and alter surface water or groundwater quality or quantity.	Not significant	Moderate	Low	High	N/A
Community Services and Infrastructure	The project in combination with other projects and activities may increase effects to established traffic patterns, and volumes and may result in additional delays in traffic on regional public roads. Increased demands on fire response and emergency medical services due to Construction vehicle and general traffic accidents, forest fire, fall of ground or mine rescue.	Not significant	High	Low	High	N/A

Notes:
1. The rating of significance for adverse residual environmental effects are those predicted effects remaining after the application of mitigation.
2. Sustainability factors are described for all predicted adverse residual environmental effects in Appendix A, Chapter 5.
3. Key federal legislation references as appropriate for relevant predicted adverse environmental effects.

5.3 Key Adverse Environmental Effects, Mitigations and Key Benefits

FNX understands the importance of implementing environmental design, mitigation measures and sustainability management practices as well as implementing inspection and maintenance procedures and monitoring initiatives to ensure effective implementation.

FNX also anticipates that the Project will result in considerable direct, indirect and induced benefits to the local economy as a result of employment and the procurement of goods and services. The Project will contribute to the City of Greater Sudbury's Master Plan and one of its key engines for growth, by helping it further develop as a global centre of excellence in hard rock mining.

As such, the following sections describe the environmental design features, procedures and monitoring initiatives that have been integrated into the Project to prevent or minimize adverse effects on the Valued Components (VC's) (refer to the Environmental Effects Analysis in Appendix A), as well as the benefits for each of the VC's, where they exist.

5.3.1 Atmospheric Environment

5.3.1.1 Regulatory Oversight

Federal regulatory oversight of Atmospheric Emissions (noise, dust, vibration, greenhouse gases, particulates) that are currently, or will be produced by activities at the Victoria Project site lies with Environment and Climate Change Canada in the form of the *Canadian Environmental Protection Act*, which requires the reporting of greenhouse gas (GHG) emissions. Federal oversight also includes the Canadian Ambient Air Quality Standards for particulate matter and ozone emissions, and the National Ambient Air Quality Objectives for other chemical compounds (sulphur dioxide, carbon monoxide, nitrogen dioxide and total suspended particulate).

Provincial Regulatory oversight of Atmospheric emissions (noise, dust, vibration, greenhouse gases, particulates) that are currently, or will be produced by activities at the Victoria Project site lies with the Ontario Ministry of Environment and Climate Change (MOECC) in the form of regulations, permits, approvals and guidelines. These permits, approvals and guidelines include the *Ontario Environmental Protection Act R.S.O. 1990*, *Ontario Regulation (O. Reg.) 194/05: Industry Emissions – Nitrogen Oxides and Sulphur Dioxide, Occupational Health and Safety Act, O. Reg. 419/05: Air Pollution – Local Air Quality, O. Reg. 452/09: Greenhouse Gas Emissions Reporting, Summary of Standards and Guidelines to support O. Reg. 419/05: Air Pollution – Local Air Quality* (MOECC), provincial Ambient Air Quality Criteria (MOECC), provincial Noise Pollution and Control Guidelines – Stationary and Transportation Sources (MOECC), and the existing ECA – Air Amendment (permit number 8794-8VFJ7B).

The Victoria Project Site will also fall under the oversight of the Ontario Ministry of Labour (MOL) under *O. Reg. 296/11: Mines and Mining Plants* under the *Ontario Occupational Health and Safety Act*, for diesel emissions underground.

Municipal regulatory oversight applies in the form of the City of Greater Sudbury Noise By-law No. 776.

5.3.1.2 Adverse Environmental Effects

Potential adverse residual environmental effects to the Atmospheric Environment resulting from the Project are reduced air quality and increased noise levels. Construction and Operation of the Project will introduce new, local sources of air contaminants to the area surrounding the Project, in the form of point sources and fugitive emissions.

A reduction in air quality due to new local air emissions sources may result in impacts on human health, however these potential effects are not predicted to be significant. The potential effects can result from exposure to ambient air concentrations or from accumulation in, or through deposition to, the environment.

During the Construction phase, the area surrounding the Project may be impacted by:

- Reduced air quality due to elevated dust levels and vented air from underground emissions (CO_2, SOx, NOx, PM), which may adversely affect the quality of life of nearby residents;
- Reduced air quality due to generator noise and generator emissions (CO_2, SOx, NOx, PM), which may adversely affect the quality of life of nearby residents;
- Vehicle noise and vehicle exhaust emissions (CO_2, SOx, NOx, PM), which may adversely affect the quality of life of nearby residents;
- Noise and vibration from ventilation fans, crushers and blasting may affect the quality of life for nearby residents;
- Reduced air quality due to the release of fugitive emissions into atmosphere caused by an accident, malfunction or unplanned events;
- Depletion of natural vegetation atmosphere caused by an accident, malfunction or unplanned event, such as a forest fire.

During mine Operations, the area surrounding the Project may be impacted by:

- Reduced air quality due to elevated dust levels and vented air from underground emissions (CO_2, SOx, NOx, PM) that may adversely affect the quality of life of nearby residents;
- Vehicle noise and vehicle exhaust emissions (CO_2, SOx, NOx, PM) which may adversely affect the quality of life of nearby residents;

- Noise and vibration from ventilation fans, materials handling and blasting may affect the quality of life for nearby residents;
- Fugitive emissions of refrigerant leading to increase of global warming potential and ozone depletion;
- Onsite fire or explosion of any size, due to an accident, malfunction or unplanned event, will release fugitive emissions into the atmosphere reducing air quality;
- Degradation of terrestrial habitat due to an accident, malfunction or unplanned event (forest fire).

Adverse effects in the Decommissioning and Abandonment phase may include:

- Reduced air quality due to elevated dust levels that may adversely affect the quality of life of nearby residents;
- Vehicle noise and vehicle exhaust emissions (CO_2, SOx, NOx, PM) that may adversely affect the quality of life of nearby residents;
- Release of fugitive emissions into the atmosphere due to an accident, malfunction or unplanned event (forest fire), may reduce air quality;
- Depletion of natural vegetation atmosphere caused by an accident, malfunction or unplanned event, such as a forest fire.

Refer to Section 9.3 of the Environmental Effects Analysis in Appendix A for a detailed description of the residual environmental effects to the Atmospheric Environment.

5.3.1.3 Environmental Design, Mitigation and Optimization

The following environmental design features, procedures and monitoring initiatives have been integrated into the Project to prevent or minimize adverse effects on the Atmospheric Environment in terms of particulate and gas emissions, noise and vibration control.

5.3.1.3.1 Dust Control

FNX has developed a management plan (The Best Management Practices Plan for the Control of Fugitive Dust) to be implemented on site that outlines all potential sources of fugitive dust, the control measures to be used and the timing of such measures (e.g., weekly, as required). This plan was submitted and accepted by MOECC in December 2015. The Plan will be reviewed annually to ensure it achieves stated objectives of preventing and controlling fugitive dust in compliance with the ECA – Air Permit (8794-8VFJ7B), considers new guidelines or regulatory requirements, and reflects changing site conditions or approved modifications to facilities.

The dust control measures identified will be achieved through engineering and procedural measures, and best management practices including:

- Applying water, calcium or magnesium chloride to roads and stockpiles; wet sprays used during drilling;
- Using dust collectors and equipment enclosures or covers at material transfer points;
- Containing material handling and processing activities within covered buildings;
- Applying a vegetative cover to overburden and topsoil stockpiles, and minimizing drop heights at stockpiles;
- Restricting the hours of off-site mine product and waste rock haulage;
- Ensuring the use of covered mine product and waste rock haul trucks for off-site transport;
- On-site speed limits and enforcement of those limits within Victoria property boundary, and use of a sweeper or vacuum truck on site;
- Adjusting or limiting mine product or waste processing or stockpiling activities during high winds, or when the wind direction will cause dust to leave the site boundary;
- Wind fencing, where appropriate, when enclosed operations are not possible, to reduce loss of finer particles from material storage piles and crushing operations;
- Operational controls, such as curtailing certain activities when winds are blowing towards receptors, to reduce off-property impacts;
- Although blasting is largely underground rather than surface blasting, the Project will operate on a reduced blasting schedule (maximum of two blasts per day) and reduced size of blast area (not to exceed 61 m^2); and
- Primary crushing and secondary crushing will operate on a restricted schedule (Monday through Friday for primary crushing; secondary crushing and sampling will typically occur four days per month).

5.3.1.3.2 Compounds of Combustion Emission Control

FNX has prepared a management plan (Air Emission Operating Procedures and Maintenance Manual) to be implemented on site, which provides guidelines to minimize air emissions for the Project. This plan will be reviewed annually to ensure it conforms to the approved ECA – Air (Permit 8794-8VFJ7B) for the Project, changes in regulatory requirements and to reflect changing site conditions and facilities.

Emission controls identified for compounds of combustion will be achieved through both engineering and procedural measures, including:

- Use of grid and transmission line for permanent stationary power source rather than fuel fired generators;
- Routine procedures for the operation and maintenance of surface mobile equipment including installation and operation of scrubbers, circle checks, and regularly scheduled maintenance according to manufacturer's recommendations. Where

manufacturer's recommended procedures are not on hand, good maintenance practices will be employed to ensure optimal equipment performance;

- Routine maintenance will be scheduled on a monthly basis. The type of service or inspection a particular piece of equipment will receive is dependent on the number of operating hours accumulated;
- Operators must complete an Operator's Pre-Check List before using any piece of equipment, as well as an annual calibration in accordance with their equipment manuals, if required;
- Emission tests will be performed on a monthly basis, which typically corresponds to 125 hours. Gases to be monitored include CO, NO_X, NO and NO_2;
- The fire suppression system on each piece of equipment will be inspected on a monthly basis. A third party inspection will also be conducted semi-annually; and
- Use of ultra-low sulphur diesel fuel for mechanical and mobile equipment.

5.3.1.3.3 Greenhouse Gas Emissions Control

Greenhouse gas (GHG) emissions associated with diesel fuel and other fuel sources is anticipated to be relatively small as the principal stationary power source for both the Construction and Operations phases is by transmission line. The greatest potential for the generation of greenhouse gases is through the use of heavy equipment, emergency or temporary generators, heaters, or vehicles fuelled by diesel, gasoline or propane during Construction, and by trucks transporting the mine product during Operations.

Emissions produced by the haul trucks which will haul mine product (ore) to Vale's Clarabelle Mill have been included in the calculation of the GHG emissions by the Victoria Mine. The trucks used to haul mine product will be owned and operated by a third party contractor. The trucks will be under the contractor's care and control both on the mine site, and along the entire length of the haul route from the mine to Vale's Clarabelle Mill (refer to Figure 3-1).

GHG emissions control will be achieved through both engineering and procedural measures, including:

- Use of grid and transmission line for permanent stationary power source rather than fuel fired generators. Approximately 90% (IESO, 2016) of the Ontario grid composition relies on non-GHG generating fuel types (nuclear, hydro, wind);
- Routine procedures for the operation and maintenance of surface mobile equipment including installation and operation of scrubbers, circle checks, and regularly scheduled maintenance according to manufacturer's recommendations. Where manufacturer's recommended procedures are not on hand, good maintenance practices will be employed to ensure optimal equipment performance; and

- Routine maintenance will be scheduled on a monthly basis. The type of service and inspection a particular piece of equipment will receive is dependent on the number of operating hours accumulated.

5.3.1.3.4 Noise and Vibration Control

Section 3.2.3 of the approved ECA – Air (Permit 8794-8VFJ7B) requires that noise emission limits from the Project comply with NPC-232 rural levels. The nearest receptor is more than one kilometre from the site and the site is surrounded by trees. The Project will carry out noise and vibration monitoring and abatement measures to reduce potential effects on the nearest temporary and permanent dwellings. A community noise monitoring study was completed that determined the existing background levels around the Project site, in an effort to develop a project design goal for noise. Based on the rural nature of the area surrounding the Project and the low levels of existing background noise, a project design goal for noise was set to 'below any provincial noise requirement, and quieter than the already existing sound levels at the nearest residences and at the park, most of the time'.

Community noise modelling predictions demonstrate this project design goal will be achieved with the following mitigation techniques implemented:

- The mine ventilation fans are required to meet noise specifications via the use of silencers and acoustical insulation on the fan casings and unsilenced ductwork;
- The Compressor Plant, Refrigeration Plant, Backfill Plant and Crusher building will be enclosed with no major openings;
- The Cooling Towers are required to meet noise specifications below 108 dBA re10-12W;
- Any vacuum truck station such as those for the off-loading of cement or backfill binders, require an indoor silenced blower or to be unloaded inside with closed doors and suitable exhaust silencers; and
- Primary crushing and secondary crushing will operate on a restricted schedule (Monday through Friday for primary crushing; secondary crushing and sampling will typically occur four days per month), and crushers will undergo regularly scheduled maintenance in accordance with manufactures' recommendations.

5.3.1.3.5 Monitoring and Follow-up Program

FNX has developed a comprehensive sustainability management system to address anticipated Project needs, including potential adverse environmental effects to the Atmospheric Environment. Mitigation and management procedures that are already in place include:

- Victoria Project Best Management Practices Plan for the Control of Fugitive Dust;
- Victoria Project Air Emission Operating Procedures and Maintenance Manual;

- Environmental Compliance Approval - Air (Permit #8794-8VFJ7B);
- Dust Control Log Sheet; and
- Victoria Public Complaint Form.

An inspection of the conformity with the Best Management Practices and Operating and Maintenance Procedures will be documented each week by the Environmental Coordinator. In the event of a non-conformance, the Environmental Coordinator will log the incident and notify the appropriate site personnel by assigning responsibility. Corrective action is to be taken to eliminate the causes of the non-conformance. It is expected that all deficiencies identified in inspections be addressed immediately. Non-conformances identified in the weekly inspection will be reviewed the following week, and any outstanding items or newly identified sources will be reviewed as part of the Best Management Practices and Operating and Maintenance Procedures continuous improvement program.

There is a high degree of confidence associated with determining potential effects to Air Quality, and with determining that there are no significant adverse environmental effects. FNX has developed comprehensive management plans and procedures to mitigate any potential adverse environmental effects. As a result, a follow-up program is not required for the Air Quality Valued Component.

5.3.1.4 Key Benefits

There are no expected benefits to the Atmospheric Environment during the Construction and Operations phases of the Victoria Project but reclamation and revegetation of abandoned work areas during the Decommissioning and Abandonment phase, will reduce site dusting and erosion and contribute to improved air quality.

5.3.2 Surface Water Quality

5.3.2.1 Regulatory Oversight

Federal oversight of activities affecting Surface Water Quality that is currently, or will be produced by activities at the Victoria Project site lies with the Department of Fisheries and Oceans (DFO) in the form of the *Metal Mining Effluent Regulations* (*MMER*) under the federal *Fisheries Act*, and the Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life.

Provincial regulatory oversight of activities affecting Surface Water Quality that is currently, or will be produced by activities at the Victoria Project site lies with the Ontario Ministry of Environment and Climate Change (MOECC) in the form of regulations, permits, approvals and guidelines. These permits, approvals and guidelines include Ontario Provincial Water Quality Objectives (PWQO), the *Ontario Water Resources Act*, *Ontario Regulation 156/06 Nickel District Conservation Authority: Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses* (which will apply for Ethel Lake and Fairbank Creek), and the existing ECA – Industrial Sewage Works

Amendment (permit number 9557-AP5FSQ), which falls under the *Ontario Environmental Protection Act*.

Municipal oversight of current or future activities at the Victoria site related to Surface Water Quality lies with Conservation Sudbury under *O. Reg. 156/06: Nickel District Conservation Authority Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses*.

5.3.2.2 Adverse Environmental Effects

The residual adverse environmental effect of the Project overall to Surface Water Quality may be reduced water quality as a result of treated site and mine effluent released to Fairbank Creek, however, with the mitigation proposed the residual environmental effect is considered to be not significant.

The Victoria wastewater treatment plant is designed such that effluent quality will meet regulatory approved discharge criteria for release to the environment. Criteria were developed based on assimilative capacity of the receiving environment using approved MOECC guidelines. Effluent comprises a very small proportion of the receiving water flows as a result of recycling and reuse of site water. Baseline studies show that there are no rare, threatened or endangered fish species or populations in the nearby receiving waters.

During the Construction phase, the area surrounding the Project may be impacted by:

- Increases in turbidity that may have adverse effects on Surface Water Quality and the aquatic ecosystem and downstream recreational water users;
- Increases in nutrients and mercury as a result of the inundation of existing terrestrial areas with adverse effects on the aquatic ecosystem and recreational and potable water users;
- Increased surface water runoff, exposure of soil and resulting increases in turbidity and adverse effects to the aquatic ecosystem and water users;
- Use of explosives resulting in increased nitrogen levels in Surface Water;
- Discharge of contaminated water to Fairbank Creek (e.g., potential increases in metals, pH and nutrients);
- Hazardous material spill due to an accident, malfunction or unplanned event, resulting in adverse effects to the aquatic ecosystem and water users;
- Sediment spill due to erosion into watercourses, resulting in adverse effects to the aquatic ecosystem and water users.

During the Operations phase, the area surrounding the Project may be impacted by:

- Discharge of contaminated water to local watercourses (e.g., potential increases in metals, pH and nutrients) resulting in adverse effects on Surface Water Quality and the aquatic ecosystem and downstream recreational water users;
- Decreases in downstream flow in Fairbank Creek resulting in inadequate dilution of discharge from the Wastewater Treatment Plant (WWTP) with adverse effects on the aquatic ecosystem and downstream recreational water users;
- Runoff from potentially acid generating rock with adverse effects on aquatic ecosystem and water users;
- Use of explosives may cause releases of nitrogen and ammonia to surface water;
- Hazardous material spill due to an accident, malfunction or unplanned event, resulting in adverse effects to the aquatic ecosystem and water users;
- Sediment spill due to erosion into watercourses, resulting in adverse effects to the aquatic ecosystem and water users.

During the Decommissioning and Abandonment phase, the area surrounding the Project may be impacted by:

- Increases in turbidity due to in-water work activities with adverse effects on the aquatic ecosystem and downstream recreational water users;
- Removal of treatment facilities and the temporary disturbance of soil and associated erosion potential with adverse effects on Surface Water Quality;
- Runoff from potentially acid generating rock with adverse effects on the aquatic ecosystem and downstream recreational water users;
- Hazardous material spill due to an accident, malfunction or unplanned event, resulting in adverse effects to the aquatic ecosystem and water users;
- Sediment spill due to erosion into watercourses, resulting in adverse effects to the aquatic ecosystem and water users.

Adverse residual environmental effects to Surface Water Quality that may occur throughout the entire life of the Project, or as the result of the Project in combination with other projects and activities, are:

- Overall increase in turbidity, nutrients and metals, above background concentrations but remaining within regulatory criteria;
- Overall increased degradation of Surface Water Quality for potential downstream water users from increases in turbidity, nutrients and other contaminants.

None of these residual effects are predicted to be significant effects. Refer to Section 10.3 of the Environmental Effects Analysis in Appendix A for a detailed description of the residual environmental effects to Surface Water Quality.

5.3.2.3 Environmental Design, Mitigation and Optimization

A number of procedures and plans have been put in place in order to mitigate against potential adverse environmental effects. These measures, as they are related to Surface Water Quality, are described below.

5.3.2.3.1 In-water Construction

In order to minimize potential effects due to increased turbidity, cofferdams will be used to isolate in-water work areas, all water from cofferdam dewatering activities will be collected and treated (as required), and sediment and erosion control measures, such as silt curtains, will be used as needed.

5.3.2.3.2 Ethel Lake Control Structure

The Ethel Lake Control structure is proposed in order to ensure that downstream flows in Fairbank Creek are maintained at all times to meet dilution requirements specified in the ECA. In order to reduce nutrient loading to Ethel Lake as a result of the control structure, all woody vegetation greater than 0.05 metres in diameter will be removed from the area prior to inundation. For Decommissioning and Abandonment, the removal of the control structure will be done behind cofferdams which would isolate the work area, including the area upstream from the control structure. The work area would be dewatered and if any sediment had accumulated immediately upstream from the control structure, it would be removed and disposed of properly.

5.3.2.3.3 Seepage

Project works have been designed to avoid adverse effects associated with contact water seeping into the receiving environment from mine facilities, and meet the Design Guidelines for Sewage Works 2008. The PAG 1 rock storage containment pad will be lined with a textured membrane with non-woven geotextile placed directly above and below the geomembrane. The geomembrane will have a 450 millimetre thick lower cover layer (sand and gravel), surrounded by perimeter berms.

The PAG 2 rock storage containment pad will be lined with a geomembrane with non-woven geotextile placed directly above and below the geomembrane. The geomembrane will be contained within sand bedding layers above and below the geomembrane and surrounded by perimeter berms. A water collection system will pump impacted water collected on the pad to the Mine Water Pond.

PAG 1 and PAG 2 pads will have lined seepage collection ditches and underdrains that report to sumps. Seepage monitoring wells will be installed at the perimeter of both pads. If water quality is shown to exceed Provincial Water Quality Objectives (PWQOs), the seepage water will be pumped to the Mine Water Pond for eventual treatment prior to discharge.

The Mine Water Pond will be contained within compacted granular embankments and have a double liner with a 60 millimetre High-Density Polyethylene (HDPE)

geomembrane or equivalent. Modifications to works can only be done in accordance with Schedule B "Limited Operational Flexibility Criteria for Modifications to Sewage Works" as described in the ECA.

5.3.2.3.4 Waste Water Treatment and Discharge

To ensure all waste water is effectively treated prior to discharge, the Project will perform regular monitoring of all wastewater discharges and will ensure strict adherence to the ECA (No. 9557-AP5FSQ) and the effluent discharge limits. Flows in Fairbank Creek will be maintained through operation of the Ethel Lake Control structure, to provide the required dilution ratio of 7:1 in accordance with the requirements of the ECA. Contact and non-contact water (i.e. all site runoff water) will be directed to the Mine Water Pond for treatment prior to discharge to Fairbank Creek.

5.3.2.3.5 Accidental Events

Spill prevention and response procedures as well as emergency response procedures are in place to limit the magnitude, duration and footprint of any accidental events and ensure protection of surface water. All fuel storage or hazardous waste storage will be located away from waterbodies and have secondary containment. All personnel will be trained in spill prevention and response procedures. Spillways on mine infrastructure (i.e., the Mine Water Pond, PAG 1 and PAG 2 spillway) have been designed to pass 1-in-200 year storm events. Emergency response, spill reporting and contingency procedures have been developed with actions that will be implemented if effluent is found to exceed PWQOs.

5.3.2.3.6 Monitoring and Follow-up Program

Monitoring activities will be undertaken during Construction in order to ensure the sediment and erosion plans have been implemented and measures are functioning as designed.

The Project's ECA contains Surface Water Quality monitoring requirements, which will be fulfilled as required during Operation of the treatment plant. Specifically, effluent monitoring will be undertaken for a variety of parameters, such as pH and total ammonia for the specified frequencies in accordance with MOECC and Environment Canada's *Metal Mining Effluent Regulation* (*MMER*) sampling protocols. Water quality monitoring will also be conducted monthly, at previously established monitoring locations and results will be evaluated against the PWQO's.

Following Decommissioning and Abandonment, the Closure Plan commits to chemical stability monitoring of surface water on a monthly basis for the first two years and then on a quarterly basis for three to five years after Decommissioning and Abandonment.

There is a high degree of confidence associated with determining potential effects to Surface Water Quality, and with determining that there are no significant adverse environmental effects. FNX has developed comprehensive management plans and

procedures to mitigate any potential adverse environmental effects. As a result, a follow-up program is not required for the Surface Water Quality Valued Component.

5.3.2.4 Key Benefits

There are no expected benefits to Surface Water Quality during the Construction, Operations or Decommissioning and Abandonment phases of the Victoria Project.

5.3.3 Groundwater Quantity

5.3.3.1 Regulatory Oversight

There is no Federal oversight of current or future activities at the Victoria site related to Groundwater Quality.

Provincial regulatory oversight of Groundwater Quantity that is currently, or will be produced by activities at the Victoria Project site lies with the Ontario Ministry of Environment and Climate Change (MOECC) in the form of regulations, permits, approvals and guidelines. These permits, approvals and guidelines include Ontario Provincial Water Quality Objectives (PWQO), the *Ontario Water Resources Act*, the *Ontario Environmental Protection Act*, and the existing Amended Permit to Take Water (PTTW) – Dewatering of the Adit (permit #0466-AJ8HRM), the proposed PTTW from Ethel Lake, and the existing Amended Environmental Compliance Approval (ECA) for the discharge of Industrial Sewage (permit #9557-AP5FSQ).

Municipal regulatory oversight will be in the form of a Sewage System Authorization from the City of Greater Sudbury, in accordance with the Ontario Building Code, prior to construction of the Permanent Wastewater Treatment Plant.

5.3.3.2 Adverse Environmental Effects

None of the residual effects to groundwater are predicted to be significant effects.

During the Construction phase, the area surrounding the Project may be impacted by:

- Decreased Groundwater Quantity that may affect supply of groundwater for domestic or ecological purposes;
- Potential changes in groundwater recharge rates and altered flow vectors;
- Alterations in groundwater elevations adjacent to Ethel Lake from control structure construction;
- Decreased Groundwater Quantity due to groundwater taking pump malfunction, may affect groundwater users;
- Decreased Groundwater Quantity due to requirement for groundwater pumping during emergency incidents (e.g. fire control), may affect supply of groundwater for domestic or ecological purposes.

During the Operations phase, the area surrounding the Project may be impacted by:

- Decreased Groundwater Quantity that may affect supply of groundwater for domestic or ecological purposes;
- Potential changes in groundwater recharge rates and altered flow vectors;
- Potential for groundwater connected with Ethel Lake to be changed due to the change in water levels;
- Decreased Groundwater Quantity due to groundwater taking pump malfunction, may affect groundwater users;
- Decreased Groundwater Quantity due to the requirement for groundwater pumping during emergency incidents (e.g. fire control), may affect supply of groundwater for domestic or ecological purposes.

During the Decommissioning and Abandonment phase, the area surrounding the Project may be impacted by:

- Decreased Groundwater Quantity in aquifer may affect other users of groundwater;
- Accidents, Malfunctions and Unplanned Events: Withdrawal of groundwater in exceedance of allowable taking limits due to a groundwater taking pump malfunction, may affect other users of ground water;
- Withdrawal of groundwater in exceedance of allowable taking limits and potential effects on Groundwater Quantity due to the requirement for groundwater pumping during emergency incidents (e.g. fire control), may affect other users of groundwater.

Adverse residual environmental effects to Groundwater Quantity that may occur throughout the entire life of the Project, or as the result of the Project in combination with other projects and activities, are:

- Reductions in Groundwater Quantity due to groundwater extraction for supply water and dewatering;
- Overall increased groundwater takings in the immediate area may reduce the total amount of groundwater available to other users.

None of these residual effects are predicted to be significant effects. Refer to Section 11.3 of the Environmental Effects Analysis in Appendix A for a detailed description of the residual environmental effects to Groundwater Quantity.

5.3.3.3 Environmental Design, Mitigation and Optimization

The Project has been designed to recycle surface water and groundwater for use as process water, limiting the overall amount needed for groundwater takings.

A number of procedures and plans have also been put in place in order to mitigate against potential adverse environmental effects related to Groundwater Quantity as described in the following sections.

5.3.3.3.1 Ethel Lake

The design of the Ethel Lake control structure and associated flooding of Ethel Lake was minimized to the extent possible, minimizing the potential effects on the hydraulically connected groundwater table levels.

5.3.3.3.2 Monitoring

The rates of groundwater withdrawal will be monitored daily and submitted in a report annually to the MOECC, in line with the requirements of the existing Permit to Take Water (PTTW). Additionally, continuous monitoring of the water level and velocity of key surface water locations, in accordance with the existing PTTW requirements, will also occur.

5.3.3.3.3 Compensation

As required in the existing PTTW, and which would be expected to continue through the Operations phase, if the taking of water is observed to cause any adverse effects to other water supplies in use prior to the issuance of the PTTW, FNX will make available a supply of water equivalent in quantity to their normal takings, or shall compensate such persons for their reasonable costs of so doing, or shall reduce the rate and amount of taking to prevent or alleviate the observed adverse effect. Temporary water supplies adequate to meet normal requirements, or compensation for such persons for their reasonable costs of obtaining temporary water supplies will be provided by FNX. If permanent interference is caused by the groundwater takings, FNX shall restore the water supplies of those permanently affected.

5.3.3.3.4 Restoration of Infiltration Rates

Decommissioning and Abandonment will return surface water infiltration rates to pre-development conditions. Mitigation may be required to loosen compaction.

5.3.3.3.5 Accidental Events

In accordance with PTTW requirements, monitoring the amount of groundwater withdrawals will occur daily, to ensure compliance with permit limits. Therefore, any malfunction of pumps will be identified in a timely manner, limiting the amount of non-permitted withdrawal to a minor quantity and duration. Emergency response protocols will be implemented as appropriate to limit effects on groundwater resources.

5.3.3.3.6 Monitoring and Follow-up Program

The existing amended PTTW (permit No. 0466-AJ8HRM) from the MOECC outlines the monitoring requirements for the approved groundwater takings and these are anticipated to be similar for a PTTW throughout the life of the Project. In general, monitoring of groundwater levels in wells will be undertaken along with monitoring of

water level and velocity at key surface water locations. A PTTW amendment will be needed for Operation activities and all monitoring requirements will be completed as outlined in the amended approval.

Following Decommissioning and Abandonment, groundwater monitoring will take place semi-annually for three years with reports being submitted to the Ministry of Northern Development and Mines, to determine if further monitoring or other actions are required (KGHM International, 2013).

There is a high degree of confidence associated with determining potential effects to Groundwater Quantity, and with determining that there are no significant adverse environmental effects. FNX has developed comprehensive management plans and procedures to mitigate any potential adverse environmental effects. As a result, a follow-up program is not required for the Groundwater Quantity Valued Component.

5.3.3.4 Key Benefits

There are no expected benefits to Groundwater Quantity during the Construction and Operations phases of the Victoria Project.

During the Decommissioning and Abandonment phase, rehabilitation will include re-establishment of natural infiltration allowing for a greater recharge on the quantity of groundwater available to other users is predicted to have a beneficial effect on Groundwater Quantity.

5.3.4 Fish and Fish Habitat

5.3.4.1 Regulatory Oversight

Federal oversight of current and future activities at the Victoria site related to Fish and Fish Habitat lies with the Department of Fisheries and Oceans (DFO) in the form of regulations namely the *Fisheries Act*, the *Metal Mining Effluent Regulations* under the *Fisheries Act*, and the *Navigable Waters Protection Act*.

A proposal was submitted by KGHM to DFO to review the Victoria Mine Project, to determine if the Project activities would trigger sections of the *Fisheries Act* and the federal *Species at Risk Act*. DFO reviewed the Victoria Mine Project activities against subsection 35(1) of the *Fisheries Act* which prohibits activities that would cause serious harm to fish, and against sections 32, 33 and 58 of the *Species at Risk Act* that are related to adverse impacts on listed aquatic species at risk. DFO has determined that there are no federal species at risk or their habitats present in the Project area, therefore no additional approvals are required for the Project under the federal *Species at Risk Act*. DFO has also determined that the Project activities will not cause serious harm to fish or fish habitat providing that the mitigation plans proposed by KGHM are carried out, as well as adherence to the DFO's mitigation plans. The mitigation plans that will be implemented by the Victoria Mine Project to prevent serious harm to fish or fish habitat include:

- Construction of a control structure and spillway that includes a gate chamber with a low-level outlet pipe and valve on the outlet of Ethel Lake, all upstream of the existing historical dam;
- Use of a temporary coffer dam, and turbidity curtains and bypass channel to isolate the construction area;
- Installation of a screened pump intake that is designed to meet the DFO's Freshwater End-of-Pipe Fish Screen Guideline for pumping rates of approximately 0.02m^3/s, and to prevent the entrapment of any fish with anguilliform (eel-like) swimming mode;
- Maintaining the flows in Fairbank Creek at all times during the construction and operating periods of the new dam to prevent dewatering and stranding of fish;
- Avoiding in-water construction and the use of explosives during the fish spawning period of April 1 to July 15;
- Following the DFO's guidelines for explosives use in or near Canadian fisheries waters, with the exception of maintaining overpressures less that 50 kPa instead of the 100 kPa that are identified in the guideline;
- Use of effective measures to prevent deleterious substances such as oil and fuel, sediment, concrete, concrete wash water, etc. from entering the water throughout the construction and operation periods of the new dam; and
- Conducting a fish rescue when constructing the coffer dams to ensure all fish are removed from areas that are to be dewatered, and return them unharmed to Ethel Lake.

With the implementation of these mitigation measures, the DFO has determined that the Project will not cause serious harm to fish or fish habitat and will not require a formal approval under the *Fisheries Act*. The letter received from the DFO outlining their decision is included in Appendix F of the Environmental Effects Analysis (Appendix A).

Provincial regulatory oversight of Fish and Fish Habitat that is currently, or will be produced by activities at the Victoria Project site lies with the Ontario Ministry of Natural Resources and Forestry (MNRF) in the form of regulations, permits, and approvals. This includes the *Lakes and Rivers Improvement Act*. Under the Act, the Victoria Project submitted and obtained a Work Permit for the construction of the Wastewater Treatment Plant outlet to Fairbank Creek. The Project also submitted an application under the Act for a Location Approval for the construction, installation and operation of the Ethel Lake Control Structure and water taking. The application is still undergoing review by the MNRF. Once detailed engineering of the Ethel Lake Control Structure is completed, an application for a Plans and Specifications Approval from MNRF will be submitted in order to allow for the construction of the Control Structure.

Municipal regulatory oversight falls with Conservation Sudbury under *O. Reg. 156/06 - Nickel District Conservation Authority: Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses*. The Victoria Project will be required to

submit an application for a Shoreline Alteration/Development Permit in order to construction the Ethel Lake Control Structure and Pumphouse, in accordance with *O. Reg. 156/06*.

5.3.4.2 Adverse Environmental Effects

As demonstrated below, none of the potential adverse residual environmental effects to Fish and Fish Habitat are predicted to be significant. The key potential adverse environmental effect to Fish and Fish Habitat is reduced water quality as a result of treated site and mine effluent released to Fairbank Creek.

The wastewater treatment and effluent discharge will meet or exceed regulatory limits for release to the environment. Effluent comprises a very small proportion of the receiving water flows as a result of recycling and reuse of site water. Baseline studies show that there are no rare, threatened or endangered fish species or populations in the nearby receiving waters. Potential environmental effects are related to localized alteration and loss of fish and fish habitat in Fairbank Creek. Fairbank Creek does not support an Indigenous, commercial or recreational fishery.

During the Construction phase, the area surrounding the Project may be impacted by:

- Effects on Fish and Fish Habitat due to temporary loss of habitat within the footprint of coffer dams and the dewatered Construction area;
- Effects on Fish during dewatering;
- Effects on Fish and Fish Habitat due to permanent loss of 48 m^2 of aquatic habitat in the footprint of the Ethel Lake control structure, blockage of upstream fish passage from Fairbank Creek into Ethel Lake and effects on the use of aquatic habitat within Ethel Lake, due to the raising of water levels by 0.5 metres;
- Disruption of Fish and Fish Habitat during in-water Construction;
- Effects to health of Fish and Fish Habitat as a result of changes in surface water quality of local watercourses due to runoff/discharge of contaminated water during Construction;
- Effects to health of Fish and Fish Habitat as a result of surface water contamination caused by accidental spill of potentially contaminated materials;
- Effects to Fish health and habitat utilization as a result of accidental increased turbidity or sedimentation of existing habitat.

During the Operations phase, the area surrounding the Project may be impacted by:

- Fish mortality due to impingement or entrainment in water intake;
- Effects on Fish and Fish Habitat associated with Ethel Lake water level fluctuation during water taking;

- Effects on Fish and Fish Habitat as a result of habitat alterations in Fairbank Creek associated with water taking from Ethel Lake and changes in the flow regime;
- Effects to health of Fish and Fish Habitat as a result of changes in surface water quality of local watercourses due to runoff/discharge of contaminated water;
- Effects to health of Fish and Fish Habitat as a result of surface water contamination caused by accidental spill of potentially contaminated materials;
- Effects on the usability of fish tissues resulting from the bioaccumulation of mercury due to the inundation of existing wetland and terrestrial areas around the shoreline during the construction of the Ethel Lake water control structure;
- Effects to Fish health and habitat utilization as a result of accidental increased turbidity or sedimentation of existing habitat.

During the Decommissioning and Abandonment phase, the area surrounding the Project may be impacted by:

- Disturbance to Fish and Fish Habitat during in-water work associated with control structure removal;
- Effects on Fish and Fish Habitat due to loss of aquatic habitat following control structure removal and permanent lowering of the Ethel Lake water level;
- Effects to health of Fish and Fish Habitat as a result of changes in surface water quality of local watercourses due to runoff/discharge of contaminated water;
- Effects to health of Fish and Fish Habitat as a result of surface water contamination caused by accidental spill of potentially contaminated materials;
- Effects to Fish health and habitat utilization as a result of accidental increased turbidity or sedimentation of existing habitat.

Potential adverse residual environmental effects to Fish and Fish Habitat that may occur throughout the entire life of the Project, or as the result of the Project in combination with other projects and activities, are:

- Alterations to Fish and Fish Habitat utilization due to habitat changes associated with the Ethel Lake Control structure and water taking;
- The Project, when combined with recreational fishing in Ethel Lake or Fairbank Creek, may result in an increase in fish mortality.

None of these potential residual effects are predicted to be significant effects. Refer to Section 12.3 of the Environmental Effects Analysis in Appendix A for a detailed description of the residual environmental effects to Fish and Fish Habitat.

5.3.4.3 Environmental Design, Mitigation and Optimization

5.3.4.3.1 Design Mitigations

The following environmental design features have been integrated into the Project to prevent or minimize adverse effects on Fish and Fish Habitat:

- The Project has been sited to avoid having any part of the physical footprint of the main mine site within fish habitat;
- The size of the Ethel Lake Control structure has been minimized to the extent necessary to ensure that adequate downstream flows can be maintained at all times to meet dilution requirements for the waste water treatment plant discharge (in accordance with Environmental Compliance Approval requirements) while limiting the amount of inundation required around Ethel Lake;
- The Ethel Lake water intake structure will be designed with appropriate screening and intake flow velocity, per the Department of Fisheries and Oceans (DFO) Freshwater Intake End-of-Pipe Fish Screen Guideline (DFO, 1995) to minimize the potential for impingement or entrainment of Fish;
- Mercury concentration in fish flesh will be monitored and advisories to fishers/anglers will be posted as warranted or required;
- A water recycling system is proposed to ensure efficient use of water within the mine and minimize the amount of water required to be taken from Ethel Lake, and therefore, minimize water level fluctuations and decreases in downstream flow and associated effects on Fish and Fish Habitat;
- A surface water management system will be in place to divert non-contact water to the Mine Water Pond for appropriate treatment prior to discharge as well as all contact water, for re-use or treatment prior to discharge;
- A waste water treatment plant will be used to ensure that all contact water discharged to Fairbank Creek is treated to meet legislated federal limits in Schedule 4 of the *Metal Mining Effluent Regulation* and provincial effluent limits, as will be specified in the Environmental Compliance Approval (ECA) for the mine;
- Containment and treatment of site runoff and process water will incorporate conventional redundancies to account for anticipated potential equipment failures and climatic events;
- The Ethel Lake Control structure has been designed with an overflow section and a low-level operable valve to ensure that it can be operated in a manner that provides a minimum flow rate that ensures that Provincial Water Quality Objectives will be met at the edge of the effluent mixing zone in Fairbank Creek.

5.3.4.3.2 Environmental Management

The following mitigation and environmental management initiatives will be implemented during the various Project phases to prevent or minimize potential adverse environmental effects on Fish and Fish Habitat:

- In-water construction will adhere to DFO's timing windows, which specify no in-water work should be completed between April 1 and July 15 (DFO, 2013) to avoid disrupting fish during critical periods of the life cycle (e.g. spawning and incubation periods);
- Work-site isolation measures will be used for all in-water work to limit the amount and duration of actual in-water work that is required. Flow diversion measures will be used to maintain downstream flows during Construction and Decommissioning of the Ethel Lake Control structure;
- Only clean materials, free of fines will be used for coffer dams and all coffer dam material will be removed from the watercourse following completion of Construction;
- Pumping from behind coffer dams will be done using a shrouded pump to prevent entrainment of fish;
- Fish will be salvaged from all areas to be dewatered and transferred to the reach immediately downstream from the work area;
- Only clean equipment will be used in or adjacent to watercourses, and equipment will be maintained to be free of fluid leaks and invasive species;
- Equipment will be operated on land above the high water mark to the extent possible;
- Blasting, if required adjacent to fisheries waters, will be undertaken in accordance with DFO requirements regarding fisheries protection (Wright and Hopky, 1998);
- Clearing of riparian vegetation at the Ethel Lake Control structure and pumphouse and along the PAG 2 waste rock storage area access road will be limited to the extent possible to minimize erosion;
- Sediment and erosion control measures will be implemented and monitored to ensure proper functioning;
- Spill prevention and response measures will be implemented and monitored to ensure proper functioning; and
- Water takings from Ethel Lake will be managed to the extent possible to minimize water-level reductions during spawning periods for Northern Pike and other species that use flooded vegetation for spawning and rearing.

5.3.4.3.3 Monitoring and Follow-up Program

FNX will have monitoring programs in place during Construction, throughout the Operations phase, during and post-Decommissioning and Abandonment. The program will include regular compliance monitoring to ensure that all regulatory requirements are being met, and that the mitigation measures identified in this document and the

terms and conditions of any permits and approvals are being implemented and having the desired effect. This will include monitoring of items such as, but not limited to:

- Sediment and erosion control measures;
- Spill prevention and response measures;
- Compliance with in-water work timelines;
- Surface water quality from the waste water treatment plant is in accordance with the requirements of the Environmental Compliance Approval; and
- Water taking volumes from Ethel Lake are in accordance with provincial Permit to Take Water monitoring requirements.

In addition, Environmental Effects Monitoring is anticipated to be required under the *Metal Mining Effluent Regulations* including components related to Fish and Fish Habitat, when mining commences. Receiver Biological Monitoring is also required as part of the ECA Permit.

5.3.4.4 Key Benefits

During the Construction phase, an increase in aquatic habitat around Ethel Lake and an increase in potential spawning habitat for Northern Pike and other fish species is predicted.

There are no expected benefits to Fish and Fish Habitat during the Operations phase of the Victoria Project.

During the Decommissioning and Abandonment phase, an increase in aquatic habitat is predicted following removal of the control structure footprint and restoration of existing fish passage conditions at the Ethel Lake Control structure site. Benefits are also predicted in Fish and Fish Habitat due to restoration of the natural water level regime in Ethel Lake.

5.3.5 Terrestrial Habitat

5.3.5.1 Regulatory Oversight

Federal oversight of current and future activities at the Victoria site related to Terrestrial Habitat lies with Environment and Climate Change Canada in the form of regulations such as the *Migratory Birds Convention Act* and the federal *Species at Risk Act*. The Provincial regulatory oversight of current and future activities at the Victoria site related to Terrestrial Habitat lies with the Ontario Ministry of Natural Resources and Forestry (MNRF), Ontario Ministry of Environment and Climate Change (MOECC), and the Ontario Ministry of Northern Development and Mines (MNDM) in the form of regulations, permits, and approvals. These regulations include the *Ontario Endangered Species Act* and the *Fish and Wildlife Conservation Act*. The permit required by the MNRF is the permit under Clause 17(2)c of the *Ontario Endangered Species Act* for Eastern Whip-poor-will. The

Project has obtained this permit for activities related to Advanced Exploration activities and will be required during the construction phase of the Project.

Permits and approvals required by the MOECC include:

- Approval to Commence Harvesting Operations (Timber Permit) under the *Crown Forest Sustainability Act* to allow for the clearing of trees from the Victoria Site. This permit requires annual renewal; and
- Hazardous Waste Generator Registration under *O. Reg. 347: General Waste Management* under the *Ontario Environmental Protection Act*. The registration is required for the generation/shipping/disposal of 'registered wastes'. The registration requires annual renewal by the Project.

Permits and approvals required by the MNDM include:

- Advanced Exploration Closure Plan Amendment under the *Ontario Mining Act*. The Victoria Project has already received this approval; and
- Mine Production Closure Plan under the *Ontario Mining Act*. The Victoria Project will submit the closure plan for filing by the MNDM, prior to the commencement of 3,500 tpd mine production.

There is no Municipal oversight of current or future activities at the Victoria site related to Terrestrial Habitat.

5.3.5.2 Adverse Environmental Effects

As demonstrated below, none of the adverse residual environmental effects to Terrestrial Habitat are predicted to be significant.

The key adverse environmental effect to the Terrestrial Habitat is the temporary loss or alteration of habitat suitable for Eastern Whip-poor-will (*Caprimulgus vociferus*), hereafter referred to as Eastern Whip-poor-will, which is a species of special conservation status in Ontario. FNX has obtained the necessary overall benefit permit to disturb up to 55 hectares at the Project site with the aim of providing overall benefit to Eastern Whip-poor-will. The permit covers the entire life of the Project, meaning that this disturbance can take place anytime from Advanced Exploration to Mine Closure. A key aspect of the permit includes provisions that tree clearing or grubbing cannot take place annually between May 1 and September 30 thus protecting these birds and any other bird species during spring arrival, the breeding season and post-fledging periods.

During the Construction phase, the area surrounding the Project may be impacted by:

- Temporary disturbance of wildlife, avoidance of area, human-wildlife interactions due to worker presence, vehicle/equipment use and drilling and blasting activities;
- Disturbance to species of special conservation status - Eastern Whip-poor-will, Blanding's Turtle, Blanding's Turtle, Snapping Turtle, Milksnake, Golden-winged

Warbler, Canada Warbler, Common Nighthawk, and Bald Eagle and their respective habitat due to worker presence, vehicle or equipment use and drilling and blasting;

- Incidental take of wildlife;
- Loss or alteration of wildlife habitat due to vegetation removal;
- Changes to the structure or composition of vegetation communities;
- Soil compaction and rutting outside of the work area;
- Habitat creation for Eastern Whip-poor-will;
- Alteration of shoreline vegetation communities and associated habitat due to a 0.5 metre increase in water level of Ethel Lake;
- Disturbance to wildlife, temporary loss of vegetation communities or wildlife habitat due to soil or water contamination caused by an accident, malfunction or unplanned event (e.g. fuel and hazardous materials storage and handling);
- Disturbance to wildlife, temporary loss of vegetation communities or wildlife habitat due to water contamination caused by an accident, malfunction or unplanned event (e.g. erosion and sedimentation from the Project site).

During the Operations phase, the area surrounding the Project may be impacted by:

- Disturbance to wildlife, avoidance of area, human-wildlife interactions due to worker presence, vehicle/equipment use and drilling and blasting activities;
- Disturbance to species of special conservation status - Eastern Whip-poor-will, Blanding's Turtle, Snapping Turtle, Milksnake, Golden-winged Warbler, Canada Warbler, Common Nighthawk, and Bald Eagle due to worker presence, vehicle/equipment use and drilling and blasting activities;
- Incidental take of wildlife;
- Wildlife mortality (aquatic mammals, reptiles or amphibians) due to impingement or entrainment in water intake;
- Vegetation community alterations due to Ethel Lake water level fluctuation during water taking;
- Potential effects on wildlife health due to changes in surface water quality in local watercourses;
- Disturbance to wildlife, temporary loss of vegetation communities or wildlife habitat due to failure of the Ethel Lake Control Structure;
- Disturbance to wildlife, temporary loss of vegetation communities or wildlife habitat due to soil or water contamination caused by an accident, malfunction or unplanned event (e.g. fuel and hazardous materials storage and handling);

- Disturbance to wildlife, temporary loss of vegetation communities or wildlife habitat due to water contamination caused by an accident, malfunction or unplanned event (e.g. erosion and sedimentation from the Project site).

During the Decommissioning and Abandonment phase, the area surrounding the Project may be impacted by:

- Disturbance to wildlife, avoidance of area, human-wildlife interactions due to worker presence, vehicle/equipment use and decommissioning and abandonment activities;
- Disturbance to species of special conservation status - Eastern Whip-poor-will, Blanding's Turtle, Snapping Turtle, Milksnake, Golden-winged Warbler, Canada Warbler, Common Nighthawk, and Bald Eagle due to worker presence, vehicle/equipment use and drilling and blasting activities;
- Incidental take of wildlife;
- Disturbance to wildlife (aquatic mammals, reptiles or amphibians);
- Altered vegetation communities or wildlife habitat due to lowered water levels in Ethel Lake;
- Disturbance to wildlife, temporary loss of wildlife habitat as a result of changes in surface water quality of local watercourses due to runoff of contaminated water;
- Disturbance to wildlife, temporary loss of vegetation communities or wildlife habitat due to soil or water contamination caused by an accident, malfunction or unplanned event (e.g. fuel and hazardous materials storage and handling);
- Disturbance to wildlife, temporary loss of vegetation communities or wildlife habitat due to water contamination caused by an accident, malfunction or unplanned event (e.g. sedimentation from the Project site).

Adverse residual environmental effects to the Terrestrial Habitat that may occur throughout the entire life of the Project, or as the result of the Project in combination with other projects and activities, are:

- Wildlife disturbance and mortality (e.g., avoidance of area, changes in behaviour and movement, vehicle collisions, human-wildlife interactions) and habitat loss and alteration;
- Increased instances of wildlife disturbance and mortality (e.g., avoidance of area, changes in behaviour and movement, vehicle collisions, human-wildlife interactions) and habitat loss and alteration.

None of these residual effects are predicted to be significant effects. Refer to Section 13.3 of the Environmental Effects Analysis in Appendix A for a detailed description of the residual environmental effects to the Terrestrial Habitat.

5.3.5.3 Environmental Design, Mitigation and Optimization

5.3.5.3.1 Design Mitigations

The following environmental design features have been integrated into the Project to prevent or minimize adverse environmental effects on Terrestrial Habitat:

- The Project will include underground mining vs. open pit mining, which reduces above-ground physical disturbance;
- The Project has been sited to minimize vegetation clearing and earthworks and disturbance to drainage;
- Surface water run-off from the Project will be contained on-site and treated prior to release to the environment; and
- PAG 1 and PAG 2 waste rock storage pads will have lined seepage collection ditches and underdrains that report to sumps. Seepage monitoring wells will be installed at the perimeter of both pads. If water quality is shown to exceed Provincial Water Quality Objectives (PWQOs), the seepage water will be pumped to the Mine Water Pond for treatment prior to discharge.

5.3.5.3.2 Environmental Management

The following mitigation and environmental management initiatives will implemented during the various Project phases to prevent or minimize adverse environmental effects on Terrestrial Habitat:

- Compliance to all federal and provincial regulatory requirements and guidelines for wildlife and wildlife habitat (e.g. timing windows);
- Adherence to conditions outlined in the Overall Benefit Permit (SU-C-001-12) for Eastern Whip-poor-will, such as no grubbing or site clearing activities during the breeding season (between May 1 and August 31). The conditions outlined in the permit are in effect throughout the life of the Project; and
- An environmental management plan will be developed and best management practices followed for wildlife, noise, dust, water, waste, hazardous spills, erosion and sediment control and prevention. Mitigation will include, but is not limited to:
  - Restricting activities during sensitive breeding seasons (e.g., vegetation removal, noise effects);
  - Restricting the hours of off-site mine product and waste rock haulage;
  - Implementing on-site speed limits to minimize incidental take;
  - Wildlife education and awareness training for all staff;
  - Implementation of sediment and erosion control measures and ongoing monitoring to ensure proper functioning; and

- Implementation of spill prevention and response measures and ongoing follow-up monitoring to ensure proper functioning.

5.3.5.3.3 Monitoring and Follow-up Program

FNX will have monitoring programs in place during Construction, throughout the Operations phase, during and post-Decommissioning and Abandonment. Monitoring will include regular compliance monitoring to ensure that all regulatory requirements are being met and that the mitigation measures identified in this document and the terms and conditions of any permits and approvals are being implemented and having the desired effect. This will include monitoring of items such as, but not limited to:

- Sediment and erosion control measures;
- Spill prevention and response measures;
- Compliance with in-water work and vegetation clearing timelines;
- Monitoring associated with Eastern Whip-poor-will in accordance with the Overall Benefit Permit (SU-C-001-12);
- Surface water quality from the waste water treatment plant is in accordance with the requirements of the Environmental Compliance Approval; and
- Water taking volumes from Ethel Lake are in accordance with provincial Permit to Take Water monitoring requirements.

There is a high degree of confidence associated with determining potential effects to Terrestrial Habitat, and with determining that there are no significant adverse environmental effects. FNX has developed comprehensive management plans and procedures to mitigate any potential adverse environmental effects. As a result, a follow-up program is not required for the Terrestrial Habitat Valued Component.

5.4 Key Environmental Effects within the Legislative Authority of Parliament

Table 5-4 provides a brief analysis of the potential environmental effects of the Project (as defined in Section 2.3 – Components and Activities) in areas of federal legislative authority.

Table 5-4: Project Environmental Effects Associated with Key Areas of Parliamentary Legislative Authority (*Canadian Environmental Assessment Act* Section 5 and Sections 17 to 19 of the *Prescribed Information for the Description of Designated Project Regulations*)

Canadian Environmental Assessment Act 2012				
Key Areas of Parliamentary Legislative Authority	**Context**	**Environmental Effects**	**Comments**	**Key Cross References in Project Description Report and Supporting Studies**
5. (1) For the purposes of the Act, the environmental effects that are to be taken into account in relation to an act or thing, a physical activity, a designated project or a project are	Victoria Mine Project is considered a project at this stage of overall project scope.	N/A	N/A	N/A
(a) a change that may be caused to the following components of the environment that are within the legislative authority of Parliament:	N/A	N/A	N/A	N/A
(i) fish and fish habitat as defined in subsection 2(1) of the *Fisheries Act*,	Freshwater fish and fish habitat will be affected.	Reduced habitat quality due to reduced surface water quality; habitat modifications in Ethel Lake; fish mortality due to release of contaminants.	Engineering design and technically proven mitigation measures will reduce environmental effects to acceptable levels. Emergency response measures will address any contingent situations regarding spills. No marine fish and fish habitat will be affected.	Appendix A: Chapter 12 - Fish and Fish Habitat (page 214); Section 2.6 (page 25)
(ii) aquatic species as defined in subsection 2(1) of the *Species at Risk Act*,	No aquatic species with special conservation status are present in project area.	N/A	FNX has developed a detailed baseline on fisheries and aquatic resources.	Appendix A: Chapter 2- Existing Environment (page 19)
(iii) migratory birds as defined in subsection 2(1) of the *Migratory Birds Convention Act*, *1994*, and	Underground mine with minimal surface "footprint". Minor areas of habitat for migratory birds to be affected.	Alteration to habitat.	Engineering design and technically proven mitigation measures will reduce environmental effects to acceptable levels. Clearing of vegetation and other similar work activities in migratory bird habitat are proposed to be completed outside of the active breeding season.	
(iv) any other components of the environmental that are set out in Schedule 2;	N/A	N/A	FNX will continue to routinely monitor the *CEA Act* and Schedule 2 for changes and updates.	N/A
(b) a change that may be caused to the environment that would occur	N/A	N/A	N/A	N/A
(i) on federal lands,	Project is not expected to have any environmental effects on federal lands.	N/A	Project comprises and underground mine with localized reduction in air quality (dust and noise) that should attenuate to ambient conditions in close proximity to the project site and haulage routes.	N/A

Canadian Environmental Assessment Act 2012				
Key Areas of Parliamentary Legislative Authority	**Context**	**Environmental Effects**	**Comments**	**Key Cross References in Project Description Report and Supporting Studies**
(ii) in a province other than the one in which the act or thing is done or where the physical activity, the designated project or the project is being carried out, and	Project is not expected to have any trans boundary environmental effects in other provinces.	N/A	Project comprises and underground mine with localized reduction in air quality (dust and noise) that should attenuate to ambient conditions in close proximity to the project site and haulage routes. As well, any potential adverse environmental effects associated with reduced water quality or quantity and subsequent environmental effects on fish and fish habitat, fisheries or downstream water users are expected to occur only in close proximity to the project site.	N/A
(iii) outside Canada; and	Project is not expected to have any trans boundary environmental effects outside Canada.	N/A	Project comprises and underground mine with localized reduction in air quality (dust and noise) that should attenuate to ambient conditions in close proximity to the project site and haulage routes. As well, any potential adverse environmental effects associated with reduced water quality or quantity and subsequent environmental effects on fish and fish habitat, fisheries or downstream water users are expected to occur only in close proximity to the project site	N/A
(c) with respect to Indigenous peoples, an effect occurring in Canada of any change that may be caused to the environment on	N/A	N/A	N/A	N/A
(i) health and socio-economic conditions,	Health conditions for Indigenous peoples in the project area were adequately addressed in the Sudbury Soils Study. The study included Health Canada oversight.		The Sudbury Soils Study predicted little risk of health effects on Sudbury area residents associated with metals in the environment anglers, hunters and Indigenous people who may consume more local fish and wild game are at no greater risk of health effects due to metals in the environment than the general population.	Project Description Report: Main text Section 1.5 (page 22). Appendix A: Chapter 7 - The Selection of Valued Components (page 119); Section 7.1 (page 119)
(ii) physical and cultural heritage,	Projects involving ground disturbances always have the potential to adversely affect sites of physical or cultural importance to Indigenous groups.	Alteration or loss of archaeological or cultural sites.	Environmental baseline conditions indicate low potential for the presence of archaeological or cultural sites. Emergency response plans in place to address contingent situations where chance encounters of previously unidentified sites occur. Extensive and ongoing information exchange and consultation with Indigenous groups as part of negotiations on Impact and Benefit Agreements as well as information sharing with Indigenous groups and continuous improvement processes.	Project Description Report: Main text Section 6 (page 115). Appendix A: Chapter 2 - Existing Environment (page 19); Section 2.8 (page 27); Chapter 14 - Archaeological Resources (page 275); Sections 14.1 (page 275); Chapter 5 - Sustainability Management (page 80); Section 5.8 - Emergency Response (page 96)

Canadian Environmental Assessment Act 2012				
Key Areas of Parliamentary Legislative Authority	**Context**	**Environmental Effects**	**Comments**	**Key Cross References in Project Description Report and Supporting Studies**
(iii) the current use of lands and resources for traditional purposes, or	All areas in the region offer lands and resources for traditional purposes.	Reduced opportunities for fisheries and angling.	Issues and concerns with respect to the current use of lands and resources or traditional purposes all within the scope of negotiations on Impact and benefits Agreement with Indigenous groups as well as information sharing with Indigenous groups. Environmental baseline conditions indicate that there are no commercial or indigenous fisheries in the project area. The area offers potential for recreational fisheries.	Project Description Report: Main text Section 6 (page 115). Appendix A: Chapter 2 - Existing Environment (page 19); Chapter 15 - Residents and Recreational Land Use (page 289)
(iv) any structure, site or thing that is of historical, archaeological, paleontological or architectural significance			Environmental baseline conditions indicate low potential for the presence of historical, archaeological, paleontological or architectural significance in the project footprint area. Emergency response plans in place to address contingent situations where chance encounters of previously unidentified sites occur. Extensive and ongoing information exchange and consultation with Indigenous groups as part of negotiations on Impact and Benefit Agreements as well as information sharing and continuous improvement processes.	
(2)However, if the carrying out of the physical activity, the designated project or the project requires a federal authority to exercise a power or perform a duty or function conferred on it under any Act of parliament other than this Act, the following environmental effects are also taken into account:	N/A	N/A	N/A	N/A
(a) a change, other than those referred to in paragraphs (1)(a) and (b), that may be caused to the environment and that is directly linked or necessarily incidental to a federal authority's exercise of a power or performance of a duty or function that would permit the carrying out, in whole or in part, of the physical activity, the designated project or the project; and	N/A	N/A	Potential environmental effects have been fully considered in relation to blasting and the transportation, handling and storage of hazardous materials and dangerous goods. Thus the project will require authorizations under the *Explosives Act* and the *Transportation of Dangerous Goods Act*.	N/A
(b) an effect , other than those referred to in paragraph (1)(c), of any change referred to in paragraph (a) on	N/A	N/A	N/A	N/A
(i) health and socio-economic conditions;	N/A	N/A	Potential environmental effects in relation to (1)(c) comprise the key environmental effects associated with the project.	N/A

Canadian Environmental Assessment Act 2012				
Key Areas of Parliamentary Legislative Authority	**Context**	**Environmental Effects**	**Comments**	**Key Cross References in Project Description Report and Supporting Studies**
(ii) physical and cultural heritage, or	N/A	N/A	Potential environmental effects in relation to (1)(c) comprise the key environmental effects associated with the project.	N/A
iii) any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.	N/A	N/A	Potential environmental effects in relation to (1)(c) comprise the key environmental effects associated with the project.	N/A

5.5 Environmental Effects on Federal Lands, Other Provinces and Other Countries

FNX does not anticipate any potential or residual adverse environmental effects that will occur on federal lands or anywhere else beyond Ontario.

5.6 Environmental Effects on Indigenous Peoples

FNX has well-established information sharing and consultation processes with each of the three Indigenous groups potentially affected by the Project. The Province of Ontario has identified several such groups through the past many years of the regulatory review of exploration activities at the Victoria property, with particular emphasis on the closure planning requirements. These groups include:

- Atikameksheng Anishnawbek First Nation;
- Sagamok First Nation; and
- The Métis Nation of Ontario (Region 5).

The closest First Nation Reserve to the Victoria Project is the Atikameksheng Anishnawbek First Nation Reserve, located 7.6 kilometres southeast of the Project. The Sagamok First Nation Reserve is located 45 kilometres west of the Project (Figure 1-1). There are no anticipated direct effects from the Victoria Project on First Nation Reserve Lands.

Indigenous Communities have reported traditional usage of the lands in the region around the Victoria Project for hunting large and small game, fish harvesting, plant gathering, road access, trapping and occupancy, while the lands closely surrounding the Project area itself have also been used for bird harvesting, harvesting of plants and natural materials, cultural practices and camping.

To accommodate Indigenous Groups' traditional use of the lands and resources in and surrounding the Victoria Project Area, FNX will provide conditional access to these areas for traditional activities throughout the life of the mine (including advanced exploration, construction, operation, decommissioning and abandonment). Access will be conditional upon the area to be accessed being deemed safe. An Access Management Plan will be developed and in use by the end of 2019. FNX will continue to meet with Indigenous Groups regularly throughout advanced exploration and all phases of the life cycle of the mine to ensure the plan is updated and continues to accommodate the traditional use needs of Indigenous Groups. The plan will protect the health and safety of those practicing traditional gathering activities, the public and Victoria Project personnel.

The Access Management Plan will be developed in consultation with Indigenous Groups to facilitate access to areas in and surrounding the Victoria Project Site for traditional usage during the life cycle of the mine. Our closure plan objectives were also developed in alignment with indigenous communities Traditional Usage values.

After mining ceases and the site is reclaimed to pre-project conditions to the extent possible, conditional access will continue to be provided for traditional land use. The access management plan will be reviewed during closure planning to ensure that access continues to be provided while protecting the health and safety of those requesting access.

FNX understands the importance of collecting and considering Traditional Knowledge and Traditional Land Use (TLU) information. Individuals and families most dependent on local resources for spiritual, cultural, and basic needs are best positioned to articulate the importance of places, areas, and activities but also to share knowledge that is grounded in learned experience. With this in mind, FNX will continue to meet with Indigenous Groups and update the Access Management Plan as information changes or new information is acquired.

Local animal and fish populations and archaeological resources are not anticipated to be meaningfully affected by the Victoria Project. The ability for Indigenous peoples to hunt, trap, fish, gather plants and carry out cultural practices will be not be comprised as conditional access will be provided throughout the life of the mine, according to all City of Greater Sudbury laws and regulations.

After mining ceases and the site is reclaimed to pre-project conditions to the extent possible, conditional access will continue to be provided for traditional land use. The access management plan will be reviewed during closure planning to ensure that access continues to be provided while protecting the health and safety of those requesting access.

Key environment-related interests or comments expressed to date from Indigenous Groups include:

1. Handling and storage of waste rock and management of potentially acidic rock drainage from onsite temporary storage of Potentially Acid Generating waste rock;
2. Management and consumption of surface and groundwater resources, such as stormwater management, runoff from waste rock storage areas, water intake sources for the Project;
3. Potential effects of the Project on water quality, fish and wildlife;
4. Spill prevention and response measures;
5. Environmental monitoring of receiving water bodies and monitoring of species at risk;
6. Interest in training, employment and contracting opportunities.

FNX has included any concerns associated with potential adverse environmental effects on potential or established Aboriginal or treaty rights in the Project design and environmental effects analysis that has been conducted for the Project.

The selection of Valued Components in the environmental effects analysis takes into consideration the key issues identified by the Indigenous groups through the consultation process. Valued components have been carefully and respectfully considered to reflect environmental protection and pollution prevention issues associated with concerns and key issues identified by Indigenous groups in Tables 6-1 through 6-3 above, in the Design of the Project while respecting existing confidential agreements. The Valued Components used in this analysis include: Atmospheric Environment, Surface Water Quality, Groundwater Quantity, Fish and Fish Habitat, Terrestrial Habitat, Archaeological Resources, Residents and Recreational Land Use, Community Services and Infrastructure, and Employment and Business. Results of the detailed environmental analysis indicate that residual adverse environmental effects for each of these VCs have been determined to be not significant. Furthermore, the Project will generate considerable local and regional economic activity during the Construction and Operation phases, resulting in positive benefits from potential economic opportunities including employment opportunities, business and contracting opportunities, and training and skills development.

FNX has also respectfully engaged these Indigenous groups in an ongoing confidential consultation about the Project, including:

- Awareness of the traditional use of such lands;
- Awareness of resources that may be of concern (such as large game, small game, fishing, and plants) as well as any concerns with established travel routes (such as overland or waterways) and cultural and sensitive areas used for the exercise of such rights;
- A respectful, confidential and balanced approach to establishing potential benefits to Indigenous groups associated with site exploration activities related to employment and business opportunities, skills development and training;
- The use of scientific methods to evaluate potential adverse environmental effects on fundamental components of the environment, with an aim to contribute to the knowledge base and information that will guide impact and benefits discussions; and
- A willingness to continue to consider any traditional knowledge made available by Indigenous groups and to incorporate this knowledge where practicable to improve overall sustainability performance for ongoing exploration activities and any future Project.

FNX has placed concerns associated with potential adverse environmental effects of the Project on potential or established Indigenous or treaty rights as an overarching planning context for conducting the environmental effects analysis (Appendix A). While specific agreements respecting potential impacts and benefits with Indigenous groups are proprietary and confidential in nature, Appendix A comprises a contribution to the further strengthening of respectful consultation and negotiations around potential

impacts and benefits using a science based approach. Key aspects of FNX's approach to Project planning include:

- Developing the Project in an area within the City of Greater Sudbury as well as an area where previous exploration, mining and minerals processing has occurred in the past;
- Minimized the biophysical footprint. The principle element of the Project resulting in an increased footprint is associated with the PAG 2 rock storage area (approximately 8.7 hectares including the haulage road);
- PAG 1 and PAG 2 rock storage is temporary as such rock will be consumed in the backfill manufacturing process designed into the Project for ground support and mining methods purposes;
- Alterations to the level of Ethel Lake as a result of the construction of the proposed Ethel Lake control structure. It should be noted that there is an existing dam located approximately 150 m downstream of the location of the control structure that is owned and operated by Vale (Figure 5-1). The level of Ethel Lake has been controlled for several decades as the dam was installed by Vale during the operation of the historical Victoria Mine. The exact date of dam construction is unknown. Historical air photos taken while the historical Victoria Mine was operational show flooding of Ethel Lake as a result of the dam (Figure 5-2);
- Progressive reclamation over the life of the Project to enable a return to pre-Project conditions of traditional land use in the area, to the extent practical.

Figure 5-1: Upstream Face of the Existing Ethel Lake Concrete Dam

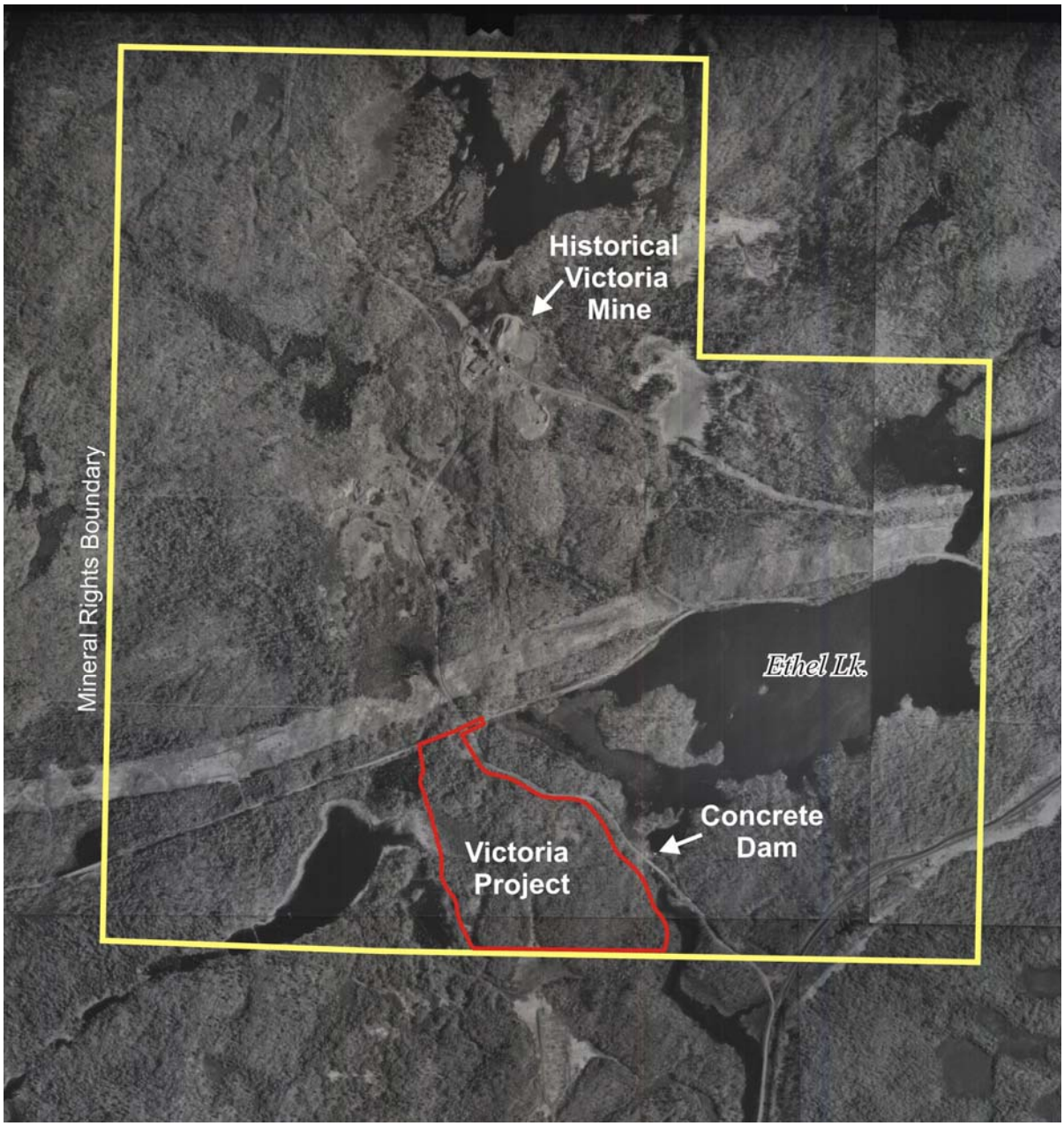

Figure 5-2: 1970s Air Photo Illustrating Historical Flooding of Ethel Lake

5.7 Other Indigenous Groups

FNX has initiated an information sharing exercise with four additional Indigenous groups as identified in discussions with the federal government. They include Whitefish River First Nation, Wikwemikong First Nation, Serpent River First Nation and Wahnapitae First Nation.

5.8 References

- Canadian Environmental Assessment Agency, 2015. Guide to Preparing a Description of a Designated Project under the *Canadian Environmental Assessment Act, 2012*.

6. Proponent Engagement and Consultation with Indigenous Groups

The Sudbury Basin has been and remains a prolific area for mineral exploration, mining and minerals processing as well as being recognized globally for activities associated with ecosystem restoration and remediation following long-term and broad scale industrial development. The Project occurs in an area where Indigenous groups claim Indigenous or treaty rights. Indigenous groups in the Sudbury Basin are knowledgeable with respect to resource development including all aspects of the exploration, mining and minerals processing industry. Contemporary expectations in the development of natural resources projects place a high degree of importance in the consultation and information sharing relationship between individual proponents and potentially affected Indigenous groups.

FNX has engaged and established relationships with the following Indigenous groups as directed by the Provincial Ministry of Northern Development and Mines:

- Atikameksheng Anishnawbek First Nation (AAFN);
- Sagamok First Nation (SFN); and
- Métis Nation of Ontario (MNO) (Region 5; Mattawa/Lake Nipissing Region).

FNX commenced its consultation and information sharing efforts in earnest in 2009 when the likelihood of a more comprehensive exploration program, including shaft sinking, was needed to support and advance its business development planning and decision making process. As such, there is a high degree of certainty about key issues associated with Project activities. Details about FNX's consultation and engagement process are provided in Table 6-1(AAFN), Table 6-2 (SFN) and Table 6-3 (MNO):

- The majority of future engagement with Indigenous stakeholders will be in the form of Community Liaison Meetings (Atikameksheng Anishnawbek First Nation), Implementation Committee or Leadership Committee meetings (Sagamok First Nation) or Liaison Committee meetings (Métis Nation of Ontario);
- The current IBA/MOU's outline Implementation or Liaison Committee requirements (who, number of members, etc.) and frequency of meetings, which vary between the stakeholders (e.g., one time per quarter, as required, etc.). Commitment has been made by FNX and SFN/AAFN to meet monthly, above and beyond IBA requirements. If only minimal updates are to be shared or there are no issues to discuss, then the meeting is to proceed. Regular meetings will keep lines of communication open and help build continued trust;
- Included in the Implementation/Liaison meetings are Community updates, Project Status updates, Construction schedule updates, Health and Safety updates, Environmental updates, Business opportunity updates, Employment and/or training

opportunities; in addition to any questions or concerns either party would like to discuss;

- Minutes of the meetings are recorded and distributed accordingly;
- An Environmental Sub-committee was formed with SFN in 2018, with the first meeting being held on January 16, 2018. Meetings will be held once every quarter, or as required and will follow mutually agreed upon Terms of Reference;
- An Environmental Sub-committee with AAFN will commence in May 2019;
- Sub-committees with the other Indigenous Groups will likely be formed as the Project progresses; for example a Human Resources Sub-committee was being discussed prior to Project deceleration. Formation of sub-committees will be based on Implementation/Liaison Committee needs and discussions; and
- Community specific meetings with FNX and MNO communities will vary depending on the IBA, needs of the community and activities at the Project.

Impact Benefit Agreements guide the consultation process by covering such items as:

- Protection of the Site (archeological sites or potential finds);
- Environmental Matters;
- Community Meetings;
- Employment and Training Opportunities;
- Business Opportunities;
- Compensation for Potential Interference or Infringement of the Exercise of Aboriginal and Treaty Right Caused by Victoria Mine Advanced Exploration Project;
- Dispute Resolution Process;
- Force Majeure and Temporary Suspension.

As part of the Impact Benefit Agreement or Engagement Agreement, FNX and each of the Indigenous communities meet or share information on a regular basis to:

- Engage in information sharing discussions;
- Review progress on implementation of the Agreement;
- Discuss ways to increase level of participation by communities in business; employment and training opportunities;
- Discuss ways KGHM will seek input from and engage in information sharing discussion respecting environmental concerns, related to the Project;
- Explore appropriate measures and/or remediation in the event of a spill or accident;
- Explore and Agree on measures required to protect any archeological site or artifacts;

- Discuss appropriate mitigation measures respecting identified adverse effects related to Treat Rights; and
- Align and agree on dates for Community Meetings.

6.1 Consultation on the Project Description Report

Specific details about FNX's consultation on the Victoria Mine Project Description Report are provided in Table 6-1(AAFN), Table 6-2 (SFN) and Table 6-3 (MNO). A draft version of the Project Description Report was provided to Atikameksheng Anishnawbek First Nation, Sagamok First Nation (SFN); and Métis Nation of Ontario (MNO) in October 2018. FNX engaged these three communities in a confidential and meaningful way regarding the Project Description Report as documented in these tables. Key comments received from the communities are provided in Figure 6-1. To protect the confidentiality of the community, the source of these comments is not provided.

A Letter of Acknowledgement and thank-you for consulting with Sagamok Anishnawbek First Nation regarding the Victoria Project Description Report, was received April 16, 2019 (Figure 6-2). The letter indicated that on a without prejudice basis, that they have no comments or concerns regarding the Victoria Project.

In addition to ongoing planned consultation, FNX plans to continue to have meaningful consultation with all three Indigenous Communities monthly throughout the Environmental Assessment process with the intent of identifying information needs and concerns as early in the process as possible, providing adequate time and resources for Indigenous Communities to respond to Project information and addressing and resolving any concerns together. FNX will continue to document potential impacts to Indigenous Communities on an ongoing basis as part of the EA process. FNX will also continue to maintain an electronic record of its consultation activities for the Victoria Project. Engaging Indigenous Communities and continuing to build long-term sustainable relationships is an important part of FNX's corporate commitments and policies and therefore is a critical component of project success.

Table 6-1: Victoria Mine Project and Site Exploration Activities – Summary of Consultation and Engagement with Atikameksheng Anishnawbek First Nation (AAFN)

Scope and Subject	Date	Current Status	Objectives/Comments
General			
Initial contact and introductions.	November 2009	Complete	Introduce the Project and Project team.
Project updates: updates on exploration activities; Project schedule and planned activities; Project plans and progress; review of environmental study results; updates or changes to permit applications; discussions about Indigenous and treaty rights; negotiation on governing agreements.	2009 – December; 2010 – April, June, October; January 2012 to present (monthly)	Ongoing	Consistent and transparent communications through community engagement strategies; AAFN / KGHM Agreement Negotiation Committee; AAFN / KGHM Community Liaison Committee; engagement with Project management and leadership.
Relationship building: community meetings; sponsorship and participation in social events; Pow Wows; site visits; commemoration of National Indigenous Day with AAFN community; Site Blessing Ceremony.	January 2012 to present	Ongoing	Consistent and transparent communications through community engagement strategies; AAFN / KGHM Community Liaison Committee; engagement with Project management and leadership.
Negotiated Agreements			
Memorandum of Understanding (MOU) – Signed.	December 2011	Complete	Agreement to enter into negotiations with the goal of defining the future working relationship that meets the needs and interest of both AAFN and KGHM.
Memorandum of Understanding – Resigned.	December 2012	Complete	Renewal of the earlier MOU whereby the two parties agreed to continue negotiations with the goal of defining a mutually beneficial future working relationship.
Victoria Advanced Exploration Project Agreement; Community meeting and ceremonial signing.	September 2014; November 2014	Complete	Established the Joint Community Liaison Committee which governs the interactions between the community and the Project.
Joint Community Liaison Committee: Terms of Reference for the committee approved by AAFN and KGHM.	April 2015	Ongoing	Promote consistent and transparent communication between KGHM and AAFN, through engagement with community leadership and Project management.
Production Impact Benefit Agreement discussions initiated.	August 2016	Ongoing	To negotiate the terms and conditions of a Production Impact Benefit Agreement. Objective is to mutually develop a comprehensive agreement governing the Project, including permitting, financing, construction, operation and closure of the Project.
Agreement Implementation			
Joint Community Liaison Committee: scheduled monthly meeting, or as required.	October 2014 to present	Ongoing	Promote communication and transparency between AAFN and the Project, including management of disputes and issues that arise from the implementation of the Agreement.
Leadership Committee: quarterly meetings, or as required.	October 2014 to present	Ongoing	Manage disputes and issues that have been escalated by the Joint Community Liaison Committee. Review and approval of recommended revisions to the Agreement from the Community Liaison Committee.
Procurement sub-committee: participation of AAFN business in work for the Victoria Project.	TBD	To be scheduled/organized based on activity	Maximize participation of AAFN on the Victoria Project through establishment and communication of procurement processes to AAFN. Communicate the status of current and pending procurement packages related to the Project.
Construction sub-committee: provide status updates for current and pending construction activities.	TBD	To be scheduled/organized based on activity	Focus on communicating construction plans and current activities that may affect AAFN or provide opportunities for AAFN participation. Based on current activity, updates are provided during Joint Community Liaison meetings and via email.

Scope and Subject	Date	Current Status	Objectives/Comments
Human Resources sub-committee: coordination of training needs and employment opportunities.	TBD	To be scheduled/organized based on activity	Communicate current and future employment opportunities. Communicate skill and educational requirements for the different jobs that will be available during Construction and Operations. Evaluate individual skills and identify training requirements.
Permitting & Environment sub-committee: communicate plans, schedule and updates for permitting applications and amendments.	March 2017 to present	Ongoing	Communicate permitting plans and requirements. Coordinate review of applications and supporting documentation prior to submission to regulatory authorities.
Dispute resolution process: Community Liaison Committee.	September 2014	Has not been required to date	Mechanism to ensure any unresolved issues are appropriately addressed.
Consultation on Permit Applications			
General review of permits: list of permits and applications, including timelines for filing; list of environmental assessment and other reports completed and pending[1].	February 2012 to present	Ongoing	Establish transparent communications and information sharing on permits, environmental reports, and other Project information of interest to AAFN.
Stage 1 Archaeological Assessment Report: draft copy provided to AAFN.	November 2010; February 2012	Complete	AAFN – KGHM Facilitation Team to provide a summary of report and study information and facilitate 3rd party reviews and responses, as required.
Advanced Exploration Closure Plan: Preliminary closure plan provided to AAFN for review. Comments returned to Project. Submitted and accepted for filing by MNDM.	June 2012; January 2013; June 2013; October 2013	Complete	All AAFN comments addressed. Accepted for filing by MNDM October 21, 2013.
Advanced Exploration Closure Plan Amendment: Notice of Material Change sent to AAFN. AAFN filed letter of non-objection to MNDM.	March 2014; February 2015; April 2015	Complete	All AAFN comments addressed. Accepted for filing by MNDM on March 16, 2015.
Environmental Compliance Approval and Permit to Take Water: Letter of support provided by AAFN for MOECC permits.	March 2012; February 2013; March 2013; June 2013	Complete	Comments and concerns from AAFN have been addressed and permit approved. All information regarding permits are maintained in the Project permit register, which is updated regularly.
Application and approval for an Environmental Compliance Approval for Air and Noise. Letter of support provided by AAFN for MOECC permits.	May 2012; February 2013; June 2013	Complete	Comments and concerns from AAFN have been addressed and permit approved. All information regarding permits are maintained in the Project permit register, which is updated regularly.
Application and approval for an Environmental Compliance Approval for Industrial Sewage. Letter of support provided by AAFN for MOECC permits.	February 2013; May 2013; June 2013	Complete	Comments and concerns from AAFN have been addressed and permit approved. All information regarding permits are maintained in the Project permit register, which is updated regularly.
Environmental Screening for <5 MW of diesel fired generating capacity.	August 2014	Complete	Screening showed that there are no significant environmental effects anticipated. Comments and concerns from AAFN have been addressed and permit approved. All information regarding permits are maintained in the Project permit register, which is updated regularly.
CEAA Project Description Report – First Submission.	March 2015; April 2015	Complete	Comments and concerns were addressed through the Community Liaison Committee.
Project Description Report (PDR) – First submission.	April 2017	On hold	Comments and concerns from AAFN to be discussed and addressed through the Community Liaison Committee and Environmental Subcommittee.

[1]Reviewed documentation such as: Stage 1 Archaeological Assessment, Archeological Historical Research Report, Baseline Aquatic Environmental Assessment Interpretative Report, Phase 2 Environmental Site Assessment Report, Application for 17(2)(c) Permit under the Endangered Species Act, Mine Hazard Inventory Report, Existing Natural Features Report, Shaft #1 Environmental Geochemistry Report, Victoria Mine Hydrogeological Study, Development Proposal, Interim Report on Acid Rock Drainage and Metal Leach Assessment, Draft Report: Waste Rock Management Plan, Hydrologic and Assimilative Capacity Assessment, Application for C of A for Industrial Sewage, Existing Natural Features Report, Annual Groundwater Monitoring Report.

Scope and Subject	Date	Current Status	Objectives/Comments
Production Closure Plan – Draft submission.	April 2017	On hold	Comments and concerns from AAFN to be discussed and addressed through the Community Liaison Committee and Environmental Subcommittee.
2017 Victoria Flow and Level Monitoring Report, in fulfillment of Clause 4.7 of Permit To Take Water (FNX Mining Company Inc.'s Victoria Advanced Exploration Project, amended PTTW Number 0466-AJ8HRM) shared.	March 2018	Complete	No comments were received.
Written Summary Report, in accordance with Condition 5.1 of the Environmental Compliance Approval (ECA) for Air (FNX Mining Company Inc. Victoria Advanced Exploration Project Certificate of Approval Number: 8794 - 8VFJ7B) shared.	March 2018	Complete	No comments were received.
Information regarding potential Notice of Limited Operational Flexibility for the Environmental Compliance Approval for Industrial Sewage.	June 2018	Complete	No comments were received.
Application for removal of 7:1 dilution ratio related to Environmental Compliance Approval (ECA) for Industrial Sewage (Number 9557-AP5FSQ).	July 2018	Complete	The reason for the application was discussed. No concerns were raised.
2017 Annual Performance Report Condition 9(2) of the Environmental Compliance Approval (ECA) for Air (Number 9557-AP5FSQ) shared.	July 2018	Complete	Comments, questions or concerns from AAFN were shared through the Community Liaison Committee. No outstanding issues or concerns.
Draft Project Description Report (PDR)	October 2018	Ongoing	Objective to provide opportunity to review draft PDR by AAFN and discuss concerns/questions prior to submitting the document to CEA Agency: • A copy of the PDR was provided to AAFN on October 19, 2018. • Meeting was held with AAFN on November 15, 2018 to discuss the PDR. • Meeting was held on November 20, 2018 to discuss the PDR and the quote for the cost of 3rd party review of the PDR. • Meeting was held on December 18, 2018. Discussed with committee KGHM presentation on PDR to Chief and Council. Discussion included Project Description Report – Components and Activities (Economic aspects of mine production), quote for 3rd party PDR review, tentative dates with chief and council • Meeting was held January 25, 2019. KGHM presented PDR Presentation (the presentation was revised based on feedback from AAFN, received during the December 18, 2018 meeting) • Meeting was held February 25, 2019. Discussed tentative dates for PDR Presentation • Meeting was held April 2, 2019 with Chief and Council. KGHM presented PDR Presentation. Positive discussion followed the presentation. No outstanding concerns were identified.
Written Summary Report, in accordance with Condition 5.1 of the Environmental Compliance Approval (ECA) for Air (FNX Mining Company Inc. Victoria Advanced Exploration Project Certificate of Approval Number: 8794 - 8VFJ7B) shared.	March 2019	Complete	The 2018 Written Summary Report was shared with AAFN on February 5, 2019. No comments or concerns were received.

Scope and Subject	Date	Current Status	Objectives/Comments
2018 Annual Groundwater Report, summarizing results of all 2018 Groundwater Sampling.	March 2019	Complete	The 2018 Annual Groundwater Report which summarizing the results of the Victoria Project 2018 Groundwater Sampling was shared with AAFN on March 5, 2019. No comments or questions were received.
Key Issues & Opportunities			
Contracting and procurement opportunities: establish and implement formal processes and procedures between AAFN and KGHM; AAFN businesses directly providing Victoria Project with goods and services; AAFN businesses subcontracting or forming joint ventures with non-Indigenous business to provide goods and services to Victoria Project.	July 2014 to present	Ongoing	Victoria Advanced Exploration Project Agreement objective to maximize participation of AAFN community. Identifying and maximizing opportunities is primarily done through the Community Liaison Committee, Project Procurement Manager, and Project Construction Manager.
Employment opportunities: employment and hiring directly with KGHM; employment and hiring by businesses working for KGHM on the Victoria Project; establish and implement formal processes and procedures.	June 2015 to present	Ongoing	Employment opportunities are continually being pursued, through the Project Human Resources Manager, including hiring summer students, posting of all employment positions, and participation in job fairs. KGHM has participated in career fairs, employed an AAFN summer student, participated in a joint Driller's Helper Training program and shares career opportunities available within the organization weekly.
Establish a Production Impact Benefit Agreement to secure equitable economic benefits for AAFN.	September 2016	Ongoing	Establish definitive Production Impacts and Benefits Agreement.
Training opportunities: align KGHM's future needs with AAFN development plans. Work with community members to identify skill gaps and establish a training plan. Communicate to community youth about careers and jobs within KGHM and the mining industry.	May 2010 to present	Ongoing	Training opportunities are continually being pursued through the Community Liaison Committee, including hiring summer students, and through school presentations. KGHM has participated in career fairs, employed an AAFN summer student, participated in a joint Driller's Helper Training program and shares careers opportunities available within the organization weekly.
Effects on Indigenous and treaty rights and cultural heritage.	October 2010 to present	Ongoing	Concerns are being addressed through AAFN community outreach initiatives that are led by the Community Liaison Committee, which includes site visits and tours to observe progress and construction activities. Visits are annual at a minimum. Project updates are also provided at annual Community Meetings. There was a site ceremony blessing with AAFN on June 22, 2015.
Management of surface and groundwater resources, including: Stormwater management, runoff from waste rock storage areas, water intake sources for the Project.	October 2010; May 2012; December 2015	Complete	Concerns have been addressed through engineering and design measures, such as the wastewater and sewage treatment plants. Concerns also addressed through various permits and site management plans and procedures, including the Permit to Take Water, site water management and waste rock management plans.
Handling and storage of waste rock at the site.	May 2012; December 2015	Complete	Concerns have been addressed through engineering and design and through site waste rock management plans and procedures.

Table 6-2: Victoria Mine Project and Site Exploration Activities: Summary of Consultation and Engagement with Sagamok First Nation (SFN)

Scope and Subject	Date	Current Status	Objectives/Comments
General			
Initial contact and introductions.	August 2010	Complete	Introduce the Project and Project team.
Victoria Mine Updates: updates on exploration activities; Project schedule and planned activities; Project plans and progress; review of environmental study results or incidents; updates or changes to permit applications; discussions about Indigenous and treaty rights; negotiation on governing agreements.	November 2010 to present	Ongoing	Consistent and transparent communications through community engagement strategies; SFN / KGHM Agreement Negotiation Committee; SFN / KGHM IBA Implementation Committee; engagement with Project management and leadership.
Relationship building: social events at SFN community; participating in SFN educational fair; site visits; sponsoring Mining Matters Earth Science Camp at Sagamok; support for Miner's Training Program; commemoration of National Aboriginal Day; Sunrise Ceremony at Site, participation with the annual Fall Harvest, Chief to Chief (CEO) meeting.	March 2011 to present	Ongoing	Consistent and transparent communications through community engagement strategies; SFN / KGHM IBA Implementation Committee; engagement with Project management and leadership.
Negotiated Agreements			
Memorandum of Understanding (MOU) – Signed.	December 2012	Complete	Agreement to enter into negotiations with the goal of defining the future working relationship that meets the needs and interest of both SFN and KGHM. Implemented through the SFN / KGHM Negotiation Committee.
Victoria Advanced Exploration Project Impacts and Benefits Agreement.	October 2014	Complete	Ensure ongoing consultation and engagement through the IBA Implementation Committee.
SFN / KGHM IBA Implementation Committee: Terms of Reference for the committee approved by SFN and KGHM.	August 2015	Ongoing	Promote consistent and transparent communication between KGHM and SFN, through engagement with community leadership and Project management.
Agreement Implementation			
IBA Implementation Committee: scheduled monthly meeting, or as required.	January 2015 to present	Ongoing	Promote communication and transparency between SFN and the Project, including management of disputes and issues that arise from the implementation of the Agreement.
Leadership Committee: quarterly meeting or as required.	January 2015 to present	Ongoing	Manage disputes and issues that have been escalated by the IBA Implementation Committee. Review and approval of recommended revisions to the Agreement from the IBA Implementation Committee.
Procurement sub-committee - participation of SFN business in work for the Victoria Project.	TBD	Ongoing meeting to be scheduled/organized based on activity	Maximize participation of SFN on the Victoria Project through establishment and communication of procurement processes to SFN. Communicate the status of current and pending procurement packages related to the Project.
Construction sub-committee: provide status of current and pending construction activities.	TBD	To be scheduled/organized based on activity	Focus on communicating construction plans and current activities that may affect SFN or provide opportunities for SFN participation.

Scope and Subject	Date	Current Status	Objectives/Comments
Human Resources sub-committee: coordination of training needs and employment opportunities.	TBD	To be scheduled/organized based on activity	Communicate current and future employment opportunities. Communicate skill and educational requirements for the different jobs that will be available during Construction and Operations. Evaluate individual skills and identify training requirements. KGHM shares career opportunities available with KGHM on a weekly basis.
Permitting & Environment sub-committee: communicate plans, schedule and updates for permitting applications and amendments.	November 2017	January 2018 to present	Communicate permitting plans and requirements. Coordinate review of applications and supporting documentation prior to submission to regulatory bodies. Review any environmental incidents since previous meeting and ensure questions or concerns are considered and addressed.
Dispute Resolution Process: IBA Implementation Committee Level.	November 2015	Resolved	Dispute elevated by SFN regarding a disagreement with SFN business over contractual issues.
Dispute Resolution Process: Leadership Committee Level.	January 2016	Resolved	Dispute with SFN related to differing interpretation of term defining Indigenous Businesses and participation in providing services to the Project.
Consultation on Permit Applications			
General review of permits: lists of permits and applications and timelines for filing; lists of environmental assessments and other reports completed and pending.[2]	August 2010 to present	Ongoing	Establish transparent communications and information sharing on permits, environmental reports, and other Project information of interest to SFN.
Closure Plan: Preliminary closure plan provided to SFN for review. SFN engaged third party to review closure plan. Comments returned to Project. Submitted and accepted for filing by MNDM.	2010 – November; 2012 – January, February, March, June, October	Complete	Comments and concerns from SFN have been addressed and permit approved. All information regarding permits is maintained in the Project permit register, which is updated regularly.
Closure Plan Amendment: Update on changes required; Notice of Material Change. SFN filed letter of non-objection to MNDM.	2013 – April, June; 2014 – January, November; 2015 – February	Complete	Comments and concerns from SFN have been addressed and permit approved. All information regarding permits is maintained in the Project permit register, which is updated regularly.
Stage 1 Archaeological Assessment Report: Draft provided; SFN engaged third party review; SFN also engaged third party to carry out additional research utilizing crown and First Nation records.	November 2010; December 2010; March 2011; January 2012	Complete	Establish transparent communication and ensure participation in the Archaeological assessment for the Project.
SFN provided copy of "SA External Consultation Guidelines".	February 2011	Complete	Ensure that Project is aware of and meets requirements of community guidelines for consultation.
Environmental Compliance Approval and Permit to Take Water; SFN provided MOECC with verbal approval on permits.	March 2012; October 2012; June 2013	Complete	Comments and concerns from SFN have been addressed and permit approved. All information regarding permits is maintained in the Project permit register, which is updated regularly.

[2] Reviewed documentation such as: Stage 1 Archaeological Assessment, Archeological Historical Research Report, Baseline Aquatic Environmental Assessment Interpretative Report, Phase 2 Environmental Site Assessment Report, Application for 17(2)(c) Permit under the *Endangered Species Act*, Mine Hazard Inventory Report, Existing Natural Features Report, Shaft #1 Environmental Geochemistry Report, Victoria Mine Hydrogeological Study, Development Proposal, Interim Report on Acid Rock Drainage and Metal Leach Assessment, Draft Report: Waste Rock Management Plan, Hydrologic and Assimilative Capacity Assessment, Application for C of A for Industrial Sewage, Existing Natural Features Report, Annual Groundwater Monitoring Report.

Scope and Subject	Date	Current Status	Objectives/Comments
Application and approval for an Environmental Compliance Approval for Air and Noise. SFN provided MOECC with verbal approval on permits.	March 2012; June 2013	Complete	Comments and concerns from SFN have been addressed and permit approved. All information regarding permits is maintained in the Project permit register, which is updated regularly.
Application and approval for an Environmental Compliance Approval for Industrial Sewage. SFN provided MOECC with verbal approval on permits.	March 2012; June 2013	Complete	Comments and concerns from SFN have been addressed and permit approved. All information regarding permits is maintained in the Project permit register, which is updated regularly.
Project Description Report (PDR) – First submission.	April 2017	On hold	Comments and concerns from SFN to be discussed and addressed through the Community Liaison Committee and Environmental Subcommittee.
Full Production Closure Plan – draft submission.	April 2017	On hold	Comments and concerns from SFN to be discussed and addressed through the Community Liaison Committee and Environmental Subcommittee.
Full Production Closure Plan, update on Project Description Report (CEAA) and status of other permit applications.	September 2016	Complete	To provide an update to SFN on the status of the PDR and Closure Plan and direction to please not engage a third party for review until revisions are finalized.
Review of required authorizations and permits for Victoria Mine Production including Environmental Compliance Approval for Industrial Sewage (PAG 2, Ethel Lake) and Environmental Compliance Approval for Air/Noise, Permit to Take Water Application for Ethel Lake Water Source, update on Project Description Report (CEAA).	December 2016	Complete	To provide an update to SFN on the status of the permits and to provide an opportunity to address any questions or concerns.
2017 Victoria Flow and Level Monitoring Report, in fulfillment of Clause 4.7 of Permit To Take Water (FNX Mining Company Inc.'s Victoria Advanced Exploration Project, amended PTTW Number 0466-AJ8HRM) shared.	March 2018	Complete	No comments or concerns were received.
Written Summary Report, in accordance with Condition 5.1 of the Environmental Compliance Approval (ECA) for Air (FNX Mining Company Inc. Victoria Advanced Exploration Project Certificate of Approval Number: 8794 - 8VFJ7B) shared.	March 2018	Complete	No comments or concerns were received.
2017 Annual Performance Report Condition 9(2) of the Environmental Compliance Approval (ECA) for Air (Number 9557-AP5FSQ) shared.	May 2018	Complete	No comments or concerns were received.
Information regarding potential Notice of Limited Operational Flexibility for the Environmental Compliance Approval for Industrial Sewage.	June 2018	Complete	No comments or concerns were received.
Application for removal of 7:1 dilution ratio related to Environmental Compliance Approval (ECA) for Industrial Sewage (Number 9557-AP5FSQ).	July 2018	Complete	No comments or concerns were received.

Scope and Subject	Date	Current Status	Objectives/Comments
Draft Project Description Report (PDR)	October 2018	Ongoing	Objective to provide opportunity to review draft PDR by SAFN and discuss concerns/questions prior to submitting the document to CEA Agency: • A presentation summarizing the PDR was given June 26, 2018 at an Environment Subcommittee Meeting. • A copy of the PDR was provided to SAFN on October 25, 2018. • Meeting was held December 17, 2018. One of the topics discussed was the PDR. • A SAFN-KGHM Environmental Subcommittee meeting was held January 24, 2019. An update on all Victoria Permitting and an update on the status of the PDR was provided during this meeting. • An updated PDR Presentation was given at the SAFN Lands and Resources Committee Meeting held February 19, 2019. Lands and Resources committee members and council members were in attendance. A question and answer session was held at the end of the presentation. • Letter of support received from Chief thanking the project for attending the February 19, 2019 meeting and stating that they have no comments or concerns about the Victoria Project.
Written Summary Report, in accordance with Condition 5.1 of the Environmental Compliance Approval (ECA) for Air (FNX Mining Company Inc. Victoria Advanced Exploration Project Certificate of Approval Number: 8794 - 8VFJ7B) shared.	March 2019	Complete	The 2018 Written Summary Report was shared with SAFN on February 5, 2019. No comments or concerns were received.
2018 Annual Groundwater Report, summarizing results of all 2018 Groundwater Sampling.	March 2019	Complete	The 2018 Annual Groundwater Report which summarizing the results of the Victoria Project 2018 Groundwater Sampling was shared with SAFN on March 5, 2019. No comments or questions were received.
2018 Victoria Flow and Level Monitoring Report, in fulfillment of Clause 4.7 of Permit To Take Water (FNX Mining Company Inc.'s Victoria Advanced Exploration Project, amended PTTW Number 0466-AJ8HRM) shared.	March 2019	Complete	The 2018 Flow and Level Monitoring report was shared with SAFN on March 4, 2019. No comments or questions were received.
Key Issues & Opportunities			
Environment monitoring of potential effect of past, present and future development on the Spanish River watershed.	August 2010	Ongoing	Monitoring services by SFN members may be established through the IBA Implementation Committee.
Implementation of the IBA, including establishing processes and procedures that ensure SFN participation is maximized.	January 2015 to present	Ongoing	Through IBA Implementation Committee, ensure transparent communications and that opportunities for SFN are maximized.
Involvement in closure plan and in particular environmental management and environmental monitoring.	August 2010	Ongoing	Discussions have been initiated with SFN about environmental monitoring, such as water quality sampling and participation in regular site inspections. Through the IBA Implementation Committee, this opportunity will be further discussed.

Scope and Subject	Date	Current Status	Objectives/Comments
Contracting and procurement opportunities: establish and implement formal processes and procedures between SFN and KGHM; SFN businesses directly providing the Project with goods and services; SFN businesses subcontracting or forming joint ventures with non-Indigenous business to provide goods and services to the Project.	September 2013 to present	Ongoing	Victoria Advanced Exploration Project Impacts and Benefits Agreement objective to maximize participation of SFN community. Identifying and maximizing opportunities is primarily done through the IBA Implementation Committee, Project Procurement Manager, and Project Construction Manager[3].
Employment opportunities: employment and hiring directly with KGHM; employment and hiring by business working for KGHM at the Project; establish and implement formal processes and procedures. Examples - hiring a community environmental liaison coordinator, drill helpers, construction employment, contracting opportunities.	August 2010 to present	Ongoing	Employment opportunities are shared through the Project Human Resources Manager, including hiring summer students, posting of all employment positions, and participation in job fairs.
Management and consumption of surface and groundwater resources, such as Stormwater management, runoff from waste rock storage areas, water intake sources for the Project.	May 2012	Complete	Concerns have been addressed through engineering and design measures, such as the wastewater and sewage treatment plants. Concerns also addressed through various permits and site management plans and procedures, including the permit to take water, site water management and waste rock management plans.
Establish a Production Impact Benefit Agreement to secure equitable economic benefits for SFN.	August 2016	Ongoing	Establish definitive Production Impacts and Benefits Agreement. Initial discussions commenced in August 2016 and have been ongoing since. Negotiation teams established and actively working together to establish a mutual agreement.
Training Opportunities: align KGHM's future needs with SFN development plans. Work with communities members to identify skill gaps and establish training plan. Communicate to community youth about careers and jobs within KGHM and the mining industry.	August 2010 to present	Ongoing	Training opportunities are continually being pursued through the IBA Implementation Committee, including hiring summer students, and through school presentations. KGHM shares career opportunities available throughout the organization on a regular basis
Effects on Indigenous and treaty rights and cultural heritage.	November 2010 to present	Ongoing	Concerns are being addressed through SFN community outreach initiatives that are led by the IBA Implementation Committee, which includes site visits and tours to observe progress and construction activities. There was a site ceremony blessing with SFN in August 2015.

[3] Examples of contracts awarded to SAFN business joint venture with local business to provide labour, equipment and materials include: Site Timbering and Grubbing Contract (September to December 2013), Overburden Removal Contract (December 2013 to June 2014), Aggregate Supply, PAG Waste Rock Crushing and Haulage (February to November 2015), Site Services Contract (February 2015 to present).

Table 6-3: Victoria Mine Project and Site Exploration Activities: Summary of Consultation and Engagement with Métis Nation of Ontario (MNO)

Scope and Subject	Date	Current Status	Objectives/Comments
General			
Initial contact and introductions.	June 2010	Complete	Introduce the Project and Project team.
Project updates: updates on exploration activities; Project schedule and planned activities; Project plans and progress; review of environmental study results; updates or changes to permit applications; discussions about Indigenous and treaty rights.	2010 – July, August, November; 2011 - February, September; 2012 – January, February, March; 2013 - April	Ongoing	Consistent and transparent communications through engagement with Project management and leadership.
Relationship building: social events with MNO; Meet and greet forum; site visits; attendance and participation at the annual Métis Collaborative Forum in Timmins, Community Meeting Updates, Christmas parties, sharing of information, sponsorship of Annual General Assembly.	2011- March, June, September; March 2013	Ongoing	Consistent and transparent communications through community engagement strategies; engagement with Project management and leadership.
Negotiated Agreements			
Victoria Advanced Exploration Project Engagement Agreement.	April 2015	Complete	Establish a working relationship and define the commitments from both parties to ensure a meaningful consultation with respect to the Project.
Agreement Implementation			
Agreement for development and implementation costs for: (a) Discussions and Finalization of Agreement (b) Ongoing Consultation Meetings and Communication Plan.	April 2015	Ongoing	Promote communication and transparency between MNO and the Project.
Third Party Assessments of environmental reports, permit applications, closure plans and Canadian Environmental Assessment Agency reviews work plan.	April 2015	Ongoing	To provide capacity funding in order to review reports, permits, etc. and to discuss appropriate mitigation measures for any impacts identified on MNO rights and interests in the Project Area. Such mitigation measures may include adjustments to the Project that are commercially reasonable and appropriate, and where such impacts cannot be mitigated, financial compensation or other mutually agreeable benefits flowing from the Project.
Métis Traditional Knowledge and Land Use Study.	April 2015	Complete	To provide capacity funding in order to review reports, permits, etc. and to discuss appropriate mitigation measures for any impacts identified on MNO rights and interests in the Project Area. Such mitigation measures may include adjustments to the Project that are commercially reasonable and appropriate, and where such impacts cannot be mitigated, financial compensation or other mutually agreeable benefits flowing from the Project.
Establish a Production Impact Benefit Agreement to secure equitable benefits for MNO.	November 2016	Ongoing	Establish definitive Production Impacts and Benefits Agreement. Initial discussions have occurred regarding a Production Impact Benefit Agreement, and negotiation teams identified. Future meetings currently pending and expected to be scheduled in Q3 2018.

Scope and Subject	Date	Current Status	Objectives/Comments
Consultation on Permit Applications			
General review of permits: lists of permits and applications and timelines for filing; lists of environmental assessments and other reports completed and pending[4].	August 2010 to present	Ongoing	Establish transparent communications and information sharing on permits, environmental reports, and other Project information of interest to MNO.
Closure Plan: Review of closure plan. MNO to conduct review of closure plan with in-house resources. MNO declined to conduct a third party review, indicating that they would rely on reviews being conducted by AAFN and SFN. Submitted and accepted for filing by MNDM.	September 2011; February 2012; June 2012; April 2013	Complete	Comments and concerns from MNO have been addressed and permit approved. All information regarding permits is maintained in the Project permit register, which is updated regularly.
Closure Plan Amendment: Update on changes required; Notice of Material Change.	June 2013; January 2015	Complete	Comments and concerns from MNO have been addressed and permit approved. All information regarding permits is maintained in the Project permit register, which is updated regularly.
Environmental Compliance Approval and Permit to Take Water; MNO provided written approval on permits, on the condition that consultation continues.	March 2012; April 2013; May 2013	Complete	Comments and concerns from MNO have been addressed and permit approved. All information regarding permits is maintained in the Project permit register, which is updated regularly.
Application and approval for an Environmental Compliance Approval for Air and Noise. MNO provided written approval on permits, on the condition that consultation continues.	April 2013; May 2013	Complete	Comments and concerns from MNO have been addressed and permit approved. All information regarding permits is maintained in the Project permit register, which is updated regularly.
Application and approval for an Environmental Compliance Approval for Industrial Sewage. MNO provided written approval on permits, on the condition that consultation continues.	January 2012; April 2013; May 2013	Complete	Comments and concerns from MNO have been addressed and permit approved. All information regarding permits is maintained in the Project permit register, which is updated regularly.
Project Description Report (PDR) – First submission.	April 2017	On hold	Comments and concerns from MNO to be discussed and addressed through the Liaison Committee.
Production Closure Plan – draft submission.	April 2017	On hold	Comments and concerns from MNO to be discussed and addressed through the Liaison Committee.
2017 Victoria Flow and Level Monitoring Report, in fulfillment of Clause 4.7 of the Permit To Take Water (FNX Mining Company Inc.'s Victoria Advanced Exploration Project, amended PTTW Number 0466-AJ8HRM) shared.	March 2018	Complete	Comments and concerns from MNO to be discussed and addressed through the Liaison Committee.
Written Summary Report, in accordance with Condition 5.1 of the Environmental Compliance Approval (ECA) for Air P (FNX Mining Company Inc. Victoria Advanced Exploration Project Certificate of Approval Number: 8794 - 8VFJ7B) shared.	March 2018	Complete	Comments and concerns from MNO to be discussed and addressed through the Liaison Committee.
Information regarding potential Notice of Limited Operational Flexibility for the Environmental Compliance Approval for Industrial Sewage.	June 2018	Complete	Comments and concerns from MNO to be discussed and addressed through the Liaison Committee.

[4] Reviewed documentation such as: Stage 1 Archaeological Assessment, Archeological Historical Research Report, Baseline Aquatic Environmental Assessment Interpretative Report, Phase 2 Environmental Site Assessment Report, Application for 17(2)(c) Permit under the *Endangered Species Act*, Mine Hazard Inventory Report, Existing Natural Features Report, Shaft #1 Environmental Geochemistry Report, Victoria Mine Hydrogeological Study, Development Proposal, Acid Rock Drainage and Metal Leach Assessment, Draft Report: Waste Rock Management Plan, Hydrologic and Assimilative Capacity Assessment, Application for C of A for Industrial Sewage, Existing Natural Features Report, Annual Groundwater Monitoring Report.

Scope and Subject	Date	Current Status	Objectives/Comments
2017 Annual Performance Report Condition 9(2) of the Environmental Compliance Approval (ECA) for Air (Number 9557-AP5FSQ) shared.	July 2018	Complete	Comments and concerns from MNO to be discussed and addressed through the Liaison Committee.
Application for removal of 7:1 dilution ratio related to Environmental Compliance Approval (ECA) for Industrial Sewage (Number 9557-AP5FSQ).	July 2018	Complete	Comments and concerns from MNO to be discussed and addressed through the Liaison Committee.
Draft Project Description Report (PDR)	October 2018	Ongoing	Objective to provide opportunity to review draft PDR by MNO and discuss concerns/questions prior to issuance of the document to CEA Agency. A copy of the PDR was provided to MNO on October 26, 2018. • In February 2019 the MNO provided feedback regarding the PDR Report. FNX provided responses to the feedback in April 2019. • Meeting was held April 11, 2019 with the MNO to discuss the PDR and EA process, MNO feedback and FNX responses in detail. MNO acknowledged that FNX has engaged in meaningful consultation to date, and based on mutual trust and respect that meaningful consultation will continue over the life cycle of the Victoria Mine.
Key Issues & Opportunities			
Effects to Métis Indigenous rights including heritage values and harvesting rights.	February 2012; April 2015	Ongoing	Concerns have been primarily addressed through capacity funding, including supporting a Traditional Knowledge and Land Use study.
Employment and business opportunities.	October 2015	Ongoing	Encouraged participation by attending a community meeting to discuss KGHM procurement process. Meetings with MNO employment representatives on how KGHM can support training and development. KGHM provides weekly summary of job postings available within the KGHM.
Handling and storage of waste rock at the site.	September 2011	Complete	Concerns have been addressed through engineering and design and through site waste rock management plans and procedures.
Management and consumption of surface and groundwater resources, such as Stormwater management and wastewater treatment.	September 2011	Complete	Concerns have been addressed through engineering and design measures, such as the wastewater and sewage treatment plants. Concerns also addressed through various permits and site management plans and procedures, including the Permit to Take Water, site water management and waste rock management plans.
Initiation of Production IBA discussions	November 2016	Ongoing	Establish definitive Production Impacts and Benefits Agreement.

	Information Request	KGHM Response to Information Request
IR#1	Please clarify how much of the increased traffic from 2011 to 2021 is related to the Victoria Mine Project and how the project may increase traffic patterns beyond 2021. Please update the impacts and potential future impacts from mine construction and operation to incorporate these concerns.	According to the Design Criteria for the Crean Hill Road and Fairbank East Road improvements, traffic for the 3.3 kilometre length of road including Crean Hill Road from Fairbank Lake Road (MR4) to Fairbank East Road, and Fairbank East Road from Crean Hill Road to Victoria Mine, had an AADT (Average Annual Daily Traffic) of 470 in 2011 and a projected AADT of 1,000 to 1,500 trips per day for 2021. The referenced report states that future mining activity projected from the Victoria Mine will result in increased truck movements however it does not state specifically how much of the traffic increase is related to the Victoria Mine Project. We estimate approximately 100 trucks a day will be hauling ore along the proposed route during mine production. During construction of the Victoria Mine, there will be additional volume of traffic on the road, which is expected to be 200 vehicles/day or a 40% increase in traffic volume. The effect of additional traffic on local roadways to the environment and community, have been discussed in the Environmental Effects Analysis (See Chapter 16 - Community Services and Infrastructure). The effect of additional traffic is discussed specifically in these sections: 1) Section 16.2.1. Construction 2) Section 16.2.2. Operations 3) Section 16.2.3 - Decommissioning and Abandonment 4) Section 16.2.4 - Environmental Design, Mitigation and Optimization **Mitigation** - Crean Hill Road from Fairbank Lake Road (MR4) to Fairbank East Road, and Fairbank East Road from Crean Hill Road to the Victoria Mine have been improved (brought up to MTO standards widened) and traffic light has been installed at the intersection of Hwy 17 and Municipal Road 4. See Figure included on separate worksheet (Figure - Road Upgrades). The construction included: full reconstruction of the road structure, improvements to the road geometry (curvature, gradient), lane and shoulder widening, pavement markings and improved drainage (culver replacement and ditching). This road construction upgrade is now completed.
IR#2	Concerns regarding potential loss of sustainable fishing use should be incorporated into the project effects. Predictions for larger, watershed impacts due to release of effluent/wastewater need to be provided, with a focus downstream of Fairbank Creek (and any connecting waterbodies). Results of any fish and wildlife monitoring studies, including reporting methods and guidelines used need to be provided; details on how to access this information need to be provided.	Please refer to Chapter 12 in the EEA - Fish and Fish Habitat - The spatial boundaries for Fish and Fish Habitat include portions of the Fairbank Creek and Victoria Creek watersheds upstream, within and downstream from the Victoria Property (see Figure 12-1). This boundary was selected because effects to Fish and Fish Habitat could potentially extend downstream in these watercourses to the Vermillion and Spanish Rivers. Appendix F of EEA - Fish and Benthic vertebrate community sampling methods includes reporting Methods and guidelines used for all fish and fish habitat investigations When mining operations begin, the Victoria Mine will be subject to Metal Mining Effluent Regulations (MMER) (applies to all operating mines in Canada) and impose limits on the release of deleterious substances (i.e., cyanide, metals, radium-226 and suspended solids) and prohibit the discharge of effluent that is acutely lethal to fish. The site is also subject to Provincial legislation that regulates impacts to water resources. The Ontario Water Resources Act (OWRA, Section 53), administered by the MOE, requires that the Site have an Environmental Compliance Approval (ECA) for a Wastewater Treatment Plan (WTP). The ECA will outline a series of terms and conditions related to the collection, transmission, treatment and discharge of effluent from the Site to Fairbank Creek. The Ontario Environmental Protection Act (EPA), also administered by MOE, imposes effluent limits on discharges to the natural environment (Ontario Regulation (O.Reg.) 560/94) under the Municipal Industrial Strategy for Abatement (MISA). The MISA limits for the Site will be specified in the ECA. Our Temporary Wastewater Treatment Plant includes reverse osmosis. When we commissioned the plant in 2015 we realized that due to the calcium/hardness being stripped by this process our water was too clean and we needed to incorporate a remineralization stage to add minerals back to the water before it's discharged. A limestone channel was added to reintroduce minerals into the water. Question to Indigenous Community - Results of any fish and wildlife monitoring studies - Would you like additional reports provided to our contact or PDR. Would adding a line to the PDR saying "Indigenous members, or public for information regarding any of these reports, contact your internal representative or KGHM".
IR#3	Potential impacts from the project should be updated to incorporate Indigenous Community concerns with respect to personal safety.	Refer to Access Management Plan currently being drafted. A draft access management plan will be provided to all Indigenous Communities for review/input prior to finalization/implementation.
IR#4	It would be helpful for understanding the project effects on the environment including on the rights and interests of the ### if the project information section contained more details of the haul route from the Victoria Mine to the Clarabelle Mill. What are the current and projected traffic volumes on this route, what are the conditions of the roadways along the route, which land uses are adjacent to it? A detailed map of the ore haul route would also be very helpful	The haulage route has been added to Figure 1-1: Project Location. The proposed haul route will exit south from the Victoria property along Fairbanks East Road to Crean Hill Road, then to MR4 (also known as Fairbanks Lake Road), then to Highway 17 (provincially maintained) east and on to Ontario Highway 144 to MR35 to Clarabelle Road. We expect an additional 100 trucks on the road/day when we are hauling ore. According to the Greater Sudbury Official Plan, the land use designation along the proposed haul route is designated as Parks, Living Area (I), Mixed Use Commercial and General Industrial (City of Greater Sudbury, 2015). According to the Zoning By-Law (2010-100Z enacted September 29, 2010 and last updated on December 2, 2015) for the City of Greater Sudbury, areas along the proposed haul route are zoned RU - Rural; RS - Rural Shoreline, and P - Park (MR4 (Fairbank Lake Road)); R – Residential, M5 – Extractive Industrial, OSC – Open Space Conservation, P – Park, OSR – Open Space Recreation, C7 – Resort Commercial, M2 – Light Industrial, FD – Future Development, C5 – Shopping Centre Commercial, M1- Mixed Light Industrial / Service Commercial and RU – Rural (Highway 17, 144 and MR35). Current and projected traffic volumes on this route are discussed in Question 1 above.
IR#5	Please provide an updated project schedule and ensure it is used consistently throughout the document.	An updated project schedule has been included in the PDR and the schedule throughout the document has been made consistent.

Figure 6-1: Key Comments from Indigenous Groups

Sagamok Anishnawbek

P.O. Box 610
Massey, Ontario
POP 1PO

Telephone: (705)865-2421
Fax (705) 865-3307

April 16, 2019

Neil Milner, Project Manager
KGHM International - Victoria Project
1010 Lorne St
Sudbury, Ontario
P3C 4R9

WITHOUT PREJUDICE

RE: Victoria Project – Project Description Report

Dear Mr. Milner,

We would like to thank the staff from the KGHM International for coming to Sagamok Anishnawbek on Tuesday February 19, 2019 to present the Victoria Project Description Report to our Lands, Resources and Environment staff and G'daa Kiim-non Committee. The presentation was a good overview of the Victoria Project as a whole and a great opportunity for our staff and committee to ask questions and get a better understanding of the project overall.

We thank you for consulting with us regarding the undertaking. We have no comments or concerns to file at this time. We make this decision without prejudice to our ability to re-evaluate this file should new information arise. We ask that you keep us apprised of the undertaking and continue to share information with us as it becomes available. We look forward to being kept apprised of the project as it progresses through the permitting process.

Sincerely,

Acting Chief

Chief Nelson Toulouse

C.c. Ross Assinewe, Director of Lands, Resources and Environment
Tammy Tremblay, Environmental Officer
Michelle Toulouse, Lands Coordinator

Figure 6-2: Sagamok Anishnawbek First Nation Letter of Support

A well-established and practiced information sharing and confidential consultation process exists between FNX and each of the three Indigenous groups potentially affected by the Project. Because of the extensive consultation efforts over the past ten years, FNX has a comprehensive understanding of key concerns of these groups (as shown in the consultation log presented in the preceding Tables 6-1 through 6-3). The key issues that FNX has engaged the three Indigenous groups about are:

1. Awareness of the traditional use of lands and resources that may be of concern;
2. Awareness of the use of Aboriginal cultural and sensitive areas;
3. Establishment of potential Aboriginal employment, business opportunities, skills development and training; and where practicable; and
4. The use and incorporation of any traditional knowledge provided to improve overall sustainability performance for ongoing exploration activities and the future Victoria Mine.

Key environment-related interests or comments expressed to date from Indigenous Groups include:

1. Handling and storage of waste rock and management of potentially acidic rock drainage from onsite temporary storage of Potentially Acid Generating waste rock;
2. Management and consumption of surface and groundwater resources, such as stormwater management, runoff from waste rock storage areas, water intake sources for the Project;
3. Potential effects of the Project on water quality, fish and wildlife;
4. Spill prevention and response measures;
5. Environmental monitoring of receiving water bodies and monitoring of species at risk;
6. Interest in training, employment and contracting opportunities.

FNX has included any concerns associated with potential adverse environmental effects on potential or established Aboriginal or treaty rights in the Project design and environmental effects analysis that has been conducted for the Project.

The selection of Valued Components in the environmental effects analysis takes into consideration the key issues identified by the Indigenous groups through the consultation process. Valued components have been carefully and respectfully considered to reflect environmental protection and pollution prevention issues associated with concerns and key issues identified by Indigenous groups in Tables 6-1 through 6-3 above, in the Design of the Project while respecting existing confidential agreements. The Valued Components used in this analysis include: Atmospheric Environment, Surface Water Quality, Groundwater Quantity, Fish and Fish Habitat,

Terrestrial Habitat, Archaeological Resources, Residents and Recreational Land Use, Community Services and Infrastructure, and Employment and Business. Results of the detailed environmental analysis indicate that residual adverse environmental effects for each of these VCs have been determined to be not significant. Furthermore, the Project will generate considerable local and regional economic activity during the Construction and Operation phases, resulting in positive benefits from potential economic opportunities including employment opportunities, business and contracting opportunities, and training and skills development.

The Project and Indigenous communities have consulted extensively since 2010, including: Atikameksheng Anishnawbek First Nation, Sagamok First Nation, and Métis Nation of Ontario (refer to Section 6 – Proponent Engagement and Consultation with Indigenous Groups). Consultation and engagement efforts have included detailed discussions regarding the potential effects of the Project on the Indigenous communities, including concerns of impacts to traditional territory and Indigenous and treaty rights. Concerns raised by each community are addressed through various outreach initiatives, which are led by FNX management and Indigenous community leadership. Outreach initiatives have included, but are not limited to information sharing; implementation meetings, site visits and tours, establishment of subcommittees (e.g. Environmental subcommittee), provision of project updates to communities, site ceremonial blessings, participation in Fall harvest events and traditional celebrations, provision of financial support for capacity funding, funding of traditional knowledge and land use studies (according to our existing agreements), and archaeology studies for Ethel Lake.

FNX has reached formal agreements for the Advanced Exploration phase of the Project with the Indigenous communities above which includes provision for addressing any issues or concerns with traditional land use and traditional knowledge and to identify opportunities for traditional knowledge to be incorporated into the design of the Project. The contents of these agreements are confidential and are not discussed herein. A traditional knowledge and land use study was undertaken by one of the Indigenous communities with funding provided by FNX. We expect to receive TKLU information from the other two communities over the course of the next few years. If any new infringement on land use is identified in the course of the studies, FNX is committed to working with the affected communities to address any concerns. The results of the study as well as traditional land usage information received to-date from Indigenous Communities have been fully considered in the relevant aspects of the Project's policies and procedures.

7. Public Consultation

FNX has been actively engaged in consultation with a number of Project stakeholders since 2009, including the following:

- **Special interest groups:** Vermilion River Stewardship Committee; Fairbank Lake Cottagers Association; Walden Sno Runners; Randolph Street Residents; Copper Cliff; Vale Totten Mine; and Sudbury Integrated Nickel Operations (A Glencore Company);
- **Federal Government:** Canadian Environmental Assessment Agency (CEAA); Environment Canada (EC); and Fisheries and Oceans Canada (DFO);
- **Provincial Government:** Ministry of Northern Development and Mines (MNDM); Ministry of Environment and Climate Change (MOECC); Ministry of Natural Resources and Forestry (MNRF); and Ministry of Transportation Ontario (MTO); and
- **Municipal Government:** City of Greater Sudbury; and Ward 2 Walden (Whitefish, Naughton, Lively, Worthington, Copper Cliff).

A detailed summary of the consultation and engagement efforts with the public is provided in Table 7-1, and consultation and engagement efforts with government agencies in Table 7-2.

Engagement with external stakeholders will continue throughout the life of the Project and will vary depending on the stakeholder.

FNX issues a newsletter providing a brief summary of key milestones achieved. The newsletter will be distributed to identify stakeholders via email or mail, depending on their preference. Some stakeholders will receive additional engagement/communications based on legal requirements, requests, needs, etc.

Education on stakeholder engagement occurs regularly for employees. The Victoria Project belongs to the FNX Sudbury Corporate Social Responsibly (CSR) Committee to ensure identified and potential new stakeholders are regularly reviewed. The CSR committee maintains a Stakeholder Registry and it is reviewed quarterly.

Table 7-1: Victoria Mine Project and Site Exploration Activities – Summary of Consultation and Engagement with the Public

Scope and Subject	Date	Key Issues	Objectives
Special Interest Groups: Vermilion River Stewardship Committee			
Invited to participate in Open House events. Newspaper advertisements placed to invite the City of Greater Sudbury. Flyers are mailed to local residents.	October 2011; August 2013; September 2014	No issues raised.	Continue to invite the Committee to open house events.
KGHM invited to give a presentation to the Committee about the Project.	2014	Significant discussion about environmental effects; No issues raised.	As posted on the Committee website, "… all questions were answered to the satisfaction of the audience in a knowledgeable and professional fashion…" KGHM is available to provide any updates and presentations, as requested.
Special Interest Groups: Fairbank Lake Cottagers Association			
Invited to participate in Open House events. Newspaper advertisements placed to invite the City of Greater Sudbury. Flyers are mailed to local residents.	October 2011; August 2013; September 2014	Traffic: atmospheric effects and public safety.	Continue to invite residents to open house events.
Concerns have been raised regarding additional trucks on local roads, and the associated effects on the atmospheric environment and public safety. Concerns have also been raised about mud on the roads.	Completed in 2018	Haul Truck Traffic, additional traffic: atmospheric effects (dust and noise) and public safety.	City of Greater Sudbury completed road upgrades to Fairbanks East Road/Crean Hill Road (completed in 2018). 2016 installation of traffic lights at the junction of Hwy. 17 and MR4 to increase public safety. The Project is committed to minimizing effects through traffic controls and safe driving procedures.
Concerns have been raised about clearing of Fairbanks East road, where clearing was done for the power line, PAG 1 Waste Rock Pad, and city road upgrade.	2014	Visual effects.	Over time some of the vegetation will return, and will block the visual impact of the PAG 1 Waste Rock Pad.
Concerns have been raised about effects to water quality.	2015	Water quality.	Ensure water quality meets effluent Sudbury Soils Study predicted limits and all other permit requirements.
KGHM Invited to contribute to the Annual Fairbank Lake Cottagers Association Spring Newsletter. An update to the Victoria Project was provided for inclusion into the annual newsletter.	2016, 2017	No issues raised	Consultation with Fairbank Lake Cottagers Association to keep them apprised of Victoria Project site activities.
KGHM invited to help support annual events: Fairbank Lake Cottagers Annual Road Clean up & Annual Picnic.	2016, 2017, 2018	NA	The Project has supported these annual events by supplying gifts for the picnic and when required, the garbage bin for annual clean-up.
Special Interest Groups: Walden Sno Runners Snowmobile Association			
Invited to participate in Open House events. Newspaper advertisements placed to invite the City of Greater Sudbury. Flyers are mailed to local residents.	October 2011; August 2013; September 2014	Traffic: atmospheric effects and public safety.	Continue to invite groups to open house events.
Temporary changes to Sudbury Trail Plan have resulted from Project activities.	2013 - 2014	Effect on existing Sudbury Trail Plan.	Through consultation with the Walden Sno Runners Snowmobile Association, the trail was modified in 2013 and 2014 to accommodate for exploration activities.

Scope and Subject	Date	Key Issues	Objectives
Construction of PAG 2 will result in waste rock haul trucks crossing the existing trail.	Ongoing	Effect on existing Sudbury Trail Plan.	Through consultation with the Walden Sno Runners Snowmobile Association, agree on whether the trail should be rerouted, or if signage should be added to warn trail users about upcoming road crossings.
KGHM invited to help support annual Sno Runners Social.	2016, 2017, 2018	N/A	The Project has supported is annual event by supplying gift(s) for silent auction.
Special Interest Groups: Randolph Street Residents			
Invited to participate in Open House events. Newspaper advertisements placed to invite the City of Greater Sudbury. Flyers are mailed to local residents.	October 2011; August 2013; September 2014	Traffic: atmospheric effects and public safety.	Continue to invite residents to open house events.
Scope of discussions has focused on the effects to the local side street (intersection of Hwy 17 and MR4). There are existing issues and concerns with traffic from Totten mine.	Completed	Traffic from Totten Mine: atmospheric effects and public safety.	Community is engaged with city council, and KGHM as required. 2016 installation of traffic lights at the junction of Hwy. 17 and MR4 to increase public safety. The Project is committed to minimizing effects through traffic controls and safe driving procedures.
Special Interest Groups: Copper Cliff			
Mine Haul route between site and Clarabelle Mill is expected to be via Hwy 144 to RR 35 to Clarabelle Road. An alternate route is via Hwy 17 to MR55 to Godfrey Drive and Clarabelle Road. Residents of Copper Cliff have raised concerns around effects of traffic on the atmospheric environment and public safety.	Ongoing	Traffic along mine haul route: atmospheric effects and public safety.	This route is part of the haul route agreement with Vale. Engagement with the community is through Vale.
Industry: Vale			
There are several agreements between KGHM and Vale, including: Sudbury Basin Properties Off-Take Agreement (August 2013), Victoria Property Surface Rights License, and Second and Amended and Restated Sudbury Basin Properties Agreement.	Ongoing	No significant issues have been raised.	Relationship is primarily managed through the following committees: Joint Technical Committee and the Environment Committee.
Totten employees have expressed concern about the increased traffic on MR4.	2016 - 2017	Traffic on MR4: public safety.	Through Joint Technical Committee, agreed that the MR4 should be upgraded, including an additional traffic light at the intersection of MR4 and Hwy 17. 2016 installation of traffic lights at the junction of Hwy. 17 and MR4 to increase public safety. The Project is committed to minimizing effects through traffic controls and safe driving procedures.
Industry: Sudbury Integrated Nickel Operations (A Glencore Company)			
Sudbury Integrated Nickel Operations and Vale own property adjacent to the Victoria Project. A shared air shed agreement has been approved for the properties to the south.	March 2012	No significant issues have been raised.	Letter from Sudbury Integrated Nickel Operations and a letter from Vale stating that the Project can use the air shed above their properties. Letters have been issued to the Ministry, and boundaries have been changed for the air model to include these parcels.

Table 7-2: Victoria Mine Project and Site Exploration Activities: Summary of Consultation and Engagement with Government Agencies

Scope and Subject	Date	Key Issues	Objectives
Provincial Government Agencies: Ministry of Northern Development and Mines			
Meetings and discussions have focussed primarily on obtaining permits and regarding permit amendments.	Ongoing since 2010	All issues have been addressed through permits.	Key permits obtained for the Project include: • Closure Plan and Advanced Exploration Closure Plan Amendment. • Advanced Exploration Future permits will include: • Application for Bulk Sample Permission.
Provincial Government Agencies: Ministry of Environment and Climate Change			
Meetings and discussions have focussed primarily on obtaining permits and regarding permit amendments.	Ongoing since 2010	All issues have been addressed through permits.	Key permits obtained for the Project include: ECA - Industrial Sewage, ECA - Air and Noise (Comprehensive), Permit to Take Water, Permit to Dewater Shaft, Hazardous Waste Generator Registration, Timber Permit, Approval to Commence Harvesting Operations, Diesel Power Generation, 1MW to 5MW.
Provincial Government Agencies: Ministry of Natural Resources and Forestry			
Meetings and discussions have focussed primarily on obtaining permits and regarding permit amendments.	Ongoing since 2010	All issues have been addressed through permits.	Key permits obtained for the Project include: Endangered Species Permit - Whip-poor-will Permit, Work Permit - Construction of the Wastewater Treatment Plant Effluent Discharge Line Outlet Channel.
Provincial Government Agencies: Ministry of Labour			
Meetings and discussions have focussed primarily on obtaining permits and regarding permit amendments.	Ongoing since 2010	All issues have been addressed through permits.	Key permits obtained for the Project include: Registration of Constructors and Employers Engaged in Construction, Notice of Diesel-Powered Equipment, Notice of Magazine or use of Explosives. Future permits will include: Notice of Mining Activities, Notice Hoisting Plant Operation, Medical certificates.
Provincial Government Agencies: Ministry of Transportation Ontario			
Responsible for conducting work for the traffic light, which is included as part of northeastern highway improvement plan 2015-2019.	Completed	No significant issues have been raised.	Traffic light at the intersection of MR4 and Hwy 17 was installed in 2016.
Federal Government Agencies: Fisheries and Oceans Canada			
Meetings and discussions have focussed primarily on obtaining permits.	Ongoing since 2010	All issues have been addressed through permits.	Permits discussed have included impacts to fish and fish habitat, placing of non-acid generating waste rock.

Scope and Subject	Date	Key Issues	Objectives
Introduction of Project to Agency and screening of Project for potential impacts to fish habitat.	August 2010	Determine if there are potential for impacts to fish and fish habitat.	Determine if the project has potential to impact fish and fish habitat and request letter of advice. Based on the project scope at the time, there were no concerns identified by DFO.
Request for review of Development Proposal and request for Letter of Advice.	2011 – June, August, September	Review the proposed location of Non-Acid Generating Waste Rock Storage.	Site visit held with DFO in August 2011 as part of review process. Letter of Advice to proceed with project issued in September 2011.
Request for review of *Fisheries Act* Authorization requirements for Ethel Lake Control Structure.	January 2016 – July 2017	No issues were identified.	DFO determined that no formal approval was required for the Ethel Lake Control Structure under the *Fisheries Act* or federal *Species at Risk Act*. A Letter of Advice to proceed was received in July 2017.
Federal Government Agencies: Environment and Climate Change Canada			
Discussions have focussed primarily on discussions about the *Metal Mining Effluent Regulations*.	Ongoing since 2015	No significant issues have been raised.	Continue discussions with Environment Canada to determine *MMER* applicability to the Project. In October 2016, Environment Canada advised that the Victoria Project was no longer subject to the *MMER*.
Federal Government Agencies: Canadian Environment Assessment Agency			
Meetings and discussions have focussed primarily on the CEAA Project Description Report.	Ongoing since 2011	Comments on the first Project Description Report were provided in Sep. 2015.	First Project Definition submitted to CEAA in 2011, which at that time did not trigger CEAA review. Subsequent updated project descriptions were submitted in 2015, 2016 and 2017 to address CEAA comments. A finalized Project Description Report will be submitted in 2018.
Municipal Groups: City of Greater Sudbury			
Conservation Sudbury	September 2017	Determine potential timelines for granting of Shoreline Alteration Permit.	Determine timelines for potential permit application for Ethel Lake Control Structure. Determined a one to two week turnaround, so will not proceed with submission at this time.
Municipalities and Communities: City of Greater Sudbury			
Building Services: building permits and development fees.	Ongoing	No significant issues have been raised.	All building permits and development fees will continue to be processed, as required.
Sewage System Authorization.	Ongoing	No significant issues have been raised.	Future permit application.
Roads upgrades: ongoing coordination for City upgrades, which are being funded by the Project.	Completed in 2018	No significant issues have been raised.	City of Greater Sudbury has completed road upgrades to Fairbanks East Road and Crean Hill Road.
Noise Bylaw Exemption.	April 2015	All issues have been addressed through the exemption.	Exemption has been approved.
Municipalities and Communities: Walden, Whitefish, Worthington			
Invited to participate in Open House events. Newspaper advertisements placed to invite the City of Greater Sudbury. Flyers are mailed to local residents.	October 2011; August 2013; September 2014	Traffic: atmospheric effects and public safety	Continue to invite residents to open house events.

Appendix A - Victoria Mine Project Environmental Effects Analysis: A Report Supporting Basic Engineering and Overall Project Planning and Permitting

KGHM

Victoria Mine Project – Environmental Effects Analysis

47VP-047700-003-RPT-0002

May 1, 2019

Environmental Effects Analysis – Table of Contents

1. Introduction 8
2. Existing Environment 19
3. Project Description 35
4. Project-Environment Interactions 74
5. Sustainability Management 80
6. Consultation and Issue Scoping 114
7. The Selection of Valued Components (VC) 119
8. Environmental Assessment Methodology 126
9. Atmospheric Environment 139
10. Surface Water Quality 169
11. Groundwater Quantity 192
12. Fish and Fish Habitat 214
13. Terrestrial Habitat 248
14. Archaeological Resources 275
15. Residents and Recreational Land Use 289
16. Community Services and Infrastructure 308
17. Employment and Business 324
18. Cumulative Environmental Effects 340
19. Summary 342
20. Closing Perspective 346

Appendix A : Non-Indigenous Consultation Activities 347
Appendix B : Indigenous Consultation Activities 353
Appendix C : Noise Impact Summary Report 367
Appendix D : Surface Water Quality Methods 368
Appendix E : Inferred Groundwater Flow Directions Drawing 371
Appendix F : Fish and Benthic Vertebrate Community Sampling Methods 373
Appendix G : Wildlife and Wildlife Habitat Sampling Methods 375

List of Figures:

Figure 1-1: Project Location 11
Figure 2-1: Environmental Setting 20
Figure 3-1: Topographical Features 37
Figure 3-2: Neighbouring Land Mineral Rights 38
Figure 3-3: Land Tenure 39
Figure 3-4: General Arrangement of Overall Site 41
Figure 3-5: General Arrangement of Site Facilities 42
Figure 3-6: Aerial Photo of the Victoria Site Taken in Q2 2014 Showing Proposed Future Location of Project Facilities and Infrastructure 43
Figure 3-7: Aerial Photo of the Victoria Site Taken in Q4 2015 Showing Proposed Future Location of Project Facilities and Infrastructure 44
Figure 3-8: Expected Site Disturbance 45
Figure 3-9: Isometric View of Proposed Mine Development Looking North 50
Figure 3-10: Process Block Flow Diagram 52
Figure 3-11: PAG 2 Rock Storage Area Plan 56
Figure 3-12: PAG 2 Geomembrane 57
Figure 3-13: Point Source Emissions During the Victoria Mine Project 59
Figure 3-14: Water Block Flow Diagram 62
Figure 3-15: Catchment Areas 64
Figure 3-16: Buried Piping General Arrangement 66
Figure 5-1: KGHM Environmental Policy 84
Figure 5-2: KGHM Social Responsibility Policy 85
Figure 5-3: KGHM Health and Safety Policy 86
Figure 5-4: KGHM Community Policy 87
Figure 5-5: Sustainability Management 94
Figure 7-1: Selection of Valued Components 121
Figure 9-1: Spatial Boundaries for Atmospheric Environment 143
Figure 10-1: Spatial Boundaries for Surface Water Quality 170
Figure 11-1: Spatial Boundaries for Groundwater Quantity 193
Figure 12-1: Spatial Boundaries for Fish and Aquatic Resources 217
Figure 13-1: Spatial Boundaries for Terrestrial Habitat 249
Figure 14-1: Spatial Boundaries for Archaeological Resources 277
Figure 15-1: Spatial Boundaries for Residential and Recreational Land Use 291
Figure 16-1: Spatial Boundaries for Community Services and Infrastructure 310
Figure 17-1: Spatial Boundaries for Employment and Business 326
Figure 20-1: Inferred Groundwater Flow Directions 372

List of Tables:

Table 3-1: Point Source Emissions and Emission Rates – Operations 60
Table 3-2: Overall Project Schedule 70
Table 4-1: Victoria Mine Project: Potential Project-Environment Interactions and Permits 76
Table 4-2: FNX Victoria Mine Project - Potential Project-Environment Interactions and Sustainability Management 77
Table 5-1: Victoria Mine Project - Key Permits, Authorizations and Approvals Anticipated for the Project 91
Table 5-2: Victoria Mine Project – Engineering Design and Sustainability Management Aspects Addressing Key Concerns– Atmospheric Environment 104
Table 5-3: Victoria Mine Project – Engineering Design and Sustainability Management Aspects Addressing Key Concerns - Surface Water Quality 105
Table 5-4: Victoria Mine Project – Engineering Design and Sustainability Management Aspects Addressing Key Concerns – Groundwater Quantity 106
Table 5-5: Victoria Mine Project – Engineering Design and Sustainability Management Aspects Addressing Key Concerns – Fish and Fish Habitat 107
Table 5-6: Victoria Mine Project – Engineering Design and Sustainability Management Aspects Addressing Key Concerns – Terrestrial Habitat 108
Table 5-7: Victoria Mine Project – Engineering Design and Sustainability Management Aspects Addressing Key Concerns – Archaeological Resources 109
Table 5-8: Victoria Mine Project – Engineering Design and Sustainability Management Aspects Addressing Key Concerns – Residential and Recreational Land Use 110
Table 5-9: Victoria Mine Project – Engineering Design and Sustainability Management Aspects Addressing Key Concerns – Community Services and Infrastructure 111
Table 5-10: Engineering Design and Sustainability Management Aspects Addressing Key Concerns: Employment and Business 112
Table 6-1: Victoria Mine Project – Identification of Key Environmental Planning Issues 115
Table 8-1: General Outline of a Typical VC Chapter 128
Table 8-2: Definitions for Magnitude and Reversibility of Environmental Effects 131
Table 8-3: Summary of Residual Adverse Environmental Effects – Template Example 135
Table 8-4: Definitions for Probability of Occurrence, Effect on Ecosystem Function and Integrity and Sustainable Use of Renewable Resources for Residual Adverse Environmental Effects 136
Table 9-1: Valid Hours AQI in Range - Sudbury 141
Table 9-2: *O. Reg. 194/05* NSSA Allowances 144
Table 9-3: Ambient Air Quality Criteria, Standards, and Objectives 147
Table 9-4: Exclusion Limit Values of One-Hour Equivalent Sound Level (Leq, dBA) Plane of Window of Noise Sensitive Spaces by Time of Day for a Class 3 Area (NPC300) 148
Table 9-5: Victoria Mine Air Emission Summary Table by Source (Advanced Exploration) 150
Table 9-6: Environmental Effects Analysis; VC – Atmospheric Environment; Project Phase – Construction 152
Table 9-7: Environmental Effects Analysis; VC – Atmospheric Environment; Project Phase – Operations 154

Table 9-8: Environmental Effects Analysis; VC – Atmospheric Environment; Project Phase – Decommissioning and Abandonment 156
Table 9-9: Summary of Residual Environmental Effects; VC- Atmospheric Environment 161
Table 9-10: Victoria Mine Air Emission Summary Table by Contaminant (Advanced Exploration) 162
Table 9-11: Victoria Mine Air Emission Summary Table by Source (Operations) 163
Table 9-12: Victoria Mine Air Emission Summary Table by Contaminant (Operations) 164
Table 10-1: Fairbank Creek and Victoria Creek Watershed Characteristics 171
Table 10-2: Provincial Water Quality Objectives – Baseline Exceedances 172
Table 10-3: ECA Effluent Parameters for Wastewater Treatment Plant Discharge 174
Table 10-4: Environmental Effects Analysis; VC - Surface Water Quality; Project Phase – Construction 178
Table 10-5: Environmental Effects Analysis; VC - Surface Water Quality; Project Phase – Operations 180
Table 10-6: Environmental Effects Analysis; VC - Surface Water Quality; Project Phase – Decommissioning and Abandonment 182
Table 10-7: Summary of Residual Environmental Effects – Surface Water Quality 186
Table 11-1: Seasonal Groundwater Table Elevations from 2012 194
Table 11-2: Total Project Water Demand During Operations 197
Table 11-3: Environmental Effects Analysis; VC - Groundwater Quantity; Project Phase - Construction 201
Table 11-4: Environmental Effects Analysis; VC - Groundwater Quantity; Project Phase - Operations 203
Table 11-5: Environmental Effects Analysis; VC - Groundwater Quantity; Project Phase - Decommissioning and Abandonment 205
Table 11-6: Summary of Residual Environmental Effects – Groundwater Quantity 208
Table 12-1: Fish Species Present at Sampling Locations in the Environmental Assessment Area 221
Table 12-2: Environmental Effects Analysis; VC - Fish and Fish Habitat; Project Phase – Construction 229
Table 12-3: Environmental Effects Analysis; VC - Fish and Fish Habitat; Project Phase – Operations 234
Table 12-4: Environmental Effects Analysis, VC - Fish and Fish Habitat; Project Phase – Decommissioning and Abandonment 237
Table 12-5: Summary of Residual Environmental Effects – Fish and Fish Habitat 241
Table 13-1: Species of Special Conservation Status Identified in the Environmental Assessment Area 254
Table 13-2: Summary of Vegetation Communities Found Within the Project Area 256
Table 13-3: Environmental Effects Analysis; VC - Terrestrial Habitat; Project Phase - Construction 259
Table 13-4: Environmental Effects Analysis; VC - Terrestrial Habitat; Project Phase - Operations 262
Table 13-5: Environmental Effects Analysis; VC - Terrestrial Habitat; Project Phase - Decommissioning and Abandonment 264
Table 13-6: Summary of Residual Environmental Effects – Terrestrial Habitat 268
Table 14-1: Environmental Effects Analysis; VC – Archaeological Resources; Project Phase – Construction 279

Table 14-2: Environmental Effects Analysis; VC – Archaeological Resources; Project Phase – Operations 281
Table 14-3: Environmental Effects Analysis; VC – Archaeological Resources; Project Phase – Decommissioning and Abandonment 282
Table 14-4: Summary of Residual Environmental Effects – Archaeological Resources 285
Table 15-1: Environmental Effects Analysis; VC - Residential and Recreational Land Use; Project Phase - Construction 295
Table 15-2: Environmental Effects Analysis; VC - Residential and Recreational Land Use; Project Phase - Operations 297
Table 15-3: Environmental Effects Analysis; VC - Residential and Recreational Land Use; Project Phase - Decommissioning and Abandonment 301
Table 15-4: Summary of Residual Environmental Effects – Residential and Recreational Land Use 303
Table 16-1: Environmental Effects Analysis; VC - Community Services and Infrastructure; Project Phase - Construction 313
Table 16-2: Environmental Effects Analysis; VC - Community Services and Infrastructure; Project Phase - Operations 315
Table 16-3: Environmental Effects Analysis; VC - Community Services and Infrastructure; Project Phase - Decommissioning and Abandonment 317
Table 16-4: Summary of Residual Environmental Effects - Community Services and Infrastructure 320
Table 17-1: Environmental Effect Analysis; VC - Employment and Business; Project Phase - Construction 329
Table 17-2: Environmental Effect Analysis; VC - Employment and Business; Project Phase - Operations 331
Table 17-3: Environmental Effect Analysis; VC - Employment and Business; Project Phase - Decommissioning and Abandonment 334
Table 17-4: Summary of Residual Environmental Effects – Employment and Business 336
Table 19-1: Significance of Adverse Residual Environmental Effects 343
Table 20-1: Victoria Mine Project and Site Exploration Activities - Summary of Consultation and Engagement with the Public 348
Table 20-2: Victoria Mine Project and Site Exploration Activities - Summary of Consultation and Engagement with Government Agencies 351
Table 20-3: Victoria Mine Project and Site Exploration Activities - Summary of Consultation and Engagement with Atikameksheng Anishnawbek First Nation (AAFN) 354
Table 20-4: Victoria Mine Project and Site Exploration Activities - Summary of Consultation and Engagement with Sagamok First Nation (SFN) 358
Table 20-5: Victoria Mine Project and Site Exploration Activities - Summary of Consultation and Engagement with Métis Nation of Ontario (MNO) 363
Table 20-6: Surface Water Quality Parameters Documented by Baseline Reports 369

Table of Contents – Chapter 1

1. Introduction 8

1.1. Context 8
1.2. The Proponent and the Project 9
1.3. Indigenous Groups in the Project Area 13
1.4. Relevant Regional Environmental Studies 13
1.5. Sustainable Development, Biodiversity and the Precautionary Principle 14
1.6. Scope of the Project, Related Activities and the Environmental Assessment 16
1.7. References 17

1. Introduction

1.1. Context

KGHM-FNX Mining Company (FNX) is nearing completion of an extensive minerals exploration program that commenced on the Victoria site in 2002. FNX is currently executing an advanced exploration program that is scheduled to be completed in 2024 with the extraction of 33,000 tonnes bulk sample. The bulk sample will be extracted at a rate of 330 tonnes/day via ore silling using development jumbo drills. The bulk sample is needed for metals analysis and recovery tests prior to committing to mining and is included in the Advanced Exploration phase. Should the bulk sample test work prove economically favourable the Victoria Mine Project (the Project) will proceed.

Commercial production is expected to begin in 2031. The mine will operate from 2031 to 2042 based on known reserves and resources. FNX has negotiated a life-of-mine off take agreement that would see ore trucked to Vale Canada Limited's (Vale) Clarabelle Mill for processing. No material modifications are required to existing off-site facilities (including tailing storage facilities) for the purpose of receiving and processing ore (mine product) or waste rock from the proposed Victoria Mine Project.

FNX conducts environmental assessments of its projects and activities as part of its overall approach to risk mitigation. Environmental assessment improves and engineering design and helps proponents strive to avoid adverse environmental effects or reduce such effects to reasonable or acceptable levels. FNX has a high degree certainty about the potential adverse environmental effects of its Project as result of:

- The nature of planned Project activities is very similar to activities that have occurred at the Victoria site since 2002 including drilling, shaft sinking, rock hoisting, mineralized rock management, water collection and treatment, and truck hauling of rock off-site to the Clarabelle Mill area;
- Site activities to date have been supported by a comprehensive understanding of environmental baseline conditions as a result of baseline studies, modeling and test work;
- The Project is very similar to many other mining and mine product and rock hauling operations in the past and in current operations throughout the Sudbury Basin; and
- Site activities have required a wide range of environmental permits, authorizations and approvals some of which required consultation with Indigenous groups and the public, in part to satisfy regulatory requirements. Thus there has been a high level of environmental scrutiny on site activities by Indigenous groups, the public and stakeholders and municipal, provincial and federal government agencies.

FNX has an internal governance process on its major capital projects to ensure completeness of its engineering and environmental planning studies as part of its overall

capital risk assessment process. The governance process includes a variety of environmental assessment evaluations associated with risk reviews, hazard and operability identification and review, constructability reviews, reviewing environmental aspects and impacts, and a review of all anticipated permits, authorizations and approvals.

FNX is also knowledgeable about the *Canadian Environmental Assessment Act, 2012* and the *Regulations Designating Physical Activities*, since the Project is planned to have a maximum daily ore production of 3,500 tonnes per day (t/d), as well as additional rock production. FNX must seek a determination from the Canadian Environmental Assessment Agency (Agency) as to whether an environmental assessment of the Project is required.

While this internal Environmental Effects Analysis largely draws on existing available supporting information (e.g., from various permit and closure plan applications), it includes contemporary aspects of environmental assessment such as:

- The identification of key issues and the selection of Valued Components (VCs) to help focus a detailed environmental effects analysis;
- A rigorous environmental assessment methodology of the planned Project, closely related or integral projects and activities (e.g., site exploration) as well as other relevant projects and activities such as traditional and local land use, permanent and seasonal residences, and the local use of public roads;
- A determination of significance for predicted residual adverse environmental effects, including those for relevant accidents, malfunctions and unplanned events; and
- Sustainability management system elements to address the environment, health and safety needs of the project based on the detailed environmental effects analysis of VCs.

FNX believes this environmental effects analysis is a useful report to support its description of potential environmental effects as required by the Agency in Section 5 of its "Guide to Preparing a Project Description of a Designated Project under the *Canadian Environmental Assessment Act*, *2012*." FNX categorizes residual adverse environmental effects as either not significant or significant. However, not significant residual adverse environmental effects are analogous to "minimal environmental effects" described in Agency guidance (CEA Agency 2015).

1.2. The Proponent and the Project

FNX is a wholly owned subsidiary of KGHM International Ltd. (KGHM). The Victoria Project comprises a copper-nickel mine with recoverable platinum group elements (PGEs), located in the City of Greater Sudbury (Figure 1-1). The nature of the Project is very similar to many other past and present base metals mining operations that process

mine product at existing mills, smelters and refineries located in the City of Greater Sudbury. Primary access to the Project site is by Municipal Road #4 that runs north from Highway 17. The mineral rights for the Victoria property were acquired by FNX from Inco Ltd. (now Vale Canada Limited, or Vale) in 2002 to allow for further exploration, development and mining operations to be conducted on the property. Although exploitation of nickel contact orebodies in other locations on the Victoria property has occurred in the past (Mond 1890s to 1920s; and Inco Ltd., 1970s), the newly identified Cu-Ni-PGE zone is within an offset environment and several kilometers away from the historical mine and as such, FNX is approaching the Project as a new mine.

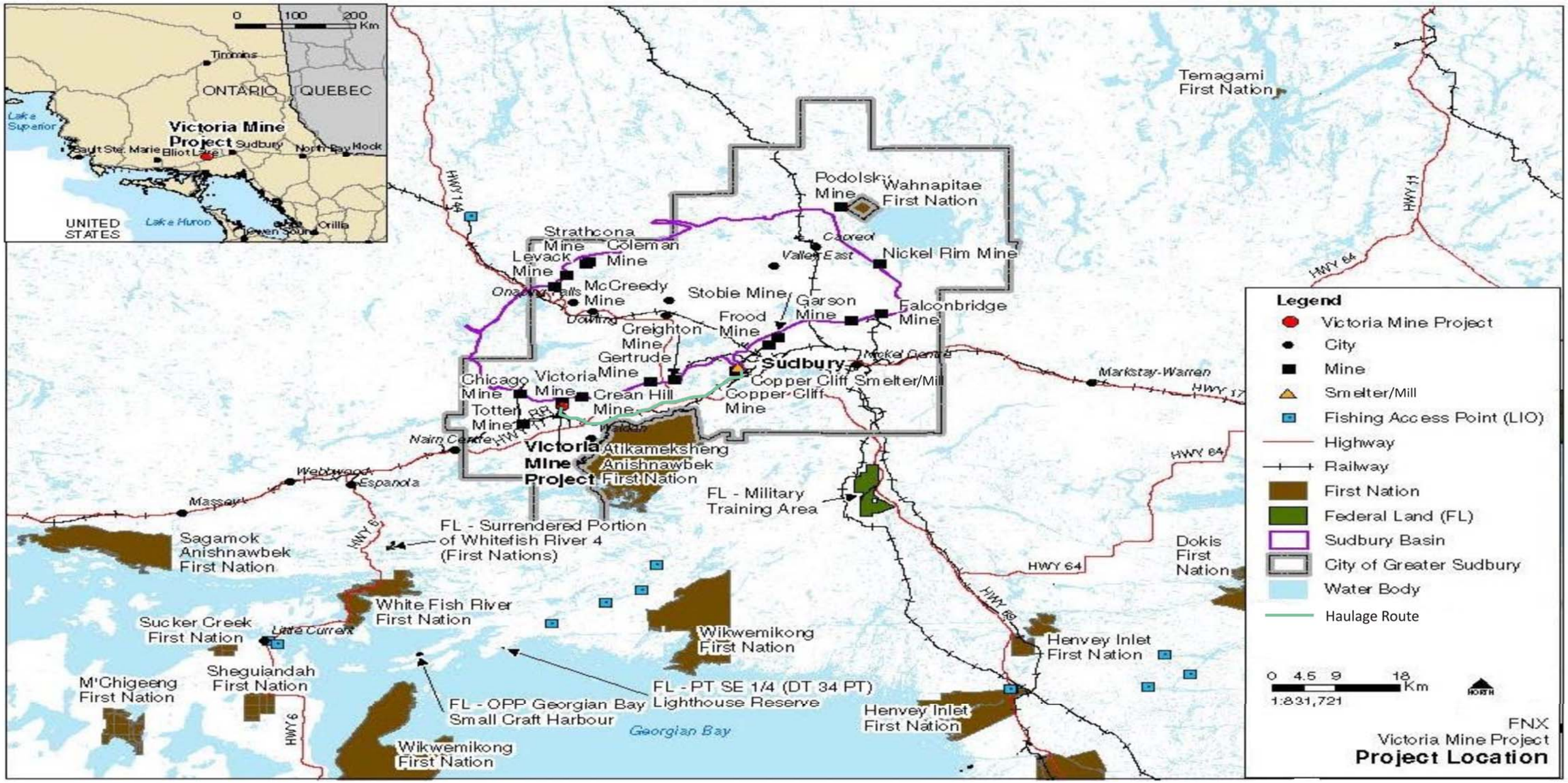

Figure 1-1: Project Location

The Mine Project comprises:

- The construction of a paste backfill plant to process waste rock into a suitable material for ground support. Backfilling mined out areas is a necessary component of the bulk stoping mining methods used to economically mine the resources;
- Construction and operation of a second engineered storage area for mineralized (PAG) rock referred to as PAG 2;
- Construction and operation of the Ethel Lake control structure to store water for Project needs, principally to provide a water source for the paste backfill manufacturing process);
- Construction of main shaft headworks and hoisting facility and development of main shaft;
- Underground mine development utilizing existing ventilation shaft and surface infrastructure for mine product and rock movement including hoisting;
- Continued use of underground ventilation system to provide a safe and healthy workplace for underground workers;
- Various enclosed facilities for mine product and waste rock crushing and handling; and
- Mine product hauling by truck to Vale's Clarabelle Mill in Copper Cliff.

Full mine construction is expected to start in 2024. Once operational (February 2031), the mine life will extend to late 2042. The Project is being designed and evaluated based on a maximum production rate of 3,500 t/d of mine product. The mining method and inferred resource characteristics will also result in 2,000 t/d of rock produced for an overall material movement rate of 5,500 t/d. Based on various factors of safety designed into hoisting equipment and its operations, the overall potential mine production capacity for the Project is thus considered to be 5,500 t/d (mine product plus waste rock).

It is important to acknowledge that certain elements, typical of many mining projects, are not part of the Project. These include:

- No camp and associated support facilities - Labour force requirements are expected to be available locally and thus housed locally;
- No mill - The City of Greater Sudbury has ample existing mine product milling capacity and the Project is part of the Vale life of facility production plan. FNX has a life of mine take off agreement with Vale for the Victoria mine product. No material modifications are required to existing off-site facilities (including tailing storage facilities) for the purpose of receiving and processing ore (mine product) or waste rock from the proposed Victoria Mine Project;

- No tailings and tailings management - FNX considers avoiding local permanent tailings placement as a major contributor to avoiding potential significant residual adverse environmental effects; and
- No mineral processing such as smelting and refining.

1.3. Indigenous Groups in the Project Area

The Project area is located in overlapping interests of the several Indigenous groups including: Atikameksheng Anishnawbek First Nation; Sagamok Anishnawbek First Nation; and, the Métis Nation of Ontario (Region 5). FNX has been meeting with and sharing information about its Project and related activities since 2009. Chapter 6 – Consultation and Issue Scoping provides more details on FNX's overall consultation efforts.

1.4. Relevant Regional Environmental Studies

The region recently underwent a thorough regional ecological and human health risk assessment into the 100+ years of mining and minerals processing that has occurred in the Sudbury Basin (Sudbury Soils Study or Sudbury Area Risk Assessment). The study was a comprehensive scientific and technical investigation into a 40,000 km^2 area of former and current mining and minerals processing areas to evaluate the state of the ecological conditions and risks to human health, plants and wildlife. It is one of the largest and most comprehensive regional environmental studies conducted to date in North America. The study area included the Victoria properties area where mining has occurred (Mond and Inco Ltd.) as well as minerals processing (Mond: open roast smelting and refining).

The Sudbury Soils Study was initiated by the Ontario Ministry of Environment (2001) and was completed in 2009. The study involved a Technical Committee (TC) for oversight as well as independent expert reviewers of the science and findings. The TC included membership from the Ministry of Environment, the City of Greater Sudbury, the Sudbury District Health Unit, Health Canada (First Nations & Inuit Health Branch) as well as Vale and Xstrata Nickel. The study focused on Chemicals of Concern (CoCs) that included nickel and copper, and concluded generally that while there are elevated levels of CoCs in plant communities they are not at levels of concern in the Project area and area wildlife populations are not likely to be directly affected by elevated levels of CoCs now or in the future. The study predicted little risk of health effects on Sudbury area residents associated with metals in the environment anglers, hunters and Indigenous people who may consume more local fish and wild game are at no greater risk of health effects due to metals in the environment than the general population.

Metals released to the environment as a result of the Project (e.g., dust, exhaust, return air and drainage) are expected to be a *di minimis* contribution to overall metals in the environment in the region. The principle sources of metals in the environment in the region are associated with smelting and refining processes (located in Copper Cliff and

Falconbridge) and modern smelter technology minerals processing practices greatly reduce metals in the environment compared to the practices of decades ago.

1.5. Sustainable Development, Biodiversity and the Precautionary Principle

FNX understands the purpose of environmental assessment in project planning and is aware of current concepts, such as sustainable development, biodiversity and the precautionary principle, that contribute to effective sustainability management. FNX is committed to such concepts and believes that regional benefits arise from projects when a cooperative approach to development takes into consideration of concerns and issues from Indigenous groups, such as Atikameksheng Anishnawbek First Nation, Sagamok Anishnawbek First Nation, and the Métis Nation of Ontario or MNO), as well as local stakeholders such as residents and recreational land users.

The concept of sustainable development was popularized in 1987 in a report of the World Commission on Environment and Development (The Brundtland Report). It defined sustainable development as:

"Development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

Fundamental to the concept of sustainability is that environmental, economic and social considerations must form an integral component of decision-making. FNX recognizes that sustainable development of the economy is dependent on the land, and the continuing good health of the natural environment. Sustainable development also means development that includes information sharing and establishing productive working relationships with Indigenous groups as well as other stakeholders in the community. FNX is committed to furthering its relationship with the Indigenous communities as well as local stakeholders and government regulators and resource managers over the life of the Project, as well as relationship building for the future.

FNX considers integrating environmental assessment and engineering methods, including consultation and issue scoping, to be part of its project development process. Environmental assessment is a cornerstone of sustainable development when it comes to planning new projects such as mines. Victoria property nickel contact orebodies have been mined successfully in the past (Mond -1890s to 1920s; Vale (Inco Ltd) - 1970s) and so it is evident that mining can occur and in the future have the potential remain for further development should economic conditions be met and mining methods allow. With emphasis on proper planning for the Project now, through a planning-for-closure perspective, FNX fully expects with the mining methods used and the closure plan executed at the end of planned operations, future re-development of Victoria mineralized zones may be possible as in the past, when favourable economic conditions

allow. Mining is an important economic pillar of the regional economy around the City of Greater Sudbury.

FNX's environmental management strategy outlined in this environmental assessment and supporting information is based on the concepts of continuous improvement and pollution prevention.

FNX has also actively sought the participation of Indigenous groups identified by the Province of Ontario as being potentially affected the Project. FNX is committed to its commitment to Indigenous groups being involved in the Project. FNX's approach to sustainability management and its policies outline its commitments to other social goals such as education and training, employment, business opportunities and environmental protection.

Natural Resources Canada (NRCan 1995) described the goal of sustainable development with respect to minerals and metals. NRCan stated the goal:

"is to find, extract, produce, add value to, use, re-use and recycle mineral and metal products in the most efficient manner possible, while respecting the needs and values of other resource users and maintaining and/or enhancing environmental quality for the present and future generations."

FNX will extract minerals efficiently and will place safety, worker health, environmental protection and pollution prevention as its top priority in all its activities and processes.

Biodiversity is a term used to describe the total of all living things in a particular area or region. FNX defines biodiversity as:

"the variability among living organisms from all sources, including, among other things: terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species and of ecosystems."

FNX has approached this environmental effects analysis from a broad ecosystem perspective supported by a thorough baseline studies program. Such biophysical, socio-economic and cultural baseline information enables FNX to have a high degree of knowledge about the environment where the Project is situated. Together with a high degree of knowledge about the technical and engineering aspects of the Project, FNX is well situated to bring forward the best Project possible in terms of sustainability performance.

FNX views biodiversity as part of its overall approach to Project planning including: engineering design (mitigation and reclamation), issues scoping, selection of VCs, environmental effects analysis, the determination of significance and monitoring. FNX has also considered important legislation such as the federal *Species at Risk Act* and

provincial *Endangered Species Act* as well as any species or population and special areas (e.g., parks, ecological reserves, wintering yards for big game etc.) with special conservation significance. FNX will remain vigilant and comprehensive in its site environmental awareness to identify other species or populations of special conservations status should they occur in the area, over the life of the Project. .

FNX also fully considered the application of the precautionary principle in the planning process for the Project. The precautionary principle, as defined by the Rio Declaration, states:

"Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost effective measures to prevent environmental degradation."

FNX believes that the precautionary principle would apply only where there is a threat of serious or irreversible damage to the receiving environment. In addition, the principle could only apply when there is uncertainty, presumably as to the occurrence of a potential cause and effect relationship between an activity or discharge and a likely change in the environment. FNX has endeavoured to conduct a complete environmental effects analysis and does not believe there is a threat of serious or irreversible damage, or any lack of scientific certainty associated with the Project or Project area. Many of the aspects of the mine Project are very similar to the range of activities being conducted at site since 2002. All of these activities have been under community and regulatory scrutiny involving various municipal, provincial and federal permits, authorizations and approvals. However, as a precautionary measure, FNX has developed site waste management facilities for rock storage based on the assumptions that all rock is mineralized and potentially acid generating. As well, while any threats to Terrestrial Habitat are not considered significant, a compensation package associated Eastern Whip-poor-will has been developed with the Province.

1.6. Scope of the Project, Related Activities and the Environmental Assessment

The scope of the Project refers to those components of the undertaking that are considered part of the Project for the purposes of this detailed environmental effects analysis. As the Project site has been also the area for a long period of exploration activities, many of the Project features are already in place. The key elements of the Project that comprise its scope include:

- Construction and operation of a second storage area approximately 8.7 hectares in size (including haulage road which is 1.2 hectares) for mineralized (PAG) waste rock referred to as PAG 2;
- Construction of main shaft headworks and hoisting facility and development of main shaft;

- Construction and operation of the Ethel Lake control structure and a pump house for water supply;
- The construction and operation of a paste backfill plant to process waste rock into a suitable material for ground support. Backfilling mined out areas is a necessary component of the bulk stoping mining methods used to economically mine the resources;
- Underground mine development utilizing existing ventilation shaft and surface infrastructure for mine product and rock movement including hoisting;
- Continued use of underground ventilation system to provide a safe and healthy workplace for underground workers;
- Various enclosed facilities for mine product (ore) and waste rock crushing and handling; and
- Mine product (ore) hauling by truck to Vale's Clarabelle Mill in Copper Cliff.

This environmental effects analysis includes the construction, operations, decommissioning and abandonment (including situations of temporary closure), of the mine and associated infrastructure. Various situations of accidents, malfunctions and unplanned events are also assessed.

The Project site is quite small in area (less than 55 hectares), as the mine is an underground mine) and in an easily accessible part of the Sudbury Basin with nearby transportation infrastructure. FNX has conducted this environmental assessment of the Project in consideration of other projects and activities in the area, including:

- The traditional use of lands by Indigenous groups;
- Other land users including permanent and seasonal residences; and
- The use of public transportation infrastructure by others.

1.7. References

- Canadian Environmental Assessment Agency, 2015. Guide to Preparing a Description of a Designated Project under the *Canadian Environmental Assessment Act*, 2012.
- Natural Resources Canada, 1995. Sustainable Development and Minerals and Metals: An Issues Paper. Ottawa, Canada, 78 p.
- Sudbury Soils Study, 2009. www.sudburysoilsstudy.com.

Table of Contents – Chapter 2

2. Existing Environment 19

2.1. Historical Activities on Victoria Property 21
2.2. Geology and Mineral Resources 21
2.2.1. Property Geology 22
2.2.2. Deposit Geology 22
2.3. Atmospheric Environment 23
2.4. Surface Water Quality 23
2.5. Groundwater Quantity 24
2.6. Fish and Fish Habitat 25
2.7. Terrestrial Habitat 25
2.8. Archaeological Resources 27
2.9. Employment and Business 27
2.10. Community Services and Infrastructure 28
2.11. Residential and Recreational Land Use 29
2.11.1. Residents and Nearby Cottagers 30
2.11.2. Local Use of Regional Roads 30
2.12. Other Projects and Activities 30
2.13. References 31

2. Existing Environment

This environmental effects analysis is intended to provide a complete and integrated environmental assessment (EA) of the planned Project in a methodological fashion that is as responsive as possible, not only to applicable Operational Policy Statements, but to issues and concerns based on the scope and scale of the Project in the regional environmental setting. FNX understands that it is important to provide the reviewer adequate and wide ranging environmental data for a broad range of subject matters to help provide focus and to serve a wide range of reader perspectives. FNX has presented descriptive environmental data at various places in this report to make the review as efficient as possible, allowing readers to focus on the discussion without having to refer to other chapters throughout the environmental effects analysis. Chapter 2 is intended to provide a high level overview of the physical, biological and socio-economic environment. This information is meant to provide the reader with an understanding of the existing environment, and features associated with the general region. Environmental setting data is also used to inform the selection of valued components (VCs) (see Chapter 7 – The Selection of Valued Components (VC)). FNX has endeavoured to create a more reader friendly EA report style. This report is structured to bring all relevant information to the assessment of environmental effects on a VC into one chapter. This includes providing the reader with information on the existing baseline condition along with a focused analysis on project-environment interactions and mitigation for all phases of the Project, the Project overall and the Project in combination with other projects and activities.

Reports such as this are based on a wide range of technical field studies and predictive modeling studies to analyze the potential effects of the Project on the environment. Detail regarding baseline methodology, sampling locations and raw results for the selected Project alternative can be found in Supporting Document studies (SDs). These studies are supported by other desktop publicly available literature and publications and these are referenced using standard practice for reports reviewed by the public, peers and regulatory and resource management agencies.

The following text provides a brief overview of the environmental setting for the Project. Environmental features are shown on Figure 2-1.

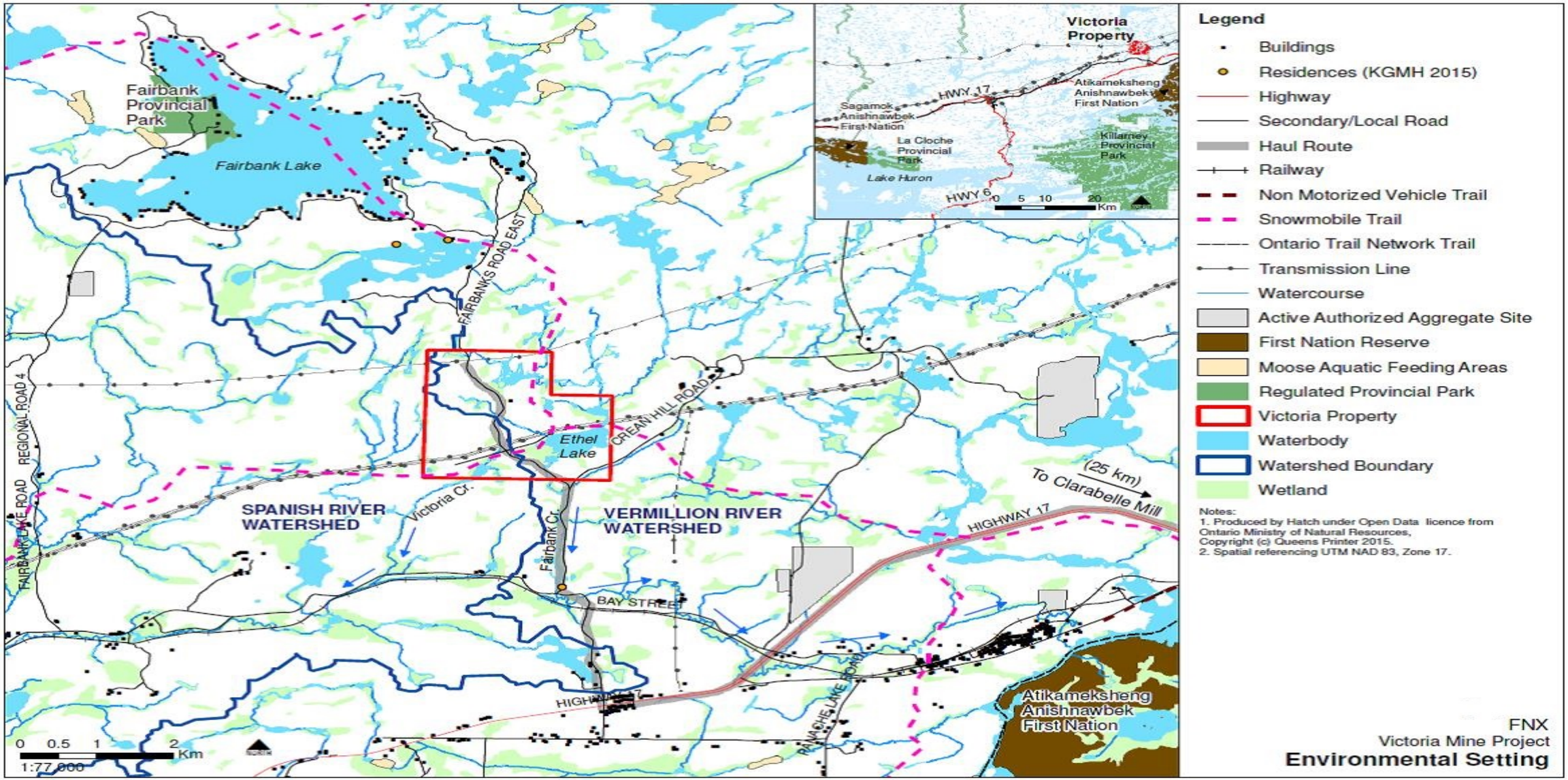

Figure 2-1: Environmental Setting

2.1. Historical Activities on Victoria Property

The history of the Victoria property is connected to the history of the Mond Nickel Company, which first prospected when Mond purchased the McConnell property in 1899, renaming it Victoria. The historical Victoria mine included mining and minerals processing (open roast smelting) and the establishment of a permanent community (Mond, Ontario). By 1919, underground mining had reached a depth of approximately 900 metres. Mond relocated its mineral smelting facilities to Coniston (City of Greater Sudbury) in 1913. Mond became part of Inco Limited in 1929 and Vale S.A. acquired Inco Limited in 2006. FNX acquired the rights to the Victoria property in 2002.

The historic site of Mond and all its structures have long been removed, however there is a substantial archaeological record of artifacts and features. Historical locations and features are located outside the old town center, but within the Victoria Project Mineral Rights boundary. These include the old historical dam at the mouth of Ethel Lake (which is still in place) and the old station at the Algoma railroad. As the property was intensively used for several decades, there are suspected to be many outlying historical archaeological remains that may be affected by ground disturbance required for the Project (Julig, St. Jean and Hawkins, 2010).

Additionally, past activities in the northeast portion of the Project Site, including a tram line and historical roast yard, have degraded the natural environment, for example surface water quality. Copper, nickel, aluminum, and cobalt concentrations regularly exceed Provincial Water Quality Objectives in the Spanish River watershed.

2.2. Geology and Mineral Resources

The Victoria Property is located within the confines of the Sudbury Structure, a collective term defined by Giblin (1984), for the greater than 15,000 km^2 area represented by the sedimentary and brecciated rocks of the Whitewater Group (Onaping, Chelmsford and Onwatin Formations), the elliptically shaped Sudbury Igneous Complex (SIC) and the surrounding brecciated country rocks of the Superior and Southern Provinces.

The SIC, which is associated with the formation and deposition of mineralization, is interpreted as having formed as a consequence of a large bolide impact 1.85 billion years ago, which either melted the crust or facilitated the release of magma from the mantle. The main mass of the SIC is characterized by a lower sequence of norites, which is separated from an upper sequence of granophyre by a quartz gabbro (Naldrett et al. 1984). An igneous breccia, termed the Sublayer Norite (Souch et al. 1969; Pattison 1979), occurs discontinuously along the contact between the base of the norite and the country rocks (Morrison 1984). Most of the Ni-rich mineralization occurs either in embayments at this contact or associated with “Offset” Quartz Diorite Dykes which extend out into the footwall. Locally these dykes are spatially offset or associated with Sudbury Breccia, which formed in the footwall to the SIC during the impact event. Mineralization

associated with Sudbury Breccia is often richer in Cu and precious metals than contact mineralization (FNX Mining Company Inc., 2013).

2.2.1. Property Geology

The Victoria Property is located at the junction of the SIC and the Worthington Offset dyke, approximately 6.5 kilometres northeast of Vale's Totten Mine. The footwall rocks in this area consist of a Paleoproterozoic Huronian Supergroup assemblage of repetitions of metasedimentary sequences with felsic and mafic metavolcanic rocks and gabbroic intrusive. These units typically trend in a 100° to 110° east to southeast orientation and dip steeply (-75° to -80°) to the south to southwest. The Worthington Offset dyke joins the main mass of the SIC in an intensely faulted and poorly exposed embayment structure at the location of the historic Victoria Mine site. The dyke thins and locally disappears at surface to the southeast of Victoria Mine before it merges with a large irregular unit of variable-textured, incipiently sulphide-mineralized, medium- to coarse-grained Quartz Diorite in the area north of Ethel Lake. This Quartz Diorite unit is terminated on its southern margin along the Creighton Fault, but re-appears 950 metres to the west in an apparent dextral shift of the unit. The Quartz Diorite intrusive is irregularly-shaped south of the Creighton Fault and terminates to the west prior to re-occurring again as the main mass of the Worthington Offset dyke. The Worthington Offset dyke is cut by the Creighton Fault along its northern margin, and extends to the southwest for 14 kilometres, with a thickness of 30 metres to 100 metres, and a dip of approximately 80° southeast (Lightfoot & Farrow 2002). Other mineralized locations are known along the Worthington Offset dyke between the Victoria Property and the Totten Deposit. Two of these, the adjacent McIntyre Property and the AER/Kidd Copper Property, located three kilometres further southwest from the Victoria Property, were the objects of small historic mining operations (FNX Mining Company Inc., 2013).

2.2.2. Deposit Geology

At the Victoria Property, mineralization is either associated with the contact of the SIC and the footwall rocks (meta-sediments, meta-volcanics and meta-gabbros of Huronian age) or with the Worthington Quartz Diorite Offset Dyke, which extends outwards from the SIC into the Huronian units and metamorphosed Sudbury Breccia. The Victoria Deposit is associated with this latter style of environment. The Victoria Deposit (Zone 4) is a polymetallic Ni-Cu-Pt-Pd-Au mine product body typical of Sudbury "Frood-style" South Range Breccia Belt deposits. The currently known up-dip extent of the contiguous Zone 4 Inferred Mineral Resource is hosted within the Ethel Lake segment of the Worthington Quartz Diorite, from approximately 900 metres to a depth of approximately 1,220 metres. Below 1,220 metres, Zone 4 is hosted by intensely thermally re-crystallized Sudbury Breccia or Meta-breccia. The Quartz Diorite and the Sudbury Breccia are all cross cut or intercalated with un-mineralized quartz diabase dykes. Three units of critical importance to the Zone 4 resource are: Quartz Diorite, Sudbury Breccia (or its metamorphosed equivalent) and Quartz Diabase (FNX Mining Company Inc., 2013).

2.3. Atmospheric Environment

The climate at the Project site generally consists of warm summers and cold winters. Long-term climate statistics based on regional climate stations indicate a total annual precipitation of approximately 900 millimetres. Annual average temperatures range from -18°C to 25°C, with minimum daily temperatures occurring in January and maximum daily temperatures occurring in July. Predominate wind direction is from the southwest.

Although air pollution caused by past methods of mineral processing historically contributed to degraded local air quality in the Greater Sudbury area, based on a review of recent air quality monitoring data collected by the Province, local air quality trends have improved. As an indicative measure of existing air quality conditions, the results of the Air Quality Index (AQI) established by the MOECC was reviewed for the Greater Sudbury area. The results show the Greater Sudbury area local air quality is in the 'Very Good' to 'Good' range 95.8% to 97.3% of the time. Review of recent air quality monitoring data from the Greater Sudbury area shows comparable air quality to other cities in northern Ontario with specific contaminants showing an overall decrease provincially (MOECC, 2015).

Although the Project site and surrounding area is zoned for industrial use, existing noise levels in the vicinity of the Project reflect a rural environment with generally low background noise from railways, wind, minor road traffic, and occasionally the sound of overhead planes or helicopters.

2.4. Surface Water Quality

The Victoria Property is bisected by two major watersheds; the Vermilion River watershed to the east and the Spanish River watershed to the west. The Fairbank Creek watershed, which includes Ethel Lake, is located immediately east of the site, with Fairbank Creek flowing southward and eastward into the Vermilion River. To the northwest are wetland complexes that flow south into an unnamed wetland and stream that drains southwest to Victoria Creek and ultimately to the Spanish River.

Approximately 66% of the Project footprint lies within the Spanish River watershed, which is approximately 150 hectares in size upstream from the Project. The main feature of this watershed is a beaver impoundment immediately adjacent to the western boundary of the Project site. Approximately 72% of the watershed area is situated north of the beaver impoundment and water flows southward from this area via a small unnamed stream and wetland complex before reporting to the beaver impoundment. About 28% of the watershed area is south of the impoundment and water is collected here via a series of small ponds and semi-connected streams which eventually flow northward into the impoundment. Water from this impoundment flows through a series

of wetland complexes that drains southwest to Victoria Creek and the Spanish River. The Spanish River is located approximately 11 kilometres downstream from the Project site.

The remainder of the Project site (approximately 34%) is in the Fairbank Creek watershed, which is approximately 5,000 hectares in surface area upstream from the Project site and includes Fairbank Lake. From Fairbank Lake, Fairbank Creek flows approximately six kilometres before draining into Ethel Lake. The outflow from Ethel Lake flows south for approximately five kilometres, before turning east to flow for an additional seven kilometres before draining into the Vermilion River in the Town of Whitefish. The proposed discharge location for treated mine effluent is on Fairbank Creek, approximately 250 metres downstream from the Ethel Lake outflow.

FNX has conducted extensive baseline environmental investigations in the area surrounding the project site. A surface water sampling program was initiated in 2002, providing several years of baseline data prior to initiation of Advanced Exploration construction activities in 2013.

Surface water quality in Ethel Lake is generally good with some exceedances of nickel, copper, cobalt, and zinc PWQO's at various depths. Monitoring indicates fairly low metal concentrations in Fairbank Creek relative to the PWQO's, with results generally equivalent to the upstream control sites. Baseline surface water quality in Fairbank Creek is good with infrequent exceedances for copper and nickel. Monitoring sites downstream experience more frequent exceedances of copper, nickel and aluminum.

Victoria Creek typically has higher concentrations of metals than Fairbank Creek and drains into the Spanish River.

Water quality is also influenced by variable seasonal flows causing erosion and sedimentation during spring and fall freshet periods and storm events (Kilgour & Associates Ltd and Denison Environmental Services, 2014).

2.5. Groundwater Quantity

Groundwater Quantity has previously been evaluated at 21 groundwater monitoring wells at locations within the Victoria Property. A hydrogeological assessment (WESA, 2012a) of the monitoring results was completed to determine baseline Groundwater Quantity conditions related to the elevation of the water table, groundwater flow and hydraulic conductivities.

Ground surface elevations through the Project area range from 270 metres near Fairbank Creek in the southeast corner of the Victoria Property to approximately 317 metres in the northwest corner of the Victoria Property. On a regional level, the hilly topography creates a complex groundwater subsystem whereby groundwater entering an area via a recharge site may be discharged at the nearest topographic low (typically a watercourse or wetland system) or flow further to be discharged at a regional discharge

location in the bottom of a major valley. Regional groundwater flow direction in the vicinity of the Project is generally expected to be southeast towards the Vermilion River (Richards, 2002; cited in WESA, 2013).

Based on local monitoring results, inferred local groundwater flow vectors at the Project site are primarily towards adjacent surface water features including Ethel Lake, Fairbank Creek and Victoria Creek. WESA (2013) notes that shallow overburden groundwater is inferred to primarily flow through a thin zone of glacial outwash and till deposits in bedrock valleys and that the bedrock topography controls the direction of this groundwater flow in the overburden. The thin overburden in the area of the Project encourages groundwater discharge to local surface water features or into bedrock valleys with thicker unconsolidated materials. Flow velocities in the shallow overburden were calculated to range from one m/yr (in the southcentral portion of the Project site, flowing towards Victoria Creek) to 100 m/yr (in the western portion of the site, also flowing towards Victoria Creek) (WESA, 2013).

WESA (2013) also indicates that the inferred direction of groundwater flow in bedrock is east-northeast, with average flow velocities of 0.3 m/yr. Hydraulic conductivity in the bedrock aquifers ranges from $1x10^{-7}$ to $3x10^{-4}$ (WESA, 2012b). The vertical gradient of groundwater flow throughout the Project site is typically downward from the overburden to the bedrock (WESA, 2013).

2.6. Fish and Fish Habitat

Baseline Fish and Fish habitat studies have been conducted in both watersheds and both have been identified as containing fish that are part of, or support, commercial, recreational or Indigenous fisheries. Northern Pike (*Esox Lucius*) are the top predator and one of two sportfish species found in the environmental assessment area within the Fairbank Creek watershed. Smallmouth Bass (*Micropterus Dolomieui*), the other sportfish species captured in the environmental assessment area, are present in Fairbank Creek upstream and downstream from Ethel Lake, but not within the lake itself. The remainder of the fish community in the portion of the Fairbank Creek watershed within the study area consists of a variety of coarse fish (e.g. White Sucker (*Catostomus commersonii*) and Silver Redhorse (*Moxostoma anisurum*)) and baitfish, predominantly cyprinids (minnow species). Watercourses that have been sampled in the Victoria Creek watershed within the environmental assessment area were found to only contain a variety of baitfish species with no large-bodied fish present.

2.7. Terrestrial Habitat

Terrestrial Habitat considers both wildlife and wildlife habitat within the Project site and takes into account the species of special conservation status found on and in the vicinity of the property. The Project is located in the Ontario Shield Ecozone and Georgian Bay Ecoregion, and within Wildlife Management Unit 39. The Project is located approximately

five kilometres from the nearest protected area; Fairbanks Provincial Park. Forest communities in the environmental assessment area are typical of the Great Lakes/St. Lawrence forest region. The dominant community types include poplar-white birch and poplar-white birch-white spruce-balsam fir mixed wood stands. There are no rare plant communities or wildlife concentration areas within the environmental assessment area based on data obtained from the MNRF Land Information Ontario (LIO) environmental datasets.

The area of the Project includes a mix of natural and disturbed areas comprising wetlands, forests, meadows and rock barren communities. The diversity of vegetation communities throughout the environmental assessment area provides suitable habitat for a variety of upland and semi-terrestrial aquatic wildlife species.

Wetlands within the environmental assessment area are predominately shallow or meadow marsh communities, although swamp communities and to a lesser extent, fens, have also been documented. Beaver activity throughout the environmental assessment area is high and appears to have influenced the creation of most of the wetlands in the environmental assessment area. All wetland communities within the environmental assessment area are common and no provincially significant wetlands (PSWs) have been identified.

Wildlife in the area is typical of Northern Ontario and includes common mammal species such as Moose, Black Bear, Whitetail Deer, Marten, Mink, Long-Tailed Weasel, Snowshoe Hare, Raccoon, Red Fox, Lynx, Wolf and Beaver.

A total of 75 bird species have been identified in the area of the Project. Common birds include the Canada Goose, Great Blue Heron, Common Loon and American Crow.

One bird species, the Eastern Whip-poor, listed as Threatened under the *Endangered Species Act* was identified on the Victoria Project's footprint during the early exploration phase, resulting in the Project obtaining an Overall Benefit Permit (SU-C-001) which is valid for the life of the Mine Project.

Snapping Turtle, a species designated as Special Concern by the *Endangered Species Act*, was identified on the proposed Victoria Mine Project footprint. Two snapping turtles were documented along the northern shoreline of Ethel Lake during a 2013 survey (EcoTec 2013).

During a regional survey, five species designated as Special Concern by the *Endangered Species Act* (Eastern Milksnake, Bald Eagle, Golden-Winged Warbler, Canada Warbler and Common Nighthawk) and one species identified as Threatened (Blanding's Turtle) were identified outside of the proposed Victoria Mine Project Footprint.

DFO has determined that there are no federal species at risk or their habitats present in the Project area, therefore no additional approvals are required for the Project under the federal *Species at Risk Act*.

2.8. Archaeological Resources

The majority of the Victoria Property (beyond the historic site of Mond) has relatively low archaeological potential. While it is near permanent water features, the area is observed to have few suitable sandy beaches being mostly rough and steep bedrock. Additionally, there is no evidence of eskers or similar sand or gravel features. The area does not contain any locations of known useable tool stones which contribute to the characterization of archaeological potential. There are some well-drained locations of moderate archaeological potential within the shorelines and 300 metre zone around Ethel and Mond Lakes, and Fairbank Creek. Further archaeological assessment has been recommended in these areas. According to the Stage 1 Archaeological Assessment of the Victoria Property there are no known archaeological sites found within 250 metres of the property boundary (Julig, St. Jean and Hawkins, 2010).

Lands required for water taking activities around Ethel Lake are located within a soil complex which includes well-drained sandy soils in some locations. Historic mapping indicates that these lands are located in proximity to historic transportation routes, features and settlement. In addition, a review of the geography and history of the environmental assessment area suggests potential for the identification of Indigenous and Euro-Canadian Archaeological Resources. Accordingly, further archaeological assessment is required in some areas (ASI, 2015).

2.9. Employment and Business

The City of Greater Sudbury is approximately 3,227 km^2 in area with a population of 160,274 people according to the 2011 census (Statistics Canada, 2011). According to the City of Greater Sudbury, the mining industry directly employs approximately 6,000 people and is reported to indirectly support a mining supply and service sector cluster of 300 companies who employ an additional 10,000 people. Sudbury is a regional centre for Northeastern Ontario in financial and business services, tourism, health care and research, education and government. The regional centre extends from the Quebec border west to the eastern shore of Lake Superior and north to the James and Hudson's Bay coastlines, which serves a market of 555,000 (City of Greater Sudbury, Undated).

The City of Greater Sudbury functions as the regional centre of learning and applied research for Northeastern Ontario. According to the 2011 census, there is strong enrollment in programs such as security services, mechanical and repair technologies, engineering, engineering and mechanical trade certificates, and construction (Statistics Canada, 2011). According to the January 2016 labour force characteristics for the Greater Sudbury census metropolitan area, the current unemployment rate is 8.6%, which is up

0.2% from December 2015. Since January 2014, the portion of the labour force which is currently unemployed has risen from 6.8% to 8.6% (a difference of 1.8%). This data suggests that there is an available labour force within Greater Sudbury currently seeking work, with a skill and education base that is compatible with the Project's needs (City of Greater Sudbury, 2016).

Sudbury's mining supply and services sector was founded in the provision of tools, parts and professional services to local mining companies. As new technology and innovation led to new products and processes, these home-grown companies found eager national and international mining markets looking to improve their productivity. With a strong history of mining, and a commitment to promoting investment and continued economic diversification, the City of Greater Sudbury has a wide range of businesses available to the mining sector for the procurement of various goods and services. FNX's Exploration and Advanced Exploration activities have been ongoing over the past decade and accordingly, there are established relationships and contributions to the local economy as a result of these activities.

2.10. Community Services and Infrastructure

The City of Greater Sudbury is composed of a mix of urban, suburban, rural and natural environments (City of Greater Sudbury, Undated b), and as such there is an extensive network of existing community services and infrastructure. The city is divided into the following zones: residential, commercial, industrial, rural, other (e.g. park, conservation, private, etc.), and overlay (e.g. airport height restriction, flood plain, etc.). Greater Sudbury is 3,267 square kilometres in area, making it geographically, the largest municipality in Ontario and second largest in Canada. There are a number of small communities in proximity to the Project. The Fairbanks area is located approximately two kilometres northwest of the Property, containing both seasonal and permanent residents. Approximately five kilometres south of the Property, at the junction of Fairbank Lake Road and Highway 17 along the proposed haul route is the community of Denlou.

A complex infrastructure system extends across the municipality, including water and sewage treatment facilities, electrical and telecommunications utility networks, modern airport, public transit services, and district energy plants. There is also an existing waste management program, which includes sewage waste disposal sites and solid waste landfills.

The City of Greater Sudbury has an extensive emergency preparedness program, which includes an Emergency Services Strategic Plan, Emergency Management Program, Comprehensive Fire Services, Training Programs, and other plans and programs to ensure appropriate response of police, fire, paramedic, and other emergency services to the community. The City of Greater Sudbury is home to a variety of institutions, including

health research centers and initiatives, such as Health Sciences North, the Northern Ontario School of Medicine and the Centre of Rural and Northern Health Research.

The City of Greater Sudbury recently completed a Transportation Master Plan, which was presented to City Council in May 2016. The existing transportation conditions from the plan indicate that trips to the southwest of Sudbury are distributed between MR55 and Highway 17, both of which have been determined to be operating at an acceptable level of service. According to this Transportation Master Plan, daily traffic volumes on "major highways" (such as Highway 17) is in the order of 10,000 to 50,000 trips per day and on "collectors" (such as Municipal Road [MR]4) is in the order of 1,000 to 12,000 trips per day (City of Greater Sudbury and MMM Group, 2015).

2.11. Residential and Recreational Land Use

The Victoria Property is comprised of over 500 hectares of mining rights contained in four contiguous patented parcels and one patented instrument. The surface rights tenure for the Victoria property is comprised of five contiguous registered parcels. All surface rights are owned by Vale Canada Ltd. The property is zoned M4 – Mining Industrial by the City of Greater Sudbury.

The Victoria Property is located in a very accessible and active area. MR4 and Fairbank East Road are all-weather roads that provide access to the community of Worthington and to the temporary and permanent residents at Fairbank Lake.

The Fairbank Lake area has approximately 94 permanent and 323 seasonal residents with approximately 57 permanent and 180 seasonal dwellings, the closest of which is located approximately two kilometres north of the Property. Fairbank Provincial Park is located on the west side of Fairbank Lake, hosting campsites, a boat launch and beaches. The Fairbank Lake Resort is also located on the lake, and is accessible via Fairbank East Road. Fairbank Lake is not serviced by city water or sewage (City of Greater Sudbury, undated). The Victoria Property hosts wilderness areas that may be used for recreational purposes such as fishing, hunting, berry picking and snowmobiling. Nearly all of the land within the Project site (including along the proposed haul route) is held under private ownership.

The Fairbank Lake area is located approximately two kilometres north of the Victoria property. Access to the area is obtained via two road routes, one of which is Fairbanks East Road. The other route is located west of the property, via MR4 (Fairbank Lake Road).

An Ontario Federation of Snowmobile Clubs (OFSC) snowmobile trail bisects the Victoria Property. This trail is part of the Sudbury Trail Plan which is operated with the City of Greater Sudbury and has eight associated clubs that support the trail system. The trails within the Victoria Property are maintained by the Walden Sno Runners, located in Lively, Whitefish, Worthington and Naughton (Sudbury Trail Plan, Undated).

Since there are no municipal water supply systems within the environmental assessment area, groundwater and major surface water bodies (i.e. Fairbank Lake) provide the only source of potable water (WESA, 2013). The Project area has several industrial and domestic groundwater users including Ellen Pit 1 (which has a PTTW in place and is valid from 2010 to 2020) within five kilometres of the Project, as well as three domestic water wells located within 2.5 kilometres of the Project (WESA, 2012a). The depth of these three domestic wells ranges from approximately 25 to 82 metres (WESA, 2013).

2.11.1. Residents and Nearby Cottagers

There are no residences or cottages located within or in the immediate vicinity of the Victoria Property. The nearest residences or cottages is located approximately two kilometres north of the Property on Fairbanks Road East.

The Fairbank Lake area has approximately 94 permanent and 323 seasonal residents with approximately 57 permanent and 180 seasonal dwellings. Fairbank Provincial Park is located on the west side of Fairbank Lake hosting campsites, a boat launch and beaches. The Fairbank Lake Resort is also located on the lake, and is accessible via Fairbank East Road (City of Greater Sudbury, Undated).

2.11.2. Local Use of Regional Roads

As described in Section 2.10 – Community Services and Infrastructure, the City of Greater Sudbury's Transportation Master Plan indicates that the daily traffic volume on major highways such as Highway 17 are in the order of 10,000 to 50,000 trips per day, while roads such as MR4 see 1,000 to 12,000 trips per day.

Within the vicinity of the Project site, the Average Annual Daily Traffic (AADT) on Fairbank Lake Road, north of Highway 17 was estimated to be 1,478 in July 2104, while the AADT on Fairbank Lake Road west of Bay Street, was estimated to be 1,616 (MR4 Traffic Volumes, 2014). According to the Design Criteria for the Crean Hill Road and Fairbank East Road improvements, traffic for Crean Hill Road from Fairbank Lake Road (MR4) to Fairbank East Road, and Fairbank East Road from Crean Hill Road to Victoria Mine, a 3.3 kilometre length of road had an AADT of 470 in 2011 and a projected AADT of 1,000 to 1,500 for 2021 (Unknown source, 2015).

2.12. Other Projects and Activities

In accordance with the Operational Policy Statement on cumulative effects (*CEAA 2015*), FNX has fully considered other past, present and reasonably foreseeable future projects and activities in the area when assessing cumulative environmental effects. A major contributor to existing environmental conditions is the historical and Advanced Exploration phase activities that have occurred. Regionally, the current use of lands and waterways are for primarily recreational activities for permanent and seasonal residents.

The residual effects of these activities have influenced the baseline condition of certain Valued Components as described above.

2.13. References

- Archaeological Services Inc., 2015. Draft Stage 1 Archaeological Assessment Victoria Project, Part Of Lots 6-8, Concession 4, City Of Greater Sudbury (Former Township Of Denison, Algoma District), District Of Sudbury, Ontario Original Report Prepared For Hatch Ltd., 4342 Queen Street, Suite 500, Niagara Falls, ON, L2E 7J7. Archaeological Licence #P392 (Ritchie) Ministry of Tourism, Culture and Sport PIF# P392-0157-2015 ASI File: 14EA-313 6 October, 2015.
- City of Greater Sudbury. Undated. Fairbank Lake – Lake Water Quality Report Card. Available online at: https://www.greatersudbury.ca/living/lakes-facts/local-lake-descriptions/fairbank-lake/. Accessed on February 9, 2016.
- City of Greater Sudbury. Undated b. About Greater Sudbury. Available online at: https://www.greatersudbury.ca/living/about-greater-sudbury/. Accessed on February 9, 2016.
- Greater Sudbury Development Corporation. 2013. City of Greater Sudbury Mining Canada's mighty mining metropolis. Available online at: http://www.investsudbury.ca/index.php?option=com_content&view=article&id=238&Itemid=224&lang=en. Accessed February 11, 2016.
- Giblin, P.E., 1984. [Within FNX Mining Company Inc. 2013. FNX International Ltd. Victoria Project Operated By FNX Mining Company Inc.: Advanced Exploration Closure Plan. Part 1 of 2 - September 2013.] History of exploration and development, of geological studies and development of geological concepts. In The Geology and Ore Deposits of the Sudbury Structure (E.G. Pye, A.J. Naldrett & P.E. Giblin, eds.). Ontario Geological Survey Special Volume 1, pp3-24.
- Golder Associates. 2011. Victoria Project Factual Report of Geotechnical Study Shaft Pilot Hole (FNX1204). Report Number 10-1193-0018. July 5, 2011. (Cited in WESA, 2012a).
- Ministry of Tourism, Culture and Sport. 2016. Archaeology. Available online at: http://www.mtc.gov.on.ca/en/archaeology/archaeology.shtml. Accessed on February 25, 2016.
- P. Julig, C. St. Jean and A. Hawkins, 2010. Final Stage 1 Archaeological Assessment of a Portion of the Victoria Property, Denison Township, Sudbury District. Work conducted for Quadra-FNX by the Archaeological Survey of Laurentian University, under Archaeological License P-100. Archaeological Survey of Laurentian University Sudbury, Ontario November 5, 2010.

- Kilgour & Associates Ltd. And Denison Environmental Services. 2014. Baseline Aquatic Environmental Assessment, Victoria Project. Prepared for KGHM International. 127 pp. Hatch Ltd. 2014a. Site Wide Water Balance.
- Lightfoot, P.C. & Farrow, C.E.G. 2002. [Within FNX Mining Company Inc. 2013. FNX International Ltd. Victoria Project Operated By FNX Mining Company Inc.: Advanced Exploration Closure Plan. Part 1 of 2 - September 2013.] Geology, geochemistry and mineralogy of the Worthington Offset dyke: towards a genetic model for Offset mineralization in the Sudbury Igneous Complex. In Economic Geology, 97: pp1419-1446.
- Ministry of the Environment and Climate Change (MOECC). 2015. Air Quality In Ontario 2013 Report.
- Morrison, G.G. 1984. [Within FNX Mining Company Inc. 2013. FNX International Ltd. Victoria Project Operated By FNX Mining Company Inc.: Advanced Exploration Closure Plan. Part 1 of 2 - September 2013.]Morphological Features of the Sudbury Structure in Relation to an Impact Origin. In The Geology and Ore Deposits of the Sudbury Structure (E.G. Pye, A.J. Naldrett & P.E. Giblin, eds.). Ontario Geological Survey Special Volume 1, pp513- 522.
- Naldrett, A.J., 1984. [Within FNX Mining Company Inc. 2013. FNX International Ltd. Victoria Project Operated By FNX Mining Company Inc.: Advanced Exploration Closure Plan. Part 1 of 2 - September 2013.] Ni-Cu Ores of the Sudbury Igneous Complex – Introduction. The Geology and Ore Deposits of the Sudbury Structure (E.G. Pye, A.J. Naldrett & P.E. Giblin, eds.). In Ontario Geological Survey Special Volume 1, pp302-307.
- Souch, B.E., Podolsky, T. & Geological Staff, 1969. [Within FNX Mining Company Inc. 2013. FNX International Ltd. Victoria Project Operated By FNX Mining Company Inc.: Advanced Exploration Closure Plan. Part 1 of 2 - September 2013.] The sulphide ores of Sudbury: their particular relationship to a distinctive inclusion-bearing species of the Nickel Irruptive. In Magmatic Ore Deposits, a Symposium (H.D.B. Wilson, ed.). Economic Geology Monograph, 4, 366 p.
- Statistics Canada. 2012. Greater Sudbury / Grand Sudbury, Ontario (Code 580) and Canada (Code 01) (table). Census Profile. 2011 Census. Statistics Canada Catalogue no. 98-316-XWE. Ottawa. Released October 24, 2012. http://www12.statcan.gc.ca/census-recensement/2011/dp-pd/prof/index.cfm?Lang=E Accessed February 11, 2016.
- Sudbury Area Risk Assessment (SARA) Group, c/o Gartner Lee Ltd. 2008. Sudbury Soils Study – Vol. II Human Health Risk Assessment. Available online at: http://www.sudburysoilsstudy.com/EN/indexE.htm. February 14, 2008. Accessed February 9, 2016.
- Sudbury Trail Plan. Undated. Walden Sno Runners. Available online at: http://www.sudburytrailplan.on.ca/clubs/wsr.php. Accessed February 9, 2016.

- Unknown source. 2015. Design Criteria. Project ID: ISD14-33 Crean Hill Road And Fairbank East Road Improvements. February 2015.
- Unknown source. 2015. Design Criteria. Project ID: ISD14-33 Crean Hill Road And Fairbank East Road Improvements. February 2015.
- WESA Inc. 2012a. Detailed Hydrogeological Study to Support a Permit to Take Water Application for FX's Victoria Advanced Exploration Project. Prepared for FNX Mining Company Inc. File No. S-B8813. February 2012.
- WESA Inc. 2012b. Victoria Advanced Exploration Project, Hydrogeological Study. Prepared for FNX Mining Company Inc. File No. SB8813. April 2012.
- WESA Inc. 2013. Victoria Advanced Exploration Project 2012 Annual Groundwater Monitoring Report. Prepared for KGHM International Ltd. FNX Mining Company Inc.

Table of Contents – Chapter 3

3. Project Description 35

3.1. The Project 35
3.1.1. Location, Land Tenure and Mineral Rights 35
3.1.2. General Arrangement of Facilities and Related Infrastructure 40
3.1.3. Key Elements of the Project 46
3.1.3.1. Proposed Underground Development 49
3.1.3.2. Potentially Acid Generating (PAG) 2 Storage Area 50
3.1.3.3. Ethel Lake Water Levels and Associated Control Structures 51
3.1.3.4. Paste Backfill Plant 51
3.1.4. Mining Activities 51
3.1.4.1. Mining Method 53
3.1.4.2. Drilling and Blasting 53
3.1.4.3. Hoisting 53
3.1.4.4. Mine Product and Waste Rock Crushing and Handling and Transportation 53
3.1.5. Waste Management 54
3.1.5.1. Non-Hazardous and Hazardous Waste 54
3.1.5.2. Waste Rock 55
3.1.6. Key Emissions and Effluents 58
3.1.6.1. Point Source and Fugitive Emissions 58
3.1.6.2. Greenhouse Gas Emissions 60
3.1.6.3. Noise Emissions 60
3.1.7. Water Management and Treatment 61
3.1.8. Sewage Treatment and Disposal 67
3.1.8.1. Labour 67
3.1.9. Procurement of Goods and Services 68
3.1.10. Alternatives to the Project 68
3.1.11. The “No Project” Alternative 69
3.1.12. Approach to Project Planning 69
3.1.12.1. Alternative Means of Carrying Out the Project 69
3.2. The Effect of the Environment on the Project 70
3.3. Schedule 70
3.4. References 71

3. Project Description

The scope of the Project includes the use of existing Advanced Exploration phase infrastructure, and proposed new infrastructure and activities for mine production. Many of the key process design elements are already in place as a result of approximately 16 years of exploration activities. The ventilation shaft headworks and hoisting facilities, and ventilation infrastructure, as well as waste storage, various building and key processes like wastewater collection and treatment plants are all permitted and construction started in 2013 to support the removal of a 33,000 tonne bulk sample.

Mine construction will take place in 2024 with commercial production expected to begin in 2031, depending on results from the bulk sample extraction and metallurgical testwork. Once operational, the mine life will extend to October 2042, followed by a three year physical decommissioning phase to October 2045, and another five years of monitoring to the end of 2050.

FNX has taken a conservative approach to the scope of the EA for the Project and has undertaken an assessment on subject areas beyond the Section 5 effects required under the *Canadian Environmental Assessment Act*, *2012* (*CEAA 2012*). Detailed, engineering design information is presented for many of the Project components below because provincial approvals enabling the Project to proceed have already been obtained (e.g., the Environmental Compliance Approval – Industrial Sewage Works, Environmental Compliance Approval – Air, Permit to Take Water).

3.1. The Project

The Project includes, after the cessation of Advanced Exploration phase activities, the development of the underground mine including both above ground and below ground supporting infrastructure to enable the extraction of a maximum of 3,500 tonnes per day (t/d) of mine product (ore) and 2,000 t/d of waste rock. Project activities include waste water treatment and discharge, construction of a second waste rock storage pad (PAG 2), stockpiling of waste rock and construction of the Ethel Lake control structure and Ethel Lake water taking infrastructure.

3.1.1. Location, Land Tenure and Mineral Rights

The Project is located in northern Ontario, approximately 35 kilometres west from the City of Greater Sudbury, within Denison Township, and approximately 400 kilometres north of Toronto, Ontario.

The main access to the area is provided by Municipal Road 4 (formerly Hwy 658), which runs north from Highway 17, followed by Crean Hill Road, which runs north for approximately two kilometres from Municipal Road 4. The main entrance to the Project

will be located off Fairbanks Road East, approximately 450 metres northwest of the junction from Crean Hill Road (Figure 3-1).

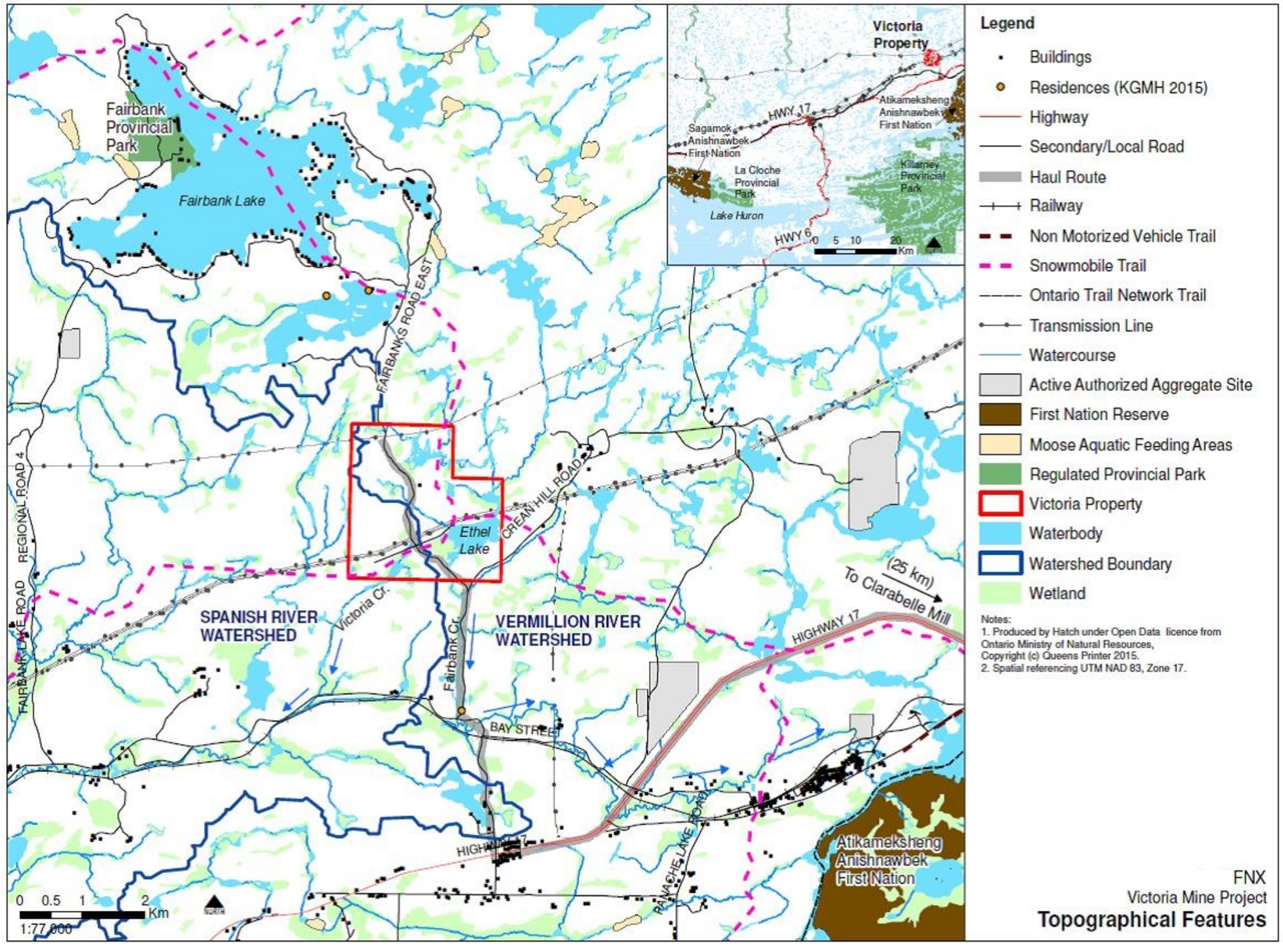

Figure 3-1: Topographical Features

The Victoria Property is privately owned, with the surface rights jointly owned by Vale and Carman Construction (515.59 hectares and 3.59 hectares respectively, for a total of 519.18 h hectares). Neighbouring properties are depicted in Figure 3-2 and land tenure on the Victoria Property is shown in Figure 3-3. FNX has agreements with each of the landowners which grant FNX access and use for the purpose of carrying out surface exploration.

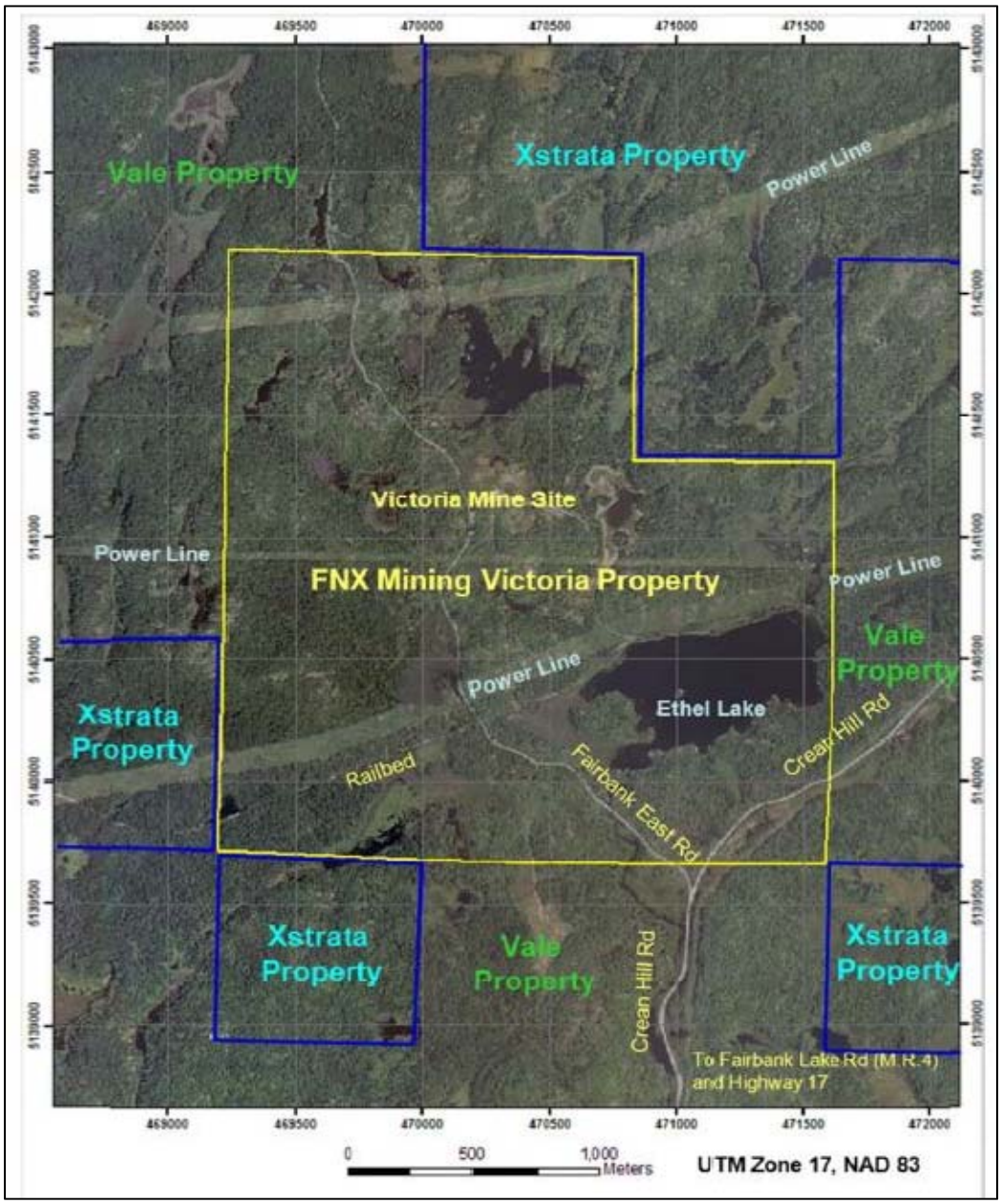

Figure 3-2: Neighbouring Land Mineral Rights

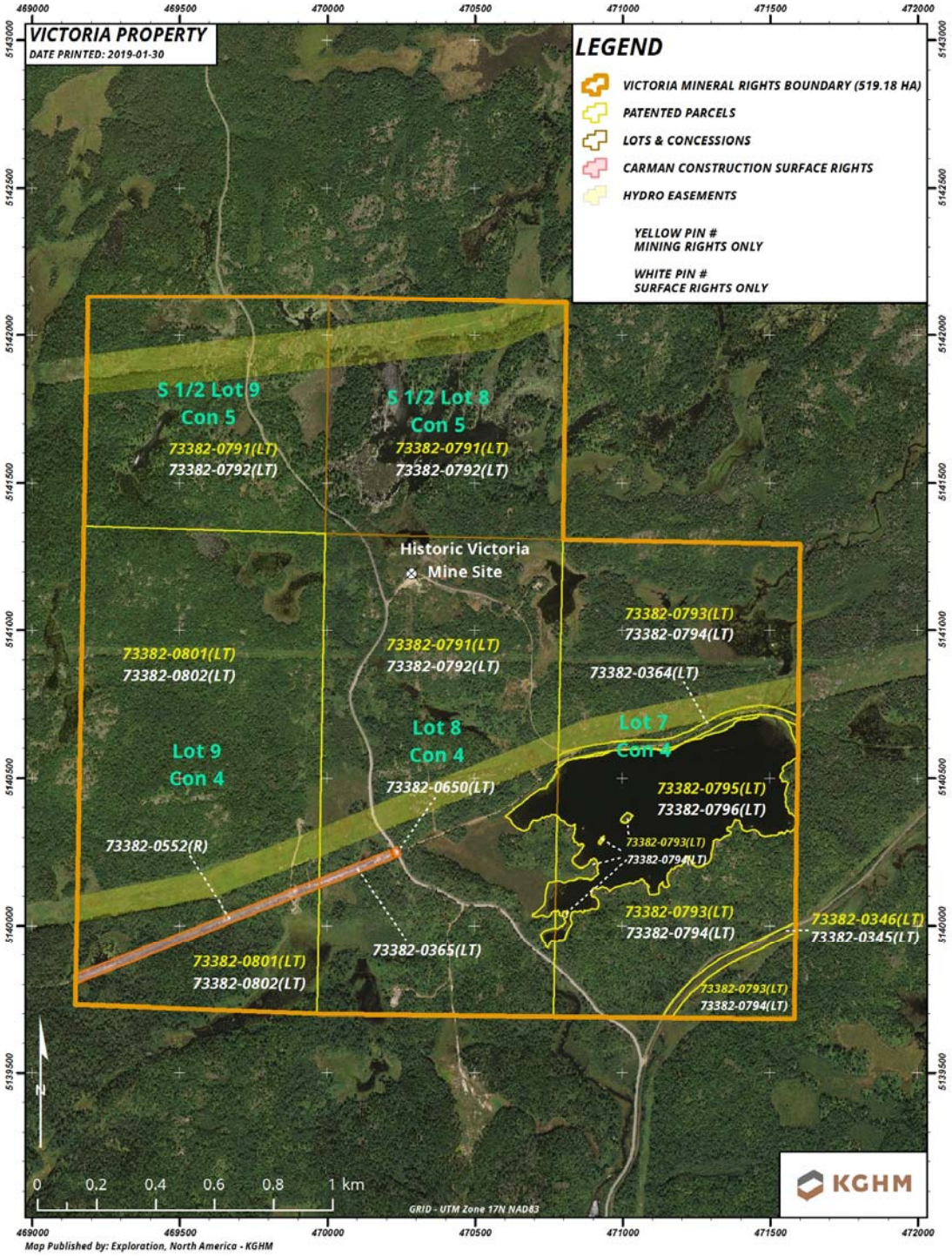

Figure 3-3: Land Tenure

FNX owns a 100% interest in the mining rights to the Victoria Property. The five patented contiguous mining rights dispositions associated with the Project and held by FNX encompass the entire Property (519.18 ha). The mineral rights boundary (i.e. outer perimeter of these parcels) is indicated on the land tenure map presented as Figure 3-3.

3.1.2. General Arrangement of Facilities and Related Infrastructure

Figure 3-4 and Figure 3-5 provide the proposed layout of the Project development including Advanced Exploration and Project phase facilities and infrastructure. The ventilation shaft headworks and hoisting facilities and ventilation infrastructure, as well as waste storage, various building and key processes like wastewater collection and treatment plants will be in place and functioning. Aerial photos taken of the site in 2014 and 2015, showing the proposed future location of facilities and infrastructure are presented in Figure 3-6 and Figure 3-7. Figure 3-8 provides a comparison of the proposed site disturbance during exploration and advanced exploration activities, with the expected site disturbance associated with operations of the proposed project. Table 3-1 includes the proposed infrastructure and building sizes associated with the Victoria Mine Project.

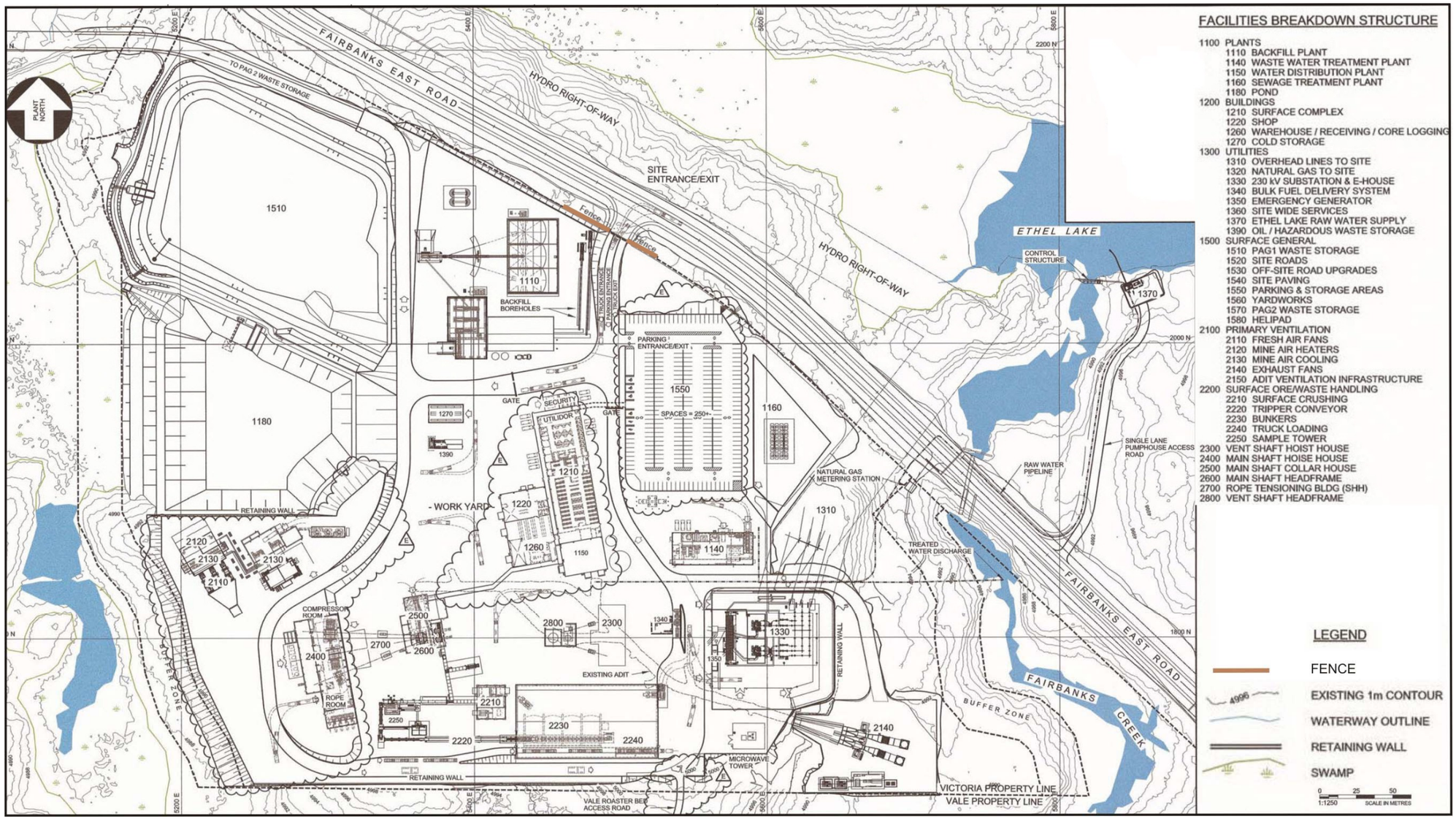

Figure 3-4: General Arrangement of Overall Site

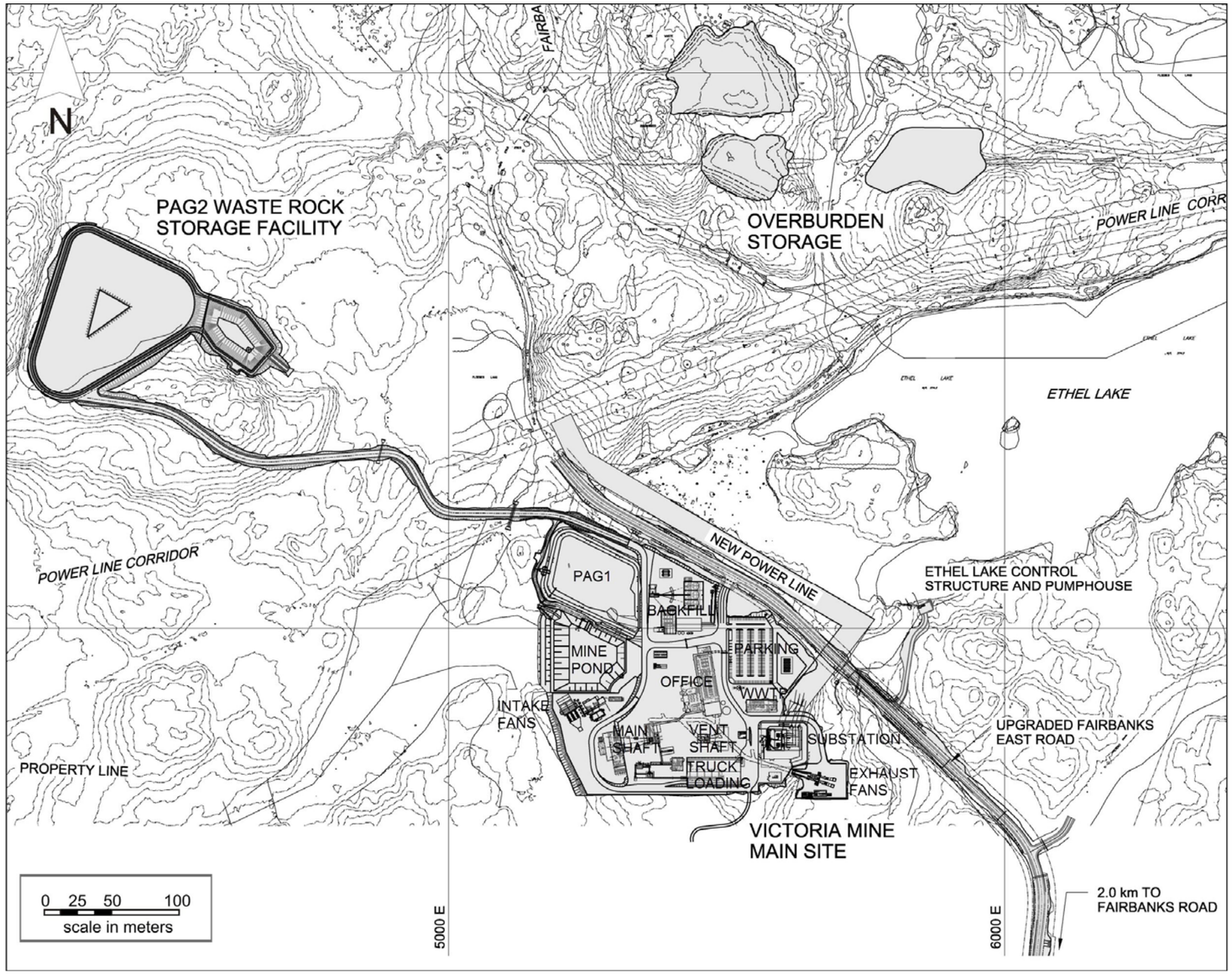

Figure 3-5: General Arrangement of Site Facilities

Figure 3-6: Aerial Photo of the Victoria Site Taken in Q2 2014 Showing Proposed Future Location of Project Facilities and Infrastructure

Figure 3-7: Aerial Photo of the Victoria Site Taken in Q4 2015 Showing Proposed Future Location of Project Facilities and Infrastructure

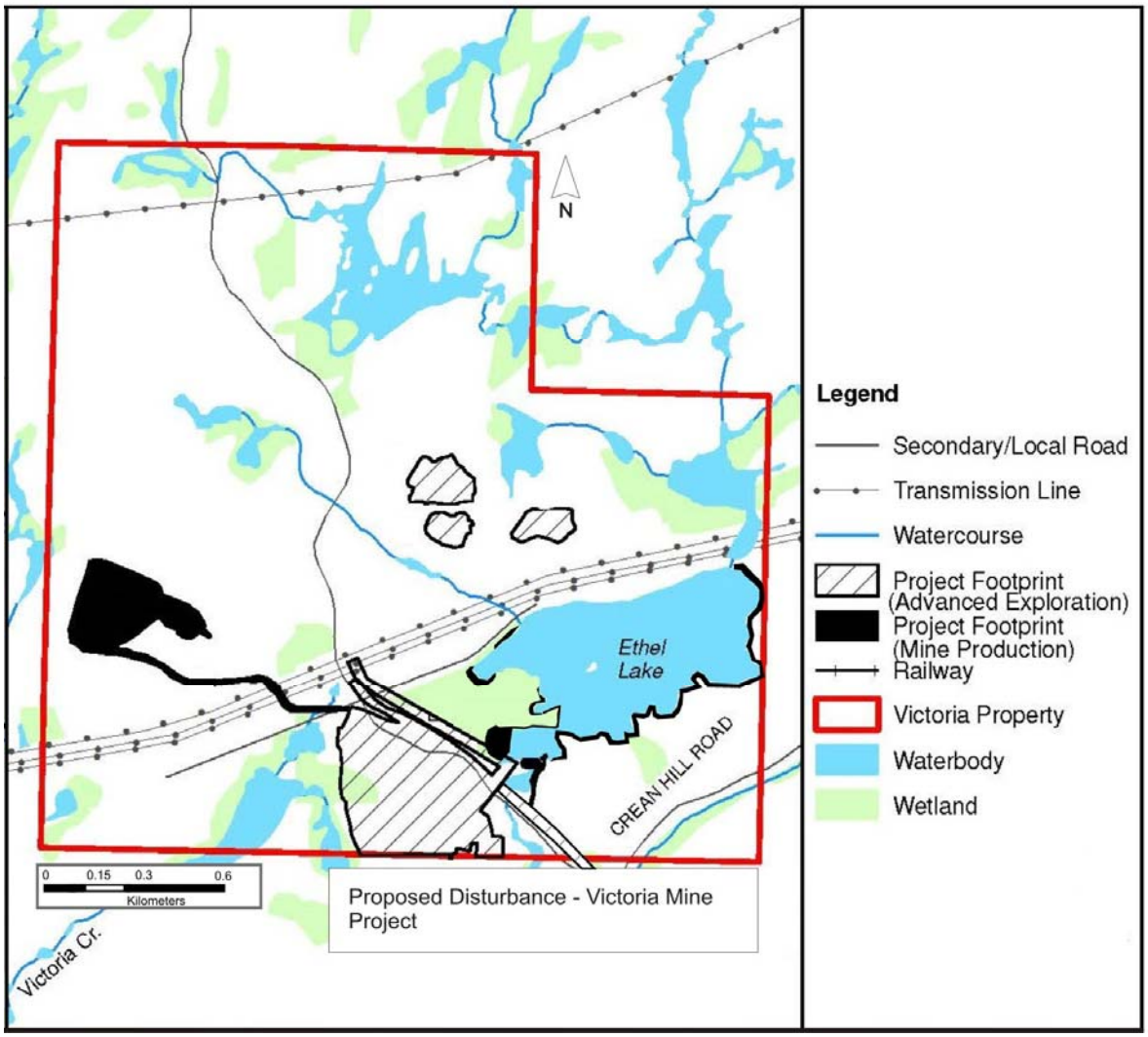

Figure 3-8: Expected Site Disturbance

Table 3-1: Proposed Infrastructure and Building Sizes – Victoria Mine Project

Development Area	Approximate Building Size (m^2)	Approximate Area (ha)	Capacity (m^3)
Ethel Lake Flooded Area		2.5	
Overburden Storage Areas		6.5	
Site Roads		2.5	
PAG 2		8.7[1]	673,000
General Site:		22	
Main Shaft Headworks and Hoisting Facilities	3289		
Crushing and Loading	5,500		
Mine Water Pond	22,720		43,400
Offices and Storage	7,000		
Dry	1,400		
Fuel and Storage	500		
Core Shack	961		
Miscellaneous	200		
Backfill Plant	2,000		
Control Structure Road and Pump House Pad		3	
Total "Footprint" (ha)		**45**	

1. *The PAG 2 Area of 8.7 ha includes the haulage road which has an area of 1.2 ha. The area of the PAG 2 waste rock storage pad (not including the road) is 7.5 ha.*

3.1.3. Key Elements of the Project

The scope of the Project for consideration by CEAA in conducting a screening and deciding whether an environmental assessment is required, comprises ongoing operation of some advanced exploration infrastructure that will be in place in advance of the Mine Project, as well as construction and operation of infrastructure associated with the producing mine as listed below.

The main physical works associated with the Mine Project include:

- Construction and operation of a second rock storage area approximately 7.5 hectares in size for mineralized (PAG) rock referred to as PAG 2. The PAG 2 waste rock storage area will be located 1.5 kilometres northwest of the main Project site and will consist of a waste rock storage pad and water collection pond to collect

runoff from the footprint of the potentially acid generating waste rock stockpile. Collected water will flow to the adjacent collection pond and ultimately be piped to the Waste Water Treatment Plant for treatment, prior to release to the environment or re-used as process water. Prior to construction of PAG 2 waste rock pad, a haulage road to the pad will be required. The total area of the haulage road from the site to the PAG 2 storage area is 1.2 hectares. Construction of the haulage road includes land clearing, grubbing, and rough grading with clean fill. Construction of PAG 2 includes land clearing and grubbing the PAG 2 footprint, importing clean fill, placing and compacting fill in the PAG 2 area to form the base of the pad and the berms, creating sumps to collect water, installation of piping along haulage road to pipe water from sumps to the Mine Water Pond and installation of a geomembrane liner to create a watertight containment area; Construction of a plant to manufacture paste backfill ground support material for placement underground in mined out areas. The plant will be situated in the area already disturbed by exploration and PAG rock will be used to manufacture backfill. Rock will be removed from PAG 1 and 2 to be used in the paste backfill process;

- Construction of a plant to produce paste backfill ground support material for placement in mined out areas. The plant will be situated in the area already disturbed by exploration and PAG rock from PAG Pad 1 and 2 will be used to produce backfill to provide additional support to the mine workings;
- Removal of waste rock from PAG 1 for use as backfill underground. Once all rock has been remove from PAG 1, the waste rock pad liner will be removed and reclamation of the pad footprint including grading and re-vegetation of the area will take place;
- Construction and Operation of the Ethel Lake control structure and a pump house for water supply. The Ethel Lake control structure and pumphouse will be located east of Fairbanks East Road, at Ethel Lake on the eastern side of the Victoria Property. The Project will require supplementary water to support shaft sinking and production activities, and maintain flow requirements in Fairbank Creek. The control structure will be installed in order to raise the level of Ethel Lake by approximately 0.5 metres. Outflow to Fairbank Creek will be controlled to ensure minimum flow requirements are achieved. The pumphouse will be installed to supply raw water via pipeline to the main Victoria Site;
- Underground mine development utilizing existing ventilation shaft and surface infrastructure for mine product and rock movement including hoisting;
- Underground ventilation and dewatering of work areas as key elements of mitigating potential workplace hazards;
- Mine product hauling by truck to Vale's Clarabelle Mill in Copper Cliff;
- Various enclosed facilities for mine product and rock crushing and handling. The crushing system will be located in an enclosed area east of PAG 1 and immediately northwest of the backfill plant. It will include three portable crushers (one jaw crusher and two cone crushers) working in series to reduce the mine waste rock

from PAG 1 to 6-millimetre aggregate to feed the grinding circuit located inside the backfill plant. The 6-millimetre product will be transferred into a storage bunker having a total storage capacity of 13,000 tonnes. The crushers will be enclosed in an unheated, sound insulated building. Dust containment enclosures along with a 64,000-cubic metre per hour (m^3/h) bag house dust collector will help to minimize the dust effects. On average, 1,800 tonnes of material will be processed by this system on a daily basis;

- Use of existing temporary stockpile locations for soil and overburden. These stockpiles were established during exploration and will be used for site remediation activities to meet closure plan expectations;
- Various office, administration, warehousing, maintenance, general storage and employee parking facilities;
- Fuel storage facilities: The fuel storage system is comprised of diesel fuel oil and gasoline storage on surface and diesel fuel oil storage underground. The primary purpose of the diesel fuel distribution system will be to transfer fuel in a batching process from surface to underground fuel bays, while also dispensing fuel on surface with a local dispensing pump:
  - The Surface Fuel System will consist of one Diesel Fuel Delivery System, comprising one 50,000-litre storage tank and 1,475-litre batch tank equipped with two distribution pumps each; and one Gasoline Fuel Dispensing System comprising one 1200-litre Gasoline Fuel Tank equipped with one dispensing pump;
  - The Underground Fuel System will consist of one shaft pipeline routed from the surface 50,000-litre storage tank through the existing adit and down the Main Shaft; four intermediate transfer stations comprising 475-litre storage tank equipped with fire suppression and one transfer pump each; four 6,000-litre diesel fuel storage tanks located within the main levels fuel bays; one 2,275-litre permanent satellite fuel station and two 2,275-litre temporary satellite fuel stations to be relocated as required to support development;
- Sewage treatment facilities designed to accommodate up to 250 people working on site or 30 m^3 of waste per day. The sewage treatment system will process all sewage-related waste generated on site. The system will be approximately 4,000 m^2 in size and will consist of an equalization tank, septic tanks, effluent tank, biofilters, septic bed, and odour control units. The approximate footprint of the facility will be 30 metres by 20 metres. The system will not tie into the municipal sanitary sewage system operated and maintained by the City of Greater Sudbury. Sewage will be directed from washrooms and shower facilities on site to a passive septic system near the parking lot. It will then be pumped through a series of peat moss filters into a prepared subsurface tile bed;
- Water management and treatment of site and mine water/effluent using the Wastewater Treatment Plant;
- The procurement of goods and services;

- A construction labour force of approximately 72 direct hires, plus approximately 200 to 300 indirect contractor employees;
- An operations labour force of 397 direct hires;
- Physical decommissioning including demolition of buildings, removal of the headframe and removal of the Ethel Lake Control Structure, removal of gatehouse and fencing;
- Removal of PAG Pad 2 liner and reclamation of the pad footprint including grading and re-vegetation of the area;
- Removal of all machinery and equipment not essential for compliance or the enhancement of environmental security. Surface equipment will be dismantled and removed for possible salvage or reuse;
- Post closure monitoring including groundwater monitoring, surface water monitoring, biological monitoring, physical stability monitoring and all other monitoring as required by the filed Victoria Mine Production Closure Plan.

3.1.3.1. Proposed Underground Development

The ventilation shaft and associated headworks and hoisting infrastructure will be in place prior to the start of the Project and will serve as the secondary egress during production mining. The underground mine will be accessed by a 7.6 metre diameter Main Shaft extending from surface to a nominal depth of 2,000 metres. The principal components of the proposed underground development are listed below and shown in Figure 3-9:

- A 7.6-metre diameter Main Shaft from surface to a nominal depth of 2,000 metres with the option to extend the shaft to the 2,250 metre elevation;
- An adit that intersects the Ventilation Shaft, Main Shaft and Fresh Air Raise on 36 Level;
- Lateral development on the main levels of 1200, 1400, 1600, 1800, 1925, 2000 and potentially 2250 Levels, consisting of mainly 5 metre by 5 metre drifts excavated to the stoping areas as well as the internal ramp; and
- Vertical development to provide a route for ventilation flow, mine product feed and waste handling, and for secondary egress from underground.

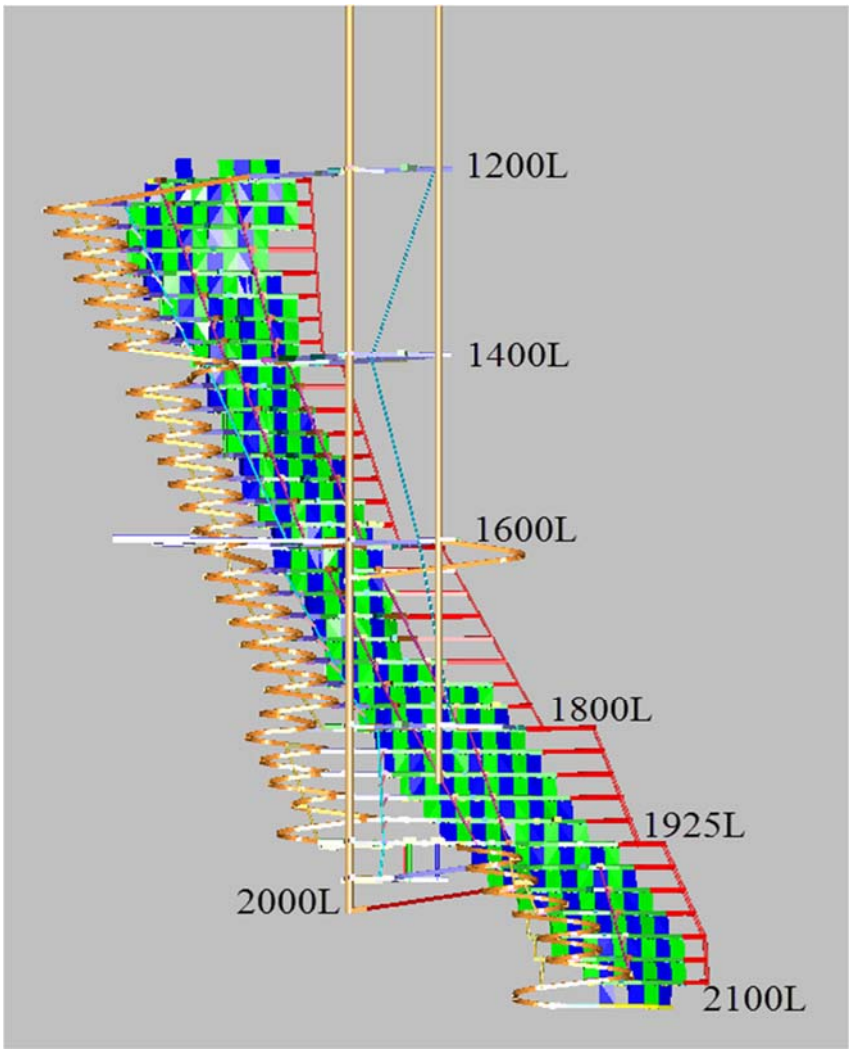

Figure 3-9: Isometric View of Proposed Mine Development Looking North

3.1.3.2. Potentially Acid Generating (PAG) 2 Storage Area

The PAG 2 Storage Area (PAG 2) will be located 1.5 kilometres northwest of the mine site and will be comprised of a waste rock storage pad, and water collection pond. The PAG 2 rock storage containment pad will be lined with a geomembrane with non-woven geotextile placed directly above and below the geomembrane. The geomembrane will be contained within sand bedding layers above and below the geomembrane and surrounded by perimeter berms. It will be accessed via a haul road from the mine site. The waste rock to be stored at PAG 2 is considered potentially acid generating and therefore runoff from the footprint of the waste rock stockpile shall be collected and treated. A seepage barrier and collection system is provided to manage and treat all water collected within the PAG 2 footprint prior to discharge into the environment. The water collected within PAG 2 will flow to the PAG 2 collection pond where it will then be

pumped through a decant structure and a heat traced discharge pipeline to the Mine Water Pond (MWP). Ultimately, the water will be sent to the Waste Water Treatment Plant (WWTP) for treatment prior to release to the environment or will be used as process water.

3.1.3.3. Ethel Lake Water Levels and Associated Control Structures

The Project requires additional water, supplementary to water obtained from on-site groundwater wells, to support shaft sinking, production activities, and meet water quality objectives. Supplementary requirements will be met through the installation of a control structure and pumphouse, situated where Ethel Lake flows into Fairbank Creek, to raise the lake level approximately 0.5 metres. A control valve will allow the outflow to Fairbanks Creek to ensure the minimum flow requirements are achieved and a spillway will be sized to ensure the Inflow Design Flood may be safely passed. A pumphouse will be constructed to supply raw water via pipeline to the raw water tank situated at the mine site.

3.1.3.4. Paste Backfill Plant

The crushing system will include three portable crushers (one jaw crusher and two cone crushers) working in series to reduce the mine waste rock to six millimetre aggregate. This aggregate will feed the grinding circuit located inside the backfill plant where the grinding circuit will further reduce the aggregate to at least 20% passing 20 micron. This grinding circuit will include two high pressure grinding roller mills used in series.

3.1.4. Mining Activities

The underground mine will consist of a pre-existing ventilation shaft to a depth of 1,860 metres, a main shaft to a depth of 2000 metres, and underground supporting infrastructure including, but not be limited to, maintenance facilities, refuge stations, ballast and shotcrete delivery systems, and explosive and detonator magazines. Mine product (ore) and waste will be moved from the main shaft to the loadout building via crushing and sampling processes prior to being shipped off site.

Surface infrastructure to support mine production includes a backfill plant, crusher, maintenance facilities, stormwater management infrastructure, administration facilities, mine dry facilities, and hygienic water, sewage and wastewater treatment plants.

A process block flow diagram is provided as Figure 3-10.

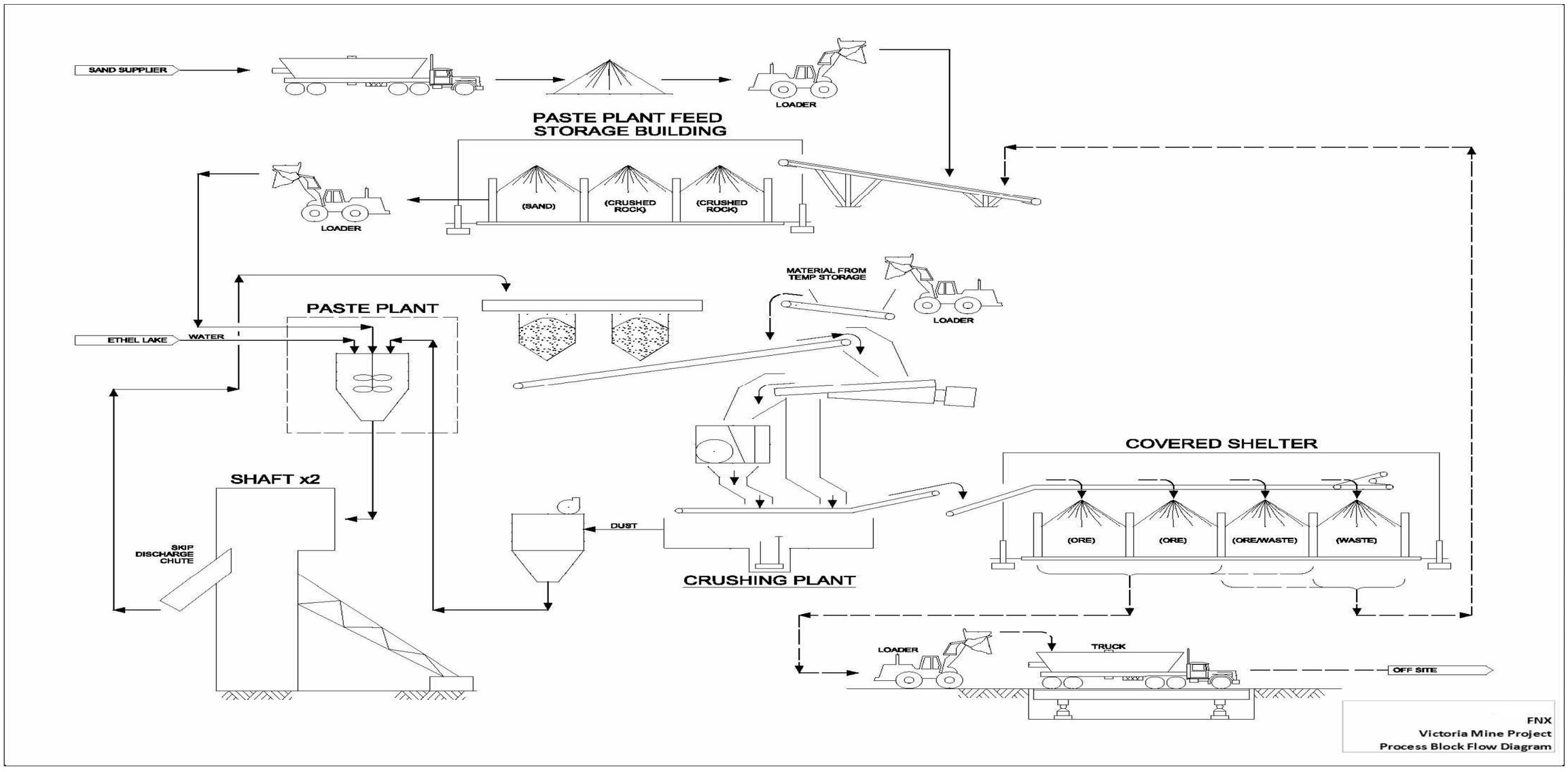

Figure 3-10: Process Block Flow Diagram

The Project components located outside of the main Project site, but within the Victoria Property boundaries, include the overburden stockpiles, 230 kV transmission line, PAG 2 (waste rock stockpile), natural gas line, and the Ethel Lake water control structure and pumphouse.

3.1.4.1. Mining Method

Due to its depth below surface, an underground mining operation is envisaged for the Victoria deposit. The attributes of the Victoria deposit support the selection of transverse over-hand blasthole stoping as the most appropriate method for the proposed mine.

3.1.4.2. Drilling and Blasting

The stope drilling patterns and blast design are based on FNX blasthole experience used in mines in the Sudbury region. Transverse over-hand blasthole stoping is a bulk mining method that requires a deposit to have a dip greater than 50° for gravity flow of the broken mine product in the stope; a thickness greater than 15 metres; and competent and continuous in-situ mineralization and wall rock.

The transverse over-hand blasthole stoping method has the advantage of good mining recovery with moderate dilution from waste rock or backfill and is inherently safe (workers are typically remote from the working face).

Drilling and blasting operations will progress until the stope is completely mined out. The stope void will then be backfilled using backfill.

3.1.4.3. Hoisting

The facilities that are involved in the mine product handling on surface are essentially related to the shaft and hoisting processes which provide access and support to the mining system; and the mine product transport and waste transport system processes, which move the broken mine product and associated waste rock to surface and off-site.

The flow of all material, personnel, and equipment into and out of the mine will be through the main shaft headframe complex. The main shaft headframe will be constructed directly over the shaft and will transfer loads between the hoists and conveyances. The permanent skips dumping arrangement and temporary sinking dump system will be installed in the main shaft headframe complex.

The ventilation shaft headframe complex will be an integral structure which consists of the ventilation shaft headframe, collar, sub-collar, hoist room with the secondary egress hoist, and associated facilities.

3.1.4.4. Mine Product and Waste Rock Crushing and Handling and Transportation

Mine product and waste rock material handling on surface will start at the discharge of the vibratory feeders below the two headframe bins. Vibratory feeders will be used as

primary flow control devices, controlled by the rock level in the bins, to transfer material from the bins to conveyors. Conveyors will transfer the mine product and waste rock to the crusher building. Both mine product and waste rock will be crushed in the same primary crusher to nominal 150 millimetre size.

After the crusher, both the fines and crushed material will drop onto the crusher discharge conveyor and will be transferred to the primary sampler. At the primary sampler, a cutter will divert 85% of the mine product and 100% of the waste to a bypass of the sampling process. A total of 15% of the mine product will go into the sample system to be further crushed, sampled, packaged and sent for analysis. In the sample tower, two barrels of samples will be retained for each batch, while the rest of the above 15% will be returned to the main mine product stream. All material bypassing or rejected from the sample system will be transferred to the storage building via a tripper conveyor, where the material will be stored in four 2,000 tonne, three-sided, concrete surface bunkers.

A front-end loader will load 40 tonne capacity highway trucks that will transport the crushed mine product off-site. Third party owned and operated trucks will deliver the mine product via truck to the Clarabelle Mill. All mine product will be processed by Vale. Waste rock will be loaded to trucks and transferred to the PAG 2 storage area.

3.1.5. Waste Management

Wastes generated by the Project include non-hazardous, hazardous, and liquid wastes as well as waste rock generated by mining activities. Tailings will not be generated on-site as the processing of all mine product will be conducted off site. Therefore, no on-site tailing storage will be required.

3.1.5.1. Non-Hazardous and Hazardous Waste

Solid, non-hazardous waste (e.g. containers, packaging) will be deposited in dedicated bins that are supplied and transported by a licensed carrier in accordance with requisite approvals and disposed of at an approved off-site facility.

Bulk products such as water treatment reagents and petroleum products will be obtained in returnable containers. Where returnable containers are not practical, products will be procured in metal containers to the maximum extent practical. Separate bins will be kept at the Project site in order to recycle scrap metal and other material as is practical. Used petroleum product pails will be returned to suppliers or recycled. Used equipment batteries will be recycled at an approved recycling facility.

All non-hazardous and recycling wastes will be managed according to a waste management plan which will contain details regarding the procedures for waste separation, collection and disposal.

All hazardous and liquid industrial wastes will be stored, managed and disposed of as detailed in the FNX hazardous and liquid industrial waste management procedure.

3.1.5.2. Waste Rock

The sources of waste rock for the Project include cut rock from grading and waste rock from underground. Waste rock produced by the Project will be separated into non-acid generating (NAG) and PAG rock. The NAG rock will be used as construction material on site and may also be used for surface backfill material.

The PAG rock will be stored on site in two lined, bermed areas (PAG 1 and PAG 2 waste rock storage areas) to be used for underground backfill material. PAG 1 is located on the northwest corner of the Property and will receive waste rock generated during the Advanced Exploration phase only. No waste rock will be added to PAG 1 (and its dimensions and capacity will not increase) during the mine project. PAG 2 waste rock storage area will be used to store waste rock produced throughout the production phase only.

Once all rock has been removed from PAG 1 for use as backfill, the liner will be removed and the area will be graded and revegetated. Removing rock from PAG 1 for use as backfill and reclamation of the PAG 1 footprint will occur during the production phase of the Project.

The entire volume of waste rock stockpiled in both PAG facilities is expected to be utilized by the backfill plant and returned underground as fill to the mined out areas during the life-of-mine operation. No PAG waste rock will remain on surface at mine closure.

The PAG 2 rock storage area plan is shown in Figure 3-11 and the proposed geomembrane design for the PAG 2 rock storage area is shown in Figure 3-12.

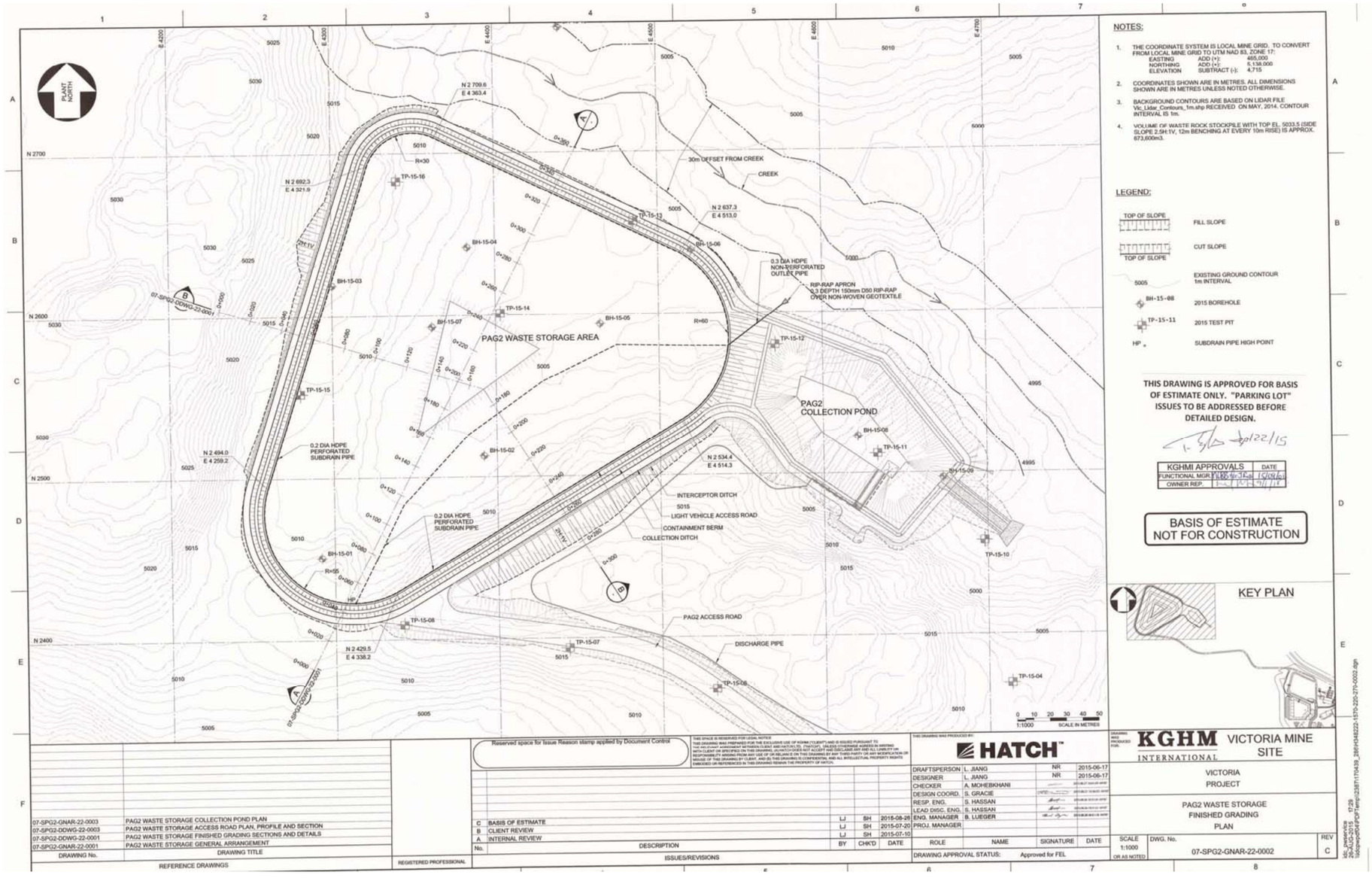

Figure 3-11: PAG 2 Rock Storage Area Plan

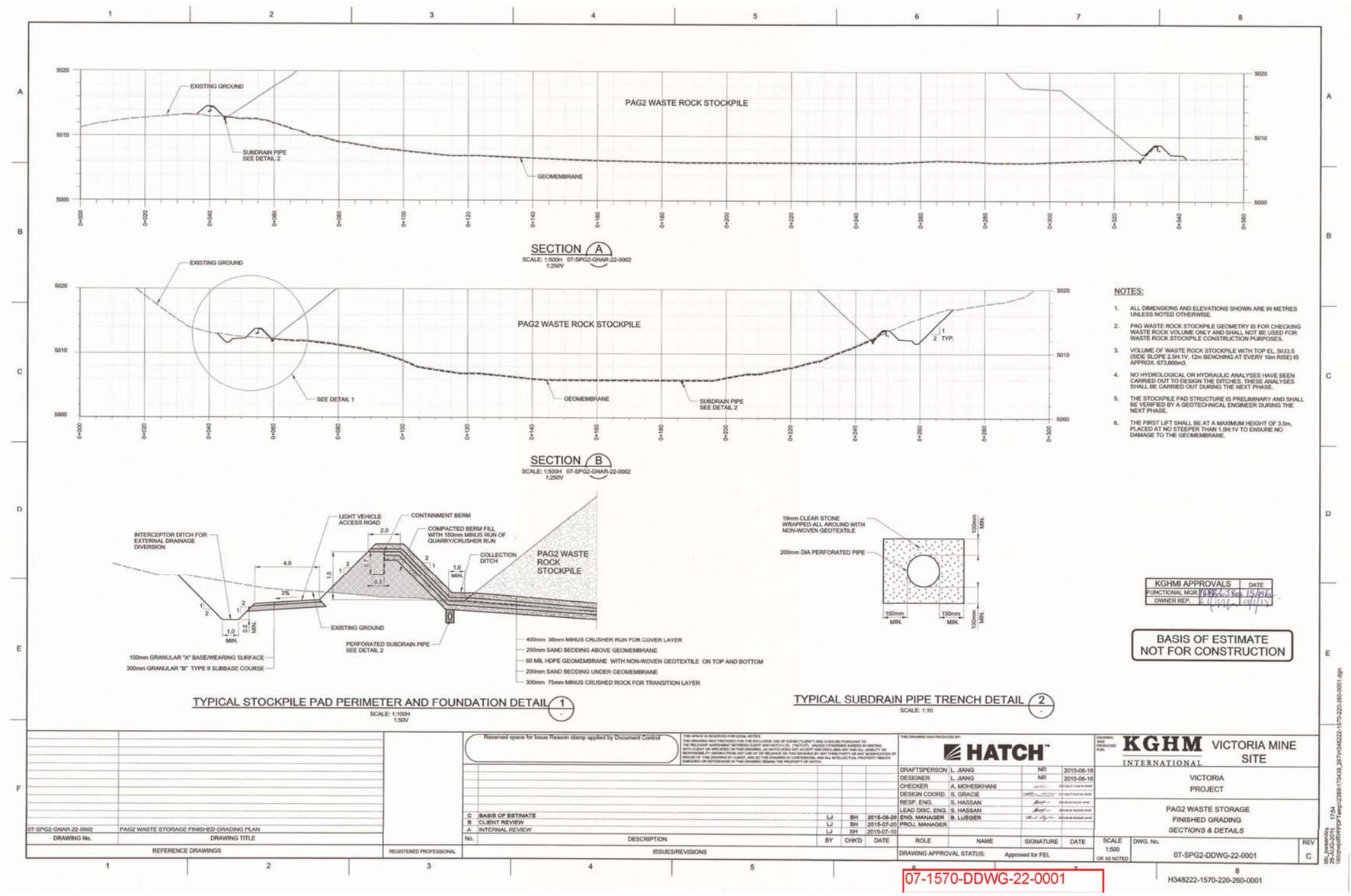

Figure 3-12: PAG 2 Geomembrane

The entire volume of waste rock stockpiled in the PAG facilities is expected to be utilized by the backfill plant and returned underground as fill to the mined out areas during the life-of-mine operation. No PAG waste rock will remain on surface at mine closure. There is also an agreement in place with Vale to provide for the transport of excess PAG waste rock to Vale for disposal should the amount of waste rock generated exceed the backfill requirements.

3.1.6. Key Emissions and Effluents

3.1.6.1. Point Source and Fugitive Emissions

It is anticipated that the main fugitive emission source will primarily be dust. The primary point source emissions are expected to be generated by the fuel fired equipment, including heaters, generators, and mine ventilation equipment, as the Project does not include a process plant, hence primary process air emissions are expected to be much lower than fuel combustion emissions. More specifically, the Project will consume natural gas for heating, diesel for surface and underground activities, and gasoline for surface vehicles and equipment. Secondarily, upstream emissions will also be generated from grid electricity production.

Fugitive dust emissions will be produced by a number of Project activities during both the construction and production phases including movement of equipment and vehicles on site roads; mine product and waste rock handling and processing activities (e.g., crushing, conveying and stockpiling); dust from ore, waste rock, topsoil and overburden stockpiles and movement of ore and waste rock offsite. Fugitive dust emissions will be produced during the decommissioning and abandonment phase due to physical decommissioning and equipment removal.

Other air emissions generated by the combustion engines of heavy equipment and Project vehicles will be generated largely during construction, but also during production from exhausts from the heaters and ventilation equipment.

Air emissions from underground, site buildings and surface equipment activity have been modeled using an Emission Summary and Dispersion Model (ESDM) prescribed by the MOECC to demonstrate compliance with the requisite environmental approvals.

Figure 3-13 and Table 3-1 provide information related to point source emissions during the Victoria Mine Project operations phase.

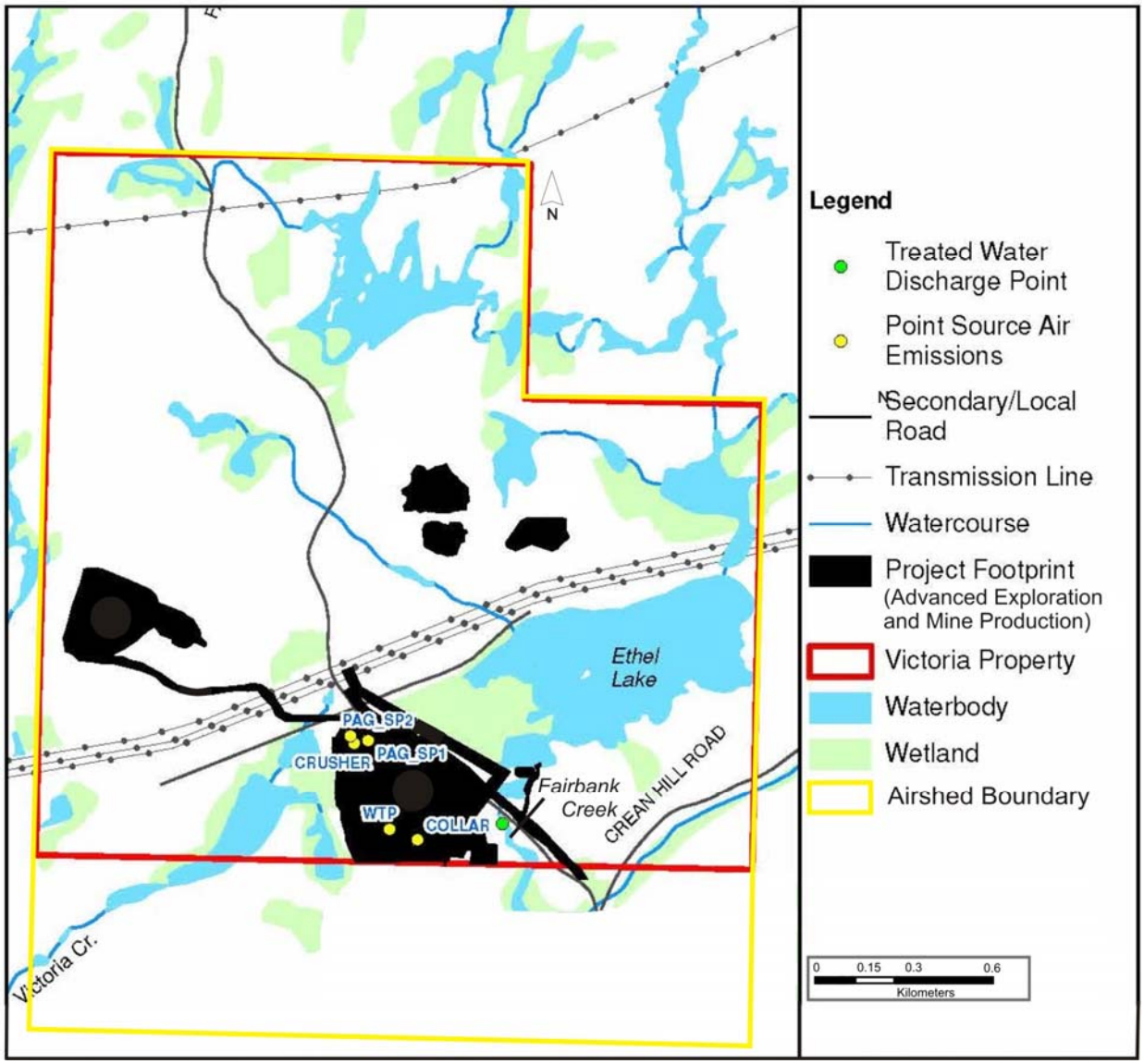

Figure 3-13: Point Source Emissions During the Victoria Mine Project

Table 3-1: Point Source Emissions and Emission Rates – Operations

ID	Source Description	Contaminate	Maximum Emission Rate [1]	Unit
COLLAR	Mine Ventilation	PM	1.65E+00	g/s
		CO	1.29E+01	g/s
		NOx	2.84E+00	g/s
		SO_2	1.93E-02	g/s
WTP	Water Treatment Plant	NOx	2.15E-02	g/s
		Ammonia	2.22E+00	g/s
IDGEN1 – IDGEN3, IDGEN5 – IDGEN7	Diesel Generators	CO	Emergency backup only	g/s
		NOx		g/s
		PM		g/s
		SO_2		g/s
CRUSHER	PAG Stockpile Area Crusher	CO	1.08E+00	g/s
		NOx	2.04E+00	g/s
		PM	2.65E-01	g/s
		SO_2	3.86E-01	g/s
PAG_SP1	PAG Material Handling 1	PM	3.63E-02	g/s
PAG_SP2	PAG Material Handling 2	PM	3.63E-02	g/s

Note 1: Assumed emissions from COLLAR, CRUSHER, PAG_SP1 and PAG_SP2 are proportional to Advanced Exploration emissions based on maximum extraction rates for respective phases (1,100 tpd vs. 5,500 tpd).

3.1.6.2. Greenhouse Gas Emissions

Greenhouse gas emissions associated with diesel fuel and other fuel sources is anticipated to be minimal as the principal stationary power source for both construction and production is by transmission line. The greatest potential for the generation of greenhouse gases is through the use of heavy equipment, generators, or vehicles fuelled by diesel, gasoline or propane during the construction phase, and by trucks transporting the mine product during production.

3.1.6.3. Noise Emissions

The primary sources of noise emissions during construction would include open air heavy equipment operation and blasting. Noise emissions will be generated by the mine

ventilation fans, materials handling and blasting and other process facilities during the production phase.

The mine ventilation fans, compressor plant, refrigeration plant, backfill plant, crusher, and vacuum truck were identified as the major source of noise emissions during operations. Accordingly, the Project will carry out noise monitoring and abatement measures to reduce the potential adverse effects to local residents, cottagers and the public. The implementation of these noise mitigation measures, which include silencers and administrative procedures, will ensure that the Project meets provincial noise guidelines.

Noise sources during the decommissioning and abandonment phases will are expected to derive from heavy equipment operation related to demolition of buildings and removal of the headframe and post closure activities.

3.1.7. Water Management and Treatment

The Waste Water Treatment Plant provides process water for mine operations, water containment and water treatment. The objectives of the water treatment process are to maximize the recycling of waste water; reduce the volume of raw water taken from natural sources; and minimize the amount of discharge to the environment. The Project has proactively planned to limit the number of water discharge points to ensure minimal effects on the receiving aquatic environment and include a Mine Water Pond (MWP) and Waste Water Treatment Plant (WWTP). A water block flow diagram is included as Figure 3-14.

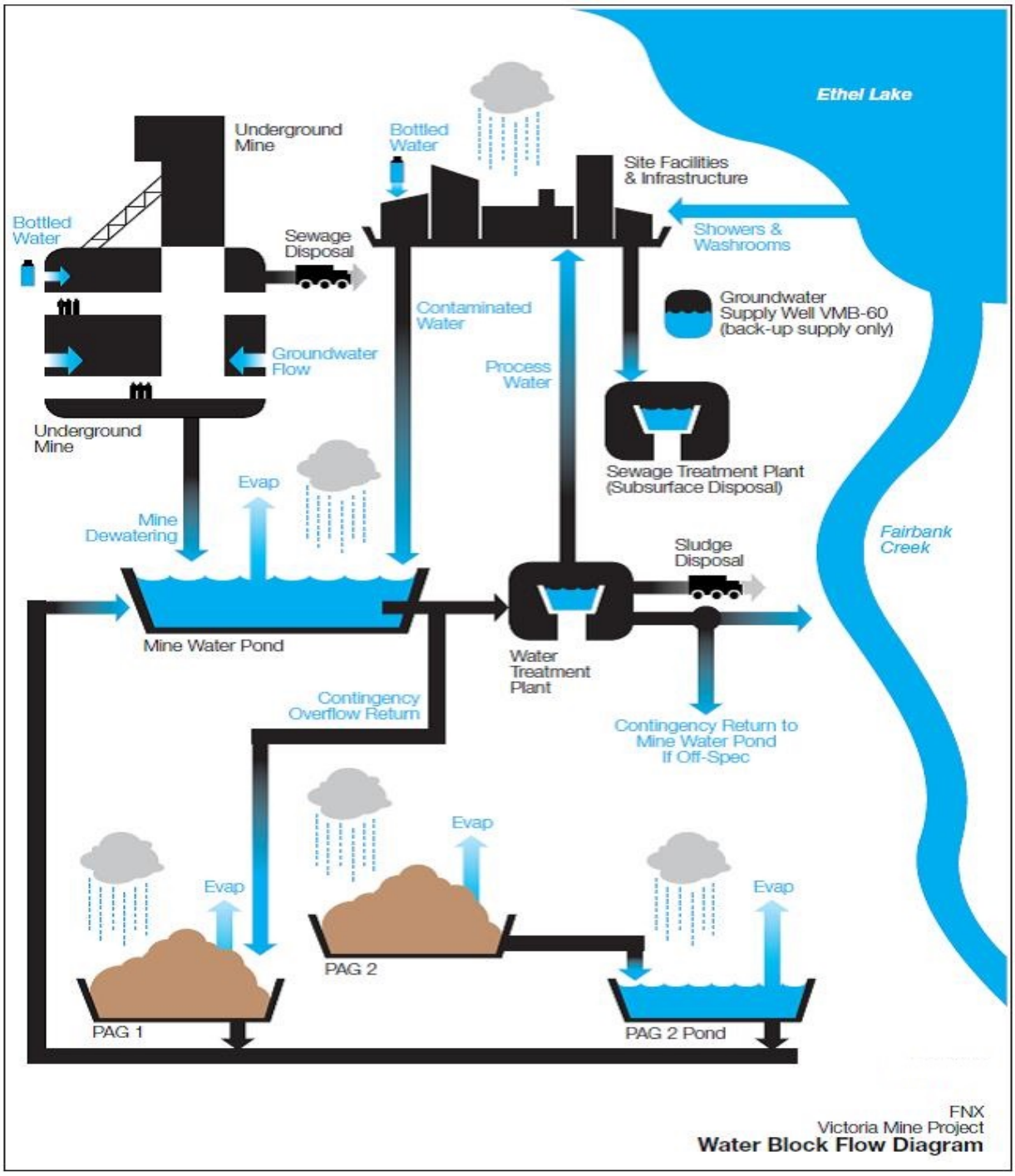

Figure 3-14: Water Block Flow Diagram

Potentially contaminated and process waters include water pumped from the underground workings and precipitation in the site area, all of which are considered potential sources of contamination. In addition, wash water and other water used on site for operational reasons is considered to be potentially contaminated. Potentially contaminated water requires collection, isolation and treatment prior to discharge into the environment or before being reused as process water in Project construction and operations. The Water Distribution Plant will be one of the last facilities constructed, therefore a separate system will be provided for construction water demands. Figure 3-15 identifies the surface drainage catchment areas within the Project site.

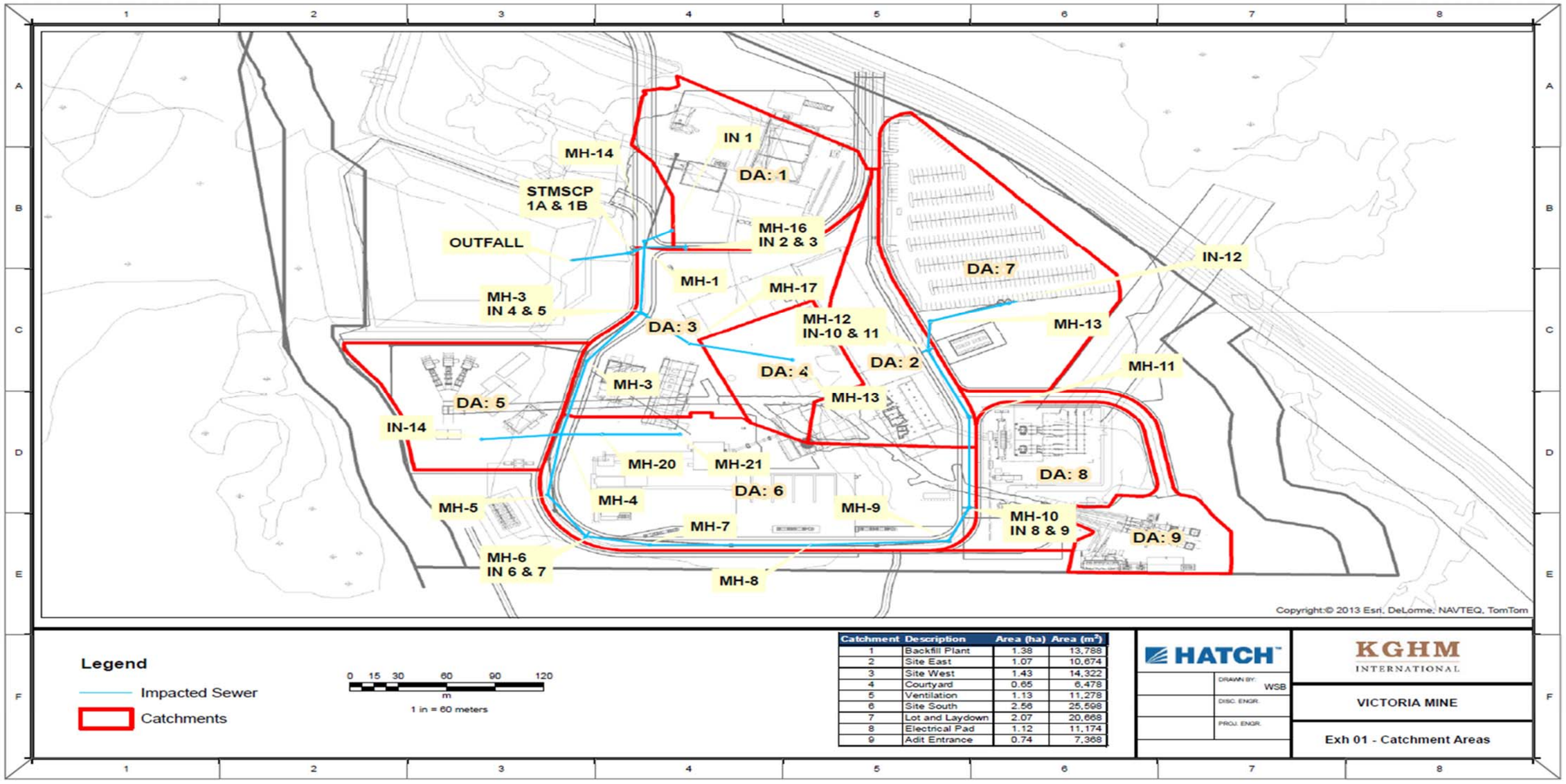

Figure 3-15: Catchment Areas

The Mine Water Pond is located on the west side of the property and is sized to accommodate a 1-in-100-year, 24-hour storm event, or 43,400 cubic metres of water. If this amount is exceeded, a spillway is included to protect dam integrity.

Water from the Mine Water Pond is delivered through a buried and above ground pipeline to the Waste Water Treatment Plant for treatment so that it can be reused in underground operations. The maximum feed rate of the Waste Water Treatment System is 3,000 cubic metres per day. This high treatment rate assists in the recovery of capacity in the Mine Water Pond after large storm events.

Figure 3-16 provides the general arrangement of buried piping (site wide services) for the Victoria Mine site, including waters and sanitary drains.

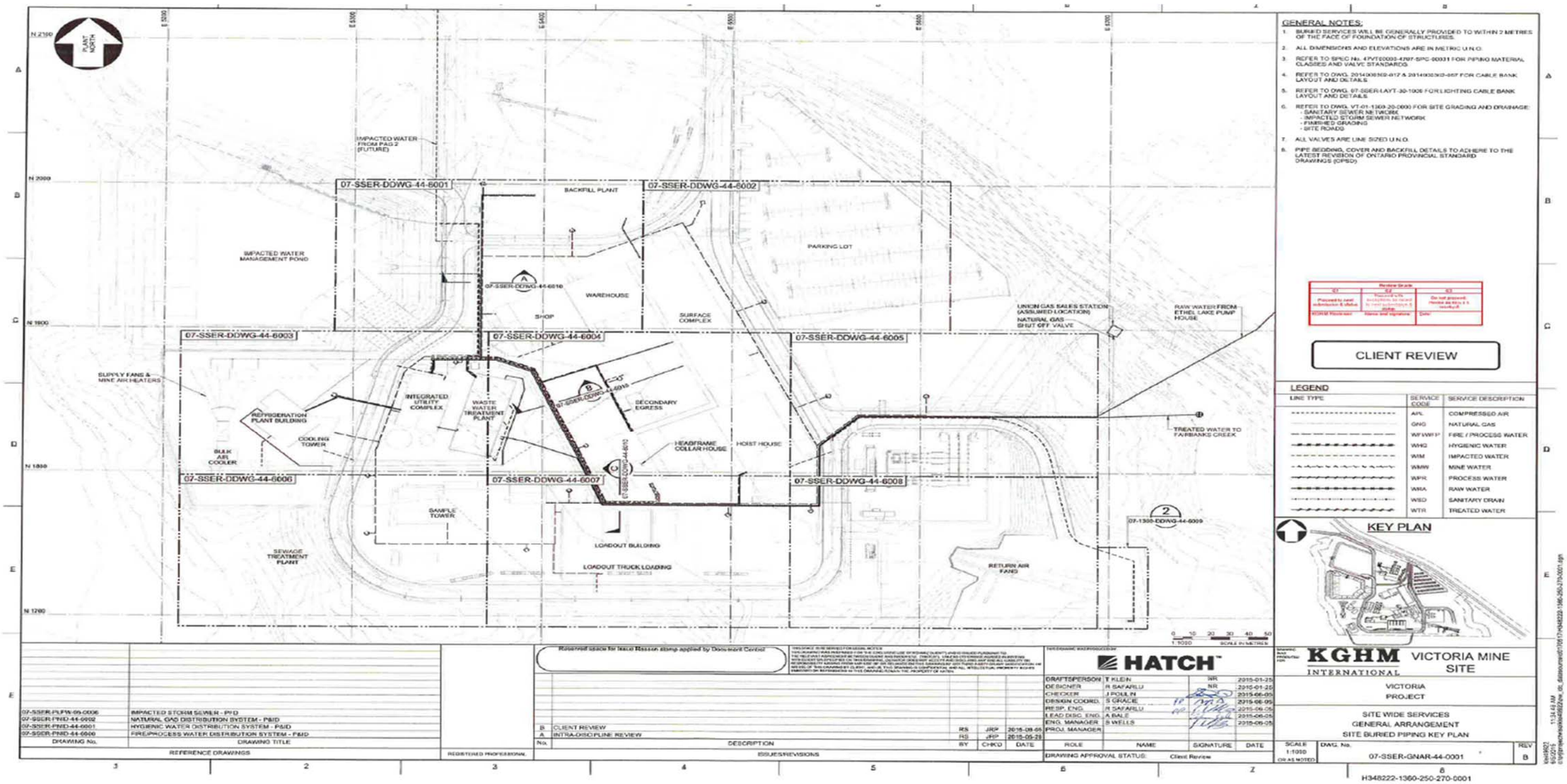

Figure 3-16: Buried Piping General Arrangement

3.1.8. Sewage Treatment and Disposal

The sewage treatment facilities on site are designed to accommodate up to 250 people working on site or 30 m^3 of waste per day. The sewage treatment system will process all sewage-related waste generated on site. The system will be approximately 4,000 m^2 in size and will consist of an equalization tank, septic tanks, effluent tank, biofilters, septic bed, and odour control units. The approximate footprint of the facility will be 30 metres by 20 metres. The system will not tie into the municipal sanitary sewage system operated and maintained by the City of Greater Sudbury. Sewage will be directed from washrooms and shower facilities on site to a passive septic system near the parking lot. It will then be pumped through a series of peat moss filters into a prepared subsurface tile bed.

The system described above will be supplied as a pre-engineered turn-key system and will be installed by either the vendor or a contractor. Installation is to be completed in a single stage.

3.1.8.1. Labour

FNX is committed to its core values which include zero harm; results driven; courageous; success through teamwork and accountability and managers will be empowered to provide leadership in alignment with these core values. A unionized and non-unionized environment will be supported during construction however, during operations; United Steelworkers Local 2020 will be the certified union.

Exploration and Advanced Exploration activities have been ongoing since 2010. The Project is currently staffed by a number of full-time employees of FNX, some secondment positions, and by a number of additional contractors currently providing services.

While the workforce will fluctuate over the course of construction, the total Project workforce will range from 252 to 437 over the life of mine. Management, supervision and technical staff positions are planned to a total of 70 employees. The maintenance crew varies from 66 to 98 people over the life of mine. The mine operations crew varies from 66 to 162 employees over the life of mine.

FNX supports employment equity practices, and has committed to employing qualified candidates from Indigenous communities in accordance with established Impacts and Benefit Agreements (IBA) s. In addition, FNX will develop a human resources plan to include strategies, policies and processes for (but not limited to):

- Employment, retention and advancement opportunities for qualified Indigenous community members;
- Training opportunities;
- Cultural awareness; and

- Workplace policies to support non-discrimination and diversity in the work place.

3.1.9. Procurement of Goods and Services

Project purchasing must be carried out ethically and professionally in the best interests of the Project, in compliance with applicable laws and without bias towards suppliers. The following conditions will be satisfied in conducting purchasing activities: compliance with the FNX policies; compliance with any arrangements between FNX and Indigenous Communities; compliance with Project criteria and specifications: within Project quality standards; within the Project budget; within the Project time schedule and within the framework of the Project systems.

The strategy for purchase of equipment and materials will include (but not be limited to) the following principles to ensure the best value for the Project is achieved:

- Use of local and global sourcing as well as utilizing the Victoria Advanced Exploration Project Impacts and Benefits Agreement already in place;
- Prequalification of bidders in those cases where a potential bidder's capabilities and performance are not already known;
- Purchase packages to receive competitive formal lump sum bidding with a maximum number of bidders per package;
- Provide justification for any equipment packages which are to be considered for single or sole sourcing; and
- Short list bidders as appropriate after receipt of proposals to minimize procurement cycle time and cost to the Project.

3.1.10. Alternatives to the Project

FNX views alternatives to the Project as different ways to achieve the same objective, which is producing metals for its customers. FNX has spread development risk amongst a group of projects that offer some potential for viable mine development. Potential risks to business development projects are constantly evaluated to ensure that capital can be optimized between projects to best meet overall objectives. Projects are constantly evaluated so as to ensure that when conditions arise that potentially impair the likelihood of success on one, the capital can be redirected to others to meet the objectives of customer demands. In addition to the Project, FNX S.A. has other mine Projects in various stages of business development including:

- The Ajax Mine Project in British Columbia; and
- The Deep Glogow Mine Project in Poland.

3.1.11. The "No Project" Alternative

If the Project does not proceed, the mineral resource will not be developed and the potential residual adverse environmental effects and the benefits described in this environmental effects analysis will not be realized.

3.1.12. Approach to Project Planning

FNX's overall approach to Project planning includes a practical respect for the precautionary principle in the scope and scale of the Project. The following aspects of the Project help protect the environmental, avoid or reduce pollution prevention and the creation of potential legacy issues. The Project is situated in the City of Greater Sudbury avoiding the need for:

- The mobilization of construction or operations work force or any associated camp facilities;
- A mill, as ore milling capacity exists within the City of Greater Sudbury to process ore;
- Site tailings storage, which often can result in long term monitoring and care and maintenance beyond closure;
- Smelting and refining facilities, as capacity exists within the City of Greater Sudbury to recover metals contained in mine product.

The underground mining methods will result in:

- A reduction and minimization of surface "footprint";
- Project related buildings (e.g., backfill plant, mine product handling) being able to fit within the area of disturbance resulting from past exploration activities;
- The need for ventilation as mitigation against unsafe working conditions; and
- Reduced and simplified decommissioning and abandonment needs.

3.1.12.1. Alternative Means of Carrying Out the Project

A variety of considerations where investigated with the purposes of bringing forward an acceptable Project and avoiding significant residual adverse environmental effects. Such alternatives included:

- Collecting and recycling of mine and site water to the extent practical to reduce demand on other sources rather than the continuous use of fresh water;
- Preferentially focus any surface water source needs on Ethel Lake as it is already considered an altered water body due to historic mining and water management activities in the area rather than create or affect another surface water body; and,
- Engineered impervious rock storage pads for mineralized (PAG) rock and assumes that all rock is PAG and fully considers developing a mine method (bulk stoping) that

can utilize mine rock for backfill for ground support. The manufacturing of backfill will use PAG rock thus PAG rock storage on site is considered temporary;

- Alternatives for excessive mineralized (PAG) rock storage or mine rock disposal until engineered pads are ready for site storage includes trucking to Vale properties for use in tailings area dam construction and water management.

3.2. The Effect of the Environment on the Project

Mining is a highly compatible and commonplace industrial activity within the City of Greater Sudbury and has been for more than a century. As such, the engineering design and environment, health and safety aspects of the Project have been factored into the Project. Key aspects include ground stability and seismic characteristics experienced in the region; the possibility of working in extremely cold weather conditions and the use of regional roads by other users.

3.3. Schedule

The overall Project schedule is provided in Table 3-2.

Table 3-2: Overall Project Schedule

Activity	Start Date	Finish Date
Exploration Activities	April 2008	December 2012
Indigenous Consultation for/During Advanced Exploration	November 2009	July 2024
Engineering for Advanced Exploration	March 2011	March 2012
Provincial Advanced Exploration	March 2012	October 2014
Advanced Exploration Phase	May 2013	July 2024
Basic Engineering for Mine Infrastructure	April 2014	December 2015
Federal Environmental Assessment (EA):		
Initial Submission of Project Description Report	April 2017	June 2017
Revised Submission of Project Description Report	May 2019	July 2019
Determination if a Formal EA is Required	July 2019	
Detailed Engineering for Mine Infrastructure	January 2017	July 2019
Indigenous Consultation for Mine Production	January 2016	January 2031
Provincial Permitting for Mine Production	January 2016	October 2023
Mine Construction	July 2024	

Activity	Start Date	Finish Date
Commercial Production	February 2031	
Indigenous Consultation during Life of Mine	February 2031	October 2042
Life of Mine	February 2031	October 2042
Indigenous Consultation during Mine Closure	October 2042	October 2045
Mine Closure	October 2042	October 2045

3.4. References

- City of Greater Sudbury. Undated. Fairbank Lake – Lake Water Quality Report Card. Available online at: https://www.greatersudbury.ca/living/lakes-facts/local-lake-descriptions/fairbank-lake/. Accessed on February 9, 2016.
- City of Greater Sudbury and MMM Group. 2015. Transportation Study Report – Draft. April 2015.
- Giblin, P.E., 1984. [Within FNX Mining Company Inc. 2013. FNX International Ltd. Victoria Project Operated By FNX Mining Company Inc.: Advanced Exploration Closure Plan. Part 1 of 2 - September 2013.] History of exploration and development, of geological studies and development of geological concepts. In The Geology and Ore Deposits of the Sudbury Structure (E.G. Pye, A.J. Naldrett & P.E. Giblin, eds.). Ontario Geological Survey Special Volume 1, pp3-24.
- KGHM International. 2014. Amendment to the Victoria Project Advances Exploration Closure Plan filed by MNDM on October 21, 2013. Addressed to Gordon MacKay, Director of Mine Rehabilitation. November 26, 2014.
- Lightfoot, P.C. & Farrow, C.E.G. 2002. [Within FNX Mining Company Inc. 2013. FNX International Ltd. Victoria Project Operated By FNX Mining Company Inc.: Advanced Exploration Closure Plan. Part 1 of 2 - September 2013.] Geology, geochemistry and mineralogy of the Worthington Offset dyke: towards a genetic model for Offset mineralization in the Sudbury Igneous Complex. In Economic Geology, 97: pp1419-1446.
- Morrison, G.G. 1984. [Within FNX Mining Company Inc. 2013. FNX International Ltd. Victoria Project Operated By FNX Mining Company Inc.: Advanced Exploration Closure Plan. Part 1 of 2 - September 2013.]Morphological Features of the Sudbury Structure in Relation to an Impact Origin. In The Geology and Ore Deposits of the Sudbury Structure (E.G. Pye, A.J. Naldrett & P.E. Giblin, eds.). Ontario Geological Survey Special Volume 1, pp513- 522.
- MR4 Traffic Volumes. 2014. City of Greater Sudbury's Open Data Portal, http://opendata.greatersudbury.ca. Naldrett, A.J., 1984. [Within FNX Mining Company

Inc. 2013. FNX International Ltd. Victoria Project Operated By FNX Mining Company Inc.: Advanced Exploration Closure Plan. Part 1 of 2 - September 2013.] Ni-Cu Ores of the Sudbury Igneous Complex – Introduction. The Geology and Ore Deposits of the Sudbury Structure (E.G. Pye, A.J. Naldrett & P.E. Giblin, eds.). In Ontario Geological Survey Special Volume 1, pp302-307.

- Souch, B.E., Podolsky, T. & Geological Staff, 1969. [Within FNX Mining Company Inc. 2013. FNX International Ltd. Victoria Project Operated By FNX Mining Company Inc.: Advanced Exploration Closure Plan. Part 1 of 2 - September 2013.] The sulphide ores of Sudbury: their particular relationship to a distinctive inclusion-bearing species of the Nickel Irruptive. In Magmatic Ore Deposits, a Symposium (H.D.B. Wilson, ed.). Economic Geology Monograph, 4, 366 p.
- Sudbury Trail Plan. Undated. Walden Sno Runners. Available online at: http://www.sudburytrailplan.on.ca/clubs/wsr.php. Accessed February 9, 2016.
- Unknown source. 2015. Design Criteria. Project ID: ISD14-33 Crean Hill Road And Fairbank East Road Improvements. February 2015.

Table of Contents – Chapter 4

4. Project-Environment Interactions 74

4. Project-Environment Interactions

FNX has a good understanding of the potential project-environment interactions associated with the Victoria Mine Project. This is as a result of the stage of engineering maturation (Basic Engineering level of study has a high degree of detail) and comprehensive understanding of a wide range of site environmental conditions and overall environmental, health and safety performance associated with exploration activities since 2002. The following key aspects of the Project enable FNX to have a high degree of certainty about its potential adverse environmental effects:

- The Project comprises the disturbance of a relatively small area (approximately 45 hectares). Although the Project area is not strictly a 'downtown' site, it is within the City of Greater Sudbury and occurring in the Sudbury Basin where many similar rock and mine product load-haul-dump mining operations exist or have occurred in the past to supply mine product to existing base metal mills and mineral smelting and refining facilities. The approximately 45 hectares area comprises the area of closely related activities contained within the exploration and advanced exploration closure plan boundaries. The Project will result in an increase of 14.2 hectares of the total area presently disturbed. The increase of 14.2 hectares represents the increase required by the following: Ethel Lake Flooded Area (2.5 ha), Ethel Lake Control Structure Road and Pumphouse Pad (3 ha), PAG 2 Pad and access road (8.7 ha);
- The planned activities associated with the Project are very similar to activities comprising exploration and advanced exploration including the load-haul-dump activities and including the hauling route to the Clarabelle Mill in Copper Cliff. FNX has been providing rock from the Project site to Vale for tailings dam construction (rock is available from FNX and thus reduces the need for new quarries). No material modifications are required to existing off-site facilities (including tailing storage facilities) for the purpose of receiving and processing ore (mine product) or waste rock from the proposed Victoria Mine Project. The key Project change will be in the frequency of truck hauling to Clarabelle Mill, however the City of Greater Sudbury has already upgraded the required roads to ensure a safe level of service to the public;
- Activities conducted to date at site have undergone a high level of environmental regulatory scrutiny through a range of environmental permits, authorizations and approvals. At this stage, no new permits are anticipated for the Project but rather renewals and amendments to existing permits. It is anticipated that all the environmental effects related to the Project can be adequately managed through existing legislation or regulatory processes should the *Canadian Environmental Assessment Act* not be applied to the Project; and
- FNX has developed and implemented a broad range of environmental management policies and practices to address the environment, health and safety needs of site activities associated with exploration and advanced exploration. Similar to

anticipated Project permits, authorizations and approvals the existing environmental management system elements already in place for site activities will likely only need to be modified as appropriate to meet the needs of the Project. New elements of a functional environmental management system for the project are not anticipated.

Table 4-1 provides and overview of the potential project-environment interactions that help provide context for the scoping of issues and the selection of Valued Components to focus the detailed environmental effects analysis.

Table 4-1: Victoria Mine Project: Potential Project-Environment Interactions and Permits

Table 4.1: FNX Victoria Mine Project: Potential Project - Environment Interactions and Permits

| | Exploration and Advanced Exploration | | | | | | | | | | | | | | | | | | | | | | | | Victoria Mine Project (the "Project") | | | | | | | | | | | | | | | | | | |

Table 4-2: FNX Victoria Mine Project - Potential Project-Environment Interactions and Sustainability Management

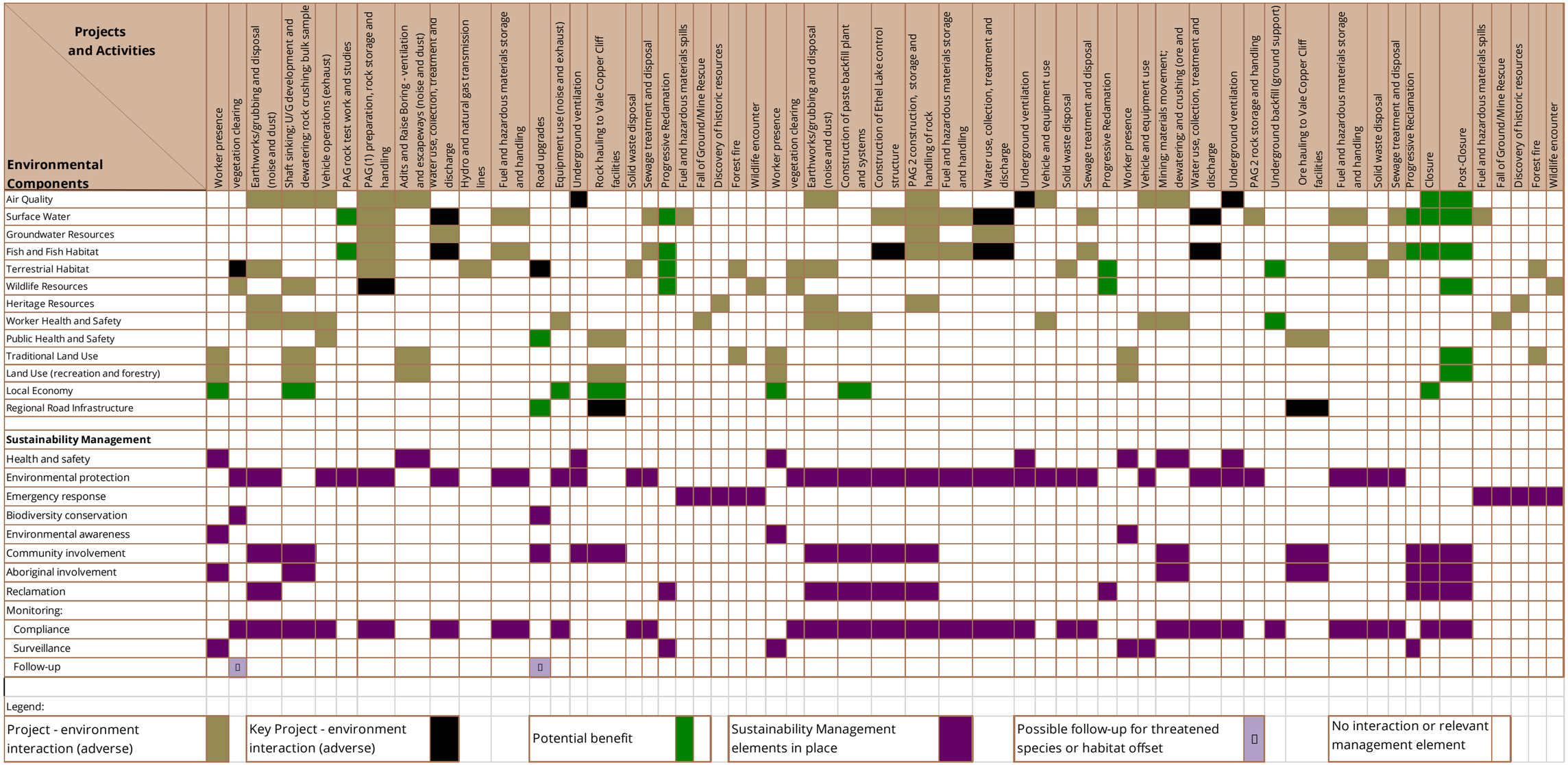

Table of Contents – Chapter 5

5. Sustainability Management 80

5.1. Purpose 80
5.1.1. Corporate Commitment 80
5.1.2. Relevant Policies 81
5.2. Approach to Energy Use and Greenhouse Gas Management 88
5.3. Approach to Biodiversity Conservation and Management 88
5.4. Engineering and Design 89
5.4.1. Key Environmental Permits, Authorizations and Approvals 90
5.5. Elements of FNX's Approach to Sustainability Performance 93
5.6. Health and Safety 95
5.6.1. Purpose 95
5.6.2. Content 95
5.6.3. Implementation 95
5.7. Environmental Protection 95
5.7.1. Purpose 95
5.7.2. Content 96
5.7.3. Implementation 96
5.8. Emergency Response 96
5.8.1. Purpose 96
5.8.2. Content 97
5.8.3. Implementation 97
5.9. Biodiversity Conservation 97
5.9.1. Purpose 97
5.9.2. Content 97
5.9.3. Implementation 98
5.10. Environmental Awareness 98
5.10.1. Purpose 98
5.10.2. Content 98
5.10.3. Implementation 98
5.11. Community Involvement 98
5.11.1. Purpose 98
5.11.2. Content 98
5.11.3. Implementation 99
5.12. Indigenous Involvement 99
5.12.1. Purpose 99
5.12.2. Content 99
5.12.3. Implementation 99
5.13. Reclamation 99
5.13.1. Purpose 99
5.13.2. Content 100
5.13.3. Implementation 101

5.14. Monitoring 101
5.14.1. Purpose 101
5.14.2. Content 101
5.14.3. Implementation 102
5.15. Continuous Improvement 102
5.15.1. Purpose 102
5.15.2. Content 103
5.15.3. Implementation 103
5.16. Project-Specific Sustainability Management Needs 103

5. Sustainability Management

5.1. Purpose

FNX recognizes the importance of sustainability management and planning in the promotion of sustainable development and in the maintenance of a healthy environment, safe workplace, and strong economy. Sustainability management and planning is the principal mechanism by which FNX will integrate design and engineering with the overall goal of protecting the environment, preventing pollution and maintaining ecosystem function and integrity. Environmental assessment is a key component of good sustainability management. Contemporary practice environmental assessment ensures environmental assessment is considered as early in the Project planning process as possible. FNX has a good understanding of environmental assessment and its integration into Project planning through:

- Overall discipline and governance though its project delivery system. Integration of engineering design and environment planning throughout the engineering maturation process;
- Hazard and risk analysis, including environmental aspects and potential environmental effects;
- Involvement of technical experts, including independent subject matter experts in environmental planning for major capital projects;
- Close working relationships with community and Indigenous groups, regulators and resource managers and stakeholders; and
- A good understanding of the legislation and regulations pertaining to project planning and execution.

FNX is fully committed to continually improve its sustainability performance through the development and modification of this management system over the life of the Project.

5.1.1. Corporate Commitment

FNX is fully committed to the implementation of its sustainability planning by having clear goals that will enable FNX to meet its corporate commitments to environmental protection and pollution prevention, providing a safe and health work environment, community and social responsibility. FNX strives to:

- To improve its safety performance for all those connected with its operations (employees, members of the community, customers and contractors);
- Continue to improve its ability to satisfy and fully meet commitments and obligations to customers, owners, employees, government regulatory agencies and members of the community;

- Conduct its operations with awareness and appreciation for environmental, health, and safety matters, and always seek to comply with all regulatory requirements;
- Provide systems so that all employees know their responsibilities, have the appropriate resources to perform their assignments, have the authority to get the job done, and are prepared and able to meet their responsibilities successfully; and
- Empower management with responsibilities that include the areas of environment, health and safety performance.

5.1.2. Relevant Policies

FNX has several policies in place that address various aspects of the notion of sustainable development. FNX subscribes to the Mining Association of Canada (MAC) policy that also promotes the consistent integration of environmental considerations with each of its member company's project planning and operations. FNX also approaches its sustainability planning framework with key aspects of general environmental management including: leadership and commitment; planning; implementation and monitoring; and, assessment and improvement.

Relevant FNX policies, in no particular order, include:

- Environmental Policy (Figure 5-1);
- Social Responsibility Policy (Figure 5-2);
- Health and Safety Policy (Figure 5-3); and
- Community Policy (Figure 5-4).

Environmental Policy

KGHM International believes that environmental protection for the natural environment is fundamental to the success of our operations and projects. Emphasizing our core value of "Zero Harm", we will use environmental and natural resource management tools and practices to minimize environmental risk during the evaluation, exploration, planning, design, operation and closure phases of new and existing projects.

KGHM International line management is accountable for providing environmental leadership by measuring performance against recognized industry standards and communicating commitments and results to employees, contractors, local communities, regulators, and the general public. Environmental professionals and committees will support the drive to "Zero Harm" to create workplaces where everyone personally commits to a culture of environmental protection.

In fulfilling our commitment to "Zero Harm" KGHM International will:

- Develop, implement and regularly evaluate environmental management systems to continually improve performance, consistent with defined objectives and targets;
- Prevent and minimize environmental impacts;
- Respond to public inquiries regarding environmental matters in an open and forthright manner; and,
- Meet or exceed all environmental laws and regulations and other requirements to which we subscribe.

Our Approach to Energy Use and Greenhouse Gas Management

KGHM International recognizes that energy management is fundamental to the success of our projects and operations and sustainable development. We will secure energy sources and will promote effective management of energy consumption and greenhouse gas (GHG) emissions to continuously improve energy efficiency and reduce our environmental impact.

KGHM International line management is accountable for providing leadership in responsible energy management. We will encourage our employees to continually improve energy efficiency. We will assure energy security of our operations and projects and support the implementation of leading practices at our operations.

Based on the principle of materiality KGHM International is committed to:

- Develop and implement energy management systems;
- Provide education and training to key employees about energy and GHG emissions management to develop energy awareness and enhance their ability to analyze consumption and recognize opportunities;
- Continuously improve energy efficiency by setting targets, aligning actions and measuring performance;
- Secure sustainable energy sources; and,
- Continuously engage with our stakeholders and regularly report on energy management performance and GHG emissions.

KGHM International Environmental Policy

Page 3

Our Approach to Biodiversity Conservation and Management

KGHM International recognizes that biodiversity conservation is a fundamental aspect of the principle of sustainable development and corporate social responsibility. Biodiversity reflects the richness of biological variation of species and communities. Accordingly, this policy sets forth KGHM International's commitment to the consideration of biodiversity conservation and management through all stages of the mining life cycle, as it relates to its projects and operations.

Based on the principle of materiality, KGHM International is committed to:

- Assess and monitor the state of relevant biodiversity through all stages of the mining life cycle;
- Use appropriate environmental assessment methods and practices to identify, assess and monitor potential impacts/risks to biodiversity;
- Identify and implement appropriate practices and procedures to avoid or reduce such potential impacts or risks to biodiversity;
- Integrate the principles of biodiversity conservation into its environmental management systems, including avoiding, minimizing, and mitigating significant adverse biodiversity effects;
- Engage with key communities of interest to address biodiversity issues through research, science and information sharing and public reporting;
- Demonstrate respect and comply with requirements of legally designated protected areas to ensure the protection and preservation of biodiversity;
- Review on a regular basis, with KGHM International's senior management, company performance with respect to biodiversity conservation and integrate biodiversity conservation management into core business planning and budgeting; and,
- Conduct appropriate reclamation throughout the mining life cycle to return mine sites to diverse and viable ecosystems that will serve the need of post-mining land-use.

KGHM International Environmental Policy Page 4

Figure 5-1: KGHM Environmental Policy

KGHM

Social Responsibility Policy

KGHM International believes in Success from Teamwork and that, by any definition, comes from working together with employees, contractors, local and indigenous people, and other stakeholders in the communities in which we operate.

We understand social responsibility as being accountable for the impacts of our decisions and activities on society and the environment, through transparent and ethical behaviour that contributes to sustainable development. We are committed to governing our business as a natural resource developer to this understanding.

In fulfilling these commitments, KGHM International will:

- Recognize the impacts, and respect the interests and expectations of society on our activities.
- Respect the rule of law and conduct our business with honesty, integrity, and fairness.
- Develop and implement policies and procedures to address: corporate governance, human rights, labour practices, including health & safety, environmental protection, and community involvement and development, in all aspects of our business and supply chain.
- Report our performance according to applicable standards.

Figure 5-2: KGHM Social Responsibility Policy

KGHM

Health and Safety Policy

The best mines are the safest mines and the safest mines are the best mines

KGHM International believes that the best mines are the safest mines and holds "Zero Harm" as a core value. We are committed to "Zero Harm" for our employees, our contractors and our local communities.

KGHM International line management is accountable for providing safety leadership through comprehensive systems of loss control, risk assessment and high energy engagement with employees. Safety professionals and committees will support the drive to "Zero Harm" to create workplaces where everyone personally commits to a culture of safe behavior.

KGHM International will hold each employee accountable for the choices they make and the actions they take towards reaching our goal of "Zero Harm".

In fulfilling our commitment to "Zero Harm" we will:

- "Show the World" by embracing a health and safety culture and measuring our actions for everyone to see.
- Continually improve our health and safety performance by setting objectives and monitoring our performance results.
- Utilize risk assessment techniques to identify hazards and implement controls to mitigate them so as to prevent injury and ill health.
- Meet or exceed all health and safety legislation.

Figure 5-3: KGHM Health and Safety Policy

KGHM

Community Policy

KGHM International recognizes itself as part of the communities in which we operate. Our success is dependent upon working in partnership with our employees, contractors, local and indigenous communities, and other stakeholders to support the exchange of our experiences, resources, and efforts. Building upon our core values of "Zero Harm" and "Success Through Team Work", we will consider a broad range of social, cultural and economic factors during all our activities.

KGHM International line management is accountable for providing leadership in supporting community engagement, development and wellbeing. Our performance will be measured against applicable standards. We will encourage employees to contribute to and be involved with local programs for the betterment of their communities, and communicate corporate commitments and results to all relevant stakeholders.

In fulfilling our commitment to people and communities, KGHM International will:

- Listen and respond to the needs of local communities and other affected parties.
- Build relationships and trust by engaging in objective, open and honest dialogue.
- Engage indigenous communities and respect their cultural knowledge and heritage.
- Support local initiatives that contribute to the sustainable development of society.

Figure 5-4: KGHM Community Policy

5.2. Approach to Energy Use and Greenhouse Gas Management

KGHM International recognizes that energy management is fundamental to the success of our projects and operations and sustainable development. We will secure energy sources and will promote effective management of energy consumption and greenhouse gas (GHG) emissions to continuously improve energy efficiency and reduce our environmental impact.

KGHM International line management is accountable for providing leadership in responsible energy management. We will encourage our employees to continually improve energy efficiency. We will assure energy security of our operations and projects and support the implementation of leading practices at our operations.

Based on the principle of materiality KGHM International is committed to:

- Develop and implement energy management systems;
- Provide education and training to key employees about energy and GHG emissions management to develop energy awareness and enhance their ability to analyze consumption and recognize opportunities;
- Continuously improve energy efficiency by setting targets, aligning actions and measuring performance;
- Secure sustainable energy sources; and
- Continuously engage with our stakeholders and regularly report on energy management performance and GHG emissions.

5.3. Approach to Biodiversity Conservation and Management

KGHM International recognizes that biodiversity conservation is a fundamental aspect of the principle of sustainable development and corporate social responsibility. Biodiversity reflects the richness of biological variation of species and communities. Accordingly, this policy sets forth KGHM International's commitment to the consideration of biodiversity conservation and management through all stages of the mining life cycle, as it relates to its projects and operations.

Based on the principle of materiality, KGHM International is committed to:

- Assess and monitor the state of relevant biodiversity through all stages of the mining life cycle;
- Use appropriate environmental assessment methods and practices to identify, assess and monitor potential impacts/risks to biodiversity;
- Identify and implement appropriate practices and procedures to avoid or reduce such potential impacts or risks to biodiversity;

- Integrate the principles of biodiversity conservation into its environmental management systems, including avoiding, minimizing, and mitigating significant adverse biodiversity effects;
- Engage with key communities of interest to address biodiversity issues through research, science and information sharing and public reporting;
- Demonstrate respect and comply with requirements of legally designated protected areas to ensure the protection and preservation of biodiversity;
- Review on a regular basis, with KGHM International's senior management, company performance with respect to biodiversity conservation and integrate biodiversity conservation management into core business planning and budgeting; and
- Conduct appropriate reclamation throughout the mining life cycle to return mine sites to diverse and viable ecosystems that will serve the need of post-mining land-use.

5.4. Engineering and Design

The scope of activities associated with the Project is highly similar to the activities conducted since 2002 during the exploration and advanced exploration phases. Many of the key engineering design features to reduce potential adverse environmental effects to acceptable levels for the Project are, for all intents and purposes, currently designed into the exploration and advanced exploration facilities at site or are part of the Project as a result of the similarities. Key elements of the integration of environmental considerations into site engineering and design to date include:

- Early engagement with Indigenous groups, regulators, resource managers, the public and stakeholders to help establish effective communications and identify key issues that can help bring forward a better project;
- Interconnection with grid electrical power and natural gas transmission pipelines to reduce the quantities of fuels stored on site and reduce atmospheric emissions;
- Rock and ore crushing in covered buildings to reduce noise and dust emissions;
- Mineralized (PAG) rock stored on engineered pads to prevent drainage to subsurface. PAG 1 and PAG 2 rock storage is temporary and will be consumed over the life of the Project in the underground backfill manufacturing process;
- Nearby public roads evaluated and upgraded to meet required level of service and safety requirements for Project vehicles and other public users;
- Mine method (underground mining) and the arrangement of facilities minimizes overall Project footprint (less than 25 hectares) to reduce landscape alterations; and
- Use of baseline studies to site facilities to avoid sensitive areas.

5.4.1. Key Environmental Permits, Authorizations and Approvals

The Project largely comprises activities that are very similar to the range of activities at site conducted for more than a decade. The activities at site associated with exploration activities have undergone a high degree of regulatory scrutiny. As a result, FNX has a good understanding of the expectations of the Project permitting requirements and such requirements are heavily weighted factors in helping design an acceptable Project. FNX strives to meet or exceed the requirements set by legislation and regulations. The permitting of site activities, including those by other proponents (Hydro One, Union Gas and the City of Greater Sudbury) for closure, atmospheric emissions, water management (withdrawal, use, treatment and discharge), and waste management results in a high degree of certainty associated with expected Project permitting needs. A list of permits, authorizations and approvals anticipated for the Project is provided in Table 5-1. The Species At Risk (SAR) Permit number SU-C-001-12 (May 2012) under Clause 17(2) of the *Endangered Species Act (ESA) 2007* is included in Table 5-1 as it is valid for the life of the Project and will apply to activities associated with the producing mine.

Table 5-1: Victoria Mine Project - Key Permits, Authorizations and Approvals Anticipated for the Project

Authorization or Permit	Responsible Ministry	Applicable Act/Regulation	Associated Facility, Infrastructure or Activities	Target Date to Obtain Approval
Mine Production Closure Plan	Ministry of Northern Development and Mines (Provincial)	*Mining Act, R.S.O. 1990 c.M.14, 0. Regulation 240/00 – Mine Development and Closure* Under Part VII of the Act	Lateral underground development, PAG 2, Ethel Lake, backfill plant, construction of main shaft including hoist house and headframe, all additional permanent surface infrastructure to support mine production.	January 2022
Environmental Compliance Approval for Industrial Sewage - Amendment	Ministry of the Environment and Climate Change (Provincial)	*Environmental Protection Act, R.S.O. 1990*, Section 20.2 of Part II. 1	Amendment required for any additional regulated infrastructure, (Ethel Lake, PAG 2) that is not currently approved for advanced exploration.	September 2022
Environmental Compliance Approval for Air - Amendment	Ministry of the Environment and Climate Change (Provincial)	*Environmental Protection Act, R.S.O. 1990*, Section 20.2 of Part II. 1	Amendment for production and update emission sources and rates to ensure air shed boundary sufficient.	September 2022

Authorization or Permit	Responsible Ministry	Applicable Act/Regulation	Associated Facility, Infrastructure or Activities	Target Date to Obtain Approval
Permit to Take Water	Ministry of the Environment and Climate Change (Provincial)	*Ontario Water Resources Act, R.S.O. 1990*, Section 34.1	Required for Ethel Lake water taking.	September 2023
Work Permit	Ministry of Natural Resources (Provincial)	*Lakes and Rivers Improvement Act, R.S.O. 1990, c.L.3*	Required for construction of Ethel Lake water control structure.	September 2023
17(2)(c) Permit	Ministry of Natural Resources (Provincial)	*Endangered Species Act, 2007*	Disturbance of Whip-poor-will habitat	Obtained in 2012
Shoreline Alteration/Development Permit	Conservation Sudbury [Nickel District Conservation Authority] (Municipal)	*Conservation Authorities Act, R.S.O. 1990, c. C.27, Section 28, Ontario Regulation 156/06 Nickel District Conservation Authority; Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses*	Required prior to construction of Ethel Lake water control structure and pumphouse.	October 2023

5.5. Elements of FNX's Approach to Sustainability Performance

FNX is preparing an approach to sustainability planning for the Project based on the range of sustainability elements already in place as a result of its ongoing exploration activities. Sustainability planning involves several distinct, but closely related, plans and programs to manage the community expectations for environment, health and safety performance. Figure 5-5 shows the relationship of environmental assessment and Project design in the planning stage to the expected components of a sustainability planning system for the implementation stage of the Project. The system is designed to be flexible and dynamic in nature to meet the changing needs of the Project.

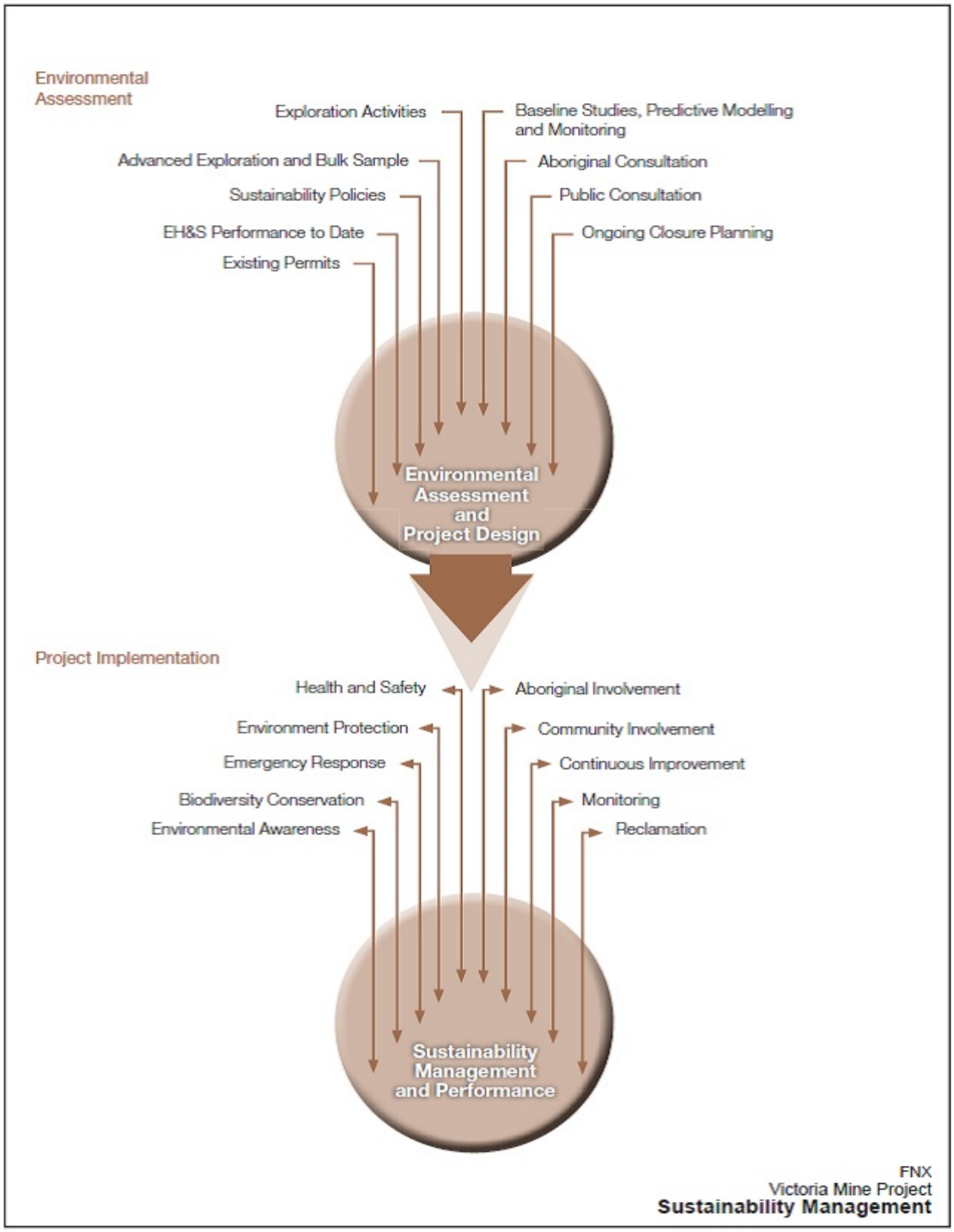

Figure 5-5: Sustainability Management

5.6. Health and Safety

5.6.1. Purpose

FNX Victoria site has been an active exploration and construction site for more than a decade and has had daily labour force number up to peaks of 250 people working on site, conducting both surface and underground activities. FNX has a health and safety plan in place for its exploration and advanced exploration activities, including hauling ore off site to Copper Cliff. Health and safety planning at FNX, as a minimum, meets the requirements of the *Ontario Occupational Health and Safety A*ct (and *Regulation 854 – Mines and Mining Plants*). The Project health and safety plan will be revised as necessary to meet the needs of the Project to ensure all workers have a healthy and safe workplace.

5.6.2. Content

Safety is the top priority for FNX. Employee involvement, good safety practices, compliance with regulatory requirements, continuous safety awareness, and risk management are integral components of FNX's approach to health and safety performance for its current site activities and planned Project activities. FNX currently has safety procedures and practices in place for exploration activities. These include safety orientation and training, health and safety committees, and emergency response and contingency plans. Employees, contractors, and visitors are required to comply with site and Project health and safety requirements.

FNX accepts its responsibilities to all employees, contractors, and visitors to provide safe operations, conditions, premises, equipment, and systems. In return, FNX expects all employees, contractors, and visitors to conduct their work in a skillful, safe, and competent manner and exercise reasonable care with respect to themselves, fellow workers, and the environment. Before arrival on site, FNX employees are given a pre-placement medical examination to ensure they will be able to perform all aspects of their work without undue stress on their mental or physical health.

5.6.3. Implementation

Health and safety planning will continue to be phased in over the life of the Project to meet the needs of the Project and the relevant health and safety legislation and regulations.

5.7. Environmental Protection

5.7.1. Purpose

Environmental protection practices are an important component of the Project. Environmental protection practices have been developed for current site activities as the exploration site is considered a mature site, since FNX has been active there for more than a decade. Environment protection practices are developed based on a good

understanding of site conditions and knowledge learned is used by FNX for the following purposes:

- Identify environmental concerns and develop appropriate protection measures, including avoiding sensitive areas, for these concerns in terms of planning activities;
- Provide concise and clear expectations to site environmental monitors and inspectors as well as site development personnel on instructions for procedures that protect the environment and prevent pollution;
- Provide a reference document for personnel when planning and/or conducting specific activities;
- Communicate changes in the program through revision process as new information becomes available;
- Provide feedback on the effectiveness of mitigation measures; and
- Provide a reference to applicable legislative requirements.

5.7.2. Content

FNX has developed and implemented environmental protection practices, which include specific procedures for activities such as clearing of vegetation, handling of fuel and hazardous materials, solid waste disposal, erosion prevention, waste management (including waste rock) and dust/emissions control.

Environmental protection measures developed and implements to date on site for exploration activities will be modified as appropriate to ensure a high level of environmental performance during project development. The development of successful environmental protection practices typically reflects conditions of clauses in permits, authorizations and approvals, as well as pertinent expectations identified in the feedback from information sharing with Indigenous groups, the public and stakeholders.

5.7.3. Implementation

At this point, FNX is in the early stages (basic engineering) of Project design. Similarly, construction methodology for the project has not been fully defined. FNX will continually review and revise its existing environmental protection practices over the life of the Project and makes adjustments as necessary.

5.8. Emergency Response

5.8.1. Purpose

Emergency response and contingency measures are currently in place to address possible accidents, malfunctions and unplanned events during exploration activities. Since the Project is so similar in many ways to ongoing exploration, the scope and effectiveness of existing emergency response and contingency plans is already in an

advanced stage and expected to meet the needs of the Project. Emergency response and contingency plans do not prevent accidents, but rather mitigate the potential magnitude of accidents and malfunctions.

5.8.2. Content

Emergency response and contingency plans contain specific procedures for these events when they occur. Emergency response and contingency plans will be developed for:

- Spills of fuels and other hazardous material spills;
- Wildlife encounters, including the discovery of new information on species with special conservation status over the life of the Project;
- Fires (underground, surface and forest);
- Medical emergencies and severe weather conditions (cold climate hazards for workers);
- Utilities failures
- Falls of ground and mine rescue; and
- The discovery of historic resources (chance encounters).

FNX ensures workers are appropriately trained for responding to emergency and contingent situations and resources are in place to adequately respond to such conditions.

5.8.3. Implementation

FNX will ensure its emergency response and contingency plans are modified as appropriate to meet the needs of the Project.

5.9. Biodiversity Conservation

5.9.1. Purpose

FNX's has completed a biodiversity conservation management plan that meets MAC's Towards Sustainable Management (TSM) guidelines. A good understanding of biodiversity in the area provides a good basis for effective environmental protection and monitoring as well as helping contribute to the FNX set environmental management priorities.

5.9.2. Content

FNX's biodiversity plan will help bring together much of the biological data that was collected on site over the exploration period to support project planning, permitting and addressing any special needs associated with species or populations with special conservations status. The biodiversity plan follows MAC TSM guidance.

5.9.3. Implementation

The biodiversity plan will be reviewed and adjusted as necessary to reflect site conditions over the life of the Project.

5.10. Environmental Awareness

5.10.1. Purpose

FNX provides environmental awareness and site orientations for all site workers, contactors, sub-contractors and visitors. Awareness of environmental concerns and issues are an important part of FNX's approach to setting high expectations regarding environmental performance in its activities and Projects.

5.10.2. Content

The Project environmental awareness program will largely be a continuation of general environmental awareness conducted on site for ongoing exploration activities during exploration. Environmental awareness will be comprehensive and adjusted as appropriate for key work areas or Project responsibilities. Adjustments or modifications to the content of the training may occur as a result of specific work areas or job actions or the improvement to site environmental information, particularly with respect to cultural awareness and sensitivity training, the locations of heritage or archaeological resources and wildlife and plant species with special conservations status.

5.10.3. Implementation

The content of general environmental awareness training for employees, contractors, sub-contractors and visitors will be reviewed and adjusted as required over the life of the Project.

5.11. Community Involvement

5.11.1. Purpose

FNX has been actively involved with local communities, stakeholders as well as regulators and resource managers for more than a decade as a result of its early exploration activities. Community involvement is integral to notions around corporate social responsibility and overall sustainability performance.

5.11.2. Content

FNX anticipates it efforts at community involvement for the Project, which have been established and developed throughout exploration, will be at a mature stage and focus on:

- Employment and business opportunities;
- Procurement of goods and services;

- Information sharing regarding key Project activities and processes in the spirit of a citizen's right to know; and
- Environment, health and safety performance, including regular updates on key emissions and effluents.

5.11.3. Implementation

The majority of FNX's community involvement for the Project will be a continuation of community liaison committee work established early in site exploration.

5.12. Indigenous Involvement

5.12.1. Purpose

FNX understands the importance of environmental issues and respectful resource development expectation by Indigenous groups associated with the Victoria site. FNX is committed to respectful, confidential information sharing and consultation with the Atikameksheng Anishnawbek First Nation, Sagamok First Nation, and Métis Nation of Ontario (Region 5). While the specific details of various negotiations are proprietary in nature, general aspects serve to improve environmental protection and overall sustainability performance for site exploration activities and will benefit any future Project development.

5.12.2. Content

Indigenous involvement embraces a wide set of potential topics ranging from identifying key issues that are of concern so, to the extent practical, a better Project can be brought forward.

5.12.3. Implementation

Indigenous groups associated with FNX exploration activities over the past several years will continue to be engaged on sustainability planning matters over the life of the Project.

5.13. Reclamation

5.13.1. Purpose

FNX is committed to the notions of planning for closure and implementing progressive reclamation of abandoned areas during construction and operations, as during conditions of temporary closure, decommissioning, and at closure. Reclamation will form an integral part of the mine plan and will be ongoing during the life of the Project. Progressive reclamation will provide the opportunity to reduce the extent of disturbed land over the life of the Project's operation.

The objectives of the site reclamation are:

- To protect public health and safety by using safe and responsible reclamation practices;
- To reduce or eliminate adverse environmental effects once the mine ceases operations;
- To re-establish conditions which permit the land to return to a similar pre-mining land use; and
- To reduce the need for long-term monitoring and maintenance by establishing effective physical and chemical stability of disturbed areas.

5.13.2. Content

Reclamation is contained in FNX's Advanced Exploration Closure Plan as required by *Ontario Mining Act* (*Reg. 240*), and the Closure Plan for mine production is in preparation. Reclamation planning will describe the procedures to restore disturbed areas to a safe and environmentally stable condition. Reclamation plans will comply with conditions of permits and authorizations and FNX policies, guidelines, and standards.

The following reclamation principles have been established for the project in order to guide the overall reclamation plan:

- Plan and implement project reclamation in compliance with all applicable legislation;
- Apply cost-effective and appropriate reclamation practices to reduce environmental risks and allow for traditional use of the land;
- Establish an internal corporate reporting and monitoring system, that verifies whether reclamation plans and practices have been appropriately implemented;
- Conduct environmental studies to predict post-closure environmental effects and monitor environmental effects during the project operating period; thus sound technical and scientific knowledge is gathered for implementation of the reclamation plan;
- Maintain a program of progressive reclamation as an integral part of project operations;
- Regularly update the reclamation plan to remain current with evolving and new reclamation methods and procedures;
- Discuss reclamation with government officials, company employees and local communities;
- Control leaching of metals, and sedimentation from erosion and runoff after closure, in a way which meets applicable water quality requirements;
- Use appropriate handling, removal and disposal of any fuel, chemicals and other hazardous materials on site, including appropriate clean-up of any areas affected by these materials; and

- Reclaim any surface disturbance and surface and groundwater related effects.

For each project component, reclamation plans will address potential environmental effects, the final end use of the land and the long term physical and chemical stability of the reclaimed component.

5.13.3. Implementation

The reclamation planning will be formulated into a mine production Closure Plan prior to the start of construction.

5.14. Monitoring

5.14.1. Purpose

FNX has established monitoring programs as part of its approach to sustainability planning to help measure overall environmental performance of site activities and processes. Findings from the range of monitoring activities provides direct feedback into the effectiveness of engineering design elements (such as drainage collection and water treatment processes, noise and dust emissions etc.) and the effectiveness of environmental protection procedures and adherence to conditions of permits, authorizations and approvals. Aspects of the monitoring program are designed to improve awareness regarding potential changes in environmental baseline conditions or changes in legislation and regulations regarding biodiversity conservation, and then manage change appropriately.

5.14.2. Content

Monitoring includes specific programs developed by FNX to comply with acts, regulations, permits, and corporate commitments. Monitoring can be further defined as those activities undertaken by the proponent to demonstrate that the Project operates within specific limits of environmental performance. Adherence to the conditions and clauses contained in permits is referred to as compliance monitoring. Another aspect of monitoring by FNX is called surveillance monitoring. For example, over the life of the Project, FNX will be vigilant regarding any new species occurring in the area that have special conservation status or any species that has its conservation status changed over the life of the Project.

A follow-up program as defined in the *Canadian Environmental Assessment Act*, means a program for (a) verifying the accuracy of the environmental assessment of a project and (b) determining the effectiveness of any measures taken to mitigate the adverse environmental effects of the project. FNX does not anticipate any follow-up being required for verifying its predictions of residual adverse environmental effects in this assessment. This largely is a result of the similarity of Project activities to past and present exploration activities, the routine nature of those activities and the proven

effectiveness of mitigation measures. Follow-up may be required for special mitigation such as compensation (e.g., Eastern Whip-poor-will habitat).

The results of monitoring will be used to improve the understanding of environmental cause-and-effect relationships and to provide an early warning of undesirable change in the environment.

5.14.3. Implementation

Monitoring programs currently in place for exploration will be modified as appropriate over the life of the Project to meet the needs of the Project.

5.15. Continuous Improvement

5.15.1. Purpose

FNX is committed to reviewing and continually improving its sustainability performance, with the objective of establishing and maintaining respectful working relationships with Indigenous groups, the public and stakeholders as well as site environment, health and safety performance. Sustainability planning is seen as an organizing framework that needs to be continually monitored and periodically reviewed to provide direction for response to changing internal and external factors. Continuous improvement will be used to review, assess and improve sustainability performance.

The objectives for continuous improvement include:

- To evaluate the conformance and effectiveness of procedures, guidelines and training in meeting with overall sustainability policies and performance;
- To ensure conformance with government legislation and management policies;
- To evaluate performance objectives and targets;
- To evaluate the ability of the internal management review process to sustain effectiveness of sustainability performance;
- To optimize environment, health and safety management and cost relationships;
- To evaluate environment, health and safety management programs;
- To identify environment, health and safety system weaknesses and areas for improvement;
- To provide information to support appropriate changes and accelerate the process of continual improvement;
- To promote understanding between parties, both internal and external; and
- To continually improve EH&S performance.

5.15.2. Content

Continuous improvement for the Project will provide mechanisms for checking sustainability performance and corrective action such as:

- Monitoring and measurement;
- Non-conformance reporting;
- Corrective action plans;
- Record keeping and documentation control; and
- Environment, health and safety system audits.

5.15.3. Implementation

Auditing is an ongoing function of FNX's exploration activities. Both formal and informal audits of sustainability performance will be conducted over the life of the Project.

5.16. Project-Specific Sustainability Management Needs

Specific environmental design and management needs for each Valued Component have been evaluated based on the key predicted residual adverse environmental effects from Chapters 9 through 17 in this environmental effects analysis. This evaluation helps ensure that the scope of plans and programs supporting FNX's approach to sustainability management meets the needs of the Project based on the detailed environmental effects analysis in each VC. Table 5-2 through Table 5-10 provide the specific engineering design and sustainability management needs for each VC. Refer to Table 5-1 in Section 5.4.1 – Key Environmental Permits, Authorizations and Approvals, for a list of the key environmental permits, authorizations and approvals anticipated for the Project.

Table 5-2: Victoria Mine Project – Engineering Design and Sustainability Management Aspects Addressing Key Concerns[1]– Atmospheric Environment

Design and Management Features	Increased Noise	Reduced Air Quality
Engineering Design	• Underground blasting; • Crusher facilities enclosed in buildings.	• Predictive modelling used to check siting of facilities and nearest neighbours; • Grid power reduces fuel consumption; • Crusher facilities enclosed in buildings.
Health and Safety	• Health and safety plan to comply with OHSA.	• Health and safety plan to comply with OHSA.
Environmental Protection	• Inspection and maintenance of all vehicle, fans, motors and pumps to OEM specifications; • Blasting procedures; • Vehicle speeds to follow road restrictions; • Minimize vegetation removal; • Maintain buffer zones of natural vegetation.	• Dust control measures (e.g., paving, dust suppression, truck washing) vehicle speed restrictions.
Emergency Response	• Workspace evacuation procedures.	• Workspace evacuation procedures.
Environmental Awareness	• Job hazard analysis and safe work practices for workers.	• Job hazard analysis and safe work practices for workers.
Community Involvement	• Information sharing on Project activities and processes; • Project telephone "hot line" access for complaints by the public.	• Information sharing on Project activities and processes; • Project telephone "hot line" access for complaints by the public.
Indigenous Involvement	• Information sharing on Project activities and processes; • Project telephone access for complaints by the public.	• Information sharing on Project activities and processes; • Project telephone "hot line" access for complaints by the public.
Reclamation		• Progressive reclamation reduces areas prone to wind erosion and dusting.
Monitoring	• Adherence to conditions and clauses in MOECC air, noise and vibration ECA; • Inspections of work areas by MOL.	• Adherence to conditions and clauses in MOECC air, noise and vibration ECA; • Inspections of work areas by MOL.
Continuous Improvement	• Audit and corrective actions.	• Audit and corrective actions.

[1] Concerns identified as a result of the environmental effects analysis in Chapter 9 - Atmospheric Environment.

Table 5-3: Victoria Mine Project – Engineering Design and Sustainability Management Aspects Addressing Key Concerns[2] - Surface Water Quality

Design and Management Features	Reduced Water Quality	Accidental Events
Engineering Design	• Construction of a pond water reclaim pipeline to recycle water from mine processes; • Extensive water surveys of freshwater environments; • Site water collection and waste water treatment plant; • Site facilities to avoid surface water flows.	• Fuel and other hazardous materials storage facilities have containment berms.
Health and Safety	N/A	• Spill response training; • Firefighting equipment on site.
Environmental Protection	• Excess effluent water treated and discharged to freshwater environment; • Identification of mineralized rock storage and handling procedures; • Water management strategies; • Erosion and sediment control procedures; • Sewage treatment and disposal procedures; • Site facilities to avoid disturbances to surface water; • Reduce or avoid instream activity.	• Fuel management procedures; • Hazardous materials management.
Emergency Response	N/A	• Oil pollution emergency response procedures; • Specific material handling procedures; • Firefighting response procedures.
Biodiversity Plan	• Update plan based on monitoring results.	N/A
Environmental Awareness	• General environmental orientation.	• General environmental orientation; • Spill response training.
Reclamation	• Progressive reclamation to reduce erosion and sediments entering water courses.	N/A
Monitoring	• Monitoring berms and embankments for seepage; • Potable water monitoring; • Effluent and receiving water quality monitoring.	• Monitoring spill remediation efforts.
Continuous Improvement	• Audit implementation of plans, policies and training; • Development of corrective action plans; • Audit review and continual improvement procedures.	N/A

[2] Concerns identified as a result of the environmental effects analysis in Chapter 10 - Surface Water Quality.

Table 5-4: Victoria Mine Project – Engineering Design and Sustainability Management Aspects Addressing Key Concerns[3] – Groundwater Quantity

Design and Management Features	Reduced Availability of Groundwater for Other Users
Engineering Design	• Construction of groundwater monitoring wells; • Measure, collect and recycle mine water for use in mining processes; • Design blasting to reduce peak particle velocity to allowable limits; • Mine design minimize alteration of groundwater patterns and Flows.
Health and Safety	• Dewater work areas to ensure safe conditions.
Environmental Protection	• Mine and site water treated before being discharged into environment; • Blasting patterns designed to allowable limits for protection of neighbouring groundwater wells • Water management strategies.
Emergency Response	• Increase underground dewatering if excessive water encountered during mining. Re-evaluate water management scheme
Environmental Awareness	• General site worker environmental orientation
Reclamation	• No further removal of groundwater
Monitoring	• Monitor water levels in groundwater monitoring wells
Continuous Improvement	• Audit implementation of plans, policies and training • Development of corrective action plans • Audit review and continual improvement procedures

[3] Concerns identified as a result of the environmental effects analysis in Chapter 11 - Groundwater Quantity.

Table 5-5: Victoria Mine Project – Engineering Design and Sustainability Management Aspects Addressing Key Concerns[4] – Fish and Fish Habitat

Design and Management Features	Harmful Alteration, Disruption or Destruction of Fish Habitat	Fish Mortality, Sub-lethal and Chronic Effects on Fish
Engineering Design	• Extensive surveys to identify and evaluate fish and fish habitat; • Use of Ethel Lake which has already been altered by water level controls in the past; • Reduction of effluent discharges to freshwater; • Treatment of effluents; • Minimal alteration of surface waterbodies; • Test work on effluent toxicity.	• Collection of potentially contaminated effluent sources and waste water treatment; • Reduction of effluent discharges to freshwater receiving environment; • Test work on effluent toxicity; • PAG rock storage and runoff collection.
Health and Safety	• Safety procedures for all work on and around water.	N/A
Environmental Protection	• Compliance with conditions of permits; • Effluent treatment procedures; • Minimal alteration of surface water flows; • Culvert installation procedures; • Guidelines for buffer zones; • Erosion prevention procedures; • Dust suppression and erosion controls procedures; • Blasting procedures; • Fuel management procedures; • Hazardous materials management procedures.	• Compliance with conditions of permits; • Waste water treatment prior to release to the environment; • Hazardous materials management procedures; • Dust suppression; • PAG rock storage and runoff control.
Emergency Response	• Pollution emergency response procedures; • Fire response procedures.	• Modify schedule for bioassay test work; • Notify authorities, stop work if required and investigate fish mortality.
Biodiversity Plan	• Baseline studies on fish assemblages and aquatic resources; • Surveillance monitoring to contribute to biodiversity plan.	n/a
Environmental Awareness	• General environmental orientation for all workers.	• General environmental orientation for all workers.
Community Involvement	• Information sharing on any restrictions to access to Ethel Lake for angling.	• Information sharing on any restrictions to access to Ethel Lake for angling.
Indigenous Involvement	• Information sharing on any restrictions to access to Ethel Lake for angling.	• Information sharing on any restrictions to access to Ethel Lake for angling.
Reclamation	• Revegetation of disturbed areas to reduce erosion and sediments in runoff; • Restore natural controls on Ethel Lake.	• Revegetation of disturbed areas to reduce erosion and sediments in runoff; • Restore natural controls on Ethel Lake.
Monitoring	• Effluent and receiving water quality monitoring; • Habitat offset as required.	• Effluent and receiving water quality monitoring.
Continuous Improvement	• Audit of implementation of procedures, policies, guidelines and training; • Development of corrective action plans; • Audit review and continual improvement procedures.	• Audit of implementation of procedures, policies, guidelines and training; • Development of corrective action plans; • Audit review and continual improvement procedures.

[4] Concerns identified as a result of the environmental effects analysis in Chapter 12 - Fish and Fish Habitat.

Table 5-6: Victoria Mine Project – Engineering Design and Sustainability Management Aspects Addressing Key Concerns[5] – Terrestrial Habitat

Design and Management Features	Eastern Whip-poor-will
Engineering Design	• Minimize biophysical footprint of the Project facilities; • Underground mining operations.
Environmental Protection	• Vegetation clearing only outside the time of year birds are potentially present including the breeding season; • Adherence to species or population specific permit conditions; • Ensure area disturbed is less than 55 hectares.
Emergency Response	• Response procedures for wildlife encounters; • Notification procedures to authorities.
Biodiversity Plan	• Surveillance monitoring inputs into biodiversity database.
Environmental Awareness	• General awareness orientation for all site personnel.
Community Involvement	• Advise communities of protection procedures associated with species with special conservation status.
Indigenous Involvement	• Advise communities of protection procedures associated with species with special conservation status.
Reclamation	• Stockpiling soil organics and overburden to help site reclamation; • Progressive reclamation.
Monitoring	• Surveillance monitoring over the life of the Project; • Broaden out species protection scope should other species such as Blanding's Turtle occur on site over the life of the Project.
Continuous Improvement	• Audit of implementation of procedures, policies, guidelines and training; • Development of corrective action plans; • Audit review and continual improvement procedures.

[5] Concerns identified as a result of the environmental effects analysis in Chapter 13 - Terrestrial Habitat.

Table 5-7: Victoria Mine Project – Engineering Design and Sustainability Management Aspects Addressing Key Concerns[6] – Archaeological Resources

Design and Management Features	Loss or Alteration of Archaeological Resources
Engineering Design	• Extensive survey to identify and evaluate archaeological resources at site during exploration; • Minimize Project footprint; • Underground mining methods minimizes surface disturbances; • Use of predictive model of historic resources potential as a planning tool; • Infrastructure will be designed or sited to avoid historic resources where possible.
Environmental Protection	• Avoidance of known sites with archaeological potential where possible.
Emergency Response	• Emergency response and contingency procedures for the discovery of archaeological and historic resources; • Use of professional archaeologist to advise on response procedures.
Environmental Awareness	• General worker orientation for historic and archaeological resources; • Key work areas include PAG 2 and Ethel Lake.
Community Involvement	• Update communities through regular Project updates and Open House Events.
Indigenous Involvement	• Report findings and investigation results to Indigenous communities.
Monitoring	• Surveillance monitoring.
Continuous Improvement	• Audit implementation of plans, policies and training; • Development of corrective action plans; • Audit review and continuous improvement procedures.

[6] Concerns identified as a result of the environmental effects analysis in Chapter 14 - Archaeological Resources.

Table 5-8: Victoria Mine Project – Engineering Design and Sustainability Management Aspects Addressing Key Concerns[7] – Residential and Recreational Land Use

Design and Management Features	Reduced Quality of Life Due to Project Emissions	Safe Use of Public Roads
Engineering Design	• Predictive modelling and consultation aspects of permitting for air and noise emissions and ground vibrations; • Reduced amount of surface blasting due to underground mining methods • Design of blast size and blasting patterns.	• Dust prevention and noise reduction procedures.
Health and Safety	• Operate Project vehicles on public roads according to applicable laws and local driving conditions.	• Operate Project vehicles on public roads according to applicable laws and local driving conditions.
Environmental Protection	• Minimize clearing of vegetated areas to leave natural buffers to help attenuate noise.	N/A
Emergency Response	• Monitoring Project complaints from the public and address through liaison committee work.	• Monitoring Project complaints from the public and address through liaison committee work.
Community Involvement	• Notification of Project activities.	• Notification of Project activities.
Indigenous Involvement	• Notification of Project activities.	• Notification of Project activities.
Monitoring	• Surveillance monitoring of complaints from the public.	• Surveillance monitoring of complaints from the public.

[7] Concerns identified as a result of the environmental effects analysis in Chapter 15 - Residents and Recreational Land Use.

Design and Management Features	Reduced Quality of Life Due to Project Emissions	Safe Use of Public Roads
Continuous Improvement	• Audit implementation of plans, policies and training; • Development of corrective action plans; • Audit review and continuous improvement procedures.	• Audit implementation of plans, policies and training; • Development of corrective action plans; • Audit review and continuous improvement procedures.

Table 5-9: Victoria Mine Project – Engineering Design and Sustainability Management Aspects Addressing Key Concerns[8] – Community Services and Infrastructure

Design and Management Features	Increased Traffic on Public Roads
Engineering Design	• Evaluation, design and upgrades to public roads potentially affected by the Project to ensure adequate level of service and safety; • Collaboration with City of Great Sudbury.
Environmental Protection	• Signage, paved shoulders and road design upgrades to meet safety requirements for Ontario roads.
Environmental Awareness	• General worker and contractor orientation regarding the use of public roads and safety needs of the travelling public.
Community Involvement	• Notification of Project activities.
Indigenous Involvement	• Notification of Project activities.
Reclamation	• Road upgrades to remain in place following closure.
Continuous Improvement	• Audit of implementation of procedures, policies, guidelines and Training; • Development of corrective action plans; • Audit review and continual improvement procedures.

[8] Concerns identified as a result of the environmental effects analysis in Chapter 16 - Community Services and Infrastructure.

Table 5-10: Engineering Design and Sustainability Management Aspects Addressing Key Concerns[9]: Employment and Business

Design and Management Features	Employment	Procurement and Business
Health and Safety	• Employee awareness information and Training.	• Employee awareness information and training.
Environmental Awareness	• Employee programs available; • Skills development and support available. All employment opportunities publicly available through Project website.	• Skills development and support available. All business opportunities publicly available through Project website.
Community Involvement	• Information sharing with communities and government agencies.	• Information sharing with communities and government agencies.
Indigenous Involvement	• Information sharing for training, employment and procurement opportunities, as required by Impact Benefit Agreements.	• Information sharing for training, employment and procurement opportunities, as required by Impact Benefits Agreements.
Monitoring	• Information sharing with communities with respect to local employment and business indicators.	• Information sharing with communities with respect to local employment and business indicators.
Continuous Improvement	• Audit of implementation of procedures, policies, guidelines and training; • Development of corrective action plans; • Audit review and continual improvement procedures.	• Audit of implementation of procedures, policies, guidelines and training; • Development of corrective action plans; • Audit review and continual improvement procedures.

[9] Concerns identified as a result of the environmental effects analysis in Chapter 17 – Employment and Business.

Table of Contents – Chapter 6

6. Consultation and Issue Scoping 114

6. Consultation and Issue Scoping

FNX has been actively engaged in a broad range of consultation and issue scoping activities to help identify concerns issues associated with its activities at the Victoria property for more than a decade. The key issues help focus the science based approach to conducting a detailed environmental effects analysis and scope out elements of the sustainability management framework to meets the needs of the Project based on the detailed environmental effects analysis of the Valued Components. Table 6-1 provides an overview of the key issues, their attribution (sources) and identifies where in this environmental effects analysis the issues are addressed or further considered.

Table 6-1: Victoria Mine Project – Identification of Key Environmental Planning Issues

Key Environmental Issue	Attribution or Source of Issue	Where Addressed in the Project or EEA
Indigenous Groups		
Opportunities for training, employment, contracting and procurement	• Atikameksheng Anishnawbek First Nation; • Sagamok First Nation; • Métis Nation of Ontario (Region 5).	• Project: Continued negotiations on impact and benefits agreements and Memorandum of Understanding processes; • EEA (Chapter 5 – Sustainability Management): Indigenous communities involvement aspects of overall Sustainability Management including training and skills development; • EEA (Chapter 17 – Employment and Business): Indigenous communities opportunities in the provision of goods and Services.
Effects on Indigenous and treaty rights and cultural heritage	• Atikameksheng Anishnawbek First Nation; • Sagamok First Nation; • Métis Nation of Ontario (Region 5).	• Project: Continued consultation and negotiations in good faith and in a respectful way with Indigenous groups identified by the Province of Ontario; • EEA (Chapter 1 - Introduction): Indigenous and treaty rights forms an overall context for conducting a science-based approach to the environmental assessment; • EEA (Chapter 14 – Archaeological Resources): A detailed environmental effects analysis on Archaeological Resources which includes baseline studies that contribute to the knowledge base ; • EEA (Chapter 5 – Sustainability Management): Indigenous involvement in information sharing including the findings of archaeological surveys.
Management of surface and groundwater resources, including stormwater management, runoff from waste rock storage areas, water intake sources for the project	• Atikameksheng Anishnawbek First Nation; • Sagamok First Nation; • Métis Nation of Ontario (Region 5).	• Project: Engineered control of surface and ground water such that all potentially contaminated water is treated to meet regulatory standards prior to being released to the environment; • Project: Surface storage of mineralized (PAG) rock is temporary and rock will be consuming in the underground backfill manufacturing process; • Project: Main surface water supply utilizes Ethel Lake that has already had man made controls in the past; • EEA (Chapter 10 – Surface Water Quality): Detailed environmental effects analysis on Surface Water Quality; • EEA (Chapter 12 – Fish and Fish Habitat): Detailed environmental effects analysis on Fish and Fish Habitat.
Opportunities for participation in environmental management and monitoring for the site	• Sagamok First Nation.	• Project: Negotiations with respect to impacts and benefits are wide ranging and can include environmental monitoring and mitigation measures inspection as key components of overall sustainability management.
Public, Regulatory Agencies and Other Stakeholders:		
Traffic: Atmospheric effects and public safety	• Fairbank Lake Cottagers Association; • Walden Sno Runners Snowmobile Association; • Randolph Street Residents; • Walden, Whitefish, Worthington.	• Project: Collaboration with the City of Greater Sudbury to upgrade city roads to improve the level of service to accommodate the needs of the Project and the travelling public; • Project: Collaboration with Hydro One for Project site interconnection with grid hydroelectric power. Reduced reliance on fossil fuels; • EEA (Chapter 9 – Atmospheric Environment): Detailed environmental effects analysis on Atmospheric Environment ; • EEA (Chapter 5 – Sustainability Management): Environmental protection elements of Sustainability Management (minimize footprint; leave natural buffers; atmospheric emissions modelling; dust suppression); • EEA (Chapter 15 – Residents and Recreational Land Use): Detailed environmental effects analysis on Residents and Recreational Land Use; • EEA (Chapter 16 – Community Services and Infrastructure): Detailed environmental effects analysis on Community Services and Infrastructure.
Haul Truck Traffic, additional traffic: Atmospheric effects (dust and noise) and public safety	• Fairbank Lake Cottagers Association.	• Project: Collaboration with the City of Greater Sudbury to upgrade city roads to improve the level of service to accommodate the needs of the Project and the travelling public;

Key Environmental Issue	Attribution or Source of Issue	Where Addressed in the Project or EEA
		• EEA (Chapter 9 – Atmospheric Environment): Detailed environmental effects analysis on Atmospheric Environment; • EEA (Chapter 5 – Sustainability Management): Environmental protection elements of Sustainability Management (minimize footprint; leave natural buffers; atmospheric emissions modelling; dust suppression); • EEA (Chapter 15 – Residents and Recreational Land Use): Detailed environmental effects analysis on Residents and Recreational Land Use; • EEA (Chapter 16 – Community Services and Infrastructure): Detailed environmental effects analysis on Community Services and Infrastructure.
Visual effects	• Fairbank Lake Cottagers Association.	• Project: Underground mine and surface minimized footprint. Mineralized (PAG) rock storage as well as soil and overburden stockpiles are temporary and will be removed by completion of closure; • EEA (Chapter 5 – Sustainability Management): Environmental protection aspects of sustainability management. Minimize vegetation clearing and leave natural buffers to the extent practical.
Water quality	• Fairbank Lake Cottagers Association.	• Project: Operational experience at collecting and treating site runoff and mine water. Test work on acid rock drainage to help design waste water treatment plant and bioassays to help ensure regulatory compliance; • EEA (Chapter 5 – Sustainability Management): Community involvement aspects of sustainability management including information sharing on monitoring; • EEA (Chapter 10 – Surface Water Quality): Detailed environmental effects analysis on Surface Water Quality; • EEA (Chapter 12 – Fish and Fish Habitat): Detailed environmental effects analysis on Fish and Fish Habitat.
Effect on existing Sudbury Trail Plan	• Walden Sno Runners Snowmobile Association.	• EEA (Chapter 15 – Residents and Recreational Land Use): Detailed environmental effects analysis on Residents and Recreational Land Use; • Project: Through consultation with the Walden Sno Runners Snowmobile Association. The trail was modified in 2013 and 2014 to accommodate for exploration activities and to allow continued use of the trail by snowmobilers.
Traffic from Totten Mine: Atmospheric effects and public safety	• Randolph Street Residents; • Copper Cliff.	• Project: Collaboration with the City of Greater Sudbury to upgrade city roads to improve the level of service to accommodate the needs of the Project and the travelling public; • EEA (Chapter 9 – Atmospheric Environment): Detailed environmental effects analysis on Atmospheric Environment; • EEA (Chapter 5 – Sustainability Management): Environmental protection elements of Sustainability Management (minimize footprint; leave natural buffers; atmospheric emissions modelling; dust suppression); • EEA (Chapter 15 – Residents and Recreational Land Use): Detailed environmental effects analysis on Residents and Recreational Land Use; • EA (Chapter 16 – Community Services and Infrastructure): Detailed environmental effects analysis on Community Services and Infrastructure.
Traffic on MR4: Public safety	• Vale Totten Mine.	• Project: Collaboration with the City of Greater Sudbury to upgrade city roads to improve the level of service to accommodate the needs of the Project and the travelling public; • Project: Life of mine take off agreement with Vale Canada Limited; • EEA (Chapter 15 – Residents and Recreational Land Use): Detailed environmental effects analysis on Residents and Recreational Land Use; • EEA (Chapter 16 – Community Services and Infrastructure): Detailed environmental effects analysis on Community Services and Infrastructure.
Determine if there are potential for impacts to fish and fish habitat	• Department of Fisheries and Oceans Canada.	• Project: Operational experience at collecting and treating site runoff and mine water. Test work on acid rock drainage to help design waste water treatment plant and bioassays to help ensure regulatory compliance; • EEA (Chapter 5 – Sustainability Management): Community involvement aspects of sustainability management including

Key Environmental Issue	Attribution or Source of Issue	Where Addressed in the Project or EEA
		information sharing on monitoring; • EEA (Chapter 10 – Surface Water Quality): Detailed environmental effects analysis on Surface Water Quality; • EEA (Chapter 12 – Fish and Fish Habitat): Detailed environmental effects analysis on Fish and Fish Habitat.
Proposed location of Non Acid Generating Waste Rock Storage	• Department of Fisheries and Oceans Canada.	• Project: Precautionary approach assuming all rock to be temporarily stored on site is mineralized (PAG), Engineered pavement pads for PAG rock to collect runoff and control to waste water treatment plant. PAG storage engineering prevents runoff from entering groundwater. Site PAG rock storage away from surface water bodies; • Project: Wastewater treated to achieve effluent quality standards. Bioassays to help ensure treated effluent is protective of aquatic life.
Comments on the first Project Description Report were provided in Sept. 2015	• Environment Canada.	• Project: Continued liaison with the Canadian Environmental Assessment Agency with respect to the any requirements for further formal environmental assessment based on the scope of project.

A background summary of the consultation initiatives with the public, regulatory agencies and other stakeholders is provided in Appendix A. A background summary of the consultation initiatives with Indigenous groups is provided In Appendix B.

Table of Contents – Chapter 7

7. The Selection of Valued Components (VC) 119

7.1. Important Project Planning Context Elements in the Selection of Valued Components.....119
7.2. Important Permitting Considerations in the Selection of Valued Components 120
7.3. Valued Components.....121
7.3.1. Atmospheric Environment.....122
7.3.2. Surface Water Quality.....122
7.3.3. Groundwater Quantity 122
7.3.4. Fish and Fish Habitat 122
7.3.5. Terrestrial Habitat.....123
7.3.6. Archaeology 123
7.3.7. Residents and Recreational Land Use.....123
7.3.8. Community Services and Infrastructure 123
7.3.9. Employment and Business 124

7. The Selection of Valued Components (VC)

It is contemporary practice in environmental assessment to use Valued Components (VCs) to help provide focus for any further detailed environmental effects analysis. The selection and rationalization of VCs in any environmental assessment is important and is helpful for reviewers to better understand the potential implications of the Project on the receiving environment. The selection of VCs in this environmental assessment takes into consideration the nature of the Project as well as key issues identified by Indigenous groups, stakeholders, regulators and resource managers as a result of consultation efforts to date by FNX. While the emphasis to date has been on exploration and advanced exploration activities at site (for more than a decade), the high degree of similarity between these activities and the Project help FNX plan and design the Project with a high degree of certainty on VCs and potential environmental effects.

7.1. Important Project Planning Context Elements in the Selection of Valued Components

The selection of VCs has been conducted taking into consideration a range of relevant processes and available information. A couple of the processes are proprietary and involve the progressive engineering and economic analyses aspects of the Project (associated with the engineering maturation process, currently at basic engineering) and negotiations associated with potential good neighbour relationships and working relationships with Indigenous groups proximate to the Project site. VCs have been carefully and respectfully considered to reflect key engineering design, environmental protection and pollution prevention issues that are likely associated with the concerns with neighbouring Indigenous groups but not in such as direct a way as to be considered prerogative or disrespectful in nature due to aspects of confidentiality so as to not undermine progress and achievements to date by FNX or duties by governments.

The selection of VCs has also fully considered the key findings of the Sudbury Soils Study. The Sudbury Soils Study comprised a thorough regional ecological and human health risk assessment into the 100+ years of mining and minerals processing that has occurred in the Sudbury Basin. The study was a comprehensive scientific and technical investigation into a 40,000 km^2 area of former and current mining and minerals processing areas to evaluate the state of the ecological conditions and risks to human health, plants and wildlife. It is one of the largest and most comprehensive regional environmental studies conducted to date in North America. The study area included the Victoria properties area where mining has occurred (Mond and Inco Ltd.) as well as minerals processing (Mond: open roast smelting and refining) and community development (Mond: up to mid-1930s).

The Sudbury Soils Study was initiated by the Ontario Ministry of Environment (2001) and was completed in 2008. The study involved a Technical Committee (TC) for oversight as well as independent expert reviewers of the science and findings. The TC included membership from the Ministry of Environment, the City of Greater Sudbury, the Sudbury District Health Unit, Health Canada (First Nations & Inuit Health Branch) as well as Vale

and Xstrata Nickel. The study focused on Chemicals of Concern (CoCs), including nickel and copper, and concluded generally that while there are elevated levels of CoCs in plant communities they are not at levels of concern in the Project area and area wildlife populations are not likely to be directly affected by elevated levels of CoCs now or in the future. The study predicted little risk of health effects on Sudbury area residents associated with metals in the environment, anglers, hunters and Indigenous people who may consume more local fish and wild game are at no greater risk of health effects due to metals in the environment than the general population.

These ongoing Project evaluations and negotiations as well as the Sudbury Soils Study supported the rationale to consider but screen out as VCs the following aspects: Indigenous rights and entitlements as well as environmental and human health.

7.2. Important Permitting Considerations in the Selection of Valued Components

The future Project has indirectly undergone, and continues to undergo, a considerable amount of regulatory scrutiny. This is largely due the similarity of activities and processes associated with more than a decade of exploration at the site and the range of environmental permits, authorizations and approvals obtained to date. Permits include those for freshwater extraction and effluent release, atmospheric emissions, the storage and handling of fuel and other hazardous materials, sewage treatment and disposal, solid waste management. Permits are also in place to allow for activities potentially affecting species with special conservation status (Whip-poor-will) and special areas (those containing historic or cultural resources).

There are also several supporting elements and services in place to support exploration activities and now to support advanced exploration and the Project. Some of these elements are under the principle control of other proponents. All of these elements have had some level of environmental assessment and permitting involved in their planning and installation. These include:

- The FNX installation of up to 5 MW diesel powered generation plant to provide power to exploration activities and be available as redundant power for site needs;
- The Hydro One construction and commissioning of a short 230 kV transmission line to enable the exploration site and Project to have access to grid power, thus reducing the need for fossil fuel consumption;
- The Union Gas construction and commissioning of a short natural gas pipeline for site heating needs; and
- The City of Greater Sudbury evaluation and upgrading of public roads in the vicinity of the Project to ensure an adequate level of service for Project needs in combination with other users.

The various environmental assessment and permitting aspects of site activities to date have been useful in the conceptualization of practical VCs on which to focus the detailed

environmental effects analysis. The range of site activities to date are also useful in having a good understanding of effective and technically proven design and mitigation measures to help reduce residual adverse environmental effects to acceptable levels.

Figure 7-1 illustrates the VC selection process.

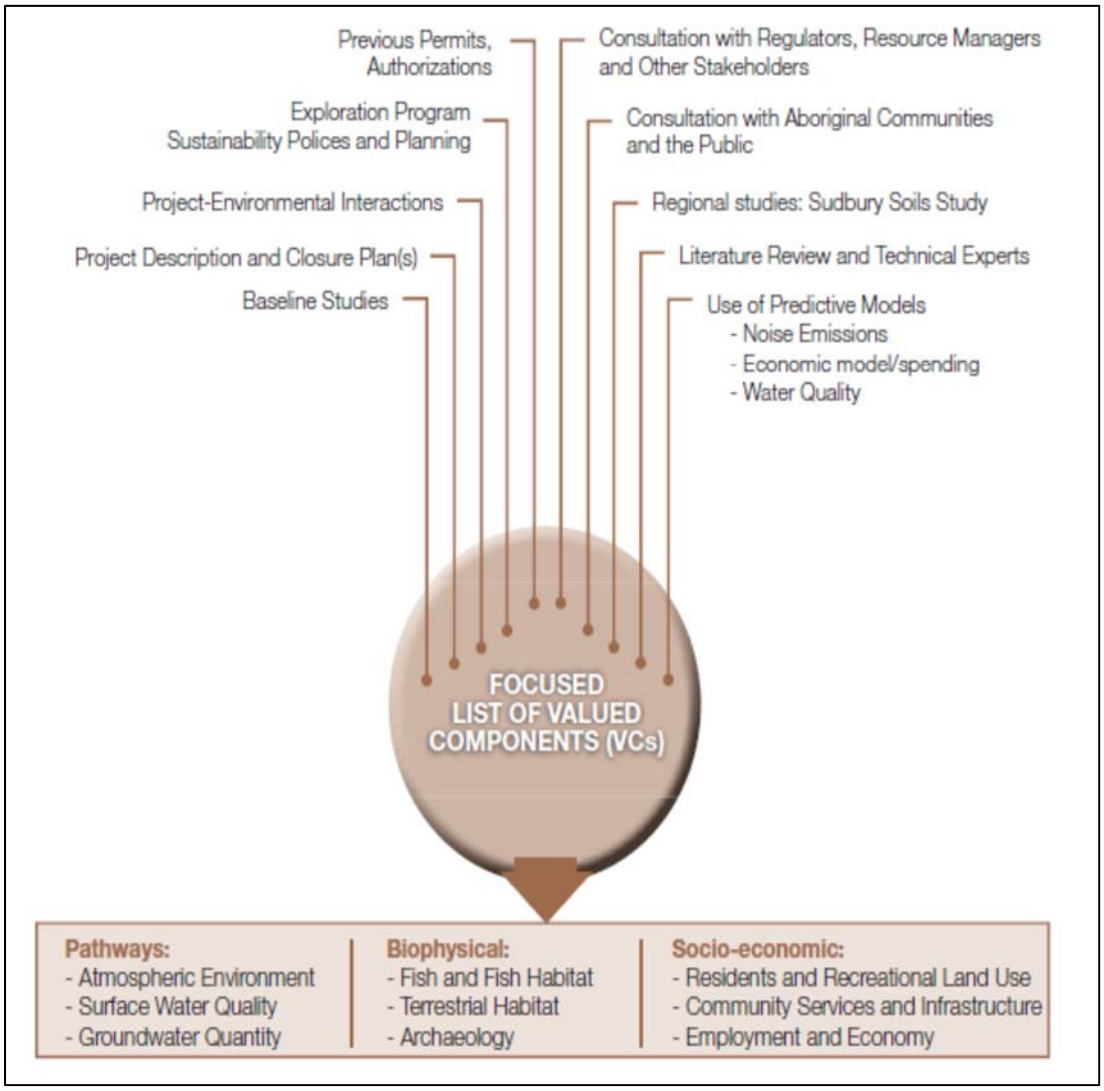

Figure 7-1: Selection of Valued Components

7.3. Valued Components

The following describes the VCs selected for the detailed environmental effects analysis in terms of key issues associated with the VC and, as appropriate, where the VC integrates into the environmental effects analysis.

7.3.1. Atmospheric Environment

The atmospheric environment is a key pathway for emissions such as noise, dust and gases (ventilation and operating equipment). Good air quality is intrinsically important to overall environmental quality:

- *Key Issues:* Noise from blasting and crushing activities; reduced air quality from vented air from underground work areas vibrations from underground blasting; contaminants in the environment; and
- *Integration:* Other VCs such as Resident and Recreational land Use; occupational health and safety; engineering design; environmental protection (minimize footprint, leave natural buffer zones); reduce demand on consuming fossil fuels; cumulative environmental effects.

7.3.2. Surface Water Quality

Surface water quality is intrinsically important to a healthy environment. Water quality is intrinsically important to overall environmental quality:

- *Key Issues:* Reduced water quality; contaminants in the environment; and
- *Integration:* Other VCs such as Fish and Fish Habitat; Residents and Recreational land Use; engineering design (site drainage collection and waste water treatment); monitoring (compliance and bioassays); closure plan; cumulative environmental effects.

7.3.3. Groundwater Quantity

Groundwater is a resource for potential use by others and it is intrinsically important to environmental health:

- *Key Issues:* Minimize groundwater removed from wells and underground work areas; contaminant transport; ensure any demand on groundwater does not affect other potential users of ground water; and
- *Integration:* Other VCs such as Residents and Recreational Land use; facility design (engineering design to ensure underground work areas remain safe from water build up; engineered temporary PAG storage facilities to prevent localized groundwater contamination from run off); closure plan; cumulative environmental effects.

7.3.4. Fish and Fish Habitat

The protection and fish and fish habitat, as well as recreational, commercial or Indigenous fisheries is an important aspect of federal legislation:

- *Key Issues:* Reduced water quality of effluent discharged into Fairbank Creek and altered habitat availability as a result of modifications to Ethel Lake to increase storage capacity; contaminants in the environment; and

- *Integration:* Other VCs such as Atmospheric Environment, Surface Water Quality; Residents and Recreational Land Use; design limited to effects on Ethel Lake; recreational land use; cumulative environmental effects.

7.3.5. Terrestrial Habitat

Terrestrial habitat is important for a wide variety of wildlife species and populations. While the region reflects a highly altered terrestrial environment due to past and present activities and developments (forestry and other resource development) it is non-the-less potential habitat for a wide variety of species:

- *Key Issues:* Focus on species with special conservation status (Whip-poor-will); and
- *Integration:* Other VCs such as Residents and Recreational Land Use and Surface Water Quality; environmental protection (minimize footprint, leave natural buffer zones to attenuate noise); cumulative environmental effects.

7.3.6. Archaeology

Archaeological resources are important due to the information they reveal about past activities and land use:

- *Key Issues:* There is an intrinsic value to archaeological resources; and
- *Integration:* General arrangement of site facilities and infrastructure to avoid known areas with archaeological resources; contingency plan for the discovery of historic resource; cumulative environmental effects; environmental awareness.

7.3.7. Residents and Recreational Land Use

While there are not a substantial number of permanent residents in the area the Project will result in increased construction and mining activity as well as project related traffic. The area supports recreational activities such as fishing, hunting and trapping as well as snowmobile riding. There is also berry picking in the region. Roads adjacent to the Project site lead to Fairbanks Provincial Park:

- *Key Issues:* Neighbour proximity to noise and return air raises; nearby groundwater users; safe driving conditions (automobile and snowmobile traffic); and
- *Integration:* Other VCs such as Atmospheric Environment, Terrestrial Habitat, Surface Water Quality and Fish and Fish habitat; engineering design and upgrades of area roads; environmental protection (minimize footprint, leave natural buffer zones); cumulative environmental effects.

7.3.8. Community Services and Infrastructure

The Project is expected to place some demands on local community services (such as fire response and emergency medical) as well as result in increased traffic flow between the site and the Clarabelle Mill in Copper Cliff:

- *Key Issues:* Increased Project traffic on regional public roads; demands on emergency services; and

- *Integration:* Other VCs such as Residents and Recreational Land Use; environmental awareness; information sharing with communities; cumulative environmental effects.

7.3.9. Employment and Business

The Project is expected to have a substantial benefit to employment and business in the region. The Sudbury Basin has an experienced construction and mining business community and it is anticipated that most of the labour as well as goods and services will be available locally:

- *Key Issues:* Employment opportunities; skills development and capacity building; procurement of goods and services; and
- *Integration:* Information sharing with communities; cumulative environmental effects.

Table of Contents – Chapter 8

8. Environmental Assessment Methodology 126

8.1. Supporting Knowledge Base for the Environmental Effects Analysis 126
8.1.1. Experience to Date Through Site Activities and Permitting 126
8.1.2. Environmental Baseline Studies and Other Relevant Studies 127
8.1.3. The Use of Models and Test Work 127
8.1.4. Anticipated Changes to the Physical Environment 128
8.1.5. Issue Scoping and Consultation 128
8.2. Structure of a Valued Component (VC) Chapter 128
8.2.1. Existing Conditions 129
8.2.1.1. Environmental Assessment Boundaries 129
8.2.2. Environmental Effects Analysis 130
8.2.2.1. Factors Considered in the Environmental Effects Analysis 130
8.2.2.1.1. Magnitude 130
8.2.2.1.2. Geographical Extent 131
8.2.2.1.3. Timing 132
8.2.2.1.4. Frequency 132
8.2.2.1.5. Duration 132
8.2.2.1.6. Reversibility 132
8.2.2.1.7. Ecological, Socio-economic and Socio-cultural Context 132
8.2.2.1.8. Certainty of Knowledge 132
8.2.2.1.9. Approach to Analyzing Cumulative Environmental Effects 132
8.2.2.1.10. Other Projects and Activities Considered in the Cumulative Environmental Effects Analysis 133
8.2.2.1.11. Engineering Design, Mitigation Measures and Sustainability Management 133
8.2.2.2. Integration into Sustainability Management 134
8.2.3. Residual Environmental Effects 134
8.3. References 137

8. Environmental Assessment Methodology

The environmental assessment of the Project has been conducted in a holistic manner using a detailed description of the Project, an understanding of projects and activities closely related to the Project (such as exploration and advanced exploration activities), and other projects and activities in the Project area factored into the cumulative environmental effects analysis. FNX has a comprehensive understanding of the existing environment within Project area and has conducted a comprehensive environmental baseline studies program supported by a range of modeling exercises and test work. In addition, most of the activities anticipated for the Project have already occurred in the Project area (exploration and advanced exploration, water management, rock handling and transportation, etc.). Studies and experience to date as well as site activities under a high level of regulatory scrutiny (many key permits have been obtained by FNX) help in the design the Project and improve the prediction of potential adverse environmental effects, understand the effectiveness of mitigation and to bring forward the best possible Project from pollution prevention and environmental protection perspective.

FNX conducted a comprehensive consultation process to identify issues and concerns from a broad range of interested parties, including Indigenous groups and communities, and other stakeholders such as community groups and regulators and resource managers. However, the detailed analysis of potential adverse environmental effects resulting from the Project is nonetheless focused on Valued Components (VCs), determined by the Project team after full consideration of potential project-environment interactions (Chapter 4 – Project-Environment Interactions, a good understanding of the nature of the Project and the local area, a good understanding of key issues and expectations. VCs have been identified (Chapter 7 – The Selection of Valued Components (VC)) to allow for a focused and practical environmental assessment on particular issues, as reflected by the scope of the Project to be assessed and in consideration of the results of the Indigenous and public consultation completed to date. This environmental assessment methodology generally follows contemporary practice (based on Beanlands and Duinker 1983) and has used federal guidance in its development and preparation (FEARO 1994a, FEARO 1994b; Hegmann; 1999; CEA Agency 2015).

8.1. Supporting Knowledge Base for the Environmental Effects Analysis

8.1.1. Experience to Date Through Site Activities and Permitting

The Project is largely a continuation of past and present activities on site that are very closely related to the Project. Except for the aspect of constructing and operating a paste backfill plant and hauling crushed ore to Vale's Clarabelle Mill in Copper Cliff for processing, the principle activities associated with the Project are all highly similar to activities that have been going on since exploration commenced more than a decade. All the major infrastructure and environmental protection facilities and process will be in place once advanced exploration proceeds to the bulk sample collection. As the Project proceeds, it is not expected that any new major environmental protection permits, authorizations and approvals will be required. It is anticipated that future activities will

be addressed by amendments to existing permits, authorizations and approvals or renewal applications.

8.1.2. Environmental Baseline Studies and Other Relevant Studies

Environmental baseline studies were conducted to determine both recent and existing environmental conditions in the vicinity of the Project and potentially affected communities to support Project planning and engineering as well as information sharing with potentially affected communities. There is a high degree of certainty around environmental baseline conditions and this is partially reflected in the preparation, review and approval of a wide range of permits, authorizations and approvals for exploration activities to date. The Project occurs within the region of the recent Sudbury Soils Study that comprised a thorough ecological and human health risk review of more than a century of mineral exploration, extraction and processing activities in the Sudbury Basin.

8.1.3. The Use of Models and Test Work

FNX has used a range of issue scoping and environmental effects analysis tools to not only help identify potential Valued Components (VCs) and the nature of potential Project–environment interactions but also to help describe the potential adverse environmental effects in this environmental effects analysis. A variety of models were used to support the environmental effects analysis and included the following:

- Noise modeling: to help provide context for a potential zone of influence;
- Air quality dispersion modeling: to help describe the zone of influence and potential effects of emissions;
- Fish and fish habitat modeling and quantification;
- Water quality and quantity modeling: water quality and quantity modeling was used to help engineer site and underground drainage collection and wastewater treatment facilities. Water quality modeling and test work (bioassays for fish toxicity) were also used to help understand waste water treatment facilities and the potential adverse environmental effects of effluent on Fairbank Creek;
- Assimilative capacity of receiving waters: to show the receiving environment has capacity to assimilate effluents and to help set the design criteria for water and effluent collection, control and treatment;
- Economic modeling: to help determine the zone of influence associated with the procurement of goods and services resulting in direct, indirect and induced benefits;
- Ecological Land Classification: to help describe the biophysical ‘footprint” zone of influence and quantify local and regional terrestrial ecology and wildlife habitat types that may be affected; and
- Wildlife habitat assessment (e.g. Whip-poor-will).

8.1.4. Anticipated Changes to the Physical Environment

Chapter 4 – Project-Environment Interactions presents an evaluation of potential project-environment interactions that help form the basis of the selection of Valued Components that the detailed environmental effects analysis is based on. The Project largely comprises activities with potential environmental interactions that have been experienced routinely over the past many years through the execution of the exploration program that consists of: shaft sinking; hoisting; drilling; underground ventilation; rock crushing and hauling; and general site development of works areas, including overburden and PAG rock management; sewage treatment; water collection and treatment; and the handling of fuel and other hazardous materials.

8.1.5. Issue Scoping and Consultation

FNX has a good understanding of the potential issues and concerns associated with the Project based on several years of conducting information sharing and consultation with Indigenous groups, the public and stakeholders and governments. Chapter 6 – Consultation and Issue Scoping provides a summary of key issues and how they have been considered in the Project design or supporting environmental management system.

8.2. Structure of a Valued Component (VC) Chapter

Each VC chapter consists of three major sections. The general outline of each VC chapter is shown in Table 8-1.

Table 8-1: General Outline of a Typical VC Chapter

Section	Contents
(VC Title)	Introduction including brief reminder of relevant changes to the physical environment that helped scope the VC as appropriate.
Existing Conditions	
Boundaries – Ecological	Description of the spatial and temporal boundaries of the VC.
Boundaries - Administrative	Description of management jurisdictions and/or relevant legislation.
Boundaries - Technical Boundaries	Description of any substantive constraints on baseline collection/presentation or environmental effects predictions.
Likely Future Conditions	Statement of likely condition of environment within expected lifespan of Project if the Project is not approved.
Environmental Effects Analysis	
(subsections)	Presentation of potential adverse environmental effects by Project phase (construction, operations, decommissioning and abandonment (including conditions of temporary closure or shut-down), accidents, malfunctions and unplanned events).

Section	Contents
	This is where the factors considered in the environmental effects analysis (typically: magnitude, geographic extent, duration, frequency, reversibility, ecological and socioeconomic/cultural context, certainty of knowledge are used to describe the potential adverse environmental effects or potential benefits.
Environmental Design, Mitigation and Optimization	Summary of environmental design features integrated into the Project, mitigation and environmental management initiatives.
Residual Environmental Effects	
(subsections)	VC specific significance criteria provided. Residual adverse environmental effects are described and rated as either not significant or significant by planned Project phase (C, O, D&A), accidents, malfunctions and unplanned events, the planned Project overall, and cumulative environmental effects of the planned Project in combination with other projects and activities. Neutral or positive environmental effects are described. Various sustainability planning embellishments are included for each residual adverse environmental effect rating as well as reference to key legislation.
Monitoring and Follow-up Program	Brief descriptions as appropriate, cross reference to Chapter 5 – Sustainability Management.
References and Appendices	Key supporting references.

8.2.1. Existing Conditions

Existing conditions presents information on the VC and comprises a presentation of information for the reviewer on: a brief description of the existing conditions of the VC including the notions of boundaries used in environmental assessment to describe the environmental assessment area for the VC; and, the likely future conditions of the VC should the Project not proceed (the “No Project” alternative).

8.2.1.1. Environmental Assessment Boundaries

Each VC chapter commences with an introduction to the regional ecological, socio-economic and socio-cultural context for the VC. Specific "boundaries" or "limits" on the environmental assessment studies are addressed. These boundaries are specific for each particular VC. The notion of boundaries in this EEA includes: ecological (spatial and temporal) boundaries; technical boundaries; and, administrative boundaries for each VC (Beanlands and Dunker 1983). KGHM acknowledges that there is the potential for confusion amongst the use of terms such as Project Area, Study Area (Local and Regional), etc. that have been used to describe, for example, areas where baseline studies occurred or where Project activities occur. Such terms can lead to confusion as to

where the potential adverse environmental effects on each VC will occur. Therefore, to try and make this EEA more understandable, the environmental assessment area for each VC will be described using, as appropriate, Project, ecological, administrative and technical boundaries. The environmental assessment area can be unique to each VC and describes where the environmental effects are predicted to occur and the area where they are assessed. The environmental assessment area for any particular VC may also coincide with the study area boundaries that were used for the purposes of collecting baseline field data, as appropriate. Establishing the environmental assessment area for each VC also helps better understand other past, present and likely future project and activities that may combine with Project activities to produce cumulative environmental effects.

8.2.2. Environmental Effects Analysis

This second major section of each VC chapter provides information relevant to the evaluation of potential environmental effects related to Project development. The potential adverse environmental effects will be described for each major phase of the Project (construction, operations, decommissioning and abandonment, as well as for accidents, malfunctions and unplanned events). Where appropriate, specific potential adverse environmental effects associated with major modifications or conditions of temporary closure or shutdown will be described.

The environmental effects analysis will include the typical factors to be considered in describing potential adverse environmental effects.

8.2.2.1. Factors Considered in the Environmental Effects Analysis

The factors considered in the environmental effects analysis are typical for contemporary environmental assessments in Canada (FEARO 1994b and CEA Agency 2015; Hegmann et al. 1999). The factors are used to help tell the reviewer about the environmental effect rather than what the environmental effect is. Any or all of the factors may or may not be directed related to the determination of significance of residual adverse environmental effects since residual environmental effects are typically based on key thresholds or measurement endpoints. As such, FNX has separated the factors considered in the environmental effects analysis from the criteria used to determine whether residual adverse environmental effects are significant or not significant, is a well-established practice in Canada. Potential neutral or positive environmental effects (or benefits) are simply described. Where any differences occur with respect to the factors considered it the environmental effects analysis, they are described in the environmental effects analysis for each VC.

8.2.2.1.1. Magnitude

The magnitude factor simply relates, for the reviewer, what the overall amount or degree of change in a measureable parameter, or variable, related to existing conditions is expected to be. The definitions established for the ratings applied to "magnitude" and "reversibility" are outlined in Table 8-2. For non-population based VCs (such as Atmospheric Environment, Surface Water Quality, Groundwater Quantity, and

Archaeological Resources), VC specific definitions for magnitude are provided in each respective VC chapter.

Table 8-2: Definitions for Magnitude and Reversibility of Environmental Effects

Rating	Magnitude	Reversibility
High	An environmental effect affecting a whole stock, population or definable group of people, or where a specific parameter is outside the range of natural variability determined from local knowledge over many seasons.	Previous research/ experience indicates the environmental effect is reversible.
Medium	An environmental effect affecting a portion of a population, or one or two generations, or the environmental effect may be where there are rapid and unpredictable changes in a specific parameter so that it is temporarily outside the range of natural variability determined from local knowledge over many seasons.	Previous research/ experience indicates the environmental effect may be reversible.
Low	An environmental effect affecting a specific group of individuals in a population in a localized area, one generation or less, or where there are distinguishable changes in a specific parameter; however, the parameter is within the range of natural variability determined from local knowledge over many seasons.	Previous research/ experience indicates that there is a small likelihood that the environmental effect is reversible.
Nil	No environmental effect.	Previous research/ experience indicates that the environmental effect is non-reversible.
Unknown	An environmental effect affecting an unknown portion of a population or group or where the changes in a specific parameter are unknown.	There is insufficient research/experience to indicate whether the environmental effect is reversible.

8.2.2.1.2. Geographical Extent

The geographic extent factor is simply presented as a range or scale of approximate geographic areas that are used to help describe to the reviewer the areas over which any particular potential interaction is anticipated to occur.

8.2.2.1.3. Timing

Timing is used, as appropriate to highlight any sensitive periods that may be important for Project planning or scheduling of activities (such as breeding seasons for important wildlife species).

8.2.2.1.4. Frequency

The frequency factor is used to help describe to the reviewer the nature of the interaction being analyzed and comprises a range of events/year from a few to continuous activities. For example, noise from blasting may occur relatively infrequently, whereas noise associated with vehicle movements would be more frequent and noise from diesel generators would be continuous.

8.2.2.1.5. Duration

The duration factor is used to help describe to the reviewer how long any potential environmental effect may occur. For example, environmental effects associated with vehicle operations will have a shorter duration during construction, compared to operations based on the anticipated construction schedule and life of Project.

8.2.2.1.6. Reversibility

The reversibility factor is used to provide to the reviewer an indication as to whether or not the anticipated adverse effect is reversible, or recoverable, or not. The factor is largely based on a combination of experience, professional judgment, and/or previous research.

8.2.2.1.7. Ecological, Socio-economic and Socio-cultural Context

The existing context factor provides the reviewer with an indication of any key local or regional ecological, socio-economic or socio-cultural features, particularly existing levels of human activity and associated disturbance. This factor is described over the assessment area for the VC and provides an indication of any special features that need to be considered in this analysis (e.g. pristine or unique ecological features, rare and endangered species habitat, parks or special areas, historic resources, cultural resources).

8.2.2.1.8. Certainty of Knowledge

This factor indicates to the reviewer the general level of confidence in the knowledge used to describe the potential environmental effect.

8.2.2.1.9. Approach to Analyzing Cumulative Environmental Effects

FNX has conducted a complete and comprehensive evaluation of the concept of cumulative environmental effects from an individual Project perspective. FNX's treatment of the notion of cumulative environmental effects should complement, or substantially contribute to, ongoing responsibilities of regional cumulative environmental effects analysis, or integrated resource planning by governments and communities. The consideration of the Project in combination with past, present and likely future projects and activities contributes to helping bring forward a complete

environmental effects analysis and augment sustainability planning in the region by others. Issues with respect to cumulative environmental effects have been considered at various levels within this environmental effects analysis by FNX.

First, FNX considers having an adequate environmental baseline is important to support key aspects of the environmental effects analysis, such as the identification of issues and concerns and the selection of VCs. An adequate environmental baseline also contributes a substantial portion to the concept cumulative environmental effects issue. A good knowledge of baseline conditions in the area also contributes to the understanding of the environmental effects of past and present projects and activities on each VC. Current baseline conditions reflect the environmental effects of past and present activities.

Second, the potential adverse environmental effects of each Project phase are rated in the residual adverse environmental effects section of each VC chapter. Therefore, it is the cumulative potential adverse environmental effects of, for example, loss of habitat, reduced water quality etc. that occur during construction, on for example Fish and Fish Habitat that are rated as significant or not significant, thus achieving an additional level of cumulative effects assessment. Third, in addition to rating the residual adverse environmental effects of each phase of the Project, the residual adverse environmental effects of the planned Project overall (not including accidents, malfunctions and unplanned events) are rated for each VC, thus achieving another level of cumulative effects analysis in this EEA. Lastly, a separate rating of significance of the Project, in combination with other likely projects and activities described in Chapter 3 – Project Description, Section 3.3 - Schedule, to address the issue of potential cumulative environmental effects from a regional use and land planning perspective.

8.2.2.1.10. Other Projects and Activities Considered in the Cumulative Environmental Effects Analysis

As described in Chapter 3 – Project Description, the Project is closely related to past and present activities on the Victoria site (exploration). These closely related activities not only enable FNX to have a high degree of certainty about what future Project environmental effects may be but also help ensure engineering design and mitigation measures are adequate to reduce residual adverse environmental effects to not significant and acceptable levels. However, there are some other projects and activities in the area that also need to be considered. Chapter 3 – Project Description includes a range of other project and activities including: local residents, local recreational properties and land use, and the use of area roads by the public.

8.2.2.1.11. Engineering Design, Mitigation Measures and Sustainability Management

Each detailed environmental effects analysis section in a VC chapter summarizes either the engineering design features that have been integrated into the Project or additional mitigation measures needed to avoid or reduce potential adverse environmental effects to acceptable levels. The identification of effective sustainability management practices is also provided to help reduce residual adverse environmental effects to acceptable levels.

8.2.2.2. Integration into Sustainability Management

The important residual adverse environmental effects of the Project on the VC are included in a detailed analysis of how engineering design or Project specific environmental management system elements to address the sustainability needs of the Project based on the environmental effects analysis on each VC (see Chapter 5 – Sustainability Management, Section 5.16 – Project-Specific Sustainability Management Needs).

8.2.3. Residual Environmental Effects

Residual environmental effects are those environmental effects predicted to remain after the application of engineering design and mitigation outlined in this environmental effects analysis. Residual environmental effects and their significance are presented in the "Residual Environmental Effects" section of each VC chapter. Following the conclusions reached in the "Environmental Effects Analysis" section of each VC chapter, the significance of environmental effects, for a particular VC is determined for each Project phase (Construction, Operations, Decommissioning and Abandonment). In addition, residual adverse environmental effects are also described for potential accidents, malfunctions and unplanned events. As previously mentioned, where appropriate, residual adverse environmental effects resulting from temporary closure will be described if such anticipated effects are different than those anticipated at closure. To provide emphasis on a key aspect of the cumulative environmental effects assessment, in a separate chapter, a separate rating of the adverse environmental effects of the Project, in combination with other projects and activities, will be provided for a more regional perspective and to assist those responsible for regional integrated land use planning.

VC specific criteria for rating residual adverse environmental effects as either not significant or significant will be presented for each VC. A simple summary of key residual adverse environmental effects is presented for each VC (example shown in Table 8-3). Residual environmental effects that are considered neutral or positive are simply described.

Table 8-3: Summary of Residual Adverse Environmental Effects – Template Example

Valued Component	Key Adverse Residual Environmental Effect	Significance[1]	Probability of Occurrence (Likelihood)[2]	Effect on Ecosystem Function and Integrity	Sustainable (Capacity) Use of Renewable Resources	Relevant Legislation[3]
Terrestrial Habitat						
Construction						
Operations						
Decommissioning and Abandonment						
Accidents, Malfunctions and Unplanned Events						
Planned Project Overall						
The Project in Combination with other Projects and Activities						

Notes:
1. The rating of significance for adverse residual environmental effects are those predicted effects remaining after the application of mitigation.
2. Sustainability factors are described for all predicted adverse residual environmental effects.
3. Key federal legislation references as appropriate for relevant predicted adverse environmental effects.

For each VC where residual adverse environmental effects are predicted, the adverse environmental effect is further described in terms of some fundamental indicators of sustainability including: probability of occurrence (likelihood); effect on ecosystem function and integrity; and the sustainable use (capacity) of renewable resources to meet present and future needs. Definitions for these sustainability ratings are shown in Table 8-4. This approach is consistent with the three steps outlined for determining whether environmental effects are adverse, significant and likely (CEA Agency 2015). The residual adverse environmental effects summary table for each VC also includes a cross-reference to key federal legislation as appropriate.

Table 8-4: Definitions for Probability of Occurrence, Effect on Ecosystem Function and Integrity and Sustainable Use of Renewable Resources for Residual Adverse Environmental Effects

Rating	Probability of Occurrence	Effect on Ecosystem Function and Integrity	Sustainable Use (Capacity) of Renewable Resources to Meet Present and Future Needs
High	An environmental effect is probable and there is no uncertainty based on previous scientific research/experience.	Residual adverse environmental effects may result in severe ecosystem changes that result in large scale changes in resource management practices/ planning and land use.	Previous research/experience indicates that the environmental effect on the VC would not reduce biodiversity or the capacity of resources to meet present and future needs.
Moderate	An environmental effect may occur but there is some uncertainty based on previous scientific research/experience.	Residual adverse environmental effects may result in temporary changes resource management practices and land use.	Previous research/experience indicates that the environmental effect on the VC may, to a certain extent, reduce biodiversity or the capacity of resources to meet present and future needs.
Low	An environmental effect has a small probability of occurring and there is little uncertainty based on previous scientific research/experience.	Residual adverse environmental effects will not result in noticeable change to ecosystem components. Changes may be similar to natural variability.	Previous research/experience indicates that the environmental effect on the VC would reduce biodiversity or the capacity of resources to meet present and future needs.

Rating	Probability of Occurrence	Effect on Ecosystem Function and Integrity	Sustainable Use (Capacity) of Renewable Resources to Meet Present and Future Needs
Nil	An environmental effect has no probability of occurring and there is no uncertainty based on previous scientific research/experience.	Anticipated adverse environmental effects area small and may not be detectable.	Previous research/ experience indicates that the environmental effect on the VC would eliminate biodiversity or the capacity of resources to meet present and future needs.
Unknown	There is insufficient research, experience, Indigenous knowledge to predict the likelihood of an environmental effect occurring.	There is insufficient knowledge to predict an ecosystem effect.	There is insufficient research/experience to indicate whether the environmental effect on the VC would reduce biodiversity or the capacity of resources to meet present and future needs.

8.3. References

- Beanlands, G.E. and P.N. Duinker. 1983. An Ecological Framework for Environmental Impact Assessment in Canada. Institute for Resource and Environmental Studies, Dalhousie University, Halifax, NS, and Federal Environmental Review Office, Ottawa, ON.
- Canadian Environmental Assessment Agency (CEAA). 2015. Determining Whether a Designated Project Is Likely to Cause Significant Adverse Environmental Effects under the *Canadian Environmental Assessment Act*, 2012. CEAA, Hull.
- Federal Environmental Assessment and Review Office (FEARO). 1994a. Determining Whether a Project Is Likely to Cause Significant Adverse Environmental Effects. CEAA, Hull.
- Federal Environmental Assessment and Review Office (FEARO). 1994b. Reference Guide: Addressing Cumulative Environmental Effects In: Responsible Authority's Guide. Ottawa: Minister of Supply and Services Canada.
- Hegmann, G., C. Cocklin, R. Creasey, S. Dupuis, A. Kennedy, L. Kingsley, W. Ross, H. Spaling and D. Stalker. 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.

Table of Contents – Chapter 9

9. Atmospheric Environment 139

9.1. Existing Conditions 140
9.1.1. Spatial and Temporal Ecological Boundaries 141
9.1.2. Administrative Boundaries 144
9.1.3. Technical Boundaries 148
9.1.4. Likely Future Conditions 149
9.2. Environmental Effects Analysis 149
9.2.1. Construction 151
9.2.2. Operations 153
9.2.3. Decommissioning and Abandonment 155
9.2.4. Environmental Design, Mitigation and Optimization 157
9.3. Residual Environmental Effects 160
9.3.1. Construction 162
9.3.2. Operations 162
9.3.3. Decommissioning and Abandonment 165
9.3.4. Accidents, Malfunctions and Unplanned Events 166
9.3.5. Planned Project Overall 166
9.3.6. Cumulative Environmental Effects 166
9.3.7. Monitoring and Follow-Up Program 166
9.4. References and Appendices 167

9. Atmospheric Environment

Atmospheric Environment was selected as a Valued Component for assessment because of the potential for Project emissions of concern from a metal mine product mining facility (e.g., particulate matter, nitrogen oxide, sulphur oxide, carbon monoxide) to affect human health in vicinity of the Project and because the Fairbank Lake Cottagers Association has raised concerns regarding atmospheric effects (dust and noise).

The Atikameksheng Anishnawbek First Nation (AAFN) did not raise air quality as an issue of concern and provided letters of support for the application for an Environmental Compliance Approval (ECA) - Air (permit number 8794-8VFJ7B) that was issued for the Project under the provincial *Environmental Protection Act (R.S.O. 1990)* in 2014. Likewise, the Sagamok First Nation (SFN) provided verbal support for the air ECA and the Métis Nation of Ontario provided written approval of the ECA as long as consultation continues. See Chapter 6 – Consultation and Issue Scoping for a summary of issues raised during consultation activities.

This section assesses predicted air quality and noise and vibration conditions in the Project area and describes potential adverse or beneficial effects of the Project on the Atmospheric Environment. Air Emissions generated by the Project, based on worst-case conditions, were estimated and compared to applicable limits including Point of Impingement limits listed in Schedule 3 of *Ontario Regulation 419/05* and in the companion document `Summary of Standards and Guidelines to support *Ontario Regulation 419/05 – Air Pollution – Local Air Quality*' (MOECC), 2012a), provincial Ambient Air Quality Criteria (MOECC, 2012b), and federal Canadian Ambient Air Quality Standards (Canadian Council of Ministers of the Environment, 2012). Primary (on-site) greenhouse gas (GHG) emissions associated with diesel fuel and other fuel sources are estimated to be 9 $ktCO_2eq/yr$ during construction, 20.1 $ktCO_2eq/yr$ during operations and 5.6 $ktCO_2eq/yr$ during decommissioning and abandonment. The principal stationary power source for both construction and operations is the transmission line from the grid, which generates GHG emissions outside of the site boundaries (secondary, upstream). Approximately 90% (IESO, 2016) of the Ontario grid composition relies on non-GHG generating fuel types (nuclear, hydro, wind). The GHG emissions associated with grid electricity production are estimated to be 11 $ktCO_2eq/yr$ during construction, 11 $ktCO_2eq/yr$ during operations and 0.11 $ktCO_2eq/yr$ during decommissioning and abandonment. These estimates are very small (<0.05%) compared to province of Ontario and Canada-wide totals and future targets.

Predicted noise levels were compared against the Ontario environmental noise guideline for stationary and transportation sources (MOECC, 2013) and community noise predictions were compared to background noise levels to determine if or when the mine is audible, based on the closest nearby community receptors (residences, recreational, public use areas). Ground-borne vibration levels were not explicitly assessed as vibration

is expected to be minor and it was assumed noise levels represent a reasonable proxy to determine the potential effects of vibration.

It should be noted this Atmospheric Environment assessment concentrates on comparisons with health-based guideline limits and effects on human receptors. The effects of potential air quality, noise, and vibration changes associated with the Project on other biophysical components, including wildlife and vegetation, are addressed elsewhere in their respective chapters.

9.1. Existing Conditions

The climate at the Project site generally consists of warm summers and cold winters. Long-term climate statistics (1981 to 2010), based on the regional climate stations maintained by Environment Canada and monitored in Sudbury, indicate a total annual precipitation of approximately 900 millimetres, with roughly 30% falling as snow in the region. Annual average temperatures range from -18°C to 25°C, with minimum daily temperatures occurring in January and maximum daily temperatures occurring in July. Predominate wind direction is from the 'south-west'.

Although the Project Site and surrounding area is zoned industrial (2010, Schedule A Bylaw and see Figure 4 in the Emission Summary and Dispersion Modelling Report, 2015, Appendix A), the existing noise levels in the vicinity of the Project reflect a rural sound environment with generally low background noise emissions, characterized by sounds of nature with little road traffic. Background noise levels in the surrounding area can drop into the 20 dBA range and it is noted some mines in the region have received noise complaints below the MOECC limit of 40 dBA as people tend to judge a new sound in comparison to existing sounds.

Although air pollution caused by past methods of mineral processing contributed to degraded local air quality in the Greater Sudbury area, based on a review of recent air quality monitoring data collected by the MOECC (MOECC, 2009-2013), local air quality trends have improved. As an indicative measure of existing air quality conditions, the results of the Air Quality Index (AQI) established by the MOECC was reviewed for the Greater Sudbury area. The AQI is an indicator of air quality which is based on air pollutants that have adverse effects on human health and the environment. The pollutants considered are ozone (O_3), Particulate Matter (PM), Nitrogen Dioxide (NO_2), Carbon Monoxide (CO), Sulphur Dioxide (SO_2) and total reduced sulphur compounds. As shown in Table 9-1, Sudbury AQI results from 2009 to 2013 show the Greater Sudbury area local air quality is in the 'Very Good' to 'Good' range 95.8% to 97.3% of the time. Local air quality in the 'Very Good' to 'Good' range is not expected to have adverse health effects in healthy people (MOECC, 2015). Review of recent air quality monitoring data from the Greater Sudbury area shows comparable air quality to other cities in Northern Ontario with specific contaminants (e.g. SO_2) showing an overall 62% decrease provincially from 1994 – 2013 (MOECC, 2015). Ambient air quality concentrations are

generally low and within federal and provincial AAQOs. The Sudbury airshed is subject to transboundary flow influences from the United States of America which can account for approximately half of Ontario's smog during an air quality episode (MOECC, 2015).

Table 9-1: Valid Hours AQI in Range - Sudbury

AQI Range	Percentage of Valid Hours AQI in Range				
	2013	2012	2011	2010	2009
Very Good	32.4	32.5	31.9	30.7	40.9
Good	63.5	63.3	65.7	66	56.4
Moderate	4.1	4.1	2.4	3.3	2.6
Poor	0	0.1	0	0.1	0.1
Very Poor	0	0	0	0	0

Source: MOECC, Air Quality in Ontario Report, 2009-2013.
http://www.airqualityontario.com/press/publications.php

9.1.1. Spatial and Temporal Ecological Boundaries

For air quality dispersion modelling, an environmental assessment area and Point of Impingement (POI) criteria were selected to represent the spatial distribution of concentrations and deposition patterns associated with pollutants of concern related to the Project (PM, products of combustion) and to predict areas where air quality effects may occur. The environmental assessment area was established in accordance with the MOECC publication Guideline A-11: Air Dispersion Modelling Guideline for Ontario, Version, 3.0, dated May 2015 (ADM GO) PIBS 5165e03 (see Figure 9-1). The environmental assessment area is represented via a nested receptor grid, centered around the outer edges of all the sources, and was placed as follows:

a) 20 metre spacing, within an area of 200 metres by 200 metres;

b) 50 metre spacing, within an area surrounding the area described in (a) with a boundary at 300 metres by 300 metres outside the boundary of the area described in (a);

c) 100 metre spacing, within an area surrounding the area described ,in (b) with a boundary at 800 metres by 800 metres outside the boundary of the area described in (a);

d) 200 metre spacing, within an-area surrounding the area described in (c) with a boundary at 1,800 metres by 1,800 metres outside the boundary of the area described in (a); and

e) 500 metre spacing, within an area surrounding the area described in (d) with a boundary at 4,800 metres by 4,800 metres outside the boundary of the area described in (a).

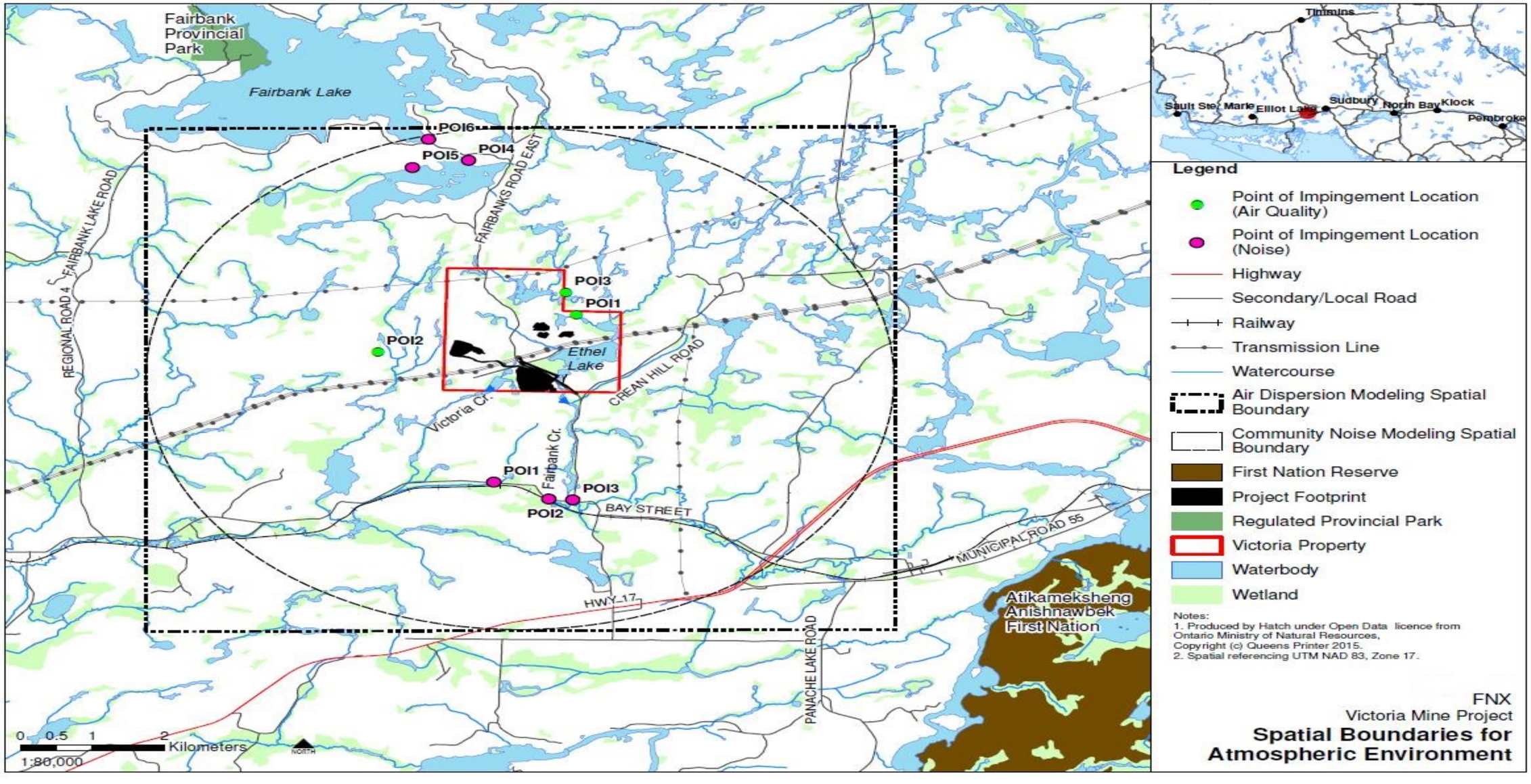

Figure 9-1: Spatial Boundaries for Atmospheric Environment

In addition to using the nested receptor grid, receptors were also placed every 10 metres along the property line in sections of the property line that are within 200 metres of an emission source and every 100 metres in sections of the property line that are greater than 200 metres from an emission source. POI criteria was established based on the nearest off-site temporary and permanent residences. See Figure 8 in the Emission Summary and Dispersion Modelling Report, 2015, Appendix A, for a visual representation of the nested receptor grid and POI locations. As concentrations and deposition will tend to be largest nearest to the emissions sources and decrease with increasing distance, a larger environmental assessment area was not specifically included.

For environmental noise emissions, the environmental assessment area was based on the surrounding area were modelling predicted off-site noise levels above 20 dBA - equivalent to the level of sound an average person would hear in deep woods on a calm day - due to project-related activities. This resulted in an environmental assessment area of approximately five kilometre radius from site in which noise levels were modelled (see Figure 9-1). Noise levels outside of this radius are not expected to have a perceivable effect on human receptors as noise levels below 20 dBA are presumed reasonably inaudible compared to background conditions.

The temporal boundary for the effects assessment on Atmospheric Environment covers the period between 2024 and 2045. Air quality modelling results for each pollutant of concern is based on the defined averaging period at assumed operating conditions for the Facility that result in the highest concentration of each significant contaminant in the environmental assessment area or at a POI. Noise modelling results at POI are based on of an equivalent sound level (Leq) or energy average of sound level over a period of time, e.g. one hour.

9.1.2. Administrative Boundaries

Air quality is managed federally and provincially, with either annual mass emissions limits or ambient air quality limits.

For annual mass emissions limits related to the Project, *Ontario Regulation 194/05*, administered by the MOECC establishes the "new source set aside" (NSSA) allowance limits (Table 9-2) or Nitrogen Oxides (NOx) and SO_2 for new or expanding facilities.

Table 9-2: *O. Reg. 194/05* NSSA Allowances

Emission Type	NSSA limits (t/y)
NOx	3,100
SO_2	10,100

Annual mass emissions limits are also triggered for facilities that emit more than 50,000 tonnes of CO_2 equivalents which require GHG emissions to be reported to the Federal government under Section 46 of the *Canadian Environmental Protection Act* (*CEPA*). Facilities that emit greater than 10,000 tonnes of CO_2 equivalents per year must provide detailed GHG emission data to the MOECC under *O. Reg. 452/09*.

For ambient air quality limits, government health and environmental agencies have established threshold levels for chemical compounds that have potential effects to human health. These thresholds are effects-based levels in air, based on health, odour, vegetation, soiling, visibility, corrosion or other effects, depending on the pollutant.

For ambient air quality limits at a federal level, the federal government prescribes thresholds for PM and O_3 via the Canadian Ambient Air Quality Standards (CAAQS) and for other chemical compounds via the National Ambient Air Quality Objectives (NAAQO). The NAAQOs are divided into three categories, described as follows (Environment Canada, 2010):

- "Maximum desirable level is the long-term goal for air quality and provides a basis for an anti-degradation policy for the unpolluted parts of the country, and for continuing development of control technology."
- "Maximum acceptable level is intended to provide adequate protection against effects on soil, water, vegetation, materials, visibility, personal comfort, and well-being."; and
- "Maximum tolerable level denotes time-based concentrations of air contaminants beyond which, due to a diminishing margin of safety, appropriate action is required without delay to protect the health of the general public."

The NAAQOs are not enforceable, but can be adopted by provincial and territorial jurisdictions as enforceable standards. For the purpose of the assessment, at a federal level only the CAAQS thresholds for PM and O_3 and the 'maximum desirable levels' and 'maximum acceptable levels' under the NAAQO were considered.

For ambient air quality limits at a provincial level, the MOECC has published *Ontario Regulation 419/05: Air Pollution – Local Air Quality (O. Reg. 419)*, which sets Point of Impingement limits or ground level concentrations (GLC) limits for approximately 350 different compounds including the pollutants of concern related to the Project (PM and products of combustion). Table 9-3 identifies and compares the Ontario ambient air quality GLC limits, the federal objectives, and the CAAQS. The time weighted average criteria refer to different averaging periods to account for potential short-term acute exposures and long-term chronic exposures. On the basis of the precautionary principle, the most stringent criteria from the various Canadian jurisdictions were selected as the threshold for each contaminant indicator. In general, if the concentration or deposition level of an airborne pollutant can be maintained below its threshold, then either no

health effect is observed or the effect is small enough that it presents an acceptably low risk to the population and the environment.

Table 9-3: Ambient Air Quality Criteria, Standards, and Objectives

Compound	Time weighted average	*Ont. Reg. 419/05*, Schedule 3 POI Limits[1]	Ontario AAQC[2]	Canadian NAAQOs[3]		CAAQS[4]	Indicator Threshold
				Maximum Desirable Level	Maximum Acceptable Level		
Sulphur Dioxide (SO_2)	1 h	690 µg/m^3	690 µg/m^3	450 µg/m^3	900 µg/m^3	-	450 µg/m^3
	24 h	275 µg/m^3	275 µg/m^3	150 µg/m^3	300 µg/m^3	-	150 µg/m^3
Carbon Monoxide (CO)	½ h	6000 µg/m^3		-	-		6,000 µg/m^3
	1 h	-	36,200 µg/m^3	15 mg/m^3	35 mg/m^3	-	15 mg/ m^3
	8 h	-	15,700 µg/m^3	6 mg/ m^3	15 mg/m^3	-	6 mg/m^3
Nitrogen Dioxide (NO_2)	1 h	400 µg/m^3 (NOx)	400 µg/m^3 (NOx)	-	400 µg/m^3	-	400 µg/m^3 (NOx)
	24 h	200 µg/m^3 (NOx)	200 µg/m^3 (NOx)	-	-	-	200 µg/m^3 (NOx)
Particulate Matter <2.5 µm (PM2.5)	24 h	-	30 µg/m^3	-	-	30 µg/ m^3	30 µg/m^3
Total Suspended Particulate (TSP)	24 h	120 µg/m^3	120 µg/m^3	-	120 µg/m^3	-	120 µg/m^3
	Annual	-	60 µg/m^3	60 µg/ m^3	70 µg/m^3	-	60 µg/m^3
Ammonia	24 h	100 µg/m3	100 µg/m^3	-	-	-	100 µg/m^3

Sources:

[1] *Ontario Regulation 419/05 Schedule 3*

[2] *Ontario Ambient Air Quality Criteria (AAQC), April 2012.*

[3] *Environment Canada National Ambient Air Quality Objectives. Conditions of 25°C and 101kPa.*

[4] *Canadian Ambient Air Quality Standards (CAAQS), established as objectives under the Canadian Environmental Protection Act (1999), 2013.*

It should be noted, the Project is regulated to *O. Reg. 419* requirements under ECA - Air No. 8794-8VFJ7B (Issued July 2, 2014) which also requires a Best Management Practices Plan be developed and implemented for the control of fugitive dust emissions.

Federally, Health Canada does not have enforceable noise thresholds or standards. Environmental noise emission concerns are addressed at a provincial level through Noise Pollution Control (NPC) guidelines. Provincial NPC guidelines can be divided into two fundamental categories. The first category contains guidelines that provide measurement and calculation procedures, instrumentation specifications and applicable definitions. The second category contains criteria guidelines that provide the applicable noise level limits, vibration limits or emission standards. These criteria guidelines have been designed based on the principle that sound levels complying with the limits minimize the potential for adverse effects from noise. They are intended to provide guidance for the planning of land uses where noise may have a potential effect. In accordance with MOECC guidelines (MOECC, 2013), the area surrounding the Project is defined as Class 3 (rural). MOECC guidelines for noise in rural areas set an equivalent (energy average) sound level limit of 40 dBA for sounds which occur at night, which becomes the limit for any 24 hour operation like a mine (see Table 9-4).

Table 9-4: Exclusion Limit Values of One-Hour Equivalent Sound Level (Leq, dBA) Plane of Window of Noise Sensitive Spaces by Time of Day for a Class 3 Area (NPC300)

Time of Day	Indicator Threshold
07:00 – 19:00	40 dBA
19:00 – 23:00	40 dBA
23:00 – 07:00	40 dBA

9.1.3. Technical Boundaries

Research was mainly web-based and included a variety of public sources, including the City of Greater Sudbury, MOECC websites, the Government of Canada websites, review of other comparable facilities in the region, and regional data from the ambient air monitoring network operated by the MOECC.

Both predictive air quality modelling and community noise modelling were used to determine environmental effects based on the 'worst case' scenario for the Project (e.g. the highest emission rate that each identified source is capable of is realized, all sources are assumed to be operating simultaneously at the corresponding maximum emission rate for the averaging period, maximum thermal heat input or engine rating for each piece of equipment used, etc.) during the Project lifecycle.

For predictive air quality modelling, an AERMOD dispersion model (v. 14134) and AERMAP surface pre-processor (v. 09040) was run using a MOECC pre-processed five year dispersion meteorological dataset (i.e. surface and profile files), last updated in

2015, in accordance with paragraph 1 of s.13(1) of *O. Reg. 419/05* for Advance Exploration activities. As the Facility is located in the Northern MOECC Region, the meteorological dataset for Sudbury was used. The land use surrounding the Facility would be characterized as rural. As a result, MOECC's "Forest" meteorological dataset was used. For more information, please see the Emission Summary and Dispersion Modelling (ESDM) report, Appendix A.

For noise and vibration modelling, a community noise model was performed using CADNA-A software which implements ISO 9613(2) – the most widely used industrial noise prediction method and the prediction method used by the Ontario MOECC – for Operations activities. The assessment complies with the NCP-232 Sound Level Limits for Stationary Sources in Class 3 (Rural) Areas' as required by the MOECC. For more information, please see the Noise Impact Summary Report (47VP-024124-005-RPT-0025) attached in Appendix C.

9.1.4. Likely Future Conditions

Likely future conditions of the Atmospheric Environment, should the Project not proceed, are generally expected to be similar to existing atmospheric conditions. Over time and assuming no significant reduction of greenhouse gas concentrations in the atmosphere globally, there is a potential for effects due to climate change such as increase in average temperature, changes in the patterns and amounts of precipitation, and increased frequency, intensity, or duration of extreme events (US EPA, 2015).

9.2. Environmental Effects Analysis

Construction and Operation of the Project will introduce new, local sources of air contaminants to the area surrounding the Project. Air emissions generated by the Project will include point source and fugitive emissions. A reduction in air quality due to these emissions may result in effects on human health, however these are not predicted to be significant. These potential effects can result from exposure to ambient air concentrations or from accumulation in, through deposition to, the environment. In addition, Construction and Operations will introduce new, local sources of noise and vibration that have the potential to disturb receptors.

The following sections discuss the potential adverse or beneficial environmental effects of the Project on the Atmospheric Environment. The sections are organized by project phase, including Construction, Operations, Decommissioning and Abandonment and, Accidents, Malfunctions and Unplanned Events. A standard assessment approach was used to analyze potential atmospheric environment effects associated with Project-related activities. This approach included the following tasks:

- Use existing baseline ambient air quality monitoring data from the MOECC to establish existing background levels for air quality and use passive baseline ambient noise monitoring to establish existing background levels of noise and vibration;

- Identify and quantify atmospheric and noise emission sources associated with the Project sites;
- Consider local meteorological conditions to determine transport and dispersion patterns in the region;
- Use air quality dispersion modelling results from Advanced Exploration and community noise and vibration modelling results based on Operations to determine ambient levels, concentrations or deposition patterns for the Project during Construction, Operations, Decommissioning and Abandonment and, Accidents, Malfunctions and Unplanned Events;
- Compare the ambient monitoring measurements and air quality predictions to the ambient air quality, annual mass emissions limit, or noise level indicator thresholds; and
- Identify the incremental atmospheric environment changes and assess the significance of these effects.

It is noted that air quality dispersion modelling was only conducted on activities occurring during Advanced Exploration. Activities considered in air quality dispersion modelling for Advanced Exploration and their associated results are summarized in Table 9-5. Air quality dispersion modelling was not conducted for Construction, Operations, and Decommissioning and Abandonment as it is reasonably expected that Operations will have an overall lower potential for adverse effects relative to Advanced Exploration based on the principal stationary power source for Operations will be by transmission line and Construction and Decommissioning and Abandonment are only temporary in nature.

Table 9-5: Victoria Mine Air Emission Summary Table by Source (Advanced Exploration)

ID	Source Description	Contaminate	Maximum Emission Rate[1] (g/s)	Percentage of Overall Emissions
COLLAR	Mine Ventilation	PM	3.30E-01	54%
		CO	2.57E+00	71%
		NOx	5.67E-01	14%
		SO_2	3.85E-03	1%
WTP	Water Treatment Plant	NOx	2.15E-02	1%
		Ammonia	2.22E+00	100%
IDGEN1-IDGEN3,	Diesel Generators	CO	8.23E-01	23%
		NOx	2.31E+00	57%
		PM	1.92E-01	31%

ID	Source Description	Contaminate	Maximum Emission Rate[1] (g/s)	Percentage of Overall Emissions
IDGEN5-IDGEN7		SO_2	2.75E-01	79%
CRUSHER	PAG Stockpile Area Crusher	CO	2.16E-01	6%
		NOx	4.07E-01	10%
		PM	5.30E-02	9%
		SO_2	7.72E-02	22%
PAG_SP1	PAG Material Handling 1	PM	7.26E-03	1%

Note 1: Based on 'worst case scenario' as described by Victoria Advanced Exploration Project, Emission Summary and Dispersion Modelling Report. Version 2.0, Golder Associates, July 2015.

The following environmental effects analysis is based on the assumption that FNX will continue to implement the Project as designed as of 2015.

9.2.1. Construction

Construction activities that have the potential to adversely affect the Atmospheric Environment include:

- Operation and movement of equipment and vehicles on both paved and unpaved surfaces;
- Drilling, blasting of material;
- Ventilation of underground work areas;
- Rock and mine product handling activities (e.g., crushing, conveying and stockpiling);
- Operation of diesel generators; and
- Accidents, Malfunctions and Unplanned Events (such as forest fire).

Due to these activities, there is a potential adverse effect to the Atmospheric Environment related to reduced air quality due to elevated fugitive dust levels, vehicle noise and vehicle exhaust emissions (CO_2, SOx, NOx, PM).

A detailed environmental effects analysis for Construction, including Accidents, Malfunctions and Unplanned Events, is provided in Table 9-6.

Table 9-6: Environmental Effects Analysis; VC – Atmospheric Environment; Project Phase – Construction

Project Components or Activities	Potential Environmental Effects (A = adverse; B = beneficial)	Engineering Design, Mitigation Measures and Proven Environmental Management Practices	Factors Considered in the Environmental Effects Analysis*							
			Magnitude	Geographic Extent	Timing	Frequency	Duration	Reversibility	Ecological & Socio-economic Context	Certainty of Knowledge
Planned Activities										
Operation and movement of equipment and vehicles on both paved and unpaved surfaces	(A) Reduced air quality due to elevated dust levels, vehicle noise and vehicle exhaust emissions (CO_2, SOx, NOx, PM) adversely affects quality of life of nearby residents.	Dust controls measures (water, calcium or magnesium solution). Paving roads where practical. Use of a sweeper or vacuum truck on site. All equipment and vehicles regularly inspected and maintained. Vehicular traffic maximum speed limit of 20km/h on site roads and 60km/h on non-posted public roads. Maintain natural buffer vegetation where practical. Adherence to conditions of permits.	1	4	N/A	4	5	2	2	1
Drilling, blasting of material; ventilation of underground work areas	(A) Reduced air quality due to elevated dust levels and vented air from underground emissions (CO_2, SOx, NOx, PM) adversely affects quality of life of nearby residents. (A) Noise and vibration from ventilation fans and blasting may affect quality of life for nearby residents.	Reduced blasting schedule (maximum of two blasts per day). Reduced size of blast area (not to exceed 61 m^2). Blasting is largely underground rather than surface blasting. Wet sprays used during drilling to reduce dust. All equipment and vehicles regularly inspected and maintained. Adherence to conditions of permits including ground vibration peak particle velocity (PPV). Mine ventilation fans equipped with silencers and acoustical insulation.	1	4	N/A	3	5	2	2	1
Rock and mine product handling activities (e.g., crushing, conveying and stockpiling)	(A) Reduced air quality due to elevated dust levels adversely affects quality of life of nearby residents and wildlife. (A) Noise and vibration from crushers may affect quality of life for nearby residents.	Crusher equipment to be outfitted with dust collection equipment and will be located in covered buildings. All equipment and vehicles regularly inspected and maintained. Adherence to conditions of permits.	1	1	N/A	3	5	1	2	1
Operation of diesel generators	(A) Reduced air quality due to generator noise and generator emissions (CO_2, SOx, NOx, PM) adversely affects quality of life of nearby residents.	<5MW power generation capacity. Equipment will be completely or partially enclosed in buildings. Use of generators is temporary in nature until energization of substation is complete.	1	4	N/A	4	5	1	2	1
Accidents, Malfunctions and Unplanned Events										
Forest fire	(A) Release of fugitive emissions into atmosphere reducing air quality. (A) Depletion of natural vegetation.	Comprehensive emergency response resources, planning, training and procedures.	3	4	N/A	1	1	1	2	1

Key:

Magnitude: *
0 = Essentially no interaction
1 = Low, changes within regulated limits
2 = Moderate, changes near regulated limits
3 = High, changes exceed regulatory limits
4 = Unknown (see definitions in text, EA methods)

Geographic Extent: *
1 = Immediate work area
2 = Within Project closure plan boundary
3 = Within 5km of Project closure plan boundary
4 = Beyond 5 km of Project closure plan boundary

Frequency: *
1 = Uncommon event, event occurs once or infrequently/ periodically
2 = Happens regularly but infrequently (e.g., once or twice per month)
3 = Happens regularly (e.g. daily)
4 = Continuous activity

Duration: *
1 = < 1 month
2 = 1-2 months
3 = 2-6 months
4 = 6-24 months
5 = 2-11 years (life of mine)
6 = >11 years (beyond Project)

Reversibility: *
1 = High
2 = Medium
3 = Low
4 = nil
5 = Unknown (see definitions in the text, EA Methods)

Ecological and Socio-economic Context: *
1 = Relatively pristine area not adversely affected by human activity
2 = Evidence of existing adverse effects
3 = High level of existing adverse effects

Certainty of Knowledge:*
1 = High – based on past performance and experience regarding environmental effects or mitigation
2 = Moderate – uncommon potential effect either not well understood or effects require compliance monitoring to modify engineering design or mitigation
3 = Low – potential for the need to follow-up based on results of compliance monitoring to modify engineering design or mitigation

9.2.2. Operations

The Operations activities that have the potential to adversely affect the Atmospheric Environment include:

- Operation and movement of equipment and vehicles on both paved and unpaved surfaces;
- Underground drilling, blasting and work space ventilation;
- Rock and mine product handling activities (e.g., crushing, conveying and stockpiling); backfill plant operations;
- Haulage of mine product offsite;
- Operation of cooling equipment (fresh air); and
- Accidents, Malfunctions and Unplanned Events (such as onsite fire or explosion, forest fire).

Due to these activities, there is a potential adverse effect to the Atmospheric Environment related to reduced air quality due to elevated dust levels, equipment noise and equipment exhaust emissions (CO_2, SOx, NOx, PM).

A detailed environmental effects analysis for Operations, including Accidents, Malfunctions and Unplanned Events, is provided in Table 9-7.

Table 9-7: Environmental Effects Analysis; VC – Atmospheric Environment; Project Phase – Operations

Project Components or Activities	Potential Environmental Effects (A = adverse; B = beneficial)	Engineering Design, Mitigation Measures and Proven Environmental Management Practices	Factors Considered in the Environmental Effects Analysis*							
			Magnitude	Geographic Extent	Timing	Frequency	Duration	Reversibility	Ecological & Socio-economic Context	Certainty of Knowledge
Planned Activities										
Operation and movement of equipment and vehicles on both paved and unpaved surfaces	(A) Reduced air quality due to elevated dust levels, vehicle noise and vehicle exhaust emissions (CO_2, SOx, NOx, PM) adversely affects the quality of life of nearby residents.	Dust controls measures (water, calcium or magnesium solution). Paving roads where practical. Use of a sweeper or vacuum truck on site. All equipment and vehicles regularly inspected and maintained. Vehicular traffic maximum speed limit of 20km/h on site roads and 60km/h on non-posted public roads. Maintain natural buffer vegetation where practical. Adherence to conditions of permits.	1	4	N/A	4	5	2	2	1
Underground drilling, blasting and work space ventilation	(A) Reduced air quality due to elevated dust levels and vented air from underground emissions (CO_2, SOx, NOx, PM) adversely affects the quality of life of nearby residents. (A) Noise and vibration from ventilation fans and blasting may affect quality of life for nearby residents.	All blasting is underground. Wet sprays used during drilling. Mine ventilation fans equipped with silencers and acoustical insulation. Site is located over 1 kilometre away from nearest receptor. Adherence to conditions of permits including compliance monitoring. Design blast to allowable PPV limits.	1	4	N/A	3	5	2	2	1
Rock and mine product handling activities (e.g., crushing, conveying and stockpiling); backfill plant operations	(A) Reduced air quality due to elevated dust levels adversely affects the quality of life of nearby residents. (A) Noise and vibration from materials handling may affect quality of life for nearby residents.	Crushing and backfill facilities to be equipped with dust collection equipment and will be located in covered buildings. All equipment and vehicles regularly inspected and maintained. Adherence to conditions of permits. Progressive reclamation and revegetation of abandoned work areas and stockpiles.	1	1	N/A	3	5	1	2	1
Operation of cooling equipment (fresh air)	(A) Fugitive emission of refrigerant leading to increase of global warming potential and ozone depletion.	Equipment will be completely or partially enclosed in buildings. Regularly scheduled maintenance according to manufacturer's recommendations on equipment. Use of R-134a refrigerant, a non-ozone depleting refrigerant at Refrigeration Plant.	1	4	N/A	4	5	1	2	1
Accidents, Malfunctions and Unplanned Events										
Onsite fire or explosion	(A) Onsite fire or explosion of any size will release fugitive emissions into atmosphere reducing air quality.	Use of utilidors and buried conduits for water, electrical, gas, etc. Comprehensive emergency response resources, planning, training and procedures.	3	4	N/A	1	1	1	2	1
Forest fire	(A) Degradation of terrestrial habitat.	Comprehensive emergency response resources, planning, training and procedures.	3	4	N/A	1	1	1	2	1

Key:

Magnitude: *
0 = Essentially no interaction
1 = Low, changes within regulated limits
2 = Moderate, changes near regulated limits
3 = High, changes exceed regulatory limits
4 = Unknown (see definitions in text, EA methods)

Geographic Extent: *
1 = Immediate work area
2 = Within Project closure plan boundary
3 = Within 5km of Project closure plan boundary
4 = Beyond 5 km of Project closure plan boundary

Frequency: *
1 = Uncommon event, event occurs once or infrequently/periodically
2 = Happens regularly but infrequently (e.g., once or twice per month)
3 = Happens regularly (e.g. daily)
4 = Continuous activity

Duration: *
1 = < 1 month
2 = 1-2 months
3 = 2-6 months
4 = 6-24 months
5 = 2-11 years (life of mine)
6 = >11 years (beyond Project)

Reversibility: *
1 = High
2 = Medium
3 = Low
4 = nil
5 = Unknown (see definitions in the text, EA Methods)

Ecological and Socio-economic Context: *
1 = Relatively pristine area not adversely affected by human activity
2 = Evidence of existing adverse effects
3 = High level of existing adverse effects

Certainty of Knowledge:*
1 = High – based on past performance and experience regarding environmental effects or mitigation
2 = Moderate – uncommon potential effect either not well understood or effects require compliance monitoring to modify engineering design or mitigation
3 = Low – potential for the need to follow-up based on results of compliance monitoring to modify engineering design or mitigation

9.2.3. Decommissioning and Abandonment

Decommissioning and Abandonment activities have the potential to positively affect the Atmospheric Environment through the reclamation of disturbed sites. Reclamation and re-vegetation of abandoned work areas will reduce site dusting and erosion and will contribute to improved air quality due to increased levels of carbon sequestration by plants.

Decommissioning and Abandonment activities that have the potential to adversely affect the Atmospheric Environment include:

- Operation and movement of equipment and vehicles; demolition and removal of buildings and the headframe; and
- Accidents, Malfunctions and Unplanned Events (such as forest fire).

Due to these activities, there is a potential adverse effect to the Atmospheric Environment related to reduced air quality due to elevated dust levels, equipment noise and equipment exhaust emissions (CO_2, SOx, NOx, PM).

A detailed environmental effects analysis for Decommissioning and Abandonment, including Accidents, Malfunctions and Unplanned Events, is provided in Table 9-8.

Table 9-8: Environmental Effects Analysis; VC – Atmospheric Environment; Project Phase – Decommissioning and Abandonment

Project Components or Activities	Potential Environmental Effects (A = adverse; B = beneficial)	Engineering Design, Mitigation Measures and Proven Environmental Management Practices	Factors Considered in the Environmental Effects Analysis*							
			Magnitude	Geographic Extent	Timing	Frequency	Duration	Reversibility	Ecological & Socio-economic Context	Certainty of Knowledge
Planned Activities										
Operation and movement of equipment and vehicles; removal of buildings	(A) Reduced air quality due to elevated dust levels, vehicle noise and vehicle exhaust emissions (CO_2, SOx, NOx, PM) adversely affects the quality of life of nearby residents.	Water, calcium or magnesium solution applied to unpaved areas on surface and underground of site. Use of a sweeper or vacuum truck on site. Use of scrubbers, circle checks, and regularly scheduled maintenance according to manufacturer's recommendations on equipment. Vehicular traffic maximum speed limit of 20km/hr on site roads and 60km/hr on non-posted public roads. Site is partially surrounded by trees and is located over one kilometre away from nearest receptor.	1	4	N/A	3	3	2	2	1
Reclamation of disturbed sites	(B) Reclamation and revegetation of abandoned work areas will reduce site dusting and erosion and will contribute to improved air quality.	Implementation of closure plan.	1	4	N/A	1	1	2	2	1
Accidents, Malfunctions and Unplanned Events										
Forest fire	(A) Release of fugitive emissions into atmosphere reducing air quality. (A) Depletion of natural vegetation.	Comprehensive emergency response resources, planning, training and procedures.	3	4	N/A	1	1	1	2	1

Key:

Magnitude: *
0 = Essentially no interaction
1 = Low, changes within regulated limits
2 = Moderate, changes near regulated limits
3 = High, changes exceed regulatory limits
4 = Unknown (see definitions in text, EA methods)

Geographic Extent: *
1 = Immediate work area
2 = Within Project closure plan boundary
3 = Within 5km of Project closure plan boundary
4 = Beyond 5 km of Project closure plan boundary

Frequency: *
1 = Uncommon event, event occurs once or infrequently/periodically
2 = Happens regularly but infrequently (e.g., once or twice per month)
3 = Happens regularly (e.g. daily)
4 = Continuous activity

Duration: *
1 = < 1 month
2 = 1-2 months
3 = 2-6 months
4 = 6-24 months
5 = 2-11 years (life of mine)
6 = >11 years (beyond Project)

Reversibility: *
1 = High
2 = Medium
3 = Low
4 = nil
5 = Unknown (see definitions in the text, EA Methods)

Ecological and Socio-economic Context: *
1 = Relatively pristine area not adversely affected by human activity
2 = Evidence of existing adverse effects
3 = High level of existing adverse effects

Certainty of Knowledge:*
1 = High – based on past performance and experience regarding environmental effects or mitigation
2 = Moderate – uncommon potential effect either not well understood or effects require compliance monitoring to modify engineering design or mitigation
3 = Low – potential for the need to follow-up based on results of compliance monitoring to modify engineering design or mitigation

9.2.4. Environmental Design, Mitigation and Optimization

FNX understands the importance of implementing environmental design, mitigation measures and sustainability management practices as well as implementing inspection and maintenance procedures and monitoring initiatives to ensure effective implementation. As such, the following environmental design features, procedures and monitoring initiatives have been integrated into the Project to prevent or minimize adverse effects on the Atmospheric Environment.

Dust Control: FNX has developed a management plan to be implemented on site "The Best Management Practices Plan for the Control of Fugitive Dust" (47VP-047700-006-PLN-0003) that outlines all potential sources of fugitive dust, the control measures to be used and the timing of such measures (e.g., weekly, as required). This plan was submitted to MOECC and accepted by MOECC in December, 2015. The Plan will be reviewed annually to ensure it achieves stated objectives of preventing and controlling fugitive dust in compliance with the ECA – Air Permit (8794-8VFJ7B), considers new guidelines or regulatory requirements, and reflects changing site conditions or approved modification to facilities.

The dust control measures identified will be achieved through both engineering and procedural measures, and best management practices including:

- Applying water, calcium or magnesium chloride to roads and stockpiles; wet sprays used during drilling;
- Using dust collectors and equipment enclosures or covers at material transfer points;
- Containing material handling and processing activities within covered buildings;
- Applying a vegetative cover to overburden and topsoil stockpiles, and minimizing drop heights at stockpiles;
- Restricting the hours of off-site mine product and waste rock haulage;
- Ensuring the use of covered mine product and waste rock haul trucks for off-site transport;
- On-site speed limits and enforcement of those limits within Victoria property boundary and use of a sweeper or vacuum truck on site;
- Adjusting or limiting mine product or waste processing or stockpiling activities during high winds, or when the wind direction will cause dust to leave the site boundary;
- Wind fencing, where appropriate, when enclosed operations are not possible, to reduce loss of finer particles from material storage piles and crushing operations;
- Operational controls, such as curtailing certain activities when winds are blowing towards receptors, to reduce off-property impacts;

- Although blasting is largely underground rather than surface blasting, the Project will operate on a reduced blasting schedule (maximum of two blasts per day) and reduced size of blast area (not to exceed 61 m^2); and
- Primary crushing and secondary crushing will operate on a restricted schedule (Monday through Friday for primary crushing, secondary crushing and sampling typically will occur four days per month).

Compounds of Combustion Emission Control: FNX has prepared a management plan to be implemented on site "Air Emission Operating Procedures and Maintenance Manual" (47VP-047700-006-MAN-0001) which provides guidelines to minimize air emissions for the Project. This plan will be reviewed annually to ensure it conforms to the approved Environmental Compliance Approval – Air (Permit 8794-8VFJ7B) for the Project, changes in regulatory requirements and to reflect changing site conditions and facilities.

Emission controls identified for compounds of combustion will be achieved through both engineering and procedural measures, including:

- Use of grid and transmission line for permanent stationary power source rather than fuel fired generators;
- Routine procedures for the operation and maintenance of surface mobile equipment including installation and operation of scrubbers, circle checks, and regularly scheduled maintenance according to manufacturer's recommendations. Where manufacturer's recommended procedures are not on hand, good maintenance practices will be employed to ensure optimal equipment performance;
- Routine maintenance will be scheduled on a monthly basis. The type of service or inspection a particular piece of equipment will receive is dependent on the number of operating hours accumulated;
- Operators must complete an Operator's Pre-Check List before using any piece of equipment, as well as an annual calibration as per their equipment manuals if required;
- Emission tests will be performed on a monthly basis, which typically corresponds to 125 hours. Testing can be performed using a Drager-type gas detector. Gases to be monitored include CO, NOX, NO and NO_2;
- The fire suppression system on each piece of equipment will be inspected on a monthly basis. A third party inspection will also be conducted semi-annually; and
- Use of ultra-low sulphur diesel fuel for mechanical and mobile equipment.

GHG Emissions Control: Greenhouse gas emissions associated with diesel fuel and other fuel sources is anticipated to be relatively small as the principal stationary power source for both Construction and Operations is by transmission line. The greatest potential for the generation of greenhouse gases is through the use of heavy equipment,

emergency or temporary generators, heaters, or vehicles fuelled by diesel, gasoline or propane during Construction, and by trucks transporting the mine product during Operations.

GHG emissions control will be achieved through both engineering and procedural measures, including:

- Use of grid and transmission line for permanent stationary power source rather than fuel fired generators. Approximately 90% (IESO, 2016) of the Ontario grid composition relies on non-GHG generating fuel types (nuclear, hydro, wind);
- Routine procedures for the operation and maintenance of surface mobile equipment including installation and operation of scrubbers, circle checks, and regularly scheduled maintenance according to manufacturer's recommendations. Where manufacturer's recommended procedures are not on hand, good maintenance practices will be employed to ensure optimal equipment performance; and
- Routine maintenance will be scheduled on a monthly basis. The type of service and inspection a particular piece of equipment will receive is dependent on the number of operating hours accumulated.

Noise and Vibration Control: Section 3.2.3 of the approved Environmental Compliance Approval – Air (Permit 8794-8VFJ7B) requires that noise emission limits from the Project comply with NPC-232 rural levels. The nearest receptor is more than one kilometre from the site and the site is surrounded by trees. The Project will carry out noise and vibration monitoring and abatement measures to reduce potential effects on the nearest temporary and permanent dwellings. A community noise monitoring study was completed (see Appendix C) that determined the existing background levels around the Project site in an effort to develop a project design goal for noise. Based on the rural nature of the area surrounding the Project and the low levels of existing background noise, a project design goal for noise was set to 'below any provincial noise requirement and quieter than the already existing sound levels at the nearest residences and at the park most of the time'.

Community noise modelling predictions demonstrate this project design goal will be achieved with the following mitigation techniques implemented:

- The mine ventilation fans, including three fresh air fans, two BAC fans and two mine exhaust fans are required to meet noise specifications via the use of silencers and acoustical insulation on the fan casings and unsilenced ductwork;
- The Compressor Plant, Refrigeration Plant, Backfill Plant and Crusher building will be enclosed with no major openings;
- The Cooling Towers are required to meet noise specifications below 108 dBA re10-12W;

- Any vacuum truck station, such as those for the off-loading of cement or backfill binders, require an indoor silenced blower or to be unloaded inside with closed doors and suitable exhaust silencers; and
- Primary crushing and secondary crushing will operate on a restricted schedule (Monday through Friday for primary crushing; secondary crushing and sampling typically will occur four days per month), and crushers will undergo regularly scheduled maintenance in accordance with manufactures' recommendations.

9.3. Residual Environmental Effects

This section describes the residual (i.e., after mitigation) adverse environmental effects the Project might have on the Atmospheric Environment. The following criteria (e.g. indicators, thresholds) are used to determine the significance of residual adverse environmental effects of the Project on the Atmospheric Environment:

A **significant** residual environmental effect of the Project on the Atmospheric Environment occurs when pollutants of concern (e.g., PM, CO, NOx, SO_2, NH_3) in a 'worst case' scenario are regularly above the indicator threshold (see Table 9-9 for the respective averaging period at a Point of Impingement (POI); annual estimated emissions exceed an applicable annual mass emissions limits; or sound levels on hourly average Leq basis regularly exceed existing background noise levels at a point of reception at a community receptor (residence, recreational areas, etc.).

Table 9-9: Summary of Residual Environmental Effects; VC- Atmospheric Environment

Valued Component	Key Adverse Residual Environmental Effect	Significance[1]	Probability of Occurrence (Likelihood)[2]	Effect on Ecosystem Function and Integrity[2]	Sustainable (Capacity) Use of Renewable Resources[2]	Relevant Legislation[3]
Construction	Localized elevated CO_2, SOx, NOx, and PM levels, additional noise events (due to blasting).	Not significant	High	Low	High	Canadian Ambient Air Quality Standards
Operations	Localized elevated CO_2, SOx, NOx, and PM levels locally, Increased continuous noise events.	Not significant	Moderate	Low	High	Canadian Ambient Air Quality Standards
Decommissioning and Abandonment	Localized elevated PM, increased noise levels due to demolition and decommissioning.	Not significant	Low	Low	High	Canadian Ambient Air Quality Standards
Accidents, Malfunctions and Unplanned Events	Reduced air quality and increased noise levels.	Not significant	Low	Nil	High	Canadian Ambient Air Quality Standards
Planned Project Overall	Reduced air quality and increased noise levels.	Not significant	Moderate	Low	High	Canadian Ambient Air Quality Standards
The Project in combination with other projects and activities	Overall reduced air quality and increased noise levels.	Not significant	Moderate	Low	High	Canadian Ambient Air Quality Standards

Notes:
1. The rating of significance for adverse residual environmental effects are those predicted effects remaining after the application of mitigation.
2. Sustainability factors are described for all predicted adverse residual environmental effects.
3. Key federal legislation references as appropriate for relevant predicted adverse environmental effects.

A **not significant** residual environmental effect of the Project on Atmospheric Environment occurs when pollutants of concern (PM, CO, NOx, SO_2, NH_3) in a 'worst case' scenario are regularly below the indicator threshold for the respective averaging period at a Point of Impingement (POI); annual estimated emissions are below applicable annual mass emissions limits; and sound levels on hourly average Leq basis are regularly within existing measured background noise levels at a point of reception at a community receptor (residence, recreational area, etc.).

9.3.1. Construction

A detailed emissions inventory and dispersion modelling assessment was not conducted for Construction because of its intermittent and temporary nature. Based on analysis of Construction activities it is reasonable to assume Construction activities will have a lower frequency and magnitude of negative environmental effects on the Atmospheric Environment compared to Operational activities in a 'worst case scenario' and other factors such as reversibility and geographic extent remain consistent between both phases. In such case, emissions of pollutants of concern are expected to be below indicator thresholds at a POI, annual estimated emissions are below applicable annual mass emissions limits and sound levels on hourly average Leq basis will not regularly exceed existing perceived background noise levels at a point of reception. On this basis, the residual adverse environmental effect to the Atmospheric Environment during Construction is considered to be not significant.

9.3.2. Operations

Advanced Exploration air emissions from underground, site buildings and surface equipment activity were modelled using an ESDM implementing AERMOD dispersion modelling as prescribed by the MOECC and results demonstrate concentrations of pollutants of concern are below Indicator Thresholds in a 'worst case' scenario for the respective averaging period at a POI (see Table 9-10).

Table 9-10: Victoria Mine Air Emission Summary Table by Contaminant (Advanced Exploration)

Contaminant	Total Facility Emission Rate (g/s)	Avg. Period (hrs)	Max POI Conc. (µg/m³)	POI Location (See Figure 9-1)	Indicator Threshold (µg/m³)	Limiting Effect	% of Indicator Threshold
Ammonia	2.22	24	32.37	POI1	100	Health	32%
CO	3.62	½	379.75	POI2	6000	Health	6%
NOx	4.07	1	328.39	POI3	400	Health	82%
	4.07	24	50.08	POI4	200	Health	25%
TSP	0.611	24	5.38	POI1	120	Visibility	4%
SO_2	0.348	1	28.89	POI2	450	Health	6%

Contaminant	Total Facility Emission Rate (g/s)	Avg. Period (hrs)	Max POI Conc. (µg/m³)	POI Location (See Figure 9-1)	Indicator Threshold (µg/m³)	Limiting Effect	% of Indicator Threshold
	0.348	24	5.06	POI2	150	Health	3%

Air quality dispersion modelling was not conducted for Operations as it is reasonably expected that Operations will have an overall lower potential for adverse effects relative to Advanced Exploration based on the principal stationary power source for Operations is by transmission line and diesel generators are only required for emergency backup power. For the purpose of predicting if pollutants of concern (e.g., PM, CO, NOx, SO_2, NH_3) concentrations in a 'worst case' scenario will be regularly above the indicator thresholds during Operations, it is assumed all air emissions associated with diesel power generation predicted during Advanced Exploration will cease and emissions associated with Mine Ventilation, Water Treatment Plant, PAG Stockpile Area Crusher, PAG Material Handling 1 and PAG Material Handling 2 will be increased proportionally relative to the maximum material extraction rates predicted for Advanced Exploration (1,100 tpd) and Operations (5,500 tpd). See Table 9-11 and Table 9-12 for the results of this approach.

Table 9-11: Victoria Mine Air Emission Summary Table by Source (Operations)

ID	Source Description	Contaminate	Maximum Emission Rate [1] (g/s)	Percentage of Overall Emissions
COLLAR	Mine Ventilation	PM	1.93E-02	5%
		CO	1.29E+01	92%
		NOx	2.84E+00	58%
		SO_2	1.93E-02	5%
WTP	Water Treatment Plant	NOx	2.15E-02	1%
		Ammonia	2.22E+00	100%
IDGEN1-IDGEN3, IDGEN5-IDGEN7	Diesel Generators	CO	Emergency Back-Up Only	-
		NOx		-
		PM		-
		SO_2		-
CRUSHER		CO	1.08E+00	8%

ID	Source Description	Contaminate	Maximum Emission Rate [1] (g/s)	Percentage of Overall Emissions
	PAG Stockpile Area Crusher	NOx	2.04E+00	42%
		PM	2.65E-01	13%
		SO_2	3.86E-01	95%
PAG_SP1	PAG Material Handling 1	PM	3.63E-02	2%
PAG_SP2	PAG Material Handling 2	PM	3.63E-02	2%

Note 1: Assumed emissions from COLLAR, CRUSHER, PAG_SP1 and PAG_SP2 proportional to Advanced Exploration emissions based on maximum material extraction rates for respective phases (1,100 tpd vs/ 5,500 tpd).

Table 9-12: Victoria Mine Air Emission Summary Table by Contaminant (Operations)

Contaminant	Total Facility Emission Rate (g/s)	Avg. Period (hrs)	Max POI Conc. (µg/m³)	Indicator Threshold (µg/m³)	Limiting Effect	% of Indicator Threshold
Ammonia	2.22	24	32.37	100	Health	32%
CO	3.62	½	1.46E+03	6000	Health	24%
NOx	4.07	1	7.06E+02	400	Health	177%
	4.07	24	1.08E+02	200	Health	54%
TSP	0.611	24	1.86E+01	120	Visibility	15%
SO_2	0.348	1	3.03E+01	450	Health	7%
	0.348	24	5.31E+00	150	Health	4%

Based on these results shown in Table 9-11 and Table 9-12 it is not expected PM, CO, SO_2, NH_3 in a 'worst case' scenario will be regularly above indicator thresholds (see Table 9-3) for the respective averaging period at a Point of Impingement (POI). NOx concentrations were identified as potentially over indicator thresholds in a 1-hour averaging period scenario that assumed the highest emission rate that sources of NOx are capable of is realized, all sources of NOx are assumed to be operating simultaneously at the corresponding maximum emission rate, and NOx emitting equipment run at the maximum thermal heat input or engine rating during the entire averaging period. However, as this results on NOx concentrations in this 'worst case' scenario were still less than double the indicator threshold (177%) and since this 1-hour averaging period scenario is unlikely to be regularly achieved, it is expected NOx

concentrations will be regularly below the indicator threshold for a 1-hour averaging period at a Point of Impingement (POI).

In addition, during Operations annual estimated emissions are not expected to exceed any applicable annual mass emissions limits on the basis of an average 12, 000 litres of fuel use per day (based on a mining rate of 5,500 tonnes per day including ore and waste rock), predicted emissions based on Advanced Exploration air dispersion modelling, and the use of grid and existing transmission line for permanent stationary power source.

For noise and vibration modelling, a community noise model was performed (see Appendix C) to determine if sound levels on hourly average Leq basis will exceed existing perceived background noise levels at a point of reception. Modelling concluded, assuming mitigation measures are implemented, Project related sound levels during Operations should be well below any provincial noise requirements and quieter than the already existing sound levels at the nearest receptors most of the time.

On the basis that pollutants of concern (PM, CO, NOx, SO_2, NH_3) in a 'worst case' scenario are regularly below the indicator threshold for the respective averaging period at a Point of Impingement (POI); annual estimated emissions are below applicable annual mass emissions limits; and sound levels on hourly average Leq basis are regularly within existing measured background noise levels at a point of reception at a community receptor, the residual adverse environmental effect to the Atmospheric Environment during Operations is considered to be not significant.

9.3.3. Decommissioning and Abandonment

Similar to Construction, a detailed emissions inventory and dispersion modelling assessment was not conducted for Decommissioning and Abandonment because of its intermittent and temporary nature. Based on analysis of Decommissioning and Abandonment activities it is reasonable to assume Decommissioning and Abandonment activities will have a lower frequency and magnitude of negative environmental effects on the Atmospheric Environment compared to Operational activities in 'worst case scenario' and other factors such as reversibility and geographic extent remain consistent between both phases. In such case, emissions of pollutants of concern are expected to below indicator thresholds at a POI, annual estimated emissions are below applicable annual mass emissions limits and or sound levels on hourly average Leq basis will not regularly exceed existing perceived background noise levels at a point of reception. In addition, Decommissioning and Abandonment activities also have the potential to positively affect the Atmospheric Environment through the reclamation of disturbed sites. Reclamation and revegetation of abandoned work areas will reduce site dusting and erosion and will contribute to improved air quality due to increased levels of sequestration by plants. On this basis, the residual adverse environmental effect to the Atmospheric Environment during Decommissioning and Abandonment is considered to be not significant. It is expected similar residual effects will occur during conditions of temporary closure.

9.3.4. Accidents, Malfunctions and Unplanned Events

The residual adverse environmental effects of Accidents, Malfunctions and Unplanned Events on Atmospheric Environment include potential degradation of air quality resulting from fugitive release of air contaminants associated with an onsite fire or explosion or an off-site forest fire. However with implementation of design considerations (e.g. utilidors and buried conduits for water, electrical, gas etc.) and comprehensive emergency response resources, planning, training and procedures, the residual adverse environmental effect is considered to be not significant.

9.3.5. Planned Project Overall

The residual adverse environmental effects of the Project overall on the Atmospheric Environment include degraded air quality due to elevated dust levels and emissions of pollutants of concern as well as periodic elevated noise and vibration above background levels. However, due to the fact effects are generally reversible, emissions are within prescribed indicator thresholds for the protection of human health, no applicable annual mass emissions limits are triggered, and Project related sound levels should be well below any provincial noise requirements and quieter than the already existing sound levels at the nearest receptors, the residual adverse environmental effect is considered to be not significant.

9.3.6. Cumulative Environmental Effects

The Project may result in a cumulative environmental effect on Atmospheric Environment, as other projects and activities such as historical mining, Advanced Exploration and permanent and seasonal residential activities affect air quality due to emission of pollutants of concern, dust and noise. Due to the fact Project emissions are well below indicator thresholds in almost all cases and are reversible, and the generally good air quality in the Sudbury airshed with rare episodes of poor air quality, cumulative effects are expected to be not significant.

9.3.7. Monitoring and Follow-Up Program

FNX has developed a comprehensive sustainability management system to address anticipated Project needs (Chapter 5 – Sustainability Management), including potential adverse environmental effects to Atmospheric Environment. Mitigation and management procedures that are already in place include:

- Victoria Project Best Management Practices Plan for the Control of Fugitive Dust (47VP-047700-006-PLN-0003);
- Victoria Project Air Emission Operating Procedures and Maintenance Manual (47VP-047700-006-MAN-0001);
- Environmental Compliance Approval - Air (Permit #8794-8VFJ7B) 47VP-047700-003-PER-0003;

- Dust Control Log Sheet (47VP-047700-006-FRM-0001); and
- Victoria Public Complaint Form (47VP-047700-000-FRM-0001).

An inspection of the conformity with the Best Management Practices and Operating and Maintenance Procedures will be documented each week by the Environmental Coordinator. In the event of a non-conformance, the Environmental Coordinator will log the incident and notify the appropriate site personnel by assigning responsibility. Corrective action is to be taken to eliminate the causes of the non-conformance. It is expected that all deficiencies identified in inspections be addressed immediately. Non-conformances identified in the weekly inspection will be reviewed the following week and any outstanding items or newly identified sources will be reviewed as part of the Best Management Practices and Operating and Maintenance Procedures continuous improvement program.

There is a high degree of confidence associated with determining potential effects to Air Quality, and with determining that there are no significant adverse environmental effects. FNX has developed comprehensive management plans and procedures to mitigate any potential adverse environmental effects. As a result, a follow-up program is not required for the Air Quality VC.

9.4. References and Appendices

- Air Quality In Ontario 2013 Report. Ministry of the Environment and Climate Change (MOECC), 2015.
- Ambient Air Quality Criteria Ministry of the Environment and Climate Change (MOECC), 2012b.
- Canadian Ambient Air Quality Standards. Canadian Council of Ministers of the Environment (2012).
- Emission Summary and Dispersion Modelling (ESDM), Version 2.0, Report No. 1419949. Golder Associates, June 2015.
- Future Climate Change. US EPA, 2016. Available at: http://www3.epa.gov/climatechange/science/future.html. Retrieved February 2016.
- Noise Impact Summary Report, Rev C, (47VP-024124-005-RPT-0025). Hatch, July 2015. *Ontario Regulation 419/05* (2013).
- Publication NPC-300 - Environmental noise guideline – stationary and transportation sources – approval and planning. Ministry of the Environment and Climate Change (MOECC), 2013.
- Summary of Standards and Guidelines to support *Ontario Regulation 419/05 – Air Pollution – Local Air Quality*. Ministry of the Environment and Climate Change (MOECC), 2012a.

Table of Contents – Chapter 10

10. Surface Water Quality 169

10.1. Existing Conditions 171
10.1.1. Ecological Boundaries 173
10.1.2. Administrative Boundaries 174
10.1.3. Technical Boundaries 175
10.1.4. Likely Future Conditions 175
10.2. Environmental Effects Analysis 176
10.2.1. Construction 176
10.2.2. Operations 179
10.2.3. Decommissioning and Abandonment 181
10.2.4. Environmental Design, Mitigation and Optimization 183
10.3. Residual Environmental Effects 184
10.3.1. Construction 187
10.3.2. Operations 187
10.3.3. Decommissioning and Abandonment 187
10.3.4. Accidents, Malfunctions and Unplanned Events 188
10.3.5. Planned Project Overall 188
10.3.6. Cumulative Environmental Effects 188
10.3.7. Monitoring and Follow-Up Program 189
10.4. References and Appendices 189

10. Surface Water Quality

Surface Water Quality has been selected as a Valued Component for assessment because the effective management of surface water quality is key to maintaining or improving existing baseline conditions of aquatic life and ensuring the continued viability of waterbodies for human recreational uses (local waterbodies are not known to provide a source of potable water). Surface Water Quality has also been identified as an issue of concern by the Atikameksheng Anishnawbek First Nation (AAFN).

This Surface Water Quality assessment provides information on baseline and predicted concentrations of potential parameters of concern in the receiving environment as a result of effluent discharge from the Project during all Phases, with particular focus on discharge from the Waste Water Treatment Plant into Fairbank Creek. Effluent limits for this discharge are established in the Environmental Compliance Approval (ECA) – Sewage Works, originally issued by the MOECC for the Project in June 2014 and amended in August 2017.

The Project is located in two major watersheds: the Vermillion River and Spanish River, as shown on Figure 10-1. The Vermillion River watershed, specifically the Fairbank Creek subwatershed covers the eastern portion of the Victoria Property, while the Spanish River watershed, specifically the Victoria Creek subwatershed covers the western portion. The majority of the Project footprint, approximately 66% of the 17.8 hectare Project site, lies within the Spanish River watershed (KGHM Int., 2013). Fairbank Creek originates north of the Project site in Fairbank Lake and its tributaries and drains south-east, through Ethel Lake before ultimately discharging to the Vermillion River in the Town of Whitefish. Victoria Creek originates as several smaller tributaries northwest and southwest of the Project area, and flows in generally western direction into the Spanish River. The watershed areas and mean annual runoff for Fairbank and Victoria Creek upstream from Surface Water Quality monitoring stations immediately adjacent to the Project area, are summarized in Table 10-1 (KGHM Int., 2013).

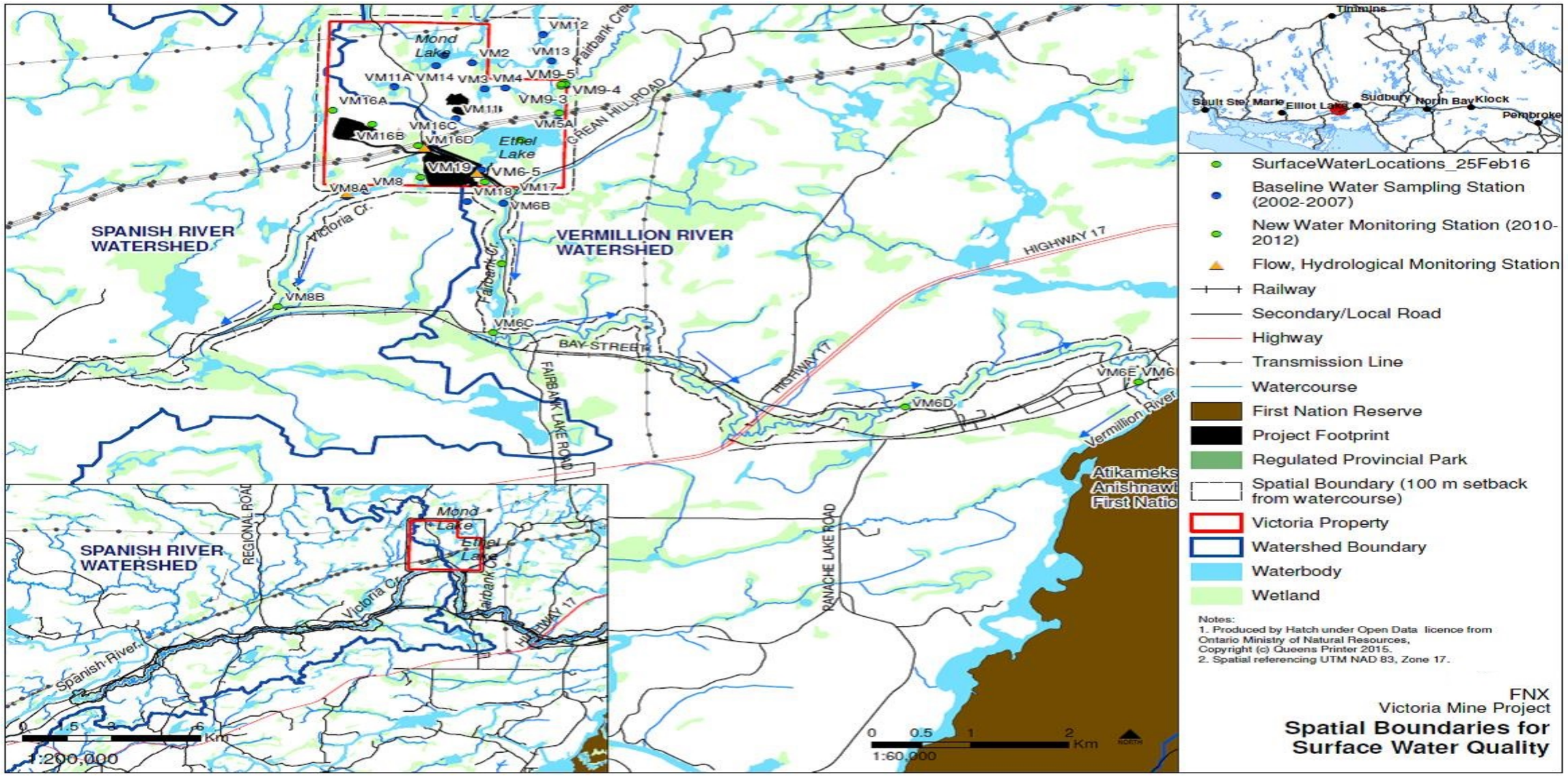

Figure 10-1: Spatial Boundaries for Surface Water Quality

Table 10-1: Fairbank Creek and Victoria Creek Watershed Characteristics

Watercourse	Mean Annual Runoff Depth (m)	Watershed Area (km^2)	Mean Annual Runoff Volume (m^3)
Fairbank Creek to VM6	0.431	50.63	$2.1x10^8$
Victoria Creek to VM8	0.269	1.5	$5.6x10^7$

10.1. Existing Conditions

Surface Water Quality monitoring in support of the Project began in October 2002, at the stations shown in Figure 10-1, all situated in near-field, far-field or reference locations around the Project site in order to obtain a representative understanding of the water quality. Water quality parameters were analyzed on a regular basis from October 2002 to present. Results (taken directly from each baseline study report from 2002, 2009, 2011, and 2013 datasets) are provided in Appendix D, along with a comparison with the Ontario Provincial Water Quality Objectives (PWQO) and *Metal and Mining Effluent Regulations* (*MMER*) Schedule 4 Limits.

In general, Fairbank Creek has low metal concentrations relative to the PWQOs, with results being generally equivalent to the upstream control sites. Baseline surface water quality in Fairbank Creek at the VM6 monitoring station, which is located just upstream from the proposed Waste Water Treatment Plant discharge location, is good with infrequent exceedances of PWQO's for copper and nickel between 2002 – 2007, and no exceedances between 2010 to 2013. Stations downstream from VM6, including VM6b, VM6a, and VM6c experience more frequent exceedances of copper, nickel and aluminum.

Conversely, Victoria Creek typically has higher concentrations of metals as compared to Fairbank Creek and the upstream control sites. Past activities in the northeast portion of the Project Site, including a tram line and historical roast yard, have degraded water quality such that copper, nickel, aluminum, and cobalt concentrations, particularly at VM8, VM8A, and VM8B regularly exceed PWQOs (Appendix D), and summarized in Table 10-2) in the Spanish River watershed.

Surface water quality in Ethel Lake is generally good with some exceedances of nickel, copper, cobalt, and zinc PWQOs at various depths.

Existing water quality is also influenced by variable seasonal flows causing erosion and sedimentation during spring and fall freshet periods and storm events (Kilgour & Associates Ltd. and Denison Environmental Services, 2014).

All water bodies in the environmental assessment area provide habitat for aquatic life, including sport fish such as Northern Pike, as outlined in Chapter 12 – Fish and Fish Habitat. Sport fishing occurs within the environmental assessment area, potentially including within Ethel Lake, Fairbank Creek and Victoria Creek, with Bluntnose Minnow being the anticipated sentinel species for future Environmental Effect Monitoring studies for the Project, due to its ubiquitous nature within the local waterbodies, high relative abundance and sensitive nature.

Existing use of surface water as a potable water supply within the environmental assessment area from Ethel Lake, Fairbank Creek and Victoria Creek is not known to occur, although three domestic groundwater wells are present within 2.5 kilometres.

Appendix D contains a description of Surface Water Quality sampling methodologies and copies of the parameter summary tables, taken directly from all the Baseline Aquatic Environmental Assessment completed to date. Table 10-2 summarizes the PWQO exceedances identified during baseline Surface Water Quality Studies. Potential parameters of concern due to elevated background conditions include aluminum, cobalt, copper and nickel.

Table 10-2: Provincial Water Quality Objectives – Baseline Exceedances

Parameter Exceeded under PWQO	2004	2009	2012	2014	2015
Aluminum		VM4, VM8, VM9	VM8, VM13	VM19	VM16A, VM16C
Cadmium	VM11, VM12			VM9-2, VM9-3, VM6-5	
Chromium				VM9-3, Ethel	
Cobalt	VM3, VM7, VM11, VM12	VM3, VM4, VM7, VM8	VM3, VM4, VM6, VM8, VM8A, VM11	VM9-3, VM6E, Ethel	
Copper	VM3, VM7, VM8, VM11	VM3, VM4, VM6A, VM7, VM8	VM1, VM3, VM4, VM7, VM8, VM8A, VM11	VM9-1, VM9-2, VM9-3, VM9-4, VM9-5, VM6-1, VM6-4, VM6-5, VM6C, VM6E, VM19, VM8a, Ethel	

Parameter Exceeded under PWQO	2004	2009	2012	2014	2015
Iron	VM1 VM3, VM8, VM11, VM12, VM13	VM2, VM4, VM8, VM11, VM11A, VM12, VM13	VM2, VM8, VM8A, VM11, VM12, VM13	VM6C, VM6E, VM19, VM8a, Ethel	VM16A
Lead		VM2		VM9-3, Ethel	
Nickel	VM3; VM7, VM11	VM3, VM4, VM7, VM8, VM11	VM3, VM4, VM7, VM8, VM8A, VM11	VM19	
Thallium				VM9-3, VM6E, Ethel	
Total Phosphorus		VM2, VM3, VM4, VM7, VM8, VM11, VM11A, VM12, VM13	VM6, VM6A, VM6B, VM8, VM11, VM12, VM13		
pH		VM8			
Vanadium		VM4			
Zinc		VM4			
Thallium	VM3				
Sodium	VM1, VM3, VM5, VM6, VM7, VM8, VM9, VM11, VM12, VM13				

10.1.1. Ecological Boundaries

The spatial boundaries for Surface Water Quality include all water bodies that could be affected directly or indirectly by the Project, which includes portions of both the Vermillion River watershed and Spanish River watershed. As shown in Figure 10-1, the spatial boundaries extend regionally beyond the immediate Project area, where effects have the potential to occur. Monitoring Surface Water Quality at locations beyond the Project is an important aspect of the monitoring program, as a way to understand upstream (reference), Project Site, and downstream Surface Water Quality. The

Ecological Boundaries are based on these considerations, and include: the Project footprint and adjacent areas within the Fairbank Creek and Victoria Creek watersheds where surface water runoff and treated discharge could have potential effects on Surface Water Quality, as well as the reach of Fairbank Creek downstream to the Vermillion River and the reach of Victoria Creek downstream to the Spanish River.

The temporal boundary covers the period between 2024 and 2050 when discussing the effects on Surface Water Quality.

10.1.2. Administrative Boundaries

The protection of Surface Water Quality is regulated provincially under *the Ontario Water Resources Act*, through the establishment of effluent discharge limits in the Environmental Compliance Approval (ECA). Federally, the protection of Surface Water Quality for mines is regulated under Schedule 4 of the *MMER*, which imposes limits on the release of deleterious substances and prohibits the discharge of effluent that is acutely lethal to fish. These limits are legally enforceable. Receiving environment guidelines for the protection of aquatic life exist both provincially (PWQOs) and federally with the Canadian Council of Ministers of the Environment (CCME) Canadian Water Quality Guidelines for the Protection of Aquatic Life (CCME, 2007). These guidelines, standards, and objectives are policy-based instruments with no legal power. Allowable effluent limits for discharge into Fairbank Creek set under the provincial ECA-Sewage Works (No. 9557-AP5FSQ) are summarized in Table 10-3.

Table 10-3: ECA Effluent Parameters for Wastewater Treatment Plant Discharge

Effluent Parameter	Daily Maximum Concentration (mg/L unless stated otherwise)	Average Monthly Concentration (mg/L unless stated otherwise)
Aluminum	0.30	0.15
Iron	1.0	0.5
Molybdenum	0.30	0.15
Vanadium	0.04	0.02
Arsenic	0.036	0.018
Cobalt	0.0056	0.0028
Copper	0.030	0.015
Lead	0.008	0.004
Nickel	0.12	0.06
Zinc	0.22	0.11

Effluent Parameter	Daily Maximum Concentration (mg/L unless stated otherwise)	Average Monthly Concentration (mg/L unless stated otherwise)
Total Suspended Solids	30.0	15.0
pH	6.5 – 8.5	

Conservation Sudbury (Nickel District Conservation Authority) maintains jurisdiction over the Vermillion River watershed, including Ethel Lake and Fairbank Creek (Conservation Sudbury, 2016). Therefore, *Ontario Regulation 156/06 Nickel District Conservation Authority: Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses*, will apply for Ethel Lake and Fairbank Creek. This would provide an administrative boundary on some Project activities that have the potential to affect Surface Water Quality.

Furthermore, the *Ontario Clean Water Act* provides for the creation of source water protection areas, though the Environmental assessment area remains outside the identified Greater Sudbury Source Protection Area Map.

10.1.3. Technical Boundaries

The assessment of potential adverse effects on Surface Water Quality is based on multiple lines of evidence, including the Fairbank Creek Assimilative Capacity Study (Klohn Crippen Berger, 2013) and Ethel Lake hydrology study (Hatch Ltd., 2014b). Further, predictive models have been used to develop the design criteria for the Waste Water Treatment Plant, a key mitigation measure to remove target metals and ammonia. The Site Wide Water Balance (Hatch Ltd, 2014a) provides the estimates of water volumes to be discharged, while the Ethel Lake Hydrology Report (Hatch Ltd., 2014b) outlines how the regulated flow of Ethel Lake into Fairbank Creek will ensure the permit criteria for maintaining the 7:1 dilution ratio are met.

The assimilative capacity study (Klohn Crippen Berger, 2013) utilized modeled water fluxes through the Monte Carlo simulation using the @Risk platforms. Mixing zone calculations utilized a simplified two-dimensional unbound domain, advection-dispersion equation. Like with any modeling study, there are inherent uncertainties associated with forecasting future conditions; uncertainties were minimized by following accepted industry standards.

10.1.4. Likely Future Conditions

Surface Water Quality in Fairbank Creek and Victoria Creek is expected to remain similar to existing conditions in the absence of the Project, as there are no other known direct point sources of potential contamination to these watercourses.

10.2. Environmental Effects Analysis

Interactions between Project activities and components with the potential to affect Surface Water Quality are outlined within this section. A total of eight effect pathways have been identified, each of which may have corresponding effects on receptors, such as Fish and Fish Habitat and downstream water users. These include:

1. Non-point source turbidity and sedimentation associated with releases from in-water construction activities (i.e. Ethel Lake Control Structure);
2. Increase in nutrients, mercury and turbidity resulting from the construction of the Ethel Lake Control Structure and associated increase in water level of Ethel Lake shoreline, as well as ongoing operation of Ethel Lake Control Structure;
3. Runoff containing sediment and nutrients from exposed soils due to vegetation clearing, grubbing and grading activities;
4. Controlled waste water discharge from the Waste Water Treatment Plant;
5. Seepage from waste rock storage areas;
6. Blasting residues resulting in an increase in nitrogen (e.g. ammonia, nitrates, nitrites) in surface water;
7. Accidental or inadvertent release of fuel or hazardous materials; and
8. A 1-in-200 year flood event leading to the spill of untreated effluent from the northwest PAG storage area or Mine Water Pond.

A discussion of each of the environmental effects potentially occurring as a result of these pathways is discussed, by Project phase, in the following sections.

10.2.1. Construction

The construction of Ethel Lake control structure will require in-water work in both Ethel Lake and an unnamed tributary of Victoria Creek. These construction activities may result in potential increases in turbidity from disturbance of sediment and potential decreases in pH from the use of concrete near water. The potential increases in turbidity levels could occur through the Ethel Lake control structure construction period, approximately two to six months, while the change in pH would be of a much shorter time span, only when the concrete pours and curing are occurring. The use of blasting for the construction of Project components may lead to a release of nitrogen, which could enter the surface water bodies in runoff. The exact number of blasts or frequency of blasting during the Construction phase is unknown, but the blasts will all occur within the environmental assessment area for the Project.

Raising the water levels of Ethel Lake by approximately 0.5 metres upstream from the proposed Ethel Lake control structure, will inundate a total of approximately 2.5 hectares

of existing riparian area adjacent to the lake. The initial inundation may result in increased nutrient concentrations in Ethel Lake due to decomposing organic matter and increased turbidity due to erosion of previously unconsolidated shoreline materials in Ethel Lake. These increases could potentially extend downstream into Fairbank Creek and, as a worst case scenario, could potentially extend into the Vermillion River. The duration of the effect could potentially be for the life of the Project though it is anticipated that an initial increase in nutrients and turbidity will occur immediately relatively soon after initial following inundation and level off in the following years, as vegetation decomposition, leaching of nutrients from soils and biochemical change are completed (Northcote and Atagi, 1997). Over time a localized increase in mercury levels may occur because of the inundation of Ethel Lake will result in the decomposition of organic carbon resulting in a corresponding increase in mercury concentrations (Bodaly et al, 2004). As the total inundation area of 2.5 hectares is small, a limited amount of mercury generation is possible. This would potentially have an adverse effect on tissue mercury concentrations in aquatic organisms.

Construction activities including vegetation clearing, grubbing and grading will expose soil within the environmental assessment area, for the duration of the construction period, potentially resulting in storm water runoff containing sediment and nutrients, entering the local water courses with associated adverse effects on Surface Water Quality with potential corresponding effects on aquatic biota and habitat.

Without mitigation, controlled release of the temporary Waste Water Treatment Plant, as approved by the ECA, effluent discharges into Fairbank Creek and seepage from waste rock storage areas and exposed rock cuts have the potential to degrade surface water quality from baseline conditions in both Fairbank Creek and Victoria Creek during construction.

Accidental or inadvertent releases of fuel or hazardous materials to water or soil, could adversely affect Surface Water Quality throughout the Construction period. The potential magnitude, extent and overall duration of the spill will be specific to each event and dependent, in part, on the mitigation implemented. Other potential malfunctions during Construction include cofferdam failure, leading to an increase in turbidity or failure of the waste water treatment plant or PAG Storage Area or Mine Water Pond, leading to increases in metal and nutrient levels. Also, the PAG storage areas and Mine Water Pond are both designed to accommodate flows up to the 1-in-200 year storm event. Should this flow be exceeded, overflow would pass through an emergency spillway into the adjacent natural environment, untreated. This could potentially have adverse effects on Surface Water Quality in the receiving water body and corresponding effects on aquatic biota and downstream water users.

Table 10-4: Environmental Effects Analysis; VC - Surface Water Quality; Project Phase – Construction

Project Components or Activities	Potential Environmental Effects (A = adverse; B = beneficial)	Engineering Design, Mitigation Measures and Proven Environmental Management Practices	Factors Considered in the Environmental Effects Analysis*							
			Magnitude	Geographic Extent	Timing	Frequency	Duration	Reversibility	Ecological & Socio-economic Context	Certainty of Knowledge
Planned Activities										
In-water Construction of Ethel Lake Control structure, related water taking infrastructure	(A) Increases in turbidity may have adverse effects on Surface Water Quality and the aquatic ecosystem and downstream recreational water users.	Work site isolation measures (e.g., cofferdams) will be used to minimize in-water work requirements and flow will be diverted around work areas. All potentially contaminated water that must be pumped from work areas will be treated prior to being returned to the watercourse or discharged to a well vegetated area away from watercourses.	2	2	N/A	1	3	1	2	1
Raising of Ethel Lake water levels	(A) Increases in nutrients and mercury as a result of the inundation of existing terrestrial areas with adverse effects on the aquatic ecosystem and recreational and portable water users.	All woody vegetation >0.05 metre diameter within the inundation zone will be cleared prior to inundation to reduce nutrient loading.	1	3	N/A	4	6	2	2	1
Vegetation clearing, grubbing and grading activities	(A) Increased surface water runoff, exposure of soil and resulting increases in turbidity and adverse effects to the aquatic ecosystem and water users.	Use of erosion and sedimentation best management practices to limit the potential for eroded material to enter water bodies.	2	3	N/A	1	4	1	2	1
Use of explosives in Construction	(A) Use of explosives resulting in increased nitrogen levels in Surface Water.	All contact or contaminated water will be directed to the Waste Water Treatment Plant prior to being released. Use of emulsion instead of ANFO for explosives. Implementation of storage and handling procedures for explosive materials and wastes.	1	3	N/A	3	4	1	2	1
Use of Temporary Waste Water Treatment Plant	(A) Discharge of contaminated water to Fairbank Creek (e.g., potential increases in metals, pH and nutrients).	Water will be treated prior to discharge in order to meet the provincial and federal requirements (PWQO and *MMER*), as specified in the Amended Environmental Compliance Approval (permit No. 9557-AP5FSQ).	1	3	N/A	3	4	1	2	1
Accidents, Malfunctions and Unplanned Events										
Fuel and hazardous material spills	(A) Hazardous material spill results in adverse effects to the aquatic ecosystem and water users.	Implement spills management and emergency response procedures.	1	3	N/A	1	4	2	2	1
Erosion and sedimentation into watercourses	(A) Sediment spill results in adverse effects to the aquatic ecosystem and water users.	Implement sediment and erosion control best management practices	1	3	N/A	1	4	2	2	1

Key:

Magnitude: *
0 = Nil
1 = Low
2 = Moderate
3 = High
4 = Unknown (see definitions in text, EA methods)

Geographic Extent: *
1 = Immediate work area
2 = Within Project closure plan boundary
3 = Within 5km of Project closure plan boundary
4 = Beyond 5 km of Project closure plan boundary

Frequency: *
1 = Uncommon event, event occurs once or infrequently / periodically
2 = Happens regularly but infrequently (e.g., once or twice per month)
3 = Happens regularly (e.g. daily)
4 = Continuous activity

Duration: *
1 = < 1 month
2 = 1-2 months
3 = 2-6 months
4 = 6-24 months
5 = 2-11 years (life of mine)
6 = > 11 years (Beyond Project)

Reversibility: *
1 = High
2 = Medium
3 = Low
4 = nil
5 = Unknown (see definitions in the text, EA Methods)

Ecological and Socio-economic Context: *
1 = Relatively pristine area not adversely affected by human activity
2 = Evidence of existing adverse effects
3 = High level of existing adverse effects

Timing: *
n/a – no sensitive periods or areas exist in baseline conditions
1 – sensitive periods or areas exist in baseline conditions that require adjustments to Project schedule or timing of activities

Certainty of Knowledge:*
1 = High – based on past performance and experience regarding environmental effects or mitigation
2 = Moderate – uncommon potential effect either not well understood or effects require compliance monitoring to modify engineering design or mitigation
3 = Low – potential for the need to follow-up based on results of compliance monitoring to modify engineering design or mitigation

10.2.2. Operations

The waste water treatment plant will discharge treated water (contact water and stormwater run-off) collected throughout the Project area which could potentially result in increased metals (total and dissolved), nutrients and sediment being discharged to Fairbank Creek, relative to baseline Surface Water Quality. However, the discharge effluent will meet the requirements of the amended Sewage Works ECA (No. 9557-AP5FSQ) obtained from the MOECC, which specifies the parameters of concern and maximum effluent limits allowed to be discharged, along with receiving environment monitoring requirements.

Blasting will occur throughout the Operations phase, for a duration of four days as a part of the stope cycle for mine production with drilling taking an average of 31 days and mucking an average of 40 days (KGHM Int., 2015). Entrainment of blasting residue, potentially containing elevated concentrations of nitrogen, could potentially result in adverse effects on Surface Water Quality in receiving waterbodies.

All surface runoff from the potentially acid generating (PAG) rock storage areas (PAG 1 and PAG 2) and any exposed rock cut faces will be collected on-site in eight discrete catchment areas, through a sewer system that conveys water to the Mine Water Pond by gravity. The diversion ditch system ensures potentially contaminated water will not be accidentally released into any nearby water bodies without appropriate treatment.

Accidental or inadvertent releases of fuel or hazardous materials to water or soil, could adversely affect Surface Water Quality throughout Operations. The potential magnitude, extent and overall duration of the spill will be specific to each event and will be dependent, in part, on the mitigation to be implemented. Other potential malfunctions during Operations include Ethel Lake Control structure failure, leading to an increase in turbidity due to mobilization of sediments stored upstream from the control structure, or failure of the waste water treatment plant, leading to increases in metal and nutrient levels in receiving waterbodies.

Also, the PAG storage areas and Mine Water Pond are both designed to accommodate flows up to the 1-in-200 year storm event. Should this flow be exceeded, overflow would pass through an emergency spillway into the adjacent natural environment, untreated. This could potentially have adverse effects on Surface Water Quality in the receiving water body and corresponding effects on aquatic biota and downstream water users.

Table 10-5: Environmental Effects Analysis; VC - Surface Water Quality; Project Phase – Operations

Project Components or Activities	Potential Environmental Effects (A = adverse; B = beneficial)	Engineering Design, Mitigation Measures and Proven Environmental Management Practices	Factors Considered in the Environmental Effects Analysis*							
			Magnitude	Geographic Extent	Timing	Frequency	Duration	Reversibility	Ecological & Socio-economic Context	Certainty of Knowledge
Planned Activities										
Site water management activities	(A) Discharge of contaminated water to local watercourses (e.g., potential increases in metals, pH and nutrients) resulting in adverse effects on Surface Water Quality and the aquatic ecosystem and downstream recreational water users.	Water will be treated prior to discharge in order to meet the provincial and federal requirements (PWQO and *MMER),* as specified in the amended Environmental Compliance Approval (No. 9557-AP5FSQ). Project works have been designed to avoid adverse effects associated with contact water seeping into the receiving environment from mine facilities, and meet the Design Guidelines for Sewage Works 2008. Storm water management best practices will be implemented to ensure all storm water runoff from the site is collected and treated prior to discharge.	1	3	N/A	3	5	1	2	1
Operation of Ethel Lake control structure and water taking infrastructure	(A) Decreases in downstream flow in Fairbank Creek resulting in inadequate dilution of discharge from WWTP with adverse effects on the aquatic ecosystem and downstream recreational water users.	Control structure will be operated to ensure minimum flows are provided downstream at all times to meet dilution requirements. A Permit to Take Water will be obtained from the MOECC to approve the water taking and specify minimum downstream flows.	1	3	N/A	3	5	2	2	1
Storage of potential acid generating waste rock in storage areas (PAG 1 and PAG 2)	(A) Runoff from potentially acid generating rock with adverse effects on aquatic ecosystem and water users.	Design of waste rock storage areas to collect and divert all potentially contaminated water to the waste water treatment facility. No untreated water will be discharged off the site.	0	3	N/A	1	5	1	2	1
Use of explosives for completion of stope cycle for production	(A) Use of explosives may cause releases of nitrogen and ammonia to surface water.	All contacted or contaminated water will be directed towards Waste Water Treatment facilities prior to being released.	1	3	N/A	2	4	1	2	1
Accidents, Malfunctions and Unplanned Events										
Fuel and hazardous material spills	(A) Hazardous material spill results in adverse effects to the aquatic ecosystem and water users.	Implement spills management and emergency response procedures.	1	3	N/A	1	5	2	2	1
Erosion and sedimentation into watercourses	(A) Sediment spill results in adverse effects to the aquatic ecosystem and water users.	Implement sediment and erosion control best management practices.	1	3	N/A	1	5	2	2	1

Key:

Magnitude: *
0 = Nil
1 = Low
2 = Moderate
3 = High
4 = Unknown (see definitions in text, EA methods)

Geographic Extent: *
1 = Immediate work area
2 = Within Project closure plan boundary
3 = Within 5km of Project closure plan boundary
4 = Beyond 5 km of Project closure plan boundary

Frequency: *
1 = Uncommon event, event occurs once or infrequently / periodically
3 = Happens regularly but infrequently (e.g., once or twice per month)
3 = Happens regularly (e.g. daily)
4 = Continuous activity

Duration: *
1 = < 1 month
2 = 1-2 months
3 = 2-6 months
4 = 6-24 months
5 = 2-11 years (life of mine)
6 = > 11 years (Beyond Project)

Reversibility: *
1 = High
2 = Medium
3 = Low
4 = nil
5 = Unknown (see definitions in the text, EA Methods)

Ecological and Socio-economic Context: *
1 = Relatively pristine area not adversely affected by human activity
2 = Evidence of existing adverse effects
3 = High level of existing adverse effects

Timing: *
N/A – no sensitive periods or areas exist in baseline conditions
1 – sensitive periods or areas exist in baseline conditions that require adjustments to Project schedule or timing of activities

Certainty of Knowledge:*
1 = High – based on past performance and experience regarding environmental effects or mitigation
2 = Moderate – uncommon potential effect either not well understood or effects require compliance monitoring to modify engineering design or mitigation
3 = Low – potential for the need to follow- up based on results of compliance monitoring to modify engineering design or mitigation

10.2.3. Decommissioning and Abandonment

Decommissioning and Abandonment activities will include removal of the Ethel Lake control structure which may result in potential increases in turbidity during in-water construction. The removal of the control structure is anticipated to take one to two months.

Decommissioning and removing the Ethel Lake control structure will end the need for reservoir management of the water level in Ethel Lake, and ultimately lower the water level of Ethel Lake. Sediment accumulated upstream from the control structure could potentially be mobilized into Fairbank Creek following control structure removal, with increased turbidity levels occurring as a result.

Decommissioning and abandonment includes removal and rehabilitation of PAG 1 and PAG 2 storage area. Therefore, surface water runoff from the site and from these storage areas will no longer result in potential release of sediments, pH effects, nutrients or metals that adversely affect Surface Water Quality.

Accidental or inadvertent releases of fuel or hazardous materials to water or soil, could adversely affect Surface Water Quality throughout Decommissioning and Abandonment. The potential magnitude, extent and overall duration of the spill will be specific to each event. Other potential malfunctions during Decommissioning and Abandonment include cofferdam failure, leading to an increase in turbidity or failure of the waste water treatment plant, leading to increases in metal and nutrient levels in surface waters.

Also, the PAG storage areas and Mine Water Pond are both designed to accommodate flows up to the 1-in-200 year storm event. Should this flow be exceeded, overflow would pass through an emergency spillway into the adjacent natural environment, untreated. This could potentially have adverse effects on Surface Water Quality in the receiving water body and corresponding effects on aquatic biota and downstream water users.

Table 10-6: Environmental Effects Analysis; VC - Surface Water Quality; Project Phase – Decommissioning and Abandonment

Project Components or Activities	Potential Environmental Effects (A = adverse; B = beneficial)	Engineering Design, Mitigation Measures and Proven Environmental Management Practices	Factors Considered in the Environmental Effects Analysis*							
			Magnitude	Geographic Extent	Timing	Frequency	Duration	Reversibility	Ecological & Socio-economic Context	Certainty of Knowledge
Planned Activities										
In-water work for removal of Ethel Lake Control structure, related water taking infrastructure	(A) Increases in turbidity due to in-water work activities with adverse effects on the aquatic ecosystem and downstream recreational water users.	Work site isolation measures (e.g., cofferdams) will be used to minimize in-water work requirements and flow will be diverted around work areas. All potentially contaminated water that must be pumped from work areas will be treated prior to being returned to the watercourse or discharged to heavily vegetated area away from watercourses.	2	2	N/A	1	3	1	2	1
Decommissioning and Abandonment of site water management facilities.	(A) Adverse effects on Surface Water Quality due to removal of treatment facilities and as a result of the temporary disturbance of soil and associated erosion potential.	All ditching and drainage features will be removed and rehabilitated to change the grading to ensure the positive drainage and integration into the surrounding ecosystem. Best management practices will be implemented to minimize erosion potential. Water management facilities will remain in place until chemical stability of the site is demonstrated through the monitoring program.	1	2	N/A	1	2	2	2	1
Decommissioning and Abandonment of PAG rock storage areas.	(A) Runoff from potentially acid generating rock with adverse effects on the aquatic ecosystem and downstream recreational water users.	Waste rock from the storage areas will be used to backfill the mine and the storage areas will be rehabilitated. The liner from the PAG rock storage areas will be assessed to determine if it is hazardous material, if confirmed it will be disposed of by a licensed carrier in a licensed hazardous waste facility. If the liner is not hazardous, it will be placed underground or used at another site.	1	3	N/A	1	6	3	3	1
Accidents, Malfunctions and Unplanned Events										
Fuel and hazardous material spills	(A) Hazardous material spill results in adverse effects to the aquatic ecosystem and water users.	Implement spills management and emergency response procedures.	2	3	N/A	1	4	2	2	1
Erosion and sedimentation into watercourses	(A) Sediment spill results in adverse effects to the aquatic ecosystem and water users.	Implement sediment and erosion control best management practices.	2	3	N/A	1	4	2	2	1

Key:

Magnitude: *
0 = Nil
1 = Low
2 = Moderate
3 = High
4 = Unknown (see definitions in text, EA methods)

Geographic Extent: *
1 = Immediate work area
2 = Within Project closure plan boundary
3 = Within 5km of Project closure plan boundary
4 = Beyond 5 km of Project closure plan boundary

Frequency: *
1 = Uncommon event, event occurs once or infrequently / periodically
2 = Happens regularly but infrequently (e.g., once or twice per month)
3 = Happens regularly (e.g. daily)
4 = Continuous activity

Duration: *
1 = < 1 month
2 = 1-2 months
3 = 2-6 months
4 = 6-24 months
5 = 2-11 years (life of mine)
6 = > 11 years (Beyond Project)

Reversibility: *
1 = High
2 = Medium
3 = Low
4 = nil
5 = Unknown (see definitions in the text, EA Methods)

Ecological and Socio-economic Context: *
1 = Relatively pristine area not adversely affected by human activity
2 = Evidence of existing adverse effects
3 = High level of existing adverse effects

Timing: *
N/A – no sensitive periods or areas exist in baseline conditions
1 – sensitive periods or areas exist in baseline conditions that require adjustments to Project schedule or timing of activities

Certainty of Knowledge:*
1 = High – based on past performance and experience regarding environmental effects or mitigation
2 = Moderate – uncommon potential effect either not well understood or effects require compliance monitoring to modify engineering design or mitigation
3 = Low – potential for the need to follow-based on results of compliance monitoring to modify engineering design or mitigation

10.2.4. Environmental Design, Mitigation and Optimization

FNX understands the importance of implementing environmental design, mitigation measures and sustainability management practices. As such, a number of procedures and plans have been put in place in order to mitigate against potential adverse environmental effects. These measures, as they are related to Surface Water Quality, include:

- **In-water construction:** In order to minimize potential effects due to increased turbidity, cofferdams will be used to isolate in-water work areas, all water from cofferdam dewatering activities will be collected and treated (as required), and sediment and erosion control measures, such as silt curtains, will be used as needed;
- **Ethel Lake Control Structure:** The Ethel Lake Control Structure is proposed in order to ensure that downstream flows in Fairbank Creek are maintained at all times to meet dilution requirements specified in the ECA. In order to reduce nutrient loading to Ethel Lake as a result of the control structure, all woody vegetation greater than 0.05 metres in diameter will be removed from the area prior to inundation. For Decommissioning and Abandonment, the removal of the control structure will be done behind cofferdams which would isolate the work area including the area upstream from the control structure. The work area would be dewatered and if any sediment had accumulated immediately upstream from the control structure, it would be removed and disposed of properly;
- **Seepage:** Project works have been designed to avoid adverse effects associated with contact water seeping into the receiving environment from mine facilities, and meet the Design Guidelines for Sewage Works 2008. The PAG 1 rock storage containment pad will be lined with a textured membrane with non-woven geotextile placed directly above and below the geomembrane. The geomembrane will have a 450 millimetre thick lower cover layer (sand and gravel), surrounded by perimeter berms;

  The PAG 2 rock storage containment pad will be lined with a geomembrane with non-woven geotextile placed directly above and below the geomembrane. The geomembrane will be contained within sand bedding layers above and below the geomembrane and surrounded by perimeter berms. A water collection system will pump impacted water collected on the pad to the Mine Water Pond.

  PAG 1 and PAG 2 pads will have lined seepage collection ditches and underdrains that report to sumps. Seepage monitoring wells will be installed at the perimeter of both pads.

  If water quality is shown to exceed PWQOs, the seepage water will be pumped to the Mine Water Pond for eventual treatment prior to discharge. The Mine Water Pond will be contained within compacted granular embankments and have a double liner with a 60 millimetre High-Density Polyethylene (HDPE) geomembrane or equivalent. Modifications to works can only be done in accordance with Schedule B “Limited

Operational Flexibility Criteria for Modifications to Sewage Works" as described in the ECA;

- **Waste Water Treatment and Discharge:** To ensure all waste water is effectively treated prior to discharge, the Project will perform regular monitoring of all wastewater discharges and will ensure strict adherence to the ECA (No. 9557-AP5FSQ) and the effluent discharge limits. Flows in Fairbank Creek will be maintained through operation of the Ethel Lake Control structure, to provide the required dilution ratio of 7:1 in accordance with the requirements of the ECA. Contact and non-contact water (i.e. all site runoff water) will be directed to the Mine Water Pond for treatment prior to discharge to Fairbank Creek.
- **Accidental Events:** Spill prevention and response procedures as well as emergency response procedures are in place to limit the magnitude, duration and footprint of any accidental events and ensure protection of surface water. All fuel storage or hazardous waste storage will be located away from waterbodies and have secondary containment. All personnel will be trained in spill prevention and response procedures. Spillways on mine infrastructure (i.e. the Mine Water Pond, PAG 1 and PAG 2 spillway) have been designed to pass 1-in-200 year storm events. Emergency response, spill reporting and contingency procedures have been developed with actions that will be implemented if effluent is found to exceed PWQOs.

10.3. Residual Environmental Effects

Residual environmental effects on Surface Water Quality are those predicted environmental effects that remain possible after the implementation of mitigation and design measures. The following definitions and criteria are used to determine the significance of residual adverse environmental effects of the Project on Surface Water Quality:

A significant residual adverse environmental effect of the Project on Surface Water Quality occurs when concentrations of parameters of concern are predicted to exceed PWQOs for aquatic life organisms throughout all Project phases, and which are beyond the range of natural variation, and which are predicted to persist well beyond Decommissioning and Abandonment; or water quality monitoring[10] (e.g. of specific metals, TSS, pH, toxicity) indicates effluent discharge quality is regularly non-compliant with the limits established in the ECA (Table 10-3) or Schedule 4 of the *MMER.*

[10] As defined by the Terms and Conditions of the Project's Environmental Compliance Approval for the specific parameters and testing methodologies, and based on Provincial legislation under *Effluent Monitoring and Effluent Limits (Ontario Regulation 560/94),* Provincial Water Quality Objectives.

A not significant residual adverse environmental effect to Surface Water Quality occurs when short term exceedances, such as spill events, do not pose a long term threat to end-point water uses (including aquatic life, recreational water use or drinking water), or when effluent discharge is predicted to remain within the range of background concentrations, or permitted effluent limits.

A summary of the residual adverse environmental effects of the Project on Surface Water Quality is provided in Table 10-7.

Table 10-7: Summary of Residual Environmental Effects – Surface Water Quality

Valued Component	Key Adverse Residual Environmental Effect	Significance[1]	Probability of Occurrence (Likelihood)[2]	Effect on Ecosystem Function and Integrity[2]	Sustainable (Capacity) Use of Renewable Resources[2]	Relevant Legislation[3]
Construction	Potential increases in turbidity and nutrients in receiving water bodies. Accidental events remain possible.	Not significant	High	Moderate	Moderate	*Metal Mining Effluent Regulation*, Schedule [4]
Operations	Increased concentrations of metals, pH, suspended solids and total ammonia from waste water treatment facility discharge. Potential for accidental events remain.	Not significant	High	Moderate	Moderate	*Metal Mining Effluent Regulation*, Schedule [4]
Decommissioning and Abandonment	Potential increases in turbidity and nutrients in receiving waterbodies. Accidental events remain possible.	Not significant	High	Moderate	Moderate	N/A
Accidents, Malfunctions and Unplanned Events	Hazardous spills and sediment releases could lead to adverse effects on Surface Water Quality.	Not significant	Low	Moderate	Moderate	N/A
Planned Project Overall	Overall increase in turbidity, nutrients and metals, above background concentrations but remaining within regulatory criteria.	Not significant	High	Moderate	Moderate	N/A
The Project in combination with other projects and activities	Overall increased degradation of Surface Water Quality for potential downstream water users from increases in turbidity, nutrients and other contaminants.	Not significant	High	Moderate	Moderate	N/A

Notes:
1. The rating of significance for adverse residual environmental effects are those predicted effects remaining after mitigation is implemented.
2. Sustainability factors are described for all predicted adverse residual environmental effects.
3. Key federal legislation references as appropriate for relevant predicted adverse environmental effects. Other provincial legislation, policies, and guidelines are also applicable (e.g., *Ontario Water Resources Act*, Provincial Water Quality Objectives).

10.3.1. Construction

The residual adverse environmental effects of construction on Surface Water Quality include potential short term increases in turbidity due to surface water runoff from construction areas and in-water work in Fairbank Creek and longer term, low magnitude increases in mercury and nutrients that may result from the inundation around the Ethel Lake shoreline. Some change compared to baseline conditions may also occur in Fairbank Creek due to discharge from the waste water treatment plant. However, given the proposed mitigation, increases in these parameters are not anticipated to pose any long-term threat to downstream water users or key aquatic organisms, and any increase in specific parameters is anticipated to remain consistently within legislated requirements and water quality objectives. Therefore, the residual adverse environmental effect is considered to be not significant.

10.3.2. Operations

The residual adverse environmental effects of Operations on Surface Water Quality include potential increases in levels of certain water quality parameters from waste water discharge into Fairbank Creek, along with potentially ongoing elevated levels of mercury due to the inundation of the shoreline around Ethel Lake. The assimilative capacity study for Fairbank Creek (Klohn Crippen Berger, 2013) indicates that copper concentration at the discharge point may exceed the PWQO, specifically may be 0.006mg/L, versus the PWQO of 0.005mg/L, although this is permitted by the ECA. Otherwise, metal concentrations will remain within target parameters. Total ammonia, contributed by the explosive compounds used during mining, will also be treated to remain below 10 mg/L. However, given the proposed mitigation, increases in these parameters are not anticipated to pose any long-term threat to downstream water users or key aquatic organisms, and any increase in specific parameters is anticipated to remain consistently within legislated requirements and water quality objectives. Therefore, the residual adverse environmental effect is considered to be not significant.

10.3.3. Decommissioning and Abandonment

The residual adverse environmental effects of Decommissioning and Abandonment on Surface Water Quality include potential short term increases in turbidity due to in-water work (Ethel Lake Control structure removal), erosion and sedimentation and potential ongoing elevated mercury in water released from Ethel Lake. During Years One and Two of Decommissioning and Abandonment, the waste water treatment plant will remain in place. After this time period, it is anticipated that the waste water treatment plant will no longer be required to meet Surface Water Quality criteria and it will be demolished. However, given the proposed mitigation, increases in these parameters are not anticipated to pose any long-term threat to downstream potable water users or key aquatic organisms, and any increase in specific parameters is anticipated to remain consistently within legislated requirements and water quality objectives. Therefore, the

residual adverse environmental effect is considered to be not significant. Similar residual effects will occur during conditions of temporary closure.

10.3.4. Accidents, Malfunctions and Unplanned Events

The residual adverse environmental effects of Accidents, Malfunctions and Unplanned Events on Surface Water Quality include a potential for spills of hazardous materials and malfunction of erosion and sedimentation control measures could result in a release of sediment, thus degrading Surface Water Quality. However, given the proposed mitigation to prevent and or minimize the potential for Accidents, Malfunctions and Unplanned Events, and to mitigate potential for effects in that instance that these activities do occur, increases in these parameters are not anticipated to pose any long-term threat to downstream potable water users or key aquatic organisms, and any increase in specific parameters is anticipated to remain consistently within legislated requirements and water quality objectives. Therefore, the residual adverse environmental effect is considered to be not significant.

10.3.5. Planned Project Overall

The residual adverse environmental effects of the Project overall on Surface Water Quality include potential increases in turbidity, mercury, other metals, and nutrients being released into surface waterbodies adjacent to the Project site. However, with the mitigation proposed, increases in these parameters are not anticipated to pose any long-term threat to downstream potable water users or key aquatic organisms, and any increase in specific parameters is anticipated to remain consistently within legislated requirements and water quality objectives. Therefore, the residual adverse environmental effect is considered to be not significant.

10.3.6. Cumulative Environmental Effects

The Project may result in cumulative environmental effects on Surface Water Quality, as other projects and activities such as historical mining, and Advanced Exploration place a stress on Surface Water Quality and together there is the potential to affect the aquatic ecosystem and downstream water users. FNX is committed to responsible development of the Project and has already put in place programs and procedures to mitigate potential adverse environmental effects, including the design of the waste water treatment plant to take into consideration the worst case scenario for water treatment. As well, the addition of the Ethel Lake control structure will allow for a controlled release of water if further dilution efforts are required. Emergency response procedures and spill response protocols are already in place for the Project, and will ensure the magnitude and extent of an accidental event are minimized. The cumulative environmental effects to Surface Water Quality are considered to be not significant.

10.3.7. Monitoring and Follow-Up Program

Monitoring activities will be undertaken during Construction in order to ensure the sediment and erosion plans have been implemented and measures are functioning as designed.

The Project's ECA contains Surface Water Quality monitoring requirements, which will be fulfilled as required during Operation of the treatment plant. Specifically, effluent monitoring will be undertaken for a variety of parameters, such as pH and total ammonia for the specified frequencies in accordance with MOECC and Environment Canada's *MMER* sampling protocols. Water quality monitoring will also be conducted monthly, at previously established monitoring locations and results will be evaluated against the PWQO's.

Following Decommissioning and Abandonment, the Closure Plan commits to chemical stability monitoring of surface water on a monthly basis for the first two years and then on a quarterly basis for three to five years after Decommissioning and Abandonment.

There is a high degree of confidence associated with determining potential effects to Surface Water Quality, and with determining that there are no significant adverse environmental effects. FNX has developed comprehensive management plans and procedures to mitigate any potential adverse environmental effects. As a result, a follow-up program is not required for the Surface Water Quality VC.

10.4. References and Appendices

- ASI Group Limited. 2004 Baseline Aquatic Environmental Assessment, Former Victoria Mine Property, Final Report. 113 pp.
- AMEC Earth and Environmental Ltd. 2009. Aquatic Baseline Environmental Assessment Victoria Mine Property, Sudbury, Ontario.
- Bodaly, R.A., K.G. Beaty, L.H. Hendzel, A.R Majewski, M.J Paterson, K.R. Rolfhus, A.F. Penn, V.L. St. Louis, B.D. Hall, C.J.D. Matthews, M. Mailman, J.P Hurley, S.L. Schiff and J.J. Venkiteswaran. 2004. Experimenting with Hydroelectric Reservoirs. Env. Sci. & Tech. September 15, 2014. 7 pp.
- CCME. 2007. Canadian Water Quality Guidelines for the Protection of Aquatic Life. Available on line at: http://ceqg-rcqe.ccme.ca/en/index.html#void. Accessed on February 4, 2016.
- Conservation Sudbury. 2016. Conservation Sudbury. Available on line: http://www.nickeldistrict.ca/en/ Accessed on February 4, 2016.
- EAG. 2012 Baseline Aquatic Environmental Assessment Interpretive Report. Prepared for FNX Mining Company Inc. 246 pp.

- Ecotec Environmental Consultants Inc. 2016. Baseline Aquatic Assessment Report. Victoria Project Stream Assessment – PAG 2. Prepared for KGHM. 131 pp.
- Kilgour & Associates Ltd. And Denison Environmental Services. 2014. Baseline Aquatic Environmental Assessment, Victoria Project. Prepared for KGHM International. 127 pp. Hatch Ltd. 2014a. Site Wide Water Balance.
- Klohn Crippen Berger. May 22, 2013. Fairbank Creek Assimilative Capacity Study. Prepared for KGHM International Ltd.
- KGHM International. 2015. Victoria Stage Gate 4 Report for Full Project Funding Request. 824 pp.
- KGHM International. March 19, 2013. 2012 Annual Surface Water Report.
- KGHM International. March 19, 2013. 2012 Annual Surface Water Report.
- KGHM International. 2015. Victoria Stage Gate 4 Report for Full Project Funding Request. 914pp.
- KGHM International. September 2013. Advanced Exploration Closure Plan.
- KGHM International. November 26, 2014. Amendment to the Victoria Project Advanced Exploration Closure Plan.
- Hatch Ltd. 2014b. Ethel Lake Hydrology. Report prepared for KGHM. 27 pp.
- Hatch Ltd. 2015. Design Basis Mine Site Storm Water Management Plan. Report prepared for KGHM. 10 pp.
- Northcote, T.G. and D.Y. Atagi. 1997. Ecological interactions in the flooded littoral zone of reservoirs: The importance and role of submerge terrestrial vegetation with special reference to fish, fish habitat and fisheries in the Nechako Reservoir of British Columbia, Canada. Skeena Fisheries Report SK-111, August 1997.

Table of Contents – Chapter 11

11. Groundwater Quantity 192

11.1. Existing Conditions 192
11.1.1. Ecological Boundaries 197
11.1.2. Administrative Boundaries 197
11.1.3. Technical Boundaries 198
11.1.4. Likely Future Conditions 198
11.2. Environmental Effects Analysis 198
11.2.1. Construction 199
11.2.2. Operations 202
11.2.3. Decommissioning and Abandonment 204
11.2.4. Environmental Design, Mitigation and Optimization 206
11.3. Residual Environmental Effects 207
11.3.1. Construction 209
11.3.2. Operations 209
11.3.3. Decommissioning and Abandonment 209
11.3.4. Accidents, Malfunctions and Unplanned Events 210
11.3.5. Planned Project Overall 210
11.3.6. Cumulative Environmental Effects 210
11.3.7. Monitoring and Follow-Up Program 211
11.4. References and Appendices 211

11. Groundwater Quantity

Groundwater Quantity was chosen as a Valued Component (VC) since the Project has the potential to affect groundwater flow and pathways due to withdrawal of groundwater for use and pumping of groundwater seeping into the mine excavation. In general, Groundwater Quantity is important in the regional area as groundwater provides a source of potable domestic water and may also support ecological functions such as maintaining baseflow.

11.1. Existing Conditions

Groundwater Quantity within the area of the Project has been previously evaluated through the installation and monitoring of groundwater monitoring wells at 21 locations within the Victoria Property (as shown on Figure 11-1) including 18 shallow overburden well locations and three deeper bedrock well locations. Well installation was completed in 2010 and 2011 (WESA, 2012a). A hydrogeological assessment (WESA, 2012b) of the monitoring results was completed to determine baseline Groundwater Quantity conditions related to the elevation of the water table, Groundwater flow and hydraulic conductivities.

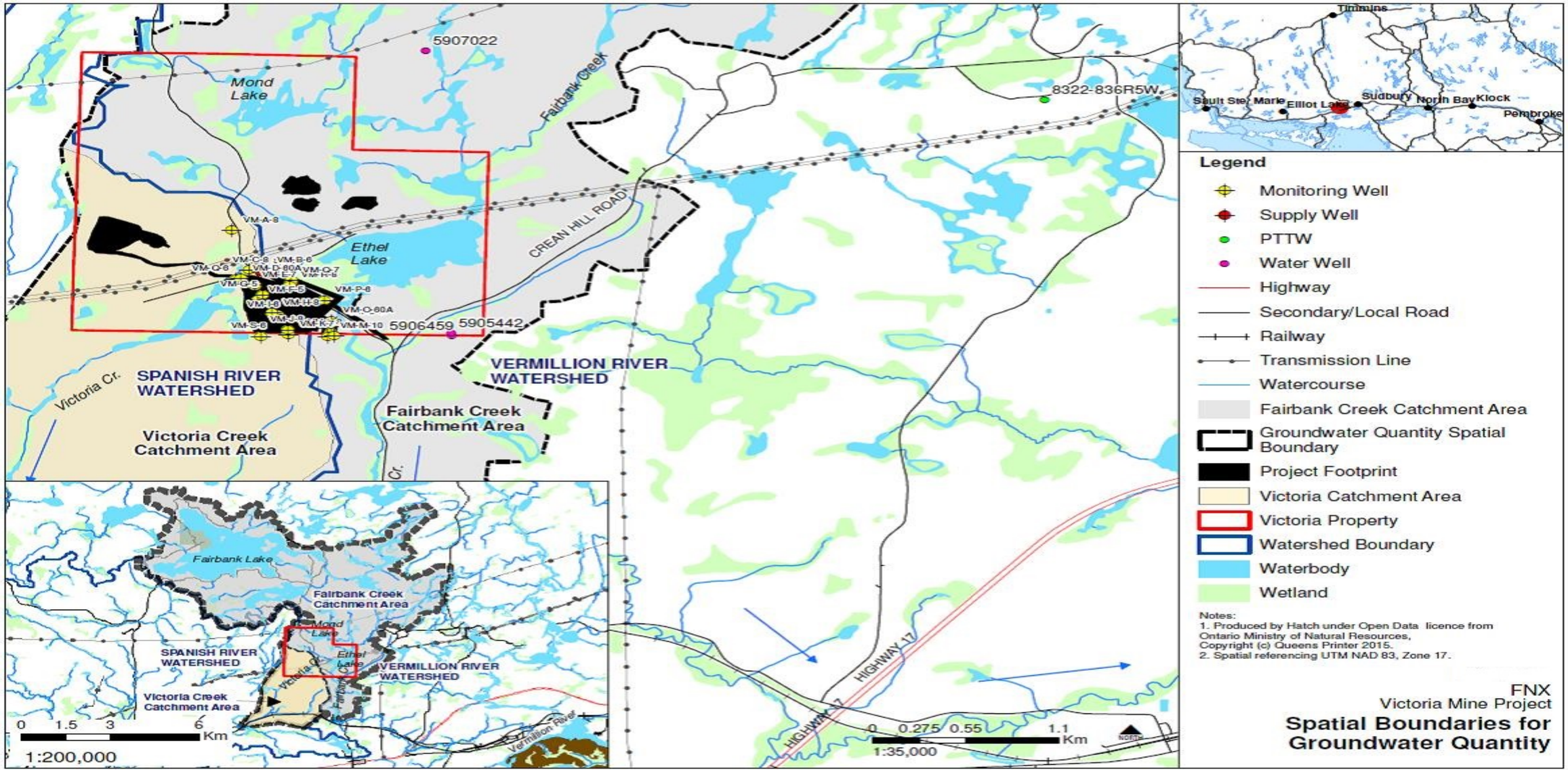

Figure 11-1: Spatial Boundaries for Groundwater Quantity

The baseline groundwater elevations at the various monitoring wells in spring and fall 2012 are summarized in Table 11-1 (WESA, 2013). Ground surface elevations through the Project area range from 270 metres near Fairbank Creek in the southeast corner of the Victoria Property to approximately 317 metres in the northwest Corner of the Victoria Property (WESA, 2013).

Table 11-1: Seasonal Groundwater Table Elevations from 2012

Monitoring Well	Ground Surface Elevation (m.a.s.l[11])	Top of Well Pipe Elevation (m.a.s.l)	Groundwater Elevations (m.a.s.l.)	
			Spring	Fall
VM-A-8	276.78	277.69	277.690	277.430
VM-B-6	274.71	275.478	275.198	274.418
VM-B-15	274.71	275.238	275.238	274.368
VM-C-8	275.28	276.246	275.336	274.581
VM-D-6	272.93	273.991	271.411	270.851
VM-D-12	272.93	273.849	272.859	272.169
VM-D-60A	275.57	276.790	274.574	274.209
VM-D-60B	275.57	276.790	273.919	273.304
VM-D-60C	275.57	276.790	272.985	272.310
VM-E-7	275.80	276.720	274.895	274.270
VM-F-5	274.54	275.33	273.980	274.010
VM-G-5	278.53	279.390	277.630	277.625
VM-H-8	273.84	274.80	272.000	272.125
VM-I-6	280.26	281.19	278.900	279.97
VM-J-8	279.62	280.50	279.445	279.700
VM-K-7	279.28	280.18	279.210	279.320
VM-L-8	273.18	274.07	272.735	272.970
VM-M-10	272.63	273.610	272.910	272.375
VM-N-8	272.86	273.70	272.535	273.020

[11] Metres above sea level

Monitoring Well	Ground Surface Elevation (m.a.s.l[11])	Top of Well Pipe Elevation (m.a.s.l)	Groundwater Elevations (m.a.s.l.)	
			Spring	Fall
VM-O-6	275.50	276.39	273.375	273.800
VM-O-60A	280.20	281.110	271.859	275.009
VM-O-60B	280.20	281.110	271.659	271.844
VM-O-60C	280.20	281.110	271.309	271.269
VM-P-6	274.24	275.17	274.030	274.100
VM-Q-7	276.75	277.67	274.385	272.610
VM-R-8	282.69	283.45	281.900	281.770
VM-S-60	277.48	278.392	277.092	277.212

Appendix E contains a figure (Figure 20-1) from the WESA (2012a) hydrogeological assessment that depicts the inferred groundwater flow directions and inferred groundwater flow divides in the area of the Project. On a regional level, the hilly topography creates a complex groundwater subsystem whereby groundwater entering an area via a recharge site may be discharged at the nearest topographic low (typically a watercourse or wetland system) or flow further to be discharged at a regional discharge location in the bottom of a major valley (WESA, 2013). Regional groundwater flow direction in the vicinity of the Project is generally expected to be southeast towards the Vermillion River (Richards, 2002; cited in WESA, 2013).

Based on the local monitoring results, inferred local groundwater flow vectors at the Project site are primarily towards adjacent surface water features including Ethel Lake, Fairbank Creek and Victoria Creek. WESA (2013) notes that shallow overburden groundwater is inferred to primarily flow through a thin zone of glacial outwash and till deposits in bedrock valleys and that the bedrock topography controls the direction of this groundwater flow in the overburden. The thin overburden in the area of the Project encourages groundwater discharge to local surface water features or into bedrock valleys with thicker unconsolidated materials (WESA, 2013). Flow velocities in the shallow overburden were calculated to range from one m/yr (in the southcentral portion of the Project site, flowing towards Victoria Creek) to 100 m/yr (in the western portion of the site, also flowing towards Victoria Creek) (WESA, 2013).

WESA (2013) also indicates that the inferred direction of groundwater flow in bedrock is east-northeast, with average flow velocities of 0.3 m/yr. Hydraulic conductivity in the

bedrock aquifers ranges from $1x10^{-7}$ to $3x10^{-4}$ (WESA, 2012a). The vertical gradient of groundwater flow throughout the Project site is typically downward from the overburden to the bedrock (WESA, 2013).

Golder (2011; cited in WESA, 2012b) conducted single-well pressure response tests in the proposed shaft area to determine hydraulic conductivity between depths of 31 and 1,062 metres below ground surface. Estimated hydraulic conductivities ranged from $2x10^{-9}$ to $6x10^{-8}$, with a geometric mean of $2x10^{-8}$ (Golder, 2011; cited in WESA, 2012b).

A total of seven monitoring wells were installed in bedrock at three locations to determine existing Groundwater Quantity yields in order to identify a suitable groundwater supply source. It was determined that the maximum sustainable pumping rate from the proposed groundwater supply well (VMB-60), was $23m^3$/hr (100 US gallons per minute) which is considered to be a suitable volume to serve as a water supply for the Project, in conjunction with other water sources (WESA, 2012b). This well, drilled to a depth of approximately 60 metres, is currently available to be used as a source of water to support advanced exploration activities, in accordance with amended Permit To Take Water (PTTW) No. 0466-AJ8HRM, issued by the MOECC.

Other groundwater users in the vicinity of the Project, based on the MOECC Water Well Information System and PTTW records, include Ellen Pit 1 (which has a PTTW in place and is valid 2010 to 2020), within five kilometres of the Project, as well as three domestic water wells located within 2.5 kilometres of the Project as shown on Figure 11-1 (WESA, 2012a). The depth of these three domestic wells ranges from approximately 25 to 82 metres (WESA, 2013). There are no municipal water supply systems within the environmental assessment area and therefore, groundwater and major surface water bodies (i.e. Fairbank Lake) provide the only source of potable water (WESA, 2013).

The total Project water demand during Operations is summarized in Table 11-2 (Hatch Ltd., 2014). This total water demand would be supplied by a mix of groundwater, pumped from supply well VMB-60, surface water pumped from Ethel Lake and recycled water from the Project water management system.

Table 11-2: Total Project Water Demand During Operations

Project Component	Water Quality Requirement	Units	Total Water Demand
Potable Water Treatment	Raw Water	m^3/day	26.1
		m^3/day	9,533.8
Washdown Allowance for Surface Facilities	Raw or Recycled water	m^3/day	12.5
		m^3/day	4559.5
Mine Air Cooling Plant Allowance	Raw Water	m^3/day	0.0 to 846.2
		m^3/day	87,443.0
Underground Mine Process Water	Raw or Recycled water	m^3/day	1543.5
		m^3/day	563,395.5
Backfill Plant	Raw or Recycled water	m^3/day	501.0 to 901.0
		m^3/day	182,865.0 to 328,865.0
Shotcrete/Concrete Line Wetting and Flushing	Raw or Recycled water	m^3/day	50.0
		m^3/day	18,250.0
Total Site Water Demand (Maximum Raw Water Demand)		m^3/day	m^3/day
		m^3/year	m^3/day

Knight Piésold (2011; cited in WESA, 2012b) notes that the average volume of groundwater required to be pumped from the mine shaft during advanced exploration (which is considered to be the same as that which will be required during Operations of the Project) is 7.92 m^3/hr or 190.08 m^3/day.

11.1.1. Ecological Boundaries

The spatial boundaries for Groundwater Quantity follow the natural drainage patterns, specifically the watershed boundary of Fairbank Creek in the Vermilion River watershed and Victoria Creek in the Spanish River watershed, as shown on Figure 11-1.

The temporal boundary for the Groundwater Quantity effects assessment covers the period between 2024 and 2050.

11.1.2. Administrative Boundaries

The MOECC regulates all groundwater taking occurring at rates greater than 50,000 litres per day through the PTTW process under the *Ontario Water Resources Act, 1990*. An amended PTTW (No. 0466-AJ8HRM) has been received from the MOECC to permit

groundwater extraction at the mine shaft in order to de-water the excavations and at well VM-B-60 to provide mine process and potable water. The PTTW was issued for advanced exploration (expiring on July 2, 2024) and allows for a maximum withdrawal of 1,300,000 L/day from the mine shafts and 547,200 L/day from well VMB-60. KGHM will require a PTTW to continue to dewater the mine shafts during Operations, although supply of water from well VMB-60 during Operations will be less than 50,000 L/day.

11.1.3. Technical Boundaries

This assessment of potential effects on Groundwater Quantity has been based on a number of hydrogeological studies (WESA, 2012a, WESA, 2012b, WESA, 2013) that have been completed for the Project in order to characterize baseline Groundwater Quantity conditions and assess the potential for adverse effects as a result of the Project.

In order to properly characterize existing conditions and assess potential adverse effects on Groundwater Quantity a number of Groundwater wells have been drilled. However, given that monitoring wells only sample a portion of the groundwater aquifer, it is necessary to extrapolate the results from well monitoring across the resource. This may provide a technical limitation to the assessment, although one that is commonly understood to exist in hydrogeological assessments. Further, the use of a hydrogeological model to predict effects on Groundwater Quantity provides a further technical boundary.

11.1.4. Likely Future Conditions

Should the Project not proceed, Groundwater Quantity is predicted to remain similar to existing conditions. Given that there are no other groundwater users in the immediate Project area, Groundwater Quantity would be expected to remain similar to baseline conditions, though the continued use of groundwater as a potable domestic water source and for Ellen Pit 1 will continue to have a minor regional effect.

11.2. Environmental Effects Analysis

The potential environmental effects of the proposed project on Groundwater Quantity are outlined within this section. Five pathways that may cause potential effects on Groundwater Quantity have been identified, including:

1. Decreased Groundwater Quantity in the localized area due to extraction for Construction and Operation purposes;
2. Reduced infiltration rate of surface water due to the increase in impervious and less pervious surfaces in the Project area, potentially causing a decrease in groundwater recharge rate and therefore, reduced Groundwater Quantity than would otherwise exist in the absence of the Project;

3. Impervious surfaces within the shallow overburden (e.g. building foundations) resulting in localized alterations to shallow overburden groundwater flows;
4. Construction of the Ethel Lake Control structure and raising of Ethel Lake by 0.5 metres, which may raise the local shallow groundwater levels adjacent to the lake by a similar magnitude, and surface water taking from Ethel Lake, which will alter surface water levels and potentially, groundwater levels in the adjacent shallow overburden; and
5. Accidental events, such as pump malfunction or emergency water taking requirements resulting in a reduction of groundwater available to other users.

Under a worst-case scenario, effects on Groundwater Quantity occurring as a result of these pathways could potentially result in decreased groundwater availability for existing groundwater users (e.g. domestic potable water) or to support ecological functions relying on groundwater (e.g. wetland form and function, watercourse baseflow).

A discussion of each of the potential environmental effects by Project phase is provided in the following sections. The potential effects of changes in Groundwater Quantity on receptors (i.e., other groundwater users or the natural environment) are also discussed, where applicable.

11.2.1. Construction

Under amended PTTW No. 0466-AJ8HRM, issued by the MOECC to support advanced exploration activities, FNX is approved to take 1,847,200 L/day of groundwater for mine dewatering purposes at the shafts, and to supply process water from Well VMB-60. The permit is valid until July 2, 2024 (MOECC, 2012) and will therefore cover groundwater extractions from these two sources for the anticipated duration of the Construction period. No increase in water taking volumes from these two sources is anticipated to be required over and above the amount permitted in the PTTW. This groundwater taking is anticipated to result in local decreases in Groundwater Quantity in the immediate vicinity of the taking location (WESA, 2012b). However, due to observed low hydraulic conductivity of the bedrock in the area, this groundwater taking is anticipated to cause a steep and localized cone in the immediate vicinity of the taking, which is similar to observed conditions at Vale's Crean Hill Mine, approximately 4 kilometres east (WESA, 2012b). Given that MOECC has already issued a PTTW for this groundwater taking, and it will be a continuation of taking that will have already commenced during advanced exploration, no adverse effects on groundwater users (domestic wells or ecological functions) or surface water features are anticipated to occur as a result of minor localized decreases in Groundwater Quantity.

Any other groundwater takings associated with the continued construction for the Project, for example for dewatering during excavation and construction of building foundations, will not either not exceed 50,000 L/day and therefore, not require PTTW, or an amendment to the PTTW is required. These activities will continue for the duration of

the Construction phase. Given that the volume of the proposed taking is anticipated to be <50,000 L/day, some decrease in Groundwater Quantity is anticipated to occur, but no adverse effects on groundwater users are anticipated.

Construction of the Ethel Lake control structure will result in an increase in the water surface elevation of Ethel Lake by approximately 0.5 metres. This is anticipated to cause a corresponding increase in the elevation of the adjacent shallow overburden groundwater table by up to an equivalent amount, provided there is a direct hydraulic connection between the lake and adjacent shallow groundwater table. This will occur for the duration of the Project, in any areas where connection to the local groundwater table occurs. However, this is not anticipated to result in any adverse effect on Groundwater Quantity.

Installation of impervious building foundations during Construction may locally alter Groundwater flow paths in the vicinity of the impervious surface. However, it is anticipated that changes will be very localized in the vicinity and that ultimately, groundwater flow will remain in the same general direction, with no adverse effects in Groundwater Quantity at the ultimate discharge location.

The presence of Project components, including but not limited to lay down areas, a new haul road, and two rock storage areas that are impervious or less pervious than the existing ground surface, may reduce the overall amount of, or rate of surface water infiltration (i.e., groundwater recharge) to underlying aquifers. This could potentially reduce the amount of groundwater in the local aquifer that would otherwise be present in the absence of the Project.

The potential for accidental events such as pump malfunction (resulting in continuous uncontrolled pumping in excess of normal conditions) or an emergency requiring an increased quantity of groundwater (e.g., a fire at the facility requiring groundwater from the well to extinguish) could also occur, potentially resulting in further decrease in Groundwater Quantity over and above that permitted by the PTTW.

These effects have the potential to reduce the amount of groundwater available to other users or have an observable or measurable effect on water levels in surrounding surface water. However, effects on adjacent groundwater users are anticipated to be negligible, due to the predicted formation of only a localized drawdown cone in vicinity of the source (WESA, 2012b) and absence of other groundwater users in the immediate vicinity of the anticipated drawdown area.

An analysis of the environmental effects to Groundwater Quantity during Construction is provided in Table 11-3.

Table 11-3: Environmental Effects Analysis; VC - Groundwater Quantity; Project Phase - Construction

Project Components or Activities	Potential Environmental Effects (A = adverse; B = beneficial)	Engineering Design, Mitigation Measures and Proven Environmental Management Practices	Factors Considered in the Environmental Effects Analysis*							
			Magnitude	Geographic Extent	Timing	Frequency	Duration	Reversibility	Ecological & Socio-economic Context	Certainty of Knowledge
Planned Activities										
Groundwater taking for mine de-watering and process water supply	(A) Decreased Groundwater Quantity may affect supply of groundwater for domestic or ecological purposes.	Project has been designed to minimize groundwater taking requirements. Groundwater taking will be limited to allowable withdrawals specified in PTTW.	1	2	N/A	4	6	3	2	1
Groundwater taking for foundation excavation	(A) Decreased Groundwater Quantity may affect supply of groundwater for domestic or ecological purposes.	Groundwater taking will either be less than 50,000 L/day or limited to allowable withdrawals specified in PTTW.	1	2	N/A	3	4	3	2	1
Construction of physical components (e.g., laydown areas, roads, PAG waste rock storage pile, building foundations)	(A) Potential changes in groundwater recharge rates and altered flow vectors.	PAG rock storage area will be consolidated, to the extent possible.	1	1	N/A	3	6	1	2	1
Inundation and change of Ethel Lake water levels	(A) Alterations in groundwater elevations adjacent to Ethel Lake from control structure construction.	The size of the Ethel Lake control structure has been minimized in order to minimize changes in groundwater level.	1	2	N/A	4	4	1	2	1
Accidents, Malfunctions and Unplanned Events										
Groundwater taking pump malfunction	(A) Decreased Groundwater Quantity may affect groundwater users.	Monitoring of water taking and implementation of automatic shut off procedures.	1	1	N/A	1	1	1	2	1
Groundwater required to be pumped during an emergency scenario (e.g., fire control)	(A) Decreased Groundwater Quantity may affect supply of groundwater for domestic or ecological purposes.	Monitoring of water takings will be employed during the event of an emergency scenario. Groundwater pumping to be returned to normal operating levels, at or below allowable limits, once emergency situation requiring additional water taking has been averted or ceased.	1	2	N/A	1	1	3	2	1

Key:

Magnitude: *
0 = Nil
1 = Low
2 = Moderate
3 = High
4 = Unknown (see definitions in text, EA methods)

Geographic Extent: *
1 = Immediate work area
2 = Within Project closure plan boundary
3 = Within 5km of Project closure plan boundary
4 = Beyond 5 km of Project closure plan boundary

Frequency: *
1 = Uncommon event, event occurs once or infrequently / periodically
2 = Happens regularly but infrequently (e.g., once or twice per month)
3 = Happens regularly (e.g. daily)
4 = Continuous activity

Duration: *
1 = < 1 month
2 = 1-2 months
3 = 2-6 months
4 = 6-24 months
5 = 2-11 years (life of mine)
6 = > 11 years (Beyond Project)

Reversibility: *
1 = High
2 = Medium
3 = Low
4 = nil
5 = Unknown (see definitions in the text, EA Methods)

Ecological and Socio-economic Context: *
1 = Relatively pristine area not adversely affected by human activity
2 = Evidence of existing adverse effects
3 = High level of existing adverse effects

Timing: *
N/A – no sensitive periods or areas exist in baseline conditions
1 – sensitive periods or areas exist in baseline conditions that require adjustments to Project schedule or timing of activities

Certainty of Knowledge:*
1 = High – based on past performance and experience regarding environmental effects or mitigation
2 = Moderate – uncommon potential effect either not well understood or effects require compliance monitoring to modify engineering design or mitigation
3 = Low – potential for the need to follow-up based on results of compliance monitoring to modify engineering design or mitigation

11.2.2. Operations

The activities and effects described in the Construction Phase above are also anticipated to continue throughout the Operations Phase. An amendment to the PTTW will be required to extend the life of the PTTW throughout the Operation phase, although it is anticipated that a similar amount of groundwater extraction (1,847,200 L/day) will occur to dewater the mine shafts, and provide process supply water from the VMB-60 well. The duration of the water taking will occur for the Project life, and the geographic extent will be limited to the drawdown cone, which will be steep and localized to the immediate vicinity of the underground workings (WESA, 2013). Given that MOECC has already issued a PTTW for this groundwater taking, and it will be a continuation of taking that will have already commenced during advanced exploration, no adverse effects on groundwater users (domestic wells or ecological functions) or surface water features are anticipated to occur as a result of minor localized decreases in Groundwater Quantity.

The presence of Project components with that are impervious or less pervious than the existing ground surface, may reduce the overall amount of, or rate of surface water infiltration (i.e., groundwater recharge) to underlying aquifers. This could potentially reduce the amount of groundwater in the local aquifer that would otherwise be present in the absence of the Project. These Project components will be present for the duration of the Project.

Presence of impervious building foundations throughout the Operations phase may locally alter groundwater flow paths in the vicinity of the impervious surface over the life of the Operations phase. However, it is anticipated that changes will be very localized in the vicinity of the structures and that ultimately, groundwater flow will remain in the same general direction, with no effects on Groundwater Quantity at the ultimate discharge location.

The use of Ethel Lake for water control will cause a fluctuation in the water levels, an estimated maximum change of approximately one metre on an annual basis, which may lead to a change in the associated groundwater table elevations in the shallow overburden adjacent to the lake. The frequency and duration of changes in groundwater table elevation will be tied to the quantity of water used from Ethel Lake, which will change based on needs of the Project as well as any changes from precipitation events. The geographic extent of changes in groundwater level will be in the immediate vicinity of the Ethel Lake shoreline. However, no adverse effects to Groundwater Quantity are anticipated to occur as a result of changes in the groundwater table surface elevation adjacent to Ethel Lake.

An analysis of the environmental effects to Groundwater Quantity during Operations is provided in Table 11-4.

Table 11-4: Environmental Effects Analysis; VC - Groundwater Quantity; Project Phase - Operations

Project Components or Activities	Potential Environmental Effects (A = adverse; B = beneficial)	Engineering Design, Mitigation Measures and Proven Environmental Management Practices	Factors Considered in the Environmental Effects Analysis*							
			Magnitude	Geographic Extent	Timing	Frequency	Duration	Reversibility	Ecological & Socio-economic Context	Certainty of Knowledge
Planned Activities										
Groundwater taking for mine de-watering and process water supply	(A) Decreased Groundwater Quantity may affect supply of groundwater for domestic or ecological purposes.	Project has been designed to minimize groundwater taking requirements. Groundwater taking will be limited to allowable withdrawals specified in PTTW.	1	2	N/A	4	6	3	2	1
Presence of physical components (e.g., laydown areas, roads, PAG waste rock storage pile, building foundations)	(A) Potential changes in groundwater recharge rates and altered flow vectors.	PAG rock storage area will be consolidated, to the extent possible.	1	1	N/A	4	6	2	2	1
Ongoing use of water from Ethel Lake results in changes of Ethel Lake water levels	(A) Potential for groundwater connected with Ethel Lake to be changed from the change in water levels.	Minimization of the Ethel Lake water level changes.	1	3	N/A	3	5	1	2	1
Accidents, Malfunctions and Unplanned Events										
Groundwater taking pump malfunction	(A) Decreased Groundwater Quantity may affect groundwater users.	Monitoring of water taking and implementation of automatic shut off procedures.	1	1	N/A	1	1	1	2	1
Groundwater required to be pumped during an emergency scenario (e.g., fire control)	(A) Decreased Groundwater Quantity may affect supply of groundwater for domestic or ecological purposes.	Monitoring of water takings will be employed during the event of an emergency scenario. Groundwater pumping to be returned to normal operating levels, at or below allowable limits, once emergency situation requiring additional water taking has been averted or ceased.	1	2	N/A	1	1	3	2	1

Key:

Magnitude: *
0 = Nil
1 = Low
2 = Moderate
3 = High
4 = Unknown (see definitions in text, EA methods)

Geographic Extent: *
1 = Immediate work area
2 = Within Project closure plan boundary
3 = Within 5km of Project closure plan boundary
4 = Beyond 5 km of Project closure plan boundary

Frequency: *
1 = Uncommon event, event occurs once or infrequently / periodically
2 = Happens regularly but infrequently (e.g., once or twice per month)
3 = Happens regularly (e.g. daily)
4 = Continuous activity

Duration: *
1 = < 1 month
2 = 1-2 months
3 = 2-6 months
4 = 6-24 months
5 = 2-11 years (life of mine)
6 = > 11 years (Beyond Project)

Reversibility: *
1 = High
2 = Medium
3 = Low
4 = nil
5 = Unknown (see definitions in the text, EA Methods)

Ecological and Socio-economic Context: *
1 = Relatively pristine area not adversely affected by human activity
2 = Evidence of existing adverse effects
3 = High level of existing adverse effects

Timing: *
N/A – no sensitive periods or areas exist in baseline conditions
1 – sensitive periods or areas exist in baseline conditions that require adjustments to Project schedule or timing of activities

Certainty of Knowledge:*
1 = High – based on past performance and experience regarding environmental effects or mitigation
2 = Moderate – uncommon potential effect either not well understood or effects require compliance monitoring to modify engineering design or mitigation
3 = Low – potential for the need to follow-up based on results of compliance monitoring to modify engineering design or mitigation

11.2.3. Decommissioning and Abandonment

Decommissioning and Abandonment may require dewatering in excavations associated with the removal of Project components, such as waste rock storage area, resulting in localized decreases in Groundwater Quantity during this phase. Pumping from the mine shaft will also continue to be required until all infrastructure is removed. It is anticipated that pumping rates would be similar than those occurring during Operations, therefore, no adverse effects on other groundwater users are anticipated due to the ongoing localized cone of depression in groundwater level and reduced Groundwater Quantity.

Once all equipment is removed from the mine shafts, they will be flooded with water thereby removing the effect of the drawdown cone surrounding the underground works, following the completion of the Project.

The potential for accidental events such as pump malfunction or an emergency requiring an increased quantity of groundwater could also result in decreased Groundwater Quantity, which depending on the magnitude of the change, could decrease the amount of groundwater available to other users.

The removal of Project components and site restoration activities will restore infiltration rates as well as the historic water level of Ethel Lake and associated effect on connect groundwater levels.

An analysis of the environmental effects to Groundwater Quantity during Decommissioning and Abandonment is provided in Table 11-5.

Table 11-5: Environmental Effects Analysis; VC - Groundwater Quantity; Project Phase - Decommissioning and Abandonment

Project Components or Activities	Potential Environmental Effects (A = adverse; B = beneficial)	Engineering Design, Mitigation Measures and Proven Environmental Management Practices	Factors Considered in the Environmental Effects Analysis*							
			Magnitude	Geographic Extent	Timing	Frequency	Duration	Reversibility	Ecological & Socio-economic Context	Certainty of Knowledge
Planned Activities										
Groundwater taking for Decommissioning and Abandonment purposes	(A) Decreased Groundwater Quantity in aquifer may affect other users of ground water.	Groundwater taking will either be less than 50,000 L/day or limited to allowable withdrawals specified in PTTW.	1	2	N/A	3	4	3	2	1
Removal of impervious surfaces	(B) Beneficial effect on Groundwater Quantity due to re-establishment of natural infiltration characteristics allowing for a greater recharge on the quantity of groundwater available to other users.	Site rehabilitation to decrease amount of impervious surfaces.	0	2	N/A	4	6	4	2	1
Removal of Ethel Lake control structure	(B) Water levels of Ethel Lake will return to pre-Project levels, returning groundwater levels to pre-Project levels.	Site rehabilitation will return Ethel Lake water levels to natural, uncontrolled levels, returning any connected groundwater levels to the pre-Project level.	1	2	N/A	4	6	1	2	1
Accidents, Malfunctions and Unplanned Events										
Groundwater taking pump malfunction	(A) Withdrawal of groundwater in exceedance of allowable taking limits may affect other users of ground water.	Monitoring of water takings will be employed, with automatic shut off procedures implemented, where necessary.	1	1	N/A	1	1	1	2	1
Groundwater required to be pumped during an emergency scenario (e.g., fire control)	(A) Withdrawal of groundwater in exceedance of allowable taking limits and potential effects on Groundwater Quantity may affect other users of ground water.	Monitoring of water takings will be employed during the event of an emergency scenario. Groundwater pumping to be returned to normal operating levels, at or below allowable limits, once emergency situation requiring additional water taking has been averted or ceased.	1	2	N/A	1	1	3	2	1

Key:

Magnitude: *
0 = Nil
1 = Low
2 = Moderate
3 = High
4 = Unknown (see definitions in text, EA methods)

Geographic Extent: *
1 = Immediate work area
2 = Within Project closure plan boundary
3 = Within 5km of Project closure plan boundary
4 = Beyond 5 km of Project closure plan boundary

Frequency: *
1 = Uncommon event, event occurs once or infrequently / periodically
2 = Happens regularly but infrequently (e.g., once or twice per month)
3 = Happens regularly (e.g. daily)
4 = Continuous activity

Duration: *
1 = < 1 month
2 = 1-2 months
3 = 2-6 months
4 = 6-24 months
5 = 2-11 years (life of mine)
6 = > 11 years (Beyond Project)

Reversibility: *
1 = High
2 = Medium
3 = Low
4 = nil
5 = Unknown (see definitions in the text, EA Methods)

Ecological and Socio-economic Context: *
1 = Relatively pristine area not adversely affected by human activity
2 = Evidence of existing adverse effects
3 = High level of existing adverse effects

Timing: *
N/A – no sensitive periods or areas exist in baseline conditions
1 – sensitive periods or areas exist in baseline conditions that require adjustments to Project schedule or timing of activities

Certainty of Knowledge:*
1 = High – based on past performance and experience regarding environmental effects or mitigation
2 = Moderate – uncommon potential effect either not well understood or effects require compliance monitoring to modify engineering design or mitigation
3 = Low – potential for the need to follow-up based on results of compliance monitoring to modify engineering design or mitigation

11.2.4. Environmental Design, Mitigation and Optimization

FNX understands the importance of implementing environmental design, mitigation measures and sustainability management practices. As such, a number of procedures and plans have been put in place in order to mitigate against potential adverse environmental effects. These measures, as they are related to Groundwater Quantity, include:

- **Design**: The Project has been designed to recycle surface water and groundwater for use as process water, limiting the overall amount needed for groundwater takings (see Chapter 3 – Project Description for more detail regarding the process water recycling process);
- **Ethel Lake**: The design of the Ethel Lake control structure and associated flooding of Ethel Lake was minimized to the extent possible, minimizing the potential effects on the hydraulically connected groundwater table levels;
- M**onitoring**: The rates of groundwater withdrawal will be monitored daily and submitted in a report annually to the MOECC, in line with the requirements of the existing PTTW. Additionally, continuous monitoring of the water level and velocity of key surface water locations, in accordance with the existing PTTW requirements, will also occur;
- **Compensation**: As required in the existing PTTW, and which would be expected to continue through the Operations phase, if the taking of water is observed to cause any adverse effects to other water supplies in use prior to the issuance of the PTTW, FNX will make available a supply of water equivalent in quantity to their normal takings, or shall compensate such persons for their reasonable costs of so doing, or shall reduce the rate and amount of taking to prevent or alleviate the observed adverse effect. Temporary water supplies adequate to meet normal requirements, or compensation for such persons for their reasonable costs of obtaining temporary water supplies will be provided by FNX. If permanent interference is caused by the groundwater takings, FNX shall restore the water supplies of those permanently affected;
- **Restoration of Infiltration Rates**: Decommissioning and Abandonment will return surface water infiltration rates to pre-development conditions. Mitigation may be required to loosen compaction; and
- **Accidental Events**: In accordance with PTTW requirements, monitoring the amount of groundwater withdrawals will occur daily, to ensure compliance with permit limits. Therefore, any malfunction of pumps will be identified in a timely manner, limiting the amount of non-permitted withdrawal to a minor quantity and duration. Emergency response protocols (see Chapter 5 – Sustainability Management) will be implemented as appropriate to limit effects on groundwater resources.

11.3. Residual Environmental Effects

Residual environmental effects on Groundwater Quantity are those predicted environmental effects that remain after mitigation measures have been implemented. The following definitions are used to determine the significance of residual adverse environmental effects of the project on Groundwater Quantity:

A **significant** residual adverse effect of the Project on Groundwater Quantity occurs when a drop in groundwater level of greater than one meter is observed at any of the groundwater monitoring stations, VM-D-60, VM-O-60, VM-S-60 (compared to the pre-mining average baseline), or if a downward hydraulic gradient at the deep wells exceeds 0.1 for one month[12]. Further, if monitoring observations and measurements during Project Construction, Operations or Decommissioning and Abandonment indicate that dewatering is having an observable or measurable effect on water levels in surrounding surface water features, a significant residual adverse environmental effect status will be triggered.

A **not significant** residual adverse effect of the Project on Groundwater Quantity includes changes to groundwater recharge or discharge flows such that when compared to background conditions, there are no observable differences in groundwater levels (both percent quantity and extent) in the Project footprint and surrounding zones. Specifically, per the PTTW, a not significant residual adverse effect occurs if groundwater levels are maintained within one meter as observed at any of the groundwater monitoring stations, VM-D-60, VM-O-60, VM-S-60, compared to the pre-mining average baseline or if the downward hydraulic gradient at the deep wells does not exceed 0.1 for the duration of one month. Furthermore, if monitoring observations and measurements during Project Construction, Operations or Decommissioning and Abandonment indicate that dewatering is resulting in no observable or measurable effect on water levels in the surrounding surface water features, a not significant residual adverse environmental effect status will be upheld.

A summary of the residual adverse environmental effects of the Project on Groundwater Quantity is provided in Table 11-6.

[12] As defined by the existing PTTW

Table 11-6: Summary of Residual Environmental Effects – Groundwater Quantity

Valued Component	Key Adverse Residual Environmental Effect	Significance[1]	Probability of Occurrence (Likelihood)[2]	Effect on Ecosystem Function and Integrity[2]	Sustainable (Capacity) Use of Renewable Resources[2]	Relevant Legislation[3]
Construction	Reductions in Groundwater Quantity due to groundwater extraction for supply water and dewatering.	Not significant	High	Low	Moderate	N/A
Operations	Reductions in Groundwater Quantity due to groundwater extraction for supply water and dewatering.	Not significant	High	Low	Moderate	N/A
Decommissioning and Abandonment	Reductions in Groundwater Quantity due to groundwater extraction for supply water and dewatering.	Not significant	High	Low	Moderate	N/A
Accidents, Malfunctions and Unplanned Events	Groundwater taking for emergency water use or due to pump malfunction may reduce the amount of groundwater available to other users.	Not significant	Low	Low	Moderate	N/A
Planned Project Overall	Reductions in Groundwater Quantity due to groundwater extraction for supply water and dewatering.	Not significant	High	Low	Moderate	N/A
The Project in combination with other projects and activities	Overall increased groundwater takings in the immediate area may reduce the total amount of groundwater available to other users.	Not significant	Low	Low	Moderate	N/A

Notes:
1. The rating of significance for adverse residual environmental effects are those predicted effects remaining after the application of mitigation.
2. Sustainability factors are described for all predicted adverse residual environmental effects.
3. Key federal legislation references as appropriate for relevant predicted adverse environmental effects.

11.3.1. Construction

The residual adverse effects of Construction on Groundwater Quantity may include decreased Groundwater Quantity due to groundwater extraction, and a reduction in infiltration rate reducing groundwater levels to no more than one metre of baseline conditions in monitoring wells. A PTTW has been issued by the MOECC for existing takings during advanced exploration associated with mine process water at well VMB-60 and for mine shaft dewatering, and this PTTW will remain in place until Construction is completed. FNX has measures in place for mitigation, monitoring, and compensation to minimize the potential for adverse effects on Groundwater Quantity in the immediate vicinity of the water takings. These residual effects are considered localized, of low magnitude (in accordance with PTTW requirements), will occur over a continuous basis during Construction. However, due to the localized geographical extent of effects on Groundwater Quantity, no adverse residual effects on other domestic groundwater users or ecological functions are anticipated as a result of decreases in Groundwater Quantity. Therefore, residual adverse environmental effects to Groundwater Quantity are considered to be not significant.

11.3.2. Operations

The residual adverse environmental effects of Operations will include continued ongoing reductions in Groundwater Quantity due to the continued dewatering of the mine shaft and extraction for water supply purposes. As well, infiltration rates will remain reduced in the vicinity of Project infrastructure throughout Operations. These residual effects on Groundwater Quantity are considered localized in the immediate area of the extraction, are of low magnitude and will be in accordance with PTTW requirements, will occur over a continuous basis during Operations, and are considered reversible. However, due to the localized geographical extent of effects on Groundwater Quantity, no adverse residual effects on other domestic groundwater users or ecological functions are anticipated as a result of decreases in Groundwater Quantity. Therefore, residual adverse environmental effects to Groundwater Quantity are considered to be not significant.

11.3.3. Decommissioning and Abandonment

The residual adverse environmental effects of Decommissioning and Abandonment on Groundwater Quantity include the use of well VMB-60 for supply water, as well as the potential for dewatering of excavations, reducing the quantity of groundwater available for other users for the Decommissioning and Abandonment phase. Following Decommissioning and Abandonment, site restoration activities will restore groundwater infiltration rates and flow vectors, through the removal of Project components. Furthermore, the water taking in the mine shaft will cease, eliminating the removal of groundwater from the environmental assessment area. Due to the localized geographical extent of effects on Groundwater Quantity during this phase, no adverse residual effects on other domestic groundwater users or ecological functions are

anticipated as a result of decreases in Groundwater Quantity. Therefore, residual adverse environmental effects to Groundwater Quantity are considered to be not significant. Similar residual effects will occur during conditions of temporary closure.

11.3.4. Accidents, Malfunctions and Unplanned Events

The residual adverse environmental effects of Accidents, Malfunctions and Unplanned Events on Groundwater Quantity include potential groundwater use in response to emergency situations. Overall, there may be a reduction in the quantity of groundwater available for other users, reducing the groundwater levels to no more than one metre of baseline conditions in monitoring wells. The residual adverse environmental effect to Groundwater Quantity is considered to be not significant.

11.3.5. Planned Project Overall

The residual adverse environmental effects of the overall Project on Groundwater Quantity include a reduction in Groundwater Quantity due to withdrawals from mine excavations, the mine shaft and well VMB-60, along with a reduction in the infiltration rate for the duration of the Project. Overall, this may reduce local Groundwater Quantity in the vicinity of the water takings, though in line with the condition of the existing PTTW obtained for advanced exploration activities, and which is anticipated to be extended throughout the Project life, groundwater levels will drop no more than one metre in the chosen monitoring wells. Due to the localized geographical extent of effects on Groundwater Quantity during this phase, no adverse residual effects on other domestic groundwater users or ecological functions are anticipated as a result of decreases in Groundwater Quantity. The residual adverse environmental effect to Groundwater Quantity is considered to be not significant.

11.3.6. Cumulative Environmental Effects

The Project may result in cumulative environmental effects on Groundwater Quantity, as other projects and activities such as historical mining, Advanced Exploration and permanent and seasonal residential activities could potentially create new demand on Groundwater Quantity, although the potential for new groundwater takings as a result of these activities, within the area where changes in Groundwater Quantity will occur as a result of the Project are anticipated to be low. FNX is committed to responsible development of the Project and has agreed to ensure any permanent interference to groundwater supply that is caused by the groundwater takings will be restored, as a legal requirement of the existing PTTW. Monitoring of groundwater wells and key surface water locations will provide an early indication of permanent effects on Groundwater Quantity, providing an opportunity to utilize mitigation measures. Emergency response procedures will provide further details, if additional groundwater is required in response to an emergency. The cumulative environmental effects to Groundwater Quantity are considered to be not significant.

11.3.7. Monitoring and Follow-Up Program

The existing amended PTTW (permit No. 0466-AJ8HRM) from the MOECC outlines the monitoring requirements for the approved groundwater takings and these are anticipated to be similar for a PTTW throughout the life of the Project. In general, monitoring of groundwater levels in wells will be undertaken along with monitoring of water level and velocity at key surface water locations. A PTTW amendment will be needed for Operation activities and all monitoring requirements will be completed as outlined in the amended approval.

Following Decommissioning and Abandonment, groundwater monitoring will take place semi-annually for three years with reports being submitted to the Ministry of Northern Development and Mines, to determine if further monitoring or other actions are required (KGHM International, 2013).

There is a high degree of confidence associated with determining potential effects to Groundwater Quantity, and with determining that there are no significant adverse environmental effects. FNX has developed comprehensive management plans and procedures to mitigate any potential adverse environmental effects. As a result, a follow-up program is not required for the Groundwater Quantity VC.

11.4. References and Appendices

- Golder Associates. 2011. Victoria Project Factual Report of Geotechnical Study Shaft Pilot Hole (FNX1204). Report Number 10-1193-0018. July 5, 2011(cited in WESA, 2012b).
- KGHM International. 2015. Victoria Stage Gate 4 Report for Full Project Funding Request. 914pp.
- KGHM International. September 2013. Advanced Exploration Closure Plan.
- Hatch Ltd., 2014. Site Wide Water Balance Report. Prepared for KGHM International Victoria Project.
- Hatch Ltd., 2014b. Raw Water Supply Demand Design Basis. Prepared for KGHM International Victoria Project.
- Knight Piésold. 2011. Memorandum for Una McCullagh to Dan Laing Re: Updated Phase 1 Water Balance for the Victoria Mine Project. File No. NB101-451/1-A.01. December 22, 2011. (Cited in WESA, 2012b).
- MOECC. February 21, 2012. Permit to Take Water Groundwater. 9 pp.
- Richards, P.A. 2002. Hydrogeology of the Sudbury Area; in The Physical Environment of the City of Greater Sudbury, Ontario Geological Survey, Special Volume 6. (Cited in WESA, 2012).

- WESA Inc. 2012a. Victoria Advanced Exploration Project, Hydrogeological Study. Prepared for FNX Mining Company Inc. File No. SB8813. April 2012.
- WESA Inc. 2012b. Detailed Hydrogeological Study to Support a Permit to Take Water Application for FX's Victoria Advanced Exploration Project. Prepared for FNX Mining Company Inc. File No. S-B8813. February 2012.
- WESA Inc. 2013. Victoria Advanced Exploration Project 2012 Annual Groundwater Monitoring Report. Prepared for KGHM International Ltd. FNX Mining Company Inc.

Table of Contents – Chapter 12

12. Fish and Fish Habitat 214

12.1. Existing Conditions 214
12.1.1. Ecological Boundaries 215
12.1.2. Administrative Boundaries 218
12.1.3. Technical Boundaries 219
12.1.4. Fish Community 219
12.1.5. Benthic Invertebrates 223
12.1.6. Likely Future Conditions 224
12.2. Environmental Effects Analysis 225
12.2.1. Construction 225
12.2.2. Operations 231
12.2.3. Decommissioning and Abandonment 235
12.2.4. Environmental Design, Mitigation and Optimization 238
12.3. Residual Environmental Effects 239
12.3.1. Construction 242
12.3.2. Operations 242
12.3.3. Decommissioning and Abandonment 243
12.3.4. Accidents, Malfunctions and Unplanned Events 243
12.3.5. Planned Project Overall 244
12.3.6. Cumulative Environmental Effects 244
12.3.7. Monitoring and Follow-Up Program 244
12.4. References and Appendices 245

12. Fish and Fish Habitat

Fish and Fish Habitat were selected as a VC since in general, Fish and Fish Habitat are valued by the public and Indigenous communities including Atikameksheng Anishnawbek First Nation, Sagamok First Nation and the Métis Nation of Ontario. Fish and Fish Habitat may be directly affected by construction of the Ethel Lake Control structure, taking of water from Ethel Lake and discharge of mine effluent from the Project to local watercourses.

12.1. Existing Conditions

The Victoria Property is bisected by two major watersheds; the Vermilion River watershed to the east and the Spanish River watershed to the west. The Fairbank Creek watershed, which includes Ethel Lake, is located immediately east of the site, with Fairbank Creek flowing southward and eastward into the Vermilion River. To the northwest are wetland complexes that flow south into an unnamed wetland and stream that drains southwest to Victoria Creek and ultimately to the Spanish River. The pre-development surface drainage patterns and surrounding watercourses are shown on Figure 12-1.

Surface water quality in the area has been monitored as part of baseline studies for the Project since 2002, with results typically showing some exceedances of Provincial Water Quality Objectives (PWQO) at some monitoring stations in both the Fairbank Creek and Victoria Creek watersheds, for parameters including copper, cadmium, cobalt, iron and selenium. Surface Water Quality is discussed further in Chapter 10 – Surface Water Quality.

Approximately 66% of the Project site lies within the Spanish River watershed, which is approximately 150 hectares in size upstream from the Project. The main feature of this watershed is a large beaver impoundment immediately adjacent to the western boundary of the Project site. Approximately 72% of the watershed area is situated north of the beaver impoundment and water flows southward from this area via a small unnamed stream and wetland complex before reporting to the beaver impoundment. About 28% of the watershed area is south of the impoundment and water is collected here via a series of small ponds and semi-connected streams which eventually flow northward into the impoundment. Water from this impoundment flows through a series of wetland complexes that drains southwest to Victoria Creek and the Spanish River. The Spanish River is located approximately 11 kilometres downstream from the Project site.

The remainder of the Project site (approximately 34%) is in the Fairbank Creek watershed, which is approximately 5,000 hectares in surface area upstream from the Project site and includes Fairbank Lake. From Fairbank Lake, Fairbank Creek flows approximately six kilometres before draining into Ethel Lake. The outflow from Ethel Lake flows south for approximately five kilometres, before turning east to flow for an

additional seven kilometres before draining into the Vermillion River in the Town of Whitefish. The proposed discharge location for treated mine effluent is on Fairbank Creek, approximately 250 metres downstream from the Ethel Lake outflow.

Baseline fish and fish habitat studies have been conducted in both watersheds (see sampling locations on Figure 12-1) and both have been identified as containing fish that could be part of, or support, commercial, recreational or Indigenous fisheries, although Ethel Lake and Fairbank Creek have not been identified as being used for these purposes. Northern Pike (*Esox Lucius*) are the top predator and one of two sportfish species found in the environmental assessment area within the Fairbank Creek watershed and this species will be the primary focus of this assessment. Smallmouth Bass (*Micropterus dolomieu*), the other sportfish species captured in the environmental assessment area, are present in Fairbank Creek upstream and downstream from Ethel Lake, but not within the lake itself. The remainder of fish community in the portion of the Fairbank Creek watershed within the study consists of a variety of coarse fish (e.g. White Sucker (*Catostomus commersonii*) and Silver Redhorse (*Moxostoma anisurum*)) and baitfish, predominantly cyprinids (minnow species). Watercourses that have been sampled in the Victoria Creek watershed within the environmental assessment area were found to only contain a variety of baitfish species with no large-bodied fish present.

The environmental assessment area has historically been used for other mining activities, as well as other land uses such as public road construction and use, public infrastructure (transmission lines, former railway line) and recreational use (snowmobiling, hunting, and fishing). These other land uses and activities have influenced the current conditions related to Fish and Fish Habitat. Influences include direct and indirect effects on fish habitat, installation of obstructions to fish movement and alterations to local water and sediment quality. Obstructions to fish movement within the environmental assessment area consist of beaver dams and man-made barriers (i.e. the former railbed at the inflow of Fairbank Creek to Ethel Lake, a remnant concrete weir structure approximately 125 metres downstream from the outlet of Ethel Lake), present at various locations throughout every watershed sampled, resulting in alternating flooding and drainage patterns and allowing only intermittent fish passage, especially for small bodied fish species at many locations.

12.1.1. Ecological Boundaries

The spatial boundaries for Fish and Fish Habitat include portions of the Fairbank Creek and Victoria Creek watersheds upstream, within and downstream from the Victoria Property (see Figure 12-1). This boundary was selected because effects to Fish and Fish Habitat could potentially extend downstream in these watercourses to the Vermillion and Spanish Rivers. The spatial boundary includes a 100 metre setback from the main channel of Fairbank Creek and Victoria Creek to account for any potential backwater effects on tributaries of these watercourses. The boundary contains all baseline biological monitoring stations, which includes both monitoring stations that may be used

to assess potential effects of the Project, as well as upstream reference stations. In addition, this spatial boundary includes all important habitat areas (e.g., spawning, nursery) for Northern Pike within and downstream from Ethel Lake, as this species is considered the primary species of interest for this assessment, given the potential for effects associated with the Ethel Lake Control structure and water taking and its status as a top predator and sportfish potentially being part of an Indigenous or recreational fishery.

The temporal boundary covers the period between 2024 and 2050 for the Fish and Fish Habitat effects assessment.

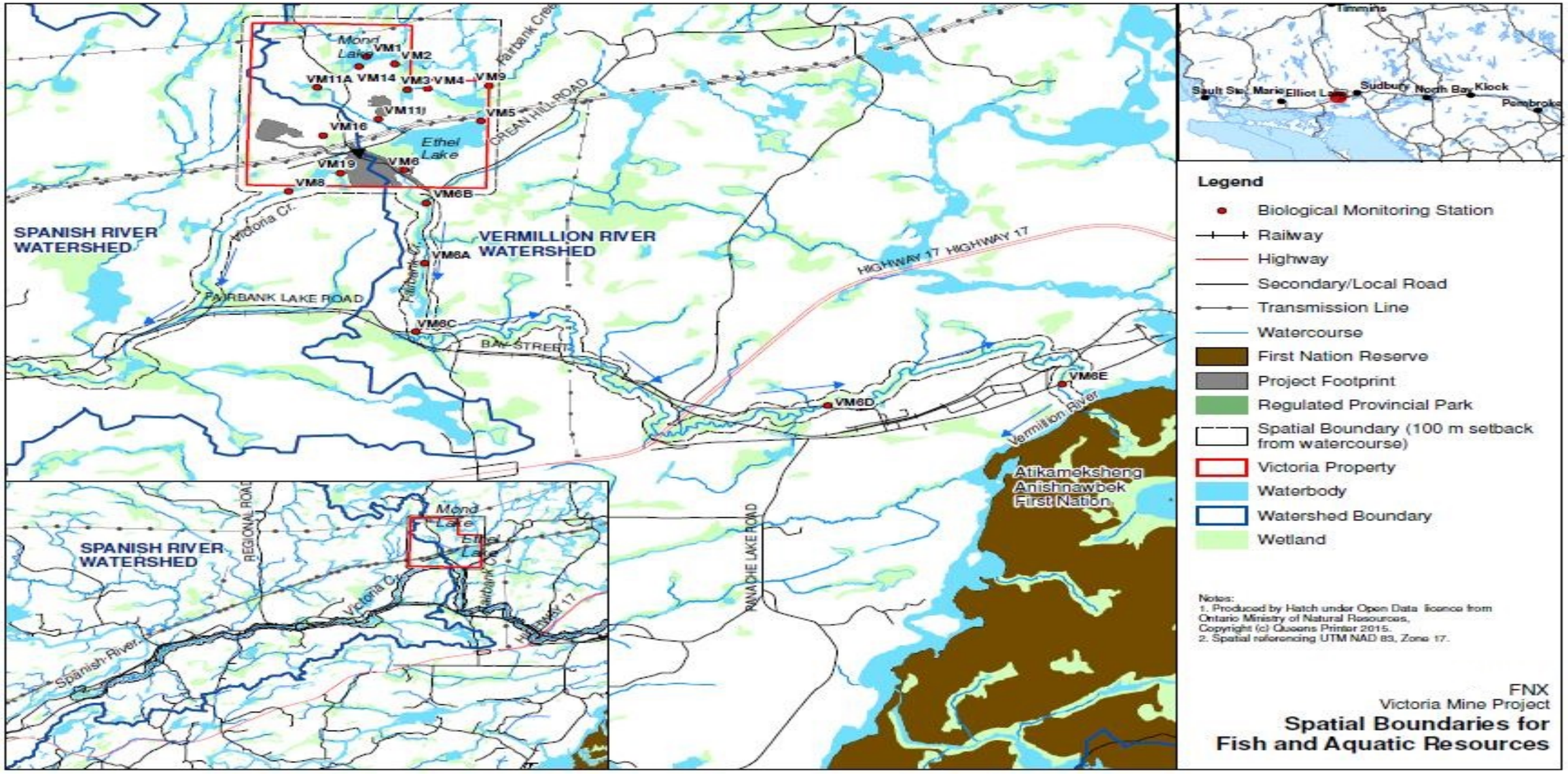

Figure 12-1: Spatial Boundaries for Fish and Aquatic Resources

The temporal boundary covers the period between 2024 and 2050 for the Fish and Fish Habitat effects assessment.

12.1.2. Administrative Boundaries

Fish and Fish Habitat primarily fall under the jurisdiction of Fisheries and Oceans Canada (DFO) under the federal *Fisheries Act* (*R.S.C, 1985*, c. F-14). This Act prohibits activities that cause Serious Harm to fish in waterbodies that are part of, or support, commercial, recreational or Indigenous fisheries. As defined in the *Fisheries Act*, Serious Harm to fish includes:

- "the death of fish or any permanent alteration to, or destruction of fish habits";
- The Department of Fisheries and Oceans interprets Serious Harm as (from http://www.dfo-mpo.gc.ca/pnw-ppe/pol/index-eng.html#ch82):"the death of fish;
- the permanent alteration of fish habitat of a spatial scale, duration or intensity that limits or diminishes the ability of fish to use such habitats as spawning grounds, or as nursery, rearing, or food supply areas, or as a migration corridor, or any other area in order to carry out one or more of their life processes; and
- The destruction of fish habitat of a spatial scale, duration or intensity that fish can no longer rely upon such habitats for use as spawning grounds, or as nursery, rearing, or food supply areas, or as a migration corridor, or any other area in order to carry out one or more of their life processes".

Where a project is deemed likely to cause Serious Harm, DFO may elect to Authorize Serious Harm, depending on a variety of factors including whether the Serious Harm can be offset or compensated through other actions and activities.

The Metal Mining Effluent Regulations (*MMER*) under the *Fisheries Act* also provide an administrative boundary as they impose limits on effluents discharged from metal mines into fish habitats. The *MMER* requires 'mines' to carry out Environmental Effects Monitoring (EEM) programs to quantify the effects of final treated effluents on fish and fish habitat (benthos).

Provincially, the Ontario Ministry of Natural Resources and Forestry (MNRF) has jurisdiction over fisheries management. With respect to the Project, MNRF may utilize the authority provided under the *Lakes and Rivers Improvement Act* (*LRIA*) (*R.S.O*., 1990, c. L.3) and the *Fish and Wildlife Conservation Act* (*FWCA*) (*S.O. 1997*, c.41) to impose administrative boundaries on the Project. Under the *LRIA*, the MNRF has authority to regulate construction of dams (e.g. Ethel Lake Control structure) to ensure that effects on fish and other natural amenities are adequately considered and mitigated. Under the *FWCA*, the MNRF has the authority to issue a License for the collection of fish for scientific purposes, which is an administrative tool typically used to permit fish salvage operations, as well as scientific studies.

12.1.3. Technical Boundaries

This assessment of Fish and Fish Habitat has been based, in part, on several technical studies that have assisted in identifying potential adverse effects. Based on the use of models in these studies (e.g. hydrological modeling and assimilative capacity modeling) and extrapolation of existing data sets (e.g. site-wide hydrology, rainfall-runoff predictions), each of these studies have their own technical limitations regarding the accuracy of the information presented therein. These studies include the following:

- Ethel Lake Hydrology Report (Hatch Ltd., 2015a);
- Fairbank Creek Assimilative Capacity Study (Klohn Crippen Berger, 2013);
- Site Wide Water Balance Report (Hatch Ltd., 2015b); and
- Surface Water Study Update (Kilgour & Associates Ltd. and Ecosystem Recover, 2017).

In addition, the assessment here is based on the results of the Fish and Fish Habitat baseline studies that have been completed. Although the studies have been conducted at a number of locations, over a number of years, they do have some technical limitations as they present the fish community as found in specific times. Common metrics used to describe the fish community at a particular sampling location, such as catch per unit effort and species richness, vary temporally (daily, seasonally, annually) as fish move around in response to natural changes in environmental variables (flow, hydraulics, temperature, light). In addition, fish community composition also varies spatially, while not all sections of each watercourse were sampled (which is a commonly accepted limitation of fisheries study programs). There is, therefore, the potential that some variations in community composition were not represented in the baseline studies. However, samples of the fish community were collected from areas deemed representative of the most sensitive and/or dominant habitats, at times which were deemed representative.

An additional technical boundary is the delineation of the inundation area around Ethel Lake as a result of the proposed Ethel Lake control structure.

12.1.4. Fish Community

A total of 24 fish species have been captured within the environmental assessment area, as summarized in Table 12-1 by watercourse reach. Raw data and data summaries of all baseline fish community studies are provided in the respective baseline study reports (ASI, 2004; AMEC, 2009; EAG, 2012; Kilgour & Associates Ltd. and Denison Environmental, 2014). All 24 species have been captured in the Vermillion River watershed portion of the environmental assessment area (15 biological monitoring stations in the Fairbank Creek watershed), while seven species have been captured in the portion of the Spanish River watershed within the environmental assessment area (three biological monitoring stations in the Victoria Creek watershed). Biological monitoring station locations are

shown on Figure 12-1. The Fairbank Creek watershed had a higher number of biological monitoring stations than Victoria Creek, since it will receive mine effluent from the waste water treatment plant.

The fish community in the Fairbank Creek watershed consists predominantly of warm- and cool-water small bodied species. Northern Pike have been captured within and downstream from Ethel Lake and are the principal game fish documented from the study area. Smallmouth Bass (*Micropterus dolomieu*) were captured upstream and downstream from Ethel Lake, but in lesser numbers and frequency. Both of these species could be considered as part of an Indigenous or recreational fishery, since the potential exists for fishing to occur throughout the Fairbank Creek watershed. The highest species richness in any one general sampling location (11 species) was found in Fairbank Creek downstream from Ethel Lake. Iowa Darter (*Etheostoma exile*), Logperch (*Percina caprodes*), White Sucker (*Catostomus commersonii*), Pumpkinseed (*Lepomis gibbosus*) and Rock Bass (*Ambloplites rupestris*) were the most widely distributed species in the Fairbank Creek watershed. These, and other baitfish species captured in Fairbank Creek and Victoria Creek watersheds could be considered part of a commercial fishery, since they could potentially be harvested by commercially licensed bait fisherman. These species are also forage, supporting the game species.

The fish community in the Victoria Creek watershed consists of warm and cool-water small bodied species. As in Fairbank Creek, Northern Pike are known to occur in Victoria Creek, though more likely closer to the Spanish River. Victoria Creek also contains Yellow Perch and Brown Bullhead, and other minor game species. A total of six species have been captured within Victoria Creek itself and three species have been captured in a tributary of Victoria Creek.

The methodology used to assess fish communities is provided in Appendix F.

Table 12-1: Fish Species Present at Sampling Locations in the Environmental Assessment Area

	Vermillion River Watershed						Spanish River Watershed	
Sampling Location	**Fairbanks Creek Upstream from Ethel Lake**	**Ethel Lake and Tributary**		**Fairbank Creek Downstream from Ethel Lake**		**Mond Lake and Other Upstream Reference Areas**	**Victoria Creek**	**Tributary of Victoria Creek**
Monitoring Stations (see Figure 12-1)	**VM9**	**VM5**	**VM11 VM11A**	**VM6 VM6A VM6B**	**VM6C VM6D VM6E**	**VM1 VM2 VM3 VM4 VM14**	**VM8 VM19**	**VM16**
Species								
Brown Bullhead					X			
Blacknose Shiner	X							
Bluntnose Minnow	X			X	X		X	
Brassy Minnow			X			X	X	
Common Shiner	X		X	X		X		
Creek Chub	X			X	X		X	
Fallfish					X			
Fathead Minnow	X	X	X	X		X		X
Golden Shiner		X	X			X		
Northern Redbelly Dace			X			X	X	X
Finescale Dace			X			X	X	
Central Mudminnow					X			
Iowa Darter	X	X	X	X	X	X		
Johnny Darter				X		X		
Logperch	X	X		X	X			
Longnose Dace	X			X				
Yellow Perch				X	X			
Northern Pike		X			X			

	Vermillion River Watershed						Spanish River Watershed	
Sampling Location	**Fairbanks Creek Upstream from Ethel Lake**	**Ethel Lake and Tributary**		**Fairbank Creek Downstream from Ethel Lake**		**Mond Lake and Other Upstream Reference Areas**	**Victoria Creek**	**Tributary of Victoria Creek**
Monitoring Stations (see Figure 12-1)	**VM9**	**VM5**	**VM11 VM11A**	**VM6 VM6A VM6B**	**VM6C VM6D VM6E**	**VM1 VM2 VM3 VM4 VM14**	**VM8 VM19**	**VM16**
Brook Stickleback			X			X	X	X
Silver Redhorse		X						
White Sucker	X	X		X	X			
Pumpkinseed	X	X		X	X	X		
Rock Bass	X	X		X	X			
Smallmouth Bass	X			X				
Species Richness	**11**	**9**	**8**	**13**	**12**	**10**	**6**	**3**

Fish community survey results from 2013 indicated a typical and reasonably diverse small bodied fish community at many of the areas surveyed, albeit with relatively low densities for most species present (Kilgour and Denison, 2014). The areas of Fairbank Creek with the highest species diversity and density tended to be reference areas upstream of Ethel Lake and mining operations. However, multiple barriers to full fish passage are present throughout the environmental assessment area including a concrete channel in the culvert at Fairbank Road, and various beaver dams upstream of Ethel Lake. Those various barriers may at times result in restricted movements of fish, and may cause variability in the composition of the fish community that are coincident with the location of the mine operations.

The last fish survey was in 2016, and which included assessment of two sentinel species to evaluate the influences releases of treated effluent being released by the exploration activities (Kilgour & Associates Ltd., 2017). Species collected in reference and exposure areas were similar to what had been caught in prior surveys in both reference and exposure areas. The catches of Pumpkinseed and Rock Bass in October 2016 from VM9 and VM6 were adequate for their use as sentinel species. There was no significant difference in survival (length-frequency distributions and age-class distributions), energy use (body weight at age and total length-at age) or energy storage (condition) for Pumpkinseed from the Exposure Area than from the Reference Area. There was a significant difference in survival of Rock Bass between the Exposure and Reference Area, with 5+ year-old fish being present in the Reference Area but not the Exposure Area. There was, however, no significant difference in energy use or energy storage of Rock Bass between reference and exposure areas.

12.1.5. Benthic Invertebrates

The results of the most recent site-wide benthic invertebrate survey (EAG, 2012) indicate healthy invertebrate communities at most biological monitoring locations (see Figure 12-1), with high abundance and diversity at some locations. The stations reporting the greatest family richness, Simpson's diversity, and *Ephemeroptera*, *Plecoptera* and T*richoptera* (EPT) taxa are VM6 and VM9, located on Fairbank Creek downstream and upstream from Ethel Lake respectively. The benthic communities at these locations are comprised of a diverse set of families, including groups of pollution-sensitive invertebrates (EPT taxa), and reflect the high-quality habitat at these locations.

The area with the lowest taxonomic richness and diversity was VM11 (on a tributary of Ethel Lake), with an average of 7.4 families, a Simpson's diversity index of 0.42 (the lowest among stations sampled in this study), the near-complete absence of EPT taxa, and a Bray-Curtis distance of 0.79 (the highest in this study) indicating that the benthic community at this location is very different from the corresponding upstream reference site, VM11A. The lower diversity may reflect the habitat and substrate at this location: VM11 is located at a series of beaver impoundments in the creek draining the former town site, and the substrate at VM11 is comprised of greater silt and less sand than

other stations. Concentrations of some chemical parameters in sediment at this location are also elevated above sediment quality guidelines, but not substantially more so than other locations in this area (EAG, 2012). At most monitoring stations, no substantial change from 2007 (AMEC, 2009) to 2010 (EAG, 2012) in taxa richness, diversity, evenness, or family composition (e.g., % EPT) was apparent. Modest increases and decreases in the various indices between 2007 and 2010 were evident, but few meaningful differences were apparent. The largest differences between 2007 and 2010 data were observed at stations VM5 (Ethel Lake) and VM11 (Tributary of Ethel Lake). Family richness at VM5 decreased by 41% from an average of 15 families in 2007 to 8.8 families in 2010. At the same time however, Simpson's diversity index and evenness at VM5 increased slightly, suggesting that diversity remained relatively good. At station VM11, a slight improvement was observed in 2010 data, with increases in mean family richness from 4.4 to 7.4 families, and a slight increase in Simpson's diversity. However, this location remains dominated by oligochaetes and chironomid larvae, and EPT taxa are almost completely absent.

Benthic communities were collected in October of 2013 and again in 2016 using a Surber sampler, (see Kilgour and Denison, 2014; Kilgour & Associates Ltd., 2017). The data collected in the 2016 survey program provide evidence that benthic communities downstream of the Victoria effluent discharge were generally like the upstream Reference Areas. Benthic communities in the Exposure Area were comprised of 33 different families, and were dominated numerically by *Chironomidae* and *Sphaeriidae*. Benthos at the Exposure Area contained a variety of sensitive taxa such as Mayflies, Caddisflies and Stoneflies (i.e. EPT taxa). Various indices of composition, including abundance, family richness, evenness, diversity and multivariate 'scores' were not significantly different between Areas in 2016. Benthos in the Exposure Area produced different multivariate 'scores', reflecting higher relative abundance of *Ephemerelidae* at a second reference area (R2) and higher relative abundances of *Plagiostomatidae* and *Planariidae* in Fairbank Creek at VM6 (i.e., downstream of Fairbank Road and the point of release of final treated effluent).

The methodology used to assess benthic invertebrates is provided in Appendix F.

12.1.6. Likely Future Conditions

Likely future conditions with respect to Fish and Fish Habitat, should the Project not proceed to implementation, would be anticipated to be generally similar to existing conditions, as there is no other known proposed development within the area that would be anticipated to have adverse effects on Fish and Fish Habitat. Therefore, Fish and Fish Habitat would continue to be influenced by existing natural and social factors (e.g. hydrology, climate, sport fishing pressure), none of which are expected to change significantly over the life of the Project.

12.2. Environmental Effects Analysis

The following sections discuss the potential environmental effects of the proposed project on Fish and Fish Habitat. The sections are organized by Project phase (i.e. Construction, Operations, Decommissioning and Abandonment). Adverse effects related to accidents, malfunctions and unplanned events are also assessed.

Effects on Fish and Fish Habitat have the potential to result from:

- In-water construction (during Construction, Decommissioning and Abandonment as a result of installation and removal of the Ethel Lake Control structure and water intake line);
- Presence of the Ethel Lake Control structure and associated inundation around Ethel Lake (initially occurring during Construction with effects extending through Operations until Decommissioning and Abandonment when the control structure will be removed);
- Water intake from Ethel Lake (400-millimetre diameter pipe with maximum intake capacity of 0.019 m^3/s) adjacent to Ethel Lake Control structure location (Operations);
- Management of potentially contaminated water, including mine effluent and stormwater runoff (all Project phases); and
- Accidents, Malfunctions and Unplanned Events such as accidental spills, cofferdam failure or outflow of untreated mine effluent (all Project phases).

12.2.1. Construction

In-water construction will be required during installation of the Ethel Lake Control structure and water intake line. It is anticipated that the Ethel Lake Control structure will be constructed within dewatered work areas isolated by upstream and downstream cofferdams, with temporary diversions around the isolated work areas to maintain downstream flows. This could result in a number of potential adverse environmental effects on Fish and Fish Habitat, including;

Loss of Fish Habitat and Effects on Fish Community Productivity:

- There will be temporary loss of habitat within a dewatered work area and blockage of normal movements of aquatic organisms through the work area. Construction of the Ethel Lake Control structure construction and water intake line is anticipated to take approximately two to three months. Construction of the control structure will require dewatering an area of 48 m^2, with installation of a coffer dam. . Fish will be 'moved' (under Permit from the Ontario Ministry of Natural Resources and Forestry) from the area that will be dewatered, such that the dewatering will not result in the death of fish. The coffer dam will be in place for a period of one to two months. The coffer dam will temporarily impede normal fish movements up into the lake from lower Fairbank Creek, and from the lake down into lower Fairbank Creek;

- Installation of the Ethel Lake Control structure during the Construction phase will result in the permanent loss of 48 m^2 of aquatic habitat in Fairbank Creek at the outflow from Ethel Lake, over the duration of the Operations phase. The control structure will be decommissioned when the mine closes, and as such will be a temporary installation and have a temporary impact on fish habitat;
- The Ethel Lake Control structure will raise the water level of Ethel Lake during the spring by approximately 0.5 metres, increasing submerged shallow aquatic habitats by approximately 2.1 hectares, and increasing the potential spawning habitat of Northern Pike from 0.5 hectares to about 1.7 hectares (Kilgour and Ecosystem Recovery, 2017); and
- Inundation of existing wetland and terrestrial area around the Ethel Lake shoreline due to construction of the control structure is anticipated to result in an increase in the mercury content in Northern Pike (the top predator) (Hatch, 2016). The baseline average tissue concentration for Northern Pike was 0.25 µg/g for a 55 cm fish. Mercury biomagnification models predict baseline tissue concentrations of between 0.45 and 0.61µg/g (for a 55 cm fish). Biomagnification models also predict a post-inundation tissue concentration in pike of between 0.7 to 0.8 µg/g (for a 55 cm fish), or roughly a doubling of the mercury concentration in pike flesh, based on a flooding of 2.5 hectares of terrestrial habitats. These changes in mercury concentrations are expected to occur over a period of about 10 to 15 years, with concentrations in fish flesh returning to normal baseline levels within about 30 years post inundation. The increase in fish flesh mercury concentrations pose no risks to fish health, but raise the risk levels to persons that would be consuming fish from Ethel Lake such that the recommended daily intake of fish would be potentially reduced from 16 meals per week to four meals per week for the general population, while daily intake for women of child-bearing age would be potentially reduced from four meals per week to none. Those changes in consumption are based on a biomagnification model that is considered to be highly conservative, overestimating risks of mercury biomagnification.

Physical Disturbance:

- Benthic invertebrates within the footprint of cofferdams and in the dewatered work area and disturbance of fish during fish salvage operations will be impacted. It is anticipated that fish mortality will be prevented during salvage.

Fish Passage Obstruction:

- The Ethel Lake Control structure will obstruct fish movement upstream from Fairbank Creek into Ethel Lake. Existing fish movement from Fairbank Creek upstream and into Ethel Lake is currently already limited by the presence of a remnant concrete control structure in Fairbank Creek at Fairbank Road, approximately 125 metres downstream from the proposed control structure location. Obstruction to upstream fish movement from Fairbank Creek into Ethel

Lake may prevent some individual fish from moving into Ethel Lake to utilize important habitat for spawning, feeding, rearing or overwintering, so this is considered to cause serious harm to fish, albeit to a relatively low population and limited spatial distribution of fish between the proposed control structure location and remnant concrete dam downstream.

Degraded Surface Water Quality:

- During Project Construction, surface water runoff due to precipitation and snow melt will occur within the mine site, including areas where runoff could potentially come in contact with reactive rock or other Project features that could cause contamination ("contact water") and areas where surface water would not come into contact with these types of areas, but could come into contact with ground with exposed soils that have been disturbed by Construction activities ("non-contact" water). Runoff water from both types of areas could potentially contain elevated levels of contaminants, such as sediment (e.g., from areas disturbed during Construction) or metals (e.g., from water coming into contact with reactive rock). Discharge of contaminated water to Fairbank Creek or Victoria Creek may have adverse effects on Fish and Fish Habitat. Potentially contaminated water could result in adverse effects to the health of Fish and Fish Habitat, and under a worst-case scenario, could potentially result in mortality. If mortality of fish were to occur, this would be considered serious harm to fish, per the *Fisheries Act* definition. Changes to Fish Habitat (e.g. due to sediment release) could also potentially result in serious harm to fish if they resulted in adverse effects on the ability of fish to use these areas to complete important life cycle requirements. Mitigation will be implemented to address these potential effects, as will be discussed in Section 12.2.4 – Environmental Design, Mitigation and Optimization. All contact water will be collected and either re-used for Construction purposes or treated in the waste water treatment plant prior to discharge to Fairbank Creek. All non-contact water will be collected in mine water pond, which will promote settling of suspended solids prior to discharge to Fairbank Creek.

Accidents, Malfunctions and Unplanned Events:

- During Construction, Accidents, Malfunctions or Unplanned Events (e.g., cofferdam failure, accidental spills of potentially contaminating materials such as oil or fuel, accidental releases of contaminated water without proper treatment) could potentially occur. Erosion and sedimentation of soils into surface waters containing Fish and Fish Habitat is also possible due to failure of sediment and erosion controls. These events could potentially result in mortality or adverse effects to the health of fish and other aquatic biota, with associated changes in productivity and indirect effects on local ecology. Sedimentation in watercourses could also result in changes to fish habitat (i.e. infilling of interstitial spaces in rocky substrate) and associated adverse effects on habitat utilization by fish. Displacement of fish and other aquatic resources as a result of changes in habitat conditions could potentially result in

decreased overall productivity due to density dependant effects or reduction in habitat availability for critical habitat functions. If mortality of fish were to occur, it would constitute serious harm. Further, if an Accident, Malfunction or Unplanned Event resulted in the destruction or permanent alteration of fish habitat such that fish could no longer rely on that habitat to provide important habitat functions, this could constitute serious harm to fish, per the *Fisheries Act* definition.

Table 12-2: Environmental Effects Analysis; VC - Fish and Fish Habitat; Project Phase – Construction

Project Components or Activities	Potential Environmental Effects (A = adverse; B = beneficial)	Engineering Design, Mitigation Measures and Proven Environmental Management Practices	Factors Considered in the Environmental Effects Analysis*							
			Magnitude	Geographic Extent	Timing	Frequency	Duration	Reversibility	Ecological & Socio-economic Context	Certainty of Knowledge
Planned Activities										
Construction of Ethel Lake Control structure, pumphouse and water intake line	(A) Effect on Fish and Fish Habitat due to temporary loss of habitat within footprint of cofferdams and dewatered Construction area. Effects on Fish during dewatering.	In-water Construction will adhere to DFO timing windows. Flow will be diverted around work area to maintain downstream flows. Fish protection measures installed around pump intake during dewatering behind cofferdam. Fish salvage will occur within area to be dewatered.	1	1	1	1	3	1	2	1
	(A) Effects on Fish and Fish Habitat due to loss of 48 m^2 of aquatic habitat in footprint of control structure. Blockage of movement of fish passage from Fairbank Creek into Ethel Lake, or of fish from Ethel Lake downstream into Fairbank Creek.	DFO (2017) has determined that the Project is of no Serious Harm so long as construction mitigations are used.	3	2	N/A	4	5	2	2	2
	(A) Effects on the usability of fish tissues. The construction of the Ethel Lake control structure will raise water levels in Ethel Lake approximately 0.5 metres, resulting in the flooding of about 2.5 hectares of terrestrial environment. The flooded land may result in the production of methyl mercury, which is anticipated to biomagnify in the aquatic food web of Ethel Lake. Tissue concentrations of mercury in the top predator, Northern Pike, may increase twofold. Consumers of Northern Pike would potentially need to reduce their average consumption rate from 16 to 4 meals per week (general population) or from 4 to 0 meals per week (women of child bearing age). Mercury concentrations in tissues of Northern Pike are anticipated to peak three to 13 years post flooding, and to return to normal baseline levels within 30 years.	Weir will be designed and constructed to minimize the increase in water level of Ethel Lake. Mercury in fish flesh will be monitored to determine actual levels in fish, and advisories to fishers/anglers posted as warranted or required.	2	2	N/A	5	2	1	1	1
	(B) Effects on Fish and Fish Habitat related to an increase in wetted area of Ethel Lake generally (approximately 2 hectares), and an increase in potential spawning habitat for Northern Pike and other species by about 1.2 hectares.	Weir will be designed and constructed to minimize the increase in water level of Ethel Lake.	2	2	N/A	5	2	1	1	1
Management of contaminated water	(A) Effects to health of Fish and Fish Habitat as a result of changes in surface water quality of local watercourses due to runoff/discharge of contaminated water during Construction.	Contaminated water will be collected and treated to meet provincial and federal requirements and either returned to the process or discharged in accordance with permit requirements.	2	3	N/A	3	4	1	2	1
Accidents, Malfunctions and Unplanned Events										
Spills of potentially contaminating materials	(A) Effects to health of Fish and Fish Habitat as a result of surface water contamination.	Implement spills management and emergency response procedures.	2	3	N/A	1	4	2	2	1
Erosion and sedimentation into watercourses	(A) Effects to Fish health and habitat utilization as a result of increased turbidity or sedimentation of existing habitat.	Implementation sediment and erosion control best management practices.	2	3	N/A	1	4	2	2	1

Project Components or Activities	Potential Environmental Effects (A = adverse; B = beneficial)				Engineering Design, Mitigation Measures and Proven Environmental Management Practices			Factors Considered in the Environmental Effects Analysis*							
								Magnitude	Geographic Extent	Timing	Frequency	Duration	Reversibility	Ecological & Socio-economic Context	Certainty of Knowledge
Key: Magnitude: * 0 = Essentially no interaction 1 = Low, changes within regulated limits 2 = Moderate, changes near regulated limits 3 = High, changes exceed regulatory limits 4 = Unknown (see definitions in text, EA methods)	Geographic Extent: * 1 = Immediate work area 2 = Within Project closure plan boundary 3 = Within 5km of Project closure plan boundary 4 = Beyond 5 km of Project closure plan boundary	Frequency: * 1 = Uncommon event, event occurs once or infrequently / periodically 2 = Happens regularly but infrequently (e.g., once or twice per month) 3 = Happens regularly (e.g. daily) 4 = Continuous activity	Duration: * 1 = < 1 month 2 = 1-2 months 3 = 2-6 months 4 = 6-24 months 5 = 2-11 years (life of mine) 6 = > 11 years (Beyond Project)	Reversibility: * 1 = High 2 = Medium 3 = Low 4 = nil 5 = Unknown (see definitions in the text, EA Methods)	Ecological and Socio-economic Context: * 1 = Relatively pristine area not adversely affected by human activity 2 = Evidence of existing adverse effects 3 = High level of existing adverse effects	Timing: * N/A – no sensitive periods or areas exist in baseline conditions 1 – sensitive periods or areas exist in baseline conditions that require adjustments to Project schedule or timing of activities							Certainty of Knowledge:* 1 = High – based on past performance and experience regarding environmental effects or mitigation 2 = Moderate – uncommon potential effect either not well understood or effects require compliance monitoring to modify engineering design or mitigation 3 = Low – potential for the need to follow-up based on results of compliance monitoring to modify engineering design or mitigation

12.2.2. Operations

Entrainment:

Water from Ethel Lake will be used over the life of the Project (Operations) for various site facilities, such as showers and washrooms. Pumping of water from Ethel Lake could potentially result in mortality to fish and other aquatic organisms should they become impinged on the pump screen or entrained into the intake flow. The potential for mortality will exist throughout the life of the Project and if mortality were to occur, this would be considered serious harm to fish, per the *Fisheries Act* definition.

Loss of Fish Habitat Productivity:

Water taking will periodically result in daily drawdown and refill cycles in the Ethel Lake water level of up to a maximum magnitude of one metre (under worst-case operating scenarios), which is within the natural absolute range of water level fluctuation in Ethel Lake, but outside the magnitude of existing daily fluctuation rates. However, the fluctuation magnitude, rate of change and duration of occurrence of high and low water levels will be dependent on a number of factors including site water requirements and natural inflows to Ethel Lake and potential effects will be periodic. This water level fluctuation may result in a number of adverse effects to Fish and Fish Habitat, including:

- Altered habitat utilization within the fluctuation area along the Ethel Lake shoreline, including avoidance of the drawdown area by benthic invertebrates not tolerant of fluctuating water levels and potential stranding of fish or eggs during drawdown cycles; and
- Altered habitat conditions within the fluctuation area, potentially including elimination of aquatic vegetation species not tolerant of fluctuating water levels, and associated changes in Fish habitat utilization and density-dependant effects in residual habitats.

Therefore, given that water level fluctuations could potentially alter important spawning, nursery and foraging habitats, or restrict access of fish to such habitats thereby preventing fish from using them for these purposes, this is considered to be serious harm to fish, per the *Fisheries Act* definition.

Water taking (up to a maximum rate of 0.019 m^3/s) will also result in changes in flow in Fairbank Creek downstream from the Ethel Lake Control Structure, although the amount of water to be taken is typically a very low percentage of overall flow in Fairbank Creek, which has an annual average flow of 0.629 m^3/s, average monthly low flow of 0.291 m^3/s in August and average monthly high flow of 1.614 m^3/s in April (Hatch Ltd., 2015a). Therefore, the maximum water taking rate equates to approximately 3% of the average annual flow in Fairbank Creek and 6.5% of flow during the low monthly flow. Changes in flow are anticipated to be within the natural variability of the Fairbank Creek hydrograph, although actual flow rates in Fairbank Creek during water taking periods will be reduced

compared to flows that would occur in the absence of water taking. Given the increase in the volume of water stored in Ethel Lake behind the control structure, periodic operation of the control structure during some periods may result in downstream flows slightly higher than those which would be occurring during that time period in the absence of the control structure, potentially resulting in an increased amount of aquatic habitat available in Fairbank Creek compared to natural conditions at the time. However, based on the low percentage of decrease in flow in Fairbank Creek during maximum water taking periods, this is not anticipated to result in serious harm to fish, since physical changes in habitat and wetted area are anticipated to be low in magnitude and not cause permanent alteration of aquatic habitat.

Degraded Surface Water Quality:

During Project operations, precipitation and snow melt will cause surface water runoff to come in contact with potentially reactive rock or other disturbed surfaces on the Project site and as a result, this contact runoff water could potentially contain elevated levels of contaminants, such as sediment, that could have adverse effects on Fish and Fish Habitat in receiving waterbodies (Fairbank Creek or Victoria Creek). Non-contact runoff water (i.e. water falling on the Project site that does not have the potential to come into contact with reactive rock or other surfaces that could result in adverse effects on water quality) will also occur on the Project site.

Similarly, groundwater taking will occur to supply water to the mine site and groundwater will have to be pumped from the mine shaft, resulting in potential decreases in Groundwater Quantity in the vicinity of the Project. This could also potentially result in adverse effects to Fish and Fish Habitat if the change in Groundwater Quantity resulted in a decrease in groundwater discharge to local watercourses and associated decreases in availability of aquatic habitat for use by the fish community. Potential effects of this activity are considered further in Chapter 11 – Groundwater Quantity. Further, pumping of groundwater from the mine shaft to the surface will provide an additional source of mine effluent to Fairbank Creek, with potential effects on Fish and Fish Habitat occurring if the quality of effluent exceeded respective criteria to prevent effects on aquatic biota.

Non-contact stormwater runoff (i.e. surface water runoff that has not come into contact with reactive rock or other site features) will be collected in the mine water pond to settle suspended solids prior to discharge to the environment.

All surface runoff that may have come in contact with reactive rock or other potentially contaminating features of the Project, as well as all groundwater pumped from the mine shaft to the surface will be collected and either re-used for internal process water or treated for a suite of metals, total suspended solids and pH (as specified in the Environmental Compliance Approval) prior to discharge to Fairbank Creek at a location downstream from the Fairbanks Road East crossing of Fairbank Creek. Degraded surface

water quality could result in adverse effects to the fitness of Fish and Fish Habitat, and under a worst-case scenario, could potentially result in mortality. If mortality were to occur, it would constitute serious harm to fish, per the *Fisheries Act* definition.

Accidents, Malfunctions and Unplanned Events:

During Operations, Accidents, Malfunctions or Unplanned Events (e.g., accidental spills of potentially contaminating materials such as fuel and oil, failure of the waste rock storage area containment, accidental discharge of potentially contaminated water from the mine site without appropriate treatment) that result in spills of potentially contaminating material (e.g. fuel, oil, sediment, contaminated water) or erosion and sedimentation of soils into surface waters containing Fish and Fish Habitat could potentially occur. These events could potentially result in mortality or adverse effects to the health of fish and other aquatic biota (e.g. due to toxicological effects of the contaminant), with associated changes in productivity and indirect effects on local ecology. Sedimentation in watercourses could also result in changes to fish habitat (i.e. infilling of interstitial spaces in rocky substrate) and associated adverse effects on habitat utilization by fish. Displacement of fish and other aquatic resources as a result of changes in habitat conditions could potentially result in decreased overall productivity due to density dependent effects or reduction in habitat availability for critical habitat functions. If mortality of fish were to occur, it would constitute serious harm. Further, if an Accident, Malfunction or Unplanned Event resulted in the destruction or permanent alteration of fish habitat such that fish could no longer rely on that habitat to provide important habitat functions, this could constitute serious harm to fish, per the *Fisheries Act* definition.

Table 12-3: Environmental Effects Analysis; VC - Fish and Fish Habitat; Project Phase – Operations

Project Components or Activities	Potential Environmental Effects (A = adverse; B = beneficial)	Engineering Design, Mitigation Measures and Proven Environmental Management Practices	Factors Considered in the Environmental Effects Analysis*							
			Magnitude	Geographic Extent	Timing	Frequency	Duration	Reversibility	Ecological & Socio-economic Context	Certainty of Knowledge
Planned Activities										
Operation of Ethel Lake Control structure and water taking	(A) Fish mortality due to impingement or entrainment in water intake.	The intake will be designed following recognized federal standards to minimize potential for impingement and entrainment of fish.	2	1	N/A	1	5	4	2	1
	(A) Effects on Fish and Fish Habitat associated with Ethel Lake water level fluctuation during water taking.	DFO (2017) has determined that the Project is not of Serious Harm to Fish or Fish Habitat.	3	2	N/A	3	5	2	2	2
	(A) Effects on Fish and Fish Habitat as a result of habitat alterations in Fairbank Creek associated with water taking from Ethel Lake and changes in the flow regime.	Water taking requirements minimized through design of facility recycled water system. Minimum downstream flows maintained in Fairbank Creek at all times. Ethel Lake Control structure designed to ensure operability to maintain downstream flows under range of water levels in Ethel Lake.	2	3	N/A	3	5	2	2	1
Management of contaminated water	(A) Effects to health of Fish and Fish Habitat as a result of changes in surface water quality of local watercourses due to runoff/discharge of contaminated water.	Contaminated water will be collected and treated to meet provincial and federal requirements and either returned to the process or discharged in accordance with permit requirements. Containment and treatment of site runoff and process water will incorporate conventional redundancies to account for anticipated potential equipment failures and climatic events.	2	3	N/A	3	5	1	2	1
Accidents, Malfunctions and Unplanned Events										
Spills of potentially contaminating materials	(A) Effects to health of Fish and Fish Habitat as a result of surface water contamination.	Implement spills management and emergency response procedures.	2	3	N/A	1	4	2	2	1
Erosion and sedimentation into watercourses	(A) Effects to fish health and habitat utilization as a result of increased turbidity or sedimentation of existing habitat.	Implement sediment and erosion control best management practices.	2	3	N/A	1	4	2	2	1

Key:

Magnitude: *
0 = Essentially no interaction
1 = Low, changes within regulated limits
2 = Moderate, changes near regulated limits
3 = High, changes exceed regulatory limits
4 = Unknown (see definitions in text, EA methods)

Geographic Extent: *
1 = Immediate work area
2 = Within Project closure plan boundary
3 = Within 5km of Project closure plan boundary
4 = Beyond 5 km of Project closure plan boundary

Frequency: *
1 = Uncommon event, event occurs once or infrequently / periodically
2 = Happens regularly but infrequently (e.g., once or twice per month)
3 = Happens regularly (e.g. daily)
4 = Continuous activity

Duration: *
1 = < 1 month
2 = 1-2 months
3 = 2-6 months
4 = 6-24 months
5 = 11 years (life of mine)
6 = > 11 years (Beyond Project)

Reversibility: *
1 = High
2 = Medium
3 = Low
4 = nil
5 = Unknown (see definitions in the text, EA Methods)

Ecological and Socio-economic Context: *
1 = Relatively pristine area not adversely affected by human activity
2 = Evidence of existing adverse effects
3 = High level of existing adverse effects

Timing: *
N/A– no sensitive periods or areas exist in baseline conditions
1 – sensitive periods or areas exist in baseline conditions that require adjustments to Project schedule or timing of activities

Certainty of Knowledge:*
1 = High – based on past performance and experience regarding environmental effects or mitigation
2 = Moderate – uncommon potential effect either not well understood or effects require compliance monitoring to modify engineering design or mitigation
3 = Low – potential for the need to follow-up based on results of compliance monitoring to modify engineering design or mitigation

12.2.3. Decommissioning and Abandonment

Loss of Fish Habitat and Effects on Fish Community Productivity:

In-water works will be required to remove the Ethel Lake Control structure and water intake line. It is anticipated that the Ethel Lake Control structure will be removed within dewatered work areas isolated by upstream and downstream cofferdams, with temporary diversions around isolated work areas to maintain downstream flows. This could result in a number of potential adverse environmental effects on Fish and Fish Habitat, including:

- Temporary loss of aquatic habitat for fish and other aquatic resources within the dewatered work area and blockage of normal movements of aquatic organisms past the work area. Ethel Lake Control structure and water intake line removal is anticipated to take one to two months;
- Temporary disturbance of Fish and Fish Habitat during in-water construction associated with cofferdam installation and removal, dewatering activities and water intake line removal. Cofferdam installation and removal activities are anticipated to take less than one week per event; and
- Mortality of benthic invertebrates within the footprint of cofferdams and in the dewatered work area and disturbance of fish during fish salvage operations. It is anticipated that fish mortality will be prevented during salvage, but physiological stress will occur.

Decommissioning and Abandonment of the Ethel Lake Control structure and cessation of consumptive water taking is anticipated to result in a benefit to Fish and Fish Habitat through the re-establishment of a natural flow and water level regime in Ethel Lake and Fairbank Creek. However, some short-term temporary adverse effects on Fish and Fish Habitat may occur until the aquatic habitat stabilizes at the lower water level following control structure removal.

Degraded Surface Water Quality:

Decommissioning and Abandonment of the Project will result in surface water runoff from exposed or disturbed surfaces (including both contact and non-contact areas as previously discussed) and as a result, this runoff water could potentially contain elevated levels of contaminants, such as sediment, that could have adverse effects on Fish and Fish Habitat. Similarly, groundwater will require pumping from the mine shaft to the surface during the early phases of Decommissioning and Abandonment, and this could also potentially result in adverse effects to Fish and Fish Habitat if discharge water is not appropriately treated.

All surface runoff from the disturbed area of the Project will be collected and treated prior to discharge to Fairbank Creek until such time as treatment is no longer required.

Discharge of potentially contaminated water could result in adverse effects to the health of Fish, and under a worst-case scenario, could potentially result in mortality. If mortality of fish were to occur, it would constitute serious harm. Further, if an Accident, Malfunction or Unplanned Event resulted in the destruction or permanent alteration of fish habitat such that fish could no longer rely on that habitat to provide important habitat functions, this could constitute serious harm to fish, per the *Fisheries Act* definition.

During Decommissioning and Abandonment, Accidents, Malfunctions or Unplanned Events (e.g., cofferdam failure, accidental spills of potentially contaminating materials such as oil or fuel, accidental releases of contaminated water without proper treatment) could potentially occur. Erosion and sedimentation of soils into surface waters containing Fish and Fish Habitat is also possible due to failure of sediment and erosion controls. These events could potentially result in mortality or adverse effects to the health of fish and other aquatic resources, with associated changes in productivity and indirect effects on local ecology. Sedimentation in watercourses could also result in changes to fish habitat (i.e. infilling of interstitial spaces in rocky substrate) and associated adverse effects on habitat utilization by fish. Displacement of fish and other aquatic resources as a result of changes in habitat conditions could potentially result in decreased overall productivity due to density dependent effects or reduction in habitat availability for critical habitat functions. If mortality of fish were to occur, it would constitute serious harm to fish. Further, if an Accident, Malfunction or Unplanned Event resulted in the destruction or permanent alteration of fish habitat such that fish could no longer rely on that habitat to provide important habitat functions, this could constitute serious harm to fish, per the *Fisheries Act* definition.

Table 12-4: Environmental Effects Analysis, VC - Fish and Fish Habitat; Project Phase – Decommissioning and Abandonment

Project Components or Activities	Potential Environmental Effects (A = adverse; B = beneficial)	Engineering Design, Mitigation Measures and Proven Environmental Management Practices	Factors Considered in the Environmental Effects Analysis*							
			Magnitude	Geographic Extent	Timing	Frequency	Duration	Reversibility	Ecological & Socio-economic Context	Certainty of Knowledge
Planned Activities										
Removal of Ethel Lake Control structure and water taking infrastructure	(A) Disturbance to Fish and Fish Habitat during in-water work associated with control structure removal.	Cofferdams will be installed to enclose in-water work areas and minimize the footprint of the works. Adherence to DFO in-water work timing windows. Fish salvage in area to be dewatered. Downstream flows maintained throughout control structure removal period.	2	1	1	1	1	1	2	1
	(B) Benefits to Fish and Fish Habitat due to increase in aquatic habitat following removal of control structure footprint and restoration of existing fish passage conditions at the Ethel Lake Control structure site.	The channel bed in the footprint of the control structure will be rehabilitated with suitably sized inorganic and organic materials to provide aquatic habitat and facilitate recolonization by benthic organisms, and fish movement into and out of Ethel Lake.	1	1	N/A	1	6	3	2	1
	(A) Effects on Fish and Fish Habitat due to loss of aquatic habitat following control structure removal and permanent lowering of Ethel Lake water level.	Water level decrease will occur slowly to prevent flush of sediments stored upstream from control structure. Water level lowering will adhere to DFO in-water timing windows.	2	2	N/A	1	6	3	2	1
	(B) Effects on Fish and Fish Habitat due to restoration of natural water level regime in Ethel Lake.	None required – beneficial effect.	1	2	N/A	4	6	3	2	1
Management of contaminated water	(A) Effects to health of Fish and Fish Habitat as a result of changes in surface water quality of local watercourses due to runoff/discharge of contaminated water.	Mine water pond will remain in place until chemical stability for the site can be demonstrated through the monitoring program.	2	2	N/A	4	6	3	2	1
Accidents, Malfunctions and Unplanned Events										
Fuel and hazardous material spills	(A) Effects to health of Fish and Fish Habitat as a result of surface water contamination.	Implement spills management and emergency response procedures.	2	3	N/A	1	4	2	2	1
Erosion and sedimentation into watercourses	(A) Effects to fish health and habitat utilization as a result of increased turbidity or sedimentation of existing habitat.	Implementation sediment and erosion control best management practices.	2	3	N/A	1	4	2	2	1

Key:

Magnitude: *
0 = Essentially no interaction
1 = Low, changes within regulated limits
2 = Moderate, changes near regulated limits
3 = High, changes exceed regulatory limits
4 = Unknown (see definitions in text, EA methods)

Geographic Extent: *
1 = Immediate work area
2 = Within Project closure plan boundary
3 = Within 5km of Project closure plan boundary
4 = Beyond 5 km of Project closure plan boundary

Frequency: *
1 = Uncommon event, event occurs once or infrequently / periodically
2 = Happens regularly but infrequently (e.g., once or twice per month)
3 = Happens regularly (e.g. daily)
4 = Continuous activity

Duration: *
1 = < 1 month
2 = 1-2 months
3 = 2-6 months
4 = 6-24 months
5 = 2-11 years (life of mine)
6 = > 11 years (Beyond Project)

Reversibility: *
1 = High
2 = Medium
3 = Low
4 = nil
5 = Unknown (see definitions in the text, EA Methods)

Ecological and Socio-economic Context: *
1 = Relatively pristine area not adversely affected by human activity
2 = Evidence of existing adverse effects
3 = High level of existing adverse effects

Timing: *
N/A – no sensitive periods or areas exist in baseline conditions
1 – sensitive periods or areas exist in baseline conditions that require adjustments to Project schedule or timing of activities

Certainty of Knowledge:*
1 = High – based on past performance and experience regarding environmental effects or mitigation
2 = Moderate – uncommon potential effect either not well understood or effects require compliance monitoring to modify engineering design or mitigation
3 = Low – potential for the need to follow-up based on results of compliance monitoring to modify engineering design or mitigation

12.2.4. Environmental Design, Mitigation and Optimization

The following environmental design features have been integrated into the Project to prevent or minimize adverse effects on Fish and Fish Habitat:

- The Project has been sited to avoid having any part of the physical footprint of the main mine site within fish habitat;
- The size of the Ethel Lake Control structure has been minimized to the extent necessary to ensure that adequate downstream flows can be maintained at all times to meet dilution requirements for the waste water treatment plant discharge (in accordance with Environmental Compliance Approval requirements) while limiting the amount of inundation required around Ethel Lake;
- The Ethel Lake water intake structure will be designed with appropriate screening and intake flow velocity, per the DFO Freshwater Intake End-of-Pipe Fish Screen Guideline (DFO, 1995) to minimize the potential for impingement or entrainment of Fish;
- A water recycling system is proposed to ensure efficient use of water within the mine and minimize the amount of water required to be taken from Ethel Lake, and therefore, minimize water level fluctuations and decreases in downstream flow and associated effects on Fish and Fish Habitat;
- A surface water management system will be in place to divert non-contact water to the Mine Water Pond for appropriate treatment prior to discharge and all contact water to the Mine Water Pond for re-use or treatment prior to discharge;
- A waste water treatment plant will be used to ensure that all contact water discharged to Fairbank Creek is treated to meet or be better than legislated federal limits in Schedule 4 of the *Metal Mining Effluent Regulation* and provincial effluent limits as will be specified in the Environmental Compliance Approval for the mine;
- The Ethel Lake Control structure has been designed with an overflow section and a low-level operable valve to ensure that it can be operated in a manner that provides a minimum flow rate that ensures that Provincial Water Quality Objectives will be met at the edge of the effluent mixing zone in Fairbank Creek (Kilgour and Ecosystem Recovery, 2017).

The following mitigation and environmental management initiatives will be implemented during the various Project phases to prevent or minimize adverse environmental effects on Fish and Fish Habitat:

- In-water construction will adhere to DFO's timing windows, which specify no in-water work should be completed between April 1 and July 15 (DFO, 2013) to avoid disrupting fish during critical periods of the life cycle (e.g. spawning and incubation periods);

- Work-site isolation measures will be used for all in-water work to limit the amount and duration of actual in-water work that is required. Flow diversion measures will be used to maintain downstream flows during Construction and Decommissioning of the Ethel Lake Control structure;
- Only clean materials, free of fines will be used for cofferdams and all cofferdam material will be removed from the watercourse following completion of Construction;
- Pumping from behind cofferdams will be done using a shrouded pump to prevent entrainment of fish;
- Fish will be salvaged from all areas to be dewatered and transferred to the reach immediately downstream from the work area;
- Only clean equipment will be used in or adjacent to watercourses, and equipment will be maintained to be free of fluid leaks and invasive species;
- Equipment will be operated on land above the high water mark to the extent possible;
- Blasting, if required adjacent to fisheries waters, will be undertaken in accordance with DFO requirements regarding fisheries protection (Wright and Hopky, 1998);
- Clearing of riparian vegetation at the Ethel Lake Control structure and pumphouse and along the PAG 2 waste rock storage area access road will be limited to the extent possible to minimize erosion;
- Sediment and erosion control measures will be implemented and monitored to ensure proper functioning;
- Spill prevention and response measures will be implemented and monitored to ensure proper functioning; and
- Water takings from Ethel Lake will be managed to the extent possible to minimize water-level reductions during spawning periods for Northern Pike and other species that use flooded vegetation for spawning and rearing.

Environmental management regarding the Project in general is discussed further in Chapter 5 – Sustainability Management.

12.3. Residual Environmental Effects

This section describes the residual (i.e., after mitigation) adverse environmental effects the Project might have on Fish and Fish Habitat. The following criteria, indicators and thresholds are used to rate the residual adverse environmental effects of the Project on Fish and Fish Habitat:

A **significant** residual adverse environmental effect of the Project on Fish and Fish Habitat occurs when Project activities eliminate the ability of indicator fish species in

Ethel Lake, Fairbank Creek or Victoria Creek, to maintain healthy, self-sustaining populations that would re-establish to pre-Project diversity, density, health and extent within several generations. Such an adverse environmental effect could not be compensated for completely with offsetting measures used to address serious harm to fish.

A **not significant** adverse environmental effect of the Project on Fish and Fish Habitat occurs when there are only short-term decreases in recruitment, abundance, fish health or low levels of mortality on a localized scale in Ethel Lake, Fairbank Creek or Victoria Creek. Such an environmental effect is one that populations can naturally recover from in a short period of time (one to two years), or that can be compensated for with offsetting measures used to address the losses of (i.e., serious harm to) fish.

A summary of the residual adverse environmental effects of the Project on Fish and Fish Habitat is provided in Table 12-5 and the residual adverse environmental effects are described in the following sections.

Table 12-5: Summary of Residual Environmental Effects – Fish and Fish Habitat

Valued Component	Key Adverse Residual Environmental Effect	Significance1	Probability of Occurrence (Likelihood)[2]	Effect on Ecosystem Function and Integrity[2]	Sustainable (Capacity) Use of Renewable Resources[2]	Relevant Legislation[3]
Construction	Temporary disturbance due to in-water construction. Effects on Fish and Fish Habitat utilization and movement due to control structure footprint and Ethel Lake water level increase.	Not Significant	High	Low	High	*Fisheries Act*, Section 35(2)(b)
Operations	Effects on Fish and Fish Habitat utilization due to water level and flow changes from Ethel Lake Water taking. Fish mortality due to water taking from Ethel Lake.	Not Significant	High	Low	High	*Fisheries Act*, Section 20(4) and 35(2)(b)
Decommissioning and Abandonment	Temporary disturbance due to in-water construction. Alteration in Fish and Fish Habitat utilization in response to permanent decrease in Ethel Lake water level.	Not Significant	High	Low	High	*Fisheries Act*, Section 35(2)(b)
Accidents, Malfunctions and Unplanned Events	Effects on fish health and/or habitat due to accidental spills of deleterious materials.	Not Significant	Low	Moderate	Low	*Fisheries Act*, Section 35(2)(b) and Section 36
Planned Project Overall	Alterations to Fish and Fish Habitat utilization due to habitat changes associated with Ethel Lake Control structure and water taking.	Not Significant	High	Low	High	*Fisheries Act*, Section 35(2)(b)
The Project in combination with other projects and activities	The Project, when combined with recreational fishing in Ethel Lake or Fairbank Creek may result in an increase in fish mortality.	Not Significant	Low	Low	High	*Fisheries Act*, Section 35(2)(b)

Notes:
1. The rating of significance for adverse residual environmental effects are those predicted effects remaining after the application of mitigation.
2. Sustainability factors are described for all predicted adverse residual environmental effects.
3. Key federal legislation references as appropriate for relevant predicted adverse environmental effects.

12.3.1. Construction

The residual adverse effects of Construction of the Project on Fish and Fish Habitat may include short-term (less than six months) temporary disturbance due to habitat loss, physiological stress to fish and mortality of benthic invertebrates during in-water work. There may also be longer term (life of mine) effects due to the Construction of Ethel Lake Control structure and associated loss of habitat in the control structure footprint, habitat changes in Ethel Lake due to inundation and obstruction of fish passage. The mitigation measures proposed to minimize adverse effects on Surface Water Quality are anticipated to be effective to prevent residual adverse effects on Fish and Fish Habitat.

With respect to temporary disturbance and loss of habitat during in-water construction work, the mitigation (e.g., adherence to timing windows, work site isolation, sediment and erosion control measures, spill prevention and response measures) to be implemented is anticipated to prevent serious harm to fish. Disruption and temporary loss of habitat will be scheduled to occur outside critical life cycle periods in accordance with timing windows specified by DFO, so effects on reproductive processes will be prevented. Some stress and altered habitat use may occur with potentially localized effects on individual fish, potentially including Northern Pike which may be part of an Indigenous or recreational fishery in Ethel Lake, but no population level effects on fish in Ethel Lake or Fairbank Creek are anticipated to occur during Construction.

DFO has determined that the construction, operation and decommissioning of the water level control structure do not pose risk of *Serious Harm* to Fish or Fish Habitat.

12.3.2. Operations

During Operations, residual adverse effects on Fish and Fish Habitat may include low potential for mortality due to impingement and entrainment at the Ethel Lake water intake and effects due to changes in water level and flow in Ethel Lake and Fairbank Creek. The mitigation measures proposed to minimize adverse effects on Surface Water Quality are anticipated to be effective to prevent residual adverse effects on Fish and Fish Habitat.

The probability of mortality at the Ethel Lake water intake is considered to be low, given that the intake screen and flow velocities will be designed to best practices following federal advice to minimize/avoid entrainment. Therefore, although there will remain some risk of periodic entrainment of small fish into the intake, the overall effect on the ecosystem function and integrity is anticipated to be low with no effect on the overall sustainability of the fisheries resource. DFO (2017) has determined that the operation of the water intake does not pose risk of *Serious Harm* to Fish or Fish Habitat.

The water control weir at the downstream end of Ethel Lake will result in a general increase in water level of some 0.5 metres, resulting in flooding of a general area of approximately 2.5 hectares (depending on the time of year). Spawning habitat for

Northern Pike and other spring spawning species that use flooded vegetation or nearshore habitats will increase by about 1.7 hectares. Variations in water level in Ethel Lake will mimic natural temporal variations, with additional minor reductions in level associated with water takings to support mine operations. Variations in water levels between the Ethel Lake weir and Fairbank Creek at the point of final treated effluent release are anticipated to be negligible.

12.3.3. Decommissioning and Abandonment

The residual adverse effects of Decommissioning and Abandonment of the Project on Fish and Fish Habitat may include short-term (less than six months) temporary disturbance due to habitat loss, physiological stress to fish and mortality of benthic invertebrates during in-water work to remove structures and some period of altered habitat utilization while the ecosystem adjusts to lower Ethel Lake water levels. The mitigation measures proposed to minimize adverse effects on Surface Water Quality are anticipated to be effective to prevent residual adverse effects on Fish and Fish Habitat.

With respect to temporary disturbance and loss of habitat during in-water construction work to remove the Ethel Lake Control structure and water intake, the mitigation measures to be implemented are anticipated to prevent serious harm to fish. Some stress and altered habitat use may occur with potentially localized effects on individual fish, but no population level effects on fish in Ethel Lake or Fairbank Creek are anticipated to occur during Decommissioning and Abandonment activities.

There may be some residual adverse effect on Fish and Fish Habitat in Ethel Lake until such time as the habitat and aquatic biota can adapt to the lower, but more natural, water level regime. However, over time, Decommissioning and Abandonment of these structures is anticipated to have a beneficial effect on Fish and Fish Habitat. Therefore, the residual adverse effects of Decommissioning and Abandonment on Fish and Fish Habitat are considered to be not significant. Similar residual effects may occur during conditions of temporary closure.

12.3.4. Accidents, Malfunctions and Unplanned Events

Accidents, Malfunctions and Unplanned Events such as accidental spills of fuel or oil, erosion and sedimentation, failure of cofferdams, or accidental discharge of mine effluent without proper treatment may potentially occur during each Project phase. With the implementation of the identified design and mitigation measures to prevent and respond to Accidents, Malfunctions and Unplanned Events, it is anticipated that there will be a low probability of occurrence of residual adverse effects on Fish and Fish Habitat. Any residual effects that may occur (e.g. effects to fish health, sedimentation of aquatic habitat and changes in habitat function) would be anticipated to have low effects on ecosystem function and integrity and the capacity of the resources following implementation of mitigation. Residual adverse effects would be anticipated to be limited to minor erosion and sedimentation in watercourses. It is considered that Fish

and Fish Habitat would have a low susceptibility to minor increases in sedimentation and that the natural environmental would have high capacity to naturally diminish effects over time. Therefore, the residual adverse effects of accidents, malfunctions and unplanned events is considered to be not significant.

12.3.5. Planned Project Overall

Overall, the Project may result in short term disturbance to Fish and Fish Habitat during in-water work periods and longer term residual effects due to potential mortality associated with water intake operations and habitat changes due to Ethel Lake Control structure construction and water taking operations. DFO (2017) has determined that residual effects do not constitute *Serious Harm* to Fish or Fish Habitat, and do not require offsetting measures. The overall residual effects associated with the Planned Project are considered to be not significant.

12.3.6. Cumulative Environmental Effects

The Project may result in cumulative environmental effects on Fish and Fish Habitat, if other projects and activities such as Advanced Exploration and permanent and seasonal residential activities (e.g. recreational angling) described in Chapter 2 – Existing Environment result in mortality of fish in Ethel Lake or Fairbank Creek. Mortality due to recreational angling could increase pressure on sport fish communities (primarily Northern Pike) when combined with the residual adverse effects of the Project in Ethel Lake and Fairbank Creek. However, the combined magnitude of effect on sport fish populations in Ethel Lake and Fairbank Creek, assuming existing low levels of recreational angling continue, is still not anticipated to cause an overall adverse effect on ecosystem function and integrity (i.e. the population status of Northern Pike) and therefore, the cumulative environmental effects are considered to be not significant.

None of the other closely related projects and activities considered in Chapter 3 – Project Description are anticipated to result in cumulative effects on Fish and Fish Habitat.

12.3.7. Monitoring and Follow-Up Program

FNX will have monitoring programs in place during Construction, throughout the Operations phase, during and post-Decommissioning and Abandonment. The program will include regular compliance monitoring to ensure that all regulatory requirements are being met and that the mitigation measures identified in this document and the terms and conditions of any permits and approvals are being implemented and having the desired effect. This will include monitoring of items such as, but not limited to:

- Sediment and erosion control measures;
- Spill prevention and response measures;
- Compliance with in-water work timelines;

- Surface water quality from the waste water treatment plant is in accordance with the requirements of the Environmental Compliance Approval; and
- Water taking volumes from Ethel Lake are in accordance with provincial Permit to Take Water monitoring requirements.

In addition, Environmental Effects Monitoring is anticipated to be required under the Metal Mining Effluent Regulations including components related to Fish and Fish Habitat, when mining commences. Receiver Biological Monitoring is also required as part of the ECA Permit.

12.4. References and Appendices

- AMEC Earth & Environmental (AMEC). 2009. Baseline Aquatic Environmental Assessment, Victoria Mine Property. Prepared for FNX Mining Company Inc., Sudbury, Ontario. February 2009. 102 pp. + Appendices.
- ASI Group Ltd (ASI). 2004. Baseline Aquatic Environmental Assessment Former Victoria Mine Property. Prepared for FNX Mining Company Inc., Sudbury, Ontario. May 31, 2004. 46 pp. + Appendices.
- Department of Fisheries and Oceans (DFO). 1995. Freshwater Intake End-of-Pipe Fish Screen Guideline. 27 pp.
- DFO. 2013. Ontario Restricted Activity Timing Windows for the Protection of Fish and Fish Habitat. Online at http://www.dfo-mpo.gc.ca/pnw-ppe/timing-periodes/on-eng.html. (Accessed February 17, 2016).
- DFO. 2017. Letter from Richard Janusz to Roberta Pedlar-Hobbs (KGHM) RE: Implementation of mitigation measures to avoid and mitigate impacts to fish and fish habitat and aquatic species at risk – Ethel Lake Dam Reconstruction. Dated July 6, 2017.
- Environmental Applications Group Inc. (EAG). 2012. Baseline Aquatic Environmental Assessment Interpretive Report. Prepared for FNX Mining Company Inc. February 2012. 84 pp. + Appendices.
- Hatch Ltd. 2015a. Ethel Lake Hydrology. Prepared for KGHM International. August 11, 2015. 24 pp.
- Hatch Ltd. 2015b. Site Wide Water Balance Report. Victoria Project. Prepared for KGHM International. 15 pp. + Appendices.
- Kilgour & Associates Ltd. and Denison Environmental Services (Kilgour and Denison). 2014. Baseline Aquatic Environmental Assessment, Victoria Project. Prepared for KGHM International. 100 pp. + Appendices.
- Kilgour & Associates Ltd. 2017. Aquatic Effects Study, 2016, Victoria Advanced Exploration Project.

- Kilgour & Associates Ltd. and Ecosystem Recovery Inc. (Kilgour & Ecosystem Recovery). 2017. Victoria Mine, Surface Water Study Update, December 2017.
- Klohn Crippen Berger. 2013. Fairbank Creek Assimilative Capacity Study. May 2013.
- Wright, D.G. and G. E. Hopky. 1998. Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters. Canadian Technical Report of Fisheries and Aquatic Sciences 2107. 34 pp.

Table of Contents – Chapter 13

13. Terrestrial Habitat 248

13.1. Existing Conditions 248
13.1.1. Ecological Boundaries 250
13.1.2. Administrative Boundaries 250
13.1.3. Technical Boundaries 252
13.1.4. Wildlife 252
13.1.5. Wildlife Habitat 255
13.1.6. Likely Future Conditions 257
13.2. Environmental Effects Analysis 257
13.2.1. Construction 257
13.2.2. Operations 261
13.2.3. Decommissioning and Abandonment 263
13.2.4. Environmental Design, Mitigation and Optimization 266
13.3. Residual Environmental Effects 267
13.3.1. Construction 269
13.3.2. Operations 269
13.3.3. Decommissioning and Abandonment 270
13.3.4. Accidents, Malfunctions and Unplanned Events 270
13.3.5. Planned Project Overall 270
13.3.6. Cumulative Environmental Effects 271
13.3.7. Monitoring and Follow-Up Program 271
13.4. References and Appendices 272

13. Terrestrial Habitat

Terrestrial Habitat includes wildlife (species of special conservation status) and wildlife habitat (vegetation communities and wetlands) and was selected as a VC because of its inherent ecological value and social, cultural and economic importance. Species of special conservation status are those that are listed on Schedule 1 of the *Species At Risk Act* (*SARA*, 2002), and/or identified as Endangered, Threatened or Special Concern on the Species at Risk in Ontario (SARO) List (*Ontario Regulation 230/08*) under *the Endangered Species Act* (*ESA*), 2007.

The existing environment surrounding the Project reflects the influence of past and present land-use practices (e.g., forestry, mining and other resource developments) that have altered the landscape. The remnant and regenerating vegetation communities that do exist provide habitat for a variety of wildlife and thus, consideration of the effects of the Project on Terrestrial Habitat is required.

13.1. Existing Conditions

The Project is located approximately 30 kilometres southwest of the City of Greater Sudbury, within Denison Township (Figure 13-1). It is located in the Ontario Shield Ecozone and Georgian Bay Ecoregion (5E-4) and within Wildlife Management Unit 39. The Project is located approximately five kilometres from the nearest protected area; Fairbanks Provincial Park. Forest communities in the environmental assessment area are typical of the Great lakes/St. Lawrence forest region. The dominant community types include poplar-white birch and poplar-white birch-white spruce-balsam fir mixed wood stands. There are no rare plant communities, wildlife concentration areas within the environmental assessment area based on data obtained from the MNRF Land Information Ontario (LIO) environmental datasets.

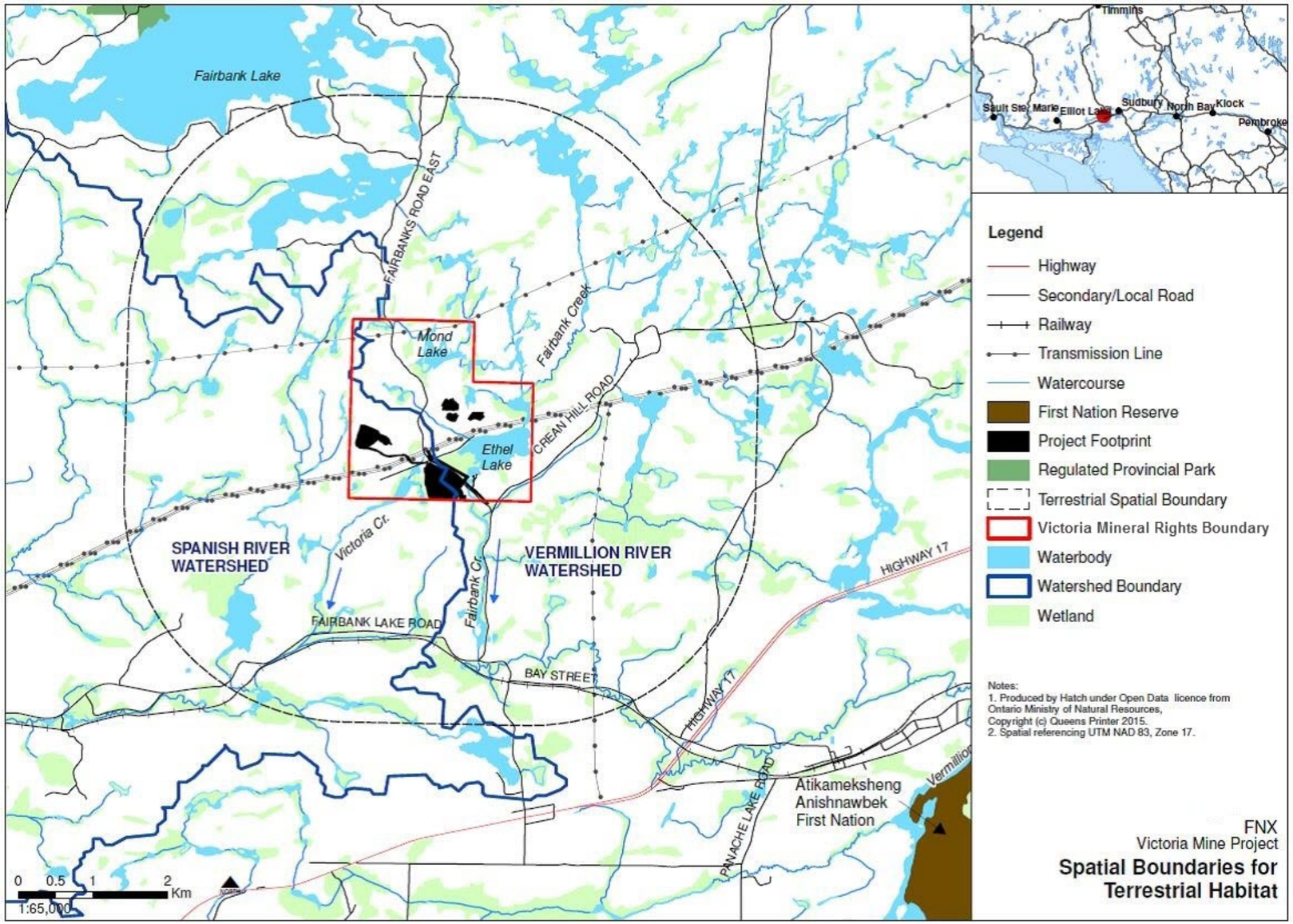

Figure 13-1: Spatial Boundaries for Terrestrial Habitat

The area of the Project includes a mix of natural and disturbed areas comprising wetlands, forests, meadows and rock barren communities. The diversity of vegetation communities throughout the environmental assessment area provides suitable habitat for a variety of upland and semi-terrestrial aquatic wildlife species.

Wetlands within the environmental assessment area are predominately shallow or meadow marsh communities, although swamp communities and to a lesser extent, fens, have also been documented. Beaver activity throughout the environmental assessment area is high and appears to have influenced the creation of most of the wetlands in the environmental assessment area. All wetland communities within the environmental assessment area are common and no provincially significant wetlands (PSWs) have been identified. Wildlife in the regional area is typical of northern Ontario with common species documented, as well as eight species of special conservation status. A discussion on these species is provided in Section 13.1.5 – Wildlife Habitat.

13.1.1. Ecological Boundaries

The spatial boundaries for Terrestrial Habitat assessment were selected based on results of the baseline studies completed for the Project. A map showing the ecological boundaries is provided in Figure 13-1. The boundary includes the Project footprint, including Ethel Lake, and extending an additional three kilometres from the Victoria Mineral Rights boundary. The Victoria Project Mineral Rights boundary was selected as the local environmental assessment area and takes into account the species of special conservation status found within this boundary according to the results of baseline studies. The additional three kilometres from the mineral rights boundary was selected as the spatial boundary as it likely encompass the home range sizes of the species of special conservation status, particularly the two species listed as threatened (i.e., Eastern Whip-poor-will and Blanding's Turtle). Eastern Whip-poor-will was found within the Project footprint, while the Blanding's Turtle was found near the southwestern edge of the mineral rights boundary, outside of the proposed Victoria Mine Project footprint. The 'territorial' range for a breeding pair of Eastern Whip-poor-will is estimated to be around 30 hectares on average up to 132 hectares, with 500 to 1,000 hectares that may be needed to support "more than a few pairs" (EC, 2015). A three kilometer ecological boundary would fall within the range of supporting "more than a few pairs" of Eastern Whip-poor-will.

The temporal boundary covers the period between 2024 and 2050 for Terrestrial Habitat effects assessment.

13.1.2. Administrative Boundaries

Administrative tools to protect Terrestrial Habitat, specifically wildlife and wildlife habitat, were determined by federal and provincial legislative and regulatory policies. Information-sharing provisions have been made between the federal and provincial governments through Canadian-Ontario Agreements. With respect to species of special

conservation status, the federal and provincial governments have been created to ensure a coordinated approach to species at risk protection and recovery through the Canadian-Ontario Agreement on Species at Risk. In addition to these Agreements, compliance to all applicable legislation is required. Where there is conflict, statutory requirements will take precedence.

- ***Species at Risk Act* (*SARA*)**: Provides species and habitat protection through provisions that prohibit killing, harming, harassing or taking of Endangered or Threatened and Extirpated species listed in Schedule 1 of *SARA*. Other prohibitions include the damage or destruction of their residences (e.g., nest or den). These prohibitions apply to:
  - Species listed on Schedule 1 of *SARA* and found on federal lands; AND
  - All migratory birds listed in the *Migratory Birds Convention Act* (*MBCA), 1994* and listed in Schedule 1 of *SARA*, anywhere they occur.

As the Project is not on federal lands, only the provisions for species listed in the *MBCA* and on Schedule 1 of *SARA* would apply. For this Project, these provisions apply to the Eastern Whip-poor-will, Canada Warbler, Common Nighthawk and Golden-winged Warbler.

- ***Endangered Species Act* (*ESA),* 2007**: Provides species and habitat (e.g., general or regulated) protection for species designated as Endangered or Threatened on the SARO List. Key protection provisions include:
  - Subsection 9(1) which prohibits the killing, harming, harassment capture, taking, possession, transport, collection, buying, selling, leasing, trading or offering to buy, sell, lease or trade species listed as Extirpated, Endangered or Threatened on the SARO List; and
  - Section 10 prohibits the damage or destruction of the habitat of an Endangered or Threatened species on the SARO List.

The *ESA*, *2007* does provide flexibility through permitting and authorizations for activities that are otherwise prohibited. MNRF is the governing agency responsible for reviewing and approving permits and authorizations under the Act. For this Project, an Overall Benefit Permit has been obtained for Eastern Whip-poor-will.

- ***Migratory Birds Convention Act* (*MBCA*)**: Provides protection and conservation for populations and individuals of migratory birds and their nests. Section 5 of the Act include prohibitions against possessing a migratory bird or nest, or buying, selling, exchanging or giving a migratory bird or nest or make or make it the subject of a commercial transaction, except as authorized by the regulations. The Act also prohibits depositing harmful substances in waters or areas frequented by migratory birds.

- ***Fish and Wildlife Conservation Act* (*FWCA*)**: Provides protection and management to furbearing mammals, game wildlife, and specially protected wildlife species, including nests, eggs, dens and beaver dams. The Act includes prohibitions against hunting and trapping specially protected species that is not a game bird, unless authorized under the authority of a license, destruction or possession of a nest or the eggs of a bird that is wild by nature, damage or destruction of a den or beaver dam, unless as authorized under the regulation.

13.1.3. Technical Boundaries

The technical boundaries are based, in part, on the baseline studies completed for the Project. Environmental information for the environmental assessment area was predominantly based on publicly available information sources. The type of available information, accuracy and relevance (e.g., recent vs. historic data) provided limitations to understanding existing conditions. Other limitations included timing of field assessments, restricted access to private lands within the environmental assessment area, and natural limitations with respect to cryptic and elusive species.

An additional technical boundary is the coarse delineation of the inundation area around Ethel Lake, in terms of both size and location of the predicted new water line as a result of the Ethel Lake control structure. Delineation of the inundation area is limited by the accuracy of the topographical data for the area (which was based on a topographical ground survey of data points, which were extrapolated to create contours at 0.5 metre intervals).

13.1.4. Wildlife

Wildlife studies (bird, mammal, reptile, amphibian) have been completed for the Project since 2002. Baseline studies, including lists of species documented during the surveys can be found in each of the respective reports (Golder Associates, 2003 and 2004; RiverStone, 2011; EcoTec, 2013; Hatch, 2015; and EcoTec, 2015).

The studies were completed to assess overall diversity and presence of species of special conservation status and their habitat. Species of special conservation status include species designated as Special Concern, Threatened or Endangered on the Species at Risk in Ontario (SARO) List (*O. Reg. 230/08*), regulated under the *Endangered Species Act* (*ESA*), 2007. Under the *ESA*, 2007, only Threatened or Endangered species and their habitat are currently protected.

Overall, the majority of wildlife species found throughout the environmental assessment area are common, with the exception of eight species of special conservation status; three reptiles and five birds. A list of species of special conservation status found within the environmental assessment area and where they were located is provided in Table 13-1 and shown on Figure 13-1. Of the species of special conservation status found in the environmental assessment area, one species, Eastern Whip-poor-will, designated as Threatened by the *ESA*, was documented within the proposed Mine Project footprint.

Snapping Turtle, a species designated as Special Concern by the *ESA* was also documented within the proposed Mine Project footprint (along the northern shoreline of Ethel Lake). The remaining five species designated as Special Concern (Eastern Milksnake, Bald Eagle, Golden-Winged Warbler, Canada Warbler and Common Nighthawk) were documented within the environmental assessment area but outside of the proposed Mine Project footprint. .

The methods to assess wildlife is provided in Appendix G.

Table 13-1: Species of Special Conservation Status Identified in the Environmental Assessment Area

Species	Common Name	At Risk Status		Documented Location
		ESA, 2007	*SARA* (Schedule 1)	
Reptiles				
Blanding's Turtle (Great Lakes / St. Lawrence Population)	*Emydoidea blandingii*	Threatened	Threatened	Southwest corner of the Victoria Mine Property boundary, approximately 900 metres west of the Victoria Project Site (EcoTec 2013), and the proposed Victoria Mine Project footprint.
Eastern Milksnake	*Lampropeltis triangulum*	Special Concern	Special Concern	A Milksnake was documented on Fairbanks East Road, more than one kilometre south of the Victoria Project (EcoTec 2013).
Snapping Turtle	*Chelydra serpentina*	Special Concern	Special Concern	Three Snapping Turtles were documented within the Victoria Mineral Rights Boundary (which includes Ethel Lake); two along the northern shoreline of Ethel Lake (EcoTec, 2013) and one near the northeast corner of the PAG 2 Survey area, along the northern hydro corridor (EcoTec, 2015)., approximately 530 metres northeast of the planned PAG 2 waste rock pad location A Snapping Turtle was also documented on Fairbanks East Road, approximately two kilometres south of the Project (EcoTec 2013). Riverstone (2011) also confirmed the presence of this species, although did not specify the location.
Birds				
Eastern Whip-poor-will	*Caprimulgus vociferus*	Threatened	Threatened	Several Eastern Whip-poor-will were documented within the advanced exploration area, near the PAG 2 waste rock storage area, overburden storage areas and around Ethel Lake (RiverStone, 2011; EcoTec, 2013). An Overall Benefit Permit (SU-C-001-12) under *ESA*, 2007 was issued in 2012 for advanced exploration and mining production to address adverse effects on Eastern Whip-poor-will occurring as a result of the Project. The permit applies throughout the life of the Project. In accordance with the information sharing provisions in s. 13.1 of the Canadian-Ontario Agreement for Species at Risk, MNRF notified Environment Canada that the permit was issued.
Bald Eagle	*Haliaeetus leucocephalus*	Special Concern	N/A	A Bald Eagle was observed flying over the PAG 2 survey area during the 2015 survey (EcoTec, 2015), approximately 300 m west of the planned PAG 2 waste rock pad location. There were no nests documented within the Project boundaries during any of the baseline studies.
Golden-winged Warbler	*Vermivora chrysoptera*	Special Concern	Threatened	A Golden-winged Warbler was documented more than two kilometres southwest of the Project (EcoTec 2013).
Canada Warbler	*Wilosonia canadensis*	Special Concern	Threatened	A breeding pair of Canada Warblers was documented near the southwest corner of the Victoria Mineral rights boundary in 2010 (Riverstone, 2011), approximately 500 m west of the proposed Victoria Mine Project footprint.
Common Nighthawk	*Chordeiles minor*	Special Concern	Threatened	This species was documented near the southeast boundary of the PAG 2 survey area (approximately 380 m southeast of the planned PAG 2 waste rock pad location) during the 2015 survey (EcoTec, 2015).

13.1.5. Wildlife Habitat

Vegetation community assessments have been completed for the Project. The purpose of the assessments was to document existing conditions, determine the presence or absence of rare communities and suitability of wildlife habitat, specifically for species of special conservation status. All of the communities documented during the field studies are common to the area. The mix of wetland and upland forested and meadow communities provide a diversity of wildlife habitat. The vegetation communities identified during the baseline studies is provided in Table 13-2.

The methods to assess wildlife habitat is provided in Appendix G.

Table 13-2: Summary of Vegetation Communities Found Within the Project Area

Vegetation Communities	Results of Records Review/Site Assessment
Wetland: There are several unevaluated wetland communities found within the environmental assessment area; no PSWs have been evaluated within the environmental assessment area. The wetlands are predominantly associated with watercourses or water bodies and are primarily marsh communities. Thicket communities are also present and to a lesser extent fen communities.	Floating-leaved Shallow Aquatic Communities: Water Lily – Bullhead Lily Floating-Leaved Shallow Aquatic Shallow Marsh Communities Cattail Shallow Marsh Broad-leaved Sedge Shallow Marsh Bur-reed Shallow Marsh Rice Cut-grass Forb Shallow Marsh Organic Shallow Marsh Meadow Marsh Communities Bluejoint Meadow Marsh Reed-canary Grass Meadow Marsh Broad-leaved Sedge Meadow Marsh Horsetail Meadow Marsh Fen Communities Leatherleaf-Forb Shrub Fen Type Open Fen Ecosite Thicket Swamp Communities Alder Thicket Swamp Willow Thicket Swamp Mineral Thicket Swamp Hardwood Swamp Intolerant Hardwood Swamp
Forest: Forest communities are present within the Project. The wooded areas are dominated by trembling aspen and white birch with conifers in the understory, such as white spruce and balsam fir.	Forest Communities: White Pine-Red Pine Jack Pine-White Pine-Red Pine Poplar-White Birch Poplar-White Birch-White Spruce-Balsam Fir Poplar-Jack Pine-White Spruce-Balsam Fir Lowland Hardwood Very Shallow, Dry to Fresh: Maple Hardwood Forest Dry to Fresh, Coarse: Aspen-Birch Hardwood Forest
Meadow: A meadow community is present along the hydro corridor, north of the mine site and south of the PAG 2 waste rock storage facility.	Meadow Communities: Fresh, Clayey: Meadow Cultural Meadow
Rock Barren: Rock barren communities were found within the PAG 2 area.	Rock Barren Community: Rock Barren

13.1.6. Likely Future Conditions

Likely future conditions of Terrestrial Habitat, should the Project not proceed to implementation, are expected to be similar to existing conditions. Over time and assuming no further development occurs within the environmental assessment area, it is expected that wildlife habitat and the natural successional changes of vegetation communities will continue to grow and support productive wildlife populations. As discussed in the Sudbury Soils Study, Ecological Risk Assessment Report (SARA Group, 2009), varying levels of plant toxicity have been noted throughout the region which will likely impede the recovery of self-sustaining communities.

13.2. Environmental Effects Analysis

The following sections discuss the potential environmental effects of the Project on Terrestrial Habitat. The sections are organized by project phase, including Construction, Operations, Decommissioning and Abandonment and Accidents, Malfunctions and Unplanned Events.

13.2.1. Construction

The Project components include construction of the PAG 2 waste rock storage facility and haul road, construction of facility infrastructure within the advanced exploration footprint, Ethel Lake Control structure, pumphouse and water intake line and associated access road. Activities associated with construction of these components and that have the potential to result in adverse environmental effects on Terrestrial Habitat include: noise (drilling and blasting), worker presence and traffic; and vegetation clearing, earthworks, grubbing and disposal. As a result of these activities, potential adverse environmental effects to Terrestrial Habitat include:

- Disturbance to wildlife and mortality; and
- Changes to vegetation communities and wildlife habitat (e.g., loss, alteration).

Wildlife disturbance through habitat avoidance, human-wildlife interactions and potential incidental take may occur due to noise, worker presence, and increased traffic generated during the Construction phase.

Marginal loss and alteration to vegetation communities and wildlife habitat is anticipated due to construction of the Project. The Project component footprints that would result in habitat loss include: PAG 2 facility (7.5 hectares); PAG 2 access (haul) road (1.2 hectares); Ethel Lake pumphouse (480 m^2); Ethel Lake access road (190 metres long by 4.5 metres wide). It is anticipated that some tree and shrub loss of upland communities along the shoreline will become inundated immediately following construction of the control structure; this is expected to result in a marginal loss of upland vegetation. Conversely, a marginal increase in wetland habitat may also occur due to increasing the lake surface area by 2.5 hectares, including potential changes to community structure associated with

the shallow and meadow marshes. Overall conversion of upland vegetation to riparian communities is anticipated along the shoreline, representing a marginal loss of general upland habitat while also creating beneficial effects through an increase in wetland habitat.

Although habitat loss due to mineral exploration is a recognized factor in the decline of Eastern Whip-poor-will (Environment Canada, 2015), an Overall Benefit Permit has been issued for the Project, which permits the damage and destruction of up to 55 hectares of habitat. The permit applies to all stages of the mining cycle, therefore disturbance to Whip-poor-will habitat can occur in any project phase.

Accidents, Malfunctions and Unplanned Events could occur during the Construction phase and may include spills associated with hazardous or contaminated materials, sedimentation, discharge of untreated mine effluent. Environmental effects associated with these events include impaired wildlife health, mortality and disturbance and habitat degradation. It is anticipated that these effects would be temporary through the implementation of appropriate mitigation measures and monitoring activities. All surface runoff will be contained and treated on-site through the waste water treatment facility.

Table 13-3: Environmental Effects Analysis; VC - Terrestrial Habitat; Project Phase - Construction

Project Components or Activities	Potential Environmental Effects (A = adverse; B = beneficial)	Engineering Design, Mitigation Measures and Proven Environmental Management Practices	Factors Considered in the Environmental Effects Analysis*							
			Magnitude	Geographic Extent	Timing	Frequency	Duration	Reversibility	Ecological & Socio-economic Context	Certainty of Knowledge
Planned Activities										
Worker presence, vehicle or equipment use, and drilling and blasting	(A) Temporary disturbance of wildlife, avoidance of area, human-wildlife interactions.	Implement speed limits and install signage to advise of wildlife. All Construction personnel and site visitors will remain within pre-determined work areas to minimize the extent of disturbance. Vegetation clearing prior to breeding bird survey (adherence to timing windows, such as *ESA*, *MBCA*).	2	2	1	3	5	1	2	1
	(A) Disturbance to species of special conservation status - Eastern Whip-poor-will (WPWI), Blanding's Turtle, Snapping Turtle, Milksnake, Golden-winged Warbler, Canada Warbler, Common Nighthawk, Bald Eagle.	Adherence to requirements in *ESA* permit for WPWI (permit number SU-C-001-12) and other legislative requirements (e.g., *MBCA* and timing windows). Pre-construction clearance surveys. Species of special conservation status educational training for all Construction personnel.	2	3	1	1	5	1	2	2
	(A) Incidental take of wildlife.	Implement speed limits and install signage to advise of wildlife.	2	3	N/A	1	5	3	2	2
Vegetation clearing, earthworks and grubbing and disposal: - Construction of PAG 2 Waste Rock Storage Facility and Access (Haul) Road - Construction of Ethel Lake Control structure, pumphouse and water intake line	(A) Loss or alteration of wildlife habitat due to vegetation removal. (A) Changes to the structure or composition of vegetation communities. (A) Soil compaction and rutting outside of work area.	The Victoria Mine Project has been designed to minimize the overall footprint and therefore the extent of vegetation removal. Clearing will be done outside of the sensitive breeding seasons in accordance with Environment Canada timing windows and Project permit requirements. All work areas will be flagged prior to site clearing to ensure work is kept within the Victoria Mine Project boundaries. Felled trees will be directed to cleared areas to prevent damage to those remaining.	2	1	N/A	1	4	1	2	1
	(A) Disturbance of species of special conservation status habitat. (B) Habitat creation for WPWI.	Adherence to *Endangered Species Act* permit requirements for WPWI (permit number SU-C-001-12). Clearing small areas may create habitat for WPWI.	3	1	1	1	4	1	2	2
Inundation of Ethel Lake	(A) (B) Alteration of shoreline vegetation communities and associated habitat due to 0.5 metre increase in water level.	Water level increase minimized to limit amount of habitat alteration. Additional wetland habitat may be created which will benefit some species.	1	2	N/A	4	3	2	2	1
Accidents, Malfunctions and Unplanned Events										
Fuel and hazardous materials storage and handling	(A) Wildlife disturbance, temporary loss of habitat associated with soil or water contamination.	Adherence to waste and hazardous materials management procedures. Implementation of spill prevention and response procedures.	1	1	N/A	1	1	2	2	1

Project Components or Activities	Potential Environmental Effects (A = adverse; B = beneficial)	Engineering Design, Mitigation Measures and Proven Environmental Management Practices	Factors Considered in the Environmental Effects Analysis*							
			Magnitude	Geographic Extent	Timing	Frequency	Duration	Reversibility	Ecological & Socio-economic Context	Certainty of Knowledge
Erosion and sedimentation	(A) Disturbance to wildlife, temporary loss of vegetation communities or wildlife habitat associated with water contamination.	Implementation of erosion and sediment control procedures.	1	1	N/A	1	1	2	2	1

Key:

Magnitude: *
0 = Essentially no interaction
1 = Low, changes within regulated limits
2 = Moderate, changes near regulated limits
3 = High, changes exceed regulatory limits
4 = Unknown (see definitions in text, EA methods)

Geographic Extent: *
1 = Immediate work area
2 = Within Project closure plan boundary
3 = Within 5km of Project closure plan boundary
4 = Beyond 5 km of Project closure plan boundary

Frequency: *
1 = Uncommon event, event occurs once or infrequently / periodically
2 = Happens regularly (e.g. daily)
3 = Happens regularly but infrequently (e.g., once or twice per month)
4 = Continuous activity

Duration: *
1 = < 1 month
2 = 1-2 months
3 = 2-6 months
4 = 6-24 months
5 = 2-11 years (life of mine)
6 = > 11 years (Beyond Project)

Reversibility: *
1 = High
2 = Medium
3 = Low
4 = nil
5 = Unknown (see definitions in the text, EA Methods)

Ecological and Socio-economic Context: *
1 = Relatively pristine area not adversely affected by human activity
2 = Evidence of existing adverse effects
3 = High level of existing adverse effects

Timing: *
N/A – no sensitive periods or areas exist in baseline conditions
1 – sensitive periods or areas exist in baseline conditions that require adjustments to Project schedule or timing of activities

Certainty of Knowledge:*
1 = High – based on past performance and experience regarding environmental effects or mitigation
2 = Moderate – uncommon potential effect either not well understood or effects require compliance monitoring to modify engineering design or mitigation
3 = Low – potential for the need to follow-up based on results of compliance monitoring to modify engineering design or mitigation

13.2.2. Operations

Activities during the Operations phase of the Project that have the potential to result in adverse environmental effects on Terrestrial Habitat, include: noise (drilling and blasting), worker presence and traffic and alterations to shoreline communities along Ethel Lake due to water level fluctuations occurring as a result of pumping of water from lake for use at the mine site. As a result of these activities, potential adverse environmental effects to Terrestrial Habitat include:

- Disturbance to wildlife and mortality (including species of special conservation status); and
- Changes to vegetation communities and wildlife habitat (e.g., alteration).

Wildlife disturbance, through habitat avoidance, human-wildlife interactions and potential incidental take may occur due to noise, worker presence, and increased traffic during the Operations phase.

Overall, the average water level in Ethel Lake is expected to decrease by approximately 40 cm through the winter, starting in October to March. It is suspected that the decrease in lake levels is a natural occurrence during this period and not solely due to Operations. Effects to hibernating species are not anticipated as a result of lower water levels throughout the winter. Changes to vegetation communities along the shoreline of Ethel Lake is anticipated due to water taking activities that may result in fluctuating water levels on a daily basis (up to one metre during worst-case water taking scenarios). Frequency and duration of water level changes will depend on water requirements of the mine and natural inflows to Ethel Lake. Minor changes to existing shoreline vegetation communities (e.g., composition, structure) are anticipated due to fluctuating water levels.

Accidents, Malfunctions and Unplanned Events could occur during the Operations phase and may include spills associated with hazardous or contaminated materials, sedimentation, discharge of untreated mine effluent or failure of the Ethel Lake control structure. Environmental effects associated with these events include impaired wildlife health, mortality and disturbance and habitat degradation. It is anticipated that these effects would be temporary through the implementation of appropriate mitigation measures and monitoring activities. All surface runoff will be contained and treated on-site through the waste water treatment facility.

Table 13-4: Environmental Effects Analysis; VC - Terrestrial Habitat; Project Phase - Operations

Project Components or Activities	Potential Environmental Effects (A = adverse; B = beneficial)	Engineering Design, Mitigation Measures and Proven Environmental Management Practices	Factors Considered in the Environmental Effects Analysis*							
			Magnitude	Geographic Extent	Timing	Frequency	Duration	Reversibility	Ecological & Socio-economic Context	Certainty of Knowledge
Planned Activities										
Worker presence, vehicle or equipment operations, drilling and blasting, waste rock handling and hauling	(A) Disturbance to wildlife, avoidance of area, human-wildlife interactions.	Implement speed limits and install signage to advise of wildlife. All personnel and site visitors will remain within pre-determined work areas to minimize the extent of disturbance outside of the Victoria Mine Project.	2	3	N/A	3	5	1	2	1
	(A) Disturbance to species of special conservation status - WPWI, Blanding's Turtle, Snapping Turtle, Milksnake, Golden-winged Warbler, Canada Warbler, Common Nighthawk, Bald Eagle.	Adherence to *Endangered Species Act* permit requirements for WPWI (permit number SU-C-001-12). Species of special conservation status educational training and awareness will be provided to all personnel.	2	3	N/A	3	5	1	2	1
	(A) Incidental take of wildlife.	Implement speed limits and install signage to advise of wildlife.	2	3	N/A	1	5	4	2	1
Operations of Ethel Lake Control structure and water taking	(A) Wildlife mortality (aquatic mammals, reptiles or amphibians) due to impingement or entrainment in water intake.	The intake will be designed to minimize potential for impingement and entrainment.	2	1	N/A	1	5	4	2	1
	(A) (B) Vegetation community alterations due to Ethel Lake water level fluctuation during water taking.	Water taking requirements minimized through use of facility recycled water system.	2	3	N/A	1	5	1	2	2
Management of contaminated water	(A) Potential effects on wildlife health due to changes in surface water quality in local watercourses.	Contaminated water will be collected and treated to meet provincial and federal requirements (*MMER*) and either returned to the process or discharged in accordance with permit requirements. A long-term Fairbank Creek biological monitoring program will be completed in accordance with the sewage works permit. Education and training awareness for birds using the mine water pond and implementation of wildlife standard protocols.	2	3	N/A	1	5	1	2	1
Accidents, Malfunctions and Unplanned Events										
Ethel Lake control structure failure	(A) Disturbance to wildlife, temporary loss of vegetation communities or wildlife habitat.	Implementation of emergency response procedures.	2	3	N/A	1	5	1	2	1
Fuel and hazardous materials storage and handling	(A) Disturbance to wildlife, temporary loss of vegetation communities or wildlife habitat due to soil or water contamination.	Adherence to waste and hazardous materials management procedures. Implementation of spill prevention and emergency response procedures.	2	3	N/A	1	5	1	2	1
Erosion and sedimentation	(A) Disturbance to wildlife, temporary loss of vegetation communities or wildlife habitat due to water contamination.	Implementation of erosion and sediment control procedures.	2	3	N/A	1	5	1	2	1

Key:

Magnitude: *
0 = Essentially no interaction
1 = Low, changes within regulated limits
2 = Moderate, changes near regulated limits
3 = High, changes exceed regulatory limits
4 = Unknown (see definitions in text, EA methods)

Geographic Extent: *
1 = Immediate work area
2 = Within Project closure plan boundary
3 = Within 5km of Project closure plan boundary
4 = Beyond 5 km of Project closure plan boundary

Frequency: *
1 = Uncommon event, event occurs once or infrequently / periodically
2 = Happens regularly but infrequently (e.g., once or twice per month)
3 = Happens regularly (e.g. daily)
4 = Continuous activity

Duration: *
1 = < 1 month
2 = 1-2 months
3 = 2-6 months
4 = 6-24 months
5 = 2-11 years (life of mine)
6 = > 11 years (beyond Project)

Reversibility: *
1 = High
2 = Medium
3 = Low
4 = nil
5 = Unknown (see definitions in the text, EA Methods)

Ecological and Socio-economic Context: *
1 = Relatively pristine area not adversely affected by human activity
2 = Evidence of existing adverse effects
3 = High level of existing adverse effects

Timing: *
N/A – no sensitive periods or areas exist in baseline conditions
1 – sensitive periods or areas exist in baseline conditions that require adjustments to Project schedule or timing of activities

Certainty of Knowledge:*
1 = High – based on past performance and experience regarding environmental effects or mitigation
2 = Moderate – uncommon potential effect either not well understood or effects require compliance monitoring to modify engineering design or mitigation
3 = Low – potential for the need to follow-up based on results of compliance monitoring to modify engineering design or mitigation

13.2.3. Decommissioning and Abandonment

Activities during the Decommissioning and Abandonment of the Project that have the potential to result in adverse environmental effects on Terrestrial Habitat include: noise, worker presence, traffic and changes to vegetation communities through the removal and demolition of Project components, including the Ethel Lake control structure and associated infrastructure.

Wildlife disturbance, through habitat avoidance, human-wildlife interactions and potential incidental take is anticipated due to noise, worker presence, and increased traffic generated during the Decommissioning and Abandonment phase.

Changes in wildlife habitat may occur due to removal of the Ethel Lake control structure and restoring the lake to its original water levels. A decrease in water level may result in changes to shoreline communities adapted to the fluctuating water levels. Site rehabilitation will also occur which will create wildlife habitat, including habitat for Eastern Whip-poor-will in accordance with the conditions of the Overall Benefit Permit.

Accidents, Malfunctions and Unplanned Events could occur during the Decommissioning and Abandonment phase and may include spills associated with hazardous or contaminated materials, sedimentation or discharge of untreated mine effluent. Potential environmental effects associated with these events include impaired wildlife health, mortality and disturbance and habitat degradation. It is anticipated that these effects would be temporary through the implementation of appropriate mitigation measures and monitoring activities. All surface runoff will be contained and treated on-site through the waste water treatment facility and will remain in place throughout the Decommissioning and Abandonment phase.

Table 13-5: Environmental Effects Analysis; VC - Terrestrial Habitat; Project Phase - Decommissioning and Abandonment

Project Components or Activities	Potential Environmental Effects (A = adverse; B = beneficial)	Engineering Design, Mitigation Measures and Proven Environmental Management Practices	Factors Considered in the Environmental Effects Analysis*							
			Magnitude	Geographic Extent	Timing	Frequency	Duration	Reversibility	Ecological & Socio-economic Context	Certainty of Knowledge
Planned Activities										
Worker presence, vehicle or equipment operations, decommissioning and abandonment activities	(A) Disturbance to wildlife, avoidance of area, human-wildlife interactions.	Implement speed limits and install signage to advise of wildlife. All personnel and site visitors will remain within pre-determined work areas to minimize the extent of disturbance outside of the Victoria Mine Project.	2	3	1	2	5	1	2	1
	(A) Disturbance to species of special conservation status - WPWI, Blanding's Turtle, Snapping Turtle, Milksnake, Golden-winged Warbler, Canada Warbler, Common Nighthawk, Bald Eagle.	Adherence to *Endangered Species Act* permit requirements for WPWI (permit number SU-C-001-12). Species of special conservation status educational training and awareness will be provided to all personnel.	2	3	1	2	5	1	2	1
	(A) Incidental take of wildlife.	Implement speed limits and install signage to advise of wildlife. Adherence to Environment Canada timing windows for in-water works.	2	3	N/A	1	5	4	2	1
Removal of Ethel Lake Control structure and water taking infrastructure	(A) Disturbance to wildlife (aquatic mammals, reptiles or amphibians).	Adherence to DFO timing windows for in-water works. All personnel will be trained in appropriate wildlife interaction procedures.	2	3	N/A	2	5	1	2	1
	(A) Altered vegetation communities or wildlife habitat due to lowered water levels in Ethel Lake.	None required - vegetation communities will naturally regenerate to adapt to water levels.	2	2	N/A	4	6	1	2	1
	(B) Vegetation community or wildlife habitat creation at control structure footprint.	Creation of wildlife habitat through re-vegetation.	1	1	N/A	4	6	1	2	1
Management of contaminated water	(A) Disturbance to wildlife, temporary loss of wildlife habitat as a result of changes in surface water quality of local watercourses due to runoff of contaminated water.	Water management facilities will remain in place until chemical stability of the site is demonstrated through the monitoring program.	2	3	N/A	1	6	1	2	1
Accidents, Malfunctions and Unplanned Events										
Fuel and hazardous materials storage and handling	(A) Disturbance to wildlife, temporary loss of vegetation communities or wildlife habitat associated with soil or water contamination.	Adherence to waste and hazardous materials management procedures. Implementation of spill prevention and emergency response procedures.	2	3	N/A	1	5	1	2	1
Sedimentation	(A) Disturbance to wildlife, temporary loss of vegetation communities or wildlife habitat associated with water contamination.	Implementation of erosion and sediment control procedures.	2	3	N/A	1	5	1	2	1

Key: Magnitude: * 0 = Essentially no interaction 1 = Low, changes within regulated limits 2 = Moderate, changes near regulated limits 3 = High, changes exceed regulatory limits 4 = Unknown (see definitions in text, EA methods)	Geographic Extent: * 1 = Immediate work area 2 = Within Project closure plan boundary 3 = Within 5 km of Project closure plan boundary 4 = Beyond 5 km of Project closure plan boundary	Frequency: * 1 = Uncommon event, event occurs once or infrequently/periodically 2 = Happens regularly (e.g. daily) 3 = Happens regularly but infrequently (e.g., once or twice per month) 4 = Continuous activity	Duration: * 1 = < 1 month 2 = 1-2 months 3 = 2-6 months 4 = 6-24 months 5 = 2-11 years (life of mine) 6 = > 11 years (Beyond Project)	Reversibility: * 1 = High 2 = Medium 3 = Low 4 = nil 5 = Unknown (see definitions in the text, EA Methods)	Ecological and Socio-economic Context: * 1 = Relatively pristine area not adversely affected by human activity 2 = Evidence of existing adverse effects 3 = High level of existing adverse effects	Timing: * N/A – no sensitive periods or areas exist in baseline conditions 1 – sensitive periods or areas exist in baseline conditions that require adjustments to Project schedule or timing of activities	Certainty of Knowledge:* 1 = High – based on past performance and experience regarding environmental effects or mitigation 2 = Moderate – uncommon potential effect either not well understood or effects require compliance monitoring to modify engineering design or mitigation 3 = Low – potential for the need to follow-up based on results of compliance monitoring to modify engineering design or mitigation

13.2.4. Environmental Design, Mitigation and Optimization

The following environmental design features have been integrated into the Project to prevent or minimize adverse environmental effects on Terrestrial Habitat:

- The Project will include underground mining vs. open pit mining, which reduces above-ground physical disturbance;
- The Project has been sited to minimize vegetation clearing and earthworks and disturbance to drainage;
- Surface water run-off from the Project will be contained on-site and treated prior to release to the environment; and
- PAG 2 waste rock pad will be double lined with a leakage collection system located in the collection pond.

The following mitigation and environmental management initiatives will implemented during the various Project phases to prevent or minimize adverse environmental effects on Terrestrial Habitat:

- Compliance to all federal and provincial regulatory requirements and guidelines for wildlife and wildlife habitat (e.g., timing windows);
- Adherence to conditions outlined in the Overall Benefit Permit (SU-C-001-12) for Eastern Whip-poor-will, such as no grubbing or site clearing activities during the breeding season (between May 1 and August 31). The conditions outlined in the permit are in effect throughout the life of the Project; and
- An environmental management plan (see Chapter 5 – Sustainability Management) will be developed and best management practices followed for wildlife, noise, dust, water, waste, hazardous spills, erosion and sediment control and prevention. Mitigation will include, but is not limited to:
  - Restricting activities during sensitive breeding seasons (e.g., vegetation removal, noise effects);
  - Restricting the hours of off-site mine product and waste rock haulage;
  - Implementing on-site speed limits to minimize incidental take;
  - Wildlife education and awareness training for all staff;
  - Implementation of sediment and erosion control measures and ongoing monitoring to ensure proper functioning; and
  - Implementation of spill prevention and response measures and ongoing follow-up monitoring to ensure proper functioning.

13.3. Residual Environmental Effects

This section describes the residual (i.e., after mitigation) adverse environmental effects the Project might have on Terrestrial Habitat for each of the Project phases.

The following criteria, indicators and thresholds are used to rate the residual adverse environmental effects of the project on Terrestrial Habitat:

- A **significant** residual adverse environmental effect of the Project on Terrestrial Habitat occurs when there is a loss or avoidance of habitat supporting any species of special conservation status (either provincially or federally) to such an extent that regulatory permits, authorizations and approvals cannot be obtained to allow such an environmental effect and offset potential harm. Such habitat includes habitat for Eastern Whip-poor-will and Blanding's Turtle as well as provincially significant wetlands;
- A **not significant** residual adverse environmental effect of the Project on Terrestrial Habitat occurs when there is a potential loss or avoidance of habitat supporting any species of special conservation status (either provincially or federally) however regulatory permits, authorizations and approvals can be obtained to allow such an environmental effect and offset potential harm. Such habitat includes habitat for Eastern Whip-poor-will and Blanding's Turtle as well as provincially significant wetlands.

A summary of residual adverse environmental effects of the Project on the Terrestrial Habitat is provided in Table 13-6.

Table 13-6: Summary of Residual Environmental Effects – Terrestrial Habitat

Valued Component	Key Adverse Residual Environmental Effect	Significance[1]	Probability of Occurrence (Likelihood)[2]	Effect on Ecosystem Function and Integrity[2]	Sustainable (Capacity) Use of Renewable Resources[2]	Relevant Legislation[3]
Terrestrial Habitat						
Construction	Wildlife disturbance and mortality (e.g., avoidance of area, changes in behaviour and movement, vehicle collisions, human-wildlife interactions) and habitat loss and alteration.	Not significant	High	Low - Moderate	High	*ESA, 2007, SARA, Migratory Bird Convention Act (MBCA), Fish and Wildlife Conservation Act (FWCA)*
Operations	Wildlife disturbance and mortality (e.g., avoidance of area, changes in behaviour and movement, vehicle collisions, human-wildlife interactions) and habitat alteration.	Not significant	High	Moderate	High	*ESA, 2007, SARA, MBCA, FWCA*
Decommissioning and Abandonment	Wildlife disturbance and mortality (e.g., avoidance of area, changes in behaviour and movement, vehicle collisions, human-wildlife interactions).	Not significant	High	Low - Moderate	High	*ESA, 2007, SARA, MBCA, FWCA*
Accidents, Malfunctions and Unplanned Events	Wildlife disturbance and mortality (e.g., toxicity effects) and habitat degradation (wildlife displacement).	Not significant	Low	Moderate	High	*ESA, 2007, SARA, MBCA, FWCA*
Planned Project Overall	Wildlife disturbance and mortality (e.g., avoidance of area, changes in behaviour and movement, vehicle collisions, human-wildlife interactions) and habitat loss and alteration.	Not significant	High	Low	High	*ESA, 2007, SARA, MBCA, FWCA*
The Project in combination with other projects and activities	Increased instances of wildlife disturbance and mortality (e.g., avoidance of area, changes in behaviour and movement, vehicle collisions, human-wildlife interactions) and habitat loss and alteration.	Not significant	High	Low	High	*ESA, 2007, SARA, MBCA, FWCA*

Notes:
1. The rating of significance for adverse residual environmental effects are those predicted effects remaining after the application of mitigation.
2. Sustainability factors are described for all predicted adverse residual environmental effects.
3. Key federal legislation references as appropriate for relevant predicted adverse environmental effects.

13.3.1. Construction

Residual adverse environmental effects during Construction of the Project on Terrestrial Habitat may include wildlife disturbance and habitat loss.

Wildlife disturbance, through habitat avoidance, human-wildlife interactions and potential incidental take may occur due to noise during construction, worker presence, and increased traffic. Wildlife disturbance may occur throughout the duration of Construction.

Marginal loss of wildlife habitat and alterations may occur as a result of construction of the PAG 2 waste rock storage facility and associated haul road and Ethel Lake control structure footprint and associated 0.5 metre water level increase. Habitat loss may occur throughout the duration of the Project and restored during the decommissioning phase.

Through implementation of mitigation measures (e.g., adherence to sensitive breeding windows, speed limit restrictions, wildlife awareness training, environmental best management practices), it is expected that any potential effects to Terrestrial Habitat during Construction will be not significant.

13.3.2. Operations

Residual adverse environmental effects during Operations of the Project on Terrestrial Habitat may include wildlife disturbance and habitat alterations surrounding Ethel Lake due to water level management.

Wildlife disturbance, through habitat avoidance, human-wildlife interactions and potential incidental take may occur due to noise generated during operations, worker presence, and increased traffic. Wildlife disturbance may occur throughout the duration of the Operations phase. Wildlife disturbance and mortality at Ethel Lake is expected to be low during Operations due to reduced activity at the control structure. Traffic along the Ethel Lake control structure access road is expected to be low.

The fluctuating inundation area may result in minor changes to existing shoreline vegetation communities. It is anticipated that some tree and shrub loss of upland communities along the shoreline may become inundated; this may result in a marginal loss of edge habitat. Conversely, a marginal increase in wetland habitat may also occur, including potential changes to community structure associated with the shallow and meadow marshes.

Through implementation of mitigation measures (e.g., adherence to sensitive breeding windows, speed limit restrictions, wildlife awareness training, environmental best management practices), it is expected that any potential effects to Terrestrial Habitat during Operations will be not significant.

13.3.3. Decommissioning and Abandonment

Residual adverse environmental effects during Decommissioning and Abandonment of the Project on Terrestrial Habitat may include wildlife disturbance and changes to wildlife habitat.

Wildlife disturbance, through habitat avoidance, human-wildlife interactions and potential incidental take may occur due to noise generated during the Decommissioning and Abandonment phase, worker presence, and increased traffic.

Changes in wildlife habitat may occur due to removal of the Ethel Lake control structure and restoring the lake to its original water levels. A decrease in water level may result in changes to shoreline communities adapted to the fluctuating water levels. Site rehabilitation will also occur which will create wildlife habitat, including habitat for Eastern Whip-poor-will.

Through implementation of mitigation measures (e.g., adherence to sensitive breeding windows, speed limit restrictions, wildlife awareness training, environmental best management practices), it is expected that any potential effects to Terrestrial Habitat during Decommissioning and Abandonment will be not significant. Similar residual effects may occur during conditions of temporary closure.

13.3.4. Accidents, Malfunctions and Unplanned Events

Residual adverse environmental effects associated with Accidents, Malfunctions and Unplanned Events on Terrestrial Habitat during all Project phases, include wildlife disturbance and wildlife habitat degradation.

Wildlife disturbance and habitat degradation may occur through events such as accidental spills associated with hazardous materials or sedimentation, discharge of untreated mine effluent or failure of the Ethel Lake control structure. It is anticipated that these potential effects would be temporary with a low probability of occurrence.

Through implementation of mitigation measures (e.g., emergency response protocols, ongoing monitoring), it is expected that any effects to Terrestrial Habitat associated with Accidents, Malfunctions and Unplanned Events will be not significant.

13.3.5. Planned Project Overall

The Project may result in wildlife disturbance throughout the duration of the Project as it relates to noise and increased human activity. Effects to wildlife habitat are considered low due to the amount of available suitable habitat surrounding the Project. Habitat loss is also considered low due to the limited amount of vegetation removal and quality of habitat being removed. Habitat loss may occur during the Construction phase, with the exception of changes to shoreline communities surrounding Ethel Lake and the

associated 0.5 metre increase in water level. The Decommissioning and Abandonment phase will include a site rehabilitation plan to create wildlife habitat.

Overall, through implementation of mitigation measures, best management practices and ongoing monitoring, any potential effects to Terrestrial Habitat are considered to be not significant.

13.3.6. Cumulative Environmental Effects

Hunting, trapping and berry picking are typical activities within the environmental assessment area. The Project may include limited habitat loss and may result in wildlife disturbance throughout the duration of the Project. Cumulative environmental effects on Terrestrial Habitat may occur if other projects and activities such as historical mining, Advanced Exploration and permanent and seasonal residential activities (Chapter 2 – Existing Environment) result in wildlife being displaced from an area frequented by hunters or trappers.

The cumulative environmental effects on wildlife associated with hunting and trapping is expected to be low and therefore not significant due to the amount of available habitat within and the surrounding the environmental assessment area. Other activities considered in Chapter 2 – Existing Environment may result in cumulative environmental effects on Terrestrial Habitat that are considered to be not significant.

13.3.7. Monitoring and Follow-Up Program

FNX will have monitoring programs in place during Construction, throughout the Operations phase, during and post-Decommissioning and Abandonment. Monitoring will include regular compliance monitoring to ensure that all regulatory requirements are being met and that the mitigation measures identified in this document and the terms and conditions of any permits and approvals are being implemented and having the desired effect. This will include monitoring of items such as, but not limited to:

- Sediment and erosion control measures;
- Spill prevention and response measures;
- Compliance with in-water work and vegetation clearing timelines;
- Monitoring associated with Eastern Whip-poor-will in accordance with the Overall Benefit Permit (SU-C-001-12);
- Surface water quality from the waste water treatment plant is in accordance with the requirements of the Environmental Compliance Approval; and
- Water taking volumes from Ethel Lake are in accordance with provincial Permit to Take Water monitoring requirements.

There is a high degree of confidence associated with determining potential effects to Terrestrial Habitat, and with determining that there are no significant adverse

environmental effects. FNX has developed comprehensive management plans and procedures to mitigate any potential adverse environmental effects. As a result, a follow-up program is not required for the Terrestrial Habitat VC.

13.4. References and Appendices

- Bird Studies Canada. Ontario Breeding Bird Atlas. 2015. Atlas Data and Maps. Available from: http://www.birdsontario.org/atlas/atlasmain.html.
- Bird Studies Canada, 1995. Marsh Monitoring Program Protocol – Amphibian Surveys. Available from: http://www.bsc-eoc.org/volunteer/glmmp/index.jsp?targetpg=glmmpfrog&lang=EN.
- Casper, G., and S.J. Hecnar, 2011. Standard Operating Procedure for: Cover Board Surveys for Snakes in the Lake Superior Basin. Available from: http://flash.lakeheadu.ca/~shecnar/uploads/docs/LS_Cover_Object_SOP.pdf.
- Chambers, B. A., B. J. Naylor, J. Nieppola, B. Merchant, and P. Uhlig. 1997. Field Guide to Forest Ecosystems of Central Ontario.
- EcoTec. 2015. FNX Mining Victoria Site – Terrestrial and Wetland Survey – PAG 2. Final Report, 54 pp.
- EcoTec. 2013. FNX Mining Victoria Site – Terrestrial and Wetland Survey. Final Report, 111 pp.
- Environment Canada. 2015. Recovery Strategy for the Eastern Whip-poor-will (*Antrostomus vociferus*) in Canada [Proposed]. *Species at Risk Act* Recovery Strategy Series. Environment Canada, Ottawa. v + 59 pp.
- Golder Associates. 2004. Supplemental Terrestrial and Wetland Survey at the Victoria Mine Property.
- Golder Associates. 2003. Baseline Terrestrial Biological Study, Victoria Property, Denison Township, Ontario.
- Hatch, 2015. Waste Rock Stockpile Extension – Aquatic and Terrestrial Investigations. Prepared for KGHM International, Victoria Project, 29 pp.
- Lee, H.T., W.D. Bakowsky, J. Riley, J Bowles, M. Puddister, P. Uhlig and S. McMurray. 1998. Ecological Land Classification for Southern Ontario. Ministry of Natural Resources, Ontario.
- Ministry of Natural Resources, 2013. Occurrence Survey Protocol for Blanding's Turtle (*Emydoidea blandingii*) in Ontario. Ontario Ministry of Natural Resources, Species at Risk Branch. Peterborough, Ontario. ii + 17 pp.
- OMNR. 1993. Ontario Wetland Evaluation System, Northern Manual.
- Riverstone Environmental Solutions Inc. 2011. Existing Natural Features Report, Victoria Property, FNX Mining Company Inc. 45 pp.

- SARA Group. 2009. Sudbury Soils Study. Volume III: Ecological Risk Assessment. Available at: http://www.sudburysoilsstudy.com/EN/indexE.htm.
- Wester, M., P. Uhlig, W. Bakowsky, E. Banton. 2012. Great Lakes-St. Lawrence Ecosite Fact sheets (2nd draft).

Table of Contents – Chapter 14

14. Archaeological Resources 275

14.1. Existing Conditions 275
14.1.1. Ecological Boundaries – Spatial and Temporal 276
14.1.2. Administrative Boundaries 278
14.1.3. Technical Boundaries 278
14.1.4. Likely Future Conditions 278
14.2. Environmental Effects Analysis 278
14.2.1. Construction 278
14.2.2. Operations 281
14.2.3. Decommissioning and Abandonment 282
14.2.4. Environmental Design, Mitigation and Optimization 283
14.3. Residual Environmental Effects 283
14.3.1. Construction 286
14.3.2. Operations 286
14.3.3. Decommissioning and Abandonment 286
14.3.4. Accidents, Malfunctions and Unplanned Events 286
14.3.5. Planned Project Overall 286
14.3.6. Cumulative Environmental Effects 286
14.3.7. Monitoring and Follow-Up Program 286
14.4. References and Appendices 286

14. Archaeological Resources

As discussed in Chapter 7 – The Selection of Valued Components (VC), VCs such as Archaeological Resources have been identified as an area of focus in analyzing the effect of the Project on the environment in consideration of ground disturbance activities during which Archaeological Resources may be uncovered. Archaeological resources are considered to be a VC due to the important information that they reveal about past activities and land use as well as their intrinsic value. It is anticipated any potential effects to Archaeological Resources can be prevented through strict adherence to the recommendations of requisite archaeological assessments of the Project footprint as required under the *Ontario Heritage Act*.

FNX has reached formal agreements with each affected Indigenous community, including: Atikameksheng Anishnawbek First Nation, Sagamok First Nation, and Métis Nation of Ontario (Appendix B). The scope of these agreements includes provision for addressing any issues or concerns with Indigenous cultural heritage. The contents of these agreements are confidential and are not discussed herein.

14.1. Existing Conditions

Archeological sites found in the immediate Sudbury region, as well as significant finds are reported in published studies and the archaeological site database files of the Ministry of Tourism, Culture and Sport (MTCS). According to the Stage 1 Archaeological Assessment of the Victoria property there are no known archaeological sites found within 250 metres of the property boundary (Julig, St. Jean and Hawkins, 2010). This type of published data, relevant environmental information on potential resources and ecological settings, and use by historical and pre-contact Indigenous communities has informed archaeological site potential. The Ontario Archaeological Sites Database currently has approximately 20,000 documented sites in the province, and adds 800 to 1,000 new sites each year as a result of archaeological investigations (MTCS, 2016).

The history of the Victoria property is integral to the history of the Mond Nickel Company, which was first prospected in 1886. The historic site of Mond has since been removed and although the structures are gone, there is a substantial archaeological record of artifacts and features. Historical locations and features exist outside the old Mond town location, but within the proposed project boundary. These include features around Ethel Lake, such as the existing historic dam and the old station at the old station at the Algoma railroad. As the property was intensively used for several decades, there are suspected to be many unknown outlying historical archaeological remains that may be affected by ground disturbance required for the Project (Julig, St. Jean and Hawkins, 2010).

The majority of the Victoria property (beyond the historic site of Mond) has relatively low archaeological potential. While it is near permanent water features, the area is observed

to have few suitable sandy beaches being mostly rough and steep bedrock. Additionally, there is no evidence of eskers or similar sand or gravel features. The area does not contain any locations of known useable tool stones which contribute to the characterization of archaeological potential. There are some well-drained locations of moderate archaeological potential within the shorelines and 300 metre zone around Ethel and Mond Lakes, and Fairbanks Creek. Further archaeological assessment has been recommended in these areas (Julig, St. Jean and Hawkins, 2010).

The mouth of Ethel Lake was previously dammed, likely associated with early twentieth century mine operations. This historical dam is still in place. Lands required for water taking activities around Ethel Lake are located within a soil complex which includes well-drained sandy soils in some locations. Historic mapping indicates that these lands are also located in proximity to historic transportation routes, features and settlement. No previously registered archaeological sites are located within one kilometre of the environmental assessment area. However, a review of the geography and history of the environmental assessment area suggests potential for the identification of Indigenous and Euro-Canadian Archaeological Resources. Accordingly, further archaeological assessment is required in some areas. This will include, where possible, conducting test-pit surveys at five metre intervals prior to site disturbance, and visual inspection of lands considered to possess potential for petroglyphs/pictographs (ASI, 2015).

14.1.1. Ecological Boundaries – Spatial and Temporal

The spatial boundaries for Archaeological Resources are restricted to the Project footprint, which includes areas where ground disturbance is proposed as part of the Project (Figure 14-1).

The temporal boundary covers the period from 2024 to 2031 when ground disturbance will occur.

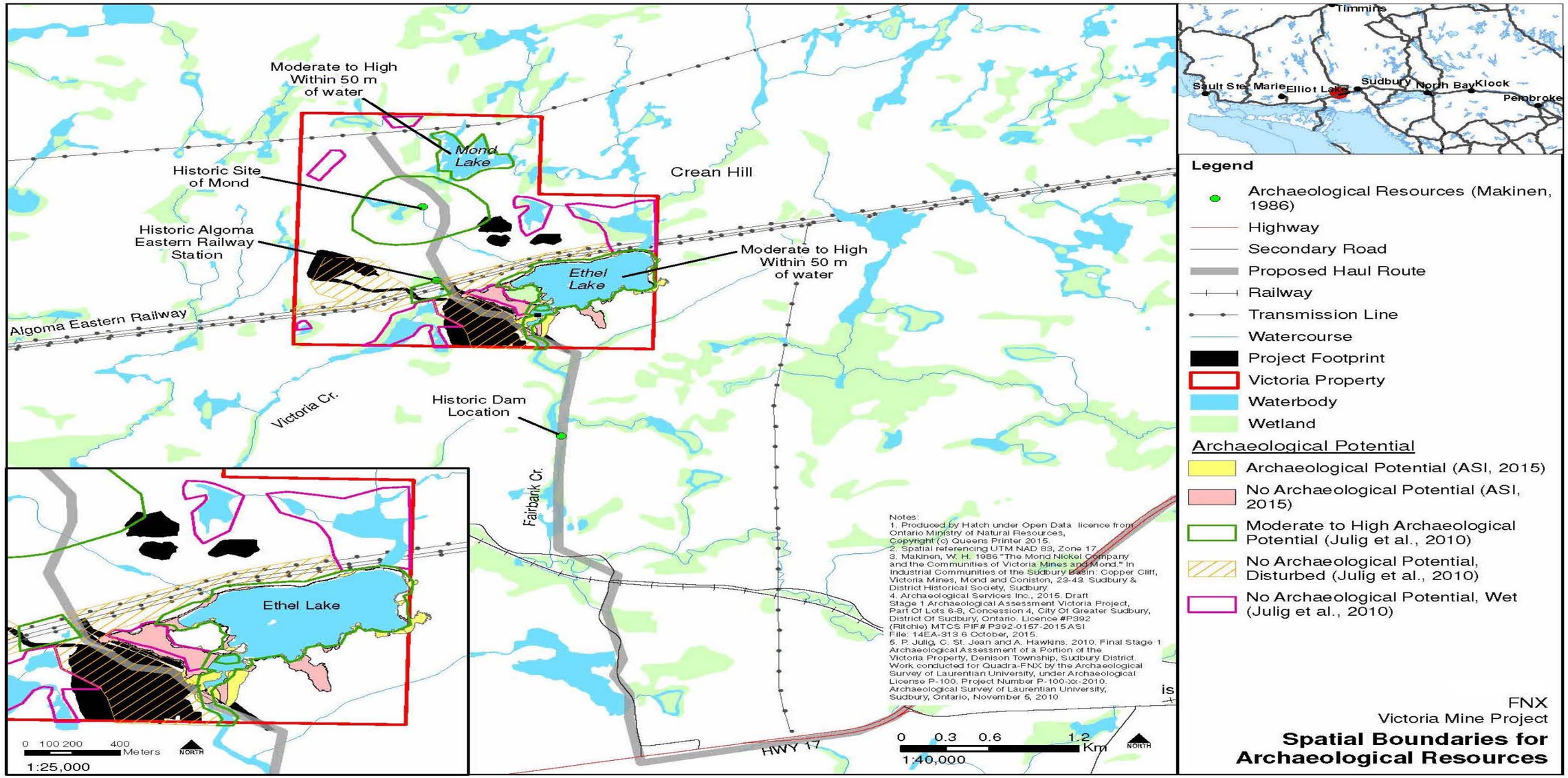

Figure 14-1: Spatial Boundaries for Archaeological Resources

14.1.2. Administrative Boundaries

Administrative boundaries include those of the *Ontario Heritage Act*, the *Funeral, Burial and Cremation Services Act*, and *CEAA 2012*. Discovery of previously undocumented Archaeological Resources may be subject to the *Ontario Heritage Act* and the person discovering the Archaeological Resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out archaeological fieldwork, in compliance with the *Ontario Heritage Act*. The *Funeral, Burial and Cremation Services Act* requires that any person discovering human remains must notify the police or coroner. *CEAA 2012* requires indirect assessment of environmental effects on Indigenous persons causing an effect on physical and cultural heritage.

14.1.3. Technical Boundaries

The assessment is based on the two Stage 1 Archaeological Assessments that have been completed for the Project. Stage 2 assessments have not yet been completed.

Notwithstanding the results and recommendations presented in the archaeological assessments prepared for the Project, no archaeological assessment, no matter how thorough or carefully completed, can necessarily predict, account for, or identify every form of isolated or deeply buried archaeological deposit.

14.1.4. Likely Future Conditions

It is anticipated that if the Project were not to proceed, that Archaeological Resources would remain undiscovered pending future ground disturbance activities.

14.2. Environmental Effects Analysis

14.2.1. Construction

During Construction, clearing, grubbing and earthworks may disturb unknown Archaeological Resources.

A detailed environmental effects analysis for Construction, including Accidents, Malfunctions and Unplanned Events, is provided in Table 14-1.

Table 14-1: Environmental Effects Analysis; VC – Archaeological Resources; Project Phase – Construction

Project Components or Activities	Potential Environmental Effects (A = adverse; B = beneficial)	Engineering Design, Mitigation Measures and Proven Environmental Management Practices	Factors Considered in the Environmental Effects Analysis*							
			Magnitude	Geographic Extent	Timing	Frequency	Duration	Reversibility	Ecological & Socio-economic Context	Certainty of Knowledge
Planned Activities										
Clearing, grubbing and earthworks on lands required for the water taking activity around Ethel Lake including a control structure located at the mouth of the Lake.	(A) Potential disturbance of Archaeological Resources.	Archaeological Services Inc.'s (ASI's) draft Stage 1 Archaeological Assessment of October 6, 2015 recommended a Stage 2 Archaeological Assessment (test-pitting and property survey) in areas surrounding Ethel Lake. Should the proposed work extend beyond the current study area, then further Stage 1 assessment must be conducted to determine the archaeological potential of the surrounding lands. Implement Project salvage procedures or chance finds procedures, as required.	1	1	N/A	1	4	4	2	1
Clearing, grubbing and earthworks on lands excluding those required for the water taking activity around Ethel Lake.	(A) Potential disturbance of Archaeological Resources.	Stage 2 Archaeological Assessment in the form of test-pitting is recommended. Survey mapping of the Project area (test-pitting and metal detector) is recommended to be used with historical mapping to assist with avoidance of high density artefacts and site features. Stage 2 archaeological survey is recommended to locate and map sensitive areas. Preferred mitigation is to avoid sites and features if possible prior to clearing areas for major development structures and features. Implement Project salvage procedures or chance finds procedures, as required.	1	1	N/A	1	5	4	2	1
Accidents, Malfunctions and Unplanned Events										
Discovery of Archaeological Resources (e.g., as a result of Project activities, flooding)	(A) Disturbance or destruction of Archaeological Resources.	No known archaeological sites or physical evidence of past human use or activity will be altered or removed until such a time that a license archaeologist has completed archaeological fieldwork, submitted a report to the MTCS and the report has been filed in the Ontario Public Register of Archaeology Reports. Should previously undocumented Archaeological Resources be discovered, they may be subject to the *Ontario Heritage Act*. The person discovering the Archaeological Resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out archaeological fieldwork, in compliance with the *Ontario Heritage Act.* The *Funeral, Burial and Cremation Services Act* requires that any person discovering human remains must notify the police or coroner. Implement Project salvage procedures or chance finds procedures, as required.	2	1	N/A	1	4	4	2	1

Key: Magnitude: * 0 = Essentially no archaeological sites affected 1 = Low, archaeological sites present but can be avoided 2 = Moderate, archaeological sites present (not of national importance) but can not be avoided; site salvage likely 3 = High, archaeological sites present (of national importance) but cannot be avoided; site salvage necessary	Geographic Extent: * 1 = Immediate work area 2 = Within Project closure plan boundary 3 = Within 5 km of Project closure plan boundary 4 = Beyond 5 km of Project closure plan boundary	Frequency: * 1 = Uncommon event, event occurs once or infrequently / periodically 2 = Happens regularly (e.g. daily) 3 = Happens regularly but infrequently (e.g., once or twice per month) 4 = Continuous activity	Duration: * 1 = < 1 month 2 = 1-2 months 3 = 2-6 months 4 = 6-24 months 5 = 2-11 years (life of mine) 6 = >11 years (beyond Project)	Reversibility: * 1 = High 2 = Medium 3 = Low 4 = nil 5 = Unknown (see definitions in the text, EA Methods)	Ecological and Socio-economic Context: * 1 = Relatively pristine area not adversely affected by human activity 2 = Evidence of existing adverse effects 3 = High level of existing adverse effects	Timing: * N/A – no sensitive periods or areas exist in baseline conditions 1 – sensitive periods or areas exist in baseline conditions that require adjustments to Project schedule or timing of activities	Certainty of Knowledge:* 1 = High – based on past performance and experience regarding environmental effects or mitigation 2 = Moderate – uncommon potential effects either not well understood or effects require compliance monitoring to modify engineering design or mitigation 3 = Low – potential for the need to follow-up based on results of compliance monitoring to modify engineering design or mitigation

14.2.2. Operations

There are no effects to Archaeological Resources anticipated during Operations.

A detailed environmental effects analysis for Operations, including Accidents, Malfunctions and Unplanned Events, is provided in Table 14-2.

Table 14-2: Environmental Effects Analysis; VC – Archaeological Resources; Project Phase – Operations

Project Components or Activities	Potential Environmental Effects (A = adverse; B = beneficial)	Engineering Design, Mitigation Measures and Proven Environmental Management Practices	Factors Considered in the Environmental Effects Analysis*							
			Magnitude	Geographic Extent	Timing	Frequency	Duration	Reversibility	Ecological & Socio-economic Context	Certainty of Knowledge
Accidents, Malfunctions and Unplanned Events										
Discovery of Archaeological Resources (e.g., as a result of Project activities, flooding)	(A) Disturbance or destruction of Archaeological Resources.	No known archaeological sites or physical evidence of past human use or activity will be altered or removed until such a time that a licensed archaeologist has completed archaeological fieldwork, submitted a report to the MTCS and the report has been filed in the Ontario Public Register of Archaeology Reports. Should previously undocumented Archaeological Resources be discovered, they may be subject to the *Ontario Heritage Act*. The person discovering the Archaeological Resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out archaeological fieldwork, in compliance with the *Ontario Heritage Act.* The *Funeral, Burial and Cremation Services Act* requires that any person discovering human remains must notify the police or coroner.	2	1	N/A	1	5	4	2	1

Key:

Magnitude: *
0 = Essentially no archaeological sites affected
1 = Low, archaeological sites present but can be avoided
2 = Moderate, archaeological sites present (not of national importance) but cannot be avoided; site salvage likely
3 = High, archaeological sites present (of national importance) but cannot be avoided; site salvage necessary

Geographic Extent: *
1 = Immediate work area
2 = Within Project closure plan boundary
3 = Within 5 km of Project closure plan boundary
4 = Beyond 5 km of Project closure plan boundary

Frequency: *
1 = Uncommon event, event occurs once or infrequently / periodically
2 = Happens regularly (e.g. daily)
3 = Happens regularly but infrequently (e.g., once or twice per month)
4 = Continuous activity

Duration: *
1 = < 1 month
2 = 1-2 months
3 = 2-6 months
4 = 6-24 months
5 = 2-11 years (life of mine)
6 = >11 years (beyond Project)

Reversibility: *
1 = High
2 = Medium
3 = Low
4 = nil
5 = Unknown (see definitions in the text, EA Methods)

Ecological and Socio-economic Context: *
1 = Relatively pristine area not adversely affected by human activity
2 = Evidence of existing adverse effects
3 = High level of existing adverse effects

Timing: *
N/A – no sensitive periods or areas exist in baseline conditions
1 – sensitive periods or areas exist in baseline conditions that require adjustments to Project schedule or timing of activities

Certainty of Knowledge:*
1 = High – based on past performance and experience regarding environmental effects or mitigation
2 = Moderate – uncommon potential effect either not well understood or effects require compliance monitoring to modify engineering design or mitigation
3 = Low – potential for the need to follow-up based on results of compliance monitoring to modify engineering design or mitigation

14.2.3. Decommissioning and Abandonment

There are no effects to Archaeological Resources anticipated during Decommissioning and Abandonment, nor during conditions of temporary closure.

A detailed environmental effects analysis for Decommissioning and Abandonment, including Accidents, Malfunctions and Unplanned Events, is provided in Table 14-3.

Table 14-3: Environmental Effects Analysis; VC – Archaeological Resources; Project Phase – Decommissioning and Abandonment

Project Components or Activities	Potential Environmental Effects (A = adverse; B = beneficial)	Engineering Design, Mitigation Measures and Proven Environmental Management Practices	Factors Considered in the Environmental Effects Analysis*							
			Magnitude	Geographic Extent	Timing	Frequency	Duration	Reversibility	Ecological & Socio-economic Context	Certainty of Knowledge
Accidents, Malfunctions and Unplanned Events										
Discovery of Archaeological Resources (e.g., as a result of Project activities, flooding)	(A) Disturbance or destruction of Archaeological Resources.	No known archaeological sites or physical evidence of past human use or activity will be altered or removed until such a time that a licensed archaeologist has completed archaeological fieldwork, submitted a report to the MTCS and the report has been filed in the Ontario Public Register of Archaeology Reports. Should previously undocumented Archaeological Resources be discovered, they may be subject to the *Ontario Heritage Act*. The person discovering the Archaeological Resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out archaeological fieldwork, in compliance with the *Ontario Heritage Act.* The *Funeral, Burial and Cremation Services Act* requires that any person discovering human remains must notify the police or coroner.	2	1	N/A	1	5	4	2	1

Key:	Geographic Extent: *	Frequency: *	Duration: *	Reversibility: *	Ecological and Socio-economic Context: *	Timing: *	Certainty of Knowledge:*
Magnitude: * 0 = Essentially no archaeological sites affected 1 = Low, archaeological sites present but can be avoided 2 = Moderate, archaeological sites present (not of national importance) but cannot be avoided; site salvage likely 3 = High, archaeological sites present (of national importance) but cannot be avoided; site salvage necessary	1 = Immediate work area 2 = Within Project closure plan boundary 3 = Within 5 km of Project closure plan boundary 4 = Beyond 5 km of Project closure plan boundary	1 = Uncommon event, event occurs once or infrequently/periodically 2 = Happens regularly (e.g. daily) 3 = Happens regularly but infrequently (e.g., once or twice per month) 4 = Continuous activity	1 = < 1 month 2 = 1-2 months 3 = 2-6 months 4 = 6-24 months 5 = 2-11 years (life of mine) 6 = >11 years (beyond Project)	1 = High 2 = Medium 3 = Low 4 = nil 5 = Unknown (see definitions in the text, EA Methods)	1 = Relatively pristine area not adversely affected by human activity 2 = Evidence of existing adverse effects 3 = High level of existing adverse effects	N/A – no sensitive periods or areas exist in baseline conditions 1 – sensitive periods or areas exist in baseline conditions that require adjustments to Project schedule or timing of activities	1 = High – based on past performance and experience regarding environmental effects or mitigation 2 = Moderate – uncommon potential effect either not well understood or effects require compliance monitoring to modify engineering design or mitigation 3 = Low – potential for the need to follow-up based on results of compliance monitoring to modify engineering design or mitigation

14.2.4. Environmental Design, Mitigation and Optimization

According to the Stage 1 Archaeological Assessment of the Project (Julig, St. Jean and Hawkins, 2010) the shorelines and 300 metre zone around Ethel Lake and Fairbanks Creek have well-drained locations of moderate archaeological potential and Stage 2 Archaeological Assessment in the form of test-pitting is recommended. Survey mapping of the Project area (test-pitting and metal detector) is recommended to be used with historical mapping to assist with avoidance of higher density concentrations of artifacts and site features. A Stage 2 archaeological survey is recommended to locate and map sensitive areas. Sites and other features will be avoided if possible before clearing areas for major development structures and features.

ASI's Draft Stage 1 Archaeological Assessment (October 2015) recommended a Stage 2 Archaeological Assessment (test-pitting and property survey) in areas surrounding Ethel Lake. Should the proposed work extend beyond the current archaeological assessment environmental assessment area, then a further Stage 1 assessment must be conducted to determine the archaeological potential of the surrounding lands.

Notwithstanding the results and recommendations presented in the archaeological assessments prepared for the Project, no archaeological assessment, no matter how thorough or carefully completed, can necessarily predict, account for, or identify every form of isolated or deeply buried archaeological deposit. In the event that unknown archaeological remains are found during subsequent Construction activities, the Project's salvage procedures or chance finds procedures will be implemented. No known archaeological sites or physical evidence of past human use or activity will be altered or removed until such a time that a license archaeologist has completed archaeological fieldwork, submitted a report to the MTCS and the report has been filed in the Ontario Public Register of Archaeology Reports. Should previously undocumented Archaeological Resources be discovered, they may be subject to the *Ontario Heritage Act* and the person discovering the Archaeological Resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out archaeological fieldwork, in compliance with the *Ontario Heritage Act*. The *Funeral, Burial and Cremation Services Act* requires that any person discovering human remains must notify the police or coroner.

14.3. Residual Environmental Effects

This section describes the residual adverse environmental effects the Project may have on Archaeological Resources. The following criteria have been developed to determine whether the residual adverse effects are determined to be significant:

A **significant** residual adverse effect of the Project on Archaeological Resources occurs when any party, other than a licensed archaeologist makes any alteration to a known archaeological site or previously undocumented site; or removes any artifact or other physical evidence of past human use or activity from the site, which is an offence under Sections 48 and 69 of the *Ontario Heritage Act*.

A **not significant** residual adverse effect of the Project on Archaeological Resources occurs when a licensed archaeologist makes an alteration to a known archaeological site or previously undocumented site; or removes any artifact or other physical evidence of past human use or activity from the site, in accordance with the *Ontario Heritage Act*.

A summary of the residual adverse environmental effects of the Project on Archaeological Resources is provided in Table 14-4.

Table 14-4: Summary of Residual Environmental Effects – Archaeological Resources

Valued Component	Key Adverse Residual Environmental Effect	Significance[1]	Probability of Occurrence (Likelihood)[2]	Effect on Ecosystem Function and Integrity[2]	Sustainable (Capacity) Use of Renewable Resources[2]	Relevant Legislation[3]
Construction	Potential disturbance of Archaeological Resources through chance finds or unplanned events.	Not significant	Low	Unknown	Unknown	*Ontario Heritage Act* *CEAA 2012*
Operations	No adverse residual environmental effects are anticipated during Operations.	N/A	N/A	N/A	N/A	N/A
Decommissioning and Abandonment	No adverse residual environmental effects are anticipated during Decommissioning and Abandonment.	N/A	N/A	N/A	N/A	N/A
Accidents, Malfunctions and Unplanned Events	Potential disturbance or destruction of Archaeological Resources through chance finds or unplanned events.	Not Significant	Low	Unknown	Unknown	*Ontario Heritage Act* *CEAA 2012*
Planned Project Overall	Potential disturbance or destruction of Archaeological Resources through chance finds or unplanned events.	Not Significant	Low	Unknown	Unknown	*Ontario Heritage Act* *CEAA 2012*
The Project in combination with other projects and activities	The Project, in combination with other projects and activities causing ground disturbance, may result in increased potential disturbance or destruction of Archaeological Resources through chance finds or unplanned events.	Not Significant	Low	Unknown	Unknown	*Ontario Heritage Act* *CEAA 2012*

Notes:
1. *The rating of significance for adverse residual environmental effects are those predicted effects remaining after the application of mitigation.*
2. *Sustainability factors are described for all predicted adverse residual environmental effects.*
3. *Key federal legislation references as appropriate for relevant predicted adverse environmental effects.*

14.3.1. Construction

Clearing, grubbing and earthworks on lands required for the water taking activity around Ethel Lake (including a dam located at the mouth of the Lake) or on other lands within the Project footprint have the potential to disturb archaeological resources. There are no known sites within the Project footprint. Stage 2 Archaeological Assessments will be performed, as required, to identify and map sensitive areas. The residual adverse effect is considered to be not significant.

14.3.2. Operations

There are no adverse residual environmental effects anticipated during Operations.

14.3.3. Decommissioning and Abandonment

There are no adverse residual environmental effects anticipated during Decommissioning or Abandonment, nor during conditions of temporary closure.

14.3.4. Accidents, Malfunctions and Unplanned Events

Unintended discovery of Archaeological Resources may result in their disturbance or destruction. This residual adverse effect would be considered not significant.

14.3.5. Planned Project Overall

Unintended discovery of Archaeological Resources could result in their disturbance or destruction. This residual adverse effect would be considered not significant.

14.3.6. Cumulative Environmental Effects

The Project may result in cumulative residual effects to Archaeological Resources, as other projects and activities such as historical mining, Advanced Exploration and permanent and seasonal residential activities (Chapter 2 – Existing Environment) may also disturb or destroy Archaeological Resources. However, the cumulative environmental effects to Archaeological Resources is considered to be not significant.

14.3.7. Monitoring and Follow-Up Program

There is a high degree of confidence associated with determining potential effects to Archaeological Resources, and with determining that there are no significant adverse environmental effects. FNX has developed comprehensive management plans and procedures to mitigate any potential adverse environmental effects. As a result, a follow-up program is not required for the Archaeological Resources VC.

14.4. References and Appendices

- Archaeological Services Inc., 2015. Draft Stage 1 Archaeological Assessment Victoria Project, Part Of Lots 6-8, Concession 4, City Of Greater Sudbury (Former Township Of

Denison, Algoma District), District Of Sudbury, Ontario Original Report Prepared For Hatch Ltd., 4342 Queen Street, Suite 500, Niagara Falls, ON, L2E 7J7. Archaeological Licence #P392 (Ritchie) Ministry of Tourism, Culture and Sport PIF# P392-0157-2015 ASI File: 14EA-313 6 October, 2015.

- Ministry of Tourism, Culture and Sport. 2016. Archaeology. Available online at: http://www.mtc.gov.on.ca/en/archaeology/archaeology.shtml. Accessed on February 25, 2016.
- P. Julig, C. St. Jean and A. Hawkins, 2010. Final Stage 1 Archaeological Assessment of a Portion of the Victoria Property, Denison Township, Sudbury District. Work conducted for Quadra-FNX by the Archaeological Survey of Laurentian University, under Archaeological License P-100. Archaeological Survey of Laurentian University Sudbury, Ontario November 5, 2010.

Table of Contents – Chapter 15

15. Residents and Recreational Land Use 289

15.1. Existing Conditions 289
15.1.1. Ecological Boundaries – Spatial and Temporal 292
15.1.2. Administrative Boundaries 293
15.1.3. Technical Boundaries 293
15.1.4. Likely Future Conditions 293
15.2. Environmental Effect Analysis 293
15.2.1. Construction 294
15.2.2. Operations 296
15.2.3. Decommissioning and Abandonment 299
15.2.4. Environmental Design, Mitigation and Optimization 299
15.3. Residual Environmental Effects 302
15.3.1. Construction 304
15.3.2. Operations 304
15.3.3. Decommissioning and Abandonment 304
15.3.4. Accidents, Malfunctions and Unplanned Events 304
15.3.5. Planned Project Overall 304
15.3.6. Cumulative Environmental Effects 305
15.3.7. Monitoring and Follow-Up Program 305
15.4. References and Appendices 305

15. Residents and Recreational Land Use

As discussed in Chapter 7 – The Selection of Valued Components (VC), Residents and Recreational Land Use (Indigenous land use has been addressed separately) has been identified as Valued Component because of potential effects to local residents and use of the land around Project. Potential concerns have been identified by stakeholders and continue to be anticipated based on experience to date through Exploration and Advanced Exploration activities and the previous permitting processes. These concerns include permanent and seasonal residents' vulnerability to changes in noise, vibration and air quality; nearby groundwater and surface water users; safe driving conditions for both automobile and snowmobile users; land use for recreational activities. It is anticipated any effects to Residents and Recreational Land Use can be adequately managed and monitored through the implementation of proven mitigation measures such as air quality monitoring, surface and groundwater sampling and testing and traffic management planning supplemented by a commitment to continually improve on accepted practices as appropriate.

15.1. Existing Conditions

The Project is in central Ontario, approximately 30 kilometres southwest of the City of Greater Sudbury, within Denison Township, approximately 400 kilometres north of Toronto, Ontario. Primary access is provided by Regional Road #4 (formerly Hwy. 658), which runs north from Highway 17.

The Victoria Property is comprised of over 500 hectares of mining rights contained in four contiguous patented parcels and one patented instrument. The surface rights tenure for the Victoria property is comprised of five contiguous registered parcels. Vale, and to a minor extent Carman Construction, own the surface rights of the Victoria Property. The property is zoned M4 – Mining Industrial by the City of Greater Sudbury.

Local Land Use

The Victoria property is located in a very accessible and active area. Regional Road #4 and Fairbank East Road are all-weather roads that provide access to the community of Worthington and to the temporary and permanent residents at Fairbank Lake.

The Fairbank Lake area has approximately 94 permanent and 323 seasonal/recreational residents with approximately 57 permanent and 180 seasonal/recreational dwellings, the closest of which is located approximately two kilometres north of the Property. Fairbank Provincial Park is located on the west side of Fairbank Lake hosting campsites, a boat launch and beaches. The Fairbank Lake Resort is also located on the lake, and is accessible via Fairbank East Road. Fairbank Lake is not serviced by city water or sewage (City of Greater Sudbury, Undated).

The Property hosts wilderness areas that may be used for recreational purposes such as fishing, hunting, berry picking and snowmobiling. Figure 15-1 presents known buildings and residences in the vicinity of the Project, as well as the location of the Victoria Property and proposed haul route in proximity to local roads, highways, railways, snowmobile trails, other trails and reserve lands.

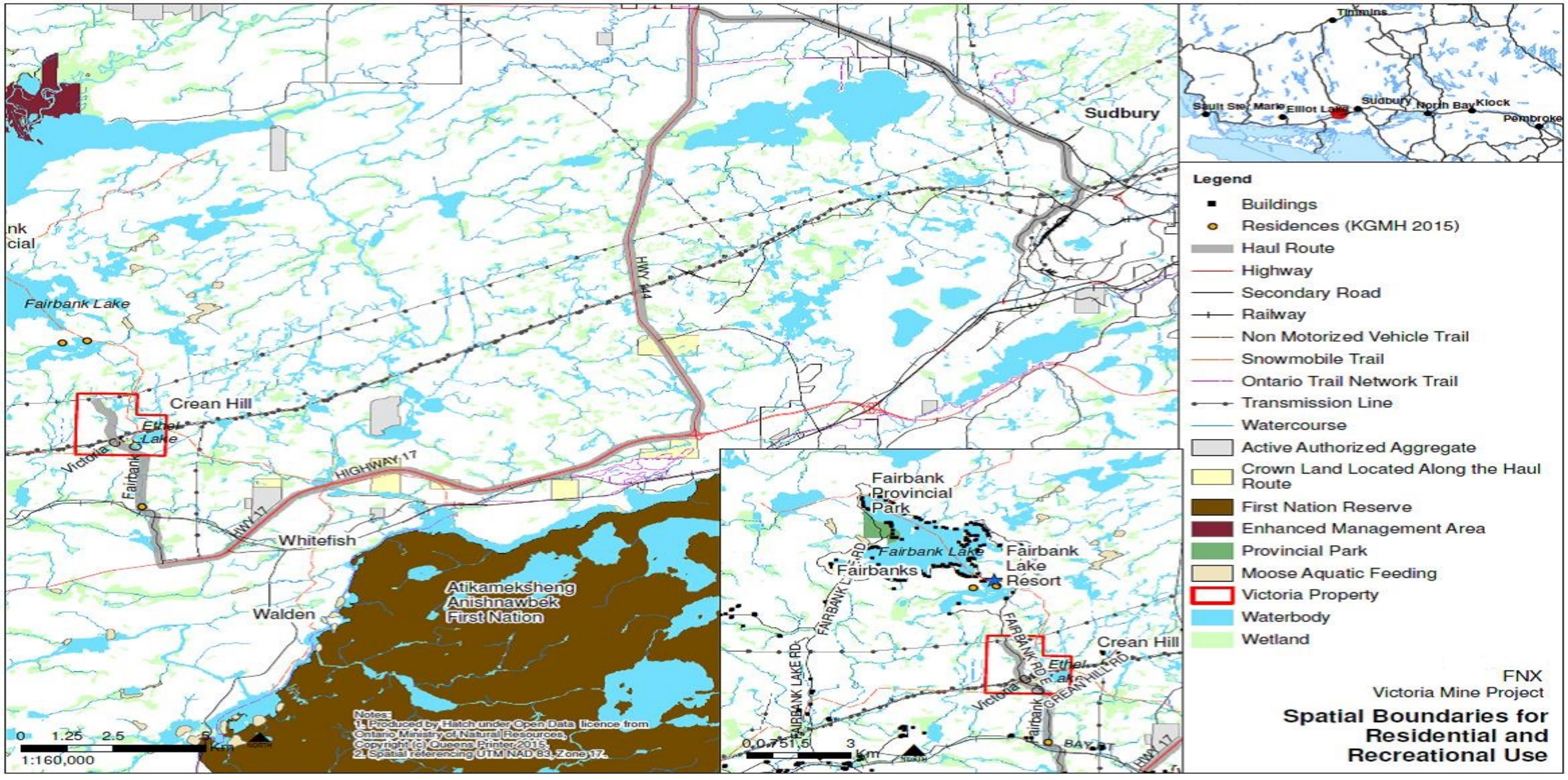

Figure 15-1: Spatial Boundaries for Residential and Recreational Land Use

Nearly all of the land within the Project site (including along the proposed haul route) is held under private ownership.

Local Roads and Highways

The proposed haul route will exit south from the Victoria property along the road known as Fairbanks East Road to Crean Hill Road, then to MR4 (also known as Fairbanks Lake Road), then to Highway 17 (provincially maintained) east and on to Ontario Highway 144 to MR35 to Clarabelle Road.

The Fairbank Lake area is located approximately two kilometres north of the Victoria property. Access to the area is obtained via two road routes, one of which is Fairbanks East Road. The other route is located west of the property, via MR4 (Fairbank Lake Road).

Recreation

Recreational activities including fishing, hunting, trapping, berry picking and snowmobiling are known to occur on the Victoria property. As illustrated in Figure 15-1, there is an OFSC snowmobile trail which bisects the Victoria property. This trail is part of the Sudbury Trail Plan which is operated with the City of Greater Sudbury and has eight associated clubs that support the trail system. The trails within the property are maintained by the Walden Sno Runners, located in Lively, Whitefish, Worthington and Naughton (Sudbury Trail Plan, Undated).

Land Use and the Sudbury Soils Study

As discussed in Section 7.1 – Important Project Planning Context Elements in the Selection of Valued Components, the Sudbury Soils Study has been fully considered in contemplating the effects of mining and minerals processing within the Sudbury Basin, including the Project site. The findings of study generally concluded that while there are elevated levels of chemicals of concern such as nickel and copper within plant communities, little risk of health effects to area residents is expected. In addition, anglers, hunters and other communities (such as Indigenous communities) who may consume greater amounts of local wild game and fish are at no greater risk than the general population (SARA Group, 2008).

15.1.1. Ecological Boundaries – Spatial and Temporal

The spatial boundary for Residents and Recreational Land Use is restricted to the perimeter of the Project Site, and along the proposed haul route. This boundary was selected due to the potential for effects to residents and recreational lands users adjacent to this area, and along the length of the 55 kilometre haul route between the Project and Vale's Clarabelle Mill in Copper Cliff, ON.

The temporal boundary covers the period between 2024 and 2045.

15.1.2. Administrative Boundaries

The administrative boundaries for the Residents and Recreational Land Use effects assessment include the City of Greater Sudbury.

According to the Greater Sudbury Official Plan, the land use designation of the Victoria property is identified to be for Mining/Mineral Reserve, with areas along the proposed haul route designated as Parks, Living Area (I), Mixed Use Commercial and General Industrial (City of Greater Sudbury, 2015).

According to the Zoning By-Law (2010-100Z enacted September 29, 2010 and last updated on December 2, 2015) for the City of Greater Sudbury, the Victoria property is zoned M4 – Mining Industrial, with areas along the proposed haul route zoned RU - Rural; RS - Rural Shoreline, and P - Park (MR4 (Fairbank Lake Road)); R – Residential, M5 – Extractive Industrial, OSC – Open Space Conservation, P – Park, OSR – Open Space Recreation, C7 – Resort Commercial, M2 – Light Industrial, FD – Future Development, C5 – Shopping Centre Commercial, M1- Mixed Light Industrial / Service Commercial and RU – Rural (Highway 17, 144 and MR35).

The Greater Sudbury Source Water Protection Plan is designed to protect existing and future sources of municipal drinking water under the *Clean Water Act*, *2006*, and accompanying regulations. The Property is located outside of the source water protection area (Nickel District Conservation Authority, 2014).

15.1.3. Technical Boundaries

Data gathering efforts were primarily focused on desktop research of publicly available information, including municipal, provincial and federal government web-based sources. Baseline information has also been gathered from meetings, open houses, and conversations with the public, government bodies, and Indigenous communities (Appendix A and Appendix B). There were no interviews or community surveys conducted as part of this research.

15.1.4. Likely Future Conditions

It is anticipated that if the Project were not to proceed, recreational uses of the property, as well as nearby residential land use would continue, subject to restrictions and interactions associated with Exploration and Advanced Exploration activities.

15.2. Environmental Effect Analysis

Given the use and enjoyment of property is closely tied to the condition of the physical environment, issues affecting local residents and recreational users correlate with adverse effects to other VCs such as the atmospheric environment, surface water quality, fish and fish habitat, terrestrial environment and groundwater quantity as these

act to effect pathways. This effects analysis is informed and supported by the following relevant models:

- Noise modeling;
- Air quality dispersion modeling; and
- Predictive water quality modelling.

In addition, effects to community services and infrastructure including local and regional roadways has the potential to adversely affect residents and recreational lands users and must be considered.

15.2.1. Construction

During construction activities the access to areas used for recreational activities such as hunting and fishing may be limited. A Gatehouse at the entrance to the site from Fairbank East Road will be modular and moved as required.

Access to Ethel Lake will not be restricted by fencing and access, with the exception of restricted areas during the construction of the Ethel Lake water control structure and pumphouse. Access to existing snowmobile trails will be provided.

The operation of construction equipment and vehicles both on-site and on local roadways may result in adverse effects to the use and enjoyment of neighbouring residential properties and recreational areas due to emissions (air and noise) to the atmospheric environment.

Construction traffic has the potential to alter established traffic patterns, particularly for residents that use roadways between the Project and Clarabelle Mill (i.e. Crean Hill Road, Fairbanks East Road, Fairbanks Lake Road (MR4), Highway 17, and Highway 144). There will be additional volume on the road during Construction. There may be resulting delays in traffic on regional public roads due to construction activities as well as increased risk to public safety correlating with the increase in traffic.

Water use and management during Construction has the potential to cause adverse effects to neighbouring residents and recreational users as a result of changes to the availability of surface and groundwater. In addition, there are potential adverse effects to neighbouring residents and recreational users as a result of changes to the quality of surface water, groundwater and soils.

Potential adverse effects of the Project on Residents and Recreational Land Use as a result of accidents, malfunctions and unplanned events during Construction includes the risk of fuel spills or forest fire.

Table 15-1: Environmental Effects Analysis; VC - Residential and Recreational Land Use; Project Phase - Construction

Project Components or Activities	Potential Environmental Effects (A = adverse; B = beneficial)	Engineering Design, Mitigation Measures and Proven Environmental Management Practices	Factors Considered in the Environmental Effects Analysis*							
			Magnitude	Geographic Extent	Timing	Frequency	Duration	Reversibility	Ecological & Socio-economic Context	Certainty of Knowledge
Planned Activities										
Site access restriction	(A) Incremental limiting of access to areas used for recreational activities.	Access to existing snowmobile trails will continue; Access to Ethel Lake will not be restricted by fencing.	2	1	N/A	4	5	1	2	1
Operation of construction equipment and vehicles, onsite and on local roadways	(A) Effects to the use and enjoyment of neighbouring residential properties and recreational areas due to changes in atmospheric environment.	Dust suppression, regular inspection and maintenance of vehicles, adherence to conditions of permit, enclosed buildings, implementation of Fugitive Dust Management Plan. Noise limits as specified in the ECA-Air permit will be met.	2	4	N/A	3	5	1	2	1
Construction traffic on local roadways	(A) Risks to public safety.	Roadway design and upgrades to meet *Highway Traffic Act* requirements for level of service Use flagmen as required to ensure that traffic on access roads is controlled. Construction vehicles will be driven in a proper manner and respect all traffic laws, regulations, and company policies.	2	4	N/A	3	5	1	2	1
Water use and management	(A) Effects to neighbouring residents and recreational users as a result of changes to the availability of surface water and groundwater.	The use of surface water and groundwater resources will be managed in accordance with the permit to take water. Groundwater monitoring will be carried out to monitor water levels.	2	3	N/A	1	5	1	2	1
Management of hazardous waste and contaminated water	(A) Effects to neighbouring residents and recreational users as a result of changes in the quality of surface water, groundwater, and soils.	Hazardous waste storage areas will be lined or fully contained. Contaminated water will be collected and treated to meet provincial and federal requirements and either returned to the process or discharged in accordance with permit requirements. Baseline surface water quality monitoring will continue and a long-term biological monitoring plan will be implemented per the ECA-Industrial Sewage Works permit requirements. *MMER* requirements will be met.	2	3	N/A	1	5	1	2	1
Accidents, Malfunctions and Unplanned Events										
Fuel spills	(A) Effects to neighbouring residents and recreational users as a result of soil, surface water or groundwater contamination.	Implement spills management and emergency response procedures.	2	3	N/A	1	4	1	2	1
Traffic accidents	(A) Risk to public safety.	Implement emergency response procedures.	2	4	N/A	1	4	3	2	1
Forest fire	(A) Risk to public safety. (A) Damage to neighbouring residential properties and recreational areas.	Implement emergency response procedures.	1	4	N/A	1	4	1	2	1

Key:

Magnitude: *
0 = High
1 = Medium
2 = Low
3 = nil
4 = Unknown (see definitions in text, EA methods)

Geographic Extent: *
1 = Immediate work area
2 = Within Project closure plan boundary
3 = Within 5 km of Project closure plan boundary
4 = Beyond 5 km of Project closure plan boundary

Frequency: *
1 = Uncommon event, event occurs once or infrequently / periodically
2 = Happens regularly (e.g. daily)
3 = Happens regularly but infrequently (e.g., once or twice per month)
4 = Continuous activity

Duration: *
1 = < 1 month
2 = 1-2 months
3 = 2-6 months
4 = 6-24 months
5 = 2-11 years (life of mine)
6 = > 11 years (beyond Project)

Reversibility: *
1 = High
2 = Medium
3 = Low
4 = nil
5 = Unknown (see definitions in the text, EA Methods)

Ecological and Socio-economic Context: *
1 = Relatively pristine area not adversely affected by human activity
2 = Evidence of existing adverse effects
3 = High level of existing adverse effects

Timing: *
N/A – no sensitive periods or areas exist in baseline conditions
1 – sensitive periods or areas exist in baseline conditions that require adjustments to Project schedule or timing of activities

Certainty of Knowledge:*
1 = High – based on past performance and experience regarding environmental effects or mitigation
2 = Moderate – uncommon potential effect either not well understood or effects require compliance monitoring to modify engineering design or mitigation
3 = Low – potential for the need to follow-up based on results of compliance monitoring to modify engineering design or mitigation

15.2.2. Operations

There may be an incremental limiting of access to areas used for recreational activities such as snowmobiling, hunting and fishing during Operations.

Access to Ethel Lake will not be restricted by fencing. Water level management and inundation of areas surrounding Ethel Lake may result in an incremental loss of area for fishing, however this is not anticipated to affect the level of use. Access to existing snowmobile trails will continue.

The operation of the combustion engines of equipment and vehicles both on-site and on local roadways may result in effects to the use and enjoyment of neighbouring residential properties and recreational areas due to emissions (air and noise) to the atmospheric environment.

Project traffic has the potential to alter established traffic patterns, particularly for residents that use roadways between the Project and Clarabelle Mill (i.e. Crean Hill Road, Fairbanks East Road, Fairbanks Lake Road (MR4), Highway 17, and Highway 144). There will be additional volume on the road during Operations. Accordingly, there may be resulting delays in traffic on regional public roads due to Project activities and a correlating increased risk to public safety.

Water use and management during Operations has the potential to cause adverse effects to neighbouring residents and recreational users as a result of changes to the availability of surface and groundwater. In addition, there are potential adverse effects to neighbouring residents and recreational users as a result of changes to the quality of surface water, groundwater and soils. Also, as discussed in Chapter 10 – Surface Water Quality, a localized increase in mercury levels may occur because of the inundation of Ethel Lake and as a result, mercury concentrations may increase in Ethel Lake and potentially, Fairbank Creek, throughout the duration of the Project, resulting in potential increases in fish tissue mercury concentrations.

Potential adverse effects of the Project on Residents and Recreational Land Use as a result of accidents, malfunctions and unplanned events during Operations include a risk to neighbouring residents and recreational users as a result of fuel spills or forest fire.

Table 15-2: Environmental Effects Analysis; VC - Residential and Recreational Land Use; Project Phase - Operations

Project Components or Activities	Potential Environmental Effects (A = adverse; B = beneficial)	Engineering Design, Mitigation Measures and Proven Environmental Management Practices	Factors Considered in the Environmental Effects Analysis*							
			Magnitude	Geographic Extent	Timing	Frequency	Duration	Reversibility	Ecological & Socio-economic Context	Certainty of Knowledge
Planned Activities										
Site access restriction	(A) Continued limiting of access to areas used for recreational activities (i.e. snowmobiling, hunting, fishing, etc.).	Access to existing snowmobile trails will continue; Access to Ethel Lake will not be restricted by fencing.	2	1	N/A	4	5	1	3	1
Operation of equipment and vehicles, onsite and on local roadways	(A) Effects to the use and enjoyment of neighbouring residential properties and recreational areas due to changes in atmospheric environment.	Dust suppression, regular inspection and maintenance of vehicles, adherence to conditions of permit.	2	4	N/A	3	5	1	2	1
Operations traffic on local roadways, especially mine haul trucks	(A) Risks to public safety.	Roadway design and upgrades to meet *Highway Traffic Act* requirements for level of service. All vehicles (especially mine haul trucks) will be driven in a proper manner and respect all traffic laws, regulations, and company policies. Installation of additional traffic lights for increased public safety.	2	4	N/A	3	5	1	2	1
Water use and management, especially water consumption for backfill plant.	(A) Changes to the availability of surface water and groundwater for residential and recreational use.	The use of surface water and groundwater resources will be managed in accordance with the permit to take water.	2	4	N/A	1	5	1	2	1
Management of hazardous waste and contaminated water	(A) Changes in the quality of surface water, groundwater, and soils affecting residential and recreational use.	Hazardous waste storage areas will be lined or fully contained, including potentially acid generating waste rock storage areas. Contaminated water will be collected and treated to meet provincial and federal requirements (*MMER)* and either returned to the process or discharged in accordance with permit requirements.	2	4	N/A	1	5	3	2	1
Water level and flow management on Ethel Lake (flooding of inundation area)	(A) Mercury generation in inundated areas causing increases in fish tissue mercury concentration and corresponding decreases in recommended consumption.	Woody vegetation within the proposed inundation area will be removed as necessary to reduce the amount of organic matter/carbon that will be subject to decomposition. Advisory programs including for fish consumption may be implemented as necessary.	2	2	N/A	4	5	2	2	1
Accidents, Malfunctions and Unplanned Events										
Fuel and hazardous material spills	(A) Soil, surface water or groundwater contamination affecting residential and recreational use.	Implement spills management and emergency response procedures.	2	4	N/A	1	5	3	2	1
Traffic accidents	(A) Risk to public safety.	Implement emergency response procedures.	2	4	N/A	1	5	3	2	1
Forest fire	(A) Risk to public safety. Damage to neighbouring residential properties and recreational areas.	Implement emergency response procedures.	1	4	N/A	1	5	1	2	1

Key: Magnitude: * 0 = High 1 = Medium 2 = Low 3 = nil 4 = Unknown (see definitions in text, EA methods)	Geographic Extent: * 1 = Immediate work area 2 = Within Project closure plan boundary 3 = Within 5km of Project closure plan boundary 4 = Beyond 5 km of Project closure plan boundary	Frequency: * 1 = Uncommon event, event occurs once or infrequently / periodically 2 = Happens regularly but infrequently (e.g., once or twice per month) 3 = Happens regularly (e.g. daily) 4 = Continuous activity	Duration: * 1 = < 1 month 2 = 1-2 months 3 = 2-6 months 4 = 6-24 months 5 = 2-11 years (life of mine) 6 = > 11 years (beyond Project)	Reversibility: * 1 = High 2 = Medium 3 = Low 4 = nil 5 = Unknown (see definitions in the text, EA Methods)	Ecological and Socio-economic Context: * 1 = Relatively pristine area not adversely affected by human activity 2 = Evidence of existing adverse effects 3 = High level of existing adverse effects	Timing: * N/A – no sensitive periods or areas exist in baseline conditions 1 – sensitive periods or areas exist in baseline conditions that require adjustments to Project schedule or timing of activities	Certainty of Knowledge:* 1 = High – based on past performance and experience regarding environmental effects or mitigation 2 = Moderate – uncommon potential effect either not well understood or effects require compliance monitoring to modify engineering design or mitigation 3 = Low – potential for the need to follow-up based on results of compliance monitoring to modify engineering design or mitigation

15.2.3. Decommissioning and Abandonment

During Decommissioning and Abandonment the same affects as discussed above are applicable during Decommissioning and Abandonment in addition to other, different effects.

Decommissioning and Abandonment activities have the potential to alter established traffic patterns from existing. During Decommissioning and Abandonment, volumes will be reduced from those experienced during Construction and Operations, but will still be more than existing baseline. There may be resulting delays in traffic on regional public roads and a correlating increased risk to public safety.

15.2.4. Environmental Design, Mitigation and Optimization

Many of the environmental design, mitigation and optimization features required for compliance with applicable regulatory requirements will already be in place prior to commencement of Construction due to their necessity during Advanced Exploration. The following sections describe these features. It is expected that in meeting the regulatory requirements for protection of the physical environment (such as those relevant to air or noise emissions and waste water discharge) will mitigate potential adverse effects beyond the footprint of the Project (i.e. at neighbouring residential and recreational properties).

Potential adverse effects to the atmospheric environment will be mitigated through dust control measures (e.g. solutions applied to roads and spraying of stockpiles and transfer stations, building enclosures for crushing equipment with baghouse), regular equipment maintenance and dust control systems as required, enclosure of equipment in buildings, limiting the speed limit on site, and use of silencers and acoustical insulation. Expected emissions will be compliant with applicable permit and approval requirements.

The local roadway has been upgraded to meet *Highway Traffic Act* requirements for level of service, and to ensure any potential adverse effects are minimized. Construction and operations vehicles (especially mine product haul trucks) will be driven in a proper manner and respect all traffic laws, regulations, and company policies. Ore, fuel and other trucks will not operate during school bus hours, resulting in 14 hours of active trucking per day.

Water quality and availability for downstream users and other residents will be protected through a number of mitigation measures, including: a waste water treatment plant that will treat all effluent to meet existing permit requirements (i.e. provincial water quality standards) and *MMER* requirements; collection and treatment of surface water runoff (including runoff from PAG rock storage areas), as required, before being discharged to Fairbank Creek; secondary containment for hazardous liquids, such as chemicals, fuels and lubricants; domestic sewage will be treated before subsurface

discharge; and monitoring of groundwater wells for potential adverse effects to quality and availability.

Table 15-3: Environmental Effects Analysis; VC - Residential and Recreational Land Use; Project Phase - Decommissioning and Abandonment

Project Components or Activities	Potential Environmental Effects (A = adverse; B = beneficial)	Engineering Design, Mitigation Measures and Proven Environmental Management Practices	Factors Considered in the Environmental Effects Analysis*							
			Magnitude	Geographic Extent	Timing	Frequency	Duration	Reversibility	Ecological & Socio-economic Context	Certainty of Knowledge
Planned Activities										
Site access restriction	(A) Continued limiting of access to areas used for recreational activities (i.e. snowmobiling, hunting, fishing, etc.).	Access to existing snowmobile trails will continue; Access to Ethel Lake will not be restricted by fencing.	2	1	N/A	4	6	1	3	1
Use of equipment and vehicles, onsite and on local roadways	(A) Effects to the use and enjoyment of neighbouring residential properties and recreational areas due to changes in atmospheric environment.	Dust suppression, regular inspection and maintenance of vehicles, adherence to conditions of permit.	2	4	N/A	3	4	1	2	1
Traffic on local roadways	(A) Risks to public safety.	Reduced traffic frequency. Vehicles will be driven in a proper manner and respect all traffic laws, regulations, and company policies.	2	4	N/A	3	4	1	2	1
Water use and management	(A) Effects to neighbouring residents and recreational users as a result of changes to the availability of surface water and groundwater.	The use of surface water and groundwater resources will be managed in accordance with the permit to take water. Water intake structures (wells and Ethel lake control structure) will be decommissioned.	2	3	N/A	1	4	1	2	1
Management of hazardous waste and contaminated water	(A) Effects to the neighbouring residents and recreational users as a result of changes in the quality of surface water, groundwater, and soils.	Hazardous waste storage areas (i.e. PAG waste rock areas), will be covered and re-vegetated in accordance with closure plan. Contaminated water will continue to be collected and treated to meet provincial and federal requirements (PWQO and *MMER)* and discharged in accordance with permit requirements.	2	3	N/A	1	4	1	2	1
Accidents, Malfunctions and Unplanned Events										
Fuel and hazardous material spills	(A) Effects to neighbouring residents and recreational users as a result of soil, surface water or groundwater contamination.	Implement spills management and emergency response procedures.	2	3	N/A	1	4	1	2	1
Traffic accidents	(A) Risk to public safety.	Implement emergency response procedures.	2	4	N/A	1	4	3	2	1
Forest fire	(A) Risk to public safety. Damage to neighbouring residential properties and recreational areas.	Implement emergency response procedures.	1	4	N/A	1	4	1	2	1

Key:

Magnitude: *
0 = High
1 = Medium
2 = Low
3 = nil
4 = Unknown (see definitions in text, EA methods)

Geographic Extent: *
1 = Immediate work area
2 = Within Project closure plan boundary
3 = Within 5km of Project closure plan boundary
4 = Beyond 5 km of Project closure plan boundary

Frequency: *
1 = Uncommon event, event occurs once or infrequently / periodically
2 = Happens regularly but infrequently (e.g., once or twice per month)
3 = Happens regularly (e.g. daily)
4 = Continuous activity

Duration: *
1 = < 1 month
2 = 1-2 months
3 = 2-6 months
4 = 6-24 months
5 = 2-11 years (life of mine)
6 = > 11 years (beyond Project)

Reversibility: *
1 = High
2 = Medium
3 = Low
4 = nil
5 = Unknown (see definitions in the text, EA Methods)

Ecological and Socio-economic Context: *
1 = Relatively pristine area not adversely affected by human activity
2 = Evidence of existing adverse effects
3 = High level of existing adverse effects

Timing: *
N/A – no sensitive periods or areas exist in baseline conditions
1 – sensitive periods or areas exist in baseline conditions that require adjustments to Project schedule or timing of activities

Certainty of Knowledge:*
1 = High – based on past performance and experience regarding environmental effects or mitigation
2 = Moderate – uncommon potential effects either not well understood or effects require compliance monitoring to modify engineering design or mitigation
3 = Low – potential for the need to follow- up based on results of compliance monitoring to modify engineering design or mitigation

15.3. Residual Environmental Effects

This section describes the residual adverse environmental effects the Project may have on Residents and Recreational Land Use. The following criteria have been developed to determine whether the residual adverse effects are determined to be significant:

A **significant** residual adverse environmental effect of the Project on Residents and Recreational Land Use occurs when there is a reduction in the use and enjoyment of neighbouring residents, recreational properties users and land use in nearby areas that is directly related to a reduction in the quality of the atmospheric environment (increased dust, noise, vibration); an increased risk to public safety from traffic accidents; a reduction in surface water quality or groundwater quantity. Such adverse environmental effects persist beyond closure.

A **not significant** residual adverse environmental effect of the Project on Residents and Recreational Land Use occurs when there is little or no change or a perceived change in the use and enjoyment of neighbouring residential or recreational properties or local land use activities related to changes in the quality of the atmospheric environment (increased dust, noise, vibration); public safety from additional vehicle traffic; changes in surface water quality or groundwater quantity. Such adverse environmental effects may occur during the life of the project.

Table 15-4: Summary of Residual Environmental Effects – Residential and Recreational Land Use

Valued Component	Key Adverse Residual Environmental Effect	Significance[1]	Probability of Occurrence (Likelihood)[2]	Effect on Ecosystem Function and Integrity[2]	Sustainable (Capacity) Use of Renewable Resources[2]	Relevant Legislation[3]
Construction	Risk to public safety as a result of traffic on local roadways. Effects to the use and enjoyment of residential and recreational properties due to changes in the atmospheric environment; the availability of surface water and groundwater resources.	Not significant	Moderate	Low	High	N/A
Operations	Risk to public safety as a result of traffic on local roadways. Effects to the use and enjoyment of residential and recreational properties due to changes in the atmospheric environment; the availability of surface water and groundwater resources (including potential increases in contaminants, such as mercury being released into the water bodies).	Not significant	Moderate	Low	High	N/A
Decommissioning and Abandonment	Risk to public safety as a result of traffic on local roadways. Effects to the use and enjoyment of residential and recreational properties due to changes in the atmospheric environment; the availability of surface water and groundwater resources.	Not significant	Moderate	Nil	High	N/A
Accidents, Malfunctions and Unplanned Events	Effects to neighbouring residents and recreational users as a result of fuel spills or forest fire.	Not significant	Moderate	Low	High	N/A
Planned Project Overall	Risk to public safety as a result of increased traffic on local roadways Effects to the use and enjoyment of residential and recreational properties due to changes in the atmospheric environment; the availability of surface water and groundwater resources (including potential increases in contaminants, such as mercury being released into the water bodies).	Not significant	Moderate	Low	High	N/A
The Project in combination with other projects and activities	The Project in combination with other projects in the area may contribute to increased access restrictions to local recreational areas; compound the reduction in the use and enjoyment of lands in the vicinity of the Project due to emissions (air and noise) to the atmospheric environment; and further increase the volume of traffic on local roadways and alter surface water or groundwater quality or quantity.	Not significant	Moderate	Low	High	N/A

Notes:
1. The rating of significance for adverse residual environmental effects are those predicted effects remaining after the application of mitigation.
2. Sustainability factors are described for all predicted adverse residual environmental effects.
3. Key federal legislation references as appropriate for relevant predicted adverse environmental effects.

15.3.1. Construction

The residual adverse effects of the Project on Residents and Recreational Land Use during Construction may include a risk to public safety as a result of increased traffic on local roadways; a reduction in the use or enjoyment of residential or recreational lands due to changes in the atmospheric environment; a reduction in the availability of surface water or groundwater; or a change in surface water, groundwater or soil quality. These residual adverse effects are considered to be not significant.

15.3.2. Operations

The residual adverse effects of the Project on Residents and Recreational Land Use during Operations may include a risk to public safety as a result of increased traffic on local roadways and along the proposed haul route; a reduction in the use or enjoyment of residential or recreational lands due to changes in the atmospheric environment; a reduction in the availability of surface water or groundwater; or a change in surface water, groundwater or soil quality (including potential increases in a contaminants, such as mercury being released into the water bodies and negatively affecting aquatic organisms and potential downstream potable water users). These residual adverse effects are considered to be not significant.

15.3.3. Decommissioning and Abandonment

The residual adverse effects of the Project on Residents and Recreational Land Use during Decommissioning and Abandonment may include a risk to public safety as a result of increased traffic on local roadways; a reduction in the use or enjoyment of residential or recreational lands due to changes in the atmospheric environment; a reduction in the availability of surface water or groundwater; or a change in surface water, groundwater or soil quality. These residual adverse effects are considered to be not significant. Similar residual effects may occur during conditions of temporary closure.

15.3.4. Accidents, Malfunctions and Unplanned Events

The residual adverse effects of the Project on Residents and Recreational Land Use as a result of accidents, malfunctions and unplanned events may include a risk to neighbouring residents and recreational users as a result of fuel spills or forest fire. These residual adverse environmental effects are considered to be not significant.

15.3.5. Planned Project Overall

The residual adverse effects of the Project overall on Residents and Recreational Land Use may include a risk to public safety as a result of increased traffic on local roadways and along the proposed haul route; a reduction in the use or enjoyment of residential or recreational lands due to changes in the atmospheric environment; a reduction in the availability of surface water or groundwater; or a change in surface water, groundwater or soil quality (including potential increases in a contaminants, such as mercury being

released into the water bodies and negatively affecting aquatic organisms and potential downstream potable water users). These residual adverse effects are considered to be not significant.

15.3.6. Cumulative Environmental Effects

The Project may result in residual cumulative environmental effects to Residents and Recreational Land Use, as other projects and activities such as historical mining, Advanced Exploration and permanent and seasonal residential activities (Chapter 2 – Existing Environment) contribute to access restrictions to local recreational areas; compound the reduction in the use and enjoyment of lands in the vicinity of the Project due to emissions (air and noise) to the atmospheric environment; and further increase the volume of traffic on local roadways and alter surface water or groundwater quality or quantity. While these potential cumulative environmental effects may result a perceived change in the use and enjoyment of neighbouring residential or recreational properties as area development increases, these are considered to be not significant.

15.3.7. Monitoring and Follow-Up Program

FNX has developed a comprehensive sustainability management system to address anticipated Project needs (Chapter 5 – Sustainability Management), including potential adverse environmental effects to Residents and Recreational Land Use. Mitigation and management procedures that are already in place include those for roadway upgrades, emergency response, traffic management, protection of surface and groundwater quality and availability and prevention of soil contamination.

There is a high degree of confidence associated with determining potential effects to Residents and Recreational Land Use, and with determining that there are no significant adverse environmental effects. FNX has developed comprehensive management plans and procedures to mitigate any potential adverse environmental effects. As a result, a follow-up program is not required for the Residents and Recreational Land Use VC.

15.4. References and Appendices

- City of Greater Sudbury. 2015. Zoning By-Law 2010-100Z. Last updated on December 2, 2105. Available online at: http://www.greatersudbury.ca/?LinkServID=9DF4AD75-A545-FE8D-59D2F1E4F01E6E43. Accessed February 9, 2016.
- City of Greater Sudbury. 2015. Official Plan – June 14, 2006. Updated December 2015. Available online at: http://www.greatersudbury.ca/inside-city-hall/official-plan/. Accessed February 9, 2016.
- City of Greater Sudbury. Undated. Fairbank Lake – Lake Water Quality Report Card. Available online at: https://www.greatersudbury.ca/living/lakes-facts/local-lake-descriptions/fairbank-lake/. Accessed on February 9, 2016.

- Nickel District Conservation Authority. 2014. Greater Sudbury Source Protection Area, Source Protection Plan. Available online at: http://www.greatersudbury.ca/sudburyen/assets/File/Greater_Sudbury_Source_Protection_Area_Approved_SPP_Sept_19.pdf. Accessed February 24, 2016. Prepared on Behalf of the Greater Sudbury Source Protection Committee. Approved September 19, 2014.
- Sudbury Area Risk Assessment (SARA) Group, c/o Gartner Lee Ltd. 2008. Sudbury Soils Study – Vol. II Human Health Risk Assessment. Available online at: http://www.sudburysoilsstudy.com/EN/indexE.htm. February 14, 2008. Accessed February 9, 2016.
- Sudbury Trail Plan. Undated. Walden Sno Runners. Available online at: http://www.sudburytrailplan.on.ca/clubs/wsr.php. Accessed February 9, 2016.

Table of Contents – Chapter 16

16. Community Services and Infrastructure 308

16.1. Existing Conditions 308
16.1.1. Ecological Boundaries – Spatial and Temporal 309
16.1.2. Administrative Boundaries 311
16.1.3. Technical Boundaries 311
16.1.4. Likely Future Conditions 311
16.2. Environmental Effects Analysis 311
16.2.1. Construction 311
16.2.2. Operations 314
16.2.3. Decommissioning and Abandonment 316
16.2.4. Environmental Design, Mitigation and Optimization 318
16.3. Residual Environmental Effects 318
16.3.1. Construction 321
16.3.2. Operations 321
16.3.3. Decommissioning and Abandonment 321
16.3.4. Accidents, Malfunctions and Unplanned Events 321
16.3.5. Planned Project Overall 321
16.3.6. Cumulative Environmental Effects 321
16.3.7. Monitoring and Follow-Up Program 322
16.4. References 322

16. Community Services and Infrastructure

The assessment of the Community Services and Infrastructure valued component for the Project considers potential effects on: the use of public infrastructure, including roads, emergency services (police, paramedic, hospital, fire), and utilities (landfill, waste management services). The Project is located within an industrial zone within the boundaries of the City of Greater Sudbury. The City of Greater Sudbury is a well-established mining community, with an extensive system of community services and infrastructure. Exploration and Advanced Exploration activities have been ongoing since 2010. The Project is currently staffed by a number of full-time employees of FNX, some secondment positions, and by a number of additional contractors currently providing services, all using local roadways to and from the Project.

The Project generates waste, which is transported off-site approximately two times per week to the City of Greater Sudbury's landfill. Project Exploration ad Advanced Exploration activities currently rely on the City's services for emergency response, however, there has been no need for emergency services to date. As a result, there are existing effects on the Community Services and Infrastructure valued component (VC) due to FNX Exploration and Advanced Exploration activities.

16.1. Existing Conditions

The City of Greater Sudbury is composed of a mix of urban, suburban, rural and natural environments[13,] and as such there is an extensive network of existing community services and infrastructure. The city is divided into the following zones: residential, commercial, industrial, rural, other (e.g. park, conservation, private, etc.), and overlay (e.g. airport height restriction, flood plain, etc.). Greater Sudbury is 3,267 square kilometres in area, making it geographically, the largest municipality in Ontario and second largest in Canada. There are a number of small communities in proximity to the Project. The Fairbanks area is located approximately two kilometres northwest of the Property, containing both seasonal and permanent residents. Approximately five kilometres south of the Property, at the junction of Fairbank Lake Road and Highway 17 along the proposed haul route is the community of Denlou. According to the 2011 census, the city's population is approximately 160,000 people, which showed a growth of 1.5% from 2006[13].

A complex infrastructure system extends across the municipality, including but not limited to water and sewage treatment facilities, electrical and telecommunications utility networks, modern airport, public transit services, and district energy plants. There is

[13] https://www.greatersudbury.ca/living/about-greater-sudbury/, retrieved February 2016.

also an existing waste management program, which includes sewage waste disposal sites and solid waste landfills (including leachate and gas collection systems).

The City of Greater Sudbury has an extensive emergency preparedness program, which includes an Emergency Services Strategic Plan, Emergency Management Program, Comprehensive Fire Services, Training Programs, and other plans and programs to ensure appropriate response of police, fire, paramedic, and other emergency services to the community. The City of Greater Sudbury is home to a variety of institutions, including health research centers and initiatives, such as Health Sciences North, the Northern Ontario School of Medicine and the Centre of Rural and Northern Health Research.

The City of Greater Sudbury recently completed a Transportation Master Plan, which was presented to City Council in May 2016. The existing transportation conditions from the plan indicate that trips to the southwest of Sudbury are distributed between the MR55 and Highway 17, both of which have been determined to be operating at an acceptable level of service[14]. According to this Transportation Master Plan, daily traffic volumes on "major highways" (such as Highway 17) is in the order of 10,000 to 50,000 trips per day and on "collectors" (such as MR4) is in the order of 1,000 to 12,000 trips per day[14].

Within the vicinity of the Project site, the Average Annual Daily Traffic (AADT) on Fairbank Lake Road: north of Highway 17 was estimated to be 1,478 in July 2104, while the AADT on Fairbank Lake Road: west of Bay Street, was estimated to be 1,616 (MR4 Traffic Volumes, 2014). According to the Design Criteria for the Crean Hill Road and Fairbank East Road improvements, traffic for Crean Hill Road from Fairbank Lake Road (MR4) to Fairbank East Road, and Fairbank East Road from Crean Hill Road to Victoria Mine, a 3.3 kilometre length of road had an AADT of 470 in 2011 and a projected AADT of 1,000 to 1,500 for 2021 (Unknown source, 2015).

16.1.1. Ecological Boundaries – Spatial and Temporal

The spatial boundary for the Community Services and Infrastructure effects assessment is the municipal boundary of the City of Greater Sudbury (Figure 16-1). This boundary was selected because potential effects on Community Services and Infrastructure may extend beyond the Project, for example traffic patterns along the approximate 55 kilometres of the proposed haul route within the City of Greater Sudbury may be altered, or there could be increased demands on emergency services anywhere within the City of Greater Sudbury.

[14] City of Greater Sudbury and MMM Group, Transportation Study Report – Draft, April 2015

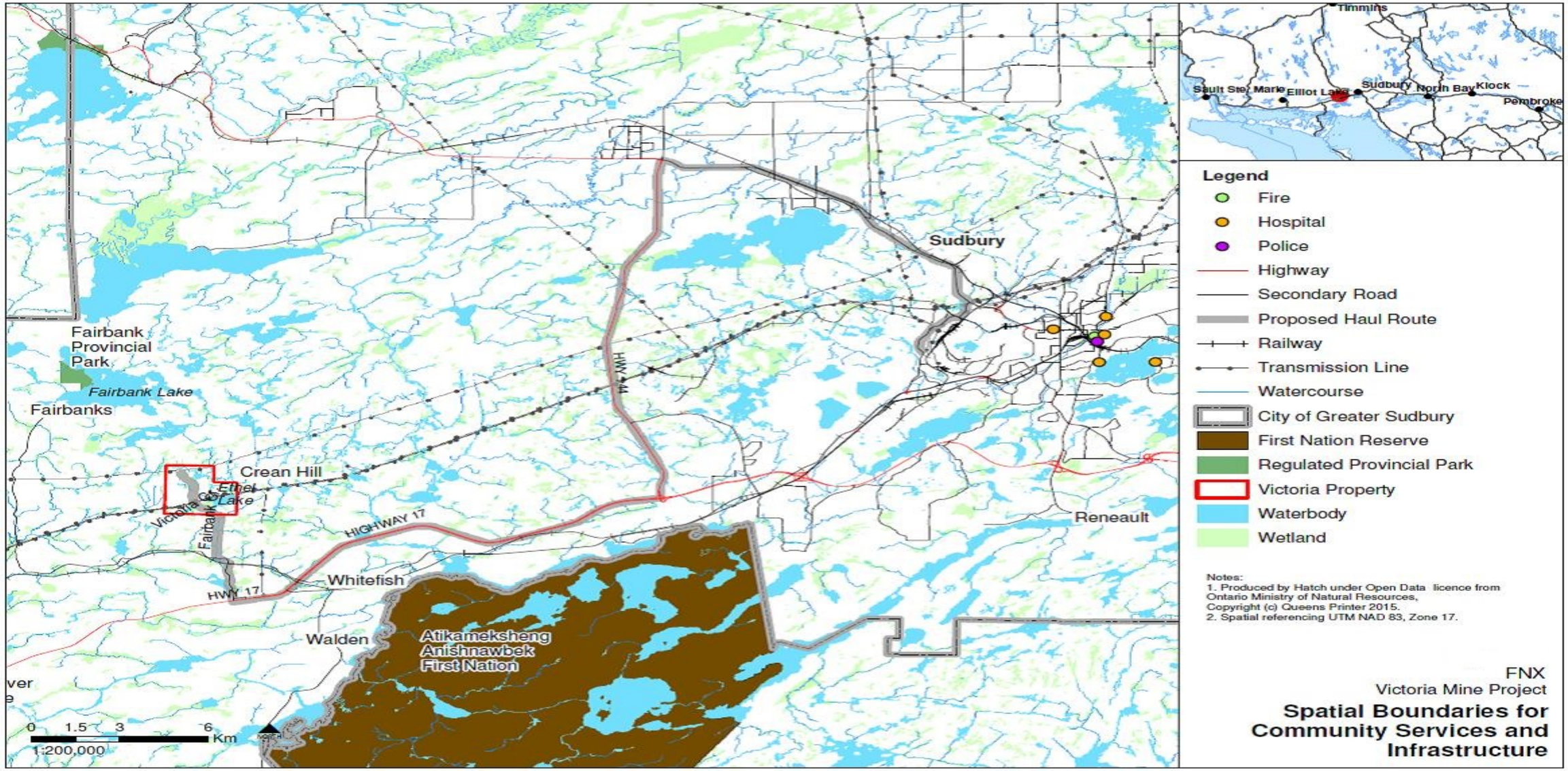

Figure 16-1: Spatial Boundaries for Community Services and Infrastructure

The temporal boundary for the effects assessment on Community Services and Infrastructure covers the period between 2024 and 2045.

16.1.2. Administrative Boundaries

The administrative boundaries for the Community Services and Infrastructure effects assessment include the relevant municipal authorities for the City of Greater Sudbury, namely: Environmental Services Division, Emergency Management Office, Roads and Transportation Division.

16.1.3. Technical Boundaries

Data gathering efforts were primarily focused on desktop research of publicly available information, including municipal, provincial and federal government web-based sources. Baseline information has also been gathered from meetings, open houses, and conversations with the public, government bodies, and Indigenous Communities (Appendix A and Appendix B). There were no interviews or community surveys conducted as part of this research.

16.1.4. Likely Future Conditions

Mining is at the economic core of the City of Greater Sudbury, with dozens of ongoing and historic mining projects located in the Sudbury Basin[15]. The Project is considered small when compared to other mining projects, and as such should the Project not proceed, there would not be any appreciable difference in the availability, quality, or type of community infrastructure and services. The City of Greater Sudbury would be expected to maintain their existing level of service to the communities and to the existing mining industry.

16.2. Environmental Effects Analysis

16.2.1. Construction

Project traffic has the potential to alter established traffic patterns, particularly for residents that use local roadways and the site access road (i.e. Crean Hill Road, Fairbanks East Road, Fairbanks Lake Road (MR4), and Highway 17). There will be additional volume on the road during Construction, which is expected to be 200 vehicles per day or a 40% increase. Mine product, fuel and other trucks will enter and exit the Property from Fairbanks East Road. There may be resulting traffic congestion or delays on regional public roads due to Project activities during all Project phases.

The Project will be generating solid wastes during Construction, which will include wastes generated by workers present on the site. In addition, building material wastes will be generated during Construction (e.g. wood, scrap metal, electrical materials, glass,

[15] https://en.wikipedia.org/wiki/Economy_of_Greater_Sudbury, retrieved February 2016.

plastics, batteries, etc.). Wastes will be segregated and transported off-site approximately three to four times per week to an approved landfill within the City of Greater Sudbury. Waste trucks will be restricted to the same hours/day as the mine product trucks hauling to Clarabelle Mill.

It is the City of Greater Sudbury's responsibility to respond in the event of an emergency, such as a traffic accident, fire, fall of ground or mine rescue. An agreement is currently in place with Vale to provide additional emergency response, in the case it is required. Emergency response services in the event of an accident, malfunction or unplanned event would be required equally during all Project phases.

A detailed environmental effects analysis for Construction, including Accidents, Malfunctions and Unplanned Events, is provided in Table 16-1.

Table 16-1: Environmental Effects Analysis; VC - Community Services and Infrastructure; Project Phase - Construction

Project Components or Activities	Potential Environmental Effects (A = adverse; B = beneficial)	Engineering Design, Mitigation Measures and Proven Environmental Management Practices	Factors Considered in the Environmental Effects Analysis*							
			Magnitude	Geographic Extent	Timing	Frequency	Duration	Reversibility	Ecological a& Socio-economic Context	Certainty of Knowledge
Planned Activities										
Construction traffic on local roadways	(A) Project traffic alters established traffic patterns and volumes and may result in delays in traffic on regional public roads.	Roadway design and upgrades to meet *Highway Traffic Act* requirements for level of service. Use flagmen as required to ensure that traffic on access roads is controlled. Construction vehicles will be driven in a proper manner and respect all traffic laws, regulations, and company policies and traffic management procedures.	2	4	N/A	3	5	1	2	1
General construction activities and waste management support services	(A) Project generated solid wastes require landfilling that could cause ground disturbance affecting terrestrial habitat and subsequent reduced surface and groundwater quality.	No landfill planned as part of Project due to small volumes of waste anticipated. Solid, non-hazardous waste (e.g. containers, packaging) will be deposited in bins that are supplied and emptied by a licensed carrier with appropriate load demarcations and transported to a licensed landfill or recycling facility. Bulk products will be returned in supplied containers. Equipment and materials will be recycled as practical (scrap metal, cardboard and batteries as a minimum).	2	4	N/A	3	5	1	2	1
Accidents, Malfunctions and Unplanned Events										
Construction vehicle and general traffic accidents, fall of ground or mine rescue	(A) Increased demands on fire response and emergency medical services.	Implement emergency response procedures. Note that it is the responsibility of the City of Greater Sudbury to provide emergency response. Agreement also in place with Vale for emergency response.	2	4	N/A	1	5	1	2	1
Forest fire	(A) Increased demands on fire response and emergency medical services.	Implement emergency response procedures.	2	4	N/A	1	5	1	2	1

Key:

Magnitude: *
0 = High
1 = Medium
2 = Low
3 = nil
4 = Unknown (see definitions in text, EA methods)

Geographic Extent: *
1 = Immediate work area
2 = Within Project closure plan boundary
3 = Within 5km of Project closure plan boundary
4 = Beyond 5 km of Project closure plan boundary

Frequency: *
1 = Uncommon event, event occurs once or infrequently / periodically
2 = Happens regularly but infrequently (e.g., once or twice per month)
3 = Happens regularly (e.g. daily)
4 = Continuous activity

Duration: *
1 = < 1 month
2 = 1-2 months
3 = 2-6 months
4 = 6-24 months
5 = 2-11 years (life of mine)
6 = > 11 years (beyond Project)

Reversibility: *
1 = High
2 = Medium
3 = Low
4 = nil
5 = Unknown (see definitions in the text, EA Methods)

Ecological and Socio-economic Context: *
1 = Relatively pristine area not adversely affected by human activity
2 = Evidence of existing adverse effects
3 = High level of existing adverse effects

Timing: *
N/A – no sensitive periods or areas exist in baseline conditions
1 – sensitive periods or areas exist in baseline conditions that require adjustments to Project schedule or timing of activities

Certainty of Knowledge:*
1 = High – based on past performance and experience regarding environmental effects or mitigation
2 = Moderate – uncommon potential effect either not well understood or effects require compliance monitoring to modify engineering design or mitigation
3 = Low – potential for the need to follow-up based on results of compliance monitoring to modify engineering design or mitigation

16.2.2. Operations

Project traffic during Operations will include light-duty vehicles and mine product haul trucks, which have the potential to alter established traffic patterns, particularly for residents that use roadways along the haul route which runs between the Project and Clarabelle Mill (i.e. Crean Hill Road, Fairbanks East Road, Fairbanks Lake Road (MR4), Highway 17, and Highway 144). There will be additional volume on the road during Operations, which is expected to be 1,000 to 1,500 vehicles per day. There may be resulting delays in traffic on regional public roads due to Project activities during all Project phases.

The Project will be generating solid wastes during Operations, which will include wastes generated by workers present on the site. Wastes will be segregated and transported off-site approximately two times per week to an approved landfill within the City of Greater Sudbury.

The Project is located within the City of Greater Sudbury, and as such it is the City's responsibility to respond in the event of an emergency, such as a traffic accident, fire, fall of ground or mine rescue. An agreement is also in place with Vale to provide additional emergency response, as required. Emergency response services in the event of an accident, malfunction or unplanned event would be required equally during all Project phases.

A detailed environmental effects analysis for Operations, including Accidents, Malfunctions and Unplanned Events, is provided in Table 16-2.

Table 16-2: Environmental Effects Analysis; VC - Community Services and Infrastructure; Project Phase - Operations

Project Components or Activities	Potential Environmental Effects (A = adverse; B = beneficial)	Engineering Design, Mitigation Measures and Proven Environmental Management Practices	Factors Considered in the Environmental Effects Analysis*							
			Magnitude	Geographic Extent	Timing	Frequency	Duration	Reversibility	Ecological & Socio-economic Context	Certainty of Knowledge
Planned Activities										
Operations traffic on local roadways, especially mine product haul trucks	(A) Project traffic alters established traffic patterns and volumes and may result in delays in traffic on regional public roads.	Roadway design and upgrades to meet *Highway Traffic Act* requirements for level of service. Use flagmen as required to ensure that traffic on access roads is controlled. Construction vehicles will be driven in a proper manner and respect all traffic laws, regulations, and company policies and traffic management procedures.	2	4	N/A	3	5	1	2	1
Waste management support services	(A) Project generated solid wastes require landfilling that could cause ground disturbance affecting terrestrial habitat and subsequent reduced surface and groundwater quality.	No landfill planned as part of Project due to small volumes of waste anticipated. Solid, non-hazardous waste (e.g. containers, packaging) will be deposited in bins that are supplied and emptied by a licensed carrier with appropriate load demarcations and transported to a licensed landfill or recycling facility. Bulk products will be returned in supplied containers. Equipment and materials will be recycled as practical (scrap metal, cardboard and batteries as a minimum).	2	4	N/A	3	5	1	2	1
Accidents, Malfunctions and Unplanned Events										
Industrial vehicle and general traffic accidents, fall of ground or mine rescue	(A)Increased demands on fire response and emergency medical services.	Implement emergency response procedures. Note that it is the responsibility of the City of Greater Sudbury to provide emergency response. Agreement also in place with Vale for emergency response.	2	4	N/A	1	5	1	2	1
Forest fire	(A) Increased demands on fire response and emergency medical services.	Implement emergency response procedures.	2	4	N/A	1	5	1	2	1

Key:

Magnitude: *
0 = High
1 = Medium
2 = Low
3 = nil
4 = Unknown (see definitions in text, EA methods)

Geographic Extent: *
1 = Immediate work area
2 = Within Project closure plan boundary
3 = Within 5km of Project closure plan boundary
4 = Beyond 5 km of Project closure plan boundary

Frequency: *
1 = Uncommon event, event occurs once or infrequently / periodically
2 = Happens regularly but infrequently (e.g., once or twice per month)
3 = Happens regularly (e.g. daily)
4 = Continuous activity

Duration: *
1 = < 1 month
2 = 1-2 months
3 = 2-6 months
4 = 6-24 months
5 = 2-11 years (life of mine)
6 = > 11 years (beyond Project)

Reversibility: *
1 = High
2 = Medium
3 = Low
4 = nil
5 = Unknown (see definitions in the text, EA Methods)

Ecological and Socio-economic Context: *
1 = Relatively pristine area not adversely affected by human activity
2 = Evidence of existing adverse effects
3 = High level of existing adverse effects

Timing: *
N/A – no sensitive periods or areas exist in baseline conditions
1 – sensitive periods or areas exist in baseline conditions that require adjustments to Project schedule or timing of activities

Certainty of Knowledge:*
1 = High – based on past performance and experience regarding environmental effects or mitigation
2 = Moderate – uncommon potential effect either not well understood or effects require compliance monitoring to modify engineering design or mitigation
3 = Low – potential for the need to follow-up based on results of compliance monitoring to modify engineering design or mitigation

16.2.3. Decommissioning and Abandonment

Project traffic has the potential to alter established traffic patterns, particularly for residents that use local roadways and the site access road (i.e. Crean Hill Road, Fairbanks East Road, Fairbanks Lake Road (MR4), and Highway 17). Volumes will be reduced during Decommissioning and Abandonment, however there will still be additional volume on the road which is expected to be 10 to 25 vehicles per day. There may be resulting delays in traffic on regional public roads due to Project activities during all Project phases.

The Project will be generating solid wastes during Decommissioning and Abandonment, which will include wastes generated by workers present on the site. In addition, building material wastes will be generated during physical decommissioning (e.g. wood, scrap metal, electrical materials, glass, plastics, batteries, etc.). Wastes will be segregated and transported off-site, including salvaged equipment and material, approximately five times per week to an approved landfill within the City of Greater Sudbury.

The Project is located within the City of Greater Sudbury, and as such it is the City's responsibility to respond in the event of an emergency, such as a traffic accident, fire, fall of ground or mine rescue. An agreement is also in place with Vale to provide additional emergency response, as required. Emergency response services in the event of an accident, malfunction or unplanned event would be required equally during all Project phases.

A detailed environmental effects analysis for Decommissioning and Abandonment, including Accidents, Malfunctions and Unplanned Events, is provided in Table 16-3.

Table 16-3: Environmental Effects Analysis; VC - Community Services and Infrastructure; Project Phase - Decommissioning and Abandonment

Project Components or Activities	Potential Environmental Effects (A = adverse; B = beneficial)	Engineering Design, Mitigation Measures and Proven Environmental Management Practices	Factors Considered in the Environmental Effects Analysis*							
			Magnitude	Geographic Extent	Timing	Frequency	Duration	Reversibility	Ecological & Socio-economic	Certainty of Knowledge
Planned Activities										
Decommissioning traffic on local roadways	(A) Project traffic alters established traffic patterns and volumes and may result in delays in traffic on regional public roads.	Reduced traffic frequency. Use flagmen as required to ensure that traffic on access roads is controlled. Vehicles will be driven in a proper manner and respect all traffic laws, regulations, and company policies and traffic management procedures.	2	4	N/A	3	4	1	2	1
General Decommissioning and Abandonment activities	(A) Project generated solid wastes require landfilling that could cause ground disturbance affecting terrestrial habitat and subsequent reduced surface and groundwater quality.	Salvage buildings and equipment to reduce volumes of materials to be landfilled Solid, non-hazardous waste (e.g. containers, packaging) will be deposited in bins that are supplied and emptied by a licensed carrier. Bulk products will be returned in supplied containers. Equipment and materials will be recycled as practical (scrap metal, cardboard and batteries as a minimum).	2	4	N/A	3	4	1	2	1
Accidents, Malfunctions and Unplanned Events										
Decommissioning vehicle and general traffic accidents, fall of ground or mine rescue	(A) Increased demands on fire response and emergency medical services.	Implement emergency response procedures.	2	4	N/A	1	4	1	2	1
Forest fire	(A) Increased demands on fire response and emergency medical services.	Implement emergency response procedures.	2	4	N/A	1	4	1	2	1

Key:

Magnitude: *
0 = High
1 = Medium
2 = Low
3 = nil
4 = Unknown (see definitions in text, EA methods)

Geographic Extent: *
1 = Immediate work area
2 = Within Project closure plan boundary
3 = Within 5km of Project closure plan boundary
4 = Beyond 5 km of Project closure plan boundary

Frequency: *
1 = Uncommon event, event occurs once or infrequently / periodically
2 = Happens regularly but infrequently (e.g., once or twice per month)
3 = Happens regularly (e.g. daily)
4 = Continuous activity

Duration: *
1 = < 1 month
2 = 1-2 months
3 = 2-6 months
4 = 6-24 months
5 = 2-11 years (life of mine)
6 = > 11 years (beyond Project)

Reversibility: *
1 = High
2 = Medium
3 = Low
4 = nil
5 = Unknown (see definitions in the text, EA Methods)

Ecological and Socio-economic Context: *
1 = Relatively pristine area not adversely affected by human activity
2 = Evidence of existing adverse effects
3 = High level of existing adverse effects

Timing: *
N/A – no sensitive periods or areas exist in baseline conditions
1 – sensitive periods or areas exist in baseline conditions that require adjustments to Project schedule or timing of activities

Certainty of Knowledge:*
1 = High – based on past performance and experience regarding environmental effects or mitigation
2 = Moderate – uncommon potential effect either not well understood or effects require compliance monitoring to modify engineering design or mitigation
3 = Low – potential for the need to follow-up based on results of compliance monitoring to modify engineering design or mitigation

16.2.4. Environmental Design, Mitigation and Optimization

FNX understands the importance of implementing environmental design, mitigation measures and sustainability management practices. As such, a number of procedures and plans have been put in place in order to mitigate against potential adverse environmental effects. These measures, as they are related to Community Services and Infrastructure, include:

1. **Traffic on Local Roadways**: The local roadway has been upgraded to meet *Highway Traffic Act* requirements for level of service, and to ensure any potential adverse effects are minimized. Mine product, fuel and other trucks will enter and exit the Property from Fairbanks East Road and will not operate during school bus hours, resulting in 14 hours of active trucking per day. The junction of Municipal Road #4 and Highway 17 has been upgraded with turning lanes and traffic lights. Construction and Operations vehicles (especially ore haul trucks) will be driven in a proper manner and respect all traffic laws, regulations, and company policies and traffic management procedures;
2. **Waste Management Services**: Due to the small volumes of solid waste being generated during all Project phases, there will not be a landfill as part of the Project. Solid, non-hazardous waste (e.g. containers, packaging) will be deposited in bins that are supplied and emptied by a licensed carrier with appropriate load demarcations and transported to a licensed landfill or recycling facility. Bulk products will be returned in supplied containers. Equipment and materials will be recycled where possible (scrap metal, cardboard and batteries as a minimum). During Decommissioning and Abandonment, buildings and equipment will be salvaged to the extent possible to reduce volumes of materials to be landfilled. All wastes will be managed in accordance with the City's requirements;
3. **Emergency Response Services**: Project-specific emergency response procedures have been established and will continue throughout all Project phases. The Project will work closely with the City of Greater Sudbury to ensure site access for emergency vehicles, where required. FNX has also developed an agreement with Vale to provide emergency services, where appropriate.

16.3. Residual Environmental Effects

This section describes the residual (i.e., after mitigation) adverse environmental effects the Project might have on Community Services and Infrastructure within the City of Greater Sudbury. The following criteria (e.g., indicators/thresholds) are used to determine whether the residual adverse environmental effects of the Project on Community Services and Infrastructure are significant:

A significant residual adverse environmental effect of the Project on Community Services and Infrastructure occurs when existing emergency services (including fire response) are

not adequate to meet the anticipated demand or ensure public safety; traffic on local roads results in temporary closures with delays to the public that are greater than one hour in duration; or public access and use of regional roads is discontinued or limited (e.g. through detours) for more than one week in duration.

A not significant residual adverse environmental effect of the Project on Community Services and Infrastructure occurs when existing emergency services are sufficient to meet the anticipated demand and maintain public safety; temporary closures that cause delays to the public are less than 1 hour in duration; or public access and use of regional roads is not discontinued or limited (e.g. through detours) for more than one week in duration.

A summary of the residual adverse environmental effects of the Project on Community Services and Infrastructure is provided in Table 16-4.

Table 16-4: Summary of Residual Environmental Effects - Community Services and Infrastructure

Valued Component	Key Adverse Residual Environmental Effect	Significance[1]	Probability of Occurrence (Likelihood)[2]	Effect on Ecosystem Function and Integrity[2]	Sustainable (Capacity) Use of Renewable Resources[2]	Relevant Legislation[3]
Construction	Project traffic alters established traffic patterns and volumes and may result in delays in traffic on regional public roads.	Not significant	High	Low	High	N/A
Operations	Project traffic alters established traffic patterns and volumes and may result in delays in traffic on regional public roads.	Not significant	High	Low	High	N/A
Decommissioning and Abandonment	Traffic volumes reduced from Operations. Delays may still cause delays during Decommissioning activities.	Not significant	High	Low	High	N/A
Accidents, Malfunctions and Unplanned Events	Increased demands on fire response and emergency medical services due to vehicle and general traffic accidents, forest fire, fall of ground or mine rescue.	Not significant	Low	Nil	High	N/A
Planned Project Overall	Traffic alters established traffic patterns and volumes and may result in delays in traffic on regional public roads. Increased demands on fire response and emergency medical services due to vehicle and general traffic accidents, forest fire, fall of ground or mine rescue.	Not significant	High	Low	High	N/A
The Project in combination with other projects and activities	The project in combination with other projects and activities may increase effects to established traffic patterns, and volumes and may result in additional delays in traffic on regional public roads. Increased demands on fire response and emergency medical services due to Construction vehicle and general traffic accidents, forest fire, fall of ground or mine rescue.	Not significant	High	Low	High	N/A

Notes:
1. *The rating of significance for adverse residual environmental effects are those predicted effects remaining after the application of mitigation.*
2. *Sustainability factors are described for all predicted adverse residual environmental effects.*
3. *Key federal legislation references as appropriate for relevant predicted adverse environmental effects.*

16.3.1. Construction

The residual adverse environmental effects of Construction on Community Services and Infrastructure may include Project traffic alterations to the established traffic patterns and volumes, which may result in delays in traffic on regional public roads. The residual adverse environmental effect is considered to be not significant.

16.3.2. Operations

The residual adverse environmental effects of Operations on Community Services and Infrastructure may include Project traffic alterations to the established traffic patterns and volumes, which may result in delays in traffic on regional public roads. The residual adverse environmental effect is considered to be not significant.

16.3.3. Decommissioning and Abandonment

The residual adverse environmental effects of Decommissioning and Abandonment on Community Services and Infrastructure may include Project traffic alterations to the established traffic patterns and volumes, which may result in delays in traffic on regional public roads. Traffic volumes during Decommissioning and Abandonment will be reduced, when compared to Construction and Operations. The residual adverse environmental effect is considered to be not significant. Similar residual effects will occur during conditions of temporary closure.

16.3.4. Accidents, Malfunctions and Unplanned Events

The residual adverse environmental effects of Accidents, Malfunctions and Unplanned Events on Community Services and Infrastructure may include increased demands on fire response and emergency medical services due to vehicle and general traffic accidents or forest fire. The residual adverse environmental effect is considered to be not significant.

16.3.5. Planned Project Overall

The residual adverse environmental effects of the Project overall on Community Services and Infrastructure may include traffic alterations to the established traffic patterns and volumes that may result in delays in traffic on regional public roads and increased demands on fire response and emergency medical services due to vehicle and general traffic accidents, forest fire, fall of ground or mine rescue. The residual adverse environmental effect is considered to be not significant.

16.3.6. Cumulative Environmental Effects

The Project may result in residual cumulative environmental effects on Community Services and Infrastructure, as other projects and activities such as historical mining, Advanced Exploration and permanent and seasonal residential activities (Chapter 2 – Existing Environment) create a demand on local roadways and emergency response

services. FNX is committed to responsible development of the Project and has already put in place programs and procedures to mitigate potential adverse environmental effects, including road upgrades to improve traffic flow, use of flagmen as required, and ensuring that all vehicles are driven in a proper manner and respect all traffic laws, regulations and company policies. In addition, emergency response procedures are already in place for the Project, and an agreement has been developed with Vale to provide emergency services in addition to those already provided by the City of Greater Sudbury. The cumulative environmental effect to Community Services and Infrastructure is considered to be not significant.

16.3.7. Monitoring and Follow-Up Program

FNX has developed a comprehensive sustainability management system to address anticipated Project needs (Chapter 5 – Sustainability Management), including potential adverse environmental effects to Community Services and Infrastructure. Mitigation and management procedures that are already in place include those for roadway upgrades, emergency response, and traffic management.

There is a high degree of confidence associated with determining potential effects to Community Services and Infrastructure, and with determining that there are no significant adverse environmental effects. FNX has developed comprehensive management plans and procedures to mitigate any potential adverse environmental effects. As a result, a follow-up program is not required for the Community Services and Infrastructure VC.

16.4. References

- City of Greater Sudbury and MMM Group, Transportation Study Report – Draft, April 2015.
- City of Greater Sudbury: https://www.greatersudbury.ca/. Retrieved February 2016.
- MR4 Traffic Volumes. 2014. City of Greater Sudbury's Open Data Portal, http://opendata.greatersudbury.ca.
- Unknown source. 2015. Design Criteria. Project ID: ISD14-33 Crean Hill Road And Fairbank East Road Improvements. February 2015.

Table of Contents – Chapter 17

17. Employment and Business 324

17.1. Existing Conditions 324
17.1.1. Ecological Boundaries – Spatial and Temporal 325
17.1.2. Administrative Boundaries 327
17.1.3. Technical Boundaries 327
17.1.4. Likely Future Conditions 327
17.2. Environmental Effect Analysis 327
17.2.1. Construction 327
17.2.2. Operations 330
17.2.3. Decommissioning and Abandonment 332
17.2.4. Environmental Design, Mitigation and Optimization 335
17.3. Residual Environmental Effects 335
17.3.1. Construction 337
17.3.2. Operations 337
17.3.3. Decommissioning and Abandonment 337
17.3.4. Accidents, Malfunctions and Unplanned Events 337
17.3.5. Planned Project Overall 337
17.3.6. Cumulative Environmental Effects 337
17.3.7. Monitoring and Follow-Up Program 338
17.4. References 338

17. Employment and Business

Employment and Business has been identified as a Valued Component in analyzing the effects of the Project in consideration of potential opportunities to the local economy and as anticipated based on experience to date through site activities and previous mine permitting processes, including: the provision of employment opportunities; skills development and capacity building; and the procurement of goods and services. The Project is expected to have a positive benefit to Employment and Business in the region. The Sudbury Basin has an experienced construction and mining business community and it is anticipated that most of the labour as well as goods and services will be available locally. The total capital cost estimate for the Project is approximately $1.5 billion CAD, and the operating cost estimate over the life of mine is approximately $3.6 billion CAD.

17.1. Existing Conditions

The City of Greater Sudbury is approximately 3,227 km^2 in area with a population of 160,274 people according to the 2011 census (Statistics Canada, 2011). According to the City of Greater Sudbury, the mining industry directly employs approximately 6,000 people and is reported to indirectly support a mining supply and service sector cluster of 300 companies who employ an additional 10,000 people. Sudbury is a regional centre for Northeastern Ontario in financial and business services, tourism, health care and research, education and government. The regional centre extends from the Quebec border west to the eastern shore of Lake Superior and north to the James and Hudson's Bay coastlines, which serves a market of 555,000 (City of Greater Sudbury, Undated).

The City of Greater Sudbury functions as the regional centre of learning and applied research for North-eastern Ontario. Laurentian University, Cambrian College, and College Boreal provide educational services through a variety of full and part-time programs. According to the 2011 census, there is strong enrollment in programs such as security services, mechanical and repair technologies, engineering, engineering and mechanical trade certificates, and construction (Statistics Canada, 2011). According to the January 2016 labour force characteristics for the Greater Sudbury census metropolitan area (CMA), the current unemployment rate is 8.6%, which is up 0.2% from December 2015. Since January 2014, the portion of the labour force which is currently unemployed has risen from 6.8% to 8.6% (a difference of 1.8%). This data suggests that there is an available labour force within Greater Sudbury currently seeking work, with a skill and education base that is compatible with the Project's needs (City of Greater Sudbury, 2016).

The City has also demonstrated a commitment to strengthen economic diversification, through creation of the Greater Sudbury Development Corporation (GSDC), which *"serves as a catalyst for economic development initiatives, and supports the attraction, development and retention of business in the community"* (City of Greater Sudbury, Undated). Sudbury's

mining supply and services sector was founded in the provision of tools, parts and professional services to local mining companies. As new technology and innovation led to new products and processes, these home-grown companies found eager national and international mining markets looking to improve their productivity. With a strong history of mining, and a commitment to promoting investment and continued economic diversification, the City of Greater Sudbury has a wide range of businesses available to the mining sector for the procurement of various goods and services. Currently, this sector of the local economy represents over 300 companies employing almost 14,000 skilled workers and professionals and generating approximately $4 billion in revenue annually. Within the Sudbury area 80% of the mining supply and services market is domestic (GSDC, 2013). FNX's Exploration and Advanced Exploration activities have been ongoing over the past decade and accordingly, there are established relationships and contributions to the local economy as a result of these activities.

Exploration and Advanced Exploration activities have been ongoing since 2010. The Project is currently staffed by a number of full-time employees of FNX, some secondment positions, and by a number of additional contractors currently providing services.

Maximizing Indigenous participation through employment and procurement opportunities are a priority for FNX, as demonstrated through their successful negotiation of three agreements with Atikameksheng First Nation, Sagamok First Nation, and the Métis Nation of Ontario. The economic details of these agreements are confidential, and therefore not addressed here, however a summary of consultation and engagement efforts associated with economic benefits is provided in Appendix B.

17.1.1. Ecological Boundaries – Spatial and Temporal

The spatial boundary for Employment and Business is primarily restricted to the City of Greater Sudbury, but may also extend to the regional, provincial and even federal level (Figure 17-1). Hiring of employees and procurement of goods and services are primarily anticipated from the City of Greater Sudbury, depending on qualification. Depending on requirements and qualifications, employees as well as goods and services may be sourced from beyond the City.

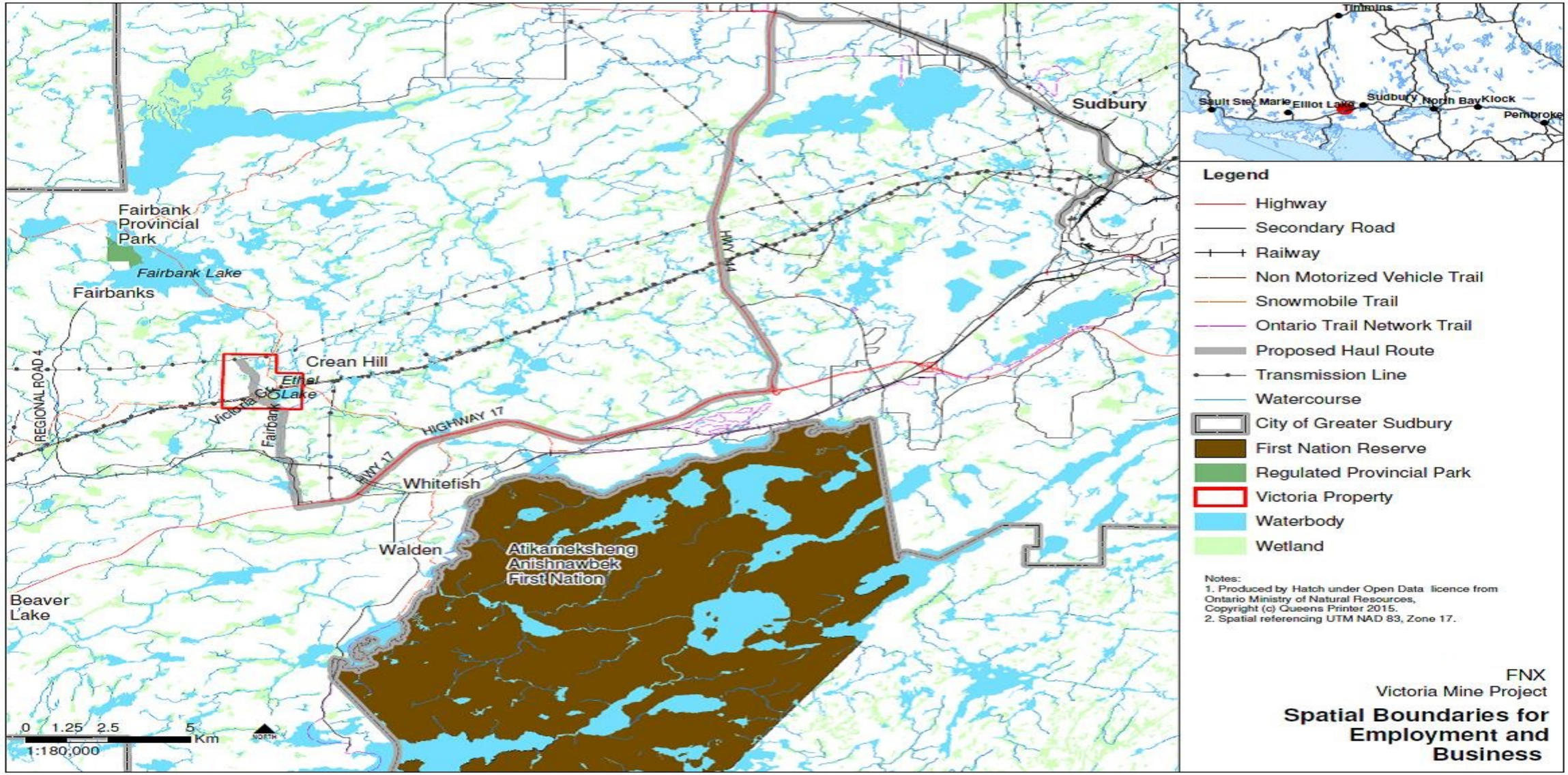

Figure 17-1: Spatial Boundaries for Employment and Business

Contributions to the local, regional and national economies in the form of economic growth, payment of corporate and income taxes, and contribution to the national Gross Domestic Product (GDP) are also expected as a result of the Project.

The temporal boundary primarily covers the period between 2024 and 2050.

17.1.2. Administrative Boundaries

The administrative boundaries for the Employment and Business effects assessment include the relevant municipal, provincial and federal authorities, namely: The City of Greater Sudbury, Ontario Ministry of Labour, and Canada Revenue Agency. The Project is also bound by the legal requirements of the agreements between FNX and Indigenous communities.

17.1.3. Technical Boundaries

Data gathering efforts were primarily focused on desktop research of publicly available information, including municipal, provincial and federal government web-based sources. There were no interviews or community surveys conducted as part of this research. Details about agreements between FNX and Indigenous communities are confidential, and are not discussed herein.

17.1.4. Likely Future Conditions

Mining is at the economic core of the City of Greater Sudbury, with numerous mining projects ongoing in the Sudbury Basin. Should the Project not proceed, there would not be any appreciable effect on Employment and Business, as the City of Greater Sudbury has a diversified range of employment and business opportunities that will continue to support the local economy, however, the potential opportunity for direct, indirect and induced economic benefits will not be realized.

17.2. Environmental Effect Analysis

The Project currently employs people from the City of Greater Sudbury and from local Indigenous communities, as well as procures local goods and services to the extent possible. The total Project workforce ranges from 252 to 437 over the life of mine. Management, supervision and technical staff positions are planned to a total of 70 employees. The maintenance crew varies from 66 to 98 people over the life of mine. The mine operations crew varies from 66 to 162 employees over the life of mine. This environmental effects analysis is based on the assumption that FNX will continue these employment and procurement practices during Construction, Operations, and Decommissioning and Abandonment.

17.2.1. Construction

Direct economic benefits would include income to the Construction work force and utilization of local and regional suppliers that would provide services, equipment and

materials for the Project. Employment for the Construction phase of the Project will be approximately 72 direct hires, plus approximately 200 to 300 indirect contractor employees.

In terms of business opportunities, the Project is poised to spend approximately $1.183 billion on packages and contracts during Construction on goods and services. There are currently approximately 35 Construction packages valued at $857 million; $144 procurement packages valued at $153 million and 107 service packages valued at $173 million for a total of 286 procurement packages to be distributed over the course of Construction.

The City of Greater Sudbury will benefit from a number of employment and procurement opportunities. The Project will look to non-local expertise only in the event that the local workforce and business communities are absent or not sufficiently qualified. Opportunities will also exist for local Indigenous communities. It is anticipated that much of the goods, services and workforce will be supplied from local and Indigenous communities, given the experienced workforce in construction industries therein.

The local community will benefit from the Project in the form of indirect and induced economic benefits (income and employment expenditures as well as services, equipment and material expenditures). Indirect benefits would also consist of expenditures within the local economy on basic goods and services such as accommodation, fuel, restaurant services and general convenience sales, while induced benefits, experienced through a portion of the direct and indirect payroll that is spent in the local community on basic goods and services would extend generally to the environmental assessment area and beyond.

In addition to economic benefits to local communities including within the City of Great Sudbury as well as local Indigenous communities, it is anticipated that capacity building and training opportunities will be an indirect benefit of the Project. Preference toward employment of local people as well as the procurement of local goods and services will be required for capacity building and training opportunities for local community members to be possible.

A detailed environmental effects analysis for Construction, including Accidents, Malfunctions and Unplanned Events, is provided in Table 17-1.

Table 17-1: Environmental Effect Analysis; VC - Employment and Business; Project Phase - Construction

Project Components or Activities	Potential Environmental Effects (A = adverse; B = beneficial)	Engineering Design, Mitigation Measures and Proven Environmental Management Practices	Factors Considered in the Environmental Effects Analysis*							
			Magnitude	Geographic Extent	Timing	Frequency	Duration	Reversibility	Ecological & Socio-economic Context	Certainty of Knowledge
Planned Activities										
Construction employment and procurement of local goods and services	(B) Employment and procurement opportunities originating locally and non-locally, based on qualification. Opportunities will also exist for Indigenous communities. It is anticipated that much of the goods, services and workforce will be supplied from local and Indigenous communities, given the experienced workforce in construction industries therein.	Employment will be sourced locally when possible. First Nation and Métis employment and procurement will be managed in accordance with relevant Impact Benefit Agreements with each community. Indigenous opportunities will be identified and prioritized, where possible.	3	4	N/A	4	5	3	2	1
	(B) The local community will benefit from the Project in the form of indirect and induced economic benefits (income and employment expenditures as well as services, equipment and material expenditures).	Not applicable.	3	4	N/A	4	5	3	2	1
	(B) Capacity building within the local, Indigenous communities as a result of training opportunities.	Employment and training opportunities will be available to local and Indigenous community members. It is also anticipated that the procurement of local services, equipment and materials will result in additional employment and training opportunities within the local community.	3	4	N/A	4	5	4	2	1
Accidents, Malfunctions and Unplanned Events										
Construction employment and procurement of local good and services	(A) Lack of qualified workforce or suppliers in the local community due to unforeseen competition for employment and business resources (e.g. if other major projects are initiated in the region).	If qualified labour and requisite good and services cannot be sourced locally, opportunities will be extended to the larger regional area as required.	3	4	N/A	4	5	3	2	1

Key:

Magnitude: *
0 = High
1 = Medium
2 = Low
3 = nil
4 = Unknown (see definitions in text, EA methods)

Geographic Extent: *
1 = Immediate work area
2 = Within Project closure plan boundary
3 = Within 5km of Project closure plan boundary
4 = Beyond 5 km of Project closure plan boundary

Frequency: *
1 = Uncommon event, event occurs once or infrequently / periodically
2 = Happens regularly but infrequently (e.g., once or twice per month)
3 = Happens regularly (e.g. daily)
4 = Continuous activity

Duration: *
1 = < 1 month
2 = 1-2 months
3 = 2-6 months
4 = 6-24 months
5 = 2-11 years (life of mine)
6 = > 11 years (beyond Project)

Reversibility: *
1 = High
2 = Medium
3 = Low
4 = nil
5 = Unknown (see definitions in the text, EA Methods)

Ecological and Socio-economic Context: *
1 = Relatively pristine area not adversely affected by human activity
2 = Evidence of existing adverse effects
3 = High level of existing adverse effects

Timing: *
N/A – no sensitive periods or areas
exist in baseline conditions
1 – sensitive periods or areas exist in baseline conditions that require adjustments to Project schedule or timing of activities

Certainty of Knowledge:*
1 = High – based on past performance and experience regarding environmental effects or mitigation
2 = Moderate – uncommon potential effect either not well understood or effects require compliance monitoring to modify engineering design or mitigation
3 = Low – potential for the need to follow-up based on results of compliance monitoring to modify engineering design or mitigation

17.2.2. Operations

Royalties and taxes (including corporate and personal income taxes) will be paid to the Provincial and Federal governments by FNX as well as by those companies and industries that supply goods and services to the Project. The operation of the Project will also result in contributions to the local, regional and national economies in the form of economic growth and contribution to the national Gross Domestic Product (GDP).

Direct economic benefits would include income to the workforce force and utilization of local and regional suppliers that would provide services, equipment and materials for the Project during Operations. Employment for the Operations phase of the Project will be approximately 397 direct hires.

In terms of business opportunities, the Project is poised to spend approximately $50 million in goods and services packages and contracts during Operations with 27 contracts to be distributed.

The City of Greater Sudbury as well as local Indigenous communities will benefit from a number of employment and procurement opportunities during Operations. The Project will source non-local expertise only in the event that the local workforce and business communities are absent or not sufficiently qualified. In addition, it is anticipated that much of the goods, services and workforce will be supplied from local and Indigenous communities, given the experienced workforce in construction industries therein.

The local community will benefit from Operations in the form of indirect and induced economic benefits (income and employment expenditures as well as services, equipment and material expenditures). Indirect benefits would also consist of expenditures within the local economy on basic goods and services such as accommodation, fuel, restaurant services and general convenience sales, while induced benefits, experienced through a portion of the direct and indirect payroll that is spent in the local community on basic goods and services would extend generally to the environmental assessment area and beyond.

In addition to economic benefits to local communities such as the City of Great Sudbury and local Indigenous communities, it is anticipated that capacity building and training opportunities will be an indirect benefit of the Project. Preference toward employment of local people as well as the procurement of local goods and services will be required for capacity building and training opportunities for local community members to be possible.

A detailed environmental effects analysis for Operations, including Accidents, Malfunctions and Unplanned Events, is provided in Table 17-2.

Table 17-2: Environmental Effect Analysis; VC - Employment and Business; Project Phase - Operations

Project Components or Activities	Potential Environmental Effects (A = adverse; B = beneficial)	Engineering Design, Mitigation Measures and Proven Environmental Management Practices	Factors Considered in the Environmental Effects Analysis*							
			Magnitude	Geographic Extent	Timing	Frequency	Duration	Reversibility	Ecological and Socio-economic Context	Certainty of Knowledge
Planned Activities										
Facility operations	(B) Contribution to the local, regional and national economies in the form of economic growth, and payment of corporate and income taxes. Contribution to the national Gross Domestic Product (GDP).	Royalties and taxes (including corporate and personal income taxes) will be paid to the provincial and federal governments by the owner as well as companies and industries that supply goods and services to the mining industry.	0	4	N/A	4	5	3	2	1
Facility employment and procurement of local goods and services	(B) Employment and procurement opportunities originating locally and non-locally, based on qualification. (B) Opportunities will also exist for local Indigenous communities. It is anticipated that much of the goods, services, and workforce will be supplied from local and Indigenous communities, given the experienced workforce in extractive and industrial sectors therein.	Employment will be sourced locally when possible. Indigenous employment and procurement will be managed in accordance with relevant Impact Benefit Agreements with each community. Indigenous opportunities will be identified and prioritized, where possible.	3	4	N/A	4	5	3	2	1
	(B) The local community will benefit from the facility in the form of indirect and induced economic benefits (income and employment expenditures as well as services, equipment and material expenditures).	Not applicable.	3	4	N/A	4	5	3	2	1
	(B) Capacity building within the local and Indigenous communities as a result of training opportunities.	Employment and training opportunities will be available to local and Indigenous community members. It is also anticipated that the procurement of local services, equipment and materials will result in additional employment and training opportunities within the local community.	3	4	N/A	4	5	4	2	1
Accidents, Malfunctions and Unplanned Events										
Facility employment and procurement of local good and services	(A) Lack of qualified workforce or suppliers in the local community due to unforeseen competition for employment and business resources (e.g. if other major projects are initiated in the region).	If qualified labour and requisite good and services cannot be sourced locally, opportunities will be extended to the larger regional area as required.	3	4	N/A	4	5	3	2	1

Key:

Magnitude: *
0 = High
1 = Medium
2 = Low
3 = nil
4 = Unknown (see definitions in text, EA methods)

Geographic Extent: *
1 = Immediate work area
2 = Within Project closure plan boundary
3 = Within 5km of Project closure plan boundary
4 = Beyond 5 km of Project closure plan boundary

Frequency: *
1 = Uncommon event, event occurs once or Infrequently / periodically
2 = Happens regularly but infrequently (e.g., once or twice per month)
3 = Happens regularly (e.g. daily)
4 = Continuous activity

Duration: *
1 = < 1 month
2 = 1-2 months
3 = 2-6 months
4 = 6-24 months
5 = 2-11 years (life of mine)
6 = > 11 years (beyond Project)

Reversibility: *
1 = High
2 = Medium
3 = Low
4 = nil
5 = Unknown (see definitions in the text, EA methods)

Ecological and Socio-economic Context: *
1 = Relatively pristine area not adversely affected by human activity
2 = Evidence of existing adverse effects
3 = High level of existing adverse effects

Timing: *
N/A – no sensitive periods or areas exist in baseline conditions
1 – sensitive periods or areas exist in baseline conditions that require adjustments to Project schedule or timing of activities

Certainty of Knowledge:*
1 = High – based on past performance and experience regarding environmental effects or mitigation
2 = Moderate – uncommon potential effect either not well understood or effects require compliance monitoring to modify engineering design or mitigation
3 = Low – potential for the need to follow-up based on results of compliance monitoring to modify engineering design or mitigation

17.2.3. Decommissioning and Abandonment

There will be a loss of royalties and taxes (including corporate and personal income taxes) that will no longer be paid to the Provincial and Federal governments by FNX following Decommissioning and Abandonment. In addition, those from companies and industries that supplied good and services to the Project will cease. Following Decommissioning and Abandonment, contributions to the local, regional and national economies in the form of economic growth and contribution to the national Gross Domestic Product (GDP) will also finish.

Direct economic benefits during Decommissioning and Abandonment would include income to the labour force and utilization of local and regional suppliers that would provide services, equipment and materials for the Project. Employment for the Construction phase of the Project will be approximately three direct hires, plus 10 to 15 indirect contractor employees.

In terms of business opportunities, the Project is poised to spend approximately $3.9 million in demolition and decommissioning costs over Decommissioning and Abandonment years one through five, the majority of which will be spent during Decommissioning and Abandonment years one through three. There currently are a minimum of four procurement packages anticipated to be distributed over the course of physical Decommissioning, with a value of those packages being approximately $8 to $12 million form operating to long term care and maintenance.

The City of Greater Sudbury will benefit from some employment and procurement opportunities during Decommissioning and Abandonment. The Project will look to non-local expertise only in the event that the local workforce and business communities are not sufficiently qualified. Opportunities will also exist for local Indigenous communities. It is anticipated that much of the goods, services and workforce will be supplied from local and Indigenous communities, given the experienced workforce in construction, metals and mining industries therein.

During Decommissioning and Abandonment, the local community will benefit from the Project in the form of indirect and induced economic benefits (income and employment expenditures as well as services, equipment and material expenditures). Indirect benefits would also consist of expenditures within the local economy on basic goods and services such as accommodation, fuel, restaurant services and general convenience sales, while induced benefits, experienced through a portion of the direct and indirect payroll that is spent in the local community on basic goods and services would extend generally to the environmental assessment area and beyond.

In addition to economic benefits to local communities including within the City of Great Sudbury as well as local Indigenous communities, it is anticipated that capacity building and training opportunities will be an indirect benefit of the Project. Preference toward employment of local people as well as the procurement of local goods and services will

be required for capacity building and training opportunities for local community members to be possible.

A detailed environmental effects analysis for Decommissioning and Abandonment, including Accidents, Malfunctions and Unplanned Events, is provided in Table 17-3.

Table 17-3: Environmental Effect Analysis; VC - Employment and Business; Project Phase - Decommissioning and Abandonment

Project Components or Activities	Potential Environmental Effects (A = adverse; B = beneficial)	Engineering Design, Mitigation Measures and Proven Environmental Management Practices	Factors Considered in the Environmental Effects Analysis*							
			Magnitude	Geographic Extent	Timing	Frequency	Duration	Reversibility	Ecological and Socio-economic Context	Certainty of Knowledge
Planned Activities										
Mine decommissioning and abandonment	(A) Income, revenues, taxes, and royalty contributions to the local, regional and national economies during operations will cease.	Royalties and taxes (including corporate and personal income taxes) will no longer be paid to the provincial and federal governments by the owner as well as companies and industries that supply good and services to the mining industry.	0	4	N/A	4	6	3	3	1
Employment and procurement of local goods and services during mine decommissioning and abandonment activities	(B) Employment and procurement opportunities originating locally and non-locally, based on qualification. Opportunities will also exist for local Indigenous communities. It is anticipated that much of the goods, services, and workforce will be supplied from local and Indigenous communities, given the experienced workforce in extractive and industrial sectors therein.	Employment will be sourced locally when possible. Indigenous employment and procurement will be managed in accordance with relevant Impact Benefit Agreements with each community. Indigenous opportunities will be identified and prioritized, where possible.	3	4	N/A	4	4	3	3	1
	(B) The local community will benefit from mine decommissioning and abandonment in the form of indirect and induced economic benefits (income and employment expenditures as well as services, equipment and material expenditures).	Not applicable.	3	4	N/A	4	4	3	3	1
	(B) Capacity building within the local and Indigenous communities as a result of training opportunities.	Employment and training opportunities will be available to local Indigenous community members. It is also anticipated that the procurement of local services, equipment and materials will result in additional employment and training opportunities within the local community.	3	4	N/A	4	4	4	3	1
Accidents, Malfunctions and Unplanned Events										
Employment and procurement of local good and services during mine decommissioning and abandonment	(A) Lack of qualified workforce or suppliers in the local community due to unforeseen competition for employment and business resources (e.g. if other major projects are initiated in the region).	If qualified labour and requisite good and services cannot be sourced locally, opportunities will be extended to the larger regional area as required.	3	4	N/A	4	4	3	3	1

Key:

Magnitude: *
0 = High
1 = Medium
2 = Low
3 = nil
4 = Unknown (see definitions in text, EA methods)

Geographic Extent: *
1 = Immediate work area
2 = Within Project closure plan boundary
3 = Within 5km of Project closure plan boundary
4 = Beyond 5 km of Project closure plan boundary

Frequency: *
1 = Uncommon event, event occurs once or infrequently / periodically
2 = Happens regularly but infrequently (e.g., once or twice per month)
3 = Happens regularly (e.g. daily)
4 = Continuous activity

Duration: *
1 = < 1 month
2 = 1-2 months
3 = 2-6 months
4 = 6-24 months
5 = 2-11 years (life of mine)
6 = > 11 years (beyond Project)

Reversibility: *
1 = High
2 = Medium
3 = Low
4 = nil
5 = Unknown (see definitions in the text, EA Methods)

Ecological and Socio-economic Context: *
1 = Relatively pristine area not adversely affected by human activity
2 = Evidence of existing adverse effects
3 = High level of existing adverse effects

Timing: *
N/A – no sensitive periods or areas exist in baseline conditions
1 – sensitive periods or areas exist in baseline conditions that require adjustments to Project schedule or timing of activities

Certainty of Knowledge:*
1 = High – based on past performance and experience regarding environmental effects or mitigation
2 = Moderate – uncommon potential effect either not well understood or effects require compliance monitoring to modify engineering design or mitigation
3 = Low – potential for the need to follow-up based on results of compliance monitoring to modify engineering design or mitigation

17.2.4. Environmental Design, Mitigation and Optimization

Many of the environmental design, mitigation and optimization features related to Employment and Business will already be in place prior to commencement of Project Construction due to their necessity during Advanced Exploration. FNX understands the importance of implementing environmental design, mitigation measures and sustainability management practices in optimizing Project benefits to the local community.

Employment opportunities are posted using a number of different methods including, but not limited to, publicly on the company website at: http://kghm-international-ltd.ttcportals.com/. In addition, opportunities for the supply of goods and services are also publicly available on the company website at: http://kghm.com/en/suppliers.

FNX has established Memorandum of Understanding (MOUs) or Impact Benefit Agreements (IBAs) with each Indigenous community identified as potentially affected by or interested in the Project. The details of the IBAs are confidential, however, each agreement includes provisions of opportunities related to employment and the procurement of goods and services.

17.3. Residual Environmental Effects

This section describes the residual adverse environmental effects the Project may have on Employment and Business. The following criteria have been developed to determine whether the residual adverse effects are determined to be significant:

A significant residual adverse effect of the Project on Employment and Business occurs when skilled and unskilled labour and the procurement of goods and services sourced locally impairs or is materially detrimental to established businesses and service providers in the region. Such impairments result from the loss of skilled workers at established businesses as a result of opportunities for workers with the proposed project.

A not significant residual adverse environmental effect of the Project on Employment and Business occurs when skilled and unskilled labour and procurement of goods and services required for the Project does not result in material impairments to established businesses and service providers in the region. Any loss of skilled workers at established businesses can be replaced through available capacity in the region.

A summary of the residual adverse environmental effects of the Project on Employment and Business is provided in Table 17-4.

Table 17-4: Summary of Residual Environmental Effects – Employment and Business

Valued Component	Key Adverse Residual Environmental Effect	Significance[1]	Probability of Occurrence (Likelihood)[2]	Effect on Ecosystem Function and Integrity[2]	Sustainable (Capacity) Use of Renewable Resources[2]	Relevant Legislation[3]
Construction	No adverse residual environmental effects are anticipated during Construction.	N/A	N/A	N/A	N/A	N/A
Operations	No adverse residual environmental effects are anticipated during Operations.	N/A	N/A	N/A	N/A	N/A
Decommissioning and Abandonment	Loss of income following Decommissioning and Abandonment.	Not significant	High	Low	High	N/A
Accidents, Malfunctions and Unplanned Events	Lack of qualified workforce or suppliers in the local community due to unforeseen competition for employment and business resources (e.g. if other major projects are initiated in the region). This will increase the area from which the Project will draw from to find qualified workers or suppliers.	Not significant	Low	Low	High	N/A
Planned Project Overall	Significant upside benefits from employment and business opportunities. Loss of income following Decommissioning and Abandonment. Opportunities not maximized if there is a lack of qualified workforce or suppliers in the local community due to unforeseen competition for employment and business resources (e.g. if other major projects are initiated in the region). Loss of income, revenues and taxes to the local, regional and national economies once mine operation ceases.	Not significant	Low	Low	High	N/A
The Project in combination with other projects and activities	Increased potential for lack of qualified workforce or suppliers in the local community due to unforeseen competition for employment and business resources. This will increase the area from which the Project will draw from to find qualified workers or suppliers.	Not significant	Low	Low	High	N/A

Notes:
1. The rating of significance for adverse residual environmental effects are those predicted effects remaining after the application of mitigation.
2. Sustainability factors are described for all predicted adverse residual environmental effects.
3. Key federal legislation references as appropriate for relevant predicted adverse environmental effects.

17.3.1. Construction

No adverse residual environmental effects are anticipated during Construction.

17.3.2. Operations

No adverse residual environmental effects are anticipated during Operations.

17.3.3. Decommissioning and Abandonment

The residual adverse environmental effects of Decommissioning and Abandonment on Employment and Business include loss of income following final Decommissioning and Abandonment. The residual adverse environmental effect is considered to be not significant. Similar residual effects will occur during conditions of temporary closure.

17.3.4. Accidents, Malfunctions and Unplanned Events

Lack of qualified workforce or suppliers in the local community due to unforeseen competition for employment and business resources (e.g. if other major projects are initiated in the region). This will increase the area from which the Project will draw from to find qualified workers or suppliers. Based on the relatively small scale of the required workforce, compounded by the available workforce in the City of Greater Sudbury, this potential adverse environmental effect is considered not significant.

17.3.5. Planned Project Overall

Overall there will be a positive economic benefit to local and regional areas through Employment and Business opportunities, which will result in direct, indirect, and induced economic benefits. There is also a potential for adverse effects, whereby opportunities would not be maximized if there is a lack of qualified workforce or suppliers in the local community due to unforeseen competition for employment and business resources (e.g. if other major projects are initiated in the region). This will increase the area from which the Project will draw from to find qualified workers or suppliers. Based on the relatively small scale of the required workforce, compounded by the availability of a workforce in the City of Greater Sudbury, this potential adverse environmental effect is considered not significant.

17.3.6. Cumulative Environmental Effects

The Project may result in residual cumulative environmental effects to Employment and Business resources, as other projects and activities such as historical mining, Advanced Exploration and permanent and seasonal residential activities (Chapter 2 – Existing Environment) contribute to the potential for limiting the local qualified workforce and suppliers. This will increase the area from which the Project will draw from to find qualified workers or suppliers. However, based on the relatively small scale of the required workforce, compounded by the available workforce in the City of Greater

Sudbury, this potential cumulative environmental effect is considered to be not significant.

17.3.7. Monitoring and Follow-Up Program

Employment and procurement for the Project is monitored and tracked. FNX is an equal opportunity employer, and supports diversity in recruitment and hiring. Employment and procurement is also monitored and reported in relation to commitments and agreements with Indigenous communities, however, due to confidentiality this information is not provided herein.

There is a high degree of confidence associated with determining potential effects to Employment and Business, and with determining that there are no significant adverse environmental effects. FNX has developed comprehensive management plans and procedures to mitigate any potential adverse environmental effects. As a result, a follow-up program is not required for the Employment and Business VC.

17.4. References

- City of Greater Sudbury. Undated. About Greater Sudbury. Available online at: http://www.greatersudbury.ca/living/about-greater-sudbury/. Accessed on February 11, 2016.
- City of Greater Sudbury. 2016. Labour Force Survey Statistical Report January 2016. Available online at: https://www.greatersudbury.ca/living/about-greater-sudbury/key-facts/labour-and-employment/labour-force-survey/. Accessed on February 11, 2016.
- Greater Sudbury Development Corporation. 2013. City of Greater Sudbury Mining Canada's mighty mining metropolis. Available online at: http://www.investsudbury.ca/index.php?option=com_content&view=article&id=238&Itemid=224&lang=en. Accessed February 11, 2016.
- Statistics Canada. 2012. Greater Sudbury / Grand Sudbury, Ontario (Code 580) and Canada (Code 01) (table). Census Profile. 2011 Census. Statistics Canada Catalogue no. 98-316-XWE. Ottawa. Released October 24, 2012. http://www12.statcan.gc.ca/census-recensement/2011/dp-pd/prof/index.cfm?Lang=E Accessed February 11, 2016.

Table of Contents – Chapter 18

18. Cumulative Environmental Effects 340

18. Cumulative Environmental Effects

FNX conducted an evaluation of the Project in combination with other past, present and likely future projects and activities in the area. FNX selected VCs partly to reflect key potential cumulative environmental effects on resources and others in the area. The Project occurs in proximity to residents (permanent and seasonal) and the area provides a range of recreational activities (such as fishing, hunting and berry picking). As well, Fairbank Lake Provincial Park occurs north of the Project site and is a destination for daily and seasonal users. The key interactions of the Project, in combination with other projects and activities in the area on VCs are principally associated with emissions and effluent leaving the site and elevated levels of vehicular traffic on public roads.

The cumulative environmental effects of the Project were evaluated in each VC chapter (Chapters 9 to 17). FNX concludes that the residual adverse environmental effects of the Project, in combinations with other projects and activities, are not significant. The Project comprises activities that are common in northern Ontario (that is the mine-load-haul-dump activities, getting mine product to established mills and minerals processing activities). The Project activities are a highly compatible land use in the Sudbury Basin as similar activities have been occurring since the late 1800s. There are several important considerations that help support this conclusion including:

- The results of predictive modelling associated with the protection of human health (atmospheric emissions) and the protection of aquatic life (wastewater treatment plant effluent);
- The results of recent ecological and human health risk assessments as part of the Sudbury Soils Study; and
- The ability of the City of Greater Sudbury to evaluate and upgrade regional public roads to ensure the travelling public has safe roads to use.

Table of Contents – Chapter 19

19. Summary..... 342

19. Summary

FNX has conducted a complete and comprehensive environmental assessment of the Project involving contemporary practice associated with focusing a detailed environmental effects analysis on Valued Components (VCs). The environmental assessment also included the Project, closely related projects and activities associated with the past decade of exploration on the Victoria site, and other project and activities in the vicinity of the Victoria site. The environmental effects analysis on VCs is summarized in Table 19-1.

FNX anticipates that the residual adverse effects of the Project in combinations with past, present and likely future projects and activities to be not significant based on its methodical phased approach to the mine development, and to conducting this environmental effects analysis. While FNX methods result in residual adverse environmental effects being considered not significant or significant, for Project review considerations residual adverse environmental effects considered not significant are analogous to “minimal environmental effects” described in CEA Agency (2015). FNX considers that the various existing legislative and regulatory processes that have been an integral part of Project planning to date are adequate to meet the environmental assessment and sustainability planning needs of the Project. As such, further formal review under the *Canadian Environmental Assessment Act* is not considered necessary to achieve a high level of community engagement, environmental protection and pollution prevention.

Table 19-1: Significance of Adverse Residual Environmental Effects

Valued Component	Significance of Adverse Residual Environmental Effects					
	Construction	Operations	Decommissioning and Abandonment	Accidents, Malfunctions and Unplanned Events	Planned Project Overall	The Project in combination with other projects and activities
Atmospheric Environment	Not significant	Not significant	Not significant	Not significant	Not significant	Not significant
Surface Water Quality	Not significant	Not significant	Not significant	Not significant	Not significant	Not significant
Groundwater Quantity	Not significant	Not significant	Not significant	Not significant	Not significant	Not significant
Fish and Fish Habitat	Not significant	Not significant	Not significant	Not significant	Not significant	Not significant
Terrestrial Habitat	Not significant	Not significant	Not significant	Not significant	Not significant	Not significant
Residents and Recreational Land Use	Not significant	Not significant	Not significant	Not significant	Not significant	Not significant
Community Services and Infrastructure	Not significant	Not significant	Not significant	Not significant	Not significant	Not significant
Employment and Business	Not significant	Not significant	Not significant	Not significant	Not significant	Not significant
Archaeological Resources	Not significant	Not significant	Not significant	Not significant	Not significant	Not significant

FNX does not anticipate any residual adverse environmental effects that would be considered significant and anticipates the Project will make a substantial contribution to the local and regional economy through direct, indirect and induced benefits as a result of employment and the procurement of goods and services. FNX has a high degree of confidence in its conclusions about the significance of residual adverse environmental effects as a result of:

- The high degree of similarity of activities associated with the Project to exploration and advanced exploration activities by FNX for more than a decade at site;
- Project activities will require the same range of permits, authorizations and approvals as those that have been acquired for site exploration and exploration activities to date. Future permits are expected to comprise renewals and amendments of existing permits;
- FNX has a good understanding of key issues related to Indigenous groups and the public (including stakeholders, regulators and resources managers) as a result of extensive consultations efforts over the past many years;
- The scope of the Project comprises an ore and rock load-haul-dump type of mine similar to many other mines in the Sudbury Basin supplying mine product to feed existing mill and smelter capacity. The Project scope does not include typical elements that possible contribute to more substantial residual adverse environmental effects such as: large waste stripping ratios typical of open pit mines; worker accommodations; tailings management areas, milling, smelting and refining; and
- Exploration, mining and minerals processing has been occurring in the Sudbury Basin for more than a century. The Sudbury Area Risk Assessment recently concluded in the Sudbury Soils Study that, while there are some elevated levels of minerals in the environment in the Sudbury Basin, they are closely associated with minerals processing centres for smelting and refining and not mineral extraction (mining) areas. The Sudbury Soils Study concluded that environmental and human health risks are at acceptable levels throughout the Sudbury Basin, including the area where the Project is located.

Table of Contents – Chapter 20

20. Closing Perspective 346

20. Closing Perspective

FNX conducted this assessment as part of its internal governance process over major capital projects and their planning. FNX expects a high level of sustainability management and planning fully integrated with its engineering and costing functions through the engineering maturation process. KGHM develops mining and minerals processing projects throughout the world and has a good sense of standard practices in environmental assessment as well as environmental assessment expectations in Canada. This environmental assessment supports other aspects of FNX's risk assessment and mitigation processes used to bring forward Projects that meet the expectations of customers and shareholders, potentially affected communities including Indigenous communities, governments and stakeholders.

FNX offers this environmental assessment to the Canadian Environmental Assessment Agency (Agency) to help support the description of potential environmental effects provided in Chapter 5 of the Project Description Report. FNX believes the spirit and substance of a Project–specific environmental assessment has been met in this EEA. However, direction is needed from the Agency as to whether further environmental assessment is required subject to the *Canadian Environmental Assessment Act* prior to allowing the Project to proceed.

Appendix A: Non-Indigenous Consultation Activities

Table 20-1: Victoria Mine Project and Site Exploration Activities - Summary of Consultation and Engagement with the Public

Scope and Subject	Date	Key Issues	Objectives/Comments
Special Interest Groups: Vermilion River Stewardship Committee			
Invited to participate in Open House events. Newspaper advertisements placed to invite the City of Greater Sudbury. Flyers are mailed to local residents.	October 2011, August 2013, September 2014	No issues raised.	Continue to invite the Committee to open house events.
KGHM invited to give a presentation to the Vermilion River Stewardship Committee about the Project.	2014	Significant discussion about environmental effects; No issues raised.	As posted on the Committee website, "… all questions were answered to the satisfaction of the audience in a knowledgeable and professional fashion…". KGHM is available to provide any updates and presentations, as requested.
Special Interest Groups: Fairbank Lake Cottagers Association			
Invited to participate in Open House events. Newspaper advertisements placed to invite the City of Greater Sudbury. Flyers are mailed to local residents.	October 2011, August 2013, September 2014	Traffic: atmospheric effects and public safety.	Continue to invite residents to open house events.
Concerns have been raised regarding additional trucks on local roads, and the associated effects on the atmospheric environment and public safety. Concerns have also been raised about mud on the roads.	Completed in 2018	Haul Truck Traffic, additional traffic: atmospheric effects (dust and noise) and public safety.	City of Greater Sudbury has completed road upgrades to Fairbanks East Road/Crean Hill Road. . 2016 installation of traffic lights at the junction of Hwy. 17 and MR4 to increase public safety. The Project is committed to minimizing effects through traffic controls and safe driving procedures.
Concerns have been raised about clearing of Fairbanks East road, where clearing was done for the power line, PAG 1 waste rock pad, and city road upgrade.	2014	Visual effects.	Over time some of the vegetation will return, and will block the visual impact of the PAG 1 waste rock pad.
Concerns have been raised about effects to water quality.	2015	Water quality.	Ensure water quality meets effluent discharge limits and all other permit requirements.
KGHM Invited to contribute to the Annual Fairbank Lake Cottagers Association Spring Newsletter. An update to the Victoria Project was provided for inclusion into the annual newsletter.	2016, 2017	No issues raised.	Consultation with Fairbank Lake Cottagers Association to keep them apprised of Victoria Project site activities.
KGHM invited to help support annual events: Fairbank Lake Cottagers Annual Road Clean up & Annual Picnic	2016, 2017, 2018	NA	The Project has supported these annual events by supplying gifts for the picnic and when required, the garbage bin for annual clean up
Special Interest Groups: Walden Sno Runners Snowmobile Association			
Invited to participate in Open House events. Newspaper advertisements placed to invite the City of Greater Sudbury. Flyers are mailed to local residents.	October 2011, August 2013, September 2014	Traffic: atmospheric effects and public safety.	Continue to invite groups to open house events.
Temporary changes to Sudbury Trail Plan have resulted from Project activities.	2013 - 2014	Effect on existing Sudbury Trail Plan.	Through consultation with the Walden Sno Runners Snowmobile Association, the trail was modified in 2013 and 2014 to accommodate for exploration activities.

Scope and Subject	Date	Key Issues	Objectives/Comments
KGHM invited to help support annual Sno Runners Social	2016, 2017, 2018, 2019	N/A	The Project has supported is annual event by supplying gift(s) for silent auction.
Construction of PAG 2 will result in waste rock haul trucks crossing the existing trail.	Ongoing	Effect on existing Sudbury Trail Plan.	Through consultation with the Walden Sno Runners Snowmobile Association, agree on whether the trail should be rerouted, or if signage should be added to warn trail users about upcoming road crossings.
Special Interest Groups: Randolph Street Residents			
Invited to participate in Open House events. Newspaper advertisements placed to invite the City of Greater Sudbury. Flyers are mailed to local residents.	October 2011, August 2013, September 2014	Traffic: atmospheric effects and public safety.	Continue to invite residents to all future open house events.
Scope of discussions has focused on the effects to the local side street (intersection of Hwy 17 and MR4). There are existing issues and concerns with traffic from Totten mine.	Completed	Traffic from Totten mine: atmospheric effects and public safety.	Community is engaged with city council, and KGHM as required. Traffic lights were installed in 2016 at the junction of Hwy. 17 and MR4 to increase public safety. The Project is committed to minimizing effects through traffic controls and safe driving procedures.
Special Interest Groups: Copper Cliff			
Mine Haul route between site and Clarabelle Mill is expected to be via Hwy 144 to RR 35 to Clarabelle Road. An alternate route is via Hwy 17 to MR55 to Godfrey Drive and Clarabelle Road. Residents of Copper Cliff have raised concerns around effects of traffic on the atmospheric environment and public safety.	Ongoing	Traffic along mine haul route: atmospheric effects and public safety.	This route is part of the haul route agreement with Vale. Engagement with the community is through Vale.
Industry: Vale			
There are several agreements between KGHM and Vale, including: Sudbury Basin Properties Off-Take Agreement (August 2013), Victoria Property Surface Rights License, and Second and Amended and Restated Sudbury Basin Properties Agreement.	Ongoing	No issues have been raised.	Relationship is primarily managed through the following committees: Joint Technical Committee and the Environment Committee.
Totten employees have expressed concern about the increased traffic on MR4.	2016 - 2017	Traffic on MR4: public safety.	Through Joint Technical Committee, agreed that the MR4 should be upgraded, including an additional traffic light at the intersection of MR4 and Hwy 17. 2016 installation of traffic lights at the junction of Hwy. 17 and MR4 to increase public safety. The Project is committed to minimizing effects through traffic controls and safe driving procedures.

Scope and Subject	Date	Key Issues	Objectives/Comments
There is a railway bed within the proposed right of way (Fairbanks East Road) constructed from mine waste rock.	Completed	Soil contamination.	The City of Greater Sudbury, Vale, and KGHM are working in collaboration to organize a clean-up through the Joint Technical Committee being funded by the Project. The area was cleaned up in cooperation with Vale with funding provided by the Victoria Project.
Industry: Glencore Sudbury Integrated Nickel Operations			
Glencore and Vale own property adjacent to the Victoria Project. A shared airshed agreement has been approved for the properties to the south.	March 2012	No issues have been raised.	Letter from Glencore and a letter from Vale stating that the Project can use the airshed above their properties. Letters have been issued to the Ministry, and boundaries have been changed for the air model to include these parcels.

Table 20-2: Victoria Mine Project and Site Exploration Activities - Summary of Consultation and Engagement with Government Agencies

Scope and Subject	Date	Key Issues	Objectives/Comments
Provincial Government Agencies: Ministry of Northern Development and Mines			
Meetings and discussions have focused primarily on obtaining permits and regarding permit amendments.	Ongoing since 2010	Questions and concerns have been addressed through the permit application review process.	Key permits obtained for the Project include: Closure Plan and Advanced Exploration Closure Plan Amendment. Advanced Exploration future permits will include: Application for Bulk Sample Permission.
Provincial Government Agencies: Ministry of Environment and Climate Change			
Meetings and discussions have focused primarily on obtaining permits and permit amendments.	Ongoing since 2010	Questions and concerns have been addressed through the permit application review process.	Key permits obtained for the Project include: ECA - Industrial Sewage, ECA - Air and Noise (Comprehensive), Permit to Take Water, Permit to Dewater Shaft, Hazardous Waste Generator Registration, Timber Permit, Approval to Commence Harvesting Operations, Diesel Power Generation, 1MW to 5MW.
Provincial Government Agencies: Ministry of Natural Resources and Forestry			
Meetings and discussions have focused primarily on obtaining permits and regarding permit amendments.	Ongoing since 2010	Questions and concerns have been addressed through the permit application review process.	Key permits obtained for the Project include: Endangered Species Permit - Whip-poor-will Permit, Work Permit - Construction of the Wastewater Treatment Plant Effluent Discharge Line Outlet Channel.
Provincial Government Agencies: Ministry of Labour			
Meetings and discussions have focused primarily on obtaining permits and regarding permit amendments.	Ongoing since 2010	Questions and concerns have been addressed through the permit application review process.	Key permits obtained for the Project include: Registration of Constructors and Employers Engaged in Construction, Notice of Diesel-Powered Equipment, Notice of Magazine or use of Explosives. Future permits will include: Notice of Mining Activities, Notice Hoisting Plant Operation, Medical certificates.
Provincial Government Agencies: Ministry of Transportation Ontario			
Responsible for conducting work for the traffic light, which is included as part of northeastern highway improvement plan 2015-2019.	Completed	No issues have been raised.	Traffic light at the intersection of MR4 and Hwy 17 was installed in 2016.
Federal Government Agencies: Fisheries and Oceans Canada			
Meetings and discussions have focused primarily on obtaining permits.	Ongoing since 2010	Questions and concerns have been addressed through the permit application review process.	Permit applications reviewed have considered potential impacts to fish and fish habitat and storage of waste rock.
Introduction of Project to Agency and screening of Project for potential impacts to fish and fish habitat.	August 2010	Determine if there are potential for impacts to fish and fish habitat	Determine if the project has potential to impact fish and fish habitat and request letter of advice. Based on the project scope at the time, there were no concerns identified by DFO.

Scope and Subject	Date	Key Issues	Objectives/Comments
Request for review of Development Proposal and request for Letter of Advice.	2011 – June, August, September	Review the proposed location of Non-Acid Generating Waste Rock Storage.	Site visit held with DFO in August 2011 as part review process. Letter of Advice to proceed with project issued in September 2011.
Request for review of *Fisheries Act* Authorization requirements for Ethel Lake Control Structure	January 2016 – July 2017	No issues were identified.	DFO determined that no formal approval was required for the Ethel Lake Control Structure under the *Fisheries Act* or federal *Species at Risk Act*. A Letter of Advice to proceed was received in July 2017.
Federal Government Agencies: Environment and Climate Change Canada			
Discussions have focused primarily on requirements of the Metal Mining Effluent Regulations.	Ongoing since 2015	No issues have been raised.	Continued discussions with Environment Canada to determine *MMER* applicability to the Project. In October 2016, Environment Canada advised that the Victoria Project was not subject to the *MMER.*
Federal Government Agencies: Canadian Environmental Assessment Agency			
Meetings and discussions have focused primarily on the Project Description Report.	Ongoing since 2011	Comments on the first Project Description Report were provided in Sep 2015.	First Project Definition submitted to CEAA in 2011, which at that time did not trigger CEAA review. Subsequent submission of updated Project Description Reports were submitted in 2015, 2016 and 2017 to address CEAA comments. An updated draft Project Description Report was submitted in October 2018.
Municipal Groups: City of Greater Sudbury			
Conservation Sudbury	September 2017	Determine potential timelines for granting of Shoreline Alteration Permit.	Determine timelines for potential permit application for Ethel Lake Control Structure. Determined a one to two week turnaround, so will not proceed with submission until required to meet project schedule.
Municipalities and Communities: City of Greater Sudbury			
Building Services: building permits and development fees.	Ongoing	No issues have been raised.	All building permits and development fees will continue to be processed, as required.
Sewage System Authorization.	Ongoing	No issues have been raised.	Future permit application.
Roads upgrades: ongoing coordination for City upgrades, which are being funded by the Project.	Completed in 2018	Safety and traffic management during road improvements	City of Sudbury has completed road upgrades to Fairbanks East Road and Crean Hill Road. No further issues identified.
Municipalities and Communities: Walden, Whitefish, Worthington			
Invited to participate in Open House events. Newspaper advertisements placed to invite residents of the City of Greater Sudbury. Flyers were mailed to local residents.	October 2011, August 2013, September 2014	Traffic: atmospheric effects and public safety.	Continue to invite residents to open house event.

Appendix B: Indigenous Consultation Activities

Table 20-3: Victoria Mine Project and Site Exploration Activities - Summary of Consultation and Engagement with Atikameksheng Anishnawbek First Nation (AAFN)

Scope and Subject	Date	Current Status	Objectives/Comments
General			
Initial contact and introductions.	November 2009	Complete	Introduce the Project and Project team.
Project updates: updates on exploration activities; Project schedule and planned activities; Project plans and progress; review of environmental study results; updates or changes to permit applications; discussions about Indigenous and treaty rights; negotiation on governing agreements.	2009 – December; 2010 – April, June, October; January 2012 to present (monthly)	Ongoing	Consistent and transparent communications through community engagement strategies; AAFN / KGHM Agreement Negotiation Committee; AAFN / KGHM Community Liaison Committee; engagement with Project management and leadership.
Relationship building: community meetings; sponsorship and participation in social events; Pow Wows; site visits; commemoration of National Indigenous Day with AAFN community; Site Blessing Ceremony.	January 2012 to present	Ongoing	Consistent and transparent communications through community engagement strategies; AAFN / KGHM Community Liaison Committee; engagement with Project management and leadership.
Negotiated Agreements			
Memorandum of Understanding (MOU) – Signed.	December 2011	Complete	Agreement to enter into negotiations with the goal of defining the future working relationship that meets the needs and interest of both AAFN and KGHM.
Memorandum of Understanding – Resigned.	December 2012	Complete	Renewal of the earlier MOU whereby the two parties agreed to continue negotiations with the goal of defining a mutually beneficial future working relationship.
Victoria Advanced Exploration Project Agreement; Community meeting and ceremonial signing.	September 2014; November 2014	Complete	Established the Joint Community Liaison Committee which governs the interactions between the community and the Project.
Joint Community Liaison Committee: Terms of Reference for the committee approved by AAFN and KGHM.	April 2015	Ongoing	Promote consistent and transparent communication between KGHM and AAFN, through engagement with community leadership and Project management.
Production Impact Benefit Agreement discussions initiated.	August 2016	Ongoing	To negotiate the terms and conditions of a Production Impact Benefit Agreement. Objective is to mutually develop a comprehensive agreement governing the Project, including permitting, financing, construction, operation and closure of the Project.
Agreement Implementation			
Joint Community Liaison Committee: scheduled monthly meeting, or as required.	October 2014 to present	Ongoing	Promote communication and transparency between AAFN and the Project, including management of disputes and issues that arise from the implementation of the Agreement.
Leadership Committee: quarterly meetings, or as required.	October 2014 to present	Ongoing	Manage disputes and issues that have been escalated by the Joint Community Liaison Committee. Review and approval of recommended revisions to the Agreement from the Community Liaison Committee.
Procurement sub-committee: participation of AAFN business in work for the Victoria Project.	TBD	To be scheduled/organized based on activity	Maximize participation of AAFN on the Victoria Project through establishment and communication of procurement processes to AAFN. Communicate the status of current and pending procurement packages related to the Project.
Construction sub-committee: provide status updates for current and pending construction activities.	TBD	To be scheduled/organized based on activity	Focus on communicating construction plans and current activities that may affect AAFN or provide opportunities for AAFN participation. Based on current activity, updates are provided during Joint Community Liaison meetings and via email.

Scope and Subject	Date	Current Status	Objectives/Comments
Human Resources sub-committee: coordination of training needs and employment opportunities.	TBD	To be scheduled/organized based on activity	Communicate current and future employment opportunities. Communicate skill and educational requirements for the different jobs that will be available during Construction and Operations. Evaluate individual skills and identify training requirements.
Permitting & Environment sub-committee: communicate plans, schedule and updates for permitting applications and amendments.	March 2017 to present	Ongoing	Communicate permitting plans and requirements. Coordinate review of applications and supporting documentation prior to submission to regulatory authorities.
Dispute resolution process: Community Liaison Committee.	September 2014	Has not been required to date	Mechanism to ensure any unresolved issues are appropriately addressed.
Consultation on Permit Applications			
General review of permits: list of permits and applications, including timelines for filing; list of environmental assessment and other reports completed and pending[1].	February 2012 to present	Ongoing	Establish transparent communications and information sharing on permits, environmental reports, and other Project information of interest to AAFN.
Stage 1 Archaeological Assessment Report: draft copy provided to AAFN.	November 2010; February 2012	Complete	AAFN – KGHM Facilitation Team to provide a summary of report and study information and facilitate 3rd party reviews and responses, as required.
Advanced Exploration Closure Plan: Preliminary closure plan provided to AAFN for review. Comments returned to Project. Submitted and accepted for filing by MNDM.	June 2012; January 2013; June 2013; October 2013	Complete	All AAFN comments addressed. Accepted for filing by MNDM October 21, 2013.
Advanced Exploration Closure Plan Amendment: Notice of Material Change sent to AAFN. AAFN filed letter of non-objection to MNDM.	March 2014; February 2015; April 2015	Complete	All AAFN comments addressed. Accepted for filing by MNDM on March 16, 2015.
Environmental Compliance Approval and Permit to Take Water: Letter of support provided by AAFN for MOECC permits.	March 2012; February 2013; March 2013; June 2013	Complete	Comments and concerns from AAFN have been addressed and permit approved. All information regarding permits are maintained in the Project permit register, which is updated regularly.
Application and approval for an Environmental Compliance Approval for Air and Noise. Letter of support provided by AAFN for MOECC permits.	May 2012; February 2013; June 2013	Complete	Comments and concerns from AAFN have been addressed and permit approved. All information regarding permits are maintained in the Project permit register, which is updated regularly.
Application and approval for an Environmental Compliance Approval for Industrial Sewage. Letter of support provided by AAFN for MOECC permits.	February 2013; May 2013; June 2013	Complete	Comments and concerns from AAFN have been addressed and permit approved. All information regarding permits are maintained in the Project permit register, which is updated regularly.
Environmental Screening for <5 MW of diesel fired generating capacity.	August 2014	Complete	Screening showed that there are no significant environmental effects anticipated. Comments and concerns from AAFN have been addressed and permit approved. All information regarding permits are maintained in the Project permit register, which is updated regularly.
CEAA Project Description Report – First Submission.	March 2015; April 2015	Complete	Comments and concerns were addressed through the Community Liaison Committee.

[1]Reviewed documentation such as: Stage 1 Archaeological Assessment, Archeological Historical Research Report, Baseline Aquatic Environmental Assessment Interpretative Report, Phase 2 Environmental Site Assessment Report, Application for 17(2)(c) Permit under the Endangered Species Act, Mine Hazard Inventory Report, Existing Natural Features Report, Shaft #1 Environmental Geochemistry Report, Victoria Mine Hydrogeological Study, Development Proposal, Interim Report on Acid Rock Drainage and Metal Leach Assessment, Draft Report: Waste Rock Management Plan, Hydrologic and Assimilative Capacity Assessment, Application for C of A for Industrial Sewage, Existing Natural Features Report, Annual Groundwater Monitoring Report.

Scope and Subject	Date	Current Status	Objectives/Comments
Project Description Report (PDR) – First submission (2017)	April 2017	On hold	
Production Closure Plan – Draft submission	April 2017	On hold	Opportunity to review the Mine Production Closure Plan prior to filing it with MNDM
2017 Victoria Flow and Level Monitoring Report, in fulfillment of Clause 4.7 of Permit To Take Water (FNX Mining Company Inc.'s Victoria Advanced Exploration Project, amended PTTW Number 0466-AJ8HRM) shared	March 2018	Complete	No comments were received.
Written Summary Report, in accordance with Condition 5.1 of the Environmental Compliance Approval (ECA) for Air (FNX Mining Company Inc. Victoria Advanced Exploration Project Certificate of Approval Number: 8794 - 8VFJ7B) shared	March 2018	Complete	No comments were received.
Information regarding potential Notice of Limited Operational Flexibility for the Environmental Compliance Approval for Industrial Sewage.	June 2018	Complete	No comments were received.
Application for removal of 7:1 dilution ratio related to Environmental Compliance Approval (ECA) for Industrial Sewage (Number 9557-AP5FSQ).	July 2018	Complete	The reason for the application was discussed. No concerns were raised.
2017 Annual Performance Report Condition 9(2) of the Environmental Compliance Approval (ECA) for Air (Number 9557-AP5FSQ) shared.	July 2018	Complete	Comments, questions or concerns from AAFN were shared through the Community Liaison Committee. No outstanding issues or concerns.
Draft Project Description Report (PDR)	October 2018	Ongoing	Objective to provide opportunity to review draft PDR by AAFN and discuss concerns/questions prior to submitting the document to CEA Agency: • A copy of the PDR was provided to AAFN on October 19, 2018; • Meeting was held with AAFN on November 15, 2018 to discuss the PDR; • Meeting was held on November 20, 2018 to discuss the PDR and the quote for the cost of 3rd party review of the PDR; • Meeting was held on December 18, 2018. Discussed with committee KGHM presentation on PDR to Chief and Council. Discussion included Project Description Report – Components and Activities (Economic aspects of mine production), quote for 3rd party PDR review, tentative dates with chief and council; • Meeting was held January 25, 2019. KGHM presented PDR Presentation (the presentation was revised based on feedback from AAFN, received during the December 18, 2018 meeting); • Meeting was held February 25, 2019. Discussed tentative dates for PDR Presentation; • Meeting was held April 2, 2019 with Chief and Council. KGHM presented PDR Presentation. Positive discussion followed the presentation. No outstanding concerns were identified.
Written Summary Report, in accordance with Condition 5.1 of the Environmental Compliance Approval (ECA) for Air (FNX Mining Company Inc. Victoria Advanced Exploration Project Certificate of Approval Number: 8794 - 8VFJ7B) shared.	March 2019	Complete	The 2018 Written Summary Report was shared with AAFN on February 5, 2019. No comments or concerns were received.

Scope and Subject	Date	Current Status	Objectives/Comments
2018 Annual Groundwater Report, summarizing results of all 2018 Groundwater Sampling.	March 2019	Complete	The 2018 Annual Groundwater Report which summarizing the results of the Victoria Project 2018 Groundwater Sampling was shared with AAFN on March 5, 2019. No comments or questions were received.
2018 Victoria Flow and Level Monitoring Report, in fulfillment of Clause 4.7 of Permit To Take Water (FNX Mining Company Inc.'s Victoria Advanced Exploration Project, amended PTTW Number 0466-AJ8HRM) shared.	March 2019	Complete	The 2018 Flow and Level Monitoring report was shared with AAFN on March 4, 2019. No comments or questions were received.
Key Issues & Opportunities			
Contracting and procurement opportunities: establish and implement formal processes and procedures between AAFN and KGHM; AAFN businesses directly providing Victoria Project with goods and services; AAFN businesses subcontracting or forming joint ventures with non-Indigenous business to provide goods and services to Victoria Project.	July 2014 to present	Ongoing	Victoria Advanced Exploration Project Agreement objective to maximize participation of AAFN community. Identifying and maximizing opportunities is primarily done through the Community Liaison Committee, Project Procurement Manager, and Project Construction Manager.
Employment opportunities: employment and hiring directly with KGHM; employment and hiring by businesses working for KGHM on the Victoria Project; establish and implement formal processes and procedures.	June 2015 to present	Ongoing	Employment opportunities are continually being pursued, through the Project Human Resources Manager, including hiring summer students, posting of all employment positions, and participation in job fairs. KGHM has participated in career fairs, employed an AAFN summer student, participated in a joint Driller's Helper Training program and shares careers opportunities available within the organization weekly.
Establish a Production Impact Benefit Agreement to secure equitable economic benefits for AAFN.	September 2016	Ongoing	Establish definitive Production Impacts and Benefits Agreement.
Training opportunities: align KGHM's future needs with AAFN development plans. Work with community members to identify skill gaps and establish a training plan. Communicate to community youth about careers and jobs within KGHM and the mining industry.	May 2010 to present	Ongoing	Training opportunities are continually being pursued through the Community Liaison Committee, including hiring summer students, and through school presentations. KGHM has participated in career fairs, employed an AAFN summer student, participated in a joint Driller's Helper Training program and shares careers opportunities available within the organization weekly.
Effects on Indigenous and treaty rights and cultural heritage.	October 2010 to present	Ongoing	Concerns are being addressed through AAFN community outreach initiatives that are led by the Community Liaison Committee, which includes site visits and tours to observe progress and construction activities. Visits are annual at a minimum. Project updates are also provided at annual Community Meetings. There was a site ceremony blessing with AAFN on June 22, 2015.
Management of surface and groundwater resources, including: stormwater management, runoff from waste rock storage areas, water intake sources for the Project.	October 2010; May 2012; December 2015	Complete	Concerns have been addressed through engineering and design measures, such as the wastewater and sewage treatment plants. Concerns also addressed through various permits and site management plans and procedures, including the Permit to Take Water, site water management and waste rock management plans.
Handling and storage of waste rock at the site.	May 2012; December 2015	Complete	Concerns have been addressed through engineering and design and through site waste rock management plans and procedures.
Discussion with Craig Nootchtai, AAFN business owner.	November – December 2018	Complete	Discussions regarding opportunity to provide services to Victoria Project. Reviewed pre-qualification requirements.

Table 20-4: Victoria Mine Project and Site Exploration Activities - Summary of Consultation and Engagement with Sagamok First Nation (SFN)

Scope and Subject	Date	Current Status	Objectives
General			
Initial contact and introductions.	August 2010	Complete	Introduce the Project and Project team.
Victoria Mine Updates: updates on exploration activities; Project schedule and planned activities; Project plans and progress; review of environmental study results or incidents; updates or changes to permit applications; discussions about Indigenous and treaty rights; negotiation on governing agreements.	November 2010 to present	Ongoing	Consistent and transparent communications through community engagement strategies; SFN / KGHM Agreement Negotiation Committee; SFN / KGHM IBA Implementation Committee; engagement with Project management and leadership.
Relationship building: social events at SFN community; participating in SFN educational fair; site visits; sponsoring Mining Matters Earth Science Camp at Sagamok; support for Miner's Training Program; commemoration of National Aboriginal Day; Sunrise Ceremony at Site, participation with the annual Fall Harvest, Chief to Chief (CEO) meeting.	March 2011 to present	Ongoing	Consistent and transparent communications through community engagement strategies; SFN / KGHM IBA Implementation Committee; engagement with Project management and leadership.
Negotiated Agreements			
Memorandum of Understanding (MOU) – Signed.	December 2012	Complete	Agreement to enter into negotiations with the goal of defining the future working relationship that meets the needs and interest of both SFN and KGHM. Implemented through the SFN / KGHM Negotiation Committee.
Victoria Advanced Exploration Project Impacts and Benefits Agreement.	October 2014	Complete	Ensure ongoing consultation and engagement through the IBA Implementation Committee.
SFN / KGHM IBA Implementation Committee: Terms of Reference for the committee approved by SFN and KGHM.	August 2015	Ongoing	Promote consistent and transparent communication between KGHM and SFN, through engagement with community leadership and Project management.
Agreement Implementation			
IBA Implementation Committee: scheduled monthly meeting, or as required.	January 2015 to present	Ongoing	Promote communication and transparency between SFN and the Project, including management of disputes and issues that arise from the implementation of the Agreement.
Leadership Committee: quarterly meeting or as required.	January 2015 to present	Ongoing	Manage disputes and issues that have been escalated by the IBA Implementation Committee. Review and approval of recommended revisions to the Agreement from the IBA Implementation Committee.
Procurement sub-committee - participation of SFN business in work for the Victoria Project.	TBD	Ongoing meeting to be scheduled/organized based on activity	Maximize participation of SFN on the Victoria Project through establishment and communication of procurement processes to SFN. Communicate the status of current and pending procurement packages related to the Project.

Scope and Subject	Date	Current Status	Objectives
Construction sub-committee: provide status of current and pending construction activities.	TBD	To be scheduled/organized based on activity	Focus on communicating construction plans and current activities that may affect SFN or provide opportunities for SFN participation.
Human Resources sub-committee: coordination of training needs and employment opportunities.	TBD	To be scheduled/organized based on activity	Communicate current and future employment opportunities. Communicate skill and educational requirements for the different jobs that will be available during Construction and Operations. Evaluate individual skills and identify training requirements. KGHM shares career opportunities available with KGHM on a weekly basis.
Permitting & Environment sub-committee: communicate plans, schedule and updates for permitting applications and amendments.	November 2017	January 2018 to present (held quarterly)	Communicate permitting plans and requirements. Coordinate review of applications and supporting documentation prior to submission to regulatory bodies. Review any environmental incidents since previous meeting and ensure questions or concerns are considered and addressed.
Dispute Resolution Process: IBA Implementation Committee Level.	November 2015	Resolved	Dispute elevated by SFN regarding a disagreement with SFN business over contractual issues.
Dispute Resolution Process: Leadership Committee Level.	January 2016	Resolved	Dispute with SFN related to differing interpretation of term defining Indigenous Businesses and participation in providing services to the Project.
Consultation on Permit Applications			
General review of permits: lists of permits and applications and timelines for filing; lists of environmental assessments and other reports completed and pending.[16]	August 2010 to present	Ongoing	Establish transparent communications and information sharing on permits, environmental reports, and other Project information of interest to SFN.
Closure Plan: Preliminary closure plan provided to SFN for review. SFN engaged third party to review closure plan. Comments returned to Project. Submitted and accepted for filing by MNDM.	2010 – November; 2012 – January, February, March, June, October	Complete	Comments and concerns from SFN have been addressed and permit approved. All information regarding permits is maintained in the Project permit register, which is updated regularly.
Closure Plan Amendment: Update on changes required; Notice of Material Change. SFN filed letter of non-objection to MNDM.	2013 – April, June; 2014 – January, November; 2015 – February	Complete	Comments and concerns from SFN have been addressed and permit approved. All information regarding permits is maintained in the Project permit register, which is updated regularly.
Stage 1 Archaeological Assessment Report: Draft provided; SFN engaged third party review; SFN also engaged third party to carry out additional research utilizing crown and First Nation records.	November 2010; December 2010; March 2011; January 2012	Complete	Establish transparent communication and ensure participation in the Archaeological assessment for the Project.
SFN provided copy of "SA External Consultation Guidelines".	February 2011	Complete	Ensure that Project is aware of and meets requirements of community guidelines for consultation.

[16] Reviewed documentation such as: Stage 1 Archaeological Assessment, Archeological Historical Research Report, Baseline Aquatic Environmental Assessment Interpretative Report, Phase 2 Environmental Site Assessment Report, Application for 17(2)(c) Permit under the *Endangered Species Act*, Mine Hazard Inventory Report, Existing Natural Features Report, Shaft #1 Environmental Geochemistry Report, Victoria Mine Hydrogeological Study, Development Proposal, Interim Report on Acid Rock Drainage and Metal Leach Assessment, Draft Report: Waste Rock Management Plan, Hydrologic and Assimilative Capacity Assessment, Application for C of A for Industrial Sewage, Existing Natural Features Report, Annual Groundwater Monitoring Report.

Scope and Subject	Date	Current Status	Objectives
Environmental Compliance Approval and Permit to Take Water; SFN provided MOECC with verbal approval on permits.	March 2012; October 2012; June 2013	Complete	Comments and concerns from SFN have been addressed and permit approved. All information regarding permits is maintained in the Project permit register, which is updated regularly.
Application and approval for an Environmental Compliance Approval for Air and Noise. SFN provided MOECC with verbal approval on permits.	March 2012; June 2013	Complete	Comments and concerns from SFN have been addressed and permit approved. All information regarding permits is maintained in the Project permit register, which is updated regularly.
Application and approval for an Environmental Compliance Approval for Industrial Sewage. SFN provided MOECC with verbal approval on permits.	March 2012; June 2013	Complete	Comments and concerns from SFN have been addressed and permit approved. All information regarding permits is maintained in the Project permit register, which is updated regularly.
Project Description Report (PDR) – First submission.	April 2017	On hold	
Full Production Closure Plan – draft submission.	April 2017	On hold	Opportunity to review the Mine Production Closure Plan prior to filing it with MNDM.
Full Production Closure Plan, update on Project Description Report (CEAA) and status of other permit applications.	September 2016	Complete	To provide an update to SFN on the status of the PDR and Closure Plan and direction to please not engage a third party for review until revisions are finalized.
Review of required authorizations and permits for Victoria Mine Production including Environmental Compliance Approval for Industrial Sewage (PAG 2, Ethel Lake) and Environmental Compliance Approval for Air/Noise, Permit to Take Water Application for Ethel Lake Water Source, update on Project Description Report (CEAA).	December 2016	Complete	To provide an update to SFN on the status of the permits and to provide an opportunity to address any questions or concerns.
2017 Victoria Flow and Level Monitoring Report, in fulfillment of Clause 4.7 of Permit To Take Water (FNX Mining Company Inc.'s Victoria Advanced Exploration Project, amended PTTW Number 0466-AJ8HRM) shared.	March 2018	Complete	No comments or concerns were received.
Written Summary Report, in accordance with Condition 5.1 of the Environmental Compliance Approval (ECA) for Air (FNX Mining Company Inc. Victoria Advanced Exploration Project Certificate of Approval Number: 8794 - 8VFJ7B) shared.	March 2018	Complete	No comments or concerns were received.
2017 Annual Performance Report Condition 9(2) of the Environmental Compliance Approval (ECA) for Air (Number 9557-AP5FSQ) shared.	May 2018	Complete	No comments or concerns were received.
Information regarding potential Notice of Limited Operational Flexibility for the Environmental Compliance Approval for Industrial Sewage.	June 2018	Complete	No comments or concerns were received.
Application for removal of 7:1 dilution ratio related to Environmental Compliance Approval (ECA) for Industrial Sewage (Number 9557-AP5FSQ).	July 2018	Complete	No comments or concerns were received.

Scope and Subject	Date	Current Status	Objectives
Draft Project Description Report (PDR)	October 2018	Ongoing	Objective to provide opportunity to review draft PDR by SAFN and discuss concerns/questions prior to submitting the document to CEA Agency: • A presentation summarizing the PDR was given June 26, 2018 at an Environment Subcommittee Meeting; • A copy of the PDR was provided to SAFN on October 25, 2018; • Meeting was held December 17, 2018. One of the topics discussed was the PDR; • A SAFN-KGHM Environmental Subcommittee meeting was held January 24, 2019. An update on all Victoria Permitting and an update on the status of the PDR was provided during this meeting; • An updated PDR Presentation was given at the SAFN Lands and Resources Committee Meeting held February 19, 2019. Lands and Resources committee members and council members were in attendance. A question and answer session was held at the end of the presentation; • Letter of support received from Chief thanking the project for attending the February 19, 2019 meeting and stating that they have no comments or concerns about the Victoria Project.
Written Summary Report, in accordance with Condition 5.1 of the Environmental Compliance Approval (ECA) for Air (FNX Mining Company Inc. Victoria Advanced Exploration Project Certificate of Approval Number: 8794 - 8VFJ7B) shared.	March 2019	Complete	The 2018 Written Summary Report was shared with SAFN on February 5, 2019. No comments or concerns were received.
2018 Annual Groundwater Report, summarizing results of all 2018 Groundwater Sampling.	March 2019	Complete	The 2018 Annual Groundwater Report which summarizing the results of the Victoria Project 2018 Groundwater Sampling was shared with SAFN on March 5, 2019. No comments or questions were received.
2018 Victoria Flow and Level Monitoring Report, in fulfillment of Clause 4.7 of Permit To Take Water (FNX Mining Company Inc.'s Victoria Advanced Exploration Project, amended PTTW Number 0466-AJ8HRM) shared.	March 2019	Complete	The 2018 Flow and Level Monitoring report was shared with SAFN on March 4, 2019. No comments or questions were received.
Key Issues & Opportunities			
Environment monitoring of potential effect of past, present and future development on the Spanish River watershed.	August 2010	Ongoing	Monitoring services by SFN members may be established through the IBA Implementation Committee.
Implementation of the IBA, including establishing processes and procedures that ensure SFN participation is maximized.	January 2015 to present	Ongoing	Through IBA Implementation Committee, ensure transparent communications and that opportunities for SFN are maximized.
Involvement in closure plan and in particular environmental management and environmental monitoring.	August 2010	Ongoing	Discussions have been initiated with SFN about environmental monitoring, such as water quality sampling and participation in regular site inspections. Through the IBA Implementation Committee, this opportunity will be further discussed.

Scope and Subject	Date	Current Status	Objectives
Contracting and procurement opportunities: establish and implement formal processes and procedures between SFN and KGHM; SFN businesses directly providing the Project with goods and services; SFN businesses subcontracting or forming joint ventures with non-Indigenous business to provide goods and services to the Project.	September 2013 to present	Ongoing	Victoria Advanced Exploration Project Impacts and Benefits Agreement objective to maximize participation of SFN community. Identifying and maximizing opportunities is primarily done through the IBA Implementation Committee, Project Procurement Manager, and Project Construction Manager17.
Employment opportunities: employment and hiring directly with KGHM; employment and hiring by business working for KGHM at the Project; establish and implement formal processes and procedures. Examples - hiring a community environmental liaison coordinator, drill helpers, construction employment, contracting opportunities.	August 2010 to present	Ongoing	Employment opportunities are shared through the Project Human Resources Manager, including hiring summer students, posting of all employment positions, and participation in job fairs.
Management and consumption of surface and groundwater resources, such as stormwater management, runoff from waste rock storage areas, water intake sources for the Project.	May 2012	Complete	Concerns have been addressed through engineering and design measures, such as the wastewater and sewage treatment plants. Concerns also addressed through various permits and site management plans and procedures, including the permit to take water, site water management and waste rock management plans.
Establish a Production Impact Benefit Agreement to secure equitable economic benefits for SFN.	August 2016	Ongoing	Establish definitive Production Impacts and Benefits Agreement. Initial discussions commenced in August 2016 and have been ongoing since. Negotiation teams established and actively working together to establish a mutual agreement.
Training Opportunities: align KGHM's future needs with SFN development plans. Work with communities members to identify skill gaps and establish training plan. Communicate to community youth about careers and jobs within KGHM and the mining industry.	August 2010 to present	Ongoing	Training opportunities are continually being pursued through the IBA Implementation Committee, including hiring summer students, and through school presentations. KGHM shares career opportunities available throughout the organization on a regular basis.
Effects on Indigenous and treaty rights and cultural heritage.	November 2010 to present	Ongoing	Concerns are being addressed through SFN community outreach initiatives that are led by the IBA Implementation Committee, which includes site visits and tours to observe progress and construction activities. There was a site ceremony blessing with SFN in August 2015.

[17] Examples of contracts awarded to SFN business joint venture with local business to provide labour, equipment and materials include: Site Timbering and Grubbing Contract (September to December 2013), Overburden Removal Contract (December 2013 to June 2014), Aggregate Supply, PAG Waste Rock Crushing and Haulage (February to November 2015), Site Services Contract (February 2015 to present).

Table 20-5: Victoria Mine Project and Site Exploration Activities - Summary of Consultation and Engagement with Métis Nation of Ontario (MNO)

Scope and Subject	Date	Current Status	Objectives
General			
Initial contact and introductions	June 2010	Complete	Introduce the Project and Project team.
Project updates: updates on exploration activities; Project schedule and planned activities; Project plans and progress; review of environmental study results; updates or changes to permit applications; discussions about Indigenous and treaty rights.	2010 – July, August, November; 2011 - February, September; 2012 – January, February, March; 2013 - April	Ongoing	Consistent and transparent communications through engagement with Project management and leadership.
Relationship building: social events with MNO; Meet and greet forum; site visits; attendance and participation at the annual Métis Collaborative Forum in Timmins, Community Meeting Updates, Children's Christmas parties, sharing of information, sponsorship of Annual General Assembly.	2011- March, June, September; March 2013, November 2018	Ongoing	Consistent and transparent communications through community engagement strategies; engagement with Project management and leadership.
Negotiated Agreements			
Victoria Advanced Exploration Project Engagement Agreement.	April 2015	Complete	Establish a working relationship and define the commitments from both parties to ensure a meaningful consultation with respect to the Project.
Agreement Implementation			
Agreement for development and implementation costs for: (a) Discussions and Finalization of Agreement; (b) Ongoing Consultation Meetings and Communication Plan.	April 2015	Ongoing	Promote communication and transparency between MNO and the Project.
Third Party Assessments of environmental reports, permit applications, closure plans and Canadian Environmental Assessment Agency reviews work plan.	April 2015	Ongoing	To provide capacity funding in order to review reports, permits, etc. and to discuss appropriate mitigation measures for any impacts identified on MNO rights and interests in the Project Area. Such mitigation measures may include adjustments to the Project that are commercially reasonable and appropriate, and where such impacts cannot be mitigated, financial compensation or other mutually agreeable benefits flowing from the Project.
Métis Traditional Knowledge and Land Use Study.	April 2015	Complete	To provide capacity funding in order to review reports, permits, etc. and to discuss appropriate mitigation measures for any impacts identified on MNO rights and interests in the Project Area. Such mitigation measures may include adjustments to the Project that are commercially reasonable and appropriate, and where such impacts cannot be mitigated, financial compensation or other mutually agreeable benefits flowing from the Project.
Establish a Production Impact Benefit Agreement to secure equitable benefits for MNO.	November 2016	Ongoing	Establish definitive Production Impacts and Benefits Agreement. Initial discussions have occurred regarding a Production Impact Benefit Agreement, and negotiation teams identified. Future meetings currently pending and expected to be scheduled in Q3 2018.

Scope and Subject	Date	Current Status	Objectives
Consultation on Permit Applications			
General review of permits: lists of permits and applications and timelines for filing; lists of environmental assessments and other reports completed and pending[18].	August 2010 to present	Ongoing	Establish transparent communications and information sharing on permits, environmental reports, and other Project information of interest to MNO.
Closure Plan: Review of closure plan. MNO to conduct review of closure plan with in-house resources. MNO declined to conduct a third party review, indicating that they would rely on reviews being conducted by AAFN and SFN. Submitted and accepted for filing by MNDM.	September 2011; February 2012; June 2012; April 2013	Complete	Comments and concerns from MNO have been addressed and permit approved. All information regarding permits is maintained in the Project permit register, which is updated regularly.
Closure Plan Amendment: Update on changes required; Notice of Material Change.	June 2013; January 2015	Complete	Comments and concerns from MNO have been addressed and permit approved. All information regarding permits is maintained in the Project permit register, which is updated regularly.
Environmental Compliance Approval and Permit to Take Water; MNO provided written approval on permits, on the condition that consultation continues.	March 2012; April 2013; May 2013	Complete	Comments and concerns from MNO have been addressed and permit approved. All information regarding permits is maintained in the Project permit register, which is updated regularly.
Application and approval for an Environmental Compliance Approval for Air and Noise. MNO provided written approval on permits, on the condition that consultation continues.	April 2013; May 2013	Complete	Comments and concerns from MNO have been addressed and permit approved. All information regarding permits is maintained in the Project permit register, which is updated regularly.
Application and approval for an Environmental Compliance Approval for Industrial Sewage. MNO provided written approval on permits, on the condition that consultation continues.	January 2012; April 2013; May 2013	Complete	Comments and concerns from MNO have been addressed and permit approved. All information regarding permits is maintained in the Project permit register, which is updated regularly.
Project Description Report (PDR) – First submission.	April 2017	On hold	Comments and concerns from MNO to be discussed and addressed through the Liaison Committee.
Production Closure Plan – draft submission.	April 2017	On hold	Comments and concerns from MNO to be discussed and addressed through the Liaison Committee.
2017 Victoria Flow and Level Monitoring Report, in fulfillment of Clause 4.7 of the Permit To Take Water (FNX Mining Company Inc.'s Victoria Advanced Exploration Project, amended PTTW Number 0466-AJ8HRM) shared.	March 2018	Complete	Comments and concerns from MNO to be discussed and addressed through the Liaison Committee.
Written Summary Report, in accordance with Condition 5.1 of the Environmental Compliance Approval (ECA) for Air P (FNX Mining Company Inc. Victoria Advanced Exploration Project Certificate of Approval Number: 8794 - 8VFJ7B) shared.	March 2018	Complete	Comments and concerns from MNO to be discussed and addressed through the Liaison Committee.

[18] Reviewed documentation such as: Stage 1 Archaeological Assessment, Archeological Historical Research Report, Baseline Aquatic Environmental Assessment Interpretative Report, Phase 2 Environmental Site Assessment Report, Application for 17(2)(c) Permit under the *Endangered Species Act*, Mine Hazard Inventory Report, Existing Natural Features Report, Shaft #1 Environmental Geochemistry Report, Victoria Mine Hydrogeological Study, Development Proposal, Acid Rock Drainage and Metal Leach Assessment, Draft Report: Waste Rock Management Plan, Hydrologic and Assimilative Capacity Assessment, Application for C of A for Industrial Sewage, Existing Natural Features Report, Annual Groundwater Monitoring Report.

Scope and Subject	Date	Current Status	Objectives
Information regarding potential Notice of Limited Operational Flexibility for the Environmental Compliance Approval for Industrial Sewage.	June 2018	Complete	Comments and concerns from MNO to be discussed and addressed through the Liaison Committee.
2017 Annual Performance Report Condition 9(2) of the Environmental Compliance Approval (ECA) for Air (Number 9557-AP5FSQ) shared.	July 2018	Complete	Comments and concerns from MNO to be discussed and addressed through the Liaison Committee.
Application for removal of 7:1 dilution ratio related to Environmental Compliance Approval (ECA) for Industrial Sewage (Number 9557-AP5FSQ).	July 2018	Complete	Comments and concerns from MNO to be discussed and addressed through the Liaison Committee.
Draft Project Description Report (PDR)	October 2018	Ongoing	Objective to provide opportunity to review draft PDR by MNO and discuss concerns/questions prior to issuance of the document to CEA Agency. A copy of the PDR was provided to MNO on October 26, 2018: • In February 2019 the MNO provided feedback regarding the PDR Report. FNX provided responses to the feedback in April 2019. • Meeting was held April 11, 2019 with the MNO to discuss the PDR and EA process, MNO feedback and FNX responses in detail. MNO acknowledged that FNX has engaged in meaningful consultation to date, and based on mutual trust and respect that meaningful consultation will continue over the life cycle of the Victoria Mine.
Written Summary Report, in accordance with Condition 5.1 of the Environmental Compliance Approval (ECA) for Air (FNX Mining Company Inc. Victoria Advanced Exploration Project Certificate of Approval Number: 8794 - 8VFJ7B) shared.	March 2019	Complete	The 2018 Written Summary Report was shared with MNO on February 5, 2019. No comments or concerns were received.
2018 Annual Groundwater Report, summarizing results of all 2018 Groundwater Sampling	March 2019	Complete	The 2018 Annual Groundwater Report which summarizing the results of the Victoria Project 2018 Groundwater Sampling was shared with MNO on March 5, 2019. No comments or questions were received.
2018 Victoria Flow and Level Monitoring Report, in fulfillment of Clause 4.7 of Permit To Take Water (FNX Mining Company Inc.'s Victoria Advanced Exploration Project, amended PTTW Number 0466-AJ8HRM) shared.	March 2019	Complete	The 2018 Flow and Level Monitoring report was shared with MNO on March 4, 2019. No comments or questions were received.
Key Issues & Opportunities			
Effects to Métis Indigenous rights including heritage values and harvesting rights.	February 2012; April 2015	Ongoing	Concerns have been primarily addressed through capacity funding, including supporting a Traditional Knowledge and Land Use study.
Employment and business opportunities.	October 2015	Ongoing	Encouraged participation by attending a community meeting to discuss KGHM procurement process. Meetings with MNO employment representatives on how KGHM can support training and development. KGHM provides weekly summary of job postings available within the KGHM.
Handling and storage of waste rock at the site.	September 2011	Complete	Concerns have been addressed through engineering and design and through site waste rock management plans and procedures.

Scope and Subject	Date	Current Status	Objectives
Management and consumption of surface and groundwater resources, such as stormwater management and wastewater treatment.	September 2011	Complete	Concerns have been addressed through engineering and design measures, such as the wastewater and sewage treatment plants. Concerns also addressed through various permits and site management plans and procedures, including the Permit to Take Water, site water management and waste rock management plans.
Initiation of Production IBA discussions.	November 2016	Ongoing	Establish definitive Production Impacts and Benefits Agreement.

Appendix C: Noise Impact Summary Report

KGHM International
Victoria Project

Noise Impact Summary Report

<Original signed by> <Original signed by>

2015-07-06	C	Final With KGHM Acceptance	Ron Andrews	Mike Watters	Mike Watters	Ian Horne
2014-11-17	B	Final	Tim Kelsall	Chris Hugh	William Kempson	N/A
2014-11-06	A	Internal Review	Tim Kelsall	Fady Ibrahim	N/A	N/A
Date	**Rev.**	**Status**	**Prepared By**	**Checked By**	**Approved By**	**Approved By**
			HATCH			**Client**

© Hatch 2015 All rights reserved, including all rights relating to the use of this document or its contents.

Table of Contents

1. Introduction **1**

2. Community Noise Model **1**

3. Mitigation Required **8**

4. Conclusion **8**

Appendix

Appendix A : Local Municipal Noise Bylaws

List of Tables

Table 2-1: Point Sources 2
Table 2-2: Area Sources (Building Roof) 3
Table 2-3: Vertical Area Sources (Building Walls) 3
Table 2-4: Assumed Attenuation of Fan Silencers 3
Table 2-5: Roads 4
Table 2-6: Noise Model Results With Natural Gas Generators 7
Table 2-7: Noise Model Results Without Natural Gas Generators 7

List of Figures

Figure 2-1 Noise Model Results for Mine Site 5
Figure 2-2 Noise Model Results with Recommended Mitigation 6

1. Introduction

Ontario Ministry of the Environment (MOE) guidelines for noise in rural areas set an equivalent (energy average) sound level limit of 40 dBA for sounds which occur at night, which becomes the limit for any 24 hour operation like a mine. However several mines in the area have received significant complaints at 40 dBA and we now recommend trying to reduce sound levels closer to the existing ambient noise in the community, especially for areas with cottages/camps where residents tend to be concerned about intrusive noise. Community noise measurements were used to establish suitable design goals and were reported in Project Report H347610-1500-50-124-0002 entitled “Community Noise Measurements and Design Goals”.

The following design goals are recommended for hourly average Leq[1] from Victoria Mine:

	Day	**Evening**	**Night**
MOE Guideline for Class 3 (rural) Area	45	40	40 dBA
Project Recommendation:			
Fairbank Camps:	30	24	24 dBA
Regional Road 4:	40	35	35 dBA.

2. Community Noise Model

A community noise model was prepared for the Victoria mine site using CADNA-A software which implements ISO 9613(2); the most widely used industrial noise prediction and the prediction used by the Ontario MOE. Elevation contours were imported for the surrounding area and used in preparing the model results shown in Table 2-1. Any noise sources expected to be tonal were increased by a 5 dB tonality penalty as required by MOE. Major buildings were assumed to be at least10m high and the office, administration and dry buildings at least 5m high.

This model represents the mine design as of October 2014 and only includes the major identified outdoor noise sources with the mitigation described in this report. The following noise sources were included:

[1] The Equivalent Sound Level or Leq is an energy average sound level measured over a given period of time, often 1h in Ontario. It is measured in A-weighted decibels or dBA which approximate the frequency response of the human ear under quieter outdoor conditions.

Table 2-1: Point Sources

Name	M.	ID	Result. PWL			Lw / Li			Correction			Sound Reduction		Attenuation
			Day	Evening	Night	Type	Value	norm.	Day	Evening	Night	R	Area	
			(dBA)	(dBA)	(dBA)			dB(A)	dB(A)	dB(A)	dB(A)		(m²)	
Fresh Air Fan		Supply	108.0	108.0	108.0	Lw	AxialSupply		5.0	5.0	5.0			axsil
Fresh Air Fan		Supply	108.0	108.0	108.0	Lw	AxialSupply		5.0	5.0	5.0			axsil
Fresh Air Fan		Supply	108.0	108.0	108.0	Lw	AxialSupply		5.0	5.0	5.0			axsil
Mine Ventilation		Exhaust	123.0	123.0	123.0	Lw	Exhaust		5.0	5.0	5.0			silencer
Mine Ventilation		Exhaust	123.0	123.0	123.0	Lw	Exhaust		5.0	5.0	5.0			silencer
BAC Fan		BAC	108.0	108.0	108.0	Lw	AxialSupply		5.0	5.0	5.0			axsil
BAC fan		BAC	108.0	108.0	108.0	Lw	AxialSupply		5.0	5.0	5.0			axsil
Natural Gas Generators	-	NatGasGen	119.7	119.7	119.7	SET								
Emergency Generator	-	Genset	111.9	111.9	111.9	Lw	UG_HAUL_TRUCK		0.0	0.0	0.0			
230kV Substation		SUB	83.9	83.9	83.9	SET								
Compressor Plant		Compressors	96.0	96.0	96.0	Lw	106	106.0	0.0	0.0	0.0			10
Crusher Building		Crusher	102.4	102.4	102.4	Lw	PrCrush		0.0	0.0	0.0			10
Loader		Loader	109.1	109.1	109.1	Lw	Loader		0.0	0.0	0.0			
Loader		Loader	109.1	109.1	109.1	Lw	Loader		0.0	0.0	0.0			
Loader		Loader	109.1	109.1	109.1	Lw	Loader		0.0	0.0	0.0			
Vacuum Truck		Vac Truck	114.1	114.1	114.1	Lw	Vac_TRUCK		5.0	5	5			
Cooilng water pumps		Vac Truck	100.8	100.8	100.8	SET								
Cooling water pumps		CWpumps	104.3	104.3	104.3	SET								
Mobile crusher		mobilecrusher	108.8	9.8	9.8	Lw	mobilecrush		0.0	-99.0	-99.0			
Cooling Tower		clgtower	108.0	108.0	108.0	Lw	113		0.0	0.0	0.0			5

Table 2-2: Area Sources (Building Roof)

Name	M.	ID	Result. PWL			Result. PWL''			Lw / Li			Correction			Attenuation	Freq.	Direct.
			Day	Evening	Night	Day	Evening	Night	Type	Value	norm.	Day	Evening	Night			
			(dBA)	(dBA)	(dBA)	(dBA)	(dBA)	(dBA)			dB(A)	dB(A)	dB(A)	dB(A)		(Hz)	
Refrigeration		BAC	91.5	91.5	91.5	73.0	73.0	73.0	Lw''	83		0.0	0.0	0.0	10	500	(none)
Backfill			107.6	107.6	107.6	71.1	71.1	71.1	Lw	Chute		0.0	0.0	0.0			(none)

Table 2-3: Vertical Area Sources (Building Walls)

Name	M.	ID	Result. PWL			Result. PWL''			Lw / Li			Correction			Sound Reduction		Attenuation	Direct.
			Day	Evening	Night	Day	Evening	Night	Type	Value	norm.	Day	Evening	Night	R	Area		
			(dBA)	(dBA)	(dBA)	(dBA)	(dBA)	(dBA)			dB(A)	dB(A)	dB(A)	dB(A)		(m^2)		
Backfill			107.6	107.6	107.6	80.6	80.6	80.6	Lw	Chute		0.0	0.0	0.0				(none)
Backfill			107.6	107.6	107.6	78.0	78.0	78.0	Lw	Chute		0.0	0.0	0.0				(none)
Backfill			107.6	107.6	107.6	80.7	80.7	80.7	Lw	Chute		0.0	0.0	0.0				(none)
Backfill			107.6	107.6	107.6	78.1	78.1	78.1	Lw	Chute		0.0	0.0	0.0				(none)

Where the noise sources in these tables are assumed to be reduced by silencers or other means the amount of attenuation is shown in the column entitled Attenuation. The Resultant PWL columns show the resulting sound power emitted by each source after any applied mitigation. The following table gives the attenuation assumed for the fan silencers.

Table 2-4: Assumed Attenuation of Fan Silencers

Name	ID	Insertion Loss Spectrum (dB)										Source
		31.5	63	125	250	500	1000	2000	4000	8000	Rw	
FA Silencer	silencer		10.0	20.0	35.0	38.0	30.0	15.0	10.0	5.0	21	
Axial silencer	axsil	0.0	6.0	8.0	12.0	18.0	15.0	10.0	10.0	5.0	14	

Table 2-5: Roads

Name	M.	ID	Lme			exact Count Data						Speed Limit	
			Day	Evening	Night	M			p (%)			Auto	Truck
			(dBA)	(dBA)	(dBA)	Day	Evening	Night	Day	Evening	Night	(km/h)	(km/h)
Haul trucks		In plant	68.7	63.9	66.9	360.0	120.0	240.0	100.0	100.0	100.0	40	40
Haul trucks		In plant	68.7	63.9	66.9	360.0	120.0	240.0	100.0	100.0	100.0	40	40
Haul trucks		In plant	68.7	63.9	66.9	360.0	120.0	240.0	100.0	100.0	100.0	40	40

Figure 2-1 shows the model results for the mine area. Figure 2-2 shows the model results for the surrounding area and includes predicted values for the noise monitoring sites referred to in this report.

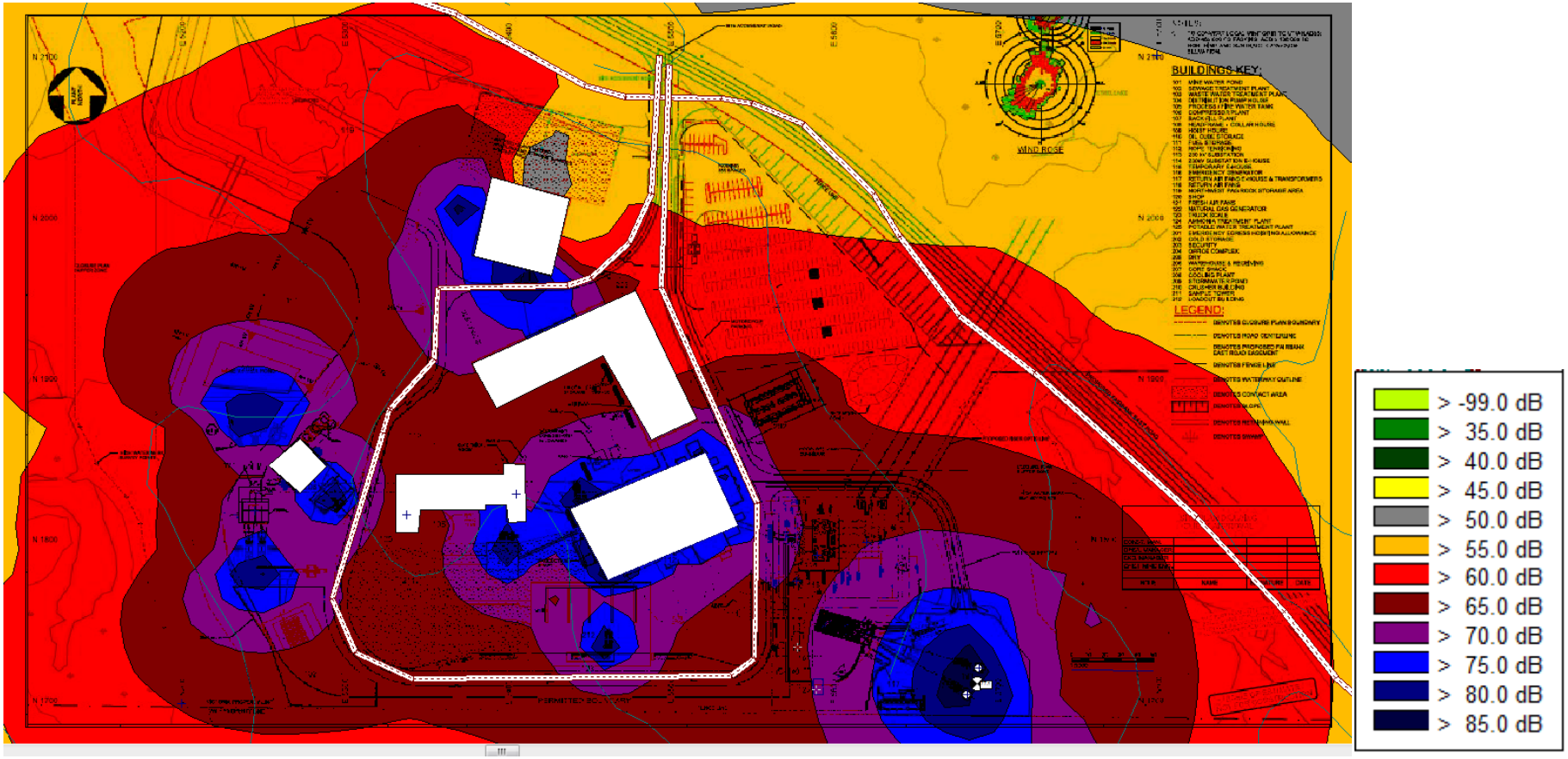

Figure 2-1 Noise Model Results for Mine Site

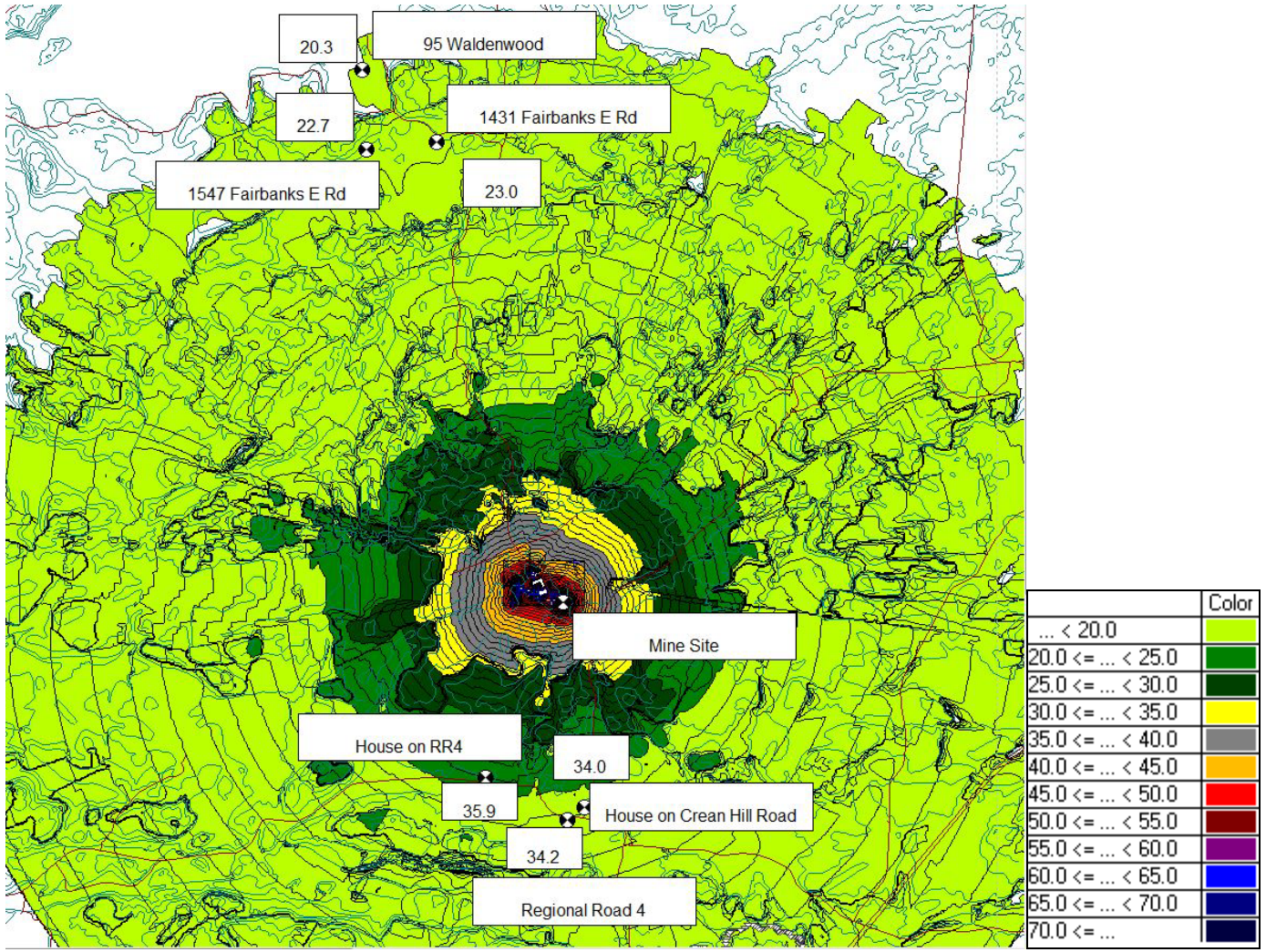

Figure 2-2 Noise Model Results with Recommended Mitigation

See Table 2-6 and Table 2-7 for the summary results:

Table 2-6: Noise Model Results With Natural Gas Generators

Name	Level Lr		Limit. Value		Height		Coordinates		
	Day	Night	Day	Night			X	Y	Z
	(dBA)	(dBA)	(dBA)	(dBA)	(m)		(m)	(m)	(m)
Regional Road 4	34.2	34.2	40.0	35.0	4.00	r	470734.82	5137540.32	264.00
1431 Fairbanks E Rd	23.0	23.0	30.0	24.0	4.00	r	469432.31	5144292.30	304.00
1547 Fairbanks E Rd	22.7	22.7	30.0	24.0	4.00	r	468731.27	5144221.62	304.53
95 Waldenwood	20.3	20.3	30.0	24.0	4.00	r	468697.40	5145017.52	304.00
House on Crean Hill Rd	34.0	34.0	82.0	82.0	1.50	r	470904.99	5137675.05	261.50
House on RR4	35.9	35.9	82.0	82.0	1.50	r	469916.91	5137970.80	251.50

Table 2-7: Noise Model Results Without Natural Gas Generators

Name	Level Lr		Limit. Value		Height		Coordinates		
	Day	Night	Day	Night			X	Y	Z
	(dBA)	(dBA)	(dBA)	(dBA)	(m)		(m)	(m)	(m)
Regional Road 4	33.7	33.7	40.0	35.0	4.00	r	470734.82	5137540.32	264.00
1431 Fairbanks E Rd	22.6	22.6	30.0	24.0	4.00	r	469432.31	5144292.30	304.00
1547 Fairbanks E Rd	22.4	22.4	30.0	24.0	4.00	r	468731.27	5144221.62	304.53
95 Waldenwood	20.0	20.0	30.0	24.0	4.00	r	468697.40	5145017.52	304.00
House on Crean Hill Rd	33.5	33.5	82.0	82.0	1.50	r	470904.99	5137675.05	261.50
House on RR4	35.4	35.4	82.0	82.0	1.50	r	469916.91	5137970.80	251.50

The natural gas generators are being installed during construction and will be the primary source of electrical power until the main power line is installed, at which time (about 2016) they will be retired and an emergency generator will be on standby except in emergencies and when tested monthly. As such this is basically a construction noise and will probably not be present when the mine is in full operation as modelled.

3. Mitigation Required

In order to meet the recommended Design Goals the following mitigation is recommended:

1. The mine ventilation fans, including 3 fresh air fans, 2 BAC fans and 2 mine exhaust fans all require the silencers which have been specified for them and may also need acoustical insulation on the fan casings and unsilenced ductwork to achieve the Design Goals. These are reflected in the current noise specifications for these fans.
2. The Compressor Plant, Refrigeration Plant, Backfill Plant and Crusher building have to be enclosed with no major openings. This will have to be modelled and designed into the building design.
3. The Cooling Towers have to together meet a sound level specification below 108 dBA re10^{-12}W, which is 5 dB below the current information from Haman. This should be possible for them to achieve with proper specification and vendor coordination during procurement.
4. Any vacuum truck station, such as those for the off-loading of cement or backfill binders, will require an indoor silenced blower so the truck does not have to use its own blower such that the outdoor sound power level is less than 115 dBA re 10^{-12}W, or about 15 dB lower than normal. Alternatively the vacuum truck could be unloaded inside with closed doors and suitable exhaust silencers.
5. All other noise sources must be diligently checked and added to the model to make sure they do not adversely affect the mine's ability to meet the design goals.

4. Conclusion

If these mitigation steps are carried out the mine sound levels should be well below any provincial noise requirements and quieter than the already existing sound levels at the nearest residences and at the park most of the time.

The appendix gives extracts of the more relevant sections of local noise bylaws and links to the full versions. Some of them are sufficiently general that they could conceivably apply but the sound levels expected at nearby residences are expected to be too low for them to be of concern.

Appendix A:
Local Municipal Noise Bylaws

Local Municipal Noise Bylaws

4.1.1.1 Noise By-laws

City of Sudbury, Municipal Code, Chapter 776, Noise - 776 (pdf 632.82 KB)
Town of Valley East - 85-33 (pdf 191.85 KB)
Town of Rayside Balfour - 82-14 (pdf 127.19 KB)
Town of Walden - 93-424 (pdf 249.19 KB)
Town of Capreol - 90-5 (pdf 201.03 KB)
Town of Nickel Centre - 92-13 (pdf 287.40 KB)
Town of Onaping Falls - 92-10 (pdf 283.35 KB)

Most likely to be applicable:

City of Sudbury http://www.greatersudbury.ca/content/bylaws/City_of_S_726566.pdf

The following sections of this bylaw could potentially apply.

GENERAL PROHIBITIONS

776.2.1 Bells - horns - sounding - prohibited
No person shall ring any bell, blow or sound any horn or cause the same to be rung, blown or sounded.

776.2.2 Shouting - noises unusual - prohibited
No person shall shout or create, cause or permit any unusual noise or noises.

776.2.3 Disturbance - of inhabitants - by noise - prohibited
No person shall create, cause, or permit any noise or noises likely to disturb the inhabitants.

776.2.4 Advertising - use of noise - unauthorized - prohibited
No person shall cause or permit to be caused any noise or sound of whatsoever nature and kind for the purpose of advertising or for attracting attention to any performance, show, or sale or display of goods, wares or merchandise, which noise or sound projects into any street or other public place unless written permission of the Council has first been obtained.

776.2.5 Sound amplification - from vehicle - without licence
No person shall cause or permit to be caused any noise or sound created by the use or operation of any radio or mechanical loud speaker or amplifier or other such instrument or device or of any sound-producing, sound re-producing or sound-transmitting instrument or apparatus in or upon any vehicle without first having obtained a licence so to do pursuant to the provisions the General Licensing By-law, Chapter 476 [City of Sudbury Municipal Code] of the City.

Article 3
UNUSUAL NOISES

776.3.1 Unusual noises - set out
For the purpose of Section 776.2.2, the noises or sounds set out in Sections 776.3.2 through 776.3.17 inclusive, without limiting the generality of Section 776.2.2, shall be deemed to be unusual noises.

776.3.2 Tires - any vehicle - squealing
The noise created by the squealing of tires of any vehicle shall be deemed to be unusual noise.

776.3.3 Radio - television - other - volume - at disturbing levels
The sound or noise from or created by any radio, phonograph, stereo equipment, television set, or any musical or sound producing instrument of whatsoever kind, when such radio, phonograph, stereo equipment, television set or musical or sound-producing instrument is played or operated in such a manner or with such volume as to annoy or disturb the peace, quiet, comfort or repose of any individual in any dwelling house, apartment house, hotel, motel, lodging house or other type of residence shall be deemed to be unusual noise.

776.3.4 Animal - bird - sounds by - disturbing
Any sound made by any animal or bird which has the effect of disturbing the peace, quiet, comfort or repose of any individual shall be deemed to be unusual noise.

776.3.5 Machinery - equipment - in disrepair
Any noise or sound of whatsoever nature and kind caused by a condition of disrepair or maladjustment of any machinery or equipment of whatsoever nature and kind or part or accessory thereof shall be deemed to be unusual noise.

776.3.6 Vehicles - in disrepair - maladjusted
Any noise or sound of whatsoever nature and kind caused by a condition of disrepair or maladjustment of any motor vehicle, motorcycle or other vehicle whatsoever or part or accessory thereof shall be deemed to be unusual noise.

776.3.7 Vehicle - maintenance - repairing - unenclosed
The sounds emanating from the repairing, refinishing, painting, repainting, plating or rust-proofing of vehicles, machinery or any parts thereof where such repairing, refinishing, painting, repainting, plating, or rust-proofing is not carried on within an enclosed structure the doors and windows of which are closed shall be deemed to be unusual noise.

776.3.8 Whistles - steam - air - blowing
The blowing of any steam or air whistle attached to or used in connection with any stationary boiler or other machine or mechanism, except for the purpose of giving notice to workmen of the time to commence or cease work or as a warning of danger shall be deemed to be unusual noise.

776.3.9 Exhaust - discharge - into open air - unmuffled
The discharge into the open air of the exhaust of any steam engine, stationary internal combustion engine, motor vehicle or motorcycle except through a muffler or other device which effectively prevents loud or explosive noises shall be deemed to be unusual noise.

776.3.10 Excavation - construction - unnecessary noise
Any unnecessary noise arising between the hour of 6 o'clock p.m. of any day and 7 o'clock a.m. of the next following day from any excavation or construction work whatsoever including the erection, demolition, alteration or repair of any building, authorized by the City except in the case of urgent necessity shall be deemed to be unusual noise.

776.3.11 Manufacturing industry - noises from - limitations
Noises arising out of any manufacturing industry between the hour of 8 o'clock p.m. of any day and 8 o'clock a.m. of the next following day and which has the effect of disturbing the repose of any City inhabitant shall be deemed to be unusual noise.

776.3.12 Any noise - near hospital - school - in session
Any unnecessary noise in the vicinity of any school, seminary of learning or court, while any of the same are in session or in the vicinity of any hospital or convalescent or rest home shall be deemed to be unusual noise.

776.3.13 Trucks - vehicle - loaded - restrictions
Noises created by any vehicle including cement trucks which bear material or by articles or things loaded on any vehicle if such noises are likely to disturb the repose of any City inhabitant between the hours of 8 o'clock p.m. of any day and 8 o'clock a.m. of the next following day shall be deemed to be unusual noise.

Town of Walden http://www.greatersudbury.ca/content/bylaws/By_law_19_700139.pdf

The following sections of this bylaw could potentially apply:

b) The sound or noise from or created by any radio, phonograph, stereo equipment, television set or musical or sound producing instrument that is played or operated in such a manner or with such volume as to annoy or disturb the peace, quiet, comfort or repose of any individual in any dwelling house, apartment house, hotel, motel, lodging house or other type of residences;

c) The persistant barking, calling or whining or other similar persistant noise made by any domestic pet or any other animal kept or used for any purpose other than agriculture;

⇒ d) Any noise or sound of whatsoever nature and kind caused by a condition of disrepair or maladjustment of any motor vehicle, motorcycle or other vehicle whatsoever or part or accessory thereof;

⇒ e) The sounds emanating from the repairing, refinishing, painting, repainting, plating or rust-proofing of vehicles, machinery or any parts thereof where such repairing, refinishing, painting, repainting, plating or rust-proofing is not carried on within an enclosed structure the doors and windows of which are closed;

⇒ f) The blowing of any steam or air whistle attached to or used in connection with any stationary boiler or other machine or mechanism except for the purpose of giving notice to workmen of the time to commence or cease work or as a warning of danger;

2. GENERAL RULES:

⇒ a) No person shall ring any bell, blow or sound any horn or cause the same to be rung, blown or sounded;

b) No person shall yell, shout, hoot or create, cause or permit any unusual noise or noises likely to disturb the inhabitants;

⇒ c) No person shall create, cause, or permit any noise or noises likely to disturb the inhabitants;

3. UNUSUAL NOISES - For the purpose of subsection (b) of Section 2 above, the following noises or sounds, without limiting the generality of the said subsection (b) of section 2, shall be deemed to be unusual noises;

a) The noise created by the squealing of tires of any vehicle;

g) The discharge into the open air of the exhaust of any steam engine, stationary internal combustion engine, motor vehicle or motorcycle except through a muffler or other device which effectively prevents loud or explosive noises;

h) Any unnecessary noise arising between the hour of eight o'clock p.m. of any day and seven o'clock a.m. of the next following day from any excavation or construction work whatsoever including the erection, demolition, alteration or repair of any building authorized by the Town except in the case of urgent necessity;

i) Noises arising out of any manufacturing industry between the hour of 8 o;clock p.m. of any day and 7 o'clock a.m. of the next following day and which has the effect of disturbing the repose of any Town inhabitant;

j) Any unnecessary noise in the vicinity of any school, seminary of learning or court, while any of the same are in session or in the vicinity of any convalescent or rest home;

k) Noises created by any vehicle including cement trucks which bear material or things loaded on any vehicle if such noises are likely to disturb the repose of any Town inhabitant between the hours of 8 o'clock p.m. of any day and 7 o'clock a.m. of the next following day;

l) The sounding of the whistle of any railway vehicle or other vehicle unnecessarily;

Appendix D: Surface Water Quality Methods

Methods

The environmental assessment methodology has been described in Chapter 8 – Environmental Assessment Methodology. This section provides additional details with respect to the methodology used to complete the assessment for Surface Water Quality, along with a discussion of the various methods used to assess Surface Water Quality. Surface Water Quality has been measured over a period of time, beginning in 2002, shortly after the mineral rights had been acquired, and into 2007 (ASI Group, 2004) (AMEC Earth and Environmental Ltd. 2009.)

In 2010, additional Surface Water Quality monitoring was undertaken to ensure no adverse effects were occurring from the start of the exploratory drilling program (EAG, 2012 and Kilgour & Associates Ltd. and Denison Environmental Services, 2014).

The baseline surveys utilized a similar sampling methodology which consisted of surface water grab samples of a minimum depth of 15 cm. Ethel Lake was sampled using different methods due to the added depth, and was only sampled on one occasion during the baseline studies (2012). The Ethel Lake samples were collected at depths of 0.5 metres from the surface, mid-depth and one metre off the bottom. Table 20-6 outlines the measured parameters documented in each baseline report, as there was some variation through the years.

Table 20-6: Surface Water Quality Parameters Documented by Baseline Reports

Parameter	2004	2009	2012	2014
Total and dissolved metals	X	X	X	X
Cyanide			X	
Hardness	X	X	X	X
Dissolved anions	X	X	X	X
Alkalinity	X	X	X	X
Total dissolved solids	X	X		X
Total suspended solids	X	X		X
Ammonia	X	X	X	X
Total Kjeldahl nitrogen	X	X		X
Total and orthophosphorus	X	X	X	X
Total and dissolved organic carbon	X	X	X	X
pH	X	X	X (in-situ only)	X
Radium 226		X		

In-situ field measurements included pH (2012 only) conductivity, redox potential (in 2004 only), dissolved oxygen, turbidity, flow (only in lotic environments for 2009) and temperature.

Furthermore, predictive models have been used to develop the design criteria for the wastewater treatment facility, a main mitigation measures for Surface Water Quality. The Site Wide Water Balance (Hatch Ltd, 2014a) provides the estimates of water volumes to be discharged, while the Ethel Lake Hydrology (Hatch Ltd., 2014b) provides how the regulated flow of Ethel Lake and outflow to Fairbank Creek will ensure PWQOs for copper are not exceeded.

Appendix E: Inferred Groundwater Flow Directions Drawing

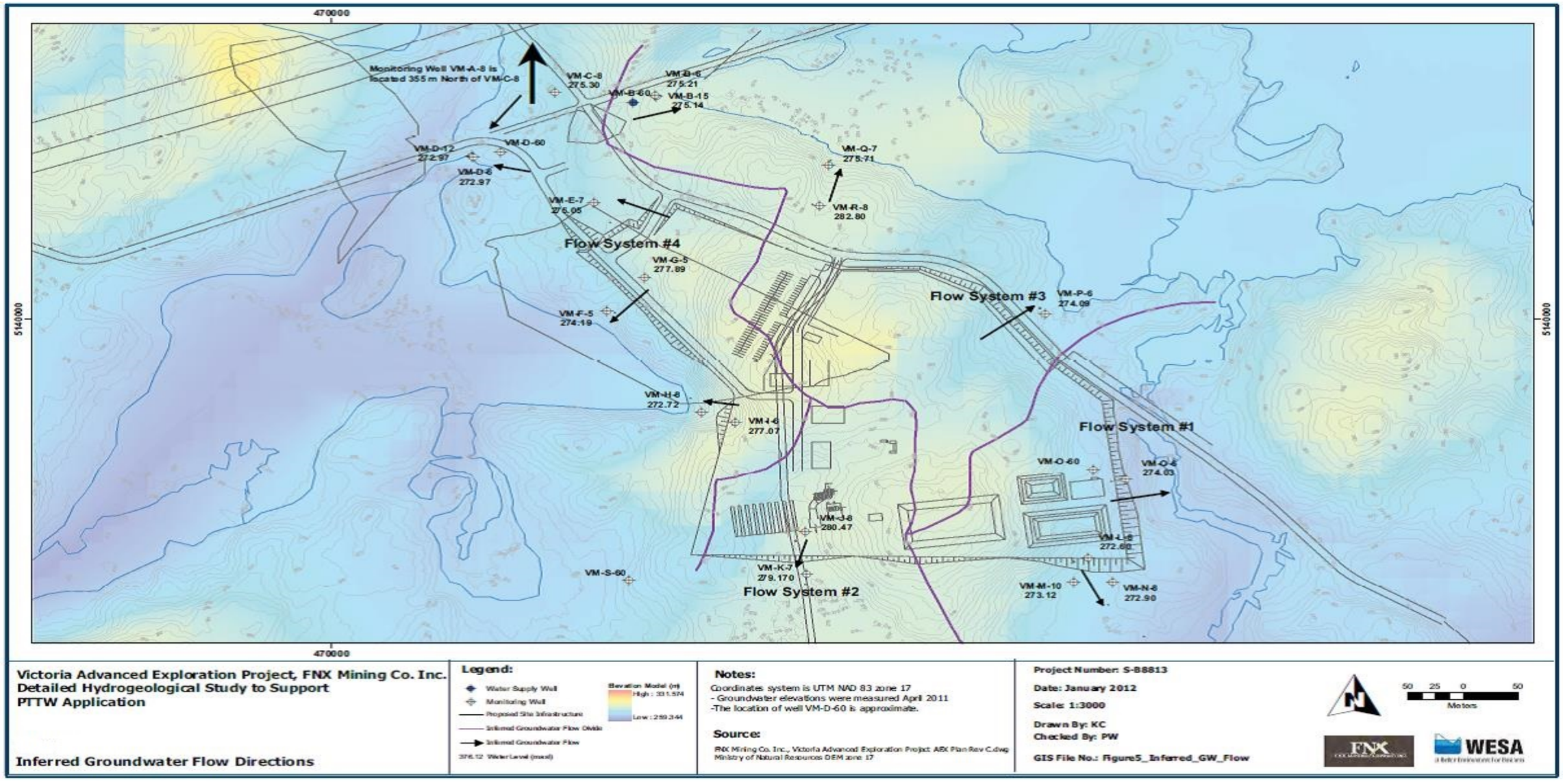

Figure 20-1: Inferred Groundwater Flow Directions

Appendix F: Fish and Benthic Vertebrate Community Sampling Methods

Methods

Baseline Fish and Fish Habitat investigations were conducted in 2003, 2007, 2010 and 2013 (ASI, 2004; AMEC, 2009; EAG, 2012; Kilgour and Denison, 2014, respectively) using a variety of methods, as outlined below for the fish community and benthic invertebrate communities:

- Fish Community:
  - Backpack electrofishing;
  - Gill Netting in Mond Lake and Ethel Lake; and
  - All fish captured identified to species, enumerated, weighed and measured;
- Benthic Invertebrates:
  - Five replicate samples with three replicate field sub-samples collected at each monitoring station;
  - Samples collected with ponar dredge (0.05 m^2), Surber sampler or D-frame sampler (CABIN kick and sweep method) depending on habitat present at monitoring station; and
  - Invertebrates identified to lowest practical level (typically genus or species).

Biological monitoring station locations are shown on Figure 12-1. Aquatic habitat assessment and mapping was also conducted at numerous locations throughout the environmental assessment area. Surface water quality sampling, flow assessments and sediment quality sampling were also typically conducted as a component of the studies identified above. Although these studies will not be discussed in detail in this chapter, they do form a component of the baseline data regarding Fish and Fish Habitat. Results of these studies are provided in full in the baseline study reports (ASI, 2004; AMEC, 2009; EAG, 2012; Kilgour and Denison, 2014). Information on Surface Water Quality can be found in Chapter 10 – Surface Water Quality of this report as it has been identified as a VC.

Fisheries and Oceans Canada | Pêches et Océans Canada

Fisheries Protection Program
Central and Arctic Region
501 University Crescent.
Winnipeg, Manitoba
R3T 2N6

Programme pour la Protection des Pêches
Région du centre et de l'arctique
501 University Crescent
Winnipeg (Manitoba)
R3T 2N6

Your file *Votre référence*

July 6, 2017

Our file *Notre référence*
16-HCAA-00071

Roberta Pedlar-Hobbs
FNX Mining Company Inc.
1010 Lorne Street
Sudbury, ON P3C 4R9

Dear Ms. Pedlar-Hobbs:

Subject: Implementation of mitigation measures to avoid and mitigate impacts to fish and fish habitat and aquatic species at risk – Ethel Lake Dam Reconstruction

The Fisheries Protection Program (the Program) of Fisheries and Oceans Canada (DFO)received your proposal on January 22, 2016.

Your proposal has been reviewed to determine whether it is likely to result in serious harm to fish which is prohibited under subsection 35(1) of the *Fisheries Act*. Your proposal has also been reviewed to determine whether it will adversely impact listed aquatic species at risk and contravene sections 32, 33 or 58 of the *Species at Risk Act* (SARA).

Our review considered the following:

- Request for Project review dated January 22, 2016
- Email responses to DFO questions received on July 13, 2016

We understand that you propose to:

- Construct a replacement concrete dam and spillway approximately 1 m tall and 13 m long and include a gate chamber with low-level outlet pipe and valve on the outlet of Ethel Lake approximately 130 m upstream of the existing dam
- Isolate the construction using a temporary coffer dam and turbidity curtains and bypass channel.
- Install a screened pump intake
- Use explosives near the lake to construct a level pad for the pump house.

Since there are no SARA species or their habitats identified in the project area, no additional approvals under SARA will be required for your proposed activities.

To avoid the potential for serious harm to fish that is prohibited under the *Fisheries Act*, the mitigation measures listed below, in addition to those set out in your project plans, are to be followed:

- Ensure that flows in Fairbank Creek are maintained to prevent dewatering and fish stranding at all times during construction and operation of the new dam.
- Avoid in-water construction and use of explosives during fish spawning periods from April 1 to July 15 of any given year.

Canada

- Follow the Guidelines for the use of explosives in or near Canadian fisheries waters. Wherever possible maintain overpressures that are less than 50 kPa rather than the 100 kPa recommended by the guideline.
- Install a screened pump intake designed to meet DFO's Freshwater end-of-pipe fish screen guideline for pumping rates of approximately 0.02 m^3/s and fish with anguilliform swimming mode.
- Ensure effective measures are in use during construction and operation to prevent deleterious substances (e.g. sediment, fresh concrete and concrete wash water, fuel, oil etc.) from entering the water.
- Conduct a fish rescue when constructing coffer dams to ensure all fish are removed from areas to be dewatered and returned unharmed to Ethel Lake.

Provided that you implement the required mitigation measures for your project, and follow the guidance available on the DFO website at http://www.dfo-mpo.gc.ca/pnw-ppe/measures/index-eng.html, the Program is of the view that your proposal should not result in serious harm to fish or contravene sections 32, 33 or 58 of the *Species at Risk Act*. No formal approval is required from the Program under the *Fisheries Act* or the *Species at Risk Act* in order to proceed with your proposal.

It remains your responsibility to ensure you avoid causing serious harm to fish in compliance with the *Fisheries Act*, and that you meet the requirements under the *Species at Risk Act* as it may apply to your project. If your plans have changed or if the description of your proposal is incomplete, or changes in the future, you should consult our website (http://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html) or consult with a qualified environmental consultant to determine if further review is required by the Program.

Please be advised that it is also your *Duty to Notify* DFO if you have caused, or are about to cause, serious harm to fish that are part of or support a commercial, recreational or Aboriginal fishery. Such notifications should be directed to http://www.dfo-mpo.gc.ca/pnw-ppe/violation-infraction/index-eng.html.

A copy of this letter should be kept on site while the work is in progress. It remains your responsibility to meet all other federal, territorial, provincial and municipal requirements that apply to your project.

If you have any questions, please contact Todd Schwartz at (204) 983-4231, or by email at Todd.Schwartz@dfo-mpo.gc.ca. Please refer to the file number referenced above when corresponding with the Program.

Yours sincerely

<Original signed by>

Richard Janusz
Senior Fisheries Protection Biologist
Fisheries Protection Program

J. Thomas (A/DFO Regional Manager Regulatory Review – Burlington)
T. Schwartz (DFO Fisheries Protection Biologist - Winnipeg)
L. Venne (Lands and Waters Technical Specialist, MNRF - Sudbury)
M. Hall (Management Biologist, MNRF– Sudbury)

Appendix G: Wildlife and Wildlife Habitat Sampling Methods

Methods

Terrestrial baseline studies were completed in 2002, 2003, 2010, 2013 and 2015 (Golder Associates, 2003 and 2004; RiverStone, 2011; EcoTec, 2013; Hatch, 2015; and EcoTec, 2015, respectively). The studies included vegetation community assessments and terrestrial wildlife surveys (including species of special conservation status).

The following protocols were used to complete the baseline studies:

- Vegetation Surveys:
  - Field Guide to Forest Ecosystems of Central (FEC) Ontario (Chambers et al. 1997);
  - Ontario Wetland Evaluation System (OWES), Northern Manual (MNR, 1994 and 2013); and
  - Ecological Land Classification (ELC) for Southern Ontario (Lee et al. 1998);
- Wildlife Surveys:
  - Survey Protocol for Blanding's Turtle in Ontario (MNR 2013);
  - Ontario Breeding Bird Atlas (OBBA) Guide for Participants (FON 2001);
  - Marsh Monitoring Program Protocol (Bird Studies Canada 1995); and
  - Standard Operating Procedure for: Cover Board Surveys for Snakes in the Lake Superior Basin (Casper and Hecnar 2011).