Environment AECOM

Hudson Bay Mining and Smelting Co., Limited

Reed Mine Environment Act Proposal

Prepared by:

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HUDBAY

December 11, 2012

Ms. Tracey Braun, M.Sc.
Director, Environmental Assessment & Licensing Branch
Manitoba Conservation and Water Stewardship
123 Main Street, Suite 160
Winnipeg, Manitoba
R3C 1A5

Dear Ms Braun,

We write to apply for a Class 2 *Environmental Act* license for the construction and operation of the Reed Mine. A cheque for the application fee in the amount of $5,000.00 is enclosed along with an *Environment Act Proposal Form* and Report (the "Proposal"), prepared by AECOM on behalf of Hudson Bay Mining and Smelting Co., Limited (HBMS).

The Reed Mine will be comprised primarily of the facilities which have been approved and are being constructed for the Reed Advanced Exploration Project (AEP). The Reed Mine will consist primarily of operation of the Reed trench, portal and decline, developed for advanced exploration purposes and converted to use for production, together with supporting infrastructure on the Reed AEP site, such as the camp site, maintenance shop and cold storage.

The site of the proposed Reed Mine lies entirely within the footprint occupied by the previously approved Reed AEP project. The Reed Mine also will be supported by other HBMS existing licensed operations in the City of Flin Flon. As outlined in this report, the proposed Reed Mine has been planned, to the maximum extent possible, to avoid adverse environmental effects by taking advantage of available existing licensed support facilities and by keeping the footprint of the development as small as possible.

The Reed AEP Closure Plan, which was approved by the Director of Mines on October 31, 2011, will be updated to account for operation of the proposed Reed Mine and will be submitted to the Director of Mines for approval, along with any increase/decrease in financial assurance that may be required. In accordance with HBMS experience with mine closure, it is expected that closure activities will result in substantial return of the site to pre-project conditions.

We provide 7 hard copies and 22 electronic copies of this submission.

As well, we can advise that we are providing both electronic and hard copies of the submission to Mathias Colomb Cree Nation, as they have expressed an interest in receiving information about the project.

We look forward to hearing from you with your instructions concerning the assessment process and schedule to be followed.

We would be pleased to provide any other information that you may require. Thank you very much for your kind attention to this application.

Sincerely,

Stephen West, P.Eng.
Superintendent, Environment Control

cc: Sheryl Rosenberg
Tom Goodman
Brad Lantz

Distribution List

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7	22	Environmental Approvals – Conservation and Water Stewardship
5	5	Hudson Bay Mining and Smelting Co., Limited
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Revision Log

Revision #	Revised By	Date	Issue / Revision Description
1	Somia Sadiq	December 07, 2012	Final

AECOM Signatures

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Certificate of Authorization
AECOM Canada Ltd. (MB)
No. 4671 Date: 2012/12/10

Executive Summary

This Environment Act Proposal (EAP) report contains the information described in Manitoba Conservation's Information Bulletin, "Environment Act Proposal Report Guidelines." It has been prepared and is submitted to assist in the consideration of the HBMS application for an *Environment Act* licence for the Reed Mine.

The Reed Mine will be comprised primarily of the facilities which have been approved and are being constructed for the Reed Advanced Exploration Project (AEP). The Reed Mine will consist primarily of use of the trench, portal and decline, developed for advanced exploration purposes and converted to use for production, together with supporting infrastructure on the Reed AEP site, such as the camp site, maintenance shop and cold storage.

The site of the proposed Reed Mine lies entirely within the footprint occupied by the previously approved Reed AEP project. The Reed Mine also will be supported by other HBMS existing licensed operations in the City of Flin Flon. As outlined in this report, the proposed Reed Mine has been planned, to the maximum extent possible, to avoid adverse environmental effects by taking advantage of available existing licensed support facilities and by keeping the footprint of the development as small as possible.

The Reed AEP Closure Plan, which was approved by the Director of Mines on October 31, 2011, will be updated to account for operation of the proposed Reed Mine and will be submitted to the Director of Mines for approval, along with any increase/decrease in financial assurance that may be required. In accordance with HBMS experience with mine closure, it is expected that closure activities will result in substantial return of the site to pre-project conditions.

The results of the effects assessment can be summarized as follows:

Topography

Construction and operation of the proposed Reed Mine will not affect the topography of the site. The Project Site has been previously cleared and levelled during construction of the Reed AEP. The closure phase will include restoration the site topography to match the surrounding area to the extent that is practical. Therefore, effects on topography are assessed to be insignificant.

Soil

The plan for operation of Reed Mine minimizes the potential to generate ARD on-site, therefore minimizing subsequent effects on soil quality. The pre-production and production phases will not include any activity that is likely to result in soil erosion. The closure phase includes assessment of any contamination caused during the life of the mine, followed by any remediation that may be required to eliminate risk to human health, safety or the environment. Therefore, the effect on soil is assessed to be insignificant.

Air

With respect to dust, the dense nature of the vegetation immediately surrounding the Project Site is expected to mitigate any dust, spatially limiting its effects. Although dust will be generated on the unpaved Reed Mine access road, dust on PTH 39 will be minimal as it is paved. With the implementation of the measures described in the assessment, the effect of dust on air quality will be negligible under normal weather conditions.

With respect to exhaust emissions, although the increase in traffic along PTH 39 is considered major in relation to the existing level of traffic on PTH 39, the resulting impact on air quality in the Project Region is assessed to be negligible. The ventilation system required on site will use propane heaters to heat the fresh air prior to pumping it

underground, which will generate pollutants such as nitrogen oxides (NOx), carbon monoxide, sulphur dioxide, particulate matter, and greenhouse gases. However, with implementation of the measures described in the assessment, the effect on air from exhaust emissions will be negligible.

With respect to noise, all practices performed on the Reed Mine site will be carried out in accordance with the *Workplace Safety and Health Act* and HBMS' OHSAS 18000 certified management system, which will minimize the risk of occurrences that may affect worker health and safety. Noise levels are not expected to be high enough to cause any significant disturbance in the Project Region. Therefore, effects due to noise are assessed to be insignificant.

Climate

Although effects of GHG emissions on climate change are considered irreversible, given the negligible contribution of GHG emissions from the pre-production, production and closure phases of the Reed Mine, the residual effect of GHG emissions on climate change is assessed to be insignificant.

Groundwater

For the purposes of this environmental assessment, a distinction has been made between shallow and deep groundwater resources.

Use of explosives could potentially introduce contaminants underground, leading to a decline in deep groundwater quality. However, given the low hydraulic conductivity of the rock formation groundwater will be fairly limited and with implementation of mitigation measures, residual effects on groundwater quality are assessed to be insignificant.

The Mine dewatering system has the potential to affect deep groundwater quantity by creating a groundwater depression zone. However, based on HBMS experience, this dewatering system has been designed to take into account all inflows for process water and any groundwater seepage. Therefore, it is anticipated that groundwater seepage into the mine underground will be lower than the design inflow rate. For these reasons, the mine dewatering system is not expected to have any significant impact on availability of deep groundwater in the Project Region.

With respect to shallow groundwater, activities such as handling fuels and lubricants can potentially affect quality of shallow groundwater. HBMS will also use groundwater as a source of process water for mining activities and fire protection, as required on site. This groundwater withdrawal could potentially act as a source of contamination of shallow groundwater in the Project Area. However, the measures described to avoid groundwater effects from leaks and spills are judged to be sufficient to mitigate any risk of such contamination to occur. Further, any withdrawal will be in accordance with permitted use and is therefore not expected to have a significant impact on groundwater availability in the Project Region.

ARD could also potentially also affect shallow groundwater quality. However, the rock management practices for both waste rock and ore will mitigate any potential effects from ARD.

Therefore, the overall effects on groundwater are assessed to be insignificant.

Surface Water

The Reed Mine will not be using any surface water, and therefore no effects are anticipated on surface water quantity in the region. Waste rock management practices will mitigate any potential effects on soil quality due to ARD, and pathways affecting surface water quality are not expected to occur.

Water discharged from the polishing pond will comply with the applicable Tier 1 criteria set out in MWQSOG. Sewage will continue to be collected in sewage holding tanks, which in turn will be regularly pumped out and trucked to a licensed sewage treatment facility in accordance with Onsite Wastewater Management System Regulation (Manitoba Regulation 83/2003). Ongoing compliance with these regulations is considered to be acceptable mitigation to reduce any potential effects on surface water quality from sanitary sewage disposal. Therefore, effects on surface water as a result of the proposed project are assessed to be insignificant.

Protected and Other Flora Species

Although the Project Site was cleared as a part of the AEP, no unique vegetation communities were lost and the species lost to the development footprint are common in the Project Region. No additional loss of vegetation will be caused by pre-production or production phases of the Reed Mine. The loss of vegetation is therefore not considered significant.

Protected and Other Fauna Species

No habitat of specific or critical value to wildlife was observed at the Project Site (such as calving or over-wintering areas) and, based on site conditions and limited field observations, it is expected that there is no critical wildlife value in the Project Area. Although the Reed AEP has resulted in a loss of wildlife habitat at the Project Site, the type of habitat that has been lost is common in the Project Area and Project Region. No additional loss of wildlife habitat will be caused during pre-production or production at Reed Mine. Disturbance to wildlife due to noise will be limited to portions of the Project Area with no noise effects anticipated beyond the Project Area. Additionally, during closure, the Project Site will be restored to pre-mining conditions to the extent possible. Therefore, effects on fauna as a result of the proposed project are assessed to be insignificant.

Aquatic Resources and Protected Species

There are no protected species known to occur in the Grass-Burntwood River watershed. The mitigation measures planned for surface water are anticipated to sufficiently mitigate potential surface water effects and avoid significant residual effects.

Land Use

The Reed Mine lies within the southern region of the Grass River Provincial Park, which allows for mining development in the area. Given the remote location of the Reed Mine Project Site, activities associated with the project are not expected to interfere with park activities. The vegetative buffer around the site further provides a visual buffer, which blankets mining activity from the main highway.

With respect to noise-related effects of mining activity, with the implementation of engineering controls on noise sources, combined with the vegetative buffer around the site is anticipated to mitigate potential noise effects at the Project Site. Given the high separation distance to the nearest campgrounds and lodges, it is not anticipated that noise from mining activities will cause any disturbance to park users. Therefore, it is assessed that the project will not cause any significant effect on land use.

Resource Use

The project will not adversely affect any water body that may be used for fishing. Therefore, no effects on fishing are expected to occur. Similarly, residual effects on wildlife and wildlife habitat in the Project Region are assessed to be negligible. Therefore, no significant impacts on trapping are expected to occur.

In accordance with the 2012 Manitoba Hunting Guide (Manitoba Conservation and Water Stewardship 2012), hunting in provincial parks is subject to specific regulations, designed to ensure human safety. The guidelines indicate that "persons may not hunt, possess a loaded firearm, or discharge a firearm within 300 m of recreation areas, cottages, dumps, roads and prescribed trails". Since the Project Site falls within 300 m of PTH 39, hunting is not allowed within the boundaries of the Project Site. Therefore, it is assessed that the project will not interfere with hunting activities.

Heritage Resources

There are no historic or heritage resources anticipated at the Project Site or in the immediate surrounding area. Any disturbances during the pre-production phase will be limited to the existing cleared and levelled Reed AEP site, and no further disturbance beyond the Project Site will occur during production or closure activities. Therefore, no effects on heritage resources are expected to occur during construction, operation or closure of the Reed Mine.

Aesthetics

Based on the remote location of the Project Site, aesthetic effects due to the pre-production and production phases are assessed to be negligible.

During closure, the Reed Mine site will be returned to its natural pre-project state to the maximum extent possible. It is anticipated that re-vegetation as well as natural succession will substantially return the mine site to pre-mine conditions. Once these efforts have been completed, aesthetic conditions on the site will be substantially restored to conditions that existed before mineral exploration on the site.

Monitoring and Follow-up

To ensure that there will be no adverse impact to surface water as a result of mining activities, it is recommended that a water quality monitoring program be developed and implemented for the polishing pond and any other potential source of surface water discharge. To ensure the success of the re-vegetation program, a re-vegetation monitoring program will be implemented. Regular monitoring during the growing season will determine the success of the re-vegetation program, and will determine if follow up reseeding or replanting is required. HBMS will continue to participate in Manitoba Conservation's ongoing large-scale caribou study in Northern Manitoba, including the Reed Project Region, which contributes information used in Manitoba's Conservation and Recovery Strategy for Boreal Woodland Caribou. HBMS has been certified to the international standard known as ISO 14001 Environmental Management Systems (EMS) since 2003. The Reed project has been added to HBMS scope of certification and the environmental management policies and procedures, as outlined in the EMS, will be implemented.

Conclusions Summary

In summary, the residual environmental effects will be negligible to minor in magnitude with the implementation of design features, standard operating, and mitigation measures described. The measures described to mitigate the risk of occurrence of accidents and malfunctions are deemed to be appropriate in mitigating the risk of such occurrences. Therefore, based on the available information and documented assumptions, it is our opinion that the overall potential adverse effects of the proposed project will be negligible to minor in magnitude, reversible, and are assessed to be not significant.

Glossary

Item	Explanation
AADT	Annual Average Daily Traffic.
AEP	Advanced Exploration Project.
Ambient	Surrounding, encircling - pertaining to any local non-point source conditions such as temperature, air quality or noise levels.
ANFO	Ammonium nitrate/fuel oil.
Aquifer	A geological formation of permeable rock, sand, or gravel that conducts groundwater and yields useable quantities of water to springs and wells.
Archaeology	The scientific study of past human cultures by analyzing the material remains.
ARD	Acid Rock Drainage
Bedrock	Solid rock that underlies soil, sand, clay, gravel, and loose materials on the Earth's surface.
Berm	A sloped wall or embankment used to prevent the inflow or outflow of material into/from an area.
Biota	Living organisms.
CCME	Canadian Council of Ministers of the Environment.
Clay	A fine-textured, sedimentary or residual deposit consisting of hydrated silicates of aluminum mixed with various impurities.
Conductivity	The ability of an aqueous solution to carry electrical current.
CSQG	*Canadian Soil Quality Guidelines.*
CWQG	*Canadian Water Quality Guidelines.*
Deposition	The geological process by which material is added to a landform or land mass.
DFO	Fisheries and Oceans Canada.
Dissolved oxygen	DO; the amount of oxygen dissolved in water.
DO	Dissolved oxygen.
EAP	*Environment Act* Proposal.
Ecoregion	Large unit of land characterized by various items including distinctive climate, ecological features and terrestrial communities.
Ecozone	The largest scale biogeographic division of the earth's surface based on the historic and evolutionary distribution patterns of plants and animals.
EEM	Environmental Effects Monitoring.
Emergent plant	A plant rooted in shallow water with most of the stem and leaves above water.
Ephemeral	A stream that flows during, and for short periods, following a precipitation event. The stream may or may not have a well-defined channel.
Erosion	The removal of solids (sediment, soil, rock and other particles) in the natural environment. It usually occurs due to transport by wind, water, or ice; by down-slope creep of soil and other material under the force of gravity; or by living organisms, such as burrowing animals.
Erosion control techniques	Methods used to prevent or reduce the risk or erosion from disturbed sites. Methods include re-vegetation, riprap and silt fences.
Eutrophic	The trophic status of a waterbody; whereby the waterbody has relatively high primary productivity, based on total phosphorus concentrations between 35μg/L and 100μg/L (CCME, 1999).
Evaporation	The transition from a liquid state into a gaseous state.
Fauna	All animal life in a particular region.

Item	Explanation
FFB	Flin Flon Belt.
Flood plain	Area of land adjacent to a watercourse that is covered by water during a flood.
Flora	All plant life and vegetation in a particular region.
Fluvial	Of, pertaining to, inhabiting, or produced by the action of a river or stream.
FMU	Forest Management Units
Glacial	Relating to or derived from a glacier; "glacial deposit".
Gravel	Gravel is rock that is of a specific particle size range. Specifically, it is any loose rock that is larger than two millimeters (2 mm/0.079 in) in its smallest dimension (about 1/12 of an inch) and no more than 64 mm (2.5 in).
Groundwater	Water that exists beneath the earth's surface in underground streams and aquifers.
HBMS	Hudson Bay Mining and Smelting Co., Limited.
Hydrogeology	The study of the distribution of groundwater.
Hydrology	The study of the distribution and movement of water.
Hydrometric station	An active water level and streamflow station that collects surface water quality and sediment data.
Infiltration	Infiltration is the process by which water on the ground surface enters the soil.
Lacustrine	Sediment deposits related to a lake.
LHD	Load haul dumps.
Loam	A loose mixture of clay, sand, and silt.
masl	Metres Above Sea Level.
MESA	*Manitoba Endangered Species Act.*
Mesotrophic	The trophic status of a waterbody; whereby the waterbody has relatively moderate primary productivity, based on total phosphorus concentrations between 10µg/L and 20µg/L (CCME, 1999).
Meso-eutrophic	The trophic status of a waterbody; whereby the waterbody has moderate to high primary productivity, based on total phosphorus concentrations between 20µg/L and 35µg/L (CCME, 1999).
Mitigation	Actions taken to reduce effects by limiting, reducing or controlling hazards and contamination sources.
MMER	Federal *Metal Mining Effluent Regulations*.
Moraine	Accumulated earth and stones deposited by a glacier.
MPN	Most Probable Number
MSQG	*Manitoba Sediment Quality Guidelines.*
NAG	Non acid generating.
OHSAS	Occupational Health and Safety Assessment Series
Oligotrophic	The trophic status of a waterbody; whereby the waterbody has relatively low primary productivity, based on total phosphorus concentrations between 4µg/L and 10µg/L (CCME, 1999).
PAG	Potentially acid generating.
Permeability	The facility with which a porous mass permits passage of a fluid. Soil permeability can be determined using the ‘constant head’ method or the ‘falling head’ method.
pH	A measure of the activity of hydrogen ions (H+) in a solution and, therefore, its acidity, a number between 0 and 14, that indicates whether a solution is acidic (pH <7).

Item	Explanation
Potable Water	Water safe for human consumption.
PM	Particulate matter.
Ppb	Parts per billion.
Proponent	A person or organization seeking approval to conduct a business or activity that impacts on the environment.
RCMP	Royal Canadian Mounted Police.
Renewable Resources	A resource that is capable of being naturally restored or replenished over time.
Residual Effects	Effects that remain after mitigation has been applied.
R.M.	Rural Municipality.
RTLs	Registered trap lines.
Sand	Material containing loose, unconsolidated accumulations of sediment.
SARA	*Species at Risk Act.*
Saturated	A condition in which all voids between soil particles are temporarily or permanently filled with water.
SCAT	Self-contained aboveground tank.
Sediment	Any particulate matter that can be transported by fluid flow and which eventually is deposited as a layer of solid particles on the bed or bottom of a body of water or other liquid.
Sewage	Wastewater produced in showers, toilets, sinks, laundry facilities sent for treatment at an onsite Sewage Treatment Facility
Shale	A consolidated clay rock which possesses closely-spaced well defined laminates.
Silt	Material of an earthy character intermediate in grain-size between sand and clay, with greater than 50% passing through a No. 200 sieve.
Silt Fences / Silt Curtain	A temporary barrier used to intercept sediment-laden runoff from small areas.
Sinking	Refers to excavating a vertical (or near vertical) shaft from the top down.
Soil series	A grouping of soils that have similar soil profiles and are developed from a particular kind of parent material.
Spawning	The production or depositing of large quantities of eggs in water.
STP	Sewage Treatment Plant.
Subsurface	The geological zone beneath the surface of the Earth.
Surface Water	Water that sits or flows above the earth, including lakes, oceans, rivers, and streams.
TDGA	*Transportation of Dangerous Goods Act.*
TDS	Total dissolved solids.
Terrestrial	Existing on land.
TIA	Tailings Impoundment Area.
Till	Dominantly unsorted and unstratified drift, generally deposited directly by and underneath a glacier without subsequent reworking by meltwater, and consisting of a heterogeneous mixture of clay, silt, sand, gravel, stones, and boulders.
Tonne	Unit of mass equal to 1,000 kg or 2,204.6 pounds. Also referred to as “metric tons”.
Topography	The physical features of the land.
Tributary	A stream or river which flows into a mainstem (or parent) river.
TSS	Total Suspended Solids.

Item	Explanation
Turbidity	A measure of water clarity.
Unemployment Rate	Number of unemployed persons expressed as a percentage of the labour force.
Ungulate	Hoofed animal such as deer.
USgpm	US gallons per minute.
VMS	Volcanic-hosted massive sulphide.
Wastewater	Water containing waste products requiring treatment. In the context of the Reed Mine, wastewater may consist of water from the mine (groundwater seepage and process water) and sewage.
Waterfowl	Birds that swim and live near water, including ducks, geese, pelicans and swans.
Watershed	The entire geographical area drained by a river and its tributaries; an area characterized by all runoff being conveyed to the same outlet.
WMA	Wildlife Management Area.
WMO	World Meteorological Organization.
WTP	Water Treatment Plant.

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Appendices

1. Introduction and Background

1.1 Project Overview

Figure 1 displays the site of the Reed Advanced Exploration Project ("Reed AEP"), which lies approximately 91 km east-southeast of Flin Flon and approximately 80 km west-southwest of the Town of Snow Lake in the Grass River Provincial Park. Hudson Bay Mining and Smelting Co., Limited (HBMS) proposes to operate an underground copper mine on the site of the existing Reed AEP, primarily by converting the use of the Reed AEP facilities from exploration to production purposes (the "Reed Mine" or "Reed Copper Project" or "Reed Project").

The proposed Reed Mine will consist primarily of the operation of the Reed decline (also known as ramp) developed for advanced exploration purposes and converted to use for production, together with the supporting infrastructure on the Reed AEP site.

This *Environment Act* Proposal (EAP) report contains the information described in Manitoba Conservation's Information Bulletin, "*Environment Act* Proposal Report Guidelines." It has been prepared and is submitted for consideration of HBMS' application for an *Environment Act* licence for the proposed Reed Mine.

A copy of the *Environment Act* Proposal Form is attached as **Appendix A**.

It is our opinion that, based on the available information and documented assumptions, the proposed project is not likely to cause significant adverse environmental effects. As outlined in the report, the proposed Reed Mine has been planned, to the maximum extent possible, to avoid adverse environmental impacts by keeping the footprint of the development as small as possible and contained within areas previously disturbed by historical foresting. Residual environmental effects of the proposed Reed Mine will be negligible to minor in magnitude with the implementation of the mitigation measures identified and the monitoring and follow up programs proposed.

It is anticipated that the Reed Mine may continue in operation until 2018, operating at a rate of approximately 1,300 tonnes of ore per day. Upon completion of mining, the Reed Mine will be closed in accordance with the requirements of the Mine Closure Regulation, including building removal, closing of all openings, removal and remediation of contaminated soil (if any), site contouring and re-vegetation of the site. The Reed Copper AEP Closure Plan, which was approved by the Director of Mines on October 31, 2011, will be updated to account for operation of the proposed Reed Mine and will be submitted to the Director of Mines for approval, along with any changes to financial assurance that may be warranted. In accordance with HBMS experience with mine closure, it is expected that closure activities will, in time, result in substantial return of the site to pre-project conditions.

The proposed Reed Mine will employ up to approximately 88 people during operation, with most workers expected to travel from the City of Flin Flon, using a 50 person camp located on site (minor expansion from the existing 42 person camp used for the AEP). Operation of the proposed Reed Mine also will entail continued use of infrastructure on the existing AEP site. It is anticipated that the Reed Mine will generate economic benefit in the region, with no significant adverse environmental effects.

1.2 Company Profile

The proponent of the proposed Reed Mine is HBMS, which is a wholly owned subsidiary of HudBay Minerals, Inc. HBMS operates the 777 Mine in Flin Flon, Manitoba, and is developing the Lalor Project near Snow Lake, Manitoba. The Trout Lake Mine, located in Flin Flon, closed in June 2012, resulting in displacement of 145 workers, some of whom will be employed at Reed Mine.

Copper and zinc ore from the 777 Mine is concentrated in the Flin Flon Metallurgical Complex. Zinc and copper ore produced in the Snow Lake area, such as from the Chisel North Mine (where ore production recently has concluded), has been processed in the Stall Lake Concentrator.

Zinc concentrate from both Flin Flon and Snow Lake is processed to produce refined zinc in the Flin Flon Metallurgical Complex (which includes the zinc pressure leach, cellhouse and zinc casting plant). Since closure of the Flin Flon copper smelter in June of 2010, copper concentrate has been shipped out of Manitoba for further processing.

For the year 2011, HBMS (Manitoba) directly employed 1,286 people, with an annual payroll of $111.26 million in wages and benefits, contributed $5.98 million in municipal taxes and grants, and paid $69.04 million in income, mining, payroll, sales taxes and royalties. HBMS also contributed $0.85 million in community investments and contributions to charities.

1.3 History of Economic Development in the Snow Lake Region

The Snow Lake area has had an active mining history ever since gold was first discovered on the eastern shore of Wekusko Lake in 1913 (Snow Lake 2012). There have been 37 mining operations within a 50 km radius of Snow Lake (Table 1-1).

Table 1-1: Mines and Shafts within 50 km of Snow Lake, Manitoba

Mine Name	Dates of Operation	UTM (NAD83, 14U)	
		Easting	Northing
Ballast-Moosehorn Shaft [N. Manitoba Shaft]	1917-31	449349	6069522
Laguna (Rex) Mine	1918-40	450575	6071394
Laguna Main Shaft	1918-40	450574	6071397
Apex Shaft	1918-55	447992	6075577
Bingo Shaft	1923-32	451293	6071876
Moss 1 (Ferguson Mine)	1927-73	445253	6090396
Ferro-Rainbow Mine	1932-74	454497	6072585
Nemo Shaft	1935	454655	6074673
Jupiter Shaft #2 #3	1938-58	400331	6075692
North Star Shaft	1938-58	400118	6077397
Gold Shower Shaft	1938-58	400369	6078784
Pocahontas Shaft	1945-46	454469	6072371
K.K. Syndicate Shaft	1941-53	449224	6073229
Kiskoba-Kiski Shaft	1941-53	448613	6068137
Snow Lake Mine	1946	433884	6079699
Nor-Acme Mine [Howe Sound]	1949-58	434714	6081164
McCafferty Shaft #2	1950	456128	6076371
McCafferty Shaft #1	1950	456051	6076311
Reed Lake Shaft	closed 1961	397468	6051679

Mine Name	**Dates of Operation**	**UTM (NAD83, 14U)**	
		Easting	Northing
Wekusko	closed 1961	450960	6045909
Chisel Lake Service Shaft	1961-87; 1989-94	428200	6076820
Rod #1	1962-64	440855	6079126
Silver Lead Shaft	closed 1963	453578	6087418
Stall Lake Mine	1964-94	439585	6079327
Osborne Lake Shaft	1967-84	453348	6090712
Dickstone Shaft	1970-75	404347	6079673
Anderson Lake Mine	1970-88	436191	6079741
Ghost Lake [Lost Lake]	1971-88	430616	6076535
Spruce Point	1982-92	409341	6048489
Rod #2	1984-95	440215	6076944
Chisel Pit Mine	1988-94	427900	6076850
Chisel North Mine	1989-2012	428352	6077865
Photo Lake Mine	1995-98	428457	6082712
New Britannia Mine [former Nor-Acme Mine]	1995-2005	431596	6083497
Winnipeg Jupiter Shaft #3	Unknown	399893	6075508
Gold Rock	Unknown	400584	6078569
Snow Lake Mine [former New Britannia Mine]	2010-present	431596	6083497

Source: (Manitoba Innovation, Energy and Mines; Mineral Resources Division n.d.)

In 1951, HBMS started aggressively exploring the area around Snow Lake. In 1958, HBMS purchased a number of Howe Sound Mining Company support facilities (owners of the Nor-Acme Mine site), including mining infrastructure and a power transmission line. These facilities were used as the Snow Lake Service Centre, which supported HBMS mining and exploration activities in the Snow Lake district.

The Town of Snow Lake developed around the Nor-Acme Mine site and a store, school, curling rink, community hall, residences and a hospital opened in 1947. In two years, another 57 residences, additional stores, a bank, hotel, and café were built. The population reached 654 in 1954.

In 1947, construction began on the Snow Lake mining road from Wekusko and on the Hudson Bay Railway line to the Town of Snow Lake. In 1960, a rail line from Chisel Lake to Optic Lake (65 km west of Chisel Lake) was completed (Government of Manitoba n.d.). Provincial Road 392 (PR 392), connecting the Town of Snow Lake to Provincial Trunk Highway 10 (PTH 10), was paved in 1960 (Snow Lake 2012).
A rail line connecting Osborne Lake Mine, Stall Lake Mine and Chisel Lake Mine was completed in 1967 (Government of Manitoba n.d.). These rail lines have since been decommissioned and there is currently no rail access to Snow Lake. The nearest active rail access to the Town of Snow Lake is at Wekusko siding, approximately 65 km south-east of Snow Lake.

Since 1973, Manitoba Hydro has been responsible for provision of electrical service to the northern communities of Flin Flon and Snow Lake. (Manitoba Hydro n.d.)

Tolko Industries Ltd. (Manitoba Solid Wood Division, Woodlands), located in The Pas, Manitoba has three Forest Sections in the region (Highrock, Nelson River and Saskatchewan River) where wood is harvested. These Forest Sections include areas surrounding Snow Lake, Flin Flon and Grass River Provincial Park. (Tolko Industries Ltd. 2012)

Wild rice is harvested for commercial purposes by companies based in Cranberry Portage (Naosap Harvest n.d.), Flin Flon (Far North Wild Rice n.d.), and The Pas (Wild Man Ricing Wild Rice n.d.). There is no evidence of commercial harvest of wild rice in the Snow Lake area or in the vicinity of the Reed AEP.

1.4 HBMS Mining History

Since the late 1950's, HBMS has operated nine mines in the Snow Lake region, including Photo Lake, Rod, Chisel Lake, Stall Lake, Osborne Lake, Spruce Point, Ghost Lake, Anderson Lake, and Chisel North. **Figure 2** displays a general overview of historic HBMS mine locations relative to the site of the proposed Reed Mine. The mines at Rod, Osborne Lake, Spruce Point, Ghost Lake, and Anderson Lake have been fully decommissioned, and partial decommissioning has occurred at the Chisel Lake and Stall Lake Mine sites.

The Chisel Lake Mine, located 16 km southwest of Snow Lake, was opened in 1958, and was the first copper zinc mine in the Snow Lake area. This was followed two years later with the opening of the Stall Lake Mine, located 7 km east of Snow Lake, and in 1968, a third mine at Osborne Lake was opened. In 1979, an ore concentrator was commissioned near the Stall Lake Mine, when five mines were in operation near Snow Lake. In 1988, the Chisel Lake Mine site was expanded with the development of an open pit mine. This open pit mine produced extremely high-grade zinc ore, mixed with small quantities of lead, silver, and gold. Ore was taken from the pit by truck and transported to the Snow Lake Concentrator for processing.

The Chisel Open Pit Mine was closed in 1994, and was followed by the opening of the Photo Lake Mine, located approximately 3 km east of the Chisel Open Pit Mine. The Photo Lake Mine was operational from 1994 to 1998. Between 1998 and 2000, a decline ramp was driven from the bottom of the Photo Lake Mine to the Chisel North Mine, located just north of the old Chisel Lake Mine. The Chisel North Mine was operational from 2000 to 2012, with a production rate of approximately 14,515 tonnes (16,000 tons) of zinc per year. Although production has ceased, the Chisel North Mine site continues to be operated because of its underground connection to the recently developed Lalor Ramp.

The Stall Lake Concentrator was commissioned in 1979 and operated continuously until shutdown in early 1993, following ore depletion at the Chisel Open Pit and Stall Lake Mines. The Concentrator was reopened in 1994 to process ore from the Photo Lake Mine and later to process ore from the Chisel North Mine. The Chisel North Mine and Stall Lake Concentrator suspended operations in 2009, but both facilities resumed operation in early 2010. The Stall Lake Concentrator has two separate crushing/grinding/flotation circuits.

As well, the Anderson Tailings Impoundment Area (TIA) has been operated throughout the decades since 1979.

HBMS also has explored and mined sites in the Grass River Provincial Park, including operation of the Spruce Point Mine on the south shore of Reed Lake, from 1981 to 1992.

1.5 History of the Reed Development

1.5.1 Early Exploration History

The Reed site, located approximately 91 km east-southeast of Flin Flon, is accessed by PTH 39, which is fully paved (see **Figure 2)**. Based on targets identified in the 1970s, the area in and around the Reed deposit has been under exploration in some form since 1974. In 2007, VMS Ventures Inc. ("VMSV"), under a mineral exploration license, an agreement with HBMS and other business arrangements, engaged in extensive airborne and ground geophysical surveys and numerous drilling campaigns, culminating in the "discovery hole" announced on October 4, 2007. VMSV drilling had intersected a 33.50 m interval of copper rich mineralization on the property boundary between HBMS claims and other interests.

Subsequent drilling by VMSV confirmed the occurrence of three base metal zones, comprised primarily of copper and zinc with lesser amounts of silver and gold. In 2007 and 2008, VMSV drilled a total of 71 holes totaling 22,200 m on the Reed Property. Exploration continued in 2008 and 2009 with additional airborne and ground surveys.

On July 5, 2010, HBMS concluded a joint venture agreement with VMSV for exploration and development of the Reed deposit. VMSV has committed to a 30% participating interest and HBMS to acquire a 70% participating interest in the 917 ha area that hosts the Reed deposit (the Reed Property). HBMS is the operator of the project and has overall management responsibility for the joint venture. (HudBay Minerals Inc. 2011)

In 2010 and 2011, Hudson Bay Exploration and Development (HBED) drilled an additional 35 holes (including one wedge) for delineation of the Reed deposit at optimum core angles, reducing the drill spacing to a range of 25 m to 50 m. All holes were drilled from surface by Rodren Drilling using NQ core size. (HudBay Minerals Inc. 2011)

1.5.2 Advanced Exploration Project

HBMS is in the process of conducting an approved Advanced Exploration Project (AEP). On September 14, 2011, HBMS submitted to the Director of Mines, the Reed Property Advanced Exploration Project Plan, dated September, 2011, prepared by AECOM on behalf of HBMS. The plan included the Reed AEP Closure Plan (Reed AEP Closure Plan). By letter dated October 31, 2011, the Director of Mines approved the Reed AEP Closure Plan and accepted financial assurance in the amount of $3.4 million to secure closure in accordance with the Reed AEP Closure Plan.

Key project tasks approved under the Reed AEP include:

- Upgrading the existing 1.5 km long logging road (access road) running southeast from PTH 39 to provide access to the Reed AEP site and construction camp to facilitate the trucking and hauling needs of advanced exploration (completed Fall of 2012).
- Constructing the surface portal (complete), decline, lateral drift, and ventilation raise and surface facilities.
- Extracting a maximum of 10,000 tonne ore sample from ore bodies located within each of the three ore zones (approximately 3,300 tonnes from each of Zones 30, 20 and 10). Testing the extracted ore samples in the Flin Flon Metallurgical Complex to determine the percent recovery of metals from the ore.

Construction of the Reed AEP infrastructure is currently underway, with the decline anticipated to be operational by mid 2013. HBMS anticipates commencement of mining activities in the shallowest depths of the deposit concurrently with advanced exploration of the deeper levels of the deposit.

1.6 Regulatory Framework

1.6.1 Mineral and Surface Rights

The Reed site lies within the Grass River Provincial Park, which covers an area of 2,279 km^2 and is characterized by numerous rivers and lakes of the Grass River system. It is classified as a “natural park” that will accommodate commercial resources, including mining, where such activities do not compromise other park purposes. The Reed Property is categorized for “resource management” under the Provincial Parks Designation Regulation, Manitoba Regulation 37/97.

The Reed AEP was supported by Mineral Claims CB5503, P5030E, MB8412 and MB8413, shown in the map attached as **Figure 3**. These mineral rights permitted use and occupation of the land surface for the purpose of prospecting, exploring for, developing, mining or production of minerals on, in, or under the land, and had been held by the company from as early as 1973.

In addition, HBMS received Mineral Claim MB5188, which was transferred to HBMS by its joint venture partner, VMS Ventures Inc.

Mineral claims CB5503 and P5030E now have been converted to Mineral Lease 335 and claims MB8412 and MB5188 have been converted to Mineral Lease 336, both granted April 11, 2012 and executed by HBMS on May 3, 2012.

In addition, pursuant to an application filed October 6, 2011, HBMS has been granted surface rights lease No. 66082, issued May 1, 2011, with a five-year term ending April 30, 2016. The lease specifies that it may be replaced with a new lease for a 21-year term on notice that an *Environment Act* Licence has been obtained.

Copies of the applicable mineral and surface leases are included in **Appendix B**.

1.6.2 Sewage and Mine Water Disposal

Sewage generated during early operation of the proposed Reed Mine will continue to be collected in sewage holding tanks that are pumped out and trucked to a licensed sewage treatment facility, in accordance with Onsite Wastewater Management System Regulation (Manitoba Regulation 83/2003), as is currently the practice for Reed AEP.

Similarly, mine water generated at the proposed Reed Mine will continue to be piped to the on-site polishing pond developed for use during advanced exploration. Prior to discharge to the environment, water from the polishing pond is monitored to ensure it meets the criteria set out in the Tier 1 criteria set out in Manitoba Water Quality Standards, Objectives and Guidelines (MWQSOG).

1.6.3 Other Approvals

The Reed AEP Closure Plan will be updated in accordance with the Mine Closure Regulation, Manitoba Regulation 67/99, to account for operation of the proposed Reed Mine and will be submitted to the Director of Mines for approval, along with any increase in financial assurance that may be required.

It is anticipated that no federal permits of any nature are required or will be sought for the proposed Reed Mine. The proposed Reed Mine does not meet the description set out in the Regulations Designating Physical Activities (SOR/2012-147), made under the *Canadian Environmental Assessment Act*, 2012.

2. Reed Mine Project Description

2.1 Overview

The proposed Reed Mine will be comprised primarily of the facilities, described below, which have been approved and will have been constructed for the existing Reed Advanced Exploration Project (AEP). These facilities also may continue to be used for exploration purposes even after commencement of market production from the proposed Reed Mine.

This section: identifies the components of the existing Reed AEP that will continue in operation during the life of the Reed Mine, including the trench, portal and decline, which are the main components of the project; describes the modifications and additions that will be required to convert the approved Reed AEP facilities from exploration to ore production; and describes operational practices planned for the proposed Reed Mine.

A number of components proposed for the Reed AEP were not built, were combined into single features, or were accommodated with temporary or mobile structures rather than permanent structures on concrete footings, thus reducing the footprint on site from the facilities that were approved. The information set out in Section 2.3 below describes the “as built” facilities on site and, as noted above, explains the additions or modifications that will be made as the facilities transition from exploration to mining purposes.

Figure 4 displays a chronological overview of the underground mine development.

The site of the proposed Reed Mine lies entirely within the footprint occupied by the existing Reed AEP. **Figure 5** displays a site plan view of the area comprising the Reed AEP and future mine facilities, including the location of all surface components which will continue in operation throughout the life of the proposed Reed Mine.

This section also includes a description of other HBMS existing licensed operations which will continue in operation and support operation of the proposed Reed Mine.

2.2 Mine Production Capacity

The Reed deposit has mineralization zones ranging in confidence from indicated to inferred. Preliminary resource estimates indicate that the accessible areas of the Reed Zone could produce up to 2.16 million tonnes of ore over a 5 year period (ending in 2018). The mine production grade will be 3.83% copper, 0.59% zinc with 0.48 g/tonne gold and 6.02 g/tonne silver. Inferred copper zones exist outside of the resource estimate and will be further defined by subsurface and underground drilling. It is assumed that no zinc concentrate will be recovered due to low zinc grades and the extensive pyrrhotite content of the mineralization. The pyrrhotite preferentially floats over the sphalerite in conventional milling, which reduces the zinc recovery and concentrate grade below saleable requirements.

2.3 Continued Use of Approved and Constructed Facilities

2.3.1 Surface Components

- Access road from PTH 39 to the Reed site.
- Cleared area: the Reed AEP Plan called for the clearing of approximately 14 ha, only 7 ha of which was required for the AEP infrastructure. For the Reed Mine, no additional clearing is planned, except for the following contingencies: if additional cell(s) are required for the polishing pond, an additional 0.7 ha of clearing may be

required; an additional 0.05 ha may be required for the planned increase of the camp. As with the development of the Reed AEP, any trees removed during site clearing will be salvaged and donated for use at local campsites.

- An approximately 1,600 m^2 ore storage pad, which will be used to store a maximum of 5,000 tonnes (reduced from 10,000 tonnes approved in the Reed AEP) of ore on surface. This pad will be lined with a geo-synthetic liner and composed of non-acid generating (NAG) rock. Ore will be trucked up the production ramp and deposited on the storage pad for transfer to haul trucks. All ore will be hauled to the Flin Flon Metallurgical Complex for processing. There will be no crushing or any other kind of processing of ore on site.

- A 20,000 m^2 storage pad capable of holding 250,000 tonnes of potentially acid generating (PAG) waste rock. This storage pad is comprised of lining composed of non-acid generating (NAG) rock (limestone boulders, approximately 500 mm of sand and cobble, and 300 mm of crushed limestone). All waste rock will continue to be managed as PAG rock on site, and will ultimately be returned underground as mine backfill.

- Three trailer-mounted gensets, with a total base load capacity of 6,000 kWe. The gensets are housed in factory design-built enclosures to provide protection and minimize noise, and equipped with a built-in exhaust system. The power cables will run underground along the escape raise. Each of these generators is equipped with a 3,850 L mobile self-contained above-ground tank (SCAT) for diesel.

- A 14,800 L mobile diesel tank used to re-fuel these gensets. An additional 40,000 to 60,000 L of diesel fuel will be stored in SCAT tanks mounted on trailers, adjacent to the gensets. A liner and berm will be installed around the trailers.

- One diesel 4,500 L skid-mounted SCAT. The SCAT will be above-ground, but used to fuel equipment that is used underground (eg. Scooptrams, mancarriers, etc.)

- An approximately 722 m^2 maintenance facility (reduced from AEP proposed size of 800 m^2) on a concrete pad, which will be upgraded to include a 7,570 L sewage holding tank (to be pumped out daily and trucked to a licensed disposal facility). The maintenance facility includes a warehouse, electrical office, pumphouse and core storage.

- A 2,000 m^2 polishing pond, currently consisting of one cell, which will continue to receive discharge water from the underground operations, and may be expanded if additional cell(s) are needed during mining.

- Approximately 400 m of 6" diameter high-density polyethylene (HDPE) pipe for discharge water distribution system, running from the mine portal into the polishing pond. This pipe will be heat-traced to prevent freezing.

- One approximately 401 m^2 office/change house complex, comprised of six trailer units, which will be expanded and ultimately include the following:
  - Dry facilities for 100 people including individual lockers for clean clothes and hanging baskets for work clothes.
  - Showers and washroom facilities.
  - Space and facilities for:
    - First aid, safety and training.
    - Mine rescue including a secure area for storage of mine rescue equipment.
    - Mine lamp storage and recharge areas.
    - Laundry facilities.
  - Offices for foremen, shift bosses, and site management.
  - Lunchroom and conference rooms.

  - Offices and work areas for mine management, maintenance management, mine engineering, mine planning, survey, geology, procurement, mine administration and other site office personnel. Open work areas with cubicles will also be utilized where practical.
  - One 18,927 L holding tank (pump-out) to contain the sewage and grey water from the office and dry. The tank is pumped out and trucked to a licensed disposal facility as required.

- A 1,600 m^2 gravel parking lot.

- Explosive/detonator magazine, with storage capacity for 2,000 kg explosives and 2,000 detonators. This magazine is a portable wheel unit, approximately 10 m x 2.5 m, and includes powder and detonator boxes. Presently, the unit is located south of the portal site, approximately 260 m away from the office/change house complex (reduced footprint from the proposed AEP plan, which proposed a new area with an access to be cleared). In the early stages of operation, while the advanced exploration continues, this unit will continue to be used. However, once the decline has descended to the 45 m level, explosives storage will be relocated underground and this unit will be removed from the site.

- Ventilation facilities will be upgraded (165m^3/s (350,000 cfm) of fresh air from the 43 m^3/s) to provide the additional fresh air needed for development. A 250 hp fan, with silencer, and accompanying propane tank, heater and vaporizer installed adjacent to the portal. This fan will remain in place until development of the ventilation raise (vent raise) described below.

- A building, approximately 11 m x 8 m, set on a concrete pad, covering the downcast ventilation raise described in Section 2.2.1.2. The building will contain the air intake and burners for heating the air.

- One 30,000 gallon propane tank on concrete footings and one vaporizer building with concrete floors (approximately 9 m^2).

- A second egress provided by a 1.8 m x 1.8 m raise that runs parallel to the vent raise, which will access every level (escape raise). A 9 m^2 raise access building will be located at surface.

- A 12.8 m x 36.6 m cold storage building.

- Three storage sea cans.

- Laydown area, with designated location for vent tube storage.

- Compressor enclosure, approximately 2.2 m x 8.4 m, for two 150 hp compressors. Compressed air will be supplied underground via pipeline described below in Section 2.3.2.

- A camp, located 400 m to the east of the exploration site, with accommodations for 42 people. For operation of the mine, the camp will be upgraded to accommodate 50 people. The camp consists of several trailers, including five sleeper units for accommodations, a 15 seat kitchen trailer, and washroom trailer with showers. Infrastructure at the camp consists of:
  - One 7,570 L sewage holding tank (pump-out) and one 13,627 L sewage holding tank (pump-out). The tanks are pumped out and trucked to a licensed disposal facility as required.
  - One diesel-powered electrical generator.
  - One 4,500 L SCAT diesel tank.
  - One 2,250 L SCAT gasoline tank.

- Leaky feeder radio system for communication around the site and from surface to underground. The communication line will run underground down the escape raise.

- Communications satellite dish providing phone internet access (replaces the communications tower approved for the Reed AEP).

- Surface portal measuring 5.5 m x 4.7 m (entrance to the decline, which is described below in **Section 2.3.2**). This portal is accessed via a surface trench to an approximate depth of 20 m.

2.3.2 Underground Components

- Decline, 5.5 m x 4.7 m, and approximately 4,000 m long at a -15% grade. Each level will be accessed from the decline, and will be spaced 25 m apart vertically. The level accesses will be 5.5 m x 4.5 m and will usually be driven at +3% to allow for drainage. The decline will also complete the ventilation circuit by exhausting air from underground operations. The decline will descend further as the mineral resource is developed over the life of the mine. Based on known resources, it will descend to the 510 m level.

- Downcast ventilation raise, with ventilation provided by a fan located underground on the 45 m level. The vent raise will be 4.6 m x 4.0 m and will descend from the surface to the bottom of the decline. The vent raise will be connected to the building described above in Section 2.3.1.

- Fill raise, 2.1 m X 2.1 m (7 ft X 7 ft), starting at 60 m level and descending to the 485 m level.

- As described in Section 2.3.1, explosives storage will be relocated underground, with the construction of one explosives magazine and one detonator magazine, located in a designated area underground. Explosives will be provided in “just-in-time” deliveries.

- Mine dewatering system, with a main sump at the 260 m level and additional sumps near the entrance to each level.

- Five refuge stations, each equipped with two fire-rated bulkheads, lighting, communication, first aid and emergency equipment, air and water lines and potable water (in 19 L containers).

- Three main level electrical substations and five portable substations.

- Compressed air pipeline, extending from the compressor enclosure to operate equipment underground. This pipeline will be mounted within the decline.

2.4 Mining Plan

2.4.1 Mineralization

The mineralization at Reed Mine consists of three stacked, tabular ore bodies that range in dip from 70° to 80° and range in thickness from 2 m to 45 m. The ore body is subdivided into three mining zones (Zone 30, Zone 20, and Zone 10).

Mine development will be based, in part, on the exploratory drilling conducted during the Reed AEP. **Figure 6** displays a conceptual mine schematic, which may be refined as more information is gathered regarding the deeper mineralization.

2.4.2 Mining Methods and Operations

Figure 7 illustrates the operations on site.

Drift Development

Drifts (horizontal levels) will be developed in order to access all reaches of the ore body. Drifts will be developed using a mobile drilling platform (twin boom jumbo) and conventional blasting practices. Ground support (to stabilize the drifts) will be accomplished using resin bars and plates installed in patterns along the walls and ceilings of openings. Cement grouting will be used in conjunction with cable bolts as required to provide additional support.

Mining Method

The mining method that has been chosen for the Reed Mine is longhole stoping, which is appropriate because of the steep dip of the mineralization and the good quality of the ground. Mining levels will be spaced vertically every 25 m to maintain stope stability while mining. This level spacing allows high productivity while minimizing stope dilution caused by hole wandering during drilling.

Two top-hammer longhole drills will be used, each drilling a series of 76 mm diameter blast holes between the mining levels, which will allow for the use of conventional blasting methods.

The blasted ore will be mucked by a remote-controlled 10 yd load haul dump (LHD), placed into 50 ton rock trucks, and sent to the surface ore storage pad.

In areas of the mine where the mineralized widths are 10 m or greater, the ore will be accessed through footwall haulage drifts and drawpoints. Areas of the mine where mineralized widths of less than 10 m will generally be mined using a longitudinal retreat method.

Blasting

Ammonium nitrate mixed with fuel oil (ANFO) will be the main explosive used for both development and production. Packaged emulsion explosives will be used in wet holes or in areas where an inhibitor is needed to prevent secondary sulphide explosions.

Once production starts, a centralized blasting system will be implemented for all development and production rounds. In accordance with applicable regulations, these rounds will be fired only between shifts when all of the workers are accounted for.

Transportation

All personnel and supplies will enter the mine through the portal and access the underground workings via the decline (ramp). Supervisors, engineers, geologists, surveyors, electricians, and mechanics will use diesel-powered trucks for transportation and delivering supplies to the mine while mining personnel will use mancarriers to travel from surface to their underground work sites. Mobile equipment consisting of scissor lifts, LHDs, rock trucks, and graders also will be used underground.

2.4.3 Ore Management

Ore will be extracted from the Reed Mine at an estimated rate of 1,300 tonnes of ore per day. Ore will be trucked up the production ramp and deposited on the 1,600 m^2 ore storage pad for transfer to haul trucks. This pad will be lined and composed of non-acid generating (NAG) rock, as shown in **Figure 8**. All ore will be hauled to the Flin Flon Metallurgical Complex for processing. There will be no crushing or any other kind of processing of ore on site.

The Flin Flon Metallurgical Complex (FFMC) has been in operation since 1929, and consists of a number of underground mining, surface processing and waste treatment facilities. Operational facilities that comprise the FFMC and will be used to process the ore from the Reed Mine are as follows:

- Flin Flon Concentrator.
- Flin Flon Tailings Impoundment System (FFTIS).

The Concentrator is located within the FFMC. This facility, which was originally commissioned in 1930, receives copper and zinc sulphide ores from the 777 Mine.

Due to the low zinc grade in the ore body, it is anticipated that zinc recovery will not be required at this time. If higher zinc grades are discovered during mine operations and are deemed recoverable through the concentrator, this will be done so at the hydrometallurgical pressure leaching facility (ZPL). The facility utilizes a two stage pressure leaching system and cellhouse technology to produce an annual capacity of 115,000 tonnes of high grade zinc. Copper ore will be processed through the concentrator, filtered and shipped out to market as a copper concentrate.

The FFTIS is located west of the FFMC and consists of a primary pond, a secondary pond, and a clarification pond. As a result of improvements made in recent years, the FFTIS has sufficient capacity to accommodate tailings produced as a result of processing ore from the Reed Mine.

2.4.4 Waste Rock Management and Mine Backfill

During pre-production, all waste rock will be hauled to surface and stored for use as backfill.

Management principles applied successfully during the Reed AEP project will be continued during operation of the proposed Reed Mine. It is anticipated that approximately 250,000 tonnes of waste rock will be hauled to surface as a part of underground development. All waste rock will be transported to the 20,000 m^2 PAG storage pad. This storage pad is multi-layered and composed of NAG rock (limestone boulders, approximately 500 mm of sand and cobble, and 300 mm of crushed limestone), as shown in **Figure 9**.

Waste rock will be placed on the stockpile in lifts (layers). Each lift will be 3 to 4 m high, with a 300 mm of crushed limestone layer between two lifts. Any waste rock brought to the surface will be treated as if it were potentially acid-generating. During production, this waste rock and any waste rock stored during the production phase will be trucked down to the 60 m level, dumped down the fill raise and used for filling empty stopes.

Once the mine is at full production, waste rock produced at the site will be insufficient to meet the need for backfill. Backfill requirements for the mine are anticipated to be approximately 1.2 million tonnes of rockfill, assuming 100% of the voids are filled. It is anticipated that, over the life of the mine, approximately 724,000 tonnes of waste rock will be generated, leaving a backfill shortfall of 463,000 tonnes. The waste rock generated from lateral and raise development will produce only 60% of the required stope backfill for the Reed Mine. The remainder of the backfill required (i.e., 463,000 tonnes) will be back-hauled onto the Reed Mine site from Flin Flon.

Table 2-1: Ore, Waste Rock and Backfill Tonnage (Tonnes/year)

	2012	2013	2014	2015	2016	2017	2018
Ore Tonnes Produced	0	51000	420000	468000	468000	468000	282376
Tonnes of Backfill Placed	0	28050	231000	257400	257400	257400	155307
Waste Rock Produced	34425	245835	106353	106353	106353	106353	17901
Waste Rock Surface Stockpile	34425	252210	127563	0	0	0	0
Waste Rock Backhauled from Flin Flon	0	0	0	23484	151047	151047	137406

2.4.5 Fresh Water

2.4.5.1 Mine Site

Fresh water will be needed for various purposes as described above, including drilling and washing blasted rock.

A pump test at the Reed site was completed by Golder Associates between July 12 and July 22, 2011 (report on file with Water Stewardship Division). Following this pump test, a groundwater well was constructed and use of the water was licensed pursuant to Groundwater Withdrawal Permit No. 2012-025, which provides for withdrawal of up to 4,320 L/min with a maximum quantity to be used in one year of 38.08 dam^3. This quantity is sufficient for water requirements during the AEP and pre-production phase.

It is estimated that, during the production phase, the average water requirements will be approximately 150 L/min, with a maximum flow of approximately 314 L/min, an average yearly use of 80 dam^3 and maximum potential use in any one year of 166 dam^3. Based on the predicted annual water volumes to be used at the Reed Mine, the quantity of water that will need to be diverted in one year is greater than the 38.08 dam^3 permitted by Groundwater Withdrawal Permit No. 2012-025, but well within the amount determined by Golder in the 2011 study to be available for use in the applicable aquifer.

During production, fresh water will be supplied to the Reed Mine from two new metered groundwater wells drilled at the site and contained in the Paleozoic carbonate rock (i.e. the water resource assessed by Golder in 2011) each equipped with a pump. Friesen Drillers Limited has been retained to obtain all necessary permits for the two wells, one of which will be used for process water and will replace the existing well permitted in accordance with Groundwater Withdrawal Permit No. 2012-025, and one to maintain access to water for fire protection, if required on an emergency basis.

Appendix C contains the drilling report prepared by Friesen Drillers Ltd., dated November 21, 2012 and the Groundwater Withdrawal permit application material prepared by HBMS in relation to groundwater use, including updates to withdrawal rates.

HBMS will ensure that Groundwater Withdrawal Permit No. 2012-025 either is amended to provide for the additional amounts of water that will be required during production, or replaced with a new permit, if such is required, and that the well needed for emergency fire protection is appropriately permitted.

The approximately 300 m of distribution lines, which were approved as a part of the Reed AEP, will continue to be utilized to transfer water across the site.

2.4.5.2 Camp Site

To accommodate 50 people, approximately 6,000 to 7,000 L/day will be consumed for domestic use, including washing, cooking, showering, etc. This water will continue to be supplied from a drill hole located at the existing campsite. Potable water will continue to be delivered for on-site use in containers.

2.4.6 Discharge Water

The mine dewatering system consists of sump pits equipped with submersible pumps. Once the works planned for the Reed AEP have been constructed, the main sump will be located at the 260 m level. Additional sumps will be located near the entrance to each subsequent underground level. Each sump above the 260 m level will drain to the main sump and each sump below the 260 m level will be pumped up in stages to the main sump. Water from the main sump will be sent to the polishing pond on surface where the water will settle before it is discharged to the environment. These pumps will collect process water as well as any groundwater seepage during the course of underground operations.

Based on the hydrogeologic work conducted for the Reed AEP and proposed Reed Mine, groundwater seepage from the limestone layer is estimated to be 6.3 L/s to 15.8 L/s (100 gpm to 250 gpm) and groundwater seepage into the rest of the mine is estimated at 5 L/s (80 gpm). The mine will require an average of 2.5 L/s as process water from the groundwater well located at the site for drilling and washing blasted rock for dust control. This totals between 14 L/s to 23 L/s (220 gpm to 370 gpm), which will be captured in an underground sump and pumped to the polishing pond.

The polishing pond at the surface will receive water from underground operations (process water and groundwater seepage) and from precipitation. This pond discharges to the environment via a surface drainage channel leading to an adjacent marsh located to the south of the site. The marsh drains into a shallow water body referred to as Unnamed Lake 3. Water will not be discharged from the polishing pond unless it meets the applicable Tier 1 criteria set out in the MWQSOG.

Sewage will continue to be collected in sewage holding tank (pump-out) (one 2,000 gallon tank, one 3,600 gallon tank at the camp, one 5,000 gallon tank at the office, and potentially one 2,000 US gallon tank at the maintenance facility) that will be pumped out and trucked to a licensed sewage treatment facility, in accordance with Onsite Wastewater Management System Regulation (Manitoba Regulation 83/2003).

2.4.7 Fresh and Exhaust Air

Figure 10 displays a conceptual overview of the Reed Mine ventilation circuit.

During the production phase, the underground mining operations will require 165 m^3/s (350,000 cfm) of fresh air. Fresh air will enter the mine through a 4.6 m by 4.0 m ventilation raise, extending from surface to the 510 m level. The large size of the ventilation raise was selected in order to reduce the electrical power consumption due to the high cost of power at the site. The main ventilation fan will be 447 kW (600 hp) and it will be installed below surface at the 45 m level in order to reduce surface noise. This fan will pull air from surface to the 45 m level and push it to the bottom of the mine through the fresh air raise. The exhaust air will travel up the ramp and exit at the portal. Ventilation fans (45 kW, 60 hp) will be installed on every active level to ventilate the working areas. During winter, the air entering the ventilation raise will be heated with a 30 million BTU/hr propane heater.

2.4.8 Power

The major sources of electrical consumption at proposed Reed Mine will be:

- Mine ventilation; both the main ventilation fan and auxiliary ventilation for each active level.
- Mine dewatering and pumping; this includes sump pumps for dewatering and fresh water supply pumps to supply process water.
- Air compressors; these will provide compressed air for drilling.
- Drilling equipment; this includes longhole drills and development drills.

During production, the mine will be powered by two 1.5 MW and one 3 MW diesel generators. Electrical power from the generators will be distributed to the surface buildings and underground mine workings. The mine will use two 4160 V feeders, and portable substations located at every four levels will reduce the power to 600 V. One of the mine electrical feeders will enter the mine through the portal and will be used to power the upper half of the mine. The second feeder will run down a series of boreholes and will be used to power the lower half of the mine.

2.4.9 Employees

During the ramp development phase, one development crew per shift is planned to drive the main decline with a total of 44 employees that will be hired over the phase. Once production starts, there will be two development crews per shift, including drillers, blasters and production mucking crews. The total number of employees required will be approximately 88. The work schedule is planned for two shifts per day on a four or seven day rotation.

2.4.10 Consumables

Diesel fuel, gasoline, propane, rebar, pipe, screen, rockbolts, explosives and other operating supplies will be delivered on a regular basis, as required. It is expected that four trucks per day will deliver materials to the Reed Mine.

Service vehicles will be fuelled at the main refueling station located on surface close to the portal but large vehicles used underground will be refueled underground from a vehicle carrying a fuel storage tank. Maintenance work on mine equipment will be performed in a shop located on surface and any small maintenance or emergency repairs will be done at the worksite underground.

Table 2-2: Total Anticipated Fuel Consumption

Fuel Type	Fuel Use	Consumption (per year)
Diesel	Mine generators	2,960,000 L
Diesel	Camp generators	57,000 L
Diesel	Mobile equipment	240,000 L
Propane	Mine heating	2,720,000 L
Propane	Mine buildings	70,000 L
Gasoline	Site Vehicles	75,000 L

2.4.11 Traffic

Traffic volumes will vary as the project ramps up production. Employee shuttle buses, employee personal vehicles, delivery vehicles, and ore haul trucks will access the site on a daily basis.

Table 2-3: Traffic Volumes

Traffic Source	Purpose of Vehicle	2013				2014 - 2018			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Ore Haul Trucks	Haul ore from ore storage pad to Flin Flon	0	0	33	33	33	33	33	33
Trucks	Site delivery	0	0	4	4	4	4	4	4
Cars/Trucks	Personal vehicles - supervisors	0	0	5	5	5	5	5	5
Shuttle Bus	Bring employees on site	0	0	2	2	2	2	2	2
Trucks	Haul waste off-site	0	0	1	1	1	1	1	1
	Total Traffic			**45**	**45**	**45**	**45**	**45**	**45**

2.4.12 Solid Waste and Hazardous Materials Management

Garbage collection bins will be maintained at surface at specific locations throughout the Reed Mine site. Bins will be emptied on a regular basis with materials removed on a regular basis for disposal at a licensed landfill or other permitted disposal site. It is estimated that approximately 4,900 L/day (1294 US gallons/day) of sewage will be produced on site (Metcalf & Eddy Inc. 2002) and trucked off to a licensed waste disposal facility in Cranberry Portage.

Hazardous materials including waste oil, lubricants, and other petroleum products will be removed by a petroleum supplier for recycling or approved disposal. Waste oils and other hazardous materials will be returned to the surface using fuel drums or other containers specifically designed for this purpose.

2.5 Mine Safety and Emergency Warning System

An underground emergency warning system will be installed as part of the Reed AEP and includes a system for injecting ethyl mercaptan (stench gas) into the ventilation intake. This system will continue to be used for the proposed Reed Mine.

Five refuge stations will be provided underground located at each main level. Each refuge station will be equipped with two fire rated bulkheads, lighting, communication, first aid and emergency equipment, air and water lines and potable water (in 19 L containers).

Secondary egress from the mine will be provided by a 1.8 m by 1.8 m escapeway.

Mine rescue equipment capable of equipping two rescue teams will be stored at the Reed Mine. The Mine rescue teams will be trained as appropriate with HBMS call out procedures implemented. In addition, HBMS has a trained mine rescue team located at the 777 Mine in Flin Flon and the Lalor AEP site in Snow Lake, and can provide backup as required.

2.6 Project Schedule

Construction of infrastructure approved under the Reed AEP is currently underway. **Figure 11** displays the project schedule.

2.7 Closure Plan

The Reed AEP Closure Plan will be updated for the proposed Reed Mine following the procedures outlined in the Mine Closure Regulation (Manitoba Regulation 67/99). HBMS has successfully completed reclamation on many mining operations across Canada with several of these sites located in the Snow Lake region.

2.7.1 Site Decommissioning

The decommissioning of the Reed Mine will be conducted in accordance with the Closure Plan and will generally consist of:

- Removal of all buildings and foundations.
- Removal and appropriate disposal of any stockpiled NAG and PAG rock.
- Removal and appropriate disposal of miscellaneous infrastructure such as power lines, generators, transformers, pipelines, pumps etc.
- Removal and appropriate disposal of site refuse.
- Scarifying the access road.
- Removal of surface and underground mining equipment.
- Removal of all fuel storage tanks.
- Testing, removal and/or remediation of any contaminated soils.
- Full decommissioning of all underground operations, including disposal of waste rock in the underground workings and capping of all shafts and raises.
- Installation of an engineered plug on the portal and filling of the trench.
- Regrading and contouring of stockpile pads, polishing pond, site roads and parking area.
- Revegetation of all disturbed areas in order to restore the landscapes as much as possible to their native appearance.

2.7.2 End-Use

Following the decommissioning of the proposed Reed Mine, the site will be returned to the greatest extent possible to its natural state. It is anticipated that the end-use of the Reed Mine site will be a natural space with no planned residential, commercial or industrial development at the site. HBMS will work with regional conservation authorities to explore opportunities for alternative final uses of the Reed site upon closure that could enhance the recreational use of the Grass River Provincial Park.

Based on HBMS closure experience in the Snow Lake region, the growth of grasses and mosses is apparent within the first few years following closure, whereas trees and shrubs take longer to establish through natural succession and may be evident within a 5 to 10 year period following closure.

2.8 Funding

Funding for the proposed project will be provided solely by HBMS.

3. Scope of the Assessment

To assess the potential environmental impact of the proposed Reed Mine, spatial and temporal boundaries were defined as follows.

3.1 Temporal Boundaries

The temporal boundaries of the assessment are divided as follows:

Pre-Production Phase – Upgrades to existing AEP infrastructure in 2012 to enable ore extraction.

Production Phase – production mining from 2013 to 2018.

Closure Phase – anticipated to occur from 2018 to 2021, depending on the time it takes for re-vegetation.

3.2 Spatial Boundaries

Spatial boundaries for the assessment are described below. However, where specifically noted, these boundaries may be adjusted to suit the environmental component (EC) affected.

- The **Project Site** includes the Reed Mine site as well as the Reed Mine access road to the intersection with PTH 39.
- The **Project Area** includes any area, up to 2 km beyond the Project Site, which could be disturbed by project effects. This includes effects due to noise, vehicle emissions, traffic, etc.
- The **Project Region** includes an area up to 10 km beyond the Project Site that may be affected by project activities. Effects that may be seen outside of the Project Area may include items such as climate change due to greenhouse gas emissions.

The Project Site, Project Area and Project Region are shown in **Figure 12**.

3.3 Environmental and Social Components

This environmental assessment considers changes to the environment caused by the project, as well as any consequential impact on the socio-economic environment. Environmental components (ECs) and social components (SC) were selected following the guidance provided in Manitoba Conservation's Information Bulletin, "Environment Act Proposal Report Guidelines." SCs include components of the socio-economic environment that may be affected by a change in the environment as a result of the project.

The potential interaction between project components and ECs and SCs are identified in **Table 3-1**. Potential Interactions were identified based on the professional judgement of the assessor combined with assumed implementation of standard environmentally responsible construction techniques and operating procedures in the course of project construction, operation and closure. The potential interactions identified in **Table 3-1** are assessed in Section 5. Mitigation measures and residual effects are also described in Section 5.

Table 3-1: Identification of EC/SC Interactions with Project

	Biophysical Components										Socio-Economic Components[2]			
	Topography	Soil	Air	Climate	Groundwater	Surface Water	Flora	Fauna	Aquatic Resources	Protected Species	Protected Areas	Resource Use	Heritage Resources	Aesthetics
Pre-Production Phase														
Construction at Reed Mine site (including surface and sub-surface components)			X	X			X	X		X	X	X	X	X
Production Phase														
Underground Development (including fresh water and wastewater supply/management & discharge and below ground and above ground ore management/transport, including ore hauling to surface)		X	X	X	X				X	X	X	X	X	
On-site Waste Rock Management	X	X			X	X	X	X	X	X	X	X		X
Closure Phase														
Closure Activities (building removal, contouring, revegetation, remediation of hydrocarbon impacts etc.)	X	X	X	X	X	X	X	X	X	X	X	X		X
Accidents and Malfunctions														
Spills		X	X		X	X	X	X	X	X	X	X		X
Polishing Pond Leaks or Embankment Failures		X	X		X	X	X	X	X	X	X			X
Fire/Explosions		X	X	X	X	X	X	X	X	X	X	X		X
Power Failure														X
Transportation Accidents		X			X	X	X	X	X	X	X	X		
Notes														
1. x = identified potential interaction														
2. only indirect interactions with SCs as a result of a direct potential project/EC interactions were considered														

4. Environmental Setting

This section describes the environmental setting associated with the Reed Mine and introduces the environmental components (ECs) that have the potential to interact with project components or activities associated with the proposed Reed Mine.

4.1 Environmental Baseline Studies

In 2010 and 2011, baseline terrestrial and aquatic investigations were commenced in anticipation that discoveries in the region of the Reed Mine could lead to future development. The investigations dealt broadly with aquatic and terrestrial resources that could be affected by future development, including local geology, soil, vegetation and wildlife in the vicinity of Reed Mine site, access route, and supporting structures. The baseline investigations are described in detail in the *Reed Project Baseline Assessment*, March 2012. This baseline report is the primary source for the information summarized in this **Section 4**.

A terrestrial ground survey of the Project Area was conducted on August 24, 2010 to examine the local floral communities and assess the potential for the occurrence of rare and endangered species. A supplemental survey was conducted on June 3, 2011 to search for early flowering plants and nesting migratory songbirds that may not have been recorded previously. An aerial reconnaissance survey covering the Project Region was also conducted.

Aquatic investigations were conducted in the fall of 2010, which included 12 potentially affected and reference water bodies within the Project Region (6 lakes, 5 creeks and 1 river). The aquatic assessment included the collection and analysis of water and sediment samples, an assessment of lake bathymetry and classification and enumeration (from field investigation and desktop review) of aquatic species and benthic invertebrates.

4.2 Physical Environment

As illustrated in **Figure 12**, and described in **Section 3**, for the purpose of information gathering and assessment, AECOM has defined the Project Area as the area located within 2 km of the existing AEP site and future proposed mine site and access road and the Project Region as the area within a 10 km radius of the mine site.

The physiographic setting for the proposed Reed Mine is defined using the ecological land classification system. This hierarchical system of ecozones, ecoregions, and ecodistricts, as shown in **Figures 13** and **14**, represents subdivisions of increasing ecological detail. The proposed Reed Mine is located on the transitional zone between the northern Boreal Shield and southern Boreal Plains Ecozones. The site itself is located within the:

- **Boreal Plains Ecozone**, which contains the
- **Mid-Boreal Lowland Ecoregion**, which contains the
- **Cormorant Lake Ecodistrict**

The Boreal Plains Ecozone extends from the Peace River area of British Columbia in the northwest to the southeastern corner of Manitoba. The Boreal Plains is not strongly bedrock controlled and has fewer lakes and fewer bedrock outcrops than the Boreal Shield to the north (Smith 1998).

The Project Region straddles two ecozones, the Boreal Plains Ecozone described above and the:

- **Boreal Shield Ecozone**, which contains the
- **Churchill River Upland Ecoregion**, which contains the
- **Reed Lake Ecodistrict**

The Boreal Shield Ecozone, which is the largest ecozone in Canada, extends from northern Saskatchewan east to Newfoundland, north and east of Lake Winnipeg and finally north of the Great Lakes and St. Lawrence River. The Churchill River Upland Ecoregion extends from the sparsely forested regions to the north, the southern edge of the Precambrian Shield to the south, and extends westward from the Grass River to the Saskatchewan border. The Reed Lake Ecodistrict extends west from Wekusko Lake to just over the Saskatchewan border.

Although the Project Site is located in the transitional zone of both Ecoregions, the wildlife is more typical of the Churchill River Upland Ecoregion to the north.

4.3 Topography

4.3.1 Cormorant Lake Ecodistrict

The elevations in the Cormorant Lake Ecodistrict range from approximately 300 metres above sea level (masl) in the west to 263 masl in the east along the Hargrave Lake shores. The ecodistrict slopes gently towards the east at approximately 0.5 m per km. Slopes 50 m to 150 m long range from 5% to 10% in subdued upland areas, while long slopes over 400 m in length range from level to 0.5% on organic terrain. Drainage is generally by small creeks and rivers and is locally contained within the Grass River watershed (Smith 1998).

The Project Site is generally flat with gentle slopes toward a historical clear-cut area, with elevations between 294 masl and 298 masl.

4.3.2 Reed Lake Ecodistrict

The elevations in the Reed Lake Ecodistrict range from approximately 335 masl to 255 masl. Slopes vary from level in the peats to up to 30% along irregular hummocky surfaces. Local strong relief is provided by rocky cliffs. Drainage is dominated by the Grass River drainage network, but is draining generally eastward at 0.6 m to 1.0 m per km (Smith 1998).

This portion of the Project Region is characterized by hummocky morainal plains covered by stony, sandy morainal veneers and glaciolacustrine blankets.

4.4 Geology

4.4.1 Regional Geology

The Project Site is at the northern boundary of the Paleozoic-covered portion of the eastern end of Paleoproterozoic meta-volcanic Flin Flon Domain. Located within Trans-Hudson Orogen, the Flin Flon Domain belongs to the juvenile (internal) Reindeer Zone. The Trans-Hudson Orogen is an approximately 450 km wide Paleoproterozoic orogen that extends from South Dakota, through western and north-western Manitoba.

The Flin Flon Belt is interpreted to be comprised of a variety of distinct assemblages including juvenile arc, back-arc, ocean-floor and ocean-island and evolved volcanic arc assemblages that were amalgamated to form an accretionary collage. This collage was then intruded by voluminous intermediate to granitoid plutons and generally subsequent deformation. Volcanic assemblages consist of mafic to felsic volcanic rocks with intercalated volcanogenic sedimentary rocks. These younger plutons and coeval successor arc volcanics, volcaniclastic, and sedimentary successor basin rocks include the older, largely marine turbidites of the Burntwood Group and the terrestrial metasedimentary sequences of the Missi Group (Hudbay 2011).

4.4.2 Local Geology

The Reed deposit is a stratabound massive sulphide deposit that occurs within Precambrian metavolcanic rocks. It is overlain by 3 m to 7 m of unconsolidated organic and glacial overburden, 15 m to 20 m of Ordovician dolomitic limestone, 1 m to 2 m of semi-consolidated to consolidated Ordovician quartz rich sandstone, and 5 m to 25 m of deeply weathered Precambrian rocks. The Precambrian rocks beneath the Ordovician cover consist of Flin Flon Domain volcanic rocks that belong to the Fourmile Island Assemblage.

The Fourmile Island Assemblage is a back arc-rift succession that was formed during the opening of an ocean basin. The basin is now occupied by successor arc sedimentary rocks of the Kisseynew domain and was closed off during the Trans Hudson Orogeny.

Alteration minerals are present in the area and include muscovite, tremolite, limonite, epidote, biotite, and possibly talc.

4.4.3 Surficial Geology

Glacial Lake Agassiz sediments comprise the dominant surficial geology units. Glaciolacustrine silts and clays blanket most areas below 295 m, the estimated water limit of Glacial Lake Agassiz (Mihychuk 1993). Till in the area is generally moderately to very strongly calcareous, medium textured and consists almost completely of Palaeozoic rocks from the Hudson Bay Lowland and the Interlake region of southern Manitoba with little Precambrian material. This till is of varying thickness underlain by flat low-lying Palaeozoic limestone. Further north the till becomes non-calcareous and sandy loam textured as the Precambrian bedrock underlies the till. Lacustrine clay deposits occur mainly in depressions with organic deposits accumulated in poorly drained areas.

4.5 Soil

Regionally, the site is overlain by 3 m to 7 m of unconsolidated organic and glacial overburden (mainly sand and gravels), 15 m to 20 m of Ordovician dolomitic limestone, 1 m to 2 m of semi-consolidated to consolidated Ordovician quartz rich sandstone, and 5 m to 25 m of deeply weathered Precambrian rocks.

Dystric Brunisols are the dominant soils in the Reed Lake Ecodistrict. These soils have developed over glacial till overlying bedrock and consist of shallow, sandy and stony veneers. Peat-filled depressions with very poorly drained Typic and Terric Fibrisolic and Mesisolic Organic soils can be found throughout the ecodistrict. These soils are overly loamy to clayey glaciolacustrine sediments. Exposed bedrock is dominant throughout the region with localized Eutric Brunisoils and Grey Luvisoils. Widely distributed patches of permafrost are found in the peat lands (Smith 1998).

Within the Cormorant Lake Ecodistrict, the dominant soils are well to imperfectly drained Eluviated Eutric Brunisols. These soils have developed on veneers of calcareous, gravelly to cobbly glacial till and beach deposits and the soil profiles are very shallow. Poor to very poorly drained Gleysolic soils and moderately decomposed organic soils are widespread. With permafrost occurring in peatlands, Crysolic soils can be found (Smith 1998).

4.6 Air

Specific measurements of air quality in the area of the Project Region are not available. However, air quality in this area is considered very good compared with larger cities and commercial and industrial areas in Manitoba. The closest significant industrial activity is at the existing Stall Lake Concentrator and in the City of Flin Flon located approximately 54 km and 80 km from the proposed Reed Mine site, respectively. Occasional regional impediments to air quality, although uncommon, may occur in the Project Region. This could include smoke from forest fires and wood-burning stoves, emissions from fuel storage tanks and vehicle emissions.

4.7 Climate

Although the closest community to the Project Site is the Town of Snow Lake, the closest weather station to the site is located near Baker's Narrows at the Flin Flon airport, approximately 66 km west of Reed Lake. The Flin Flon airport is located at an elevation of 304 masl and is considered to be climatically representative of the Project Site. The mean annual air temperature at the Flin Flon airport is -0.2°C. The daily mean temperature ranges between 18°C in July and -21°C in January. Precipitation at the Flin Flon airport averages 471 mm annually, with 339 mm of this precipitation as rain and 132 mm as snow. Highest average rainfall is in July and highest average snowfall is in November and December (Environment Canada 1971-2000).

Table 4-1: Climate Data for the Flin Flon A, Manitoba (1971-2000)
Latitude 54° 41' N Longitude 101° 41' W Elevation 303.90 m

	Month													
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Year**	**Code**
Temperature (°C)														
Daily Average	-21.4	-16.7	-9.3	0.7	8.8	14.9	17.8	16.6	9.8	2.7	-8.4	-18.4	-0.2	A
Daily Maximum	-16.6	-11	-2.9	6.9	15	20.4	23.1	21.8	14.2	6.2	-5.1	-14	4.8	A
Daily Minimum	-26.2	-22.3	-15.8	-5.5	2.6	9.3	12.6	11.4	5.4	-0.8	-11.7	-22.6	-5.3	A
Precipitation (mm)														
Rainfall	0.1	0.3	0.9	8.6	36.9	66.6	76.5	66.6	55.3	25.6	1.4	0.4	339.2	A
Snowfall	19.6	14.6	19.1	20.0	3.7	0	0	0	2.0	13.0	25.4	23.9	141.3	A
Total (Precipitation)	19.7	14.9	20.0	28.6	37.6	66.6	76.5	66.6	57.3	38.6	26.8	24.3	470.8	A
Wind Conditions (km/h)														
Speed	9.4	9.7	10	10.9	11.1	11.2	10.9	10.7	12.1	12.2	11.1	9.3	10.7	A
Most Frequent Direction	NW	NW	S	S	NE	S	NW	S	NW	NW	NW	NW	NW	A

Notes:

Data obtained from Environment Canada Flin Flon A meteorological station (2012)

"A": World Meteorological Organization (WMO) "3 and 5 rule" (i.e. no more than 3 consecutive and no more than 5 total missing for either temperature or precipitation) between 1971 and 2000.

4.7.1 Groundwater

There is no published data source for the regional groundwater flow system. However, based on conditions in similar environments, the regional shallow groundwater flow, in particular in the overburden, is likely controlled by the topography and bedrock surface in and around the Project Region. Locally, the topography of the buried bedrock surface can have a significant effect on groundwater flow direction. Recharge of shallow groundwater can be expected to occur in elevated areas. From there, shallow groundwater flow will generally follow the topography and drain to the low-lying areas where it will discharge to surface water bodies and wetlands. Groundwater tables are high in most wetlands and in low areas bordering the wetlands. Shallow groundwater levels in the area are generally at or near surface in the spring and early summer and drop as the year progresses. Similar to much of the Boreal Plains ecozone, contiguous and isolated wetlands cover between 20% and 40% of the area around Reed Lake. Wetlands are found within the Project Region.

The Manitoba Water Stewardship water well records indicate little groundwater development near the Project Site. There are no groundwater wells in use within a distance of at least 5 km from the proposed Reed Mine with the exception of the water well currently being used as a process water source at the AEP site. The water resource accessed from this water well will continue to be used during the life of the mine. Bedrock groundwater wells, when present, are likely connected to fractures or discontinuities that are connected to the local water table and are not likely regionally interconnected.

Hydrogeological testing of the bedrock was conducted in the vicinity of the Reed deposit. The program was designed to obtain information required to characterize the local groundwater conditions in both the deep and shallow groundwater and to provide estimates on the hydraulic conductivity at the site (Golder Associates 2011). In total, 18 hydrogeological tests were conducted, including 10 deep boreholes and 8 shallow boreholes.

For the deep boreholes, testing was conducted in overlapping intervals between approximately 90 m and 393 m in length. Estimated hydraulic conductivities for the deep boreholes ranged between 3×10^{-7} m/s and 1×10^{-8} m/s, with a geometric mean of 3×10^{-8} m/s. This assessment report describes this groundwater as deep groundwater (**Section 5.6**).

For the shallow boreholes, the test interval length varied between 5 m and 25 m. The estimated hydraulic conductivities from the shallow boreholes ranged between 5×10^{-4} m/s in the limestone to 8×10^{-10} m/s in weathered mafic rock. The highest hydraulic conductivity (5×10^{-4} m/s) was estimated in the limestone. Equilibrated static formation pressures from all test intervals were close to ground surface. This assessment report describes this groundwater as shallow groundwater (**Section 5.6**).

4.8 Surface Water

4.8.1 Hydrology

The Cormorant and Reed Lake Ecodistrict is part of the Grass River-Burntwood River watershed, within the larger Nelson River drainage system. The area generally drains northeastward through Reed Lake and Wekusko Lake, other medium sized lakes in the region, and an irregular bedrock-controlled network of streams that are all part of the Grassy River watershed (Smith 1998).

As a result of varying topography created by hummocky bedrock surfaces, the drainage conditions vary considerably over short distances. Terrain falls at about 0.6 m to 1.0 m per km. Similar to much of the Boreal Shield Ecozone, contiguous and isolated bogs cover between 20% and 40% of the area around Reed Lake.

Water levels in the area are generally at or near surface in the spring and early summer and drop as the year progresses. Water retained in wetlands surrounding Reed Lake helps maintain water levels during drier climate periods. These low-lying depressions are generally underlain by poorly drained clayey glaciolacustrine sediments. Bedrock areas and associated till uplands are generally well drained.

The Project Site is contained within the Reed Lake Regional Watershed. This watershed has a gross contributing area of 817 km^2, with an upstream contributing watershed area of 3,023 km^2. The major downstream receptor for all drainage in the Project Area is the Grass River of which Reed Lake is a part. The eastern portion of the Project Area is defined by Unnamed Lake 4 and Unnamed Lake 5, which are drained by Unnamed Creek 1 and Unnamed Creek 2 respectively. This drainage system joins Unnamed Creek 4 before it flows into Reed Lake. The western portion of the Project Area is defined by Unnamed Lake 2 which drains into Whitehouse Creek. This drainage system joins the Grass River before discharging into Reed Lake. Unnamed Lake 3 and Unnamed Lake 1 are both lakes characterised by depressional lows, where there is no clearly defined inflow or outflow from these water bodies.

Regionally, runoff from bedrock and upland areas collects in peat-filled lows, which slowly releases excess water to surrounding lakes and creeks. Groundwater tables are high in most wetlands and in low areas bordering the wetlands. As noted above in **Section 4**, there are several wetlands in the Project Area, particularly to the south where there are widespread areas of muskeg and string bogs (see **Figure 12**). Areas to the north of the Project Area are generally well drained.

4.8.2 Lake Bathymetry

Lake bathymetry was assessed as part of the baseline aquatic work conducted in 2010 and 2011.

Bathymetric surveys were performed at each of the unnamed lakes during the 2010 field program (**Table 4-2**). The surveys were conducted using a boat with motor and a chart plotting sonar attachment, which was used to log position and depth to bottom.

The unnamed lakes were generally shallow (i.e., maximum depths did not exceed 2 m). Surface area and volume were lowest in Unnamed Lake 2 and highest in Unnamed Lake 5, while average depth and average grade were highest in Unnamed Lake 2 and lowest in Unnamed Lake 1 (**Table 4-2**). These parameters are typical of other small headwater lakes in the region. The sediment was generally highly organic with limited distribution of cobble or mineral soils in most unnamed lakes. Unnamed Lake 4 and Unnamed Lake 5 had significant cobble/boulder distribution.

Table 4-2: Summary of Bathymetric Surveys

Waterbody	Maximum Depth (m)	Average Depth (m)	Area (m^2)	Volume (m^3)	Average Grade (%)
Unnamed Lake 1	1.5	0.97	556,400	542,500	0.80
Unnamed Lake 2	1.5	1.11	73,800	82,200	2.90
Unnamed Lake 3	1.8	1.10	120,600	132,600	1.60
Unnamed Lake 4	1.7	1.05	360,700	379,400	1.60
Unnamed Lake 5	1.8	1.01	872,300	877,800	1.30

Bottom topography ranged from relatively homogenous in Unnamed Lake 1 and Unnamed Lake 2, to a bowl-shape in Unnamed Lake 3 to more complex in Unnamed Lake 4 and Unnamed Lake 5. Unnamed Lake 5 was different from the other lakes in the bottom topography, where several reef-type structures and emergent rocks were prevalent throughout the lake.

Water levels demonstrated significant seasonal fluctuations. During the terrestrial survey conducted in July 2010, Unnamed Lake 2 was observed to have 3 m to 5 m of bottom exposed from shore. Significant rainfall following this survey resulted in higher water levels observed during the aquatic survey performed in September 2010. The June 2011 supplemental baseline work confirmed that the water levels are significantly lower in the spring. The deepest portion of Unnamed Lake 2 was less than 0.6 m with significant sediment exposed along the shore. The connection with Whitehouse Creek was limited and there was no observable flow between the creek and lake. The connection was less than 1 m wide at points and less than 0.5 m deep.

Reed Lake is a large lake with a maximum depth of over 30 m. It has complex bottom topography (particularly in the northern section of the lake) with several deep holes, reef structures, and emergent rocks. Reed Lake is nearly 14 km by 19 km at its widest north-south and east-west axis. In the southern sampling area, the depth was uniform and did not exceed 1 m. The lake sediments in these areas were highly organic with small amounts of mineral soils. The northern sampling sites (i.e., near the Grass River confluence) were typically less than 6 m in total depth and the sediments were characterized by a high mineral content.

4.8.3 Surface Water Quality

In the fall of 2010 AECOM conducted an aquatic study by sampling surface water from 11 water bodies in the Project Region (see **Figure 1**). Two sites were sampled in Unnamed Lakes 1, 2, 3, 4 and 5, Whitehouse Creek and Grass River. Reed Lake had six water quality stations while Unnamed Creeks 2, 3 and 4 each had a single sampling site. Unnamed Creek 1 was chosen as part of the desktop review of the Project Region as the hydraulic connection between Unnamed Lake 4 and Unnamed Lake 5. During the aerial reconnaissance conducted during the field-sampling program, it was discovered that no stream channel existed between Unnamed Lake 4 and Unnamed Lake 5. The two lakes were separated by an area of bog/fen and the hydraulic connection was disseminated over the area. For this reason, Unnamed Creek 1 was removed from the sampling program in 2010.

4.8.3.1 Water Quality Results

In situ water quality parameters such as pH, temperature, specific conductance, turbidity, and dissolved oxygen (DO) were collected. Secchi Disk depth was also measured at the approximate centre of each lake.

Samples were analyzed for the following parameters:

- Routine parameters (e.g., physical and nutrients).
- Major ions (i.e., chloride, sulphate, bromide and silicate).
- Total and dissolved metals.
- Total and dissolved ultra-trace mercury.
- Biological parameters (i.e., chlorophyll *a* and pheophytin).

The following is a summary of the water quality data collected in the 2010 baseline sampling events. Additional details are provided in the AECOM 2012 *Reed Baseline Assessment* report. The Canadian Council of Ministers of the Environment (CCME) *Canadian Water Quality Guidelines* (CWQG) for the *Protection of Aquatic Life* (PAL) (freshwater) (CCME 2006)were compared to the water quality data collected during this survey. In addition, the trophic status of each waterbody was described using categories developed by the CCME (2004) which are based on total phosphorus concentrations.

Reed Lake

Reed Lake is a large lake with a maximum depth over 30 m. During the sampling events, temperatures in the lake ranged from 7.8 °C to 10.7 °C and had high dissolved oxygen (average 13.8 mg/L) over all sample depths (maximum depth of 5 m). The lake was alkaline and well oxygenated and no evidence of thermal stratification was observed.

According to the CCME classification scheme for lake trophic status based on phosphorus, Reed Lake was *meso-eutrophic* in 2010. Reed Lake had the highest average chlorophyll *a* concentration amongst the other water bodies sampled.

All metals and metalloids were at or below CCME CWQG PAL for the 2010 sampling event. A number of metals were not detected during both sampling events including; antimony, beryllium, bismuth, cadmium, cesium, chromium, cobalt, mercury, molybdenum, nickel, silver, tellurium, thallium, thorium, tungsten, uranium, and zinc.

Unnamed Lake 1

Unnamed Lake 1, having a maximum depth of 1.5 m, was not thermally stratified, alkaline and well oxygenated. The average water temperature and measured dissolved oxygen were 10.4 °C and 15.7 mg/L respectively.

According to the CCME classification scheme for lake trophic status based on phosphorus, Unnamed Lake 1 was *mesotrophic* in 2010. Ammonia concentrations exceeded CCME CWQG PAL guideline in Unnamed Lake 1 with average concentrations of 0.49 mg/L.

All metals and metalloids were at or below CCME CWQG PAL for the 2010 sampling event. A number of metals were not detected during both sampling events including; antimony, beryllium, bismuth, cadmium, cesium, chromium, cobalt, iron, lead, mercury, molybdenum, nickel, selenium, silver, tellurium, thallium, thorium, tin, tungsten, uranium, and zinc.

Unnamed Lake 2

Unnamed Lake 2, having a maximum depth of 1.5 m was not thermally stratified, alkaline and well oxygenated. Average temperatures and measured dissolved oxygen were 9.7 °C and 16.5 mg/L respectively. According to the CCME classification scheme for lake trophic status based on phosphorus, Unnamed Lake 2 was *mesotrophic* in 2010.

All metals and metalloids were at or below CCME CWQG PAL for the 2010 sampling event. A number of metals were not detected during both sampling events including; antimony, beryllium, bismuth, cadmium, cesium, chromium, cobalt, lead, mercury, molybdenum, nickel, selenium, silver, tellurium, thallium, thorium, tin, tungsten, uranium, and zinc.

Unnamed Lake 3

Unnamed Lake 3, having a maximum depth of 1.8 m, was not thermally stratified and had an average temperature of 11.8 °C. Dissolved oxygen concentrations averaged 15.0 mg/L.

Unnamed Lake 3 was alkaline, generally had the highest nutrient concentrations among the other water bodies sampled and had ammonia concentrations that exceeded the CCME CWQG PAL guideline with average concentrations of 0.63 mg/L. According to the CCME classification scheme for lake trophic status based on phosphorus, Unnamed Lake 3 was *meso-eutrophic* in 2010.

All metals and metalloids were at or below CCME CWQG PAL for the 2010 sampling event. A number of metals were not detected during both sampling events including; antimony, beryllium, bismuth, cadmium, cesium, chromium, cobalt, iron, lead, mercury, molybdenum, nickel, selenium, silver, tellurium, thallium, thorium, tungsten, uranium, and zinc.

Unnamed Lake 4

Unnamed Lake 4 had a maximum depth of 1.7 m, average temperatures of 11.9 °C and high dissolved oxygen (average 14.1 mg/L). The lake was alkaline and showed no evidence of thermal stratification.

Unnamed Lake 4 was neutral and according to the CCME classification scheme for lake trophic status based on phosphorus, Unnamed Lake 4 was *mesotrophic* in 2010.

All metals and metalloids were at or below CCME CWQG PAL for the 2010 sampling event. A number of metals were not detected during both sampling events including; antimony, beryllium, bismuth, cesium, chromium, cobalt, iron, lead, mercury, molybdenum, nickel, selenium, silver, tellurium, thallium, thorium, tungsten, uranium, and zinc.

Unnamed Lake 5

Unnamed Lake 5 had temperatures averaging 10.4 °C and high dissolved oxygen (average 16.3 mg/L) over all sample depths. With a maximum depth of 1.8 m, this lake was alkaline and showed no evidence of thermal stratification.

According to the CCME classification scheme for lake trophic status based on phosphorus, Unnamed Lake 5 was *mesotrophic* in 2010.

All metals and metalloids were at or below CCME CWQG PAL for the 2010 sampling event. A number of metals were not detected during both sampling events including; antimony, beryllium, bismuth, cesium, chromium, cobalt, mercury, molybdenum, nickel, silver, tellurium, thallium, thorium, tungsten, uranium, and zinc.

Whitehouse Creek

Whitehouse Creek was not thermally stratified and well oxygenated with sample depths ranging from surface to 0.6 m below the surface. Average temperatures and measured dissolved oxygen were 9.2 °C and 12.75 mg/L respectively.

Whitehouse Creek was alkaline and according to the CCME classification scheme for lake trophic status based on phosphorus, Whitehouse Creek was *mesotrophic* in 2010. Nutrient and chlorophyll *a* concentrations were lowest in Whitehouse Creek among the other water bodies sampled.

All metals and metalloids were at or below CCME CWQG PAL for the 2010 sampling event. A number of metals were not detected during both sampling events including; antimony, beryllium, bismuth, cadmium, cesium, chromium, cobalt, lead, mercury, molybdenum, nickel, selenium, silver, tellurium, thallium, thorium, tin, tungsten, uranium, and zinc.

Unnamed Creek 2

Unnamed Creek 2 had temperatures averaging 11.5 °C and high dissolved oxygen (average 13.6 mg/L). The creek was sampled to a depth of 0.5 m, was noted to be alkaline, and showed no evidence of thermal stratification.

According to the CCME classification scheme for lake trophic status based on phosphorus, Unnamed Creek 2 was *mesotrophic* in 2010.

Total iron concentrations in water samples collected from Unnamed Creek 2 (0.49 mg/L) exceeded the CCME CWQG PAL guideline (0.3 mg/L) in the 2010 sampling event. A number of metals were not detected during both sampling events including; antimony, beryllium, bismuth, cesium, chromium, cobalt, mercury, molybdenum, nickel, silver, tellurium, thallium, thorium, tungsten, uranium, and zinc.

Unnamed Creek 3

Unnamed Creek 3 had a temperature of 11.3 °C and high dissolved oxygen (average 10.6 mg/L). The creek was sampled to a depth of 1.5 m, and was noted to be alkaline and well-oxygenated.

According to the CCME classification scheme for lake trophic status based on phosphorus, Unnamed Creek 3 was *mesotrophic* in 2010.

Total iron concentrations in water samples collected from Unnamed Creek 3 (0.46 mg/L) exceeded the CCME CWQG PAL guideline (0.3 mg/L) in the 2010 sampling event. A number of metals were not detected during both sampling events including; antimony, beryllium, bismuth, cesium, chromium, cobalt, mercury, molybdenum, nickel, selenium, silver, tellurium, thallium, thorium, tungsten, uranium, and zinc.

Unnamed Creek 4

Unnamed Creek 4 had a temperature of 7.3 °C at the time of sampling and high dissolved oxygen (average 13.9 mg/L). The creek was sampled to a depth of 2 m, was noted to be alkaline and well oxygenated.

According to the CCME classification scheme for lake trophic status based on phosphorus, Unnamed Creek 4 was *oligotrophic* in 2010.

All metals and metalloids were at or below CCME CWQG PAL for the 2010 sampling event. A number of metals were not detected during both sampling events including; antimony, beryllium, bismuth, cadmium, cesium, chromium, cobalt, lead, mercury, molybdenum, nickel, selenium, silver, tellurium, thallium, thorium, tin, tungsten, uranium, and zinc.

Grass River

Grass River had average temperatures of 11.0 °C and high dissolved oxygen (average 13.3 mg/L). Grass River was alkaline and well oxygenated and no evidence of thermal stratification was observed to a sampling depth of 2.1 m.

According to the CCME classification scheme for lake trophic status based on phosphorus, Grass River was *meso-eutrophic* in 2010.

All metals and metalloids were at or below CCME CWQG PAL for the 2010 sampling event. A number of metals were not detected during both sampling events including; antimony, beryllium, bismuth, cadmium, cesium, chromium, cobalt, mercury, molybdenum, nickel, silver, tellurium, thallium, thorium, tungsten, uranium, and zinc.

4.8.4 Sediment Quality

In 2010, AECOM collected sediment samples for chemical and physical analysis from 11 water bodies in the Project Area as part of the aquatic assessment study. Water bodies included in the 2010 studies are indicated in **Section 4.8.3**.

4.8.4.1 Sediment Quality Results

The following is a summary of the sediment quality data collected in the 2010 baseline sampling events (AECOM 2012). When comparing the analytical results, both the *Manitoba Sediment Quality Guidelines* (MSQG) (Williamson,

2002) and the Canadian Council of Ministers of the Environment *Canadian Soil Quality Guidelines for Residential/Parkland Use* (CCME SQG) were used (CCME 1999).

Reed Lake

Nine of 18 samples collected from Reed Lake in 2010 had concentrations of chromium that exceeded the applicable sediment quality guidelines (MSQG) of 37.3 mg/Kg (exceedances averaging 52.8 mg/kg). Two of the 18 samples exceeded the MSQG of 35.7 mg/kg (exceedances averaging 36.4 mg/kg). Five samples had exceeding concentrations that averaged 1.02 mg/kg compared to the applicable soil quality guideline (CCME SQG) of 1 mg/kg.

Unnamed Creek 2

Two of the three samples collected at Unnamed Creek in 2010 had concentrations that exceeded the lowest applicable sediment quality guidelines for cadmium (0.6 mg/kg) and selenium (1 mg/kg). Cadmium concentrations measured were 0.889 mg/kg and 1.27 mg/kg and selenium concentrations were 1.30 mg/kg and 1.44 mg/kg. One of the three samples had concentrations (0.173 mg/kg) that exceeded the lowest applicable soil quality guideline of 0.17 mg/kg.

Unnamed Creek 3

One of three samples taken at Unnamed Creek 3 in 2010 had concentrations of selenium (1.13 mg/kg) that exceeded the CCME SQG of 1 mg/kg. No other exceedances were detected in Unnamed Lake 3.

Unnamed Creek 4

No exceedances were measured from the three samples that were collected from Unnamed Creek 4 in 2010.

Unnamed Lake 1

Two of the six samples collected from Unnamed Lake 1 in 2010 had arsenic concentrations averaging 7.31 mg/kg and cadmium concentrations averaging 0.707 mg/kg. These exceeded the lowest applicable soil quality guidelines (MSQG) of 5.9 mg/kg and 0.6 mg/kg respectively. In all samples collected, selenium concentrations exceeded the CCME SQG of 1 mg/kg with concentrations averaging 1.66 mg/kg.

Unnamed Lake 2

Of the six samples collected at Unnamed Lake 2 in 2010, one sample had an arsenic concentration of 14.5 mg/kg which exceeded the MSQG of 5.9 mg/kg. Four of the samples had cadmium concentrations (averaging 1.36 mg/kg) and selenium concentrations (averaging 1.26 mg/kg) that exceeded the lowest applicable soil quality guideline of 0.6 mg/kg and 1 mg/kg respectively. Three of the samples had mercury concentrations (averaging 0.187 mg/kg) that exceeded the MSQG of 0.17 mg/kg.

Unnamed Lake 3

Two of the six sediment samples that were collected from Unnamed Lake 3 in 2010 had concentrations of arsenic (averaging 8.73 mg/kg) and cadmium (averaging 1.059 mg/kg) that exceeded applicable soil quality guidelines of 5.9 mg/kg and 0.6 mg/kg respectively. One sample had a lead concentration of 48.1 mg/kg, which exceeded the MSGQ of 35.0 mg/kg.

Unnamed Lake 4

Two of the six samples that were collected from Unnamed Lake 4 in 2010 had arsenic concentrations averaging 8.57 mg/kg and cadmium concentrations averaging 1.44 mg/kg that exceeded the applicable soil quality guidelines of 5.9 mg/kg and 1.44 mg/kg respectively. One sample had lead (47.3 mg/kg), mercury (0.197 mg/kg) and zinc (150 mg/kg) concentrations that exceeded soil quality guidelines of 35.0 mg/kg, 0.17 mg/kg and 123 mg/kg respectively. In all six samples collected (average 0.64 mg/kg), selenium soil quality guidelines (1 mg/kg) were exceeded.

Unnamed Lake 5

One of six samples collected from Unnamed Lake 5 in 2010 exceeded the applicable arsenic soil quality guidelines (5.9 mg/kg) with a concentration of 6.51 mg/kg. All of the samples collected had selenium concentrations (averaging 1.60 mg/kg) that exceeded the soil quality guideline of 1 mg/kg.

Whitehouse Creek

Three samples collected at Whitehouse Creek exceeded applicable soil quality guidelines (MSQG 5.9 mg/kg or CCME SQG 12 mg/kg) for arsenic, with average concentrations of 11.01 mg/kg. Two samples with average selenium concentrations of 1.22 mg/kg exceeded the applicable soil quality guideline of 1 mg/kg.

Grass River

One of six sediment samples collected from the Grass River in 2010 had a chromium concentration of 49.9 mg/kg, which exceeded the MSQG of 37.3 mg/kg. No other exceedances were measured in the Grass River.

4.9 Terrestrial Environment

4.9.1 Flora

Vegetation within uplands in the Cormorant Lake and Reed Lake Ecodistricts vary based on fire history. After a fire, Jack Pine is typically the dominant species, with areas of Trembling Aspen regenerating on favourable sites. Eventually Black Spruce will become dominant with the understory including alder and ericaceous shrubs and ground cover varying from moss to herbs and ferns. Within the Ecodistrict, bog peat-lands have stunted Black Spruce with Dwarf Birch and ericaceous shrubs and mosses, while fens have sedges, brown mosses and Swamp Birch, alder, willow and stunted tamarack. (Smith 1998)

4.9.1.1 Terrestrial Field Surveys

In the fall of 2010 and spring of 2011, AECOM conducted a wildlife and vegetation assessment for the Project Area. The study included ground truthing to confirm the presence or absence of endangered, threatened or special concern species on the Project Site and within the Project Area, and also to conduct an inventory of botanical species to support a desktop review. An aerial reconnaissance survey of the Project Region was also conducted. No species at risk were observed during the assessment.

Three distinct floral communities were identified in the Project Region: a large clear-cut area; a mature mixed wood forest with a dense canopy; and a wet fen. The large clear-cut area in the process of re-growth and appears to be proceeding naturally through a hardwood forest stage. There is no evidence of supplemental planting in this old clear-cut area. Trees in the area are not yet mature, the canopy is fairly closed, and trees are young, averaging about 2 m in height.

The mature open stand is part of the mature and diverse forest stands that occur along the south shore of Reed Lake and the Grass River. There are poplar and White Spruce stands in the Project Area that extend into the Project Site, both containing large mature trees. This and the overall diversity of species indicate the high productivity of soils in the upland areas of this region. The mature forest biome is extensive and is composed of White Spruce, poplar, and birch, interspersed with small Black Spruce bogs. The canopy is more open as is typical in a mature forest stand. Ground cover is a mixture of sphagnum, grassy areas, and sedge. Shrubby growth is common with ground plants comprising a mixture of typical boreal ground species interspersed with open area growth.

The third floral community is wet fen with tamarack margins, in some cases bordering open lakes. These areas show typical fen vegetation with deep accumulations of sphagnum covered in Bog Birch and alder. The wet fen environment borders both the mature stands and clear-cut areas to the south. This is a typical wet fen environment with floating sphagnum mats and larch trees. The larch trees attain normal height near the hard rock boundaries of the fen, but taper off towards open water in the centre. The sphagnum mats are covered in typical fen vegetation such as Bog Birch and several areas support extensive growth of pitcher plants, an insectivorous plant species. This area offers little in terms of wildlife habitat.

Tables 4-3 to **4-5** provide a list of vegetation identified in each of the three major local environments (large clear-cut area, mature mixed wood forest with a dense canopy, and wet fen).

Table 4-3: Vegetation Observed in Clear-Cut Area in 2010 and 2011

Overstory Species
White Spruce (*Picea glauca)*
Balsam Poplar (*Populus balsamifera*)
Paper Birch (*Betula papyrifera*)
Trembling Leaf Aspen (*Populus tremuloides*)
Shrub Species
Pin Cherry (*Prunus pensylvanica*)
Saskatoon (*Amelanchier alnifolia*)
Chokecherry (*Prunus virginiana*)
Ground Cover Species
American Vetch (*Vicia americana*)
Arrow-Leaved Coltsfoot (*Petasites sagittatus*)
Canada Anemone (*Anemone canadensis*)
Common Harebell (*Campanula rotundifolia*)
Drooping Wood-Reed (*Cinna latifolia)*
Fairybells (*Disporum trachycarpum*)
Fern (*Matteuccia sp.*)
Foxtail Barley (*Hordeum jubatum)*
Goldenrod (*Solidago canadensis*)
Gooseberry (*Ribes oxyacanthoides*)
Hairy Wild Rye (*Elymus innovatus)*
Long-leaved Chickweed (*Stellaria longifolia*)
Meadow Rue (*Thalictrum aquilegiifolium*)
Northern Bed Straw (Gallium *boreale*)
Pink Corydalis (*Corydalis sempervirens)*
Raspberry (*Rubus idaeus*)
Red-Osier Dogwood (*Cornus stolonifera*)
Rose (*Rosa acicularis*)
Slender Wheat Grass (*Agropyron trachycaulum)*

Overstory Species
Snowberry (*Symphoricarpos albus*)
Tall Bluebells (*Mertensia paniculata*)
Yarrow (*Achillea millefolium*)
Wetland Species
Marsh Cinquefoil (*Potentilla palustris*)
Sedge (*Carex sp.*)
Slough Grass (*Bechmania syzigachne*)
Wild Mint (*Mentha arvensis*)
Moss and Lichen species
Awned hair cap moss (*Polytrichum piliferum*)
Tufted moss (*Aulacomium palustre*)
Wavy Dicranum (*Dicranum undulatum*)
Invasive Species
Canada Thistle (*Cirsium arvense*)
Perennial Sow Thistle (*Sonchus arvensis*)
Quack Grass (*Agropyron repens*)
Red Clover (*Trifolium pretense*)
Stinging Nettle (*Urtica dioica*)

Table 4-4: Vegetation Observed in Mature Upland Area in 2010 and 2011

Overstory Species
Balsam Fir (*Abies balsamea*)
Balsam Poplar (*Populus balsamifera*)
Black Spruce (*Picea mariana*)
Bur Oak (*Quercus macrocarpa*)
Jack Pine (*Pinus banksiana*)
Larch (*Larix decidua*)
Paper Birch (*Betula papyrifera*)
Trembling Leaf Aspen (*Populus tremuloides*)
White Spruce (*Picea glauca*)
Shrub Species
Pin Cherry (*Prunus pensylvanica*)
Saskatoon (*Amelanchier alnifolia*)
Willow (*Salix sp.*)
Chokecherry (*Prunus virginiana*)
Ground Cover Species
American Vetch (*Vicia americana*)
Arrow-Leaved Coltsfoot (*Petasites sagittatus*)
Bearberry (*Arctostaphylos uva-ursi*)
Blunt-Leaved Bog-Orchid (*Habenaria obtusata*)
Bog Cranberry (*Vaccinium vitis-idaea*)
Bunchberry (*Cornus canadensis*)
Canada Anemone (*Anemone canadensis*)
Canada Buffaloberry (*Sheperdia canadensis*)
Clintonia (*Clintonia borealis*)
Cloudberry (*Rubus chamaemorus*)
Common Harebell (*Campanula rotundifolia*)

Overstory Species
Drooping Wood-Reed (*Cinna latifolia)*
Dwarf Bilberry (Vaccinium caespitosum)
Fairybells (*Disporum trachycarpum*)
Fern (*Matteuccia sp.*)
Foxtail Barley (*Hordeum jubatum)*
Goldenrod (*Solidago canadensis*)
Gooseberry (*Ribes oxyacanthoides*)
Graceful Potentilla (*Potentilla gracilis*)
Hairy Wild Rye (*Elymus innovatus)*
Highbush Cranberry (*Viburnum edule*)
Horsetail (*Equisetum arvense*)
Labrador Tea (*Ledum groenlandicum*)
Leatherleaf (Chamaedaphne calyculata)
Lily of the Valley (*Maianthemum canadense*)
Meadow Rue (*Thalictrum aquilegiifolium*)
Moccasin Flower (*Cypripedium acaule*)
Northern Bed Straw (Gallium *boreale*)
Northern Bog-Laurel (*Kalmia polifolia*)
Northern Star Flower (*Trientalis borealis*)
Pink Corydalis (*Corydalis sempervirens)*
Raspberry (*Rubus idaeus*)
Red-Osier Dogwood (*Cornus stolonifera*)
Richardson's Alumroot (*Heuchera richardsonii)*
Rock Cress (*Arabis sp.*)
Rose (*Rosa acicularis*)
Rough Cinquefoil (*Potentilla norvegica*)
Sarsaparilla (*Aralia nudicaulis*)
Slender Wheat Grass (*Agropyron trachycaulum)*
Small Bog Cranberry (*Oxycoccus microcarpus*)
Small-Leaved Pussytoes (*Antennaria microphylla*)
Snowberry (*Symphoricarpos albus*)
Stiff Club Moss (*Lycopodium annotinum)*
Strawberry (*Fragaria virginiana*)
Tall Bluebells (*Mertensia paniculata*)
Three-Leaved False Solomon's-Seal (*Smilacina trifolia*)
Three-Toothed Cinquefoil (*Potentilla tridentata*)
Twinflower (*Linnaea borealis*)
Velvet-Leaved Blueberry (*Vaccinium myrtilloides*)
Wintergreen (*Pyrola asarifolia*)
Yarrow (*Achillea millefolium*)
Wetland Species
Bluejoint (*Calamagrostis canadensis)*
Common Cattail (*Typha latifolia*)
Common Reed Grass (*Phragmites australis*)
Marsh Cinquefoil (*Potentilla palustris*)
Reed Canary Grass (*Phalaris arundinacea*)
Sedge (*Carex sp.*)
Slough Grass (*Bechmania syzigachne*)
Small-Flowered Bulrush (*Scirpus microcarpus*)
Tall Cotton-Grass (*Eriophorum angustifolium*)

Overstory Species
Wild Mint (*Mentha arvensis*)
Moss and Lichen Species
Awned hair cap moss (Polytrichum piliferum)
Cladonia (Cladonia sp.)
Sphagnum Moss (Sphagnum sp.)
Tufted moss (Aulacomium palustre)
Wavy Dicranum (Dicranum undulatum)
Invasive Species
Canada Thistle (*Cirsium arvense*)
Perennial Sow Thistle (*Sonchus arvensis*)
Quack Grass (*Agropyron repens*)
Red Clover (*Trifolium pretense*)
Stinging Nettle (*Urtica dioica*)

Table 4-5: Vegetation Observed in the Wet Fen Area in 2010 and 2011

Overstory Species
Larch (*Larix decidua*)
Shrub Species
Bog Birch (*Betula glandulosa*)
Green Alder (*Alnus crispa*)
Ground Cover Species
Bearberry (*Arctostaphylos uva-ursi*)
Bog Cranberry (*Vaccinium vitis-idaea*)
Bunchberry (*Cornus canadensis*)
Labrador Tea (*Ledum groenlandicum*)
Pitcher Plant (*Sarracenia purpurea*)
Wetland Species
Marsh Cinquefoil (*Potentilla palustris*)
Sedge (*Carex sp.*)
Moss and Lichen Species
Awned hair cap moss (*Polytrichum piliferum*)

The vegetation within the Project Area and Project Region is typical for this Ecoregion. In the mature upland area, Dwarf Bilberry (*Vaccinium caespitosum*) and sedge *(Carex sp.*) were found in the Project Area but not observed on the Project Site. For the Mid-boreal Lowlands, Dwarf Bilberry is globally listed in the MCDC rankings as demonstrably widespread, abundant and secure throughout its range. Provincially, it is ranked as rare. Located in the Mid-Boreal Lowlands and Churchill River Upland Ecoregions, various *Carex sp.* are ranked by MCDC as globally demonstrably widespread, abundant and secure throughout its range and provincially ranked as rare to uncommon, but status is uncertain in the province (Manitoba Conservation 2012 b).

AECOM consulted Manitoba Hydro's Environmental Impact Statement (EIS) for the Bipole III Transmission Project to obtain information on plants that have been identified as having cultural value to Aboriginal people in Manitoba. The Bipole III EIS was consulted because it is the most comprehensive and recent source of documentation of traditional land use by Aboriginal Peoples in Northern Manitoba, covering a study area of over 136,000 km^2, and involving interviews with participants from numerous First Nation and other Aboriginal communities.

Table 4-6 provides a list of plants that were observed during the terrestrial surveys conducted for the Reed Project that have been identified in the Bipole III EIS as having cultural value to Aboriginal people.

Table 4-6 Plants found during the Reed Baseline Terrestrial Surveys that may have cultural value to Aboriginal people.

Common Name	Scientific Name
Labrador Tea	*Ledum groenlandicum*
Red Willow Bark or Dogwood	*Cornus stolonifera*
Poplar Leaves	*Populus balsamifera L.*
Cranberry	*Vaccinium macrocarpon*
Bearberry	*Arctostaphylos uva-ursi*
Alumroot	*Heuchera richardsonii*
Pitcher Plant	*Sarracenia purpurea*
Tamarack	*Larix laricena*
Birch Tree Leaves	*Betula papyrifera*
Yarrow	*Achillea millefolium*
Red Clover	*Trifolium pretense*
Wild Sarsaparilla	*Aralia nudicaulis*
Lowbush Blueberry/Velvet-Leaved Blueberry	*Vaccinium myrtilloides*
Mint	*Mentha arvensis*
Raspberry	*Rubus idaeus*
Strawberry	*Fragaria virginiana*
Lowbush Cranberry/Highbush Cranberry	*Viburnum edule*
Bunchberry	*Cornus canadensis*
Arrow-Leaved Colt's Foot	*Petasites frigidus* var. *sagittatus*
Wild Rose	*Rosa spp.*
Stinging Nettle	*Urtica dioica*

Stinging Nettle is an invasive weed, and would likely be encountered in road ditches and cleared areas within the Project Region.

The other species identified in **Table 4-6** are very common boreal species and are expected to be encountered in abundance throughout the Project Area and Project Region.

4.9.2 Fauna

Wildlife in the region includes moose, Black Bear, lynx, wolf, beaver, muskrat, Snowshoe Hare and Red-backed Vole. Moose are fairly common in the area, especially along waterways, while White-Tailed Deer have moved in from the south and their numbers are increasing. The main predators of ungulates such as the moose, caribou and deer are wolves, several packs of which are found in various sections of Grass River Provincial Park. Other predators such as lynx, marten, fisher and wolverine are found in varying numbers. Mink and otter are common in the lakes and rivers. Bird species include raven, Common Loon, Spruce Grouse, Bald Eagle, Gray Jay, Hawk Owl, and waterfowl, including ducks and geese. Woodland Caribou range throughout most of the Grass River Provincial Park during the year, and are most often associated with mature forest and treed muskeg. Many islands on Reed Lake provide important calving habitat. Cows and their calves tend to stay on the predator-free islands during the summer. They may also be seen crossing PTH 39, especially in the early morning and at dusk.

Wildlife populations have open access to large areas of natural woodland in the Grass River Provincial Park, including river and lake shore edge habitat and many burned areas in various stages of regrowth. Such areas provide a large diversity of habitats that favours wildlife populations. While wildlife species may use the Project Area, they have no preference for the Project Area over similar habitat in the Project Region.

The Project Site does not contain any specific critical wildlife value (such as calving or over-wintering areas). Based on site conditions and the field observations described above, it is expected that there is no critical wildlife value in the Project Area.

4.10 Aquatic Resources

Aquatic investigations conducted in the fall of 2010 included classification and enumeration (from field investigation and desktop review) of phytoplankton, zooplankton, benthic invertebrate communities, and fish and fish habitat aquatic species and benthic invertebrates.

4.10.1 Aquatic Non-Fish Community

The aquatic baseline studies confirmed several aquatic non-fish species within the Project Region. Samples were collected from 8 water bodies, including all the lakes, Whitehouse Creek and the Grass River. This allowed for phytoplankton and zooplankton enumeration and taxonomic composition.

Phytoplankton communities include *Dictyosphaerium* (chlorophyte), *Nitzschia sp.* and *Microsystis* sp. (cyanophytes). Whitehouse Creek had the lowest overall biovolume (0.19 mm^3/L) and species diversity (18 species) while Reed Lake and Grass River had the highest species diversity (46 species) and Unnamed Lake 3 had the highest overall biovolume (15.9 mm^3/L).

Zooplankton communities include *Diaptomus sp.*, *Kellicottia longispina* and *Actinosphaerium sp*. The zooplankton communities were dominated by Monogononta in all the water bodies examined. Total abundance ranged from 1,515 n/m^3 (Whitehouse Creek) to 4,530 n/m^3 (Unnamed Lake 1). Eight classes of zooplankton were identified in the collected samples. Unnamed Lake 2 had the highest species diversity with 20 species identified.

A total of 69 benthic invertebrate community (BIC) samples were collected from 23 stations in 11 water bodies. However, only one replicate from each station was submitted for taxonomic identification and enumeration. The remaining two replicates per station were archived for future use. Benthic invertebrate family richness ranged from 1 to 14 taxa and species density ranged from 1,000 to 63,050 individuals/m^3. Communities consisted of *Amphipoda*, *Hyalellidae Hyalella azteca*, *Isotomidae* and *Chironomidae*. Family richness was highest in Reed Lake. The Grass River had low diversity, with over 90% of the sample dominated by *Cladocera*.

4.10.2 Fish Community

Fishing effort included the use of Standard Gang index gill nets, seine nets, electrofishing and minnow traps. Reed Lake, Unnamed Lake 1, Unnamed Lake 2, Unnamed Lake 3, Unnamed Lake 4, Unnamed Lake 5, Unnamed Creed 2, Unnamed Creek 3, Unnamed Creek 4, Whitehouse Creek and Grass River were all fished during the 2010 program. (AECOM 2012)

Fish species known to be present in the Nelson River watershed are listed in **Table 4-7**.

Table 4-7: List of Expected Aquatic Species in the area of the proposed Reed Mine site

Family Name	Common Name	Species Name	Distribution
Petromyzontidae	Silver Lamprey	*Ichthyomyzon unicuspis*	N
Acipenseridae	Lake Sturgeon	*Acipenser fulvescens*	N
Hiodontidae	Mooneye	*Hiodon tergisus*	N
Cyprinidae	Lake Chub	*Couesius plumbeus*	N
	Carp	*Cyprinus carpio*	I
	Pearl Dace	*Margariscus margarita*	N
	Emerald Shiner	*Notrophis atherinoides*	N
	Blacknose Shiner	*Notropis heterolepis*	N
	Spottail Shiner	*Notropis hudsonius*	N
	Fathead Minnow	*Pimephales promelas*	N
	Longnose Dace	*Rhinichthys cataractae*	N
Catostomidae	Longnose Sucker	*Catostomus catostomus*	N
	White Sucker	*Catostomus commersoni*	N
	Shorthead Redhorse	*Moxostoma erythurum*	N
Ictaluridae	Channel Catfish	*Ictalurus punctatus*	R
Esocidae	Northern Pike	*Esox lucius*	N
Umbridae	Central Mudminnow	*Umbra limi*	0
Osmeridae	Rainbow Smelt	*Osmerus mordax*	I
Salmonidae	Cisco	*Coregonus artedi*	N
	Lake Whitefish	*Coregonus clupeaformis*	N
	Rainbow Trout	*Oncorhynchus mykiss*	I
	Brook Trout	*Salvelinus fontinalis*	N
	Lake Trout	*Salvelinus namaycush*	N
Percopsidae	Trout-perch	*Percopsis omiscomaycus*	N
Gadidae	Burbot	*Lota lota*	N
Gasterosteidae	Brook Stickleback	*Culaea inconstans*	N
	Ninespine Stickleback	*Pungitius pungitius*	N
Cottidae	Slimy Sculpin	*Cottus cognatus*	N
Percidae	Johnny Darter	*Etheostoma nigrum*	N
	Yellow Perch	*Perca flavescens*	N
	River Darter	*Percina shumardi*	N
	Sauger	*Sander canadensis*	N
	Walleye	*Sander vitreus*	N
Sciaenidae	Freshwater Drum	*Aplodinotus grunniens*	N

Source: (Stewart and Watkinson 2004)
Notes: Estuarine species are excluded from this list. N = native; I = introduced; R = rare, 0 = not previously captured in this watershed.

The most abundant species captured was the Fathead Minnow and second most abundant was Brook Stickleback. Large-bodied fish that were captured in the 2010 baseline surveys include Northern Pike, Walleye, Lake Whitefish, Lake Trout, Burbot and Yellow Perch.

Reed Lake

Fish collections were conducted in Reed Lake on September 18 and 19, 2010. The most abundant species captured in this lake was Yellow Perch. Other fish species collected include: Lake Whitefish, Northern Pike, Walleye, White Sucker, Brook Stickleback, Emerald Shiner, Johnny Darter, Lake Trout and Spot Tail Shiner.

Unnamed Lake 1

Fish collections were conducted in Unnamed Lake 1 from September 14 to September 15, 2010. The only forage fish species captured was Brook Stickleback. However, they were abundant (141 captured).

Unnamed Lake 2

Fishing effort in Unnamed Lake 2 occurred from September 13 to14, 2010. Two forage fish species were captured, Brook Stickleback and Fathead Minnow. Two large bodied fish species were also captured, Northern Pike and White Sucker.

Unnamed Lake 3

Fish collections were conducted between September 12 and September 14, 2010. Two species of forage fish were captured, Brook Stickleback and Fathead Minnow.

Unnamed Lake 4

Fishing efforts were conducted in Unnamed Lake 4 between September 10 and September 12, 2010. Two forage fish species were captured, Brook Stickleback and Fathead Minnow.

Unnamed Lake 5

Fish collections were conducted in Unnamed Lake 5 between September 12 and September 13, 2010. Two forage fish species were captured, Brook Stickleback and Fathead Minnow.

Whitehouse Creek

Fish collections were conducted in Whitehouse Creek during June 3 to June 6 and September 16, September 18 and September 19, 2010. Five fish species were collected in Whitehouse Creek: Brook Stickleback, Burbot, Iowa Darter, Northern Pike, and Pearl Dace.

Unnamed Creek 1

During the desktop review, the area identified as “Unnamed Creek 1” on maps for the area was selected for sampling as it appeared to be a hydraulic connection between Unnamed Lake 4 and Unnamed Lake 5. During the aerial reconnaissance, however, it was discovered that no stream channel existed between Unnamed Lake 4 and Unnamed Lake 5. Rather, the two lakes were separated by an area of bog/fen, with the hydraulic connection disseminated over the area. Therefore, area previously identified as “Unnamed Creek 1” was removed from the sampling programs.

Unnamed Creek 2

Fishing effort in Unnamed Creek 2 occurred on September 15, 2010. Two forage fish species were captured, Brook Stickleback and Pearl Dace.

Unnamed Creek 3

No fish species were captured in Unnamed Creek 3 on September 16, 2010.

Unnamed Creek 4

Only Brook Stickleback were captured in Unnamed Creek 4 on September 17, 2010.

Grass River

Fish collections were conducted in the Grass River from September 16 to September 19, 2010. The most abundant species captured in the Grass River was Slimy Sculpin. Six additional fish species were captured: Longnose Dace, Burbot, Walleye, Brook Stickleback, Northern Pike and Lake Whitefish.

4.10.1 Metal Residues in Fish

Fish from Reed Lake, Unnamed Lake 1, Unnamed Lake 2, Unnamed Lake 3, Unnamed Lake 4, Unnamed Lake 5 and Grass River were analysed for metals. Muscle and liver tissue were submitted from the large bodied fish (Northern Pike and White Sucker) from Unnamed Lake 2. Small bodied fish (Yellow Perch, Brook Stickleback, Fathead Minnow and Slimy Sculpin) were submitted for analysis of whole-body metal concentrations from Reed Lake, Unnamed Lake 1, Unnamed Lake 3, Unnamed Lake 4, Unnamed Lake 5 and Grass River (AECOM 2012).

In total, 75 fish were submitted for analysis. Results of the analysis indicated that concentrations of most metals were either low or below the detection limit. None of the concentrations exceeded the MWQSOG aquatic life residue guidelines for human consumption for arsenic, lead or mercury (Williamson 2002-11).

4.10.2 Aquatic Habitat

A variety of fish habitats were noted in the water bodies within the Project Region. In general, the Project Region is characterized by low-lying headwater lakes and creeks (with the exception of Grass River and Reed Lake). Upstream water bodies, including unnamed lakes and creeks, are less diverse than Reed Lake, Whitehouse Creek, and Grass River. These upstream water bodies provide limited potential for foraging, spawning, and overwintering habitat for small and large-bodied fish. The majority of cover in these upstream water bodies includes vegetation (overhanging, submergent and emergent) with patchy distribution of cobble, boulders, woody debris, and depth as cover. Most of the shoreline consists of fen or bog areas. Unnamed Lake 4 and Unnamed Lake 5 provide the most diverse cover types, shoreline complexity and greater depths.

The unnamed lakes (except Unnamed Lake 2) show limited or no connectivity to other lakes and only support small-bodied (*i.e.*, forage) fish species. Unnamed Lake 2, which had a channel connecting it to Whitehouse Creek, was the only unnamed lake in which large-bodied fish (Northern Pike and White Sucker) were captured. However, there would be very limited overwintering habitat available in the unnamed lakes, as ice thickness can be greater than 1.2 m in this region.

Grass River, Whitehouse Creek, and Reed Lake provide a diversity of foraging, spawning, and overwintering habitats for small and large-bodied fishes. These water bodies have well-defined watercourses and provide stable habitat for fishes.

The Grass River is a large, complex river extending 545 km from Webster Lake to its confluence with the Nelson River, with numerous widened areas forming lakes and several rapids. Within the Project Area, the Grass River hosts a variety of habitat types from riffle areas (where the available cover types include large woody debris, turbulence, cobble and boulder substrate) to flat runs (where the substrate is comprised of organics and silt, with submergent and emergent vegetation along the river margins). The Grass River is generally confined by mature dense forest, with wetted width generally 10 m greater than channel width. As a more stable watercourse, it provides abundant foraging and spawning habitat for small and large-bodied fish species.

Whitehouse Creek is characterized by a range of habitat types. The diversity of habitats in Whitehouse Creek provides abundant habitat for forage and spawning activities, primarily for small-bodied fish. During seasons in which water levels are sufficient, habitat also would be available for feeding and spawning for large-bodied fish. Whitehouse Lake may also provide overwintering habitats for large-bodied fish, as suggested by the spring 2011 capture of juvenile Northern Pike near the connection between Whitehouse Creek and Unnamed Lake 2.

Reed Lake is a very large lake on the Grass River system. It hosts a diversity of fish species and provides abundant areas for foraging, spawning, and overwintering habitat for large and small-bodied fish. There are several deep areas (in excess of 30 m) and the shoreline habitat provides abundant cover (substrate, emergent and submergent vegetation, woody debris and depth).

4.11 Protected Species

Protected species are species that are endangered, threatened or of special interest, as defined by either Federal or Provincial legislation. In the Province of Manitoba, endangered, threatened or special interest species are protected by *The Manitoba Endangered Species Act* (MESA), which may have species that overlap with the Federal *Species at Risk Act* (SARA). The Woodland Caribou is classified as threatened under MESA and may be found in the Churchill River Ecoregion. No other provincially listed species occurs in the Project Region. A search of the *Species at Risk Public Registry* revealed occurrences within the Project Region of species listed as endangered, threatened or of special concern under SARA.

Table 4-8 provides a list of protected species with potential to occur in the Project Region.

Table 4-8: List of Protected Species with Potential to Occur in the Project Region

Common Name	Scientific Name	SARA Status	MB Status
Boreal Woodland Caribou	*Rangifer tarandus caribou*	Threatened	Threatened
Yellow Rail	*Coturnicops noveboracensis*	Special Concern	Not Ranked
Shortjaw Cisco	*Coregonus zenithicus*	Threatened	Not Ranked
Monarch	*Danaus plexippus*	Special Concern	Not Ranked
Flooded Jellyskin	*Leptogium rivulare*	Threatened	Not Ranked

Source: (Government of Canada 2012) *and* (Manitoba Conservation 2012)

4.11.1 Woodland Caribou

According to Manitoba Conservation Fact Sheets, Manitoba recognizes three varieties of caribou: Coastal, Barren Ground and Boreal Woodland. The current estimated population ranges from approximately 1,800 to 3,150 and it is believed by Manitoba Conservation that the Provincial population is stable. However, the Boreal Woodland caribou was designated as threatened under *The Endangered Species Act* in June 2006. (Manitoba Conservation 2012)

The Reed Boreal Woodland Caribou range is located within the Project Region. Manitoba Conservation lists the Reed Range to be of medium conservation concern and numbering between 100 and 150 individuals (Manitoba Conservation 2012). Boreal Woodland Caribou are listed as "threatened" by the Committee on the Status of

Endangered Wildlife in Canada (COSEWIC) and Manitoba's Boreal Woodland Caribou populations were listed as threatened under *The Endangered Species Act* in June, 2006 (Manitoba Conservation 2012).

Boreal Woodland Caribou have several distinct spatial and temporal habitat requirements (Manitoba Conservation 2012). Boreal Woodland Caribou range throughout most of the Grass River Provincial Park during the year, and are most often associated with mature forest for most of their seasonal range. The area in and around the Project Region includes large amounts of very high quality habitat, which varies according to the season. Boreal Woodland Caribou are known to avoid areas with a high degree of human disturbance. Winter range and spring calving areas are highly critical.

The Boreal Woodland Caribou use treed muskeg during the winter for foraging. Many islands on Reed Lake are used as important calving habitat, as cows and their calves tend to stay on the predator-free islands during the summer. They may also be seen crossing PTH 39, especially in the early morning and at dusk.

HBMS participates in Manitoba Conservation's ongoing large-scale caribou study in Northern Manitoba, including the Reed Project Region, which contributes information used in Manitoba's Conservation and Recovery Strategy for Boreal Woodland Caribou. The strategy document groups caribou ranges as Low, Medium or High risk, based on levels of disturbance and various other threats for each range. (Government of Manitoba 2005)

In 2009 and 2010, the Northwest Region Woodland Caribou Research and Management Committee, with funding from HBMS, collared female Boreal Woodland Caribou on islands of Reed Lake to document areas of use (travel corridors, rutting areas and calving sites). Ongoing monitoring of caribou deaths will continue to contribute to assessment of herd stability. As of September 2012, 40,000 location points have been established and, using telemetry data, two different areas of use on the range have been determined.

The Reed herd caribou spend the majority of their time on the west side of Reed Lake, which is outside of the Project Region. However, HBMS will continue to participate in ongoing studies in cooperation with Manitoba Conservation.

4.11.2 Other Protected Species

The Manitoba Conservation Data Centre provides a ranking of species of conservation concern for the Churchill River Upland and Mid-Boreal Lowland Ecoregions. The term "species of concern" includes species that are rare, distinct, or at risk throughout their range or in Manitoba and need further research. Species are evaluated and ranked on the basis of their range-wide (global) status, and their province-wide (sub-national) status according to a standardized procedure used by all Conservation Centres and Natural Heritage Programs.

Table 4-9 provides a list of fungi, plants and vertebrate animals of special concern and their ranking for the Mid-Boreal Lowland and Churchill River Upland Ecoregion.

Table 4-9: List of Species of Special Concern

Scientific Name	Common Name	Rank
Mid-Boreal Lowland		
Animal Assemblage		
Bat Colony		Globally a species rank has not yet been assigned and provincially a species rank has not yet been assigned in the province.
Snake Hibernaculum		Globally a species rank has not yet been assigned and provincially a species rank has not yet been assigned in the

Scientific Name	Common Name	Rank
		province.
Invertebrate Animal		
Strophitus undulatus		Globally ranked demonstrably widespread, abundant and secure throughout its range and provincially a species rank has not yet been assigned in the province.
Terrestrial Community - Other Classification		
Boreal Inland Alkaline Cliff Sparse Vegetation		Globally a species rank has not yet been assigned and provincially ranked rare in the province.
Distichlis stricta-Hordeum jubatum-Puccinellia nuttalliana-Plantago maritime (saline herbaceous vegetation)	Alkali Grass-Wild Barley-Nuttall's Salt Meadow Grass- Seaside Plantain (Saline Herbaceous Vegetation)	Globally a species rank has not yet been assigned and provincially ranked rare in the province.
Inland Lake cobble-gravel shore sparse Vegetation		Globally a species rank has not yet been assigned and provincially ranked uncommon in the province.
Thuja occidentalis-(Picea mariana, Abies balsamea)/Alnus rugosa (wetland forest)	Eastern White Cedar-(Black Spruce, Balsam Fir)/Speckled Alder (Wetland Forest)	Globally a species rank has not yet been assigned and provincially ranked rare in the province.
Vascular Plant		
Arethusa bulbosa	Arethusa	Globally ranked widespread, abundant and apparently secure throughout its range and provincially ranked rare in the province.
Botrychium multifidum	Leathery Grape-fern	Globally ranked demonstrably widespread, abundant and secure throughout its range and provincially ranked uncommon in the province.
Calopogon tuberosus	Swamp-pink	Globally ranked demonstrably widespread, abundant and secure throughout its range and provincially ranked rare in the province.
Carex communis	Fibrous-rooted Sedge	Globally ranked demonstrably widespread, abundant and secure throughout its range and provincially a status rank is not applicable in the province.
Carex flava	Yellow Sedge	Globally ranked demonstrably widespread, abundant and secure throughout its range and provincially ranked uncommon to rare in the province.
Carex garberi	Elk Sedge	Globally ranked demonstrably widespread, abundant and secure throughout its range and provincially ranked very rare, but status is uncertain in the province.
Carex hystericina	Porcupine Sedge	Globally ranked demonstrably widespread, abundant and secure throughout its range and provincially ranked uncommon, but status is uncertain in the province.
Carex pedunculata	Stalked Sedge	Globally ranked demonstrably widespread, abundant and secure throughout its range and provincially ranked uncommon, but status is uncertain in the province.
Carex projecta	Necklace Sedge	Globally ranked demonstrably widespread, abundant and secure throughout its range and provincially ranked rare, but status is uncertain in the province.
Carex vulpinoidea	Fox Sedge	Globally ranked demonstrably widespread, abundant and secure throughout its range and provincially ranked uncommon, but status is uncertain in the province.
Cypripedium arietinum	Ram's Head Lady's-slipper	Globally ranked uncommon throughout its range and provincially ranked uncommon to rare in the province.
Drosera anglica	Oblong-leaved Sundew	Globally ranked demonstrably widespread, abundant and secure throughout its range and provincially ranked uncommon in the province.
Drosera linearis	Slender-leaved Sundew	Globally ranked widespread, abundant and apparently secure throughout its range and provincially ranked rare in the province.
Dulichium arundinaceum	Three-way Sedge	Globally ranked demonstrably widespread, abundant and

Scientific Name	Common Name	Rank
		secure throughout its range and provincially ranked rare in the province.
Eleocharis engelmannii	Engelmann's Spike-rush	Globally ranked demonstrably widespread, abundant and secure to widespread, abundant and apparently secure, but species is uncertain throughout its range and provincially ranked very rare in the province.
Eriophorum callitrix	Beautiful Cotton-grass	Globally ranked demonstrably widespread, abundant and secure throughout its range and provincially ranked rare in the province.
Galium aparine	Cleavers	Globally ranked demonstrably widespread, abundant and secure throughout its range and provincially status is uncertain and may possibly be in peril in the province.
Goodyera tesselata	Tesselated Rattlesnake Plantain	Globally ranked demonstrably widespread, abundant and secure throughout its range and provincially ranked rare in the province.
Gymnocarpium jessoense	Northern Oak Fern	Globally ranked demonstrably widespread, abundant and secure throughout its range and provincially ranked uncommon to widespread, abundant and apparently secure in the province.
Gymnocarpium robertianum	Limestone Oak Fern	Globally ranked demonstrably widespread, abundant and secure throughout its range and provincially ranked very rare in the province.
Heteranthera dubia	Water Star-grass	Globally ranked demonstrably widespread, abundant and secure throughout its range and provincially ranked rare in the province.
Leucophysalis grandiflora	Large White-flowered Ground-cherry	Globally ranked widespread, abundant and apparently secure, but status is uncertain throughout its range and provincially ranked uncommon in the province.
Liparis loeselii	Yellow Twayblade	Globally ranked demonstrably widespread, abundant and secure throughout its range and provincially ranked widespread, abundant and apparently secure to uncommon in the province.
Listera auriculata	Auricled Twayblade	Globally ranked widespread, abundant and apparently secure to uncommon throughout its range and provincially ranked very rare in the province.
Malaxis monophyllos	White Adder's-mouth	Globally ranked demonstrably widespread, abundant and secure throughout its range and provincially ranked rare, but status is uncertain in the province.
Malaxis unifolia	Green Adder's-mouth	Globally ranked demonstrably widespread, abundant and secure throughout its range and provincially ranked rare, but status is uncertain in the province.
Nymphaea odorata	Fragrant Water-lily	Globally ranked demonstrably widespread, abundant and secure throughout its range and provincially ranked rare in the province.
Onoclea sensibilis	Sensitive Fern	Globally ranked demonstrably widespread, abundant and secure throughout its range and provincially ranked widespread, abundant and apparently secure to uncommon in the province.
Parietaria pensylvanica	American Pellitory	Globally ranked demonstrably widespread, abundant and secure throughout its range and provincially ranked widespread, abundant and apparently secure in the province.
Pellaea glabella ssp. occidentalis	Cliff-brake	Globally ranked demonstrably widespread, abundant and secure throughout its range, including its subspecies and provincially ranked rare in the province.
Plantago maritima	Seaside Plantain	Globally ranked demonstrably widespread, abundant and secure throughout its range and provincially ranked rare in the province.
Platanthera lacera	Fringed Orchid	Globally ranked demonstrably widespread, abundant and secure throughout its range and provincially ranked rare in the province.
Platanthera orbiculata	Round-leaved Bog Orchid	Globally ranked demonstrably widespread, abundant and secure throughout its range and provincially ranked uncommon in the province.
Potamogeton strictifolius	Straightleaf Pondweed	Globally ranked demonstrably widespread, abundant and secure throughout its range and provincially ranked uncommon in the province.
Pyrola americana	Round-leaved Pyrola	Globally ranked demonstrably widespread, abundant and

Scientific Name	Common Name	Rank
		secure throughout its range and provincially ranked rare in the province.
Rhynchospora alba	White Beakrush	Globally ranked demonstrably widespread, abundant and secure throughout its range and provincially ranked uncommon, but status is uncertain in the province.
Rhynchospora capillacea	Horned Beakrush	Globally ranked widespread, abundant and apparently secure throughout its range and provincially ranked rare in the province.
Taxus canadensis	Canada Yew	Globally ranked demonstrably widespread, abundant and secure throughout its range and provincially ranked uncommon in the province.
Thalictrum sparsiflorum	Few-flowered Meadow-rue	Globally ranked demonstrably widespread, abundant and secure throughout its range and provincially ranked uncommon to rare in the province.
Vaccinium caespitosum	Dwarf Bilberry	Globally ranked demonstrably widespread, abundant and secure throughout its range and provincially ranked rare in the province.
Viola selkirkii	Long-spurred Violet	Globally ranked demonstrably widespread, abundant and secure throughout its range, but status is uncertain and provincially ranked rare in the province.
Woodsia glabella	Smooth Woodsia	Globally ranked demonstrably widespread, abundant and secure throughout its range and provincially ranked rare in the province.
Vertebrate Animal		
Aechmophorus occidentalis	Western Grebe	Globally ranked demonstrably widespread, abundant and secure throughout its range and provincially ranked widespread, abundant and apparently secure for its breeding status in the province.
Ardea herodias	Great Blue Heron	Globally ranked demonstrably widespread, abundant and secure throughout its range and provincially ranked widespread, abundant and apparently secure and demonstrably widespread, abundant and secure for its breeding status in the province.
Aythya marila	Greater Scaup	Globally ranked demonstrably widespread, abundant and secure throughout its range and provincially ranked demonstrably widespread, abundant and secure for its breeding status in the province.
Charadrius melodus	Piping Plover	Globally ranked uncommon throughout its range and provincially ranked very rare for its breeding status in the province.
Coregonus zenithicus	Shortjaw Cisco	Globally ranked uncommon throughout its range and provincially ranked uncommon in the province.
Haliaeetus leucocephalus	Bald Eagle	Globally ranked widespread, abundant and apparently secure throughout its range and provincially ranked widespread, abundant and apparently secure and demonstrably widespread, abundant and secure for its breeding status in the province.
Ichthyomyzon castaneus	Chestnut Lamprey	Globally ranked widespread, abundant and apparently secure throughout its range and provincially ranked widespread, abundant and apparently secure to uncommon in the province.
Macrhybopsis storeriana	Silver Chub	Globally ranked demonstrably widespread, abundant and secure throughout its range and provincially ranked uncommon in the province.
Myotis lucifugus	Little Brown Myotis	Globally ranked demonstrably widespread, abundant and secure throughout its range and provincially its non breeding status is ranked rare in the province and its breeding status is ranked demonstrably widespread, abundant and secure in the province.
Nycticorax nycticorax	Black-crowned Night-heron	Globally ranked demonstrably widespread, abundant and secure throughout its range and provincially its breeding status is ranked widespread, abundant and apparently secure to uncommon in the province.
Pelecanus erythrorhynchos	American White Pelican	Globally ranked uncommon throughout its range and provincially its breeding status is ranked widespread, abundant and apparently secure to uncommon in the province.
Phalacrocorax auritus	Double-	Globally ranked demonstrably widespread, abundant and

Scientific Name	Common Name	Rank
	crested Cormorant	secure throughout its range and provincially its breeding status is ranked demonstrably widespread, abundant and secure in the province.
Rangifer tarandus caribou	Caribou	Globally ranked demonstrably widespread, abundant and secure throughout its range including its subspecies and provincially ranked widespread, abundant and is apparently secure in the province.
Sterna caspia	Caspian Tern	Globally ranked demonstrably widespread, abundant and secure throughout its range and provincially its breeding status is ranked widespread, abundant and is apparently secure to uncommon in the province.
Sterna forsteri	Forster's Tern	Globally ranked demonstrably widespread, abundant and secure throughout its range and provincially its breeding status is ranked widespread, abundant, and apparently secure in the province.
Strix varia	Barred Owl	Globally ranked demonstrably widespread, abundant and secure throughout its range and provincially ranked uncommon to rare in the province.
Churchill River Upland		
Fungus		
Leptogium rivulare	Flooded jellyskin	Globally and provincially the species is not ranked; a rank has not yet been assigned or the species has not been evaluated.
Vascular Plant		
Carex michauxiana	Long-fruited Sedge	Globally ranked demonstrably widespread, abundant and secure throughout its range and provincially ranked rare in the province.
Carex oligosperma	Few-fruited Sedge	Globally ranked demonstrably widespread, abundant and secure throughout its range and provincially ranked uncommon in the province, but status is uncertain.
Carex pauciflora	Few-flowered Sedge	Globally ranked demonstrably widespread, abundant and secure throughout its range and provincially ranked uncommon in the province.
Dryopteris fragrans	Fragrant Shield Fern	Globally ranked demonstrably widespread, abundant and secure throughout its range and provincially ranked uncommon to widespread, abundant and apparently secure throughout the province.
Gymnocarpium jessoense	Northern Oak Fern	Globally ranked demonstrably widespread, abundant and secure throughout its range and provincially ranked uncommon to widespread, abundant and apparently secure throughout the province.
Gymnocarpium robertianum	Limestone Oak Fern	Globally ranked demonstrably widespread, abundant and secure throughout its range and provincially ranked very rare throughout the province.
Juncus stygius ssp. americanus	Moor Rush	Globally ranked demonstrably widespread, abundant and secure throughout its range including its subspecies and provincially ranked very rare in the province, but status is uncertain.
Nymphaea tetragona	Small Water-lily	Globally ranked demonstrably widespread, abundant and secure throughout its range and provincially ranked rare throughout the province.
Platanthera orbiculata	Round-leaved Bog Orchid	Globally ranked demonstrably widespread, abundant and secure throughout its range and provincially ranked uncommon in the province.
Rhynchospora alba	White Beakrush	Globally ranked demonstrably widespread, abundant and secure throughout its range and provincially ranked uncommon in the province, but status is uncertain.
Woodsia alpina	Northern Woodsia	Globally ranked widespread, abundant and apparently secure throughout its range and provincially ranked very rare in the province.
Woodsia glabella	Smooth Woodsia	Globally ranked demonstrably widespread, abundant and secure throughout its range and provincially ranked rare in the province.
Woodsia oregana ssp. cathcartiana		Globally ranked demonstrably widespread, abundant and secure throughout its range including its subspecies and

Scientific Name	Common Name	Rank
		provincially ranked very rare in the province.
Vertebrate Animal		
Coregonus zenithicus	Shortjaw Cisco	Globally ranked uncommon throughout its range and provincially ranked uncommon in the province.
Rangifer tarandus caribou	Caribou	Globally ranked widespread, abundant and apparently secure throughout its range including its subspecies and provincially ranked widespread, abundant, and apparently secure in the province.

Source: Manitoba Conservation Data Centre – Churchill River Upland and Mid-Boreal Lowland (Manitoba Conservation 2012 b)

The vegetation within the Project Region is typical for these Ecoregions. In the mature upland area, Dwarf Bilberry (*Vaccinium caespitosum*) and Sedge *(Carex sp.*) were found in the Project Area but not observed on the Project Site. For the Mid-boreal Lowlands, Dwarf Bilberry is globally listed in the MCDC rankings as demonstrably widespread, abundant and secure throughout its range, though it is ranked as rare in the Province. Located in the Mid-Boreal Lowands and Churchill River Upland Ecoregions, various *Carex sp.* are ranked by MCDC as globally demonstrably widespread, abundant and secure throughout their ranges. The Province of Manitoba ranks them as rare to uncommon, though status in the province is uncertain (Manitoba Conservation 2012 b). As confirmed through field observations conducted in 2010 and 2011, the wildlife habitats within the Project Area were considered to be typical for the region, with no unique or rare habitats encountered.

4.12 Socio-Economic Environment

4.12.1 Protected Areas

The Project Site is located within the southern region of the Grass River Provincial Park (see **Figure 1**). The Park encompasses an area of 2,279 km^2 and is characterized by the rivers and lakes of the Grass River watershed. Defined as a Natural Park, its stated purpose is:

> *To preserve areas that are representative of the Churchill River Upland portion of the Precambrian Boreal Forest Natural Region, and the Mid-Boreal portion of the Manitoba Lowlands Natural Region and accommodates a diversity of recreational opportunities and resource use* (Manitoba Conservation n.d.).

The park is intended to:

- *Preserve woodland caribou habitat and the high water quality of the Grass River;*
- *Promote canoeing, camping and fishing opportunities, and permit related facilities and services;*
- *Promote public appreciation and education of the cultural and natural history of the Grass River; and*
- *Accommodate commercial resource uses such as mining, where such activities do not compromise the other park purposes.* (Manitoba Conservation n.d.)

The upper Grass River Watershed, which includes the Grass River Provincial Park, was designated a High Quality Water by the CCME and *Manitoba Water Quality Standards, Objectives, and Guidelines* (MWQSOG) (Williamson 2002). Although forestry operations are not currently active in this particular section of the Park, historic areas of clear cutting were observed and are under a process of natural re-growth. There also is a history of mining activity in the Park, including operation of the former Spruce Point Mine on the south shore of Reed Lake from 1981 to 1992. Spruce Point deposits were recently drilled in 2012 as potential targets for Rockcliff Resources Inc (Rockcliff Resources Inc. 2012).

Cormorant Provincial Forest is located approximately 30 km south of the Project Site and is the northern most Provincial Forest in Manitoba. This provincial forest was established in 1947 and covers an area of 1,479 km^2

including Clearwater Lake Provincial Park. Provincial forests are Crown Lands managed by Manitoba Natural Resources (Manitoba Conservation).

Clearwater Lake Provincial Park is located approximately 60 km southwest of the Project Site and covers an area of 593 km^2. This Provincial Park is classified as a Natural Park as its purpose is to preserve natural areas that represent the Mid-Boreal portion of the Manitoba Lowlands. (Manitoba Conservation)

The Saskeram Wildlife Management Area (WMA) is located approximately 85 km southwest of the proposed Reed Mine site and occupies an area of 958 km^2. The Tom Lamb WMA is located approximately 45 km south-southeast of the proposed Reed Mine site and occupies an area of 2,083 km^2. Both of these WMAs encompass a large portion of the Saskatchewan River Delta. These areas provide breeding and staging areas for waterfowl and habitat for moose, wolves, black bears and furbearers. (Manitoba Conservation b n.d.)

4.12.1.1 Heritage Resources

A request for information about the presence of, or potential for heritage resources (including sites of cultural, traditional, historic and/or scientific significance) in the area was submitted to Heather Docking on June 29, 2011 at the Historic Resources Branch (HRB) of Manitoba Culture, Heritage and Tourism. HRB responded via email on June 30, 2011 indicating there were no archaeological resources at all within the Project Region. A copy of the correspondence is provided in **Appendix D.**

The closest heritage resources are located at Tramping Lake, approximately 30 km east of the Project Site. Tramping Lake is the site of one of Manitoba's largest known concentrations of Aboriginal pictographs. At the narrows of Tramping Lake, on a granite outcropping that dominates the shore in the southeastern part of the Grass River waterway, ancient artwork appears on a series of 14 rock faces. These paintings of deer, bison, moose, birds, fish, snakes, and humans are thought to have been created 1,500 to 3,000 years ago by the Algonkian-speaking ancestors of the Cree and Ojibway First Nations (Great Canadian Rivers 2007).

4.12.2 Economy

4.12.2.1 Town of Snow Lake

According to the 2011 census data from Statistics Canada, Snow Lake has a population of 723 with the majority of these residents employed at, or supported by, the mines located throughout the area. Many other Snow Lake residents are employed in the industries and services that support the region's mining operations. (Census Profile 2012 a)

The Snow Lake area has had an active mining history for more than 50 years. HBMS has played an integral part in this history since the late 1950's by operating nine mines in the area including Photo Lake, Rod, Chisel Lake, Stall Lake, Osborne Lake, Spruce Point, Ghost Lake, Anderson Lake and in current production at Chisel North Mine. In addition to providing employment to Snow Lake residents, HBMS has greatly contributed financially to the essential developments of Snow Lake. A total of $2.8 million has been committed from HBMS to assist in the construction of the Snow Lake Waste Water Treatment Plant and $100,000 toward the Snow Lake Community Hall Roof Project (Hudbay 2011). Also, HBMS has agreed to cover the cost up to $50,000 for the proposed business plan for the Snow Lake Airport. HBMS has facilitated development by others in areas within the Town of Snow Lake, in which it holds mineral rights, including with respect to the Manitoba Hydro Easement Applications for Bipole III Transmission Project, applications for cottage Subdivisions on Herblet Lake and Manitoba Infrastructure and Highways proposed re-alignment of PR 392 (Hudbay 2012).

In addition to mining activities, extensive forestry operations have occurred within the region and surrounding area, with wood sent to the pulp and paper mill operation in The Pas, Manitoba. Trapping and hunting are popular activities in this region.

4.12.2.2 City of Flin Flon

According to the 2011 census data from Statistics Canada, the City of Flin Flon has an approximate population of 5,592 people (Statistics Canada 2012 b). The City of Flin Flon is the main mining community in northwestern Manitoba and northeastern Saskatchewan. Flin Flon is located just over 800 km northwest of Winnipeg, Manitoba, and 120 km west of the Town of Snow Lake. The community occupies portions of both Manitoba and Saskatchewan.

Since 2010 alone, HBMS has donated approximately $781,000 to support programs in the Flin Flon area, in addition to providing in-kind services and offering use of HBMS facilities for community events. Many employees also volunteered their time to community projects such as building a judging platform for the skating club, science fair judging, parade float preparation and sign-making.

In addition to mining, Flin Flon has a strong tourism industry which includes hunting, fishing, camping, and boating.

4.12.3 Community Infrastructure

4.12.3.1 Town of Snow Lake

The Town of Snow Lake is situated mid-way between Thompson, Flin Flon and The Pas. Year-round road access is provided to Snow Lake by PR 392. The community is serviced directly by Manitoba Hydro transmission lines and has telephone access through Manitoba Telecom Services Inc. The drinking water source is Snow Lake, with treatment provided in a water treatment plant located in the Town of Snow Lake.

In 2011, HBMS announced a $2 million commitment to the Town of Snow Lake to assist in funding the municipality's new waste water treatment plant, and a $100,000 contribution towards repair of the roof of the Snow Lake Community Hall.

4.12.3.2 City of Flin Flon

Access to Flin Flon is along paved PTH 10 from The Pas and Southern Manitoba, PTH 39 from Snow Lake and Thompson, and Highway 106 from Saskatchewan. Flin Flon is serviced directly by Manitoba Hydro transmission lines and has telephone and cellular access through Manitoba Telecom Services Inc.

4.12.4 Community Services

4.12.4.1 Town of Snow Lake

The Town of Snow Lake has various community services including: a health facility that is staffed by two doctors, a grocery store, two hotels/motels, two service stations, a hockey arena, a curling rink and a nine-hole golf course. There is an un-serviced gravel municipal airstrip located approximately 63 km northeast of the Project Site, along the PR 393, that is designed to accommodate air ambulances for medical evacuations. Other services include an RCMP station and a volunteer fire department. There are also numerous recreational opportunities including camping, hiking trails, fishing, hunting, snowmobiling and all-terrain vehicle trails. (Snow Lake 2012)

4.12.4.2 City of Flin Flon

The City of Flin Flon operates an airport located 20 km southeast of the city near Baker's Narrows. Many other facilities and services are located in Flin Flon, including the Flin Flon General Hospital, five doctors, two dentists, two grocery stores, two daycares, a fire hall and a police/RCMP station, along with recreational facilities, such as a hockey arena, curling rinks, a drive in theatre, a golf course, a public swimming pool and numerous sports fields. There are two high schools located in Flin Flon, Hapnot Collegiate and Many Faces Education Centre. (The City of Flin Flon 2012)

4.12.5 Personal, Family, and Community Life

4.12.5.1 Town of Snow Lake

Some of the larger community events held in Snow Lake include the Winter Whoot Festival and the Sno-Drifters Radar Runs. Other events include Bingo and Texas Hold'em, held at The Royal Canadian Legion #241. (Snow Lake 2012)

4.12.5.2 City of Flin Flon

Various community events are held in Flin Flon during the year. Some of these include the Friendship Center Sled Dog Races, Baker's Narrows Day, Phantom Lake Father's Day Picnic and the Trout Festival. Other smaller events include a Spring Breakout Program, Canada Health Day Event, Terry Fox Run and the Christmas Family Event (The City of Flin Flon 2012).

4.12.6 Regional Resource Use

4.12.6.1 Trappers

The Manitoba Conservation office in Snow Lake has confirmed that there is one registered trap line in the Project Area, operated by Kirk Melnick. (Snow Lake Conservation District Office 2011)

4.12.6.2 Cottages or Remote Residences

Reed Lake does not have any cottage subdivisions. However, there are three Provincial campgrounds located on Reed Lake within the Grass River Provincial Park. First Cranberry Lake (45 km west) and Wekusko Lake (50 km east), both outside the Project Region, are the lakes with cottage subdivisions that are closest to the Project Area.

4.12.6.3 Lodge Owners

There are two lodges in operation on Reed Lake and four additional lodges in the Snow Lake area. Petersons' Reed Lake Lodge and Grass River Lodge are both in operation on Reed Lake. Peterson's Reed Lake Lodge is located on Fourmile Island and is only accessible by boat, while the Grass River Lodge is located on the south shore of Reed Lake adjacent to the Provincial campground. The Grass River Lodge has outpost cabins on Dolomite Lake (13 km southeast of the proposed Reed Mine site) and Moody Lakes (57 km northwest of the proposed Reed Mine site). The Wekusko Falls Lodge is located on Trampling Lake, but utilizes Reed Lake and its surrounding area for activities such as fishing and hunting. The Tawow Lodge Ltd. (Herb Lake Landing) is located approximately 56 km east of the Project Site. The Burntwood Lodge is a fly-in fishing lodge located on Burntwood Lake and is estimated to be approximately 85 km north of the Project Site. The Diamond Willow Inn & Willow House is located in the Town of Snow Lake at 200 Lakeshore Drive and is approximately 50 km northeast of the Project Site.

4.12.6.4 Snowmobilers

There are no known snowmobile trails located within the Project Area.

4.12.6.5 Forestry

As indicated in **Section 4.12.1**, the Cormorant Provincial Forest is located approximately 30 km southwest of the Project Site and covers an area of 1,479 km^2. Provincial forests are Crown lands managed by Manitoba Natural Resources on a sustainable yield basis. A licence or permit allows harvesting of trees on Crown lands and also indicates the quantity of each type of trees that can be harvested. In accordance with their Forest Management Licenses, present-day, large-scale forestry companies must regenerate forest lands that they are harvesting. Individuals and small companies pay a forest renewal fee to cover reforestation. (Manitoba Conservation and Water Stewardship, 2012)

Tolko Industries Ltd. (Manitoba Solid Wood Division, Woodlands), located in The Pas, Manitoba has three Forest Sections in and around the Project Region (Highrock, Nelson River and Saskatchewan River) where wood is harvested. These Forest Sections include areas surrounding Snow Lake, Flin Flon and Grass River Provincial Park. (Tolko Industries Ltd. 2012)

4.12.7 First Nations

The Opaskwayak Cree Nation (OCN) is located approximately 92 km southwest of the proposed Reed Mine at the community of Opaskwayak, near The Pas. According to the 2011 census data from Statistics Canada, OCN had a population of 2,714 (Statistics Canada 2012 c). The OCN Chief and Council mandated Paskwayak Business Development Corporation (PBDC) in 1987 to promote economic development for OCN members. Located in the Otineka Mall in The Pas, the PBDC plans and undertakes investment initiatives and long-term growth of business portfolios including retail outlets (The Pas IGA, Otineka Mall, Dollar Store and Food Town), property management, and other businesses (Kikiwak Inn, OCN Shell and Redi-Mix). Various community events are held each year such as the annual tradition of Celebration of Life and Customs in Native Song and Dance and the Opaskwayak Indian Days including a parade, traditional dress contest and Foot Races (Opaskwayak Cree Nation 2007).

The Mosakahiken Creen Nation (MCN) at Moose Lake is located approximately 100 km south of the Project Site. The registered population as of November 2012 is 2,001 (Aboriginal Affairs and Northern Development Canada 2012 a). MCN has an elected mayor and council under the *The Northern Affairs Act* and have represented MCN since 1971 (Nor-man Regional Health Authority n.d.). In the fall of 2010, MCN opened a new 5,110 m^2 school for students in kindergarten to grade 12. The school is named Frontier Mosakahiken School and can accommodate 650 students (Manitoba Conservation 2010).

Mathias Colomb Cree Nation (MCCN) at Pukatawagan is located approximately 136 km north of the Project Site. As of December 31 2003, MCCN had a population of 2,977 (Northwest CFDC n.d.). The community of Pukatawagan is connected by gravel road to a train station and an airport. An RCMP detachment is located in Pukatawagan and has one sergeant, one corporal and five constables. The community has a Northern Store, Akochikan Co-op, airport, Co-op Gas Depot, Nursing Station, Crisis Centre, Catholic Church and the CFPX Radio Station (Hillman 2007).

Nisichawayasihk Cree Nation (NCN) at Nelson house is located approximately 173 km northeast of the Project Site. As of 2011, the population of Nelson house was 2,399 (Statistics Canada 2012 e). NCN is located 10 km south of PTH 391 and is accessible by an all-weather road. Twice daily, there is Greyhound bus service to Thompson and a taxi service is also available in the community. NCN has a nursing station, school, teacherage, Northern Store, an RCMP detachment and emergency fire and medical services. The Wuskwatim Generating Station, a 200 MW hydroelectric generating station on the Burntwood River, has been a large economic contributor to NCN. NCN has established the Taskinigahp Power Corp (TPC) to act as a partner with Manitoba Hydro in the Wuskwatim Power Limited Partnership. Recreation and traditional economy in the community largely consists of fishing, hunting and trapping (Nisichawayasihk Cree Nation n.d.).

Cross Lake Cree Nation at Cross Lake is located approximately 185 km east of the Reed Mine Site. As of 2012, there were 5498 residents on Cross Lake (Aboriginal Affairs and Northern Development Canada 2012 b). The community consists of a Chief and Council, Welfare Office, Band and Chief Constables, RCMP, Fire Hall, car repair shops, Early Childhood Education Centre, Otter Nelson River High School and Elementary School, Mikisew Middle School, Aboriginal Head Start, Housing Department, Pharmacy, Home Care services and dentists, among other services (411.ca 2012).

Norway House Cree Nation at Norway House is located approximately 195 km southeast of the Project Site. In 2011, Norway House had a population of 4,758 (Statistics Canada 2012 d). Various community events are held each year, including the annual Treaty and York Boat Days which has been held in the first week of August since 1973. Activities include York Boat races, volleyball, mini soccer tournament, adult coed voyageur canoe – 1000 m sprint, parade and a square dance competition (Norway House Cree Nation 2007). Businesses in Norway House include Northern Stores, Royal Bank, The York Boat Diner, Norway House Fisherman's Co-op, Hospital Pharmacy, Mowat Backhoe Rentals, West Island Cottages, Grey Goose Bus Lines and the York Boat Inn (Norway House 2010).

5. Environmental Effects Assessment and Mitigation Measures

5.1 Environmental Assessment Methods

This section contains the results of the environmental assessment.

Applying professional judgement and a thorough understanding of the different components of the proposed project (outlined in **Section 2** of this application), AECOM determined the potential for each component of the proposed project to interact with each environmental component (presented in **Table 3-1** above). The assessment includes any effects on social components resulting from residual adverse environmental effects.

As indicated in **Section 3**, the assessment takes into account mitigation measures that have been incorporated into the proponent's proposed plan, as well as environmental protection practices and procedures included in the proponent's standard of operation (such as compliance with ISO certified safety and environmental management systems). The assessment includes AECOM's assessment of the sufficiency of such measures and also considers and makes recommendations for any additional measures which, in our view, would be advisable. The assessment of significance of any residual effects is based on the magnitude, spatial scope, duration, frequency and reversibility of that effect.

Environmental effects that may be caused as a result of accidents of malfunctions are discussed separately in **Section 5.12**.

Table 5-1 below explains the technical terms used in the effects assessment.

Table 5-1: Terms Used in the Effects Assessment

Project Phase:	Refers to the phase of the project as pre-production, production or closure.
Potential Effect:	Potential change that the project may cause in the environment
Magnitude of Effect:	Refers to the estimated percentage of population or resource that may be affected by activities associated with the pre-production, production and closure phases of the Reed Mine. Where possible and practical, the population or resource base has been defined in quantitative or ordinal terms (e.g., hectares of soil types, units of habitat). Magnitude of effect has been classified as less than (<) 1%, 1% to 10%, or greater than (>) 10% of the population or resource base. Where the magnitude of an effect has been defined as virtually immeasurable and represents a non-significant change from background in the population or resource, the effect is considered negligible. An exception to this is in terms of potential human health effects where, for example health issues due to water-borne diseases amounting to 1% of the population being affected would still be considered major.
Direction of Effect:	Refers to whether an effect on a population or a resource is considered to have a positive, adverse or neutral effect.
Duration of Effect:	Refers to the time it takes a population or resource to recover from the effect. If quantitative information was lacking, duration was identified as short-term (<1 year), moderate term (1 to 10 years) and long term (>10 years).
Frequency:	Refers to the number of times an activity occurs over the project phase, and is identified as once, rare, intermittent, or continuous.
Scope of Effect:	Refers to the spatial area potentially affected by the effect and was rated as Project Site, Project Area or Project Region as defined in **Section 3**. Where possible, quantitative estimates of the resource affected by the effect were provided.
Reversibility:	Refers to the extent to which an adverse effect is reversible or irreversible over a 10-year period.

Project Phase:	Refers to the phase of the project as pre-production, production or closure.				
Residual Effect:	A qualitative assessment of the residual effect remaining after employing mitigation measures				
Magnitude of Effect	**Direction of Effect**	**Duration of Effect**	**Frequency**	**Scope of Effect**	**Reversibility of Effect**
Negligible (immeasurable)	Positive	Short term (< 1 year)	Once	Project Site	Reversible
Minor (<1%)	Adverse	Moderate (1 to 10 years)	Rare	Project Area	Irreversible
Moderate (1 to 10%)	Neutral	Long term (>10 years)	Intermittent	Project Region	
Major (>10%)			Continuous		

5.2 Topography

Sources of changes to site topography include activities such as clearing, blasting, levelling, trenching or stockpiling materials. Since the Reed Mine site has already been levelled and cleared and the portal trench has been developed as a part of the AEP, no additional effects are anticipated during the pre-production phase of the project.

During production, there will be stockpiling of both waste rock and ore on site as described in **Section 2.4** above.

As described in **Section 2.4.4**, waste rock will be stockpiled until it is needed underground as mine backfill. As outlined in **Table 2-1**, it is expected that waste rock will be stockpiled on surface between 2012 and 2014, for a total period of up to three years. The topography will begin returning to pre-stockpiling conditions in and after 2014, as the waste rock is returned underground. During the years 2014 to 2018, additional backfill material will be brought and stockpiled for mine backfill, with the entire stockpile returned underground at the end of production.

Ore will be stockpiled on site only until it can be trucked to Flin Flon for processing, with a maximum expected time on site of three days. The ore storage pad will stay on site throughout the production phase of the project.

Once the production phase ends, the closure phase will include restoration of any changes to topography of the site to match the pre-production condition of the surrounding area to the extent practical. Therefore, effects on topography from stockpiling waste rock and ore are assessed to be negligible.

5.3 Soil

5.3.1 Acid Rock Drainage

PAG waste rock has the potential, when exposed to air and water, to create acid rock drainage (ARD). ARD also has the potential to release metals from the waste rock or dust from the waste rock which can increase metal concentration in soil. ARD and elevated metal concentrations can potentially cause a decline in soil quality, which can in turn affect vegetation, groundwater (seepage), or surface water (runoff).

As outlined in **Section 2.4.4**, HBMS has incorporated the following measures designed to prevent generation of ARD:

- The waste rock storage pad is multi-layered and composed of NAG rock (limestone boulders, sand and crushed limestone filter), which will filter and neutralize any ARD that may be generated by the stockpile.

- Waste rock will be placed on the pad in layers. A layer of crushed limestone will be placed in between two layers to act as a neutralizing agent.
- Waste rock will be used as mine backfill to limit surface storage and hence potential for ARD.

In addition, HBMS will continue to monitor the stockpile for any signs of potential ARD on site.

In our view, the measures identified above are sufficient to minimize the generation of ARD to the extent necessary, and therefore any consequential effects on soil quality are assessed to be negligible.

5.3.2 Materials and Waste Management

Wastes such as sewage from the holding tanks, used oils, rags, drums and miscellaneous garbage can potentially affect soil quality, which can in turn affect other environmental components (vegetation, groundwater, surface water). To prevent adverse effects on soil quality from wastes, HBMS will undertake the following waste management practices:

- Wastes generated on surface will be collected in garbage bins maintained at specific locations throughout the Reed Mine site. The bins will be emptied on a regular basis for recycling or disposal at a licensed waste disposal facility.
- Waste oils and other hazardous materials generated underground will be returned to surface using containers specifically designed for this purpose.
- Any hazardous materials (waste oil, lubricants, or petroleum products) will be removed by a licensed hazardous materials handler for appropriate disposal or recycling.

In our opinion the measures listed above will be sufficient and therefore effects on soil quality from wastes are assessed to be negligible.

5.3.3 Erosion

High wind and precipitation events can lead to soil erosion on site, which can in turn affect other environmental components (air quality through dust generation, water quality through sediment loading or vegetation through dust deposition). However, the Reed Mine site has already been cleared, levelled and covered with crushed limestone as a part of the AEP. The pre-production and production phases will not include any activities likely to result in soil erosion.

Closure activities will involve application of soil to disturbed areas, and re-seeding the site with species native to the area.

The following measures will minimize soil erosion and any consequent effects on other environmental components:

- The treed buffer around the Reed Mine site and between the mine site and PTH 39 will be maintained to minimize erosion due to wind.
- The site will be contoured to match the surrounding topography to the extent possible.
- Re-vegetation will occur as soon as practical following application of soil.
- Success of re-vegetation efforts will be monitored until vegetation has re-established with additional re-vegetation activities to occur as required.

The closure measures outlined for this project are assessed to be sufficient to mitigate soil erosion. Therefore, no residual adverse effects on soil are anticipated.

5.4 Air

5.4.1 Dust

Dust and particulate matter can cause deterioration of air quality with consequent effects on human health (respiratory concerns and impaired visibility), vegetation (decline in growth potential due to deposition), and soil quality (discussed in **Section 5.3**). Sources of dust include activities such as blasting, clearing, leveling, crushing, traffic on roads, stockpiling materials, etc. Dust will occur primarily during summer and fall, with greater likelihood for an increase in dust during dry and windy conditions.

Since all clearing, leveling and surface blasting has been completed as a part of the AEP, potential for dust during the pre-production phase is limited to vehicular use of the site to undertake minor upgrades to the AEP infrastructure. There will be no crushing of ore on site, and therefore no dust will be generated in that manner.

During the production phase, dust will be generated from vehicle and equipment movement on site and along the Reed Mine access road. **Section 2.4.11** outlines traffic volumes expected during the production phase. Since PTH 39 is a paved road, dust generation from haul trucks along this highway is expected to be minimal.

In addition to the haul trucks along PTH 39, other vehicles, such as rock trucks, will operate on site, hauling ore and waste rock from underground for storage on the ore and waste rock storage pads.

During closure, activities such as leveling, contouring, excavating and hauling materials and soils to the site will generate some dust.

To reduce dust generation at the Project Site and within the Project Area, the following mitigation measures will be implemented:

- If required, dust suppression activities such as the use of approved dust control agents, will be undertaken for the Reed Mine access road.
- Both the Reed Mine site and access road have speed limits (20 km/hr on site and 40 km/hr on access road), which will continue to be imposed.
- Ore trucks going to Flin Flon will be covered to minimize dust coming off loads.

The mitigation measures proposed above are judged to be sufficient to mitigate any adverse effects due to dust during the production and closure phases. Residual effects on air quality are therefore assessed to be negligible.

5.4.2 Emissions

Exhaust emissions from vehicles and equipment can cause deterioration in air quality. During pre-production, emissions will be generated during delivery of materials required for minor infrastructure upgrades. During closure, emissions will be generated during hauling, excavating, grading, and placing materials. Approximately five pieces of equipment (back hoe, haul trucks, and miscellaneous equipment) are anticipated to be required for closure-related activities. Emissions from these are anticipated to be limited to the Project Site and Project Area and mainly occur during summer months over the 2-3 years during which closure activities are being undertaken.

The following mitigation measures will be implemented:

- Vehicles and equipment will be well maintained
- Vehicle idling will be kept to a minimum

During production, sources of exhaust emissions include: vehicle and equipment use on surface, vehicle and equipment use underground, propane combustion, and diesel generators on site. As indicated in **Section 2.4.11**, it is expected that a maximum of 45 vehicles per day will access PTH 39. According to Manitoba Infrastructure and Transportation (MIT), the annual average daily traffic flow (AADT) on PTH 39 ranges from 310 to 390 vehicles per day (Manitoba Infrastructure and Transportation 2012). The additional traffic represents approximately 23-29% increase along PTH 39, but a fairly small increase (approximately 3.6% based on AADT flow of 2490 vehicles per day) in the City of Flin Flon. While the increase in traffic along PTH 39 is considered major (higher than 10%), exhaust emissions as a result of this increase are assessed to be insignificant in relation to air quality in the Project Region. The ore trucks and vehicles used for the Reed Mine will comply with Environment Canada's *On-Road Vehicle and Engine Emission Regulations* as required.

The second source of exhaust emissions is mining equipment used underground. The number of vehicles and equipment used underground will vary during the life of the mine. **Section 2.4.6** and **Figure 10** provide information on the ventilation system for the Reed Mine. This ventilation system uses propane heaters to heat the fresh air prior to pumping it underground. This combustion process will generate pollutants such as nitrogen oxides (NOx), carbon monoxide, sulphur dioxide, particulate matter, and greenhouse gases (discussed separately in **Section 5.5**). However, in order to ensure good air quality underground (and hence mitigate against any adverse air quality effects), two design measures have been incorporated in the project:

- The ventilation system underground has been equipped with low NOx burners, and has been designed to provide fresh air, taking into account all emissions from underground vehicles and mine equipment.
- As an additional safety measure, employees working underground will be equipped with handheld carbon monoxide monitors.

These design measures are judged to be sufficient to mitigate any adverse air quality effects during the production phase of the proposed project.

Following production, air quality underground and on surface is expected to return to pre-project conditions. Therefore, potential residual effects are considered reversible and not significant.

5.4.3 Noise and Vibration

An increase in noise levels at the Project Site and within the Project Area could potentially affect people, wildlife and infrastructure (from vibration) in the surrounding area. Potential effects of noise on wildlife are discussed in **Section 5.9.1.**

Since the pre-production phase involves very minimal construction activity, noise and vibration levels are not expected to be significant. The closure phase will involve a higher degree of activity and therefore sources of noise would be typical of heavy equipment such as haulage trucks, graders, loaders and excavators, with a majority of closure activities undertaken in summer months following cessation of mining activities at the site.

Other human receptors within the general vicinity of the Project Site include campgrounds and lodges in the Project Area, with the closest campground at Iskwasum (8 km) and Reed Lake (12 km), and the Grass River Lodge (which has outpost cabins on Dolomite Lake – approximately 13 km southeast of Project Site). These receptors are too distant to be affected by noise on the Project Site. Since the City of Flon Flon and the Town of Snow Lake are much further away from the Project Site, human receptors in the two localities are not expected to be impacted by noise from pre-production, production and activities. For these reasons, the focus of the assessment of noise-related effects is for employees on site.

During the production phase, sources of noise include vehicle movement, trucks loading/unloading, ventilation fans, compressors, generators, pumps, emergency generators, and other general equipment use on the mine site. Blasting underground will also contribute to noise as well as vibration at the site.

Mitigation measures that will minimize noise related effects for employees on site include:

- A centralized blasting system will be implemented for both development underground and production rounds. In accordance with applicable regulations, these rounds will be fired only between shifts when all of the employees are accounted for.
- The gensets being used on site are housed in factory designed-built enclosures to minimize noise.
- The permanent ventilation intake on surface has been engineered to be 70 dB at 1 m. The silencer for this equipment is 6.1 m x 3.4 m x 2.1 m in dimensions.
- The main ventilation fan being used for underground operations will be installed below surface at the 60 m level to reduce surface noise.
- HBMS will provide hearing protection as required to ensure employees working on site are protected from noise during production and closure activities.
- All closure activities will be carried out in accordance with the *Workplace Safety and Health Act* and HBMS's OHSAS 18000 certified management system, which will avoid potential effects on health and safety.

Noise levels from vehicular movement along PTH 39 during the production phase would be typical of levels experienced along major roadways and are hence assessed to be insignificant. Based on the remote location of the Project Site, the vegetated nature of the land between the site and PTH 39, and the intermittent nature of noise resulting from project activities, noise levels are not expected to cause disturbance to human receptors off site. The mitigation measures identified above are judged to be sufficient to mitigate for other noise-related effects that the proposed project may cause to employees on site. Therefore, residual effects from noise are assessed to be insignificant. Similarly, given the remoteness of the site, blasting activities underground are not anticipated to affect infrastructure in the area and effects from blasting are therefore assessed to be negligible and insignificant.

5.5 Climate Change

Greenhouse gases (GHGs) contribute to climate change. Typical sources of GHGs such as carbon dioxide, methane and nitrous oxide include: vehicles, diesel construction equipment exhausts (during vehicle movement on site, using equipment on site for excavating, grading and placing materials etc.) and combustion of propane in propane heaters, as noted in **Section 5.4.2**.

Since the pre-production phase involves minimal construction, GHG emissions during this phase are expected to be negligible and hence no mitigation measures are proposed.

Based on the annual fuel consumption for the Reed Mine (outlined above in **Section 2.4.9**), the annual greenhouse gas projection is 13,250 tonnes of CO_2e (HBMS 2012). Using the 20,300,000 tonnes of GHG emissions reported in 2011 for the Province of Manitoba (Environment Canada 2011), an addition of 13,250 tonnes per year represents a negligible increase of 0.065% in GHG emissions. To further minimize the GHG emissions from production activities at the Reed Mine, the following mitigation measures will be implemented:

- Idling at the site will be kept to a minimum (while waiting for trucks to load for haulage for example)
- Vehicles and equipment will be maintained in good working condition

- HBMS is providing an employee shuttle to bring employees on site. This will reduce the number of personal vehicles used during the life of the Mine.

With implementation of the above listed mitigation measures and given the negligible increase in greenhouse gas emissions from the project, the overall residual effect of GHG emissions is assessed to be insignificant.

5.6 Groundwater

For the purpose of this environmental assessment, a distinction has been made between shallow and deep groundwater resources. Shallow groundwater is described as water encountered below the ground surface within the overburden materials which may be affected by surface activities associated with the Project (waste and fuel management and ARD from rock storage). Deep groundwater is described as water encountered below the ground surface within the bedrock, which may be affected by underground mining activities associated with ore extraction (such as use of explosives for blasting and the mine dewatering process).

The following sections describe potential sources of impacts and mitigation measures for deep and shallow groundwater.

5.6.1 Use of Explosives and Other Potential Contaminants

Explosives and other materials, such as fuels and lubricants, used underground have the potential to introduce contaminants, which could cause a decline in the quality of deep groundwater. For instance, blasting will use Ammonium nitrate/fuel oil (ANFO), which is a water soluble material, and as such blast residuals from blasting activities can potentially affect groundwater quality. However, the mining methods used during production will mitigate the risk as follows:

- Any ANFO spillage will be cleaned up immediately before coming in contact with groundwater.
- Groundwater will be pumped to the polishing pond as a part of the mine dewatering process (explained above in **Section 2.4.5**). Therefore, groundwater that may have been contaminated by coming in contact with explosives or other materials will be prevented from re-entering deep bedrock.
- Charges will be designed to be as small as possible to minimize the volume of potential blast residuals.
- In wetter areas, emulsion type explosives will be used to minimize the potential for ammonium nitrate to dissolve in groundwater.

These standard operating measures are judged to be sufficient in mitigating any risk of changes to the quality of deep groundwater.

5.6.2 Mine Dewatering

As described in **Section 2.4.5**, the mine dewatering system has been designed to take into account a maximum potential groundwater inflow of 23 L/s (370 US gpm) (including all inflows for process water, and any groundwater seepage). Based on HBMS experience in the region, it is anticipated that groundwater seepage into the mine underground will be lower than the design inflow rate. The mine dewatering process could potentially create a groundwater depression zone in the area of the Reed Mine, which could in turn affect the quantity of deep groundwater available in the region.

Based on the nature of the topography, bedrock surface and low hydraulic conductivity in the region (described in **Section 4.7.1**), which limits groundwater movement, the potential for creation of this groundwater depression zone is low. Further, deep groundwater in the region is not used as a resource. At closure, flooding of the mine will eliminate the localized depression zone that may have been created.

As part of construction of the trench, a grout curtain was installed around the trench and decline in the shallow groundwater zone. This grout curtain prevents water from entering the mine, and has the secondary benefit of preventing contaminants from entering shallow groundwater.

Based on these reasons, the mine dewatering process is not expected to cause any significant impact on the quantity of groundwater available in the region.

5.6.3 Surface Activities

Activities such as handling fuels and lubricants can potentially affect quality of shallow groundwater. Measures to avoid groundwater effects from leaks and spills are addressed in **Section 5.12.2**.

ARD could potentially also affect groundwater quality (discussed above in **Section 5.3.1**). Since waste rock management practices outlined in that section will be implemented and soil quality around the waste rock pad monitored, no changes to groundwater quality from ARD are anticipated. At closure, the Reed Mine will be allowed to flood, with the underground mine workings acting as a groundwater sink. Flooding of the mine in this manner will prevent generation of ARD underground as oxygen supply will be limited and waste rock filled back in will be submerged.

As indicated in **Section 2.3.1**, the ore storage pad is lined with a geo-synthetic liner, which will prevent any ARD generated from affecting groundwater quality.

HBMS will use groundwater as a source of process water for mining activities and fire protection, as required on site (described in **Section 2.4.4**). This groundwater withdrawal could potentially act as a source of contamination of shallow groundwater in the Project Area.

The following standard operating measures will mitigate the risk for contamination of shallow groundwater:

- No fueling will be done around the groundwater wells.
- Groundwater wells are housed and segregated in the maintenance shop, and installed above grade.
- Any fuel storage tank used on-site will be a self-contained aboveground storage tank (SCAT), and appropriate fueling procedures will be followed.

These measures are judged to be sufficient to mitigate the risk for shallow groundwater contamination.

5.7 Surface Water

Water withdrawal (water quantity), ARD (water quality), waste management (quality), erosion (quality), and storage and handling of materials (water quality) and wastewater disposal (water quality) all have the potential to affect either quality or quantity of surface water.

Since operation of the Reed Mine will not entail any withdrawal of surface water, there is no potential for effects on surface water quantity in the region.

As outlined in **Section 5.3.1**, waste rock management practices will mitigate any potential effects on soil quality due to ARD, thus removing any pathways affecting surface water quality. As indicated in **Section 2.3.1**, the ore storage pad is lined with a geo-synthetic liner, which will prevent any ARD generated from affecting surface water quality.

As outlined in **Section 5.3.2,** by implementing proper waste management measures, it is assessed that surface water quality will not be affected.

As indicated in **Section 5.3.3**., the closure phase will involve re-application of soil, which could potentially erode and consequently affect surface water quality. Implementation of the mitigation measures outlined in **Section 5.3.3** will minimize the potential for soil erosion and therefore any consequential effects on surface water quality.

As described in **Section 2.4.5**, wastewater generated during the production phase of the Reed Mine will include process water and groundwater seepage from underground operations, both of which will be pumped from underground into the polishing pond on surface. This polishing pond discharges to an adjacent marsh located to the south of the site, which eventually drains into Unnamed Lake 3. Water will not be discharged from the polishing pond unless it meets the applicable Tier 1 criteria set out in MWQSOG. Similarly, sewage will continue to be collected in sewage holding tanks, which in turn will be regularly pumped out and trucked to a licensed sewage treatment facility in accordance with *Onsite Wastewater Management System Regulation* (Manitoba Regulation 83/2003).

Ongoing compliance with these regulations is assessed to be acceptable mitigation for any potential effects on surface water quality.

5.8 Protected and Other Flora Species

As noted in **Section 4.11**, the Federally protected Flooded Jellyskin (*Leptogium rivulare*) may occur in the Project Region. However, this lichen species was not observed in the terrestrial surveys conducted for the project. As such, no effects on Flooded Jellyskin are anticipated during the pre-production, production and closure phases of the proposed Reed Copper Project.

Dwarf Bilberry (*Vaccinium caespitosum*) and Sedge *(Carex sp.)* were found in the Project Area but not observed on the Project Site. Since no additional clearing is required during the pre-production or production phases of the project, no effects on these species are expected to occur.

5.8.1 Dust Deposition

As noted in **Section 5.4.1**, dust generated during the life of the mine can potentially adversely affect vegetation in the area by interfering with the photosynthetic ability of vegetation. However, in light of the mitigation measures identified in **Section 5.4.1**, potential residual effects on flora due to dust are assessed to be negligible and not significant.

5.8.2 Re-vegetation

At closure, the Reed mine site will be returned to pre-project conditions to the maximum extent possible. The portal and trench will be filled in with local limestone. Once the areas have been filled in, a clay cover or liner will be placed over the re-sloped portal entrance to prevent groundwater from entering into the opening. Once site infrastructure has been removed and the site has been re-graded, disturbed areas will be re-vegetated with native vegetation species. Scarification of the access road will prevent site access and promote the growth of natural vegetation in the area.

Based on HBMS experience with mine closure in the region, growth of grasses and mosses will be apparent within the first few years following closure, whereas trees and shrubs will take longer to establish through natural succession and may be visible within the 5-10 year period following closure.

It is assessed that re-vegetation as well as natural succession will substantially return the mine site to pre-mining conditions. Therefore, residual effects on vegetation as a result of the proposed Reed Mine are assessed to be negligible and not significant.

5.9 Protected and Other Fauna Species

Clearing (loss of habitat), noise, vehicle collisions (mortality), and light pollution are potential sources of effects on fauna.

As described in **Section 4.11**, the Boreal Woodland Caribou (*Rangifer tarandus caribou*) is a Provincially protected mammal species that is found in the Churchill River Ecoregion. The Federally protected Yellow Rail (*Coturnicops voveboracensis*), which is a bird species, and Monarch (*Danaus plexippus*), which is an anthropod species, may also occur in the Project Region. None of these protected species were observed during the terrestrial surveys conducted for the project. Further, field observations confirmed that the wildlife habitats within the Project Area are typical for the region, with no unique or rare habitats encountered. The habitat available on the Project Site is not expected to support Yellow Rail or Monarch.

HBMS participates in Manitoba Conservation's ongoing large-scale caribou study in Northern Manitoba, including the Reed Project Region, which contributes information used in Manitoba's Conservation and Recovery Strategy for Boreal Woodland Caribou (Government of Manitoba 2005). The strategy document groups Caribou ranges as Low, Medium or High risk, based on levels of disturbance and various other threats for each range. The Reed Mine occurs within the range of the Reed herd, which is ranked as Medium risk.

In 2009 and 2010, the Northwest Region Woodland Caribou Research and Management Committee, with funding from HBMS, collared female boreal woodland caribou on islands of Reed Lake to document areas of use (travel corridors, rutting areas and calving sites). Ongoing monitoring of caribou deaths will continue to contribute to assessment of herd stability. As of September 2012, 40,000 location points have been established and, using telemetry data, two different areas of use on the range have been determined.

The Reed herd Caribou spend the majority of their time on the west side of Reed Lake, which is outside of the Project Region. However, HBMS will continue to participate in ongoing studies in cooperation with Manitoba Conservation.

5.9.1 Loss of Habitat

No habitat of specific or critical value to wildlife was observed at the Project Site (such as calving or over-wintering areas) and, based on site conditions and limited field observations, the Project Area is not expected to contain habitat of critical wildlife value. Although the Reed Mine development has resulted in loss of wildlife habitat (as a result of clearing activities during AEP), the type of habitat that was lost is common in the Project Area and Region. Since no additional clearing is anticipated to occur during the pre-production and production phases of the project, no additional loss of habitat is expected to occur. Further, at closure, the Reed Mine site will be returned to the pre-mining conditions to the extent possible. The restoration of vegetation during closure will provide for restoration of available habitat. Therefore, residual effects on wildlife from clearing activities are assessed to be minor and not significant.

5.9.2 Noise

As described in **Section 5.4.3.**, noise generated during the pre-production, production and closure phases of the proposed project and has the potential to deter wildlife from the area. Since the pre-production phase involves minimal activity on site, the impact of noise on fauna during this phase is assessed to be negligible.

During the production phase of the project, relatively higher noise levels will be expected. However, as described in **Section 5.4.3**, HBMS has incorporated several engineering controls to minimize noise levels at the Project Site. Therefore, noise levels post-mitigation are assessed to be low and not expected to cause any significant disturbance to wildlife in the area.

5.9.3 Vehicle Collisions

With the anticipated increase in traffic on local roads (discussed in more detail in **Sections 2.1.1** and **5.11.2**), there is potential for increased wildlife collisions. Moose, coyotes and wolves may pass through the Project Area, including PTH 39 and the Reed access road. Edge vegetation and the open nature of these roads allows for ease of migration, making the area attractive to wildlife. However, as local wildlife populations are considered low, the potential for increased wildlife collisions is also considered low. Further, HBMS experience in the local area also indicates that wildlife collisions are rare. With implementation of speed limits on the access road, any potential collisions will be mitigated. Therefore, the residual effect on wildlife population from increase in traffic is assessed to be negligible and not significant.

5.9.4 Light Pollution

The Reed Mine will operate 24 hours per day and seven days per week, resulting in the need for lighting on the site to allow for a safe working environment. Light pollution has the potential to adversely affect animal behaviour by interfering with their biological cycles, which may consequently affect navigational abilities.

To minimize potential light pollution effects, HBMS has selected lighting that directs light down to the mine site only. With selection of this lighting, residual disturbance from light would be limited to the Project Site and the area immediately surrounding the site and therefore is assessed to be insignificant.

5.10 Aquatic Resources and Protected Species

Aquatic resources are living species present in a surface water body, including benthic invertebrates, macrophytes and fish, and their habitat. Aquatic resources may be affected directly or indirectly through changes in surface water quality.

As noted in **Section 4.11**, Shortjaw Cisco (*Coregonus artedi*), which is a Federally protected fish species, may occur in the Churchill River Upload Ecoregion. According to the COSEWIC status report (COSEWIC 2003), occurrences of this species in Manitoba include:

- Athapapushkow Lake
- Clearwater Lake
- Reindeer Lake
- George Lake
- Lake Winnipeg

- Lake Winnipegosis

None of these water bodies are in the Grass-Burntwood River watershed and therefore Shortjaw Cisco is not expected to be found in the Project Region. Secondly, no Shortjaw Cisco was captured in the aquatic surveys conducted as a part of the baseline assessment.

The mitigation measures outlined in **Section 5.7** are judged to be sufficient to mitigate for any potential effects to surface water quality that may have consequential effects on aquatic resources and protected aquatic species. Therefore, residual effects on aquatic resources and protected aquatic species from the project are assessed to be negligible.

5.11 Socio-Economic Effects

As outlined in the preceding sections, with appropriate mitigation measures implemented, the residual environmental effects of the proposed Reed Mine are assessed to be minor to negligible. Therefore, no adverse socio-economic effects are expected to occur as a result of environmental effects from the project.

5.11.1 Land Use

As indicated in **Section 4.12.1**, the Reed Mine lies within the southern region of the Grass River Provincial Park. The Grass River Provincial Park Management Plan allows for mining development in the area with consideration to ‘its impact on other park features and activities’ (Department of Natural Resources 1984). Given the remote location of the Reed Mine Project Site, activities associated with the project are not expected to interfere with park activities. The vegetative buffer around the site further provides a visual buffer, which blankets mining activity from the main highway. Further, as outlined in this environmental assessment, residual environmental effects on aquatic and terrestrial resources have been assessed to be minor to negligible, and as such no consequential effects on natural resource harvesting are anticipated to occur in the Project Area or Region.

With respect to noise-related effects of mining activity, as indicated in **Section 5.4.3**., with the implementation of engineering controls on noise sources, combined with the vegetative buffer around the site is anticipated to mitigate potential noise effects at the Project Site. Given the high separation distance to the nearest campgrounds and lodges (which are outside the Project Region), it is not anticipated that noise from mining activities will cause any disturbance to park users. Therefore, it is assessed that the project will not cause any significant effect on land use.

5.11.2 Resource Use

As noted in **Section 4.9**, certain plants may be found in the Project Area that may be of cultural value to Aboriginal people. These plants are considered to be abundant in the region and not limited to the Project Site. Since no additional clearing is expected to occur during the production phase of the project, activities associated with the Reed Mine are not expected to impact use of these traditional plants.

HBMS has provided funding support to MCCN to undertake a traditional land use study to determine Aboriginal resource use in the general area. It is expected that the results from this study will allow HBMS to ensure that its activities will not impact any Aboriginal resource use that may be occurring in the Project Region.

As noted in **Section 4.12.7**, the Manitoba Conservation office in Snow Lake has confirmed that there is one registered trap line in the Project Region. Trapping activities may be affected by noise and other general activities associated with the project. However, noise is expected to be minimal (as noted above), and wildlife population that may be deterred from the area are expected to return to pre-mining conditions within the 5-10 year period following mine closure. AECOM has corresponded with Kirk Melnick, who is the only registered trapper in the Project Area. Mr. Melnick has not expressed any concerns with activities associated with the Reed Mine. However, HBMS will continue to work collaboratively with Mr. Melnick to address any concerns that may arise.

In accordance with the 2012 Manitoba Hunting Guide (Manitoba Conservation and Water Stewardship 2012), hunting in provincial parks is subject to specific regulations, designed to ensure human safety. The guidelines indicate that “persons may not hunt, possess a loaded firearm, or discharge a firearm within 300 m of recreation areas, cottages, dumps, roads and prescribed trails.” Since the Project Site falls within 300 m of PTH 39, hunting is not allowed within the boundaries of the Project Site. Therefore, it is assessed that the project will not interfere with hunting activities.

As indicated in **Section 5.7**, the project is not expected to adversely affect any water body that may be used for fishing.

5.11.3 Traffic

As outlined in **Section 2.1.1**., traffic volumes associated with the Reed Copper Project will vary as the project ramps up production. Since the pre-production phase only requires minor upgrades, it is not expected to result in a substantial increase in traffic.

In total, at full production, it is anticipated that a maximum of 45 additional vehicles will access PTH 39 (or 90 two-way trips). According to Manitoba Infrastructure and Transportation (MIT), the annual average daily traffic flow on PTH 39 ranges from 310 to 390 vehicles per day. The additional traffic represents approximately 23-29% increase along PTH 39, but a fairly small increase (approximately 3.6% based on AADT flow of 2490 vehicles per day) in the City of Flin Flon. The increase in traffic along PTH 39 is considered to be major (higher than 10%); however, it will be experienced for a period of three years (2015 to 2017) only. With ore extraction rates declining in 2018, the number of vehicles transporting the ore to the Flin Flon Metallurgical Complex will decline as well.

During closure, the number of vehicles required will reduce, with traffic associated with traffic dispersed over a period of two to three years (and higher in summer than winter months).

Therefore, overall it is assessed that the increase in traffic will be temporary and insignificant.

5.11.4 Heritage Resources

As indicated in **Section 4.12.2**, correspondence with the Heritage Resources Branch indicated that there are no heritage resources anticipated at the Reed Mine site or in the immediate surrounding area. The nearest recognised historic site is at Tramping Lake, approximately 30 km east of the Project Site. Since the pre-production phase will not involve any additional clearing, blasting or leveling of the site, no further disturbance beyond what has been done during the AEP activities will occur. Therefore, it is anticipated that activities during pre-production, production and closure phases of the proposed project will not have any effects on heritage resources.

In the unlikely event that heritage resources are identified, the following mitigation measures will be implemented:

- If artifacts, historical features or skeletal remains are encountered during closure activities, work activities will stop immediately around the affected area with the find reported to the site supervisor. A qualified archaeologist may investigate and assess the find prior to continuation of work.

- If skeletal remains are encountered, the find will be immediately reported to the site supervisor and the RCMP.

5.11.5 Aesthetics

The aesthetics of the Reed Mine site are not anticipated to change significantly during the life of the mine. The Reed Mine site is accessed by an access road which is owned by HBMS and the site is surrounded by dense vegetation. To maintain a clean, aesthetically pleasing mine site, HBMS will undertake the following measures:

- The site will be inspected for loose waste and debris on a regular basis.
- Waste and debris will be stored in bins and removed on a regular basis.

Based on the remote location of the site, aesthetic effects due to the pre-production and production phases are assessed to be negligible.

During the closure phase, the Reed Mine site will be returned to its natural pre-project state to the maximum extent possible. It is anticipated that re-vegetation as well as natural succession will substantially return the mine site to pre-mine conditions. Vegetation growth will be monitored and if necessary, areas may need to be re-vegetated until vegetation has been re-established. Once these efforts have been completed, aesthetic conditions on the site will be substantially restored to conditions that existed before mineral exploration on the site.

5.12 Accidents and Malfunctions

To prevent accidents and malfunctions, all phases of the project will be conducted in accordance with applicable regulatory requirements. The following sections provide additional details on precautionary measures that will be implemented by HBMS to further minimize the potential for accidents and malfunctions to occur.

5.12.1 Worker Health and Safety

Worker protection in Manitoba is regulated through standards, procedures and training required under *The Workplace Safety and Health Act*. The Reed Mine will be operated in accordance with *The Workplace Safety and Health Act* and the HBMS OHSAS 18000 certified management system, which will minimize potential effects on worker health and safety. Safety equipment and personal protective equipment will either be supplied to the employees or be located throughout the facility, where needed.

5.12.2 Spills

Environmental effects may occur due to fuel and chemical spills from diesel fuel, lubricants, oils, hydraulic fluids and explosives (ANFO and emulsion type) on-site. An accidental release of hazardous materials and/or equipment fluids could occur from improper storage and handling procedures (including transporting materials such as explosives from one location to other). Accidental releases have the potential to affect air, surface water, groundwater, soils, with consequent effects on vegetation, aquatic resources and possibly human health and safety. In accordance with the HBMS ISO14001-certified Environmental Management System, any activities that may result in spills or accidents will be identified along with measures to mitigate risks from such occurrences.

The following HBMS standard procedures will be employed to prevent spills from occurring during project activities:

- Any diesel tank used on-site will be a self-contained aboveground storage tank (SCAT).

- Explosives will be stored in areas equipped with spill containment measures and in accordance with *The Explosives Act*.
- When servicing requires drainage or pumping of lubricating oils or other fluids from equipment, a groundsheet of suitable material and size shall be spread on the ground to catch all fluid in the event of a leak or spill. An adequate supply of suitable absorbent material and any other supplies and equipment necessary to immediately clean up spills will also be available.
- Storage and disposal of liquid wastes and filters from equipment maintenance, and any residual material from spill clean-up will be contained in an environmentally safe manner and in accordance with any existing regulations.
- Waste oils, fuels and hazardous wastes (if any) shall be handled in a safe manner. Staff will be required to transport, store and handle all such substances a recommended by the suppliers and/or manufacturers and in compliance with applicable Federal, Provincial and Municipal regulations. Manitoba Conservation shall be notified immediately if a reportable spill occurs.
- Fuels, oils or other hazardous materials will be stored only in designated areas.
- HBMS will ensure that fuel handlers are trained and qualified, and that appropriate emergency response measures are in place and readily available.
- Storage sites will be inspected periodically for compliance with requirements as applicable
- Investigation and remediation of spills will be undertaken, if necessary.
- Remediation of soils, as required, will be undertaken as a part of closure activities
- Appropriate personnel will be trained in how to deal with spills, including knowledge of how to properly deploy site spill kit materials.
- Service and repairs of equipment shall only be performed by trained personnel.
- Vehicles and equipment will be maintained to minimize leaks. Regular inspections of hydraulic and fuel systems on machinery will be completed on a routine basis; when detected, leaks will be repaired immediately.

With these mitigation measures employed as necessary and assuming implementation of safe work practices, the risk of spills is assessed to be appropriately mitigated.

5.12.3 Fire/Explosions

The presence of mechanical equipment, fuels and explosives on-site creates a potential for fires and explosions. Such incidents can harm on-site personnel, cause equipment damage and lead to a release of contaminants, resulting in consequent effects to other environmental components (air, surface water, groundwater, flora, fauna, aquatic resources, and aesthetics. Potential socio-economic effects may occur if mine shut-downs are required in the event of a large accident (such as incidents that may require evacuation, disruption of traffic, business and other activity).

The Reed Mine has the potential to be affected by off-site forest fires during the summer months. Effects could include loss of infrastructure, which could consequently affect access to the site, with possible economic repercussions. The Reed Mine site has been cleared of vegetation with infrastructure constructed on a crushed rock pad. This crushed rock is anticipated to act as a fire barrier for the site.

The Reed Mine site is equipped with appropriate fire control measures. Water stored in the polishing pond can also be used for firefighting purposes if required. The following additional measures will be employed:

- Explosives and detonators will be stored in a designated station at the 45 m level underground. A fire suppression system and fire resistant door will be provided for this station.

- The underground explosive storage area will comply with the requirements of the *Explosives Act*.
- Explosives will be provided in "just-in-time" deliveries.
- An underground emergency mine warming system will be installed which will introduce ethyl mercaptan (stench gas) from pressurized cylinders into the mine ventilation intake and compressed air distribution to notify workers if mine evacuation needs to occur.
- Mine rescue teams will be trained for fire and explosion response with HBMS call out procedures implemented.
- HBMS can coordinate with mine rescue teams in other HBMS facilities to provide backup as required.
- All flammable waste will be removed on a regular basis and disposed of at an approved disposal site. Such equipment will comply, and be maintained in accordance, with manufacturers' standards.
- Greasy or oily rags or materials subject to spontaneous combustion will be deposited and stored in appropriate receptacles. This material will be removed from the site on a regular basis and be disposed of at an appropriate waste disposal facility.
- Chemical storage and use will be in compliance with regulatory requirements.
- Smoking will be restricted to designated areas.

With these mitigation measures employed and assuming implementation of typical safe work practices, the risk of fires and explosions is assessed to be appropriately mitigated.

5.12.4 Transportation Accidents

An increase in traffic has the potential to increase the potential for transportation accidents, including vehicular and wildlife collisions. Wildlife collisions were discussed above in **Section 5.9**. Transportation accidents can further result in release of pollutants to the environment (diesel, oils, etc.), or materials that the vehicles colliding are transporting (ore, sewage, fuel, etc.). Such accidental releases to the environment may result in consequential effects to other environmental components (contamination of groundwater through seepage, decline in surface water quality through runoff) and tertiary effects on flora, fauna, aquatic resources and human health. Potential socio-economic effects may occur if road shut-downs are required in the event of a large accident (disruption of traffic, leading to disruption of businesses and activity).

Since the pre-production phase only involves minor upgrades, the increase in traffic and the associated risk of traffic accidents is assessed to be negligible.

During production, the increase in traffic on PTH 39 is considered to be major, and could potentially increase the number of transportation accidents. To mitigate for this increase, the following measures will be implemented by HBMS:

- Vehicle speed limits will be imposed (20 km/hr at the site itself and 40 km/hr) along the access road.
- Appropriate road signage will be provided along the access road. Signage and speed limits on PTH 39 is provided and maintained by the Province of Manitoba.
- Personnel retained to drive vehicles will have a valid Manitoba Driver's License with a copy provided to HBMS personnel.

Implementation of the above-noted measures is anticipated to appropriately mitigate the potential for transportation accidents during the production phase of the proposed project.

During closure, a maximum of five pieces of equipment will be required. This increase is not expected to cause a significant increase in the risk of transportation accidents. However, the mitigation measures noted for the production phase will also apply to closure and hence further mitigate any such risk.

5.12.5 Polishing Pond

As discussed in **Section 2**, the polishing pond will receive discharge water from underground operations and serve as a source of emergency water for fire suppression. Leaks from the polishing pond, or overflow due to failure of the polishing pond berms or emergency overflow have the potential to affect soil quality with consequent affects on surface water (runoff) or groundwater (seepage).

To prevent leaks, the polishing pond has been lined with a geo-synthetic liner. To prevent failure of the polishing pond embankment, the structure has been designed to contain the required volume of discharge water and surface runoff. These design considerations are judged to be sufficient to appropriately mitigate the potential risk of polishing pond leaks, overflows or failures.

5.12.6 Power Failure

During pre-production and production, there is potential for environmental effects resulting from power failure. Site power may be lost due to equipment malfunctions, accidental fires/explosions or severe weather events etc. The likelihood of this occurring is low, given that the site is not powered through a single source and diesel generators will be used to power different infrastructure components on the site. Ventilation equipment and dewatering pumps require power to operate. A complete power failure would impact worker safety if ventilation ceases or if mine flooding occurs.

Therefore, to prevent effects due to power failure, backup power will be available (diesel generators) to provide safe evacuation from the mine. While using backup diesel generators may itself result in potential effects on air quality (emissions), these are assessed to be negligible. The supply of backup power is assessed to appropriately mitigate the potential risks of a power failure.

5.13 Summary of Environmental Assessment and Mitigation Measures

Table 5-2 summarizes the potential environmental effects of the proposed project and the design features, standard operating procedures and other mitigation measures that will be implemented.

Table 5-3 summarizes potential accidents and malfunctions and measures to reduce the risk of such occurrences.

Table 5-2: Potential Interactions with Environmental and Social Components

Environmental and Social Component	Project Phase	Sources of Potential Effects	Summary of Measures	Residual
Topography	Production and Closure	Waste rock and Ore stockpiles	None required	Insignificant
		Leveling and grading	None required	N/A
Soil	Pre-Production, Production and Closure	Improper waste management and storage and handling of materials (soil quality)	Wastes will be collected in garbage bins and emptied on a regular basis for recycling or disposal at a licensed waste disposal facility	Negligible and Insignificant
			Waste oils and other hazardous materials will be returned to surface using containers specifically designed for this purpose	
			Hazardous materials will be removed by a licensed hazardous materials handler for appropriate disposal or recycling	
	Production	Acid Rock Drainage (soil quality)	The waste rock storage pad is multi-layered and composed of NAG rock which will filter and neutralize any ARD that may be generated by the stockpile.	Negligible to Minor and Insignificant
			Waste rock will be placed on the pad in layers. A layer of crushed limestone will be placed in between two layers to act as a neutralizing agent.	
			Waste rock will be used as mine backfill to limit surface storage.	
	Production and Closure	Erosion (soil quantity)	The treed buffer around the Reed Mine site and between the mine site and PTH 39 will be maintained to minimize erosion due to wind.	Negligible and Insignificant
			The site will be contoured to match the surrounding topography to the extent possible.	
			Re-vegetation will occur as soon as practical following application of soil.	
			Success of re-vegetation efforts will be monitored until vegetation has re-established with additional re-vegetation activities to occur as required	
Air	Production and Closure	Dust (air quality)	If required, dust suppression activities will be undertaken for the Reed Mine access road.	Negligible and Insignificant
			Speed limits (20 km/hr on site and 40 km/hr on access road) will continue to be imposed.	
			Ore trucks going to Flin Flon will be covered to minimize dust coming off loads.	
	Pre-Production, Production and Closure	Surface and underground emissions (air quality)	Vehicles and equipment will be well maintained	Negligible and Insignificant
			Vehicle idling will be kept to a minimum	
			The ventilation system underground has been equipped with low NOx burners, and has been designed by taking into account all emissions from underground vehicles and mine equipment.	
			Employees working underground will be equipped with handheld carbon monoxide monitors.	
	Production and Closure	Noise and vibration	A centralized blasting system will be implemented for both development underground and production rounds. These rounds will be fired only between shifts when all of the employees are accounted for.	Negligible and Insignificant
			Gensets on site are housed in factory designed-built enclosures to minimize noise.	
			The ventilation intake on surface has been engineering to be 70 dB at 1 m.	
			The main ventilation fan will be installed below surface at the 60 m level to reduce surface noise.	
			HBMS will provide hearing protection as required	
			All closure activities will be carried out in accordance with the *Workplace Safety and Health Act* and HBMS's OHSAS 18000 certified management system	
Climate Change	Pre-Production and Closure	GHG emissions (climate change)	Idling at the site will be kept to a minimum (while waiting for trucks to load for haulage for example)	Negligible and Insignificant
			Vehicles and equipment will be maintained in good working condition	
			HBMS is providing an employee shuttle to reduce the number of personal vehicles used.	

Environmental and Social Component	Project Phase	Sources of Potential Effects	Summary of Measures	Residual
Groundwater	Production	Use of explosives and other potential contaminants (deep groundwater quality)	Any ANFO spillage will be cleaned up immediately before coming in contact with groundwater.	
			Groundwater will be pumped to the polishing pond, which will prevent any groundwater that may have been contaminated from re-entering deep bedrock.	Negligible and Insignificant
			Charges will be designed to be as small as possible to minimize the volume of potential blast residuals.	
			In wetter areas, emulsion type explosives will be used to minimize the potential for ammonium nitrate to dissolve in groundwater	
		Mine dewatering (groundwater quantity)	None required	N/A
		Groundwater withdrawal (groundwater quantity and quality)	Compliance to license for use will sustain quantity	Negligible to Minor and Insignificant
			No fueling will be done around the groundwater wells.	
			Groundwater wells are housed and segregated in the maintenance shop, and installed above grade.	
		Acid Rock Drainage (groundwater quality)	Measures listed under ARD for soil quality will prevent any effects on groundwater quality from ARD	Negligible to Minor and Insignificant
Surface Water	Production	Water withdrawal (water quantity)	See measures identified for ARD under Soil	Negligible and Insignificant
		Acid Rock Drainage (water quality)	See measures identified for ARD under Soil	Negligible and Insignificant
		Waste management and storage and handling materials (water quality)	See measures identified for waste management and storage and handling materials under Soil	Negligible and Insignificant
		Erosion (water quality)	See measures identified for Erosion under Soil	Negligible and Insignificant
		Wastewater disposal (water quality)	Wastewater discharged from polishing pond will compy with Tier 1 criteria set out in MWQSOG	Negligible and Insignificant
		Sewage disposal	Sewage will be collected in sewage holding tanks and pumped out in accordance with *Onsite Wastewater Management System Regulation*	Negligible and Insignificant
Protected and Other Flora Species	Production	Dust (vegetative growth capacity)	See measures identified for dust under Air	Negligible and Insignificant
	Closure	Re-vegetation (restoration)	None required	N/A
Protected and Other Fauna Species	Production and Closure	Clearing (habitat loss)	Site will be re-vegetated during closure	Minor and Insignificant
	Pre-Production, Production and Closure	Noise (disturbance)	See measures for noise under Air	Negligible to Minor and Insignificant
	Production and Closure	Vehicle collisions (mortality)	None required	Negligible and Insignificant
	Production	Light pollution (disturbance)	HBMS has selected lighting that directs light down to the mine site only	Negligible and Insignificant
Aquatic Resources and Protected Species	Production	Water quality (loss of habitat)	See measures to protect water quality under Surface water	Negligible and Insignificant
Heritage Resources	Pre-Production, Production and Closure	No heritage resources in the Project Region	If artifacts, historical features or skeletal remains are encountered during closure activities, work activities will stop immediately around the affected area with the find reported to the site supervisor. A qualified archaeologist may investigate and assess the find prior to continuation of work.	N/A
			If skeletal remains are encountered, the find will be immediately reported to the site supervisor and the RCMP.	N/A
Aesthetics	Production and Closure	Waste management and storage and handling materials	See measures for waste management under Soil	Negligible and Insignificant
		Light pollution (disturbance)	Site is surrounded by dense vegetation and will be returned to pre-mining conditions at closure	Negligible and Insignificant
			HBMS has selected lighting that directs light down to the mine site only	
		Noise and Vibration	See measures for noise under Air	Negligible and Insignificant
Land and Resource Use	Pre-Production, Production and Closure	Wildlife habitat (loss of habitat), noise (disturbance)	See measures for Flora, Fauna and Aquatic Species	Negligible and Insignificant

Table 5-3: Summary of Accidents and Malfunctions and Measures to Mitigate Risk of Occurrence

Risks Associated with Accidents and Malfunctions	Project Phase	Possible Consequences	Measures to Reduce Risk of Occurrence	Conclusion
Worker Health and Safety	Pre-Production, Production and Closure	Workplace accidents (worker safety)	The Mine will be operated in accordance with *The Workplace Safety and Health Act* and the HBMS OHSAS 18000 certified management system	Risk is assessed to be appropriately mitigated
			Safety equipment and personal protective equipment will either be supplied to the employees or be located throughout the facility, where needed	
Spills	Pre-Production, Production and Closure	Chemical spills from diesel fuel, lubricants, oils, hydraulic fluids, and explosives (air quality, water quality, groundwater quality, fauna, flora and aquatic species, human health and safety).	Diesel tanks will be a self-contained aboveground storage tank	Risk is assessed to be appropriately mitigated
			Explosives will be stored in areas equipped with spill containment measures and in accordance with *The Explosives Act*.	
			Appropriate groundsheet will be used when refueling.	
			Wastes and residual material from spill clean-upwill be contained in an environmentally safe manner and in accordance with any existing regulations	
			Hazardous wastes will be stored and handled in compliance with applicable Federal, Provincial and Municipal regulations.	
			Fuel handlers are trained and qualified, Appropriate emergency response measures will be in place and readily available.	
			Storage sites will be inspected periodically for compliance	
			Investigation and remediation of spills will be undertaken, if necessary.	
			Remediation of soils, as required, will be undertaken	
			Vehicles and equipment will be maintained and inspected on a routine basis	
Fires and Explosions	Pre-Production, Production and Closure	Fires (loss of infrastructure, business activity, worker health and safety, loss of wildlife habitat)	Explosives and detonators will be stored in a designated station. A fire suppression system and fire resistant door will be provided for this station	Risk is assessed to be appropriately mitigated
			The underground explosive storage area will comply with the requirements of the *Explosives Act*.	
			Explosives will be provided in "just-in-time" deliveries.	
			An underground emergency mine warming system will be installed	
			Mine rescue teams will be trained for fire and explosion response with HBMS call out procedures implemented. Backup teams will be available	
			Flammable waste will be removed on a regular basis and disposed of at an approved disposal site.	
			Materials subject to spontaneous combustion will be deposited and stored and disposed appropriately	
			Chemical storage and use will be in compliance with regulatory requirements.	
			Smoking will be restricted to designated areas.	
Transportation Accidents	Pre-Production, Production and Closure	Vehicular collisions (human health and safety, traffic disruption, road closure, release of contaminants) and Wildlife collisions (loss of wildlife, human health and safety, road closures)	Vehicle speed limits will be imposed (20 km/hr at the site itself and 40 km/hr) along the access road.	Risk is assessed to be appropriately mitigated
			Appropriate road signage will be provided along the access road.	
			Personnel retained to drive vehicles will have a valid Manitoba Driver's License	
Polishing Pond	Production	Failure of polishing pond berms (surface water quality, groundwater quality)	Polishing pond has been lined with a geo-synthetic liner.	Risk is assessed to be appropriately mitigated
			To prevent embankment failure, pond has been designed to contain the required volume of discharge water and surface runoff	
Power Failure	Production	Equipment malfunctions (loss of power), accidents and explosions, inability to evacuate mine (human health and safety).	Backup power will be available (diesel generators) to provide safe evacuation from the mine	Risk is assessed to be appropriately mitigated

6. Public Engagement

Public engagement is an integral part of the environmental assessment process. It provides the opportunity for interested stakeholders to receive information from project proponents and, in return, it allows the proponents to gain an understanding of public concerns. Public engagement can also provide an opportunity to actively involve stakeholders in the early stages of a project which, in turn, delivers a sense of transparency in the assessment and project planning process.

It was determined that the City of Flin Flon and Town of Snow Lake would be interested in participating in the public consultation process as the project will occur near these two communities, will employ residents, provide local economic benefits and utilize existing infrastructure in the City of Flin Flon. It was also determined that the Mathias Colomb Cree Nation (MCCN) may have an interest in the project.

Public engagement has consisted of a community open house in the City of Flin Flon and discussions with MCCN, and a second open house is planned for the Town on Snow Lake in January 2013. In addition to formal public consultation events, the Reed Copper Project has been covered extensively in various forms of media since 2010, and has been presented at numerous industry events.

A summary of the public engagement that has been undertaken for the Reed Copper Project is included in the following sections.

6.1 Proponent Lead Public Involvement

6.1.1 Open House 1: City of Flin Flon

The first community open house for the proposed Reed Mine was held on November 26, 2012, in Flin Flon, Manitoba. The purpose of the open house was to provide members of the community, interested stakeholders and members of the general public with an overview of the project, summarize the environmental assessment findings to date, and collect any feedback.

To inform the public of this open house event, an advertisement was placed in the November 21, 2012 and November 23, 2012 edition of the *Flin Flon Reminder*. A copy of the advertisement is included in **Appendix E**. The event was also advertised in the Snow Lake community newspaper, the *Underground Press*, on November 22, 2012. A copy of this advertisement is included in **Appendix E**.

The open house event was held at the Victoria Inn in Flin Flon, and a total of six attendees, including local residents and current and former HBMS employees, participated in the event. The open house event consisted of a formal presentation with a question and answer period followed by informal discussions with attendees and representatives from AECOM and HBMS. Large print outs of several of the presentation slides were displayed on easels around the room for attendees to examine in detail following the presentation. Questionnaires were provided to all attendees. A copy of the open house attendance sheet and presentation has been provided in **Appendix E.**

Although no questionnaires were completed or submitted by the open house attendees, a few questions and comments were tabled at the conclusion of the presentation. The following summarizes the questions/comments received and responses provided:

Question: How will over-sized ore be handled?

Response: Oversized ore will be broken down with a rock hammer underground prior to being hauled to surface. This will minimize dust and noise at the Reed Mine site. All ore will be sent to Flin Flon for further processing.

Comment: Why is noise an emerging concern? Is it because of human health, the Provincial Park or wildlife?

Response: All of these factors mentioned contribute to noise being a potential concern at the Reed Mine.

Comment: When will underground exploration start?

Response: Definition drilling will be done by next year. We need to develop depths before exploration can occur. It is expected that this will start in 2014-2015.

6.1.2 Open House 2: Town of Snow Lake

HBMS is planning to conduct a second open house in the Town of Snow Lake in early January, 2013. Given the participation and the questions that came forward at the open house in the City of Flin Flon, it is not expected that the open house in Snow Lake will generate any significant concerns. However, the results of this open house will be submitted as a supplemental filing, subsequent to this *Environment Act* Proposal.

6.2 Discussions with Mathias Colomb Cree Nation

A number of discussions and meeting with MCCN have taken place since the announcement of the Reed discovery in 2010. The following section summarizes the discussions and meetings with MCCN involving the Reed Mine and other HBMS development projects.

6.2.1 Meeting #1 – May 9-10, 2011

On May 9-10, 2011, HBMS held an informal meeting in Flin Flon with members of the Mathias Colomb Cree Nation (MCCN) regarding the Reed Mine and other HBMS mining projects. There were seven members in attendance from the First Nation, including Chief Arlen Dumas, Sherman Lewis, Floyd North, Ken Bighetty, Hanson Dumas, Gordie Bear and Jimmy Colomb, and Pam Marsden of the Mining Association of Manitoba Inc. Detailed minutes from this meeting are provided in **Appendix E**.

The visit began in the afternoon of Monday, May 9, 2011 with a safety orientation required to prepare MCCN for a tour of the underground workings of the 777 Mine in Flin Flon, to be held the following day. The safety orientation was followed by dinner in the Staff House with representatives of the Northern Manitoba Sector Council (NMSC). Doug Lauvstad, Executive Director, gave a presentation on the Mining Academy and its relationship with the satellite sites for the University College of the North (UCN). The Mining Academy and Flin Flon UCN site were both under construction. The presentation included some of the past history around the NMSC's work with First Nation groups in all aspects of mining, forestry, exploration and related programs. Don Nisbet, Aboriginal Liaison Coordinator with NMSC, talked about the programs that have been undertaken at Wabowden with the training of First Nations workers and spoke to what worked and what didn't work. There was also discussion about the plans for the Mining Academy, including when it would be open, and how students could be enrolled.

The discussion focused on how MCCN could participate in future programs either through business opportunities or careers, and training options for band members. Exploration was discussed in general, including increased activity by Hudbay in the region of Flin Flon and Snow Lake, which MCCN consider as traditional lands. HBMS mentioned the potential for the Reed Copper Project to generate additional employment opportunities, with the potential for approximately 80 positions.

MCCN discussed work that they were doing for the Manitoba government in Sherridon, Manitoba on the rehabilitation of mine site tailings. Chief Dumas emphasized that MCCN have people and equipment who could do more work. Given their experience, MCCN leaders feel strongly that their First Nation should be considered for potential construction opportunities associated with HBMS mine development projects.

On Tuesday, May 10, 2011, the MCCN visitors toured the underground 777 Mine, Zinc Plant and Flin Flon Concentrator. The site tours were intended as an opportunity for MCCN to learn about HBMS operations and what potential job opportunities may exist.

6.2.2 Meeting #2 – January 10-12, 2012

A meeting was scheduled with MCCN on September 12, 2011, to present a project update and environmental information about the Reed Mine and other HBMS mining projects to MCCN in Pukatawagan, but the meeting was cancelled on September 9, 2012. The meeting was rescheduled and held in Flin Flon on January 10-12, 2012. The purpose of the meeting was to provide members of MCCN with information on the Reed AEP and Reed Mine, the Lalor AEP, and Lalor Mine. In addition to the meetings in Flin Flon on January 10, 2012 and January 12, 2012, HBMS provided a tour of the Reed site and Lalor site in Snow Lake on January 11, 2012.

Chief Arlen Dumas, Elder Marcel Caribou and Councilor Jimmy Colomb arrived in Flin Flon during the evening of January 10, 2012, and participated in a planned tour of the Mining Academy and the new satellite campus of the University College of the North (UCN). Pam Marsden of the Mining Association of Manitoba also arrived later that evening. The other members of the MCCN delegation and Mr. Chris Beaumont-Smith (Manitoba Mines Branch) did not arrive in time for the evening meeting, but did arrive in time attend the site visit and follow up meetings on January 11-12, 2012.

Topics of discussion that occurred throughout the course of the visit included training and employment opportunities, mine project descriptions, environmental impact assessment, and First Nation experience in the region. A full list of attendees and detailed minutes from this meeting are provided in **Appendix E**.

The HBMS and MCCN groups were joined for dinner on January 10, 2012, by Don Nisbet, Aboriginal Liaison Coordinator for the Northern Manitoba Sector Council, and Rob Penner, Chair of the Faculty of Arts and Sciences of UCN (the Pas) and Executive Director of the Northern Manitoba Mining Academy. Following dinner, Don and Rob gave the group a tour of the UCN and Mining Academy facilities and discussed the potential benefit of the education and training opportunities that these facilities might offer to Aboriginal residents of the North. It was stated that the fundamental goal is to train northern people for northern jobs. HBMS has been instrumental in supporting these facilities, with a grant of land and cooperation with their facilities and programs.

During the course of the visit, there was further discussion regarding jobs and Councilor Linklater offered information about MCCN experience in constructing water and sewer lines in their community. Mr. Beaumont-Smith commented on potential support for training provided by the Province of Manitoba, as well as opportunities that may be afforded by construction of a new STP and 200 serviced lots in the Town of Snow Lake. HBMS indicated that they can assist in connecting MCCN with Jeff Precourt, Administrator of the Town of Snow Lake.

On Wednesday morning, January 11, 2012, the group boarded a bus for the Town of Snow Lake, for a day of site tours. Along the way, Stephen West (HBMS) was able to point out the location of the Reed Copper Project AEP and some of HBMS' supporting infrastructure in Snow Lake, including the Anderson TIA and the access road to the Stall Lake Concentrator. Once in Snow Lake, the group toured the Lalor Camp, located on HBMS lots in town, including the dormitories and cafeteria. Lunch was served, after which the group proceeded on to the Chisel North Mine site, a distance of about 12 km down the highway. On the way, Mr. West pointed out some existing HBMS infrastructure supporting the Chisel North Mine.

On the way back to Flin Flon, Mr. West again pointed out the site of the Reed Copper Project. He also pointed out former access to the site of the closed Spruce Point Mine, where re-vegetation has made the site nearly indistinguishable from the surrounding landscape.

On the following morning, January 12, 2012, the group met in the HBMS Staff House in Flin Flon and were joined by two additional HBMS Environmental Control Department employees, Jay Cooper and Riley Little. Cliff Samoiloff (AECOM) gave a presentation on the environmental impact assessment conducted for the Reed Mine, Lalor AEP, Lalor Mine, outlining the background on mining in the respective areas and the baseline environmental data collected to date. The presentation included a review of public consultation undertaken to date, as well as the preliminary findings of the ongoing environmental assessment of the project.

At the close of the meetings, discussion returned to potential employment. Chief Dumas emphasized that tree-cutting is an activity that was completed for the project and that the First Nation should be given opportunities in that regard. HBMS agreed, but indicated that the representatives in the room that day could not address employment. HBMS promised that a follow-up contact would be made by other HBMS officials who would speak further about employment and contracting opportunities. HBMS was advised that the Councilor with the applicable portfolio is Gordie Bear.

Chief Dumas advised that MCCN was not in a position to respond at this meeting to the information presented by HBMS. HBMS invited MCCN to continue with another meeting at which there could be more discussion and information sharing by MCCN. HBMS also offered to bring the meeting to Pukatwagan to facilitate participation by elders and resource harvesters. AECOM also would like to return to the project areas with the elders who attended the meeting and any other MCCN members who might have additional knowledge that could contribute to the environmental assessment. Chief Dumas expressed appreciation for the offer and will be glad to consider it and let HBMS know. Following the meeting, Mr. West wrote to Chief Dumas to reiterate HBMS request for MCCN participation in the follow-up environmental review with AECOM. A copy of this letter is provided in **Appendix E.**

MCCN requested and HBMS agreed to provide copies of the presentations given to MCCN and copies of the applications it had filed and permits received for the Lalor and Reed projects. It was agreed that we would have a follow up meeting to discuss MCCN's views on the environmental assessment information presented at this week's meetings. Mr. Sloan (MCCN counsel) suggested that HBMS consider funding a traditional knowledge study, to be carried out by a third party expert, incorporating matters of culture. MCCN now has provided a proposal for such a study and the follow up meeting has been scheduled.

Following the meeting, MCCN was provided with copies of environmental reports, licenses and permits associated with the Reed and Lalor projects. As well was an exchange of correspondence between counsel with a view to considering MCCN's assertion of rights and request for funding of a traditional knowledge study, HBMS's position concerning the likelihood that the Lalor site would be useful for traditional practices, and completion of HBMS's environmental information sharing process. It was expected that the information sharing process would continue with a follow-up meetings with members of MCCN.

6.2.3 Community Meeting in Pukatawagan – November 23, 2012

On November 23, 2012, HBMS held a meeting in Pukatawagan with members of MCCN to discuss the Reed Mine and other HBMS mining projects. The meeting was attended by Stephen West, Jay Cooper and Pam Marsden from HBMS; Clifton Samoiloff, Alison Weiss and Shawna Kjartanson from AECOM; and Ginger Gibson and Stephen DeRoy from the Firelight Group. Fifteen (15) members of MCCN were in attendance, including Chief Arlen Dumas and various Council members and elders.

For this meeting, HBMS and AECOM prepared a presentation for the Chief and Council of MCCN regarding the environmental assessment and description of the proposed Lalor and Reed Copper Projects near Snow Lake, Manitoba. The goal of the presentation was to provide the Chief and Council and community members with information regarding the environmental work conducted as well as to describe the proposed Projects. A copy of the presentation is provided in **Appendix E**.

Generally, the presentation was well received and many good discussions between the attendees from MCCN and HBMS were held. The main concerns from MCCN members that were brought forward during the meeting (in no particular order) were as follows:

- Mine closure and/or historical mining impacts.
- Long-term effects of the tailings deposition.
- Scope of potential effects (duration or geographic extent).
- Involvement in the early stages of planning or environmental assessment.
- Employment, training and business opportunities for MCCN members.

Detailed minutes and an attendance sheet from this meeting will be submitted as a supplemental filing, subsequent to this *Environment Act* Proposal.

6.3 Other Local Stakeholders

6.3.1 Trappers

The Manitoba Conservation office in Snow Lake has confirmed that there is one registered trap line (RTL 8) in the Project Area, operated by Kirk Melnick. (Snow Lake Conservation District Office 2011). On September 8, 2011, AECOM contacted Mr. Melnick to discuss the Reed Project and identify any of his concerns with the project. At that time Mr. Melnick did not express any concerns with the development. Although no further communication was initiated, HBMS is committed to working with Mr. Melnick to ensure access to trap lines is not impacted by the Reed Mine.

6.3.2 Cottages, Remote Residences and Campgrounds

Reed Lake does not have any cottage subdivisions. However, there are three Provincial campgrounds located on Reed Lake within the Grass River Provincial Park. First Cranberry Lake (45 km west) and Wekusko Lake (50 km east), both outside the Project Region, are the lakes with cottage subdivisions that are closest to the Project Area.

As indicated in **Section 5.11.1**, no adverse environmental effects are expected to affect the use of campgrounds in the region. Potential concerns associated with noise impacts have been addressed, and are discussed in detail in **Sections 5.4.3** and **5.9.2**.

6.3.3 Lodge Owners

There are two lodges in operation on Reed Lake and four additional lodges in the Snow Lake area. Petersons' Reed Lake Lodge and Grass River Lodge are both in operation on Reed Lake. Peterson's Reed Lake Lodge is located on Fourmile Island and is only accessible by boat, while the Grass River Lodge is located on the south shore of Reed Lake adjacent to the Provincial campground. The Grass River Lodge has outpost cabins on Dolomite Lake (13 km southeast of the proposed Reed Mine site) and Moody Lakes (57 km northwest of the proposed Reed Mine site). The Wekusko Falls Lodge is located on Trampling Lake, but utilizes Reed Lake and its surrounding area for activities such as fishing and hunting. The Tawow Lodge Ltd. (Herb Lake Landing) is located approximately 56 km east of the Project Site. The Burntwood Lodge is a fly-in fishing lodge located on Burntwood Lake and is estimated to be approximately 85 km north of the Project Site. The Diamond Willow Inn & Willow House is located in the Town of Snow Lake at 200 Lakeshore Drive and is approximately 50 km northeast of the Project Site.

On April 30, 2012, HBMS received a telephone call from Norman Sancartier, owner of the Caribou Lodge located in Cranberry Portage, Manitoba. Mr. Sancartier expressed some concern regarding the potential impact of exploration drilling and operation of the Reed Mine would have on his bear hunting within the region. Mr. Sancartier indicated that the hunt is part of his livelihood and he has invested time and effort in developing hunting facilities in and around Leak Lake, approximately 10 km west of the Project Site.
Mr. Sancartier made it clear in the discussion that he is not filing a complaint and understands that HBMS has the required permits to conduct exploration work in the area.

In response to the conversation, HBMS provided Mr. Sancartier with a map and project plan for the Reed Mine, and made preliminary arrangements for a site visit to the Reed AEP site. HBMS also provided Mr. Sancartier with an overview of the mitigation measures that will be in place to minimize noise and other potential impacts of the mine on the surrounding environment. HBMS also made a commitment to keep Mr. Sancartier informed on the development of the project and any additional exploration drilling that may be occurring in the area.

As indicated in **Sections 5.11.1** and **5.11.2**, no adverse environmental effects are expected to affect lodges or hunting activity in the region.

6.3.4 Snowmobilers

There are no known snowmobile trails located within the Project Region.

6.3.5 Forestry

As indicated in **Section 4.12.1**, the Cormorant Provincial Forest is located approximately 30 km southwest of the Project Site and covers an area of 1,479 km^2. Provincial forests are Crown lands managed by Manitoba Natural Resources on a sustainable yield basis. A licence or permit allows harvesting of trees on Crown lands and also indicates the quantity of each type of trees that can be harvested. In accordance with their Forest Management Licenses, present-day, large-scale forestry companies must regenerate forest lands that they are harvesting. Individuals and small companies pay a forest renewal fee to cover reforestation (Manitoba Conservation n.d.).

Tolko Industries Ltd. (Manitoba Solid Wood Division, Woodlands), located in The Pas, Manitoba has three Forest Sections in and around the Project Region (Highrock, Nelson River and Saskatchewan River) where wood is harvested. These Forest Sections include areas surrounding Snow Lake, Flin Flon and Grass River Provincial Park. (Tolko Industries Ltd. 2012)

As part of the planning process and as documented in their *Annual Harvest and Renewal Plan*, public consultation has been undertaken with MCCN in Pukatawagan and the Town of Snow Lake as well as other surrounding communities regarding the proposed harvest plan. According to Tolko Industries Ltd.'s record of the public consultation events in Pukatawagan and Snow Lake, no concerns regarding unique vegetation areas were identified to Tolko Industries Ltd. representatives. (Tolko Industries Ltd. 2012)

6.4 Additional Public Notification and Information Sharing

In addition to formal public consultation events, the Reed Copper Project has been covered extensively in various forms of media since 2010, and has been a topic of presentation at numerous industry events. The following listing includes a sampling of publications that have provided information regarding the Reed Copper Project:

<u>Brandon Sun</u>

- *Mines are Gold for Province's North- Hudbay Celebrates Three New Facilities near Flin Flon, Snow Lake,* August 15, 2012

<u>Canadian Mining Journal</u>

- *VMS Acquires Large Land Package Adjacent to the Reed Copper Mine Property, Snow Lake, Manitoba*, June 21, 2012
- *Copper Development: Hudbay, VMS Break Ground for Reed Mine*, August 15, 2012

<u>Hudson Bay Mining and Smelting Co. Limited Website</u>

- *Hudbay Enters Into Letter of Intent with VMS Ventures*, March 4, 2010
- *Hudbay Announces Joint Venture with VMS Ventures*, July 6, 2010
- *Hudbay Minerals Announces 2011 Production Guidance and Production and Capital and Exploration Budgets*, December 13, 2010
- *Hudbay Announces Increases in Metals Reserves and Resources*, April 2, 2012

Marketwatch

- VMS Ventures Updates Progress at the Reed Copper Project Near Snow Lake, Manitoba, July 19, 2012
- *VMS Ventures Inc. and Hudbay Break Ground at New Copper Mine in Manitoba*, August 14, 2012

Mining Weekly.com

- *Hudbay in 'Advanced' Ttalks on Copper Conc Sales*, March 5, 2010
- *Hudbay Could See 2012 Output from Reed Lake Project*, November 4, 2010
- *VMS Eyes Healthy Cash Flows at Reed Copper Project*, March 13, 2012
- *Hudbay and VMS form JV to Develop Reed Lake*, July 6, 2012
- *Hudbay Lays Our Project Plans, Acquisition Strategy*, August 5, 2012

The Globe and Mail

- *VMS Ventures Inc. and Hudbay Break Ground at New Copper Mine in Manitoba*, July 19, 2012

The Underground Press

- *First Ore From Lalor; Reed Well Underway*, August 30, 2012

Winnipeg Free Press

- *Snow Lake's Got it's Groove Back*, December 1, 2011
- *Mines are Gold for Province's North*, August 15, 2012
- *Lalor Mine Stealing Thunder of Other Site*, August 23, 2012

7. Follow-up Programs and Monitoring

Follow-up programs verify the accuracy of the environmental assessment of a project and determine the effectiveness of measures taken to mitigate any potential adverse environmental effects. For the proposed project, mitigation measures will be applied as described herein, and summarized in **Table 5-2**. Based on the completeness of the baseline studies and the level of certainty for the conclusions stated in this report regarding the potential environmental impact, AECOM is of the opinion that no technical or formal follow-up program is required.

Monitoring programs involve the collection and analysis of data on the state of a particular environment to identify changes or trends over time. Results from monitoring programs indicate the success of mitigation measures implemented to protect the environment. They are also used to ensure compliance with environmental standards/regulations and to assist in any potential project operational changes. Monitoring programs proposed for the Reed Mine project and are described in the following sections.

7.1 Water Quality Monitoring

As described in **Section 2.4.6**, wastewater generated during the production phase of the Reed Mine will include process water and groundwater seepage from underground operations, both of which will be pumped from underground into the polishing pond on surface. This polishing pond discharges to an adjacent marsh located to the south of the site, which eventually drains into Unnamed Lake 3.

To ensure that there will be no adverse impact to surface water as a result of mining activities, it is recommended that a water quality monitoring program be developed and implemented for the polishing pond and any other potential source of surface water discharge. Water samples from the polishing pond should be collected and analyzed, and the results compared to the parameters indicated in the applicable Tier 1 criteria set out in MWQSOG to ensure compliance, proactively identify the need for additional treatment, and apply appropriate treatment, if such should ever be required.

7.2 Success of Re-Vegetation Efforts

Following closure activities, once the site has been cleared of existing infrastructure and regraded, soil will be applied to disturbed areas of the Reed Mine site. Re-vegetation will occur as soon as practical following the application of soil.

To ensure the success of the re-vegetation program, a re-vegetation monitoring program will be implemented. Regular monitoring during the growing season will determine the success of the re-vegetation program, and will determine if follow up reseeding or replanting is required. The program will include quarterly monitoring during the growing season until the seedlings appear to be established. Quarterly monitoring will then follow during the growing season, for a minimum of two years, before a successful re-vegetation program can be declared.

Access to the Reed Mine will be prevented by closing off the connection of the western terminus of the access road to PTH 39. The access road will then be scarified to restrict site access and promote growth of local vegetation in the surrounding area.

7.3 Boreal Woodland Caribou Monitoring

HBMS participates in Manitoba Conservation's ongoing large-scale caribou study in Northern Manitoba, including the Reed Project Region, which contributes information used in Manitoba's Conservation and Recovery Strategy for Boreal Woodland Caribou. The strategy document groups caribou ranges as Low, Medium or High risk, based on levels of disturbance and various other threats for each range. (Government of Manitoba 2005).

In 2009 and 2010, the Northwest Region Woodland Caribou Research and Management Committee, with funding from HBMS, collared female Boreal Woodland Caribou on islands of Reed Lake to document areas of use (travel corridors, rutting areas and calving sites). Ongoing monitoring of caribou deaths will continue to contribute to assessment of herd stability. As of September 2012, 40,000 location points have been established and, using telemetry data, two different areas of use on the range have been determined.

The Reed herd caribou spend the majority of their time on the west side of Reed Lake, which is outside of the Project Region. However, HBMS will continue to participate in ongoing studies in cooperation with Manitoba Conservation.

HBMS is committed to continued involvement in the Recovery Strategy for Boreal Woodland Caribou through participation in the Northwest Region Woodland Caribou Research and Management Committee and by funding additional research efforts in 2012 through 2014.

7.4 Environmental Management System

HBMS has been certified to the international standard known as ISO 14001 Environmental Management Systems (EMS) since 2003. The scope of registration is "Mining and metallurgical operations related to copper and zinc production in the Flin Flon/Snow Lake area, including associated ancillary facilities." The Reed project has been added to HBMS's scope of certification and the environmental management policies and procedures, as outlined in the EMS, will be implemented.

8. Summary and Conclusions

The results of the effects assessment can be summarized as follows:

Topography

Construction and operation of the proposed Reed Mine will not affect the topography of the site. The Project Site has been previously cleared and levelled during construction of the Reed AEP. The closure phase will include restoration the site topography to match the surrounding area to the extent that is practical. Therefore, effects on topography are assessed to be insignificant.

Soil

The plan for operation of Reed Mine minimizes the potential to generate ARD on-site, therefore minimizing subsequent effects on soil quality. The pre-production and production phases will not include any activity that is likely to result in soil erosion. The closure phase includes assessment of any contamination caused during the life of the mine, followed by any remediation that may be required to eliminate risk to human health, safety or the environment. Therefore, the effect on soil is assessed to be insignificant.

Air

With respect to dust, the dense nature of the vegetation immediately surrounding the Project Site is expected to mitigate any dust, spatially limiting its effects. Although dust will be generated on the unpaved Reed Mine access road, dust on PTH 39 will be minimal as it is paved. With the implementation of the measures described in the assessment, the effect of dust on air quality will be negligible under normal weather conditions.

With respect to exhaust emissions, although the increase in traffic along PTH 39 is considered major in relation to the existing level of traffic on PTH 39, the resulting impact on air quality in the Project Region is assessed to be negligible. The ventilation system required on site will use propane heaters to heat the fresh air prior to pumping it underground, which will generate pollutants such as nitrogen oxides (NOx), carbon monoxide, sulphur dioxide, particulate matter, and greenhouse gases. However, with implementation of the measures described in the assessment, the effect on air from exhaust emissions will be negligible.

With respect to noise, all practices performed on the Reed Mine site will be carried out in accordance with the *Workplace Safety and Health Act* and HBMS' OHSAS 18000 certified management system, which will minimize the risk of occurrences that may affect worker health and safety. Noise levels are not expected to be high enough to cause any significant disturbance in the Project Region. Therefore, effects due to noise are assessed to be insignificant.

Climate

Although effects of GHG emissions on climate change are considered irreversible, given the negligible contribution of GHG emissions from the pre-production, production and closure phases of the Reed Mine, the residual effect of GHG emissions on climate change is assessed to be insignificant.

Groundwater

For the purposes of this environmental assessment, a distinction has been made between shallow and deep groundwater resources.

Use of explosives could potentially introduce contaminants underground, leading to a decline in deep groundwater quality. However, given the low hydraulic conductivity of the rock formation groundwater will be fairly limited and with implementation of mitigation measures, residual effects on groundwater quality are assessed to be insignificant.

The Mine dewatering system has the potential to affect deep groundwater quantity by creating a groundwater depression zone. However, based on HBMS experience, this dewatering system has been designed to take into account all inflows for process water and any groundwater seepage. Therefore, it is anticipated that groundwater seepage into the mine underground will be lower than the design inflow rate. For these reasons, the mine dewatering system is not expected to have any significant impact on availability of deep groundwater in the Project Region.

With respect to shallow groundwater, activities such as handling fuels and lubricants can potentially affect quality of shallow groundwater. HBMS will also use groundwater as a source of process water for mining activities and fire protection, as required on site. This groundwater withdrawal could potentially act as a source of contamination of shallow groundwater in the Project Area. However, the measures described to avoid groundwater effects from leaks and spills are judged to be sufficient to mitigate any risk of such contamination to occur. Further, any withdrawal will be in accordance with permitted use and is therefore not expected to have a significant impact on groundwater availability in the Project Region.

ARD could also potentially also affect shallow groundwater quality. However, the rock management practices for both waste rock and ore will mitigate any potential effects from ARD.

Therefore, the overall effects on groundwater are assessed to be insignificant.

Surface Water

The Reed Mine will not be using any surface water, and therefore no effects are anticipated on surface water quantity in the region. Waste rock management practices will mitigate any potential effects on soil quality due to ARD, and pathways affecting surface water quality are not expected to occur.

Water discharged from the polishing pond will comply with the applicable Tier 1 criteria set out in MWQSOG. Sewage will continue to be collected in sewage holding tanks, which in turn will be regularly pumped out and trucked to a licensed sewage treatment facility in accordance with Onsite Wastewater Management System Regulation (Manitoba Regulation 83/2003). Ongoing compliance with these regulations is considered to be acceptable mitigation to reduce any potential effects on surface water quality from sanitary sewage disposal. Therefore, effects on surface water as a result of the proposed project are assessed to be insignificant.

Protected and Other Flora Species

Although the Project Site was cleared as a part of the AEP, no unique vegetation communities were lost and the species lost to the development footprint are common in the Project Region. No additional loss of vegetation will be caused by pre-production or production phases of the Reed Mine. The loss of vegetation is therefore not considered significant.

Protected and Other Fauna Species

No habitat of specific or critical value to wildlife was observed at the Project Site (such as calving or over-wintering areas) and, based on site conditions and limited field observations, it is expected that there is no critical wildlife value in the Project Area. Although the Reed AEP has resulted in a loss of wildlife habitat at the Project Site, the type of habitat that has been lost is common in the Project Area and Project Region. No additional loss of wildlife habitat will be caused during pre-production or production at Reed Mine. Disturbance to wildlife due to noise will be limited to portions of the Project Area with no noise effects anticipated beyond the Project Area. Additionally, during closure, the Project Site will be restored to pre-mining conditions to the extent possible. Therefore, effects on fauna as a result of the proposed project are assessed to be insignificant.

Aquatic Resources and Protected Species

There are no protected species known to occur in the Grass-Burntwood River watershed. The mitigation measures planned for surface water are anticipated to sufficiently mitigate potential surface water effects and avoid significant residual effects.

Land Use

The Reed Mine lies within the southern region of the Grass River Provincial Park, which allows for mining development in the area. Given the remote location of the Reed Mine Project Site, activities associated with the project are not expected to interfere with park activities. The vegetative buffer around the site further provides a visual buffer, which blankets mining activity from the main highway.

With respect to noise-related effects of mining activity, with the implementation of engineering controls on noise sources, combined with the vegetative buffer around the site is anticipated to mitigate potential noise effects at the Project Site. Given the high separation distance to the nearest campgrounds and lodges, it is not anticipated that noise from mining activities will cause any disturbance to park users. Therefore, it is assessed that the project will not cause any significant effect on land use.

Resource Use

The project will not adversely affect any water body that may be used for fishing. Therefore, no effects on fishing are expected to occur. Similarly, residual effects on wildlife and wildlife habitat in the Project Region are assessed to be negligible. Therefore, no significant impacts on trapping are expected to occur.

In accordance with the 2012 Manitoba Hunting Guide (Manitoba Conservation and Water Stewardship 2012), hunting in provincial parks is subject to specific regulations, designed to ensure human safety. The guidelines indicate that “persons may not hunt, possess a loaded firearm, or discharge a firearm within 300 m of recreation areas, cottages, dumps, roads and prescribed trails.” Since the Project Site falls within 300 m of PTH 39, hunting is not allowed within the boundaries of the Project Site. Therefore, it is assessed that the project will not interfere with hunting activities.

Heritage Resources

There are no historic or heritage resources anticipated at the Project Site or in the immediate surrounding area. Any disturbances during the pre-production phase will be limited to the existing cleared and levelled Reed AEP site, and no further disturbance beyond the Project Site will occur during production or closure activities. Therefore, no effects on heritage resources are expected to occur during construction, operation or closure of the Reed Mine.

Aesthetics

Based on the remote location of the Project Site, aesthetic effects due to the pre-production and production phases are assessed to be negligible.

During closure, the Reed Mine site will be returned to its natural pre-project state to the maximum extent possible. It is anticipated that re-vegetation as well as natural succession will substantially return the mine site to pre-mine conditions. Once these efforts have been completed, aesthetic conditions on the site will be substantially restored to conditions that existed before mineral exploration on the site.

Conclusions Summary

In summary, the residual environmental effects will be negligible to minor in magnitude with the implementation of design features, standard operating, and mitigation measures described. The measures described to mitigate the risk of occurrence of accidents and malfunctions are deemed to be appropriate in mitigating the risk of such occurrences. Therefore, based on the available information and documented assumptions, it is our opinion that the overall potential adverse effects of the proposed project will be negligible to minor in magnitude, reversible, and are assessed to be not significant.

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