GREENSTONE GOLD MINES

Hardrock Project

Biodiversity Management and Monitoring Plan

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BMMP	Biodiversity Management and Monitoring Plan
CEA	Canadian Environmental Assessment Agency
COSEWIC	Status of Endangered Wildlife in Canada
COSSARO	Committee on the Status of Species at Risk in Ontario
DFO	Fisheries and Oceans Canada
EAC	Environmental Advisory Committees
EC	Environment Canada
EIS/EA	Environmental Impact Statement/Environmental Assessment
ELC	Ecological Land Classification
EMMPs	Environmental Management and Monitoring Plans
ESA	*Endangered Species Act*
GGM	Greenstone Gold Mines GP Inc.
GIS	geographic information system
LOM	Life of Mine
MECP	Ministry of Environment Conservation and Parks
MNRF	Ministry of Natural Resources and Forestry
MTO	Ministry of Transportation
NHIC	Natural Heritage Information Centre
OMAFRA	Ontario Ministry of Agriculture, Food and Rural Affairs

PDA	Project development area
SAR	species at risk
SARA	*Species at Risk Act*
SARO	Species at Risk in Ontario
SOCC	species of conservation concern
SWH	significant wildlife habitats
TMF	tailings management facility
UTM	Universal Transverse Mercator

1 Introduction and Environmental Management and Monitoring Plan Overview

Greenstone Gold Mines GP Inc. (GGM) is committed to minimizing environmental effects through the implementation of mitigation measures, monitoring, and adaptive management for the Hardrock Project (the Project) within Environmental Management and Monitoring Plans (EMMPs) for construction and operation. The Biodiversity Management and Monitoring Plan (BMMP) describes monitoring to address regulatory and permit requirements and outlines how monitoring results will be used to guide management decisions.

Through the EMMPs, the Project's environmental risks and opportunities are addressed in a comprehensive, systematic, planned and documented manner to meet the following objectives:

- The Project is carried out in compliance with existing legislation, consistent with federal and provincial guidelines, best practices, GGM corporate policies, and commitments made to Indigenous groups and communities during project review
- Predictions of environmental effects identified in the environmental assessment are confirmed
- Measures to mitigate environmental effects are documented, their effectiveness assessed, and needs for further mitigation identified as needed
- Benefits from the Project are enhanced
- Reporting is structured to inform adaptive management and continual improvement.

The EMMPs guide environmental management for the Project. They are being progressively refined as the Project moves - through permitting and construction. They will be updated based on continual improvement during operations, using an adaptive management approach.

An adaptive management process, including a framework for ongoing review of monitoring data and mine site performance, is used to identify whether corrective actions (further mitigation measures) are needed. This process is described in Section 7.3.

The BMMP is structured to contain general information about management and monitoring in the main part of the report and specific monitoring and corrective action plans for wetlands, invasive plants, woodland caribou, wildlife-vehicle interactions, wildlife-water interactions, bank swallow, bald eagle, barn swallow, breeding birds, migratory birds nests and revegetation in appendices.

1.1 Ecological Context for Individual Vegetation and Wildlife Plans

The information in this section provides background information and rationale for development of individual management and monitoring plans (Appendices A through L) for vegetation and wildlife. Wetlands, invasive plants, woodland caribou, wildlife-vehicle interactions, wildlife-water interactions,

bank swallow, bald eagle, breeding birds, barn swallow, migratory birds nests, revegetation and the realignment of Goldfield Creek were selected for specific monitoring and management because of regulatory requirements or conservation concern.

1.1.1 *Upland Vegetation and Wetlands*

The Project is in the southern boreal forest of Northwestern Ontario in the Lake Nipigon Ecoregion (3W) (Crins et al 2009). The ecoregion is underlain by crystalline Precambrian bedrock of granitic and greenstone origin, resulting in a poorly drained landscape supporting a wide variety of upland and lowland communities. The climate is relatively cool with a mean annual temperature of 0.6°C and 764.6mm of precipitation, roughly two thirds of which falls as rain (Environment and Climate Change Canada, 2019). Relatively frequent stand replacing fires result in large areas of even aged jackpine and aspen stands while lowlands support extensive conifer swamps and bogs, with smaller amounts of fens.

During baseline studies, 245 species of vascular plants were recorded, with no species at risk (SAR[1]) or species of conservation concern (SOCC[2]) identified. The upland vegetation and wetland ecosites are typical Ecoregion 3W. No provincially rare or specialized habitat for upland vegetation communities have been identified and there are no designated natural heritage or protected areas (i.e., provincial or national parks) within the mine area.

The wetland ecosite types (coniferous swamp and fen community types) present in the mine area are common types across the region and throughout northern Ontario. In the approved Environmental Impact Statement/Environmental Assessment (EIS/EA) for the Project, it was concluded that functional integrity of the wetland systems will be maintained. One sensitive (but not provincially designated as rare) wetland community was identified and has been avoided through Project design (Appendix A).

1.1.2 *Wildlife and Wildlife Habitat*

During the baseline surveys, 184 wildlife species were recorded. Resident or breeding SAR and SOCC included Canada warbler, bald eagle, eastern wood-pewee, common nighthawk, barn swallow, northern myotis, little brown myotis, and taiga alpine butterfly. Although not breeding locally, American white pelican staging and foraging habitat is present (associated with Kenogamisis Lake). Bank swallow nesting occurred outside of the Local Assessment Area defined in the EIS/EA.

[1] SAR: a species listed on Schedule 1 of SARA or listed as threatened or endangered under the ESA.]

[2] SOCC: a species special concern as defined under the federal *Species at Risk Act* [SARA] or the provincial *Endangered Species Act* [ESA]

Woodland caribou were not recorded and their presence is unlikely; however, the Project occurs within their historical range. Provincially significant wildlife habitats (SWH) identified within the Project area include:

- Moose late winter cover
- Waterfowl stopover and staging habitat (aquatic)
- Amphibian breeding habitat
- Turtle wintering area
- Taiga alpine butterfly habitat
- Waterfowl nesting habitat

Other important wildlife habitats identified in the EIS/EA as occurring within the mine area are moose foraging habitat and non-treed-wetland bird breeding habitat.

2 Mine Overview

The Hardrock deposit will be mined as an open pit. The process plant will operate 365 days per year with a Life of Mine (LOM) of approximately 15 years. Mill throughput will range from 24,000 tonnes per day (tpd) increasing to 30,000 tpd as conditions warrant. The overall Project schedule will consist of the following phases:

- Construction: Years -3 to -1, with early ore stockpiling commencing after the first year of construction.
- Operation: Years 1 to 15, with Year 1 representing a transition from construction to operation.
- Closure: Years 16 to 20 for Active Closure and Years 21 to 36 for Post-Closure.

Key mine components of the Project development area (PDA) are an open pit, waste rock storage areas (WRSAs), overburden storage areas, ore stockpile, ore crushing and mill feed ore storage activities, process plant, water management facilities, tailings management facility (TMF), power plant and associated infrastructure, natural gas plant and explosives facility. Ancillary Project components are buildings, service water supply and associated infrastructure, sewage and effluent treatment plants, site roads, watercourse crossings, realignments, and habitat compensation/offsets, onsite pipelines and piping, fuel and hazardous materials storage, aggregate sources, and temporary camp. Existing infrastructure currently located within the PDA will be relocated, including a portion of Highway 11, a Ministry of Transportation (MTO) Patrol Yard, and Hydro One Networks Inc. (Hydro One) facilities.

3 Purpose of the Biodiversity Management and Monitoring Plan

The purpose of the BMMP is to describe monitoring to address regulatory and permit requirements and outline how monitoring results will be used to guide management (e.g., implementation of additional mitigation measures), as follows:

- Describe vegetation and wildlife monitoring programs to confirm effectiveness of mitigation measures that have been implemented
- Describe mitigation approaches and protection measures for reducing effects on vegetation and wildlife
- Verify conclusions of the EIS/EA regarding environmental effects on vegetation and wildlife.

The BMMP addresses planning, management and/or monitoring activities related to vegetation and wildlife during construction and operations, including protection measures intended to support the achievement of the eventual end land-use objective as provided in the Closure Plan. The Closure Plan further outlines the measures associated with vegetation and wildlife during the closure and post-closure phases.

Biodiversity refers to a rich variety of life and is generally considered to exist at three levels: variety of genetic information (genetic diversity), variety of species (species diversity) and variety of habitats (ecosystems diversity). A diversity of healthy, functioning ecosystems on the landscape is considered essential for maintaining genetic and species diversity (Ontario Biodiversity Council 2011).

In this context, GGM's BMMP focuses on mitigation, monitoring, and corrective actions related to habitats and species identified in the EIS/EA for vegetation and wildlife. Specifically, these habitats and species are: plant or wildlife species at risk; species of conservation concern; components of significant wildlife habitat; specific plant or animal species of importance to Indigenous groups or agencies; and upland, wetland, and rare vegetation communities. Protection and monitoring of these habitats and species supports the maintenance of the natural biodiversity within the area around the mine.

The BMMP is intended to be used in conjunction with the Water Management and Monitoring Plan (to evaluate whether changes in groundwater associated with the Project affect wetland water levels).

3.1 Performance Objectives

Objectives and targets are established to drive continuous improvement in environmental performance and are consistent with the overall strategic goals of the Project. Objectives are measurable (where possible), monitored, communicated, and updated as appropriate.

In support of GGM's overarching environmental objective (i.e., to work to prevent or mitigate any adverse environmental effects, meet or exceed regulatory requirements, and strive to continually improve

environmental practices and performance), GGM has established the following performance objectives for the management of biodiversity that consider key Project interactions and compliance obligations:

- Reduce Project-related wildlife mortality and conflicts (e.g., vehicle collisions, TMF interactions)
- Reduce Project-related disturbance to vegetation and wildlife
- Maintain long-term viability of vegetation communities
- Protect species, and critical habitat of SAR and SOCC
- Reduce effects to provincial SWH and adverse effects on the sustainability of wildlife populations.

These obligations will be met through monitoring and use of corrective actions (mitigation measures) to address concerns that are identified.

3.1.1 *Triggers and Thresholds for Action and Adaptive Management*

Triggers for further action within an adaptive management structure need to be robust (based on sufficient data to describe variability), reliable (easily and consistently measurable), and meaningful (reflect potential adverse effects on the environment). For the BMMP, the mitigation measures described in Section 6 and in the Appendices are considered to be in place to reduce potential adverse effects or to provide corrective actions; however, adaptive management will be used as follows:

- Guide the continual improvement process[3]
- Incorporate changes to the management and monitoring plan related to introduction of new regulatory requirements, revised objectives or criteria, or updated best practices or technology.

Further information about the adaptive management process is provided in Section 7.3.

[3] Continual improvement refers to improving environmental management practices and adjusting monitoring by learning from outcomes. Adaptive management provides the flexibility to address/accommodate new circumstances, to adjust monitoring, implement new mitigation measures or modify existing measures. GGM will identify and correct incidents with appropriate measures aimed to prevent reoccurrence and/or similar occurrences, including modifying operations if required.

4 Scope

The BMMP applies to Project infrastructure and management under the care and maintenance of GGM. It does not include components managed or maintained by third parties. The BMMP covers the following:

- Geographic scope - area of the Project that will undergo changes through construction and/or operation to accommodate the advancement of Project, and associated monitoring
- Temporal scope - construction and operation phases
- Regulatory scope – applicable laws and regulations, described in Table 4-1.

The BMMP applies to individuals working for or on behalf of GGM, including employees and contractors, who have a role and/or accountability for the development, implementation and maintenance of this BMMP.

Table 4-1: Regulatory Requirements that Apply to the Biodiversity Management and Monitoring Program

Type of Requirement	Relevant Act or Document	Details
Environmental Assessment Process Requirements	Federal Decision Statement Conditions	A decision statement was issued by the Canadian Environmental Assessment Agency under Section 54 of the *Canadian Environmental Assessment Act* on December 10, 2018 that outlined a series of conditions in which GGM must comply. This BMMP addresses the following conditions: • Condition 4 (Migratory Birds) • Condition 8 (Listed species at risk)
	Provincial Environmental Assessment Certificate Conditions	A Provincial Environmental Assessment Certificate was issued by the Ministry of the Environment, Conservation and Parks (MECP) in March 2019. This BMMP addresses the following conditions: • Condition 17 (Vegetation and Habitat Restoration)
Regulatory Requirements	Federal	*Species at Risk Act* *Migratory Birds Convention Act*
	Provincial	*Endangered Species Act* *Fish and Wildlife Conservation Act* *Provincial Policy Statement*
	Municipal Regulatory Requirements	There are no known local or municipal regulatory requirements related to wildlife and vegetation.
Other Commitments and Requirements	N/A	This section will be updated as commitments are identified during the permitting process. It is expected that monitoring requirements not required by specific regulations will be identified in a Follow-up Agreement.

4.1 Regulatory Requirements

The BMMP has been developed and will be implemented to comply with applicable legislative, regulatory, permit and other relevant obligations, outlined in the following sections.

4.1.1 *Federal Regulatory Requirements*

4.1.1.1 Species at Risk Act

The federal *Species at Risk Act* (SARA) became law in June 2003 and protects federally listed species at risk (SAR) and designated critical habitats. SARA applies to federal lands and is administered throughout Canada by Environment and Climate Change Canada (ECCC). The purposes of SARA are to provide for the recovery of wildlife species that are extirpated (no longer exist in the wild in Canada), endangered, or

threatened as a result of human activity, and to manage species of special concern to prevent them from becoming endangered or threatened.

SARA includes prohibitions against killing, harming, harassing, capturing or taking individuals of SAR, damaging or destroying residences or critical habitats, and can impose restrictions on development and construction projects which could affect SAR.

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC), an independent body of experts, assesses wildlife according to a broad range of scientific data. The committee meets annually to review status reports on species suspected of being at risk and provides assessments to government and the public. The federal Cabinet then decides whether those species should get legal protection under SARA. These decisions are made after consultation with affected stakeholders and other groups.

SARA is implemented by the Government of Canada to protect SAR in Canada and it applies to wildlife listed in Schedule 1 of SARA and their critical habitat.

The Project is not located on federal lands. On lands under provincial jurisdiction, SARA goals are typically implemented through provincial legislation, policy, and guidelines. Therefore, SARA does not directly apply to the Project. The effective Species at Risk policy for this Project is the provincial policy, the Ontario Endangered Species Act 2007 (ESA).

4.1.1.2 Recovery Strategies

Federal Recovery Strategies are developed for species designated as extirpated, endangered, or threatened under Schedule 1 of SARA, and include the identification of critical habitat.

There are three recovery strategies (boreal caribou, Environment Canada (EC) 2012; Canada warbler, EC 2016a; common nighthawk, EC 2016b) and one proposed recovery strategy (little brown myotis and northern myotis, EC 2015) applicable to the Project. The recovery strategies for boreal caribou, little brown myotis, and northern myotis identify critical habitat and are considered for the Hardrock Project.

4.1.1.3 Migratory Birds Convention Act

The *Migratory Birds Convention Act* pertains to migratory birds and their habitat, as defined in Article 1 of the Act[4]. It prohibits the harming, killing, disturbance or destruction of migratory birds, nests and eggs (Section 6) and also prohibits depositing oil, oily waters, or other substances harmful to migratory birds in areas that they may inhabit (Section 5[1]).

[4] Birds not addressed under the *Migratory Birds Convention Act* are grouse, quail, pheasants, ptarmigan, hawks, owls, eagles, falcons, cormorants, pelicans, crows, jays, kingfishers, and some species of blackbirds

4.1.2 *Provincial Regulatory Requirements*

4.1.2.1 Endangered Species Act

The *Ontario Endangered Species Act, 2007* (ESA) protects species that are listed as threatened or endangered on the Species at Risk in Ontario (SARO) List. The SARO list is developed by the Committee on the Status of Species at Risk in Ontario (COSSARO), which is a committee of scientists and individuals. COSSARO classifies species according to their degree of risk based on the best available scientific information, community knowledge and Indigenous traditional knowledge.

The ESA protects individuals of the listed species from harm or harassment and their habitats from damage or destruction. Threatened and endangered species on the SARO list receive immediate general habitat protection, defined as areas on which the species depends, directly or indirectly, to carry out its life processes. Regulated habitat is scheduled to be defined within two (endangered) or three (threatened) years of a species being added to the SARO list. Regulated habitat is species-specific and is more precisely defined than general habitat to include specific habitat features and geographic boundaries.

Under certain circumstances, different types of permits may be issued under the ESA to allow activities that would otherwise be prohibited by the Act. The permit type that would likely be most relevant to the Project would be issued under Section 17(2)(c) of the ESA. Commonly referred to as an overall benefit permit, requirements include:

- Demonstration that reasonable alternatives were considered
- Documentation of steps taken to limit residual effects on the species
- Commitment to measures to be undertaken that will achieve an overall benefit to the species

Ontario Regulation 242/08 provides specific exemptions from the provisions of the ESA under certain conditions. Exemptions and conditions vary by species, type of activity, the date the species was listed and the date the activity commenced.

Protection under the ESA extends to both public and private lands and is administered by the MECP . When COSSARO classifies a SARO, the classification applies throughout Ontario, unless COSSARO indicates that the classification applies only to a specified geographic area in Ontario. Ministry of Natural Resources and Forestry (MNRF) may continue to play a role in the management of Special Concern species.

4.1.2.2 Ontario's Woodland Caribou Conservation Plan

The Project is not in an area identified as critical habitat for woodland caribou (Environment Canada 2012). However, woodland caribou were addressed in the EIS/EA and are considered in this plan because the area historically provided habitat for this species. The Woodland Caribou Conservation Plan (MNR 2009) provides policy direction for the management and recovery of woodland caribou (forest-dwelling boreal

population). Habitat is identified in accordance with the *General Habitat Description for the Forest-dwelling Woodland Caribou* (MNR 2013a) and the Recovery Strategy for Woodland Caribou (*Rangifer tarandus caribou*) (Environment Canada 2012). In Ontario, protected (critical) habitat for woodland caribou is classed as: Category 1 – nursery areas, winter use areas, travel corridors; Category 2 – seasonal ranges; and, Category 3 – remaining areas within the range (MNR 2013a).

4.1.2.3 Fish and Wildlife Conservation Act

The *Fish and Wildlife Conservation Act* is administered by the MNRF for planning, wildlife management, and wildlife enforcement. It provides protection for wildlife and wildlife residences (e.g., dens and nests).

4.1.2.4 Provincial Policy Statement

The Provincial Policy Statement (PPS) (MMAH, 2014; MMAH, 2020) informs land use planning decisions under the *Planning Act* in Ontario. While EAs are not subject to *Planning Act* approval, the policy guidance and practice developed to support the PPS provides a framework for assessing the functions and sensitivities of natural features. This framework was considered in evaluating potential environmental effects and the identification of mitigation measures to reduce environmental effects.

Policy 2.1 of the PPS establishes a provincial interest in the protection of natural heritage features including provincially significant wetlands, significant woodlands, significant valleylands, significant wildlife habitat, areas of natural and scientific interest, significant habitat of endangered and threatened species, and fish habitat. Guidance to help identify and evaluate natural heritage features is provided in the Natural Heritage Reference Manual (MNR, 2010), the Significant Wildlife Habitat Technical Guide (MNR, 2000), and the Eco-Region Criteria Schedules (MNRF 2015a) for significant wildlife habitat.

The PPS recommends criteria for determining the significance of natural heritage features. While some significant features may already be identified and mapped by MNRF, the significance of others can only be determined after field verified evaluation. While specifically developed for decisions under the *Planning Act,* the PPS and guidance documents can also be used as tools for identifying important natural features for consideration under the environmental assessment.

It should be noted that “significance” under the PPS is not associated with the term “significant” as it relates to the assessment of residual adverse environmental effects.

Development and site alteration will not be permitted in habitat of endangered species and threatened species, or in fish habitat, except in accordance with provincial and federal requirements.

5 Roles and Responsibilities

All persons working for or on behalf of GGM, including employees and contractors, have a role in the successful implementation and maintenance of the BMMP. Table 5-1 outlines roles and responsibilities for activities under this plan:

Table 5-1: Roles and Responsibilities

Role	Responsibility
Construction Manager (for construction phase) Mine Manager (for operation phase)	• Collaborate with the Environmental Superintendent to plan soil handling activities in regards to invasive plant management. • Collaborate with the Environmental Superintendent to plan the development and construction of compensation areas. • Collaborate with the Environmental Superintendent to provide wildlife awareness and safety training to Project personnel and contractors.
Environmental Superintendent	• Collaborate with the Construction Manager and Mine Manager, as described above. • Collaborate with the Construction Manager and Mine Manager to communicate compliance obligations and provide training to employees and contractors related to EMMP. • Identify, document, track, and maintain up-to-date compliance obligations related to EMMP goals. • Completion of the annual Biodiversity Assessment Report for internal review to aid in adaptive management of the BMMP.
Environmental Supervisor	• Collaborate with Construction Management to delineate areas of disturbance for construction activities. • Supervise clearing and grubbing activities to minimize ground disturbance. • Organize and schedule monitoring activities • Oversee implementation of monitoring activities by Environmental Monitors/Technicians
Environmental Monitors / Technicians	• Review and provide input into BMMP. • Participate in implementation of mitigation measures and monitoring. • Provide input into any future revisions of the BMMP and adaptive management as required. • Communicate results of monitoring to their community
Environmental Advisory Committees (EAC)	• Review and provide input into BMMP. • Provide input into any future revisions of the BMMP and adaptive management as required. • Meet regularly and report EAC activities to the Implementation Committee.

Table 5-1: Roles and Responsibilities

Role	Responsibility
Qualified Biologist(s)	• Undertake bird nest searches prior to vegetation clearing undertaken during the breeding period for migratory birds • Review potential bat habitat trees to make a determination on occupancy before removal during the maternity roosting period • Undertake follow-up vegetation and wildlife monitoring. • Advise on corrective actions as required (as detailed in Appendices A-K)
Equipment Operator	• Complete applicable training in clearing activities, soil salvage, soil handling, and erosion and sediment control. • Complete clearing/grubbing and soil salvage/handling activities according to defined procedures.
Employees / Contractors	• Be aware of risks associated with wildlife that may be present at or near to the Project site. • Follow outlined compliance obligations related to BMMP, including wildlife and wildlife habitat reporting requirements.

5.1 Communication

5.1.1 *Notification for Reportable Incidents*

The following incidents are to be reported immediately to relevant agencies:

- **SAR Mortality -** all relevant data regarding identification of mortality of an endangered or threatened species on the SARO list will be reported to MECP within two business days
- **Wildlife Mortality Event -** All relevant data regarding identification of a mortality event (i.e. a mortality of multiple individuals of a species, attributable to the Project) will be reported to MNRF Nipigon District, Canadian Environmental Assessment Agency (CEA Agency), and Indigenous Communities within two business days (See Appendix D.4)
- **Bald eagle mortality** - Data on any bald eagle mortality recovered at the Project Site will be reported to MNRF Nipigon District, MECP and Environmental Monitors within two business days
- **Injured Wildlife** - Upon discovery of an injured wildlife at the Project Site, MNRF and MECP (for ESA-protected species) will be contacted as soon as possible.

Additional reporting requirements for the BMMP are described in Section 7.2.

5.2 Support

5.2.1 *Competence, Training and Awareness*

GGM requires that persons working under its management, including employees and contractors, have the knowledge, understanding, skills, and abilities to complete work in a manner that safeguards the environment. The following actions will be established to provide worker competency, training and awareness:

- Construction Manager, Mine Manager, Environmental Superintendent, Environmental Supervisor, Environmental Monitors/Technicians, and equipment operators will undertake environmental training relevant to their roles to ensure mitigation measures are successfully implemented (see Table 5-2 for roles and responsibilities)

- Provide wildlife awareness and safety training to Project personnel and contractors. All persons entering the Project site to perform construction activities or mine operations will receive wildlife awareness and safety training by the Environmental Superintendent, Environmental Supervisor or a Qualified Biologist). The training will include:

- Information on the types of wildlife species expected to occur at the Site, including species at risk

- Appropriate action to take if wildlife is encountered

- How to record species occurrences (Wildlife Encounter Report described in Section 7)

- When to notify a qualified biologist to fulfil mitigation commitments

- Recommended precaution and care when undertaking construction and operation activities in order to avoid harming wildlife or unnecessarily damaging or destroying their habitat.

6 Mitigation and Protection Measures

The mitigation and protection measures described in this section are derived from regulatory requirements and commitments made in the EIS/EA to manage potential adverse effects of the Project on wildlife and vegetation and to meet the end land-use objective outlined in the Closure Plan.

6.1 General Approach

Project planning, design, and implementation of mitigation measures will be used to avoid or limit adverse environmental effects on vegetation and wildlife. Standard practices and general environmental protection measures for mining projects will address Project-related effects.

Environmental effects on upland vegetation and wetlands will result from vegetation removal in upland and wetland habitat types which are generally common and widespread in the region. By implementing the mitigation measures described below and in the Appendices, the Project will not alter or remove an upland vegetation community type in a way that is expected to result in the long-term loss or viability of that habitat type, and will not result in effects on a species listed on Schedule 1 of SARA or listed as threatened or endangered under the ESA. Also, the Project will not alter a wetland community type such that the long-term viability of that type is compromised. Following active closure, the wetland system in the region will include the same complement of wetland types, including isolated, palustrine, riverine and lacustrine, as it did before the Project. These wetlands will be distributed across the subwatersheds except where removed locally by Project development, and are predicted to continue to support rivers, streams and lakeshores. Mitigation measures for vegetation and wetlands include those to limit adverse effects on the abundance of vegetation species of interest, overall vegetation communities, and wetland function.

One notable wetland feature was identified that partially overlaps with the Project. This sensitive wetland feature is comprised of three wetland ecosites (Sparse Treed Fen (B136), Intermediate Conifer Swamp (B128) and Rich Conifer Swamp (B129). The fen portion of the wetland occupies a shallow basin that covers about 40 ha and supports habitat for a SOCC butterfly (taiga alpine butterfly [*Erebia mancinus*]; provincially ranked as S3). Although the Sparse Treed Fen ecosite (B136) is not listed as provincially rare, this fen and adjacent wetland community types are considered a sensitive feature due to its size, potential habitat for the butterfly SOCC, dependence on nutrient rich groundwater, and general wetland functions. The Project has been designed to avoid direct impacts to the above-noted sparse treed fen (B136) community (see Figure A1, Appendix A). There will be no construction or vegetation removal inside this fen, and it will also be protected by a buffer of upland forest and treed wetland.

The Project will result in the loss of habitat for:

- Canada warbler (breeding)
- Common nighthawk (breeding)
- Eastern wood peewee (breeding)
- Taiga alpine butterfly
- Amphibian (breeding)
- Waterfowl (Nesting)
- Raptor (nesting, including bald eagle),
- Moose (late winter cover and foraging)
- Bat maternity (roosting)
- Turtle (overwintering)
- Non-treed wetland breeding bird

Other potential effects on wildlife include mortality due to site clearing and vehicle collisions, change in wildlife movement due to sensory disturbance and Project components which may act as physical barriers. Mitigation measures for wildlife and wildlife habitat include those to avoid and reduce adverse effects to wildlife habitat, wildlife mortality risk, and wildlife movement.

6.2 Vegetation and Wetlands

Measures to mitigate direct and indirect effects of the Project on vegetation and wetlands for all phases of the Project will be implemented as described in the following plans:

- Wetland Management Plan (Appendix A)
- Invasive Species Management Plan (Appendix B)
- Revegetation Plan (Appendix K)
- Goldfield Creek Diversion Biodiversity Monitoring Plan (Appendix L)

6.3 Wildlife

The following measures will be implemented to mitigate the direct and indirect effects of the Project on wildlife and wildlife habitat during all Project phases:

- Retain actual or potential wildlife trees (e.g., cavity trees, snags) in areas where it is safe to do so
- Consult with MNRF on the direction provided in Ontario's White-nose Syndrome Response Plan (MNRF 2015b) and its applicability to the Project
- Remove mature deciduous and mixed forest communities or buildings outside the core maternity roosting season for bats (May 1 to August 31), to the extent practical; if that is not practical,

additional mitigation may be required between May and August. This measure will also reduce the risk to other species that use trees for denning or shelter (e.g., marten).

- Implement management practices for helicopter activity around wildlife including low level flying restriction where safe to do so
- Restrict project vehicles to designated areas and limit off road use by Project personnel
- Provide wildlife awareness and safety training to Project personnel and contractors
- Maintain the Project site, through proper handling and storage of industrial materials and debris, in a manner that reduces the risk that wildlife will encounter potential hazards, such as ropes, wires and holes
- Upon discovery of injured wildlife at the Project site or on Project roads, take measures to protect the individual from further harm and do not perform any work in the immediate location of the injured species that would subject it to further harm. Implement required actions (e.g., contact MNRF, and if feasible assist in the capture and relocation of an injured animal to a safe area and/or appropriate care.
- Regularly review relevant applicable legislation and guidance, including the results of COSSARO and COSEWIC assessments, and assess regulatory changes for applicability to the Project. Any newly listed species and critical habitat that may interact with the Project will be added to the BMMP as applicable/required.
- Implement project activity restrictions during wildlife sensitive periods as detailed in Table 6-1
- Implement the following Wildlife Plans:
    - Woodland Caribou Mitigation Plan (Appendix C)
    - Wildlife-Vehicle Monitoring and Management Plan (Appendix D)
    - Wildlife-Water Monitoring and Management (Appendix E)
    - Bank Swallow Management Plan (Appendix F)
    - Bald Eagle Protection Plan (Appendix G)
    - Breeding Bird Monitoring Plan (Appendix H)
    - Barn Swallow Mitigation and Restoration Plan (Appendix I)
    - Migratory Bird Nest Management Plan (Appendix J)
    - Goldfield Creek Diversion Biodiversity Monitoring Plan (Appendix L)

Table 6-1: Wildlife Sensitive Periods

Group	Life Cycle Function	Sensitive Period	Applicable Project Activities
Migratory Birds	Nesting	May 1 to August 31	Vegetation clearing and site preparation activities that could result in the incidental take of bird nests will occur outside of this period to the extent feasible. If activities that could result in incidental take cannot be avoided, GGM will implement the Migratory Bird Nest Management Plan (Appendix J).
Bats	Maternity Roosting	May 1 to August 31	Removal of mature deciduous and mixed forest communities or buildings will occur outside of the core maternity roosting season for bats to the extent practical. Additional mitigation may be required for occupied features or activities between May and August. This measure will also reduce the risk to other species that use trees for denning or shelter (e.g., marten).
Raptors [1]	Nesting	February 1 to July 31	Removal of any raptor nests will occur outside of this period or a period as indicated in any Fish and Wildlife Conservation Act (FWCA) permits that are obtained.
Bald Eagle	Nesting	March 1 to June 30	Vegetation clearing activities and site preparation activities between 400 m- 800 m of nests 271, 003, 008 and 487 (if active) will occur outside of this period.
		March 1 to August 31	Vegetation clearing or site preparation activities that are required between 200 m and 400 m of nests 271 and 003 (if active) will occur outside of this period.
Barn Swallow	Nesting	May 1 to August 31	Removal of barn swallow nesting habitat (e.g. the MTO dome and garage) will occur outside of this period.

NOTE:

1. Raptors include species such as barred owl, broad-winged hawk, common raven, Cooper's hawk, great horned owl, long-eared owl, merlin, red-tailed hawk, or sharp-shinned hawk.

6.3.1 *Construction*

The following measures will be implemented to mitigate the direct and indirect effects of the Project on wildlife and wildlife habitat during construction:

- Implement mitigation for the potential effects from lighting on wildlife habitat including:
    - Construction lighting will be specified to use only as much lighting as is necessary for safe and efficient construction activities
    - Use down-lighting, a technique of directing night lighting downward, to reduce potential light effects on wildlife

- Prior to construction, flag environmentally sensitive areas adjacent to work areas (e.g., key habitat features such as dens, roosts, stick nests, beaver dams, hibernacula) prior to clearing and construction, and evaluate the features for additional mitigation measures (e.g., timing windows and/or setbacks).

- Obtain a permit under the *Fish and Wildlife Conservation Act* for the removal of any raptor nests or beaver dams required for the Project. Removal to be conducted following timing restrictions and any other mitigation specified in the permit and as determined during consultation with MNRF.

- Consult with the Fisheries and Oceans Canada (DFO) prior to the removal of any beaver dams to determine if authorization is required.

- To the extent feasible, recover and relocate turtles and amphibians encountered during fish salvage/rescues.

- Any geotextiles used for erosion control or other applications will be net-free to avoid the risk of entanglement by snakes.

6.3.2 *Operation*

The following measure will be used to mitigate direct and indirect effects of the Project on wildlife and wildlife habitat during operation:

- Implement a progressive reclamation program for facilities, as possible, in Project planning as per the Closure Plan.

6.3.3 *Closure*

The following measures will be implemented to mitigate the direct and indirect effects of the Project on wildlife and wildlife habitat during closure:

- Close mine shafts so that the potential for bat hibernacula is considered and the site is closed in compliance with the ESA, 2007.

- Evaluate the potential for closure activities to contravene the ESA prior to closure and complete closure activities in ways to avoid adverse effects on a SAR or its habitat, or if that is not possible, work with MECP to obtain required authorizations.

7 Monitoring, Evaluation, and Reporting

The purpose of the monitoring component of the BMMP is to evaluate and document performance objectives. As such, monitoring is expected to fulfil the following objectives:

- Verify accuracy of the effects assessment for the Project with respect to wildlife and vegetation
- Determine the effectiveness of measures taken to mitigate adverse effects of the Project and identify when additional corrective actions may be required
- Confirm compliance with environmental approvals, permits and authorizations.

The individual monitoring and management plans are described in Appendices A through K. General information is provided below.

7.1 Monitoring and Evaluation

7.1.1 *Vegetation and Wetlands*

To confirm the effectiveness of mitigation measures and verify the conclusions of the EIS/EA for upland vegetation and wetlands, the following monitoring activities will be completed to assess potential disturbance to upland vegetation and wetlands during construction and operation:

- Project footprint tracking through construction and operation:
    - Monitoring of the limits of clearing, using visual examination, to confirm limits are clearly marked and that the clearing works stay within marked out areas
    - Annual spatial mapping of the actual Project footprint using GIS with comparison to plan
- Prior to construction, and in consultation with MNRF, GGM will identify the spatial extent of vegetation communities (per Ecological Land Classification; ELC) and habitats that are likely to be removed or altered
- Verification of wetland effects, as detailed in the Wetland Management Plan (Appendix A)
- Monitoring the presence of invasive species, as detailed in the Invasive Species Management Plan (Appendix B)
- Monitoring to determine the success and stability of areas that are rehabilitated, as detailed in the Revegetation Plan (Appendix K)

7.1.2 *Wildlife and Wildlife Habitat*

To confirm the effectiveness of mitigation measures and to verify the conclusions of the EIS/EA for wildlife, the following monitoring activities will be completed to assess potential effects to wildlife and wildlife habitat during construction and operation:

- Bald eagle nest monitoring (Appendix G)
- Barn swallow replacement habitat monitoring (Appendix I)
- Maintaining a wildlife observation log (Table 7-1) for the Project and associated infrastructure (e.g., access roads). Project personnel and contractors will be encouraged to report sightings of wildlife on and around the Project, and discovery of occupied habitat features (e.g., active dens, beaver dams) for direction on follow-up actions.
- Monitoring of bank swallow management actions (Appendix F)
- Monitoring of breeding birds (Appendix H)
- Monitoring wildlife-vehicle interactions as detailed in the Wildlife-Vehicle Monitoring and Management Plan (Appendix D)
- Monitoring wildlife use of open water areas contained within the Project as detailed in the Wildlife-water Monitoring and Management Plan (Appendix E)

Table 7-1: Wildlife Encounter Report

Name of the observer(s)	
Date and time of the observation(s)	
Location of the observation(s) (habitat/area description, and UTM/ marked location on a map, if possible)	
Species observed	
Number of individuals observed (dead and/or alive)	
Description of the observation (e.g. direction of travel, observed behaviours, presence of habitat features such as dens, other notable observations)	
Photograph of the observation (if possible)	
Actions taken to minimize or mitigate any adverse impacts to wildlife individuals(s), if required (e.g. turtle moved off road in direction it was travelling)	

Small mammal tissue surveys and moose sampling surveys are being undertaken as part of the human health risk assessment, and do not form part of the BMMP. These are provided in the Health of Indigenous Peoples Follow-Up Plan.

7.2 Reporting

The form and frequency of follow-up reporting will be determined as the Project progresses through permitting. However, it is anticipated that elements relevant to the BMMP will be compiled in a formal annual summary report to be provided to interested parties during construction, operation, and, when applicable, during closure. The reporting will be used to inform adaptive management reviews. Receiving, documenting, and responding to communication from external interested parties, including complaints, will also form part of reporting under the BMMP.

Project personnel and contractors will be encouraged to report sightings of wildlife on and around the Project site. Each wildlife observation will be recorded using a Wildlife Encounter Report (Table 7-1). This information can be adapted to an online format or app.

Data on wildlife encounters will be incorporated into geospatial mapping to facilitate visual analysis and mitigation planning. All wildlife encounter data will be incorporated into the Annual report.

7.2.1 *Annual Reporting*

An annual Biodiversity Assessment Report will be compiled that includes the following:

- A record of all personnel that have completed the wildlife awareness and safety training including name; dates of training; training completed and subject matter or list of the training materials reviewed; and the name of the qualified professional who provided the training
- All wildlife encounter data, including geospatial mapping of data
- The monitoring methods, results, and any corrective actions implemented in accordance with the monitoring and management plans included in Appendices A-L

The annual monitoring data will be reviewed internally by GGM and used to adjust the monitoring programs and/or implement corrective actions as appropriate.

Table 7-2 summarizes the reporting requirements for the annual Biodiversity Assessment Report, including distribution list and timing.

Table 7-2: Summary of Reporting Requirements

Report	Data	Submission To:	Timeline
Biodiversity Assessment Report	- all wildlife encounter data - all monitoring methods, results, and corrective actions implemented as part of Appendices A-L - recommendations for BMMP	Internal review at GGM MNRF CEA Agency Indigenous Communities	Annually, within three months of the end of the calendar (monitoring) year

Table 7-2: Summary of Reporting Requirements

Report	Data	Submission To:	Timeline
Injured Wildlife	Upon discovery of injured wildlife at the Project site	MNRF Nipigon District	As soon as possible
SAR Mortality	All relevant data regarding the identification of a mortality of an endangered or threatened species on the SARO list	MECP	Within two business days
Wildlife Mortality Event	All relevant data regarding the identification of a mortality event (i.e. a mortality of multiple individuals of a species, attributable to the Project)	MNRF Nipigon District CEA Agency Environmental Monitors	Within two business days
SAR and SOCC observations	Data on all provincially endangered, threatened or special concern species collected through implementation of the BMMP	Natural Heritage Information Centre (NHIC)	Annually, within three months of the end of the calendar (monitoring) year
Bald eagle mortality	Data on any bald eagle mortality recovered at the Project Site	MNRF Nipigon District Environmental Monitors	Within two business days
Bald eagle nest locations and activity status	Results of annual bald eagle nesting surveys	MNRF Nipigon District CEA Agency Environmental Monitors	Within 30 days of the end of the survey
Invasive Species	Data on any new invasive species recorded at the Project site	MNRF for species listed under the Ontario Invasive Species Act, or Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) for species listed under the Weed Control Act	Annually, within three months of the end of the calendar (monitoring) year

7.2.2 *Notifications*

The following sections describe notifications that will be submitted in accordance with the timelines indicated in Table 7-2.

7.2.2.1 Project Personnel Notification Procedures

Notifications required by Project personnel are as follows:

- Project personnel and contractors working in active zones (e.g., mine site) will relay wildlife sightings to other workers as soon as possible (e.g., by radio)
- Discovery of occupied habitat features (e.g., active dens, beaver dams) will be reported to the Environmental Superintendent as soon as possible for direction on follow-up actions.

- Project personnel and contractors will report wildlife incidents and encounters related to garbage or other attractants so that corrective action (i.e. removal and/or clean up) can be initiated.

7.2.2.2 External Notifications

External notification procedures are detailed in Table 7-2.

7.3 Continual Improvement

GGM is committed to the continual improvement of its environmental management and performance. As part of the GGM Adaptive Management Framework, the BMMP will be assessed annually to verify how it is implemented and the continued suitability, adequacy and effectiveness of the Plan. The review will identify elements in need of revision and evaluate performance against established performance objectives.

Adaptive management is a planned and systematic process for continuously improving environmental management practices by learning from their outcomes. This approach provides the flexibility to address and accommodate new circumstances, adjust monitoring, and implement new mitigation measures or modify existing measures. The Adaptive Management Framework (Figure 7-1) provides a formalized approach to:

- Formally track and monitor activities
- Report and as needed investigate incidents, including non-conformance and non-compliance events
- Develop and implement mitigation measures and corrective actions
- Continue monitoring and update the BMMP as needed.

GGM will identify and correct incidents with appropriate and lasting measures aimed to prevent reoccurrence and/or similar occurrences. Corrective actions will be assigned as appropriate, including actions to prevent their reoccurrence. Corrective actions will vary according to the results of incident investigation and in consideration of other incidents related to biodiversity.

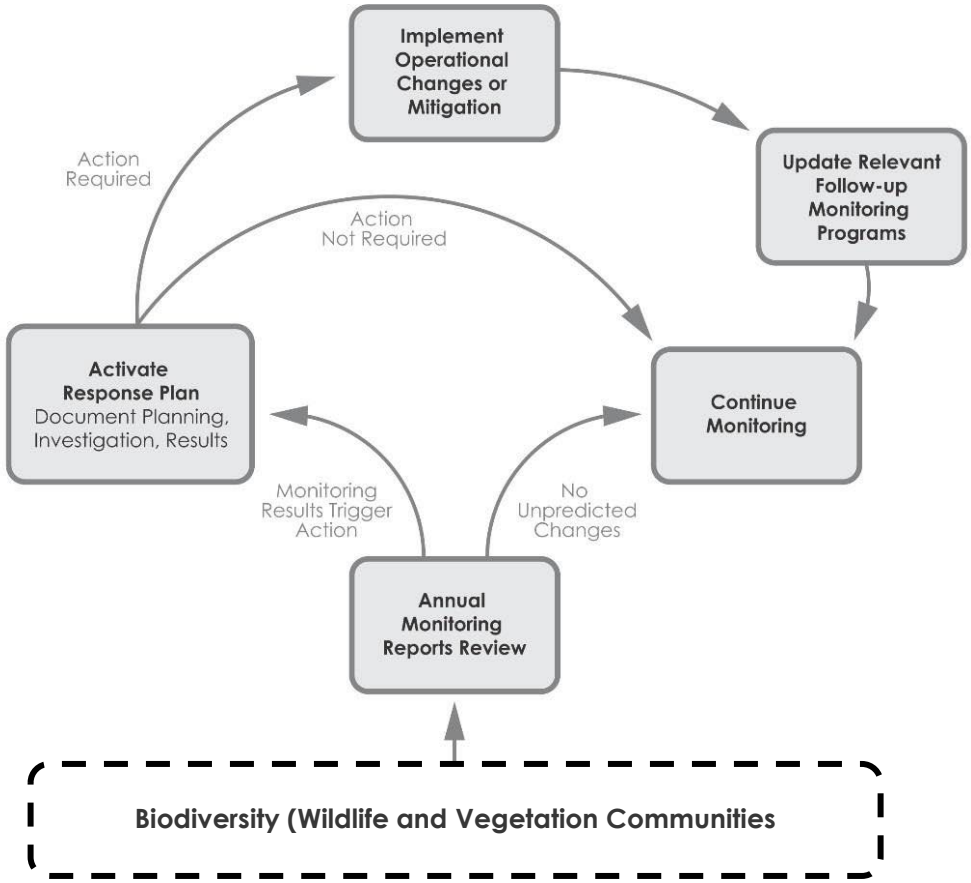

Figure 7-1: Hardrock Project Adaptive Management Framework

8 References

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APPENDIX A
WETLAND MANAGEMENT PLAN

Appendix A Wetland Management Plan

A.1 Background

The purpose of the wetland management plan is to provide a framework for monitoring wetland extent and function and provide management recommendations if changes are observed. This plan should be read in conjunction with the Invasive Plants Management Plan (Appendix B), the Water Management and Monitoring Plan (WMMP) (under separate cover), and the Revegetation Monitoring Plan (Appendix K).

Wetlands occupy 37% of the Project Development Area, of which 90% is swamp forest. One sensitive wetland community, a sparse treed fen (ecosite B136, see also Section 6.1), is present close to the Hardrock Project but is not within the PDA. Removal of wetlands that overlap Project components will result in direct effects (loss of 810 ha), as described in the EIS/EA. Potential indirect effects to wetlands include changes in groundwater levels due to mine dewatering (potential reduction) and TMF (potential increase). Monitoring of created wetlands is addressed in the Revegetation Plan (Appendix K).

A.2 Performance Objective(s)

The performance objective of the Wetland Management Plan is to maintain extent and function of wetlands outside the Project footprint. This objective will be achieved through:

- Implementing mitigation measures during construction and operation of the mine
- Undertaking regular monitoring to identify changes in extent, vegetation composition, and water level of wetlands in the PDA
- Implementing water control measures, if feasible, to increase or reduce input to wetlands

Monitoring of groundwater and surface water levels, and development of potential water management responses, will be undertaken as part of Water Management and Monitoring Plan (WMMP).

A.3 Mitigation Measures

A.3.1 General

The following measures will be implemented to mitigate direct and indirect effects of the Project on wetlands and wetland vegetation during all Project phases:

- Excluding the sensitive Sparse Treed Fen (B136; as described in Section 6.1) from development
- Limiting vegetation clearing to the extent possible within the overall Project footprint

- Conducting pre-clearing meetings with site clearing crew to review areas to be avoided (daily meetings when vegetation clearing is extensive) and marking off all vegetation clearing areas with flagging tape

- Employing mechanical and/or manual vegetation removal practices to the extent practical. If chemical application methods are needed, they will be completed by a licensed herbicide applicator in accordance with Ontario regulations and best management practices for herbicide application (see Invasive Species Management Plan, Appendix B)

- Avoiding tire rutting on wet ground

    - To the extent feasible, construction activities should occur during drier times of the year. Lands affected by heavy rainfall events and wet soil conditions should be monitored, to avoid the potential for topsoil and subsoil mixing. Construction activities should be temporarily halted on lands where excessively wet soil conditions are encountered.

    - If a situation develops that necessitates construction during wet soil conditions, soil protection measures should be implemented, such as: confining construction activity to the narrowest area practical, installing surface protection measures such as matting, gravel access routes over geotextile, and using wide tracked or low ground pressure vehicles.

- Implementing erosion and sedimentation control measures in accordance with the approved Erosion and Sediment Control Plan (under separate cover)

- Implementing a Clean Vehicle Protocol (see Invasive Species Management Plan, Appendix B)

- Use of dust suppressants (e.g., water) on roadways during times of increased potential to generate airborne dust

A.3.2 Construction

The following measures will be implemented to mitigate direct and indirect effects during construction:

- Providing opportunities to Indigenous communities for harvest of food and medicinal plants prior to construction

- Considering commemoration for areas of traditional vegetation to be removed. These ceremonies would be developed as per the Archaeology and Heritage Resource Plan (under separate cover)

- Installing culverts at key locations to maintain drainage and limit potential effects down gradient

- Discussing with MNRF the establishment of a forested buffer along the alignment of the Goldfield Creek diversion to the Southwest Arm Tributary and the sensitive fen community

A.3.3 Operations

The following measures will be implemented to mitigate direct and indirect effects during operation:

- Using dust collection/control systems to reduce potential dust emissions during ore crushing and grinding activities
- Enclosing dust sources such as the mill feed ore storage area
- If water alone is ineffective, using chemical means to control fugitive dust emission from roads
- Implementing progressive reclamation for facilities as per the Closure Plan, and incorporating plant species of interest to Indigenous communities where appropriate and technically feasible
- Mitigating for wetland functional changes, as detailed in the WMMP, including:
    - Diverting seepage and runoff to collection ponds and releasing overland once it meets effluent criteria
    - Monitoring surface water quality and quantity in the water collection systems and select surface water creeks and lakes in the vicinity of the PDA
    - Investigating deviations from predicted values and determining an appropriate response, including implementation of corrective or preventative actions

A.3.3.1 Monitoring

To confirm the effectiveness of mitigation measures and verify the conclusions of the EIS/EA for wetlands, the monitoring program will be implemented to assess potential disturbance to wetlands during construction and operation. Monitoring will focus on collecting data to identify both predicted and unexpected effects to key wetlands. This section describes sites selected for monitoring, methods of data collection, and the monitoring schedule. Baseline data will be collected prior to start-up.

The monitoring program will incorporate:

- Project footprint tracking through construction and operation to document the extent of vegetation clearing and quantify direct effects to wetlands (see Section 7 of the BMMP)
- Verification of indirect wetland effects.

A.3.4 Monitoring Locations

Monitoring will target wetland complexes adjacent to the Project that were anticipated to experience indirect effects due to: groundwater drawdown and/or changes in surface water input (either flow increase or decrease).

Nine target wetland complexes will be monitored, as shown in Figure A1. These include:

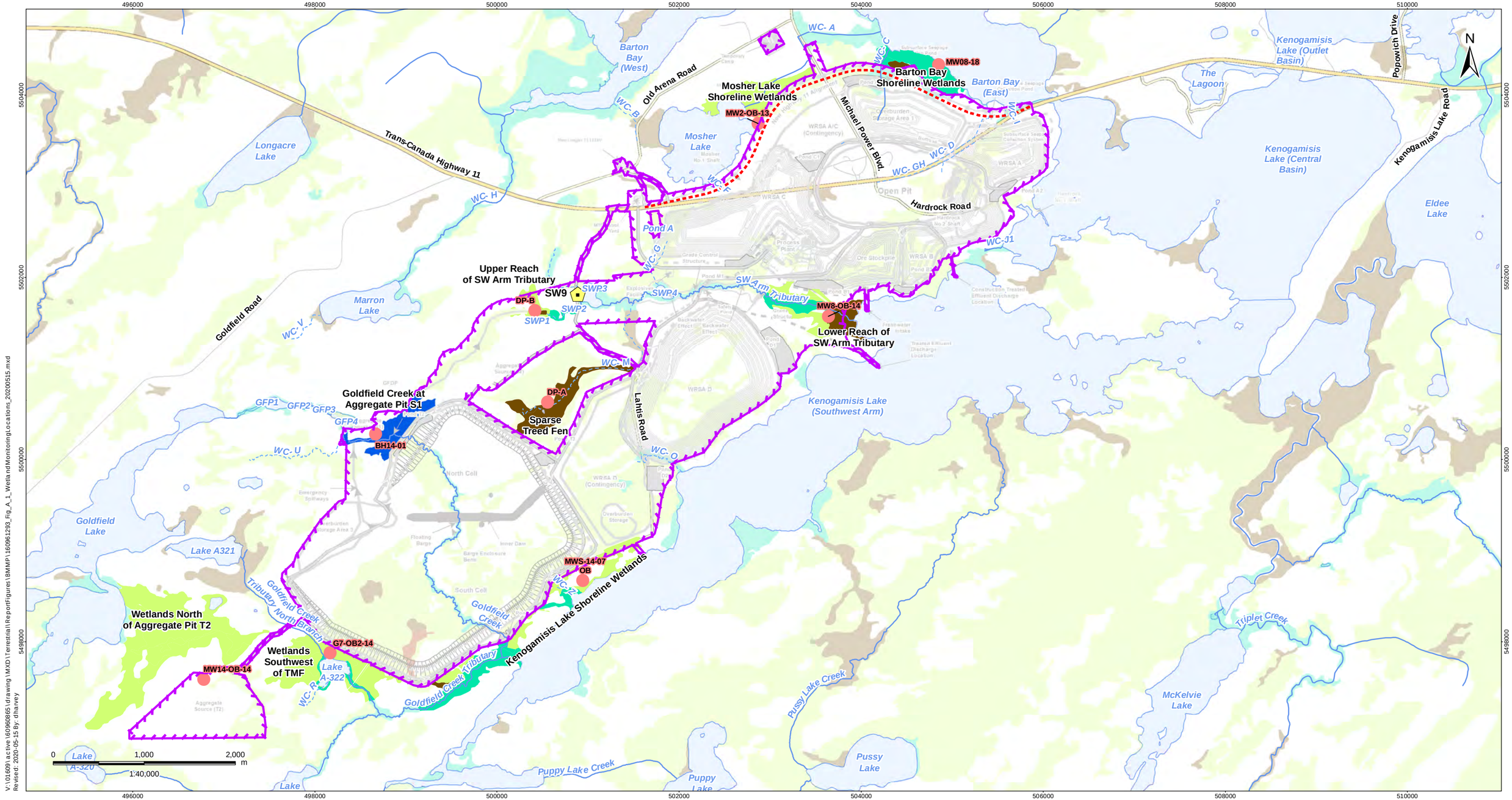
- Sensitive Sparse Treed Fen (ecosite (B136) – associated with a proposed new drive-point piezometer location
- Barton Bay shoreline wetlands (marsh) – associated with monitoring well MW08-18
- Mosher Lake shoreline wetlands (swamp) – associated with monitoring well MW2-OB-13
- Wetlands along the lower reach of Southwest Arm Tributary – associated with monitoring well MW8-OB-14
- Wetlands along the upper reach of Southwest Arm Tributary at confluence with Goldfield Creek diversion channel – associated with the surface water monitoring station SW9
- Kenogamisis Lake (Southwest Arm) shoreline wetlands east of the TMF (marsh) – associated with monitoring well MWS-14-07 OB
- Wetlands directly southwest of the TMF (swamp) – associated with monitoring well G7-OB1-14
- Wetlands north of aggregate pit T2 (swamp) – associated with monitoring well MW14-OB-14
- Goldfield Creek at aggregate pit S1, during active extraction phase – associated with monitoring well BH14-01 (or an alternate nearby monitoring well in the case that BH14-01 is not available as a result of construction).

Additional sites may be selected in the future; the monitoring data collected from the above nine sites may assist in determining whether additional or more detailed studies are required.

A.3.5 Monitoring Methods

Programs to monitor surface water and groundwater during operation of the site will be undertaken, as detailed in the WMMP. This program will confirm predicted effects of the Project with respect to ground and surface water quality, changes in drainage patterns and surface water flow. Groundwater and surface water monitoring will be undertaken during all phases of the mine.

Groundwater levels at target wetlands will be monitored and the monitoring data will be used together with vegetation monitoring to track the predicted effects on wetlands.



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Notes

1. Coordinate System: NAD 1983 UTM Zone 16N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2013.

Legend

- Project Development Area (Optimized Site Plan, May 2019)
- Ground Water Level Monitoring Locations
- Hydrometric Monitoring Stations
- New Highway 11 Alignment
- Watercourse- Permanent
- Watercourse- Intermittent

Monitoring Target Wetland Complex

- Bog
- Fen
- Marsh
- Swamp

Wetland Vegetation Communities

- Bog
- Fen
- Marsh
- Swamp

Client/Project

Greenstone Gold Mines GP Inc (GGM)
Hardrock Project

Figure No.
A-1

Title

Wetland Monitoring Locations

Wetlands will be monitored during the life of mine to document changes in:

- Vegetation composition (ground and canopy)
- Wildlife diversity and abundance (see Appendix H)
- Ecosite type (based on vegetation composition and soil type)
- Soil type (i.e., moisture regimes, soil composition)
- Surface water and hydrogeology (see WMMP)

Data Collection Procedures and Schedule

The nine wetland complexes will be monitored as follows:

- Groundwater and surface water monitoring as described in the WMMP.
- A central 2m x 2m square plot will be located within the wetland complex as close as possible to the groundwater monitoring wells or surface water monitoring station. Four additional 2m x 2m square plots will be placed within the wetland complex, either 100 m from the central monitoring plot or 10 m from the wetland edge, whichever distance is less, in each of the cardinal directions. For linear wetlands, plots may be located along a central transect at 100 m intervals or to 10 m from the wetland edge, whichever distance is less. A total of five plots should be monitored within each wetland complex.
- Each monitoring plot will be sampled twice a year: in early summer (June) and late summer (August/September) to capture a range of water levels from spring freshet to late summer drought, as well as the plants at different times of the growing season
- Monitoring will occur for the first five years of operation, at which point results will be re-assessed to determine the need and frequency of future monitoring.
- Data to be collected are listed in Table A-1
- Species composition and diversity, including calculation of mean coefficient of conservatism (CC), floristic quality index (FQI) and wetness index (WI) for each plot. Trends in the floristic data will be compared to water level data obtained from the groundwater monitoring well.
- Photographic records taken at precise and replicable directions at each monitoring plot.
- Wetland soil moisture, characterized at the locations in vegetation plots follows:
    - Dry - no water present, organic matter is “friable” and crumbles when squeezed not holding a shape

- Moist - organic material or soil is damp and holds shape when squeezed
- Wet - moisture can be squeezed out of the soil or the organic matter

Table A-1: Wetland Monitoring Parameters

Monitoring Type	Strata	Monitoring Parameters
Quantitative and Qualitative Assessment	Herbaceous and woody flora	• List vascular flora in strata • Note presence of species of interest to Indigenous communities[1] • Calculate plant CC, FQI and WI • Relative abundance by species (i.e., dominant, abundant, occasional, rare) • Percent absolute cover—by strata • Plant condition, note evidence of stress
	Physical environment	• Soil moisture and texture, approximate composition (% clay, silt and sand) • Presence of standing water and approximate depth • Evidence of seasonal presence of water • Approximate change in groundwater level from baseline (at designated monitoring well)
Photo–documentation	Community profile and ground vegetation	• Standardized photography to document ground cover and the community profile

[1]Species were identified through the EIS/EA process from project-specific Traditional Knowledge studies and consultation. For complete list see Table 12-4 in EIS/EA, also included in Appendix K.

A.3.5.1 Corrective Actions

Based on groundwater modelling and wetland studies undertaken for the EIS/EA, the nine target wetland complexes are expected to experience some level of effect from surface or groundwater changes during mine operation up to until closure (Table A-2, below). Long term effects may also occur where surface water catchments have been modified, such as along the Southwest Arm Tributary and the TMF. Wetland monitoring will allow comparison to predicted changes. Where deviations beyond predicted values and the triggers as identified in Table A-2 are observed, these will be investigated in conjunction with the project surface water and groundwater monitoring team and an appropriate response determined. Corrective actions, if necessary and feasible, may include additional or more detailed vegetation studies, drainage management along roadways, or implementation of water level control measures.

Table A-2: Predicted Effects to Target Wetlands

Target Wetland	Predicted Effects	Trigger
Sparse Treed Fen (ecosite (B136)	• Wetland will experience a reduction in surface water input • Wetland will experience groundwater drawdown. However, discharge to ground surface will continue so fen characteristics are expected to be retained.	• Change in ELC community classification from a fen community • A pattern of change in CC, FQI or WI from baseline conditions that is not attributable to natural fluctuations • Absence of surface water (groundwater discharge to surface) • Thresholds/ triggers for groundwater levels as detailed in the WMMP
Shoreline wetlands: • Barton Bay • Mosher Lake • Kenogamisis L. (Southwest Arm) east of TMF	• Wetlands will experience a reduction in surface water input • Wetlands will experience groundwater drawdown but are unlikely to change as the primary input is from the lake surface. Variability in lake levels from year to year can affect interpretation of results	• Change in ELC community classification from wetland • A pattern of change in CC, FQI or WI from baseline conditions that is not attributable to natural fluctuations • Thresholds/ triggers for groundwater levels as detailed in the WMMP
Wetlands along the lower reach of Southwest Arm Tributary	• Wetlands will experience an increase in surface water input • Wetlands will experience groundwater drawdown • Potential shift from swamp to marsh or fen, or from marsh to emergent vegetation	• Change in ELC community classification from wetland • A pattern of change in CC, FQI or WI from baseline conditions that is not attributable to natural fluctuations • Thresholds/ triggers for groundwater levels as detailed in the WMMP
Wetlands along upper reach of Southwest Arm Tributary at confluence with Goldfield Creek diversion channel	• Wetlands will experience an increase in surface water input • Wetlands will experience groundwater drawdown • Potential shift from swamp to marsh or fen, or from marsh to emergent vegetation	• Change in ELC community classification from wetland • Thresholds/ triggers for groundwater levels as detailed in the WMMP
Wetlands directly southwest of the TMF	• Wetlands will experience a reduction in surface water input • Wetlands will experience groundwater drawdown	• Change in ELC community classification from wetland • A pattern of change in CC, FQI or WI from baseline conditions that is not attributable to natural fluctuations • Thresholds/ triggers for groundwater levels as detailed in the WMMP
Wetlands north of aggregate pit T2	• Wetland will experience a reduction in surface water input • Wetlands will experience groundwater drawdown	• Change in ELC community classification from wetland • A pattern of change in CC, FQI or WI from baseline conditions that is not attributable to natural fluctuations

Table A-2: Predicted Effects to Target Wetlands

Target Wetland	Predicted Effects	Trigger
		• Thresholds/ triggers for groundwater levels as detailed in the WMMP
Goldfield Creek at aggregate pit S1, during active extraction	• Wetlands will experience a reduction in surface water input • Wetlands will experience a temporary groundwater drawdown	• Change in ELC community classification from wetland • A pattern of change in CC, FQI or WI from baseline conditions that is not attributable to natural fluctuations • Thresholds/ triggers for groundwater levels as detailed in the WMMP

A.3.5.2 Reporting

The annual Biodiversity Assessment Report will include a description of activities undertaken to mitigate and monitor wetland effects, such as:

- Documentation of mitigation measures that were undertaken and the results of that mitigation
- Documentation of monitoring and results, including a photographic record.
- Comparison of monitoring results to predicted effects and thresholds (as per Table A-2)
- Recommendations for modifying performance indicator triggers and/or mitigation, if required.

APPENDIX B
INVASIVE PLANTS MANAGEMENT PLAN

Appendix B Invasive Plants Management Plan

B.1 Background

Invasive and exotic (non-native) plant species can displace native vegetation, altering the composition of vegetation communities and diminishing ecosystem function. The purpose of the Invasive Plants Management Plan (IPMP) is to provide guidance on mitigation measures to avoid the introduction or spread of invasive plants during construction, operation and closure; monitoring to identify when invasive plant control may be necessary; and methods to implement it in the Project Development Area (PDA).

This IPMP provides long-term management measures that can be incorporated in the regular operation and maintenance of the PDA and short-term measures for preventing weed establishment when site disturbance occurs.

B.2 Definitions

For the purpose of the IPMP, an invasive plant is defined as a plant listed by the Ontario Invasive Species Act (2015) as *restricted* or *prohibited*, as a *noxious weed* under the Weed Control Act (O.Reg. 1096), or an aggressive non-native species demonstrated to have allelopathic properties (producing a chemical to inhibit germination or growth of other plants) or to displace native species (see Table B-1). Not all regulated species have been included in Table B-1, as some are highly restricted in their distribution or only known as crop pests. Additional species may be added to Table B-1 as they become relevant.

No invasive plants were identified in the Project LAA during baseline investigations. Table B-1 will be used for guidance with respect to invasive plants with the potential to occur within the Hardrock Site.

Table B-1: List of Invasive Plants

Plant Name	Type	Provincial Status	Regulatory Agency	Found in Northern Ontario?[1]
Dog-Strangling Vine (*Cynanchum louiseae*)	Woody	Restricted Invasive Species, Noxious Weed	MNRF, OMAFRA	N
Dog-Strangling Vine (*Cynanchum rossicum)*	Woody	Restricted Invasive Species, Noxious Weed	MNRF, OMAFRA	N
Japanese knotweed (*Reynoutria japonica* var. *japonica*)	Woody	Restricted Invasive Species	MNRF	Y

Table B-1: List of Invasive Plants

Plant Name	Type	Provincial Status	Regulatory Agency	Found in Northern Ontario?[1]
European common reed (*Phragmites australis* var. *australis*)	Wetland Herbaceous	Restricted Invasive Species	MNRF	Y
Bull Thistle (*Cirsium vulgare*)	Upland Herbaceous	Noxious Weed	OMAFRA	Y
Canada Thistle (*Cirsium arvense*)	Upland Herbaceous	Noxious Weed	OMAFRA	Y
Common Barberry (*Berberis vulgaris*)	Woody	Noxious Weed	OMAFRA	N
Cypress Spurge (*Euphorbia cyparissias*)	Upland Herbaceous	Noxious Weed	OMAFRA	Y
European Buckthorn (*Rhamnus cathartica*)	Woody	Noxious Weed, Allelopathic[2]	OMAFRA	N
Garlic Mustard (*Alliaria petiolata*)	Upland Herbaceous	Allelopathic[2]	n/a	Y
Giant Hogweed (*Heracleum mantegazzianum*)	Upland Herbaceous	Noxious Weed, Risk to Human Health	OMAFRA	Y
Leafy Spurge (*Euphorbia esula*)	Upland Herbaceous	Noxious Weed	OMAFRA	Y
Poison Hemlock (*Conium maculatum*)	Upland Herbaceous	Noxious Weed	OMAFRA	N
Ragweed (*Ambrosia artemisifolia*)	Upland Herbaceous	Noxious Weed	OMAFRA	Y
Serrated Tussock (*Nassella trichotoma*)	Upland Herbaceous	Noxious Weed	OMAFRA	N
Sow Thistle (*Sonchus oleraceus*)	Upland Herbaceous	Noxious Weed	OMAFRA	Y
Wild Chervil (*Anthriscus sylvestris*)	Upland Herbaceous	Noxious Weed	OMAFRA	N

Table B-1: List of Invasive Plants

Plant Name	Type	Provincial Status	Regulatory Agency	Found in Northern Ontario?[1]
Wild Parsnip (*Pastinaca sativa*)	Upland Herbaceous	Noxious Weed	OMAFRA	N
Woolly Cupgrass (*Eriochloa villosa*)	Upland Herbaceous	Noxious Weed	OMAFRA	N

[1]Ecoregions 0, 1, 2, 3, 4

[2] Allelopathic plants produce a chemical which inhibits germination or growth of other plant species nearby.

Per the Ontario *Invasive Species Act, 2015*:

"invasive species" means a species that is not native to Ontario, or to a part of Ontario, and,

(a) is harming the natural environment of Ontario or of the part of Ontario in which it is present, or

(b) is likely to harm the natural environment of Ontario or of a part of Ontario, regardless of whether it is present in Ontario or in a part of Ontario;

There are two classes of invasive plants controlled under the *Invasive Species Act* (2015). Restricted species are those which it is illegal to import, deposit, release, breed/grow, buy sell lease or trade. Prohibited invasive species are not yet established in Ontario. It is illegal to import, possess, deposit, release, transport, breed/grow, buy, sell, lease or trade a prohibited invasive species in Ontario.

In general, a noxious weed as regulated by the *Weed Control Act* (O.Reg. 1096) is a plant species which is:

- difficult to manage on agricultural land and reduces crop yield and quality; or,
- negatively affects the health and well-being of livestock; or,
- poses a risk to the health and well-being of agricultural workers (OMAFRA, 2015).

B.3 Performance Objective

Invasive plants usually colonize an area after ground disturbance, which provides new colonizing opportunities for aggressive species that are often more tolerant of bare, compacted soil than many native plants. In total, 253 species of vascular plants were recorded in the PDA and the local assessment area studied in the EIS/EA, of which 91% (230 species) were native species to Ontario and 9% (23 species) were non-native. As the Project already hosts invasive and non-native species, the performance objective of the IPMP is to reduce or eliminate potential effects on native vegetation communities from the spread of these invasive species or the introduction of new species. This objective will be achieved through:

- Implementing mitigation measures to avoid the introduction and spread of invasive plants during all phases of the Project
- Completing regular monitoring to identify changes in composition, extent and distribution of invasive plants in the PDA
- Controlling invasive plants, as needed, using appropriate techniques to maintain or restore native vegetation community integrity

B.4 Mitigation Measures

Mitigation measures include:

- Using clean fill material for grading to reduce the potential for introducing or spreading non-native, or invasive plant species
- Minimizing soil disturbance. All disturbed substrates will be seeded with a non-invasive species seed mix and cover crop as soon as possible post disturbance
- Assessing the presence of invasive species in the PDA and targeting removal through manual, mechanical and/or chemical methods
- Implementing a Clean Vehicle Protocol:
    - Vehicles and heavy equipment will stay on formed roads to the extent practical
    - Prior to equipment entering areas that are not yet serviced by roads visual inspections of machinery and equipment will be completed. Particular attention will be paid to inspecting the undersides, wheels, wheel arches, guards, radiator grills and other attachments as applicable.
    - If clods of dirt, seed or other plant materials are found, cleaning/removal will take place by brushing, knocking or washing soil and debris from exterior surfaces of equipment. Removal will occur at least 30 m away from a watercourse, water body or natural vegetation (Halloran et al 2013).

B.5 Monitoring

Preventing invasive plant establishment is one of the most effective management techniques. Regular monitoring of vegetation within the PDA will allow for early detection of invasive plants. Monitoring for invasive plants in the PDA will consist of:

- Monitoring of all disturbed and recently re-planted areas (within two years) and the sides of project roads and the sensitive fen feature will be carried out twice-annually (spring and summer) and will be coordinated with revegetation monitoring as feasible

- Additional monitoring may be undertaken as part of regular scheduled site surveillance monitoring by the environment department staff

- Monitoring will consist of walking through all relevant areas, within 30 m of new project components (with the exception of the fen and restoration areas), and visually scanning for the presence of invasive plants.

- If an invasive plant, or suspected invasive plant, is observed, the location and approximate extent will be recorded. Photo documentation will be used to confirm plant identification and track spread within an area over time, if necessary.

- Any confirmed locations of invasive plants will be marked with flagging tape and either immediately removed or scheduled for targeted removal through manual, mechanical and/or chemical methods and proper disposal (see Attachment B1).

- At the three aggregate pits, invasive species monitoring should be undertaken for two years following rehabilitation of the aggregate pit footprints until all re-vegetated areas have stabilized. Invasive plants will be controlled as necessary based on monitoring results.

B.6 Invasive Plants Control

Some control methods may be appropriate for the entire PDA, whereas others may be best suited to certain soil moisture conditions or where sensitive features are present. The selection of a treatment option or technique will depend on:

- The species, or type of plant, requiring control.

- Timing (time of year, or stage of plant growth cycle).

- Site characteristics, including land use and proximity to water sources and sensitive environmental features.

If weeds become established, there are two general methods of control: (1) manual or mechanical; and (2) chemical. Manual and mechanical methods are those that kill or suppress weeds through physical disruption, e.g., pulling, digging, disking, plowing, and mowing. The degree of success of various mechanical control methods is dependent on the life cycle of the target weeds. Chemical (herbicide) application can provide an effective and timely method of managing weeds. Numerous herbicides are available that provide effective weed control and are selective in that desirable native grasses are not injured. Should herbicide application be selected as a method of invasive plant control, all herbicides must be applied by a licensed applicator in accordance with Ontario regulations and Best Management Practices (BMPs).

An integrated approach combining chemical and nonchemical treatment options can generally be the most effective method when tailored to the species and conditions. **The use of herbicides should only be**

considered where other control methods have proven ineffective in weed management. Control and removal methods, and appropriate timing of management, differ based on plant type and habitat.

Detailed methods for control and removal of wetland herbaceous, upland herbaceous and woody invasive plants are provided in Attachment B1.

B.7 Reporting

The annual Biodiversity Assessment Report will include a description of activities undertaken to prevent the establishment or spread of invasive plants in the PDA, such as:

- Summary of monitoring and control activities, including a photographic record.
- An assessment of the effectiveness of monitoring and control methods, and actions taken to improve the invasive plants management program.
- Proposed changes to the IPMP to address negative trends, if these occur, adjust monitoring programs, or respond to emerging strategies for invasive plant control.

Notifications

New occurrences of invasive species (as per Table B1) will be documented and reported to the relevant provincial authorities responsible for administering the *Ontario Invasive Species Act* (currently MNRF) or *Weed Control Act* (currently OMAFRA) within three months of the end of the monitoring year within which the species was observed.

ATTACHMENT B1
CONTROL AND REMOVAL OF INVASIVE PLANT SPECIES

Attachment B1: Control and Removal of Invasive Plant Species

This attachment provides guidance on the use of herbicides of invasive plant control, if necessary, and more specific steps for removing wetland, herbaceous and woody invasive plants.

General Notes on the Use of Herbicides

Herbicides can be applied by spot spraying to target individual plants, or broadcast spraying to cover an entire area. Care will be taken to avoid application to non-target species, including spraying within optimal weather and wind conditions. Herbicides should only be applied in accordance with MOECC guidelines and according to the application guidelines for the specific product being applied. A permit may be required for the use of herbicide within the regulated area.

Where chemical control is required, application via backpack sprayer or other method of hand application should occur within centimeters to a few meters of target plants to minimize risk of spray drift to non-target species. Risk is negligible when standard mitigation is applied, including key mitigation summarized below (adopted in part from Deveau and Beaton, 2011):

- Spray when winds are light and moving away from sensitive receptors
- Avoid spraying when no wind is present (spray can remain suspended and move off target when wind changes
- Avoid spraying when relative humidity is < 40% and air temp. is > 25° Celsius (conditions that lead to rapid evaporation)
- Maintain minimally effective nozzle to target distance
- Change sprayer settings and nozzle depending on weather conditions (fine droplets are prone to evaporation and drift); regularly calibrate equipment.
- Use drift-reducing additives compatible with herbicide such as soybean oil

Wetland Herbaceous Plants

Description

Wetland herbaceous invasive plants are found in permanent or temporarily flooded habitats, such as wetlands, riparian areas, roadside ditches, and other low, wet areas. They may spread through rhizomes (horizontal roots that produce new shoots) and establishes new colonies when fragmented, or through seed production and dispersal. Dispersal of root fragments and seeds occurs via natural modes of transportation such as water, air, or animal movement, and through human vectors, such as construction equipment.

Removal and Control Methods

Several methods exist for managing wetland herbaceous invasive plants, including herbicide treatment, mowing, compressing or rolling, and mechanical removal. The following table is adapted from MNRF's BMP for *Phragmites australis var. australis* and summarizes each method. Some invasive plant colonies have extensive underground networks of rhizomes that are difficult to control. To address this condition, MNRF (2011) recommends an integrated management plan that combines two or more methods.

Table B1-1: Recommended Methods of Wetland Herbaceous Invasive Plant Management

Method	Summary of Considerations
Herbicide Hand-applied (wicking wand, daubing or similar) in new or small colonies OR Non-selective application (controlled back-pack sprayer, carpet method) in large, dense colonies	• Most effective method, especially when used in combination with other methods • Can be cost-efficient for large areas • Cannot be used in areas of standing water • Affects non-target species • May interact with wildlife • Detrimental effects often far outweigh negative effects of invasive species • Minimizes soil disturbance
Mowing	• Low cost • Most effective when used in combination with herbicide application • Affects non-target species • May interact with wildlife
Compression/rolling	• Low cost • Most effective when used in combination with herbicide application • May interact with wildlife
Mechanical removal	• Targets Phragmites plants • Very labour-intensive • Most effective on small, isolated stands • Not effective for large stands unless heavy equipment is used • Minimal effects on wildlife • Soil disturbance can increase colonization opportunities for weeds, monitor for colonization by weeds.

Herbicide application in combination with mowing is widely accepted as the most successful method. However, this method is not a viable option when surface water is present (MNRF, 2011). Under wet conditions, some flexibility of application is required, such as applying herbicide to seasonally flooded areas during the dry season. Herbicides should be applied using one of two methods depending on the age, size and composition of the plants as described in Table B1-1. Secondary methods of management

are also proposed to supplement herbicide application, including mowing/compression, or mechanical removal.

Timing of Control

Optimal timing of herbicide application is between early spring (after emergence of new growth) and fall (before the first frost). During this window, herbicide applications should not occur when standing surface water is present. Herbicide application can occur from late spring to early fall, however, after the first frost plants become dormant and application will be less effective The timing of application must also minimize risk to wildlife, including nesting birds that may be protected by the federal *Migratory Bird Convention Act*. The recommended timing of control is presented by task in Table B1-2. Generally, late summer is considered ideal to minimize impact on wildlife. In the Geraldton area, August application is likely the ideal application time.

Table B1-2: Recommended timing and tasks for wetland herbaceous invasive plant removal

Timing	Tasks	New /Small Colonies	Established / Large Colonies	Colonies in Permanent Standing Water
July/August	Remove and bag flower and seed heads, including any seed heads from previous years to eliminate retained seed. Seal all removed material in plastic bags and dispose at a landfill. Care will be taken to avoid breaking live stems during this task (success of task 3 depends on the plants ability to transport herbicides to roots).	✓		✓
August/September	Apply glyphosate herbicide via hand application (wicking or daubing).	✓		
	Apply glyphosate herbicide via controlled spray applications using a backpack sprayer or other non-selective means.		✓	
October	Cut plant to within 60cm of ground level using a string trimmer or other means to promote germination of native seeds and allow for spot treatment of new growth during subsequent herbicide applications. Cutting will not occur within 2 weeks of herbicide application to allow translocation to the roots. Cut material can be left on site to decompose. For colonies in standing water, stems will be cut below the high water line to prevent oxygen exchange with the roots.	✓	✓	✓

Upland Herbaceous Invasive plants

Description

Upland herbaceous invasive plants are found in agricultural lands, roadsides, meadows, and woodlands, often appearing after a soil disturbance provides new colonizing opportunities for these fast growing species adapted to open conditions. Once established, they may continue to spread by seed or through vegetative reproduction.

Removal and Control Methods

Several methods exist for managing upland herbaceous invasive plants including herbicide treatment, mowing, hand pulling or digging, and deep tilling. Table B1-3 summarizes each method. Perennial invasive plants may have a deep and widespread root system which can make them difficult to control. To address this condition, OMAFRA (2016) recommends an integrated management plan that combines two or more methods.

Table B1-3: Recommended Methods for Herbaceous Invasive Plant Management

Method	Summary of Considerations
Herbicide	• Very effective method, especially when used in combination with mechanical methods • Cost-efficient for large areas or persistent invasive plants • Cannot be used in areas of standing water • Affects non-target species • May interact with wildlife
Mowing or String Trimmer	• Using a commercial mower such as a flail mower set to the lowest deck height, OR cut weeds at the ground surface using a string trimmer. • Low cost • Most effective when used in combination with Herbicide application • Affects non-target species • May interact with wildlife
Hand Pulling	• Undertake hand pulling for small patches of certain established invasive plants that can be easily uprooted • Labour-intensive • Soil disturbance can increase colonization opportunities for weeds, monitor for colonization by weeds
Digging	• Suitable for plants with toxic sap (ex. Giant Hogweed) that could be spread by mechanical control methods • Labour-intensive • Most effective when used in combination with herbicide application
Deep Tilling	• Suitable for disrupting extensive root systems of perennial invasive plants • May affect non-target species

Timing of Control

Timing of control varies among methods. A pre-emergent herbicide can be used to control perennial weeds early in the growing season. However, this class of herbicide may be less effective than one applied in summer or fall. Control using a post-emergent selective herbicide is best undertaken from mid-summer to fall when the plant has produced extensive above-ground growth and is beginning to store energy in the root system, allowing for herbicide transport directly to the roots (OMAFRA 2016). Recommended timing and tasks for upland herbaceous weed removal are summarized in Table B1-4.

Mechanical removal can take place from summer to fall. When applied without a herbicide treatment, mowing and trimming should occur prior to maturation to prevent the spread of seed. When combining mechanical or hand removal methods with herbicide application, there should be a period of at least two weeks between herbicide treatment and mowing to allow herbicide to be absorbed by the plants.

Hand pulling or digging can be undertaken at any time in the growing season. For perennial invasive plants with an extensive root system, deep tilling (greater than 15 cm) with a disc plough can be effective at disrupting the root system. A standard roto-tiller can be used in small or large areas.

Table B1-4: Recommended timing and tasks for upland herbaceous weed removal

Timing	Tasks
April - May	Apply a pre-emergent herbicide. Recommended only if control in summer or fall is not an option.
July-September	Apply a post-emergent herbicide using a backpack sprayer or other non-selective means.
October	Cut dead plants to ground level using a mower, string trimmer or other equipment. Cutting should not occur within 2 weeks of herbicide application to allow translocation to the roots. Cut material which has been treated with herbicide can be left on site to decompose. For deeply-rooted invasive plants (ex. Canada thistle), deep tilling (greater than 15 cm) can also be effective at disrupting an extensive root system.

Woody Invasive plants

Description

Woody invasive plants include all trees, shrubs and woody vines meeting the definition of noxious or invasive. Due to their perennial habitat, these plants can be more difficult to control or eradicate once established. No woody invasive plants have been identified in the PDA.

Removal and Control Methods

Several methods exist for managing woody invasive plants, depending on their size, including hand pulling or digging, cutting and herbicide application. Table B1-5 summarizes each method. Large, established

trees are best managed using a combination of cutting and herbicide application, and may also require repeat treatments to prevent suckers.

Table B1-5: Recommended Methods for Woody Weed Management

Method	Summary of Considerations
Hand Pulling / Digging	• Undertake hand pulling or digging up of small trees and their root systems. Small plants (up to 1 m in height) may be pulled by hand, however a tree wrench may be required for larger plants as lateral roots can reach out 2 to 3 m. All roots must be removed to prevent re-sprouting. • Labour-intensive
Cutting and herbicide	• Effective method for large trees • Cut large stems (greater than 5 cm in diameter) close to the ground (50 mm) and apply a glyphosate herbicide (20-25% solution) directly on the exposed stump using a wick applicator.

Timing of Control

Recommended timing of management applications for woody invasive plants depends on the risk of disturbance to surrounding vegetation. Recommended timing and tasks for woody weed removal are summarized in Table B1-6. Removing trees late in the year (October to November) reduces disturbance to surrounding vegetation (Anderson 2012). Fruiting trees (mid-July to fall) can be bagged prior to removal to prevent spreading seed. Removing trees prior to fruit maturity (mid-July) eliminates need to bag and dispose of fruit, however, this may result in disturbance to nearby vegetation during the growing season. Follow-up control may be required in subsequent years to hand pull new seedlings or remove suckers from cut stumps.

Removal of any woody vegetation should take place outside of the core nesting period for birds, from April 1 to August 31.

Table B1-6: Recommended timing and tasks for woody weed removal

Timing	Tasks
September	The best timing for glyphosate application is August or September when the tree is actively storing energy for overwintering, thus promoting movement of the active ingredient to the roots (Cowbrough and Sikkema 2005). Cut large trees and apply glyphosate herbicide to stumps via hand application (wicking or daubing). Bag fruit or seeds on fruiting trees to prevent spreading seed when moving to off-site disposal. In subsequent years, a follow-up hand application of glyphosate may be required for sprouting stumps.
September – March	Hand pull or dig smaller trees. Bag fruiting trees to prevent spreading seed when moving to off-site disposal.

Disposal

Viable waste of all weed plants (ex. seed heads, fruit, roots) should be collected in thick black plastic bags and left in a sunny location to kill viable seeds and rhizomes until it can be disposed of at an appropriate waste facility.

B.8 References

Anderson, H. 2012. Invasive Common (European) Buckthorn (*Rhamnus cathartica*): Best Management Practices in Ontario. Ontario Invasive Plant Council, Peterborough, ON.

Cowbrough, M. and P. Sikkema. 2005. Guidelines for Fall Weed Control, Ontario Ministry of Agriculture, Food and Rural Affairs Bulletin. Available online at: http://www.omafra.gov.on.ca/english/crops/field/news/croptalk/2005/ct_0905a2.htm

Deveau, J. and D. Beaton. 2011. Pesticide Drift from Ground Applications. OMAFRA Factsheet Order NO 11-001. AGDEX 607. January 2011.

Halloran, Joe. Anderson, Hayley and Tassie, Danielle. 2013. Clean Equipment Protocol for Industry. Peterborough Stewardship Council and Ontario Invasive Plant Council. Peterborough ON, April 2013. 16pp.

Ontario Ministry of Natural Resources. 2011. Invasive *Phragmites* – Best Management Practices, Ontario Ministry of Natural Resources, Peterborough, Ontario. Version 2011. 17 pp.

Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA). 2016. Guide to Weed Control 2016-2017, Publication 75. Accessed online at: http://www.omafra.gov.on.ca/english/crops/pub75/pub75.pdf

APPENDIX C
WOODLAND CARIBOU MITIGATION PLAN

Appendix C Woodland Caribou Mitigation Plan

C.1 Background

The Project is within the historical range of the boreal population of woodland caribou (EC 2012), a population that is on Schedule 1 of SARA and listed as Threatened provincially and federally. The Project is in a discontinuous distribution area between the Nipigon and Pagwachuan ranges and the isolated Coast Range (EC 2012; MNRF 2014). The discontinuous distribution area is the area within Ontario "where caribou exist in isolated populations, where individuals and local populations do not freely intermingle and mix and where there are geographic or human-caused barriers preventing the genetic interchange of information" (MNR 2009). The Project is not within the seasonal range of caribou and does not contain high use areas, e.g., nursery or winter use areas, or travel corridors for caribou. The Project Development Area (PDA) is considered Category 3 habitat (i.e., remaining area within the range that supports caribou indirectly). The Project is not in an area identified as critical habitat for woodland caribou (EC 2012). One of the goals of the provincial Caribou Conservation Plan is to develop a management strategy for the discontinuous distribution area, and to enhance connectivity between the northern continuous ranges and the Coast Range (MNR 2009).

C.2 Mitigation Measures

The following mitigation measures will be implemented for Woodland Caribou:

- Incorporate the following measures from the Best Management Practices for Mineral Exploration and Development Activities and Woodland Caribou in Ontario (MNR 2013):
    - Reduce the risk of caribou mortality (e.g. vehicle collision risk; see Wildlife-Vehicle Monitoring and Management Plan (Appendix D)
    - Provide caribou awareness and education to workers (see Section 5.2 of the BMMP)
    - Operate site in a manner to minimize risk to caribou (e.g. minimize dust, noise, control vegetation along road edges, post speed limits, see Section 6.3 of the BMMP and the Wildlife-Vehicle Monitoring and Management Plan (Appendix D)
- For the S4 aggregate pit, where site conditions permit, aggregate pit rehabilitation will incorporate revegetation practices to restore caribou habitat. Rehabilitation will be implemented by placing stockpiled topsoil and seeding to minimize colonization by non-native weedy species and reduce erosion. Where sufficient topsoil depth is available, planting of jack pine and spruce at 1,000 stems per hectare will occur in upland areas in order to provide permanent cover for ungulates, including caribou. Over time, additional trees and shrubs will become established through active (wildlife-assisted) or passive seed dispersal from adjacent forest communities.
- At the time of mine closure, the status of caribou in the Project area will be considered when finalizing and implementing reclamation treatments.

C.3 References

Environment Canada. 2012. Recovery Strategy for the Woodland Caribou (*Rangifer tarandus caribou*), Boreal population, in Canada. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa. xi + 138 pp.

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

Ontario Ministry of Natural Resources (MNR). 2013. Best Management Practices for Mineral Exploration and Development Activities and Woodland Caribou in Ontario.

Ontario Ministry of Natural Resources and Forestry (MNRF). 2014. *Range Management Policy in Support of Caribou Conservation and Recovery*.

APPENDIX D
WILDLIFE-VEHICLE MONITORING AND MANAGEMENT PLAN

Appendix D Wildlife-Vehicle Monitoring and Management Plan

D.1 Background

Site-specific and species-specific wildlife vehicle collision data are required to inform the effectiveness of mitigation measures and to identify requirements for corrective actions, if required. Wildlife movement in and around the Project site, and the effectiveness of measures to mitigate vehicle collisions will be monitored through driver reporting and systematic monitoring surveys.

Populations of species with small populations (e.g., species at risk or species of conservation concern), with low reproductive rates (e.g., turtles), and those with an inability to avoid cars (e.g., turtles and amphibians) are considered to be more vulnerable from road mortality.

Wildlife using the Project area that are most at risk of mortality from vehicle incidents are primarily amphibians and large mammals (e.g., moose), though other groups may also experience mortality (e.g., small mammals or birds such as common nighthawk).

Amphibians are actively dispersing in the spring and summer and the highest risk period for vehicle-related amphibian mortality is April to June. For moose the highest risk periods are spring and fall. For both groups, dusk and dawn are considered higher risk time periods. May and June are the most common times of the year for reported road mortalities (Ontario Road Ecology Group 2010).

D.2 Mitigation

During all phases:

- Implement road safety measures (e.g., speed limits and signage) to reduce wildlife road mortality at potential wildlife crossings during the construction and operation phases of the Project

Operation:

- Implement road safety measures on Project access and haul roads (e.g., speed limits and signage) and yield the right of way to wildlife
- If safe to do so, move slow-moving wildlife (e.g. turtles, snakes) off the road by gently moving the individual in the direction it was traveling. For turtles, use the Turtle Handling guidelines in Attachment D1
- Where Project site roads run through forest or treed wetland communities, implement a regular vegetation cutting regime along the edges roadsides to increase driver visibility and reduce their attractiveness as moose browse (Tanner and Leroux 2015)

D.3 Monitoring

Wildlife movement in and around the Project site, and the effectiveness of measures to mitigate vehicle collisions, will be monitored through mandatory driver reporting. All drivers of Project-related vehicles will be required and encouraged to report wildlife-vehicle encounters roadside observations of wildlife, and wildlife road mortalities. For each vehicle encounter or roadside observation of wildlife, drivers will record details including: date, time, road conditions, lighting, weather), characteristics of the animal(s) (species, and number, injury severity if struck by the vehicle), and location of the incident including UTM, if possible. Visible risk factors will be identified and recorded (e.g., garbage or carcasses present along roadside, vegetation that obscures visibility).

The following will be undertaken to enhance the effectiveness of the wildlife monitoring program:

- Training to understand the Program Purpose - All environmental monitors and drivers will be educated on the purpose of the program: to identify areas of high mortality, and to review conditions and species affected in order to adjust activities to lower vehicle-wildlife mortality.

- Training on Wildlife Behavior - Education should include pictures and description of various wildlife (mammals, reptiles, amphibians, etc.), general habitats or conditions where wildlife are frequently encountered (salt areas/licks, creeks, wetland areas, timber cuts, wildlife trails, etc.), as well as seasonal changes in wildlife behavior, rutting movement, amphibian breeding, turtle nesting.

- Training on Wildlife Encounter Form - Supervisors will be trained on how to complete the Wildlife Encounter Form (Table 7-1) quickly and effectively.

- Mortality Location and Species Detail Survey - All mortality incidents where the carcass is present on or adjacent to the road will be surveyed by an environmental monitor to confirm location and species. If required, the appropriate Ministry will be notified and the carcass will be removed safely by a cleanup crew.

- Hotspot Mapping - High frequency wildlife encountered areas will be mapped on wall maps for review by all drivers.

Environmental monitors will compile observations as part of annual reporting in order to identify higher risk locations, species, or seasons to inform adaptive management (see Section D.4 for thresholds and corrective actions).

The monitoring methods will be reassessed annually, based on the data collected, to adjust survey frequency and duration as appropriate.

D.4 Thresholds and Corrective Actions

Data on the species, numbers and locations of wildlife mortalities will be tracked through each monitoring year to identify areas of wildlife-vehicle conflict that require further mitigation.

Corrective actions will be implemented at locations that meet one or more of the following criteria:

- Repeat (i.e., two or more) mortalities at the same location of large mammals, reptiles, a species at risk or a species of conservation concern either within or across monitoring years
- Observations of multiple (i.e. three or more) amphibian, bird, or small- to medium-sized mammal (e.g., beaver, marten) mortalities at the same location on two separate surveys within the same monitoring year
- Documented higher use by wildlife (i.e., multiple observations individuals of the same species or the same location) or multiple observations of observations of individuals of different species at the same location).

Corrective actions will be determined by a qualified professional (and in consultation with relevant agencies and Indigenous communities) in response to which animal groups are affected, where conflicts are occurring, and any identified risk factors. Corrective actions may include:

- Installing wildlife awareness and/or crossing signs, or using a temporary electronic/flashing sign board
- Implementing location-specific reduced speed limits, and/or traffic calming measures
- Adjusting the road surface to make it less attractive to wildlife (e.g. paving to discourage turtle nesting or bird roosting)
- Implementing additional management and maintenance of roadside vegetation (e.g. increased mowing/cutting)
- Adjusting drainage along roadsides so that pooling water that may attract amphibians is not established
- Implementing additional education and awareness for drivers of Project-vehicles

If additional mortalities are recorded at the same location after corrective actions have been implemented, additional corrective actions may be required. Depending on the species group affected, numbers affected, and the location, these additional actions may include:

- Permanent Fencing. If fencing is installed, an appropriate wildlife crossing structure (e.g., overpass, tunnel or culvert) may be required to allow continued wildlife movement through the Project site and into the surrounding area.

- In the case of a large amphibian dispersal event, deployment of project staff to assist in the movement of amphibians across the roadway and a temporary stop of traffic passage.

D.5 Reporting and Notifications

If visible risk factors are identified during the surveys, they will be reported as soon as possible to the Environment Superintendent for corrective action (i.e., clean up of garbage or removal of carcasses, vegetation cutting).

If injured wildlife is found, MNRF will be contacted as soon as possible. Any mortality of a SAR will be reported to MECP within 2 business days of the observation.

Wildlife-vehicle collisions, near misses, roadside observations of wildlife, and wildlife road mortalities as well as information on any corrective action measures will be included in the annual Biodiversity Assessment Report for each year of mine operation. The results of the wildlife-vehicle monitoring program will be reviewed annually by the Environmental Superintendent, qualified professionals, relevant agencies and Indigenous communities and used to revise the monitoring and corrective action plan, as required.

D.6 References

Ontario Road Ecology Group, Toronto Zoo (2010) A Guide to Road Ecology in Ontario, prepared for the Environment Canada Habitat Stewardship Program for Species at Risk. 72 pp.

Tanner AL, Leroux SJ (2015) Effect of Roadside Vegetation Cutting on Moose Browsing. PLoS ONE 10(8): e0133155. doi:10.1371/journal.pone.0133155.

ATTACHMENT D1
TURTLE HANDLING GUIDELINES

The Ontario Turtle Conservation Centre *works to protect and conserve Ontario's native turtles and the habitat in which they live*

Turtle Handling 101

Do:

- Use both hands, positioned firmly at the sides of the turtle
  - For snapping turtles, position hands at ***rear*** of shell. For larger snapping turtles, position one hand at the rear of the shell and the other underneath the turtle
- Expect the turtle to hiss and/or scratch your hands
- Always be aware of the turtle's head

Do not:

- Tap on the shell, or knock it
- Pick up a turtle that you are not comfortable holding
- ***Never*** pick a turtle up by its tail

Examples:

Most Ontario Turtles:

Snapping Turtles:

How to help a turtle cross the road:

- Be aware of cars, do not attempt to help a turtle if it is not safe to do so
- Always move the turtle in the direction it was going/is facing
- Use a floor mat or shovel if you are uncomfortable or unable to lift the turtle
- Demonstration: https://www.youtube.com/watch?v=Lgd_B6iKPxU

ONTARIO TURTLE CONSERVATION CENTRE

Tel: (705)741-5000

4-1434 Chemong Rd
Selwyn,ON K9J 6X2

Ontario Turtle Conservation Centre
@OntarioTurtleCC
@OntarioTurtleCC

APPENDIX E
WILDLIFE-WATER MONITORING AND MANAGEMENT PLAN

Appendix E Wildlife-Water Monitoring and Management Plan

E.1 Background

Mining operations produce waste that can contain substances that may be harmful to wildlife. Open water features located at mining facilities (specifically tailings management facilities [TMF]) have been associated with migratory bird use and mortality (Timoney and Ronconi 2010; St. Clair 2014). In Canada, many occurrences of bird mortality associated with TMFs have resulted from the oilsands and much of the research around wildlife risks and deterrents is based on oilsands tailings (Boag and Lewin 1980; St. Clair 2014). However, different types of mining result in different TMFs with different water quality characteristics and associated resulting risks to wildlife.

Gold mines have been associated with migratory bird mortalities as a result of cyanide use (Henny et al. 1994; Northern Territory of Australia 1998). The International Cyanide Management Code for the Manufacture, Transport, and Use of Cyanide In the Production of Gold (Cyanide Code) indicates that cyanide levels of less than 50 mg/L WAD are appropriate for wildlife protection (ICMI 2007).

A mitigation measure, monitoring plan, triggers, and corrective actions have been identified to protect wildlife (specifically waterfowl and large mammals) that have the potential to come in contact with the TMF and water management collection ponds at the Hardrock Mine.

E.2 Mitigation

During all phases of the Project:

- To reduce use of the ponds by waterfowl for foraging or breeding, no vegetation will be planted on the embankments of the TMF or the water management collection ponds. Vegetation that naturally regenerates around seepage and water collection ponds and the TMF will be removed as required.

E.3 Monitoring

The monitoring program will include vegetation growth, wildlife use and water quality monitoring of open water project areas as follows:

- Once per month during the growing season (May to September) the perimeter embankments of the TMF and the collection ponds will be visually inspected for evidence of revegetation.
- Water quality in the TMF and the collection ponds will be monitored as part of internal operations.
- During operation of the mine, open water areas associated with the Project such as the TMF and the collection (i.e., Ponds T2, T3, D2, D1, M1, B1, B2, A2, A1, C1) will be monitored for use by

wildlife, with an emphasis on waterfowl and large mammals such as moose. From the start of filling of the pit lake until the end of decommissioning the pit lake will also be monitored for use by wildlife in accordance with the methods outlined below:

  - The survey of the TMF and each operational collection pond will be completed from a single survey station at each feature. The survey stations will be selected based on accessibility, safety, repeatability, and a suitable field of view of the pond surface. Extra survey stations will be added if additional vantage points are required to obtain full visibility of the features.

  - Twice a week, starting at spring break-up and continuing until the start of freeze up (approximately April to October), environment staff will survey the TMF pond and operational collection ponds. The surveyor will use binoculars and/or a spotting scope as required. If waterfowl are present, the surveyor will document their species, age class, behaviour (e.g., resting, feeding, flying over), abundance, and specific location (to be marked on a large-scale site map). Observations of flyovers (i.e., any birds flying directly over the water feature, but not landing) will also be recorded. Species, number and flight height and direction of flyovers will be documented.

- Observations of other wildlife, including evidence of their presence (e.g., tracks, scat) will also be recorded. In addition, as described above, project personnel and contractors will be instructed to report sightings of wildlife near or within the TMF boundaries and other project water areas directly to the Environmental Superintendent, by radio or in person. These sightings will be recorded in the wildlife observation log maintained by GGM.

- Any occurrences of wildlife mortality observed in the TMF or operational collection ponds will be recorded (species, number of individuals, location)

- During each survey, surveyors will also record any visual evidence indicating abnormal water conditions (e.g. odour, cloudiness, oil sheen)

The monitoring program will be reassessed annually considering water quality monitoring data and wildlife use survey results. For example, monitoring may be discontinued at open water areas that have no recorded use by waterfowl or mammals after the first year of monitoring, if water quality data indicate little to no risk of exposure to wildlife, or the monitoring period may be adjusted to reflect periods of use.

E.4 Thresholds and Corrective Actions

Measures to deter wildlife from the TMF or other open water areas will be directed by the Environment Superintendent as needed. Wildlife use data from the TMF and collection ponds will be reviewed to identify the need for such measures and water quality monitoring data will be used to further assess risk to wildlife and inform the need for corrective actions. Specific corrective actions will need to be determined based on the results of wildlife use data (species, numbers, behaviour, and season/time of day of use).

Corrective actions will be implemented:

- If revegetation is observed along the perimeter embankments of the TMF or the collection ponds
- If the water quality monitoring results indicate cyanide levels that exceed 40 mg/L WAD (i.e. prior to the 50 mg/L WAD Cyanide Code threshold)
- If wildlife use monitoring records the following:
    - Consistent observations of waterfowl use over a one-month period
    - A mortality of waterfowl or large mammals (e.g., bear, moose) in or adjacent to the open water areas associated with the Project (e.g., TMF or the collection ponds)
    - More than one incidence of a large mammal (e.g., moose, bear) entering the TMF per year

The Environmental Superintendent, in consultation with relevant regulatory agencies and possibly a qualified biologist, will direct corrective actions to deter/exclude wildlife based on the wildlife use data.

Corrective actions may include:

- Prevention of continued vegetation growth will be controlled using manual methods (e.g., pulling, cutting, tarping)
- Use of automated auditory deterrents (e.g., air horns, propane bangers) at certain times of the year (e.g., spring) and for certain durations (e.g., one month), based on observations at the TMF
- Installation of site-specific visual deterrents (e.g., posts with predator decoys, reflectors strung along or over sections of the TMF)
- Strategic placement of fences or barriers along sections of the TMF

Upon implementation of a corrective action, continued monitoring will assess the action's effectiveness. If the corrective action is determined to be ineffective (i.e., number of individuals observed does not decrease after implementation) the deterrents will be re-evaluated and changed, as appropriate.

E.5 Reporting and Notifications

Any abnormal water conditions or incidences of wildlife mortality will be reported as soon as possible to the Environmental Superintendent for follow up actions.

Identification of a mortality event (i.e., mortality of multiple individuals of a species, attributable to the Project) will be reported within 2 business days to CEA Agency and MNRF. Mortality of a SAR will also be reported within 2 business days to MECP.

Wildlife use of the TMF and operational collection ponds as well as the effectiveness of mitigation measures and corrective actions (i.e., vegetation control on embankments, use of wildlife deterrents) will be included in the annual Biodiversity Assessment Report for each year of mine operation. The results of the wildlife-water monitoring program will be reviewed annually by the Environmental Superintendent, qualified professionals, relevant agencies and Indigenous communities and used to revise the monitoring and corrective action plan, as required.

E.6 References

Boag, A, D & Lewin, V. (1980). Effectiveness of Three Waterfowl Deterrents on Natural and Polluted Ponds. The Journal of Wildlife Management. 44. 145. 10.2307/3808360.

C. C. St. Clair (2014) Final Report on the Research on Avian Protection Project. Prepared for Alberta Justice, Edmonton, Canada.

Henny, Charles & J. Hallock, Robert & F. Hill, Elwood. (1994). Cyanide and migratory birds at gold mines in Nevada, USA. Ecotoxicology (London, England). 3. 45-58. 10.1007/BF00121387.

ICMI (International Cyanide Management Institute) (2007) Gold Mining Operations Verification Protocol. International Cyanide Management Institute. ICMI, Washington, DC. Available at: http://www.cyanidecode.org/

Northern Territory of Australia (1998). Best Practices Guidelines. Reducing Impacts of Tailings Storage Facilities on Avian Wildlife in the Northern Territory of Australia.

Timoney, Kevin P., and Robert A. Ronconi (2010). Annual Bird Mortality in The Bitumen Tailings Ponds In Northeastern Alberta, Canada." *The Wilson Journal of Ornithology*, Vol. 122, No. 3, 2010, Pp. 569–576. *Jstor*, Jstor, Www.Jstor.Org/Stable/40962179.

APPENDIX F
BANK SWALLOW MANAGEMENT PLAN

Appendix F Bank Swallow Management Plan

F.1 Background

Bank swallows (*Riparia riparia*) are a provincially threatened species and they, and their habitat, receive protection under the *Ontario Endangered Species Act* (ESA 2007). While no nesting was confirmed within the Project Development Area during field studies completed for the EIS/EA, the bank swallow's breeding range includes the Project area.

Bank swallows nest in burrows that they excavate in natural or human-made settings. They prefer to construct burrows in areas of silt or sand with a vertical face; they will readily occupy excavated sandy slopes and embankments, including topsoil piles, cut sewer trenches, gullies created by rainfall, dredge piles from sediment ponds, and stone dust piles. Bank swallows are faithful to nesting areas and will return year after year to the same location as long as the vertical face remains suitable (MNRF 2017).

Bank swallows generally return to Ontario in mid to late April and colonies are established quickly, usually within a few days, and sometimes as quickly as overnight. Nesting takes place from May to August but peaks in June (MNRF 2017).

F.2 Mitigation

The following mitigation measures apply:

- Project personnel should receive training on the identification of bank swallows, their habitat, their burrows, and the protections afforded to the species and its habitat under the ESA.
- To prevent bank swallow colonization of Project work sites, work areas that involve the creation or stockpiling of silt or sandy materials (e.g., soil stockpiles, excavations, trenches, aggregate areas) will not be left with vertical faces during the bank swallow breeding season. Slope faces will be reduced to 70 degrees or less (MNRF 2017). This can be achieved by sloping off stockpiles, using an excavator to create the desired slopes or contouring faces or piling material on the face. Slope management will be completed by mid-April and slopes will be maintained daily throughout the nesting season (i.e., until the end of August) to meet the 70 degrees or less target.
- GGM may consider creating habitat for bank swallow nesting (i.e., creating a vertical slope in an embankment) if there are suitable locations within the Project area that will not be required during the life of the mine, that will be subject to little or no disturbance during the breeding season, and where there are no human safety concerns.

F.3 Monitoring

The monitoring program for bank swallow will consist of the following activities:

- Monitoring to assess the effectiveness of the sloping mitigation will be completed twice weekly from mid April to the end of August. Visual inspections and slope measurement will be completed and sites with slopes of greater than 70 degrees will be identified for follow-up action.
- Concurrently, the sites will be monitored for presence of bank swallow or their colonies. If present, the location, number of birds, and number of burrows will be recorded and a setback established at the direction of a qualified professional.
- Active bank swallow colonies where setbacks are established will be monitored twice weekly while active. The number of bank swallow burrows, active nests and an assessment of nesting success will be documented.
- MNRF and MECP will be notified if Bank Swallows are detected nesting in the PDA.

F.4 Corrective Actions

The following corrective actions will be taken:

- If monitoring identifies areas of silty/sandy slopes with vertical faces greater than 70 degrees, and these are not occupied by bank swallows, then these areas will be sloped to less than 70 degrees and maintained that way as per direction outlined above).
- Should bank swallow occupy habitat within the Project area, a setback will be established within which Project activities that may cause disturbance (e.g., use of heavy machinery, human presence) are restricted while the colony is active. The setback will be established by a qualified biologist based on the type and intensity of the proposed activities; however human presence and use of heavy machinery will be setback at least 50 m from the colony. The colony will be clearly cordoned off and Site personnel will be informed of the presence of the colony and associated restrictions. Monitoring of the active colony (as described in the second last bullet point under “Monitoring” above) will be used to assess the effectiveness of the setback and if required, adjust the recommended setback size.

Consultation will occur with MECP to determine additional requirements under the Ontario *Endangered Species Act* (ESA 2007) prior to undertaking any activity that would damage or destroy the habitat.

F.5 References

Ontario Ministry of Natural Resources and Forestry. (2017). Best Management Practices for the Protection, Creation and Maintenance of Bank Swallow Habitat in Ontario. Queen's Printer for Ontario, 2017. 37pp.

APPENDIX G
BALD EAGLE PROTECTION PLAN

Appendix G Bald Eagle Protection Plan

G.1 Background

Bald eagle nesting was identified within the Local Assessment Area used in the EIS/EA. The bald eagle is a provincial species of special concern but is federally not at risk. This species was also identified as having traditional value and interest to Indigenous communities.

Bald eagles typically nest near water, usually on large lakes. Bald eagle nests are protected by the *Fish and Wildlife Conservation Act*.

The Bald Eagle Habitat Management Guidelines (MNR 1987) identify three buffer zones that should be applied to bald eagle nests. Varying levels of activity restrictions apply to each buffer zone:

- Primary zone: the first 100 m around the nest and carries the highest level of restriction.
- Secondary zone: extends from 100 to 200 m around the nest and activities significantly altering the landscape are prohibited within this zone.
- Tertiary zone: extends from 200 to 800 m around the nest; this is the least restrictive zone and allows some activities except during the most critical life cycle period for nesting eagles.

The Forest Management Guide for Conserving Biodiversity at Stand and Site Scales (MNR 2010), the Significant Wildlife Habitat Mitigation Support Tool (MNRF 2014), and the Management Plan for the Bald Eagle in Ontario (Armstrong 2014) also provide recommendations for bald eagle mitigation measures and management. These documents have also been used to develop this protection plan.

As of 2019, three nests (Nest 271, Nest 003 and Nest 487) were known to occur within 800 m of the Project Development Area (see Table G-1 and Figures 1-3, Attachment G1). These nests do not need to be removed for the Project. A fourth nest (Nest 008) was observed along Barton Bay in 2019 but is more than 800 m from any project components (Figure 4).

Nest 271 was confirmed as active in April 2018 by MNRF and in May 2019 by Northern Bioscience (2019). Project components that occur within 800 m of this nest include the conduit and access road to the effluent treatment plant (ETP) discharge, Pond D1, and Waste Rock Storage Area (WRSA) D (see Figure 1, Attachment G1). No activities associated with WRSA D or Pond D1 are expected to occur until approximately 2022.

Nest 003 was confirmed as active in May 2019 by Northern Bioscience (2019). Project components that occur within 800 m of this nest include an access road, Pond T1, a seepage collection ditch and the Tailings Management Facility (TMF) dam (see Figure 2, Attachment G1).

Nest 487 was identified by MNRF in March 2018 however it was unknown whether the nest was active at the time. In 2019 this nest was confirmed as inactive in May 2019 by Northern Bioscience (2019). Bald Eagles will often maintain both active and alternate nests within a territory (Cadman et al. 2007), an inactive nest one year may become active in another year. The TMF is within 800 m of Nest 487 (see Figure 3, Attachment G1). For the purposes of this Plan, Nest 487 is assumed to be an inactive nest. Annual monitoring is recommended to confirm activity as described in Section G.3.

Nest 008 was confirmed as active in May 2019 by Northern Bioscience (2019). There are no project components within 800 m of this nest (see Figure 4, Attachment G1).

Table G-1 Active and Inactive Bald Eagle Nests

Nest ID	Field Observations	Distance from Project Components
Nest 271 (WP 005)	• Confirmed active in April 2018 by MNRF • Confirmed active in May 2019 by Northern Bioscience	• 575 m from the ETP discharge conduit and access road • 120 m from Pond D1 • 175 m from WRSA D
Nest 003 (WP 003)	• Confirmed active in May 2019 by Northern Bioscience	• 217 m from access road • 242 m from Pond T1 • 350 m from the seepage collection ditch • 352 m from the TMF dam
Nest 487 (WP 004)	• Observed (use unconfirmed) in March 2018 by MNRF • Confirmed inactive in May 2019 by Northern Bioscience	• 650 m from the TMF (southeast corner)
Nest 008 (WP 008)	• Confirmed active in May 2019 by Northern Bioscience	• No project components within 800 m

G.2 Mitigation

These mitigation measure only apply to active nests (those used for breeding and that contain eggs or young, or that are attended by adults in anticipation of laying eggs) within 800 m of project components. If no spring survey is undertaken to confirm nest activity in a given year, a nest used in the previous year will be considered active. Mitigation measures will apply to Nest 487 if it is confirmed as active prior to Project construction or during Project operation.

G.2.1 Construction

Mitigation measures during construction are as follows:

- No vegetation removal or Project activities will occur within 200 m (i.e., the primary and secondary zones, as defined by MNR, 1987) of an active nest. If Nest 271 is still active prior to the development of Pond D1 and WRSA D (approximately 2022) this protection plan should be adjusted accordingly.
- The limits of the vegetation removal and construction area within 800 m of an active nest will be staked in the field. Activities will occur inside the marked limit of work.
- A 120 m vegetated buffer zone will be retained along the shoreline of the lake; and all vegetation that is present between each nest and the lakeshore will be retained.
- Large and mature trees will be retained between each nest and the closest Project components to maintain a visibility barrier to Project activities to the extent possible
- Vegetation clearing activities and site preparation activities between 400 m and 800 m of active nests will not occur from March 1 to June 30 (the incubation and nestling period for bald eagle [MNR 1987; MNR 2010]).
- If any vegetation clearing or site preparation activities are required within 200- 400 m of the nest they should occur outside of the incubation, nestling, and fledging period (March 1 to August 31 [MNR 2010]).

G.2.2 Operation

The following mitigation measures will be implemented during operation for any active nest within 800 m of project components:

- Mitigation for wildlife and wildlife habitat (e.g., lighting and noise as per Section 6.3 of the BMMP)
- Collection and disposal of any animal carcasses found within the Project area to prevent bald eagles feeding on them and being attracted to the site
- Avoidance of human presence within 200 m of active nests from March 1 to August 31
- Restriction of human activities, to the extent possible, between 200 m and 800 m of the nests between March 1 to June 30

G.3 Monitoring

Throughout the life of the Project an annual survey will be undertaken by air to document and confirm the location of bald eagle nests and their activity. MNRF conducts annual stick nest surveys in February and March for forestry planning and relevant data may be shared with GGM as part of this monitoring program. If the MNRF survey is not conducted or the results are not available to GGM, GGM will conduct a survey as follows:

- The survey will be done once in spring when raptors would likely be incubating but when deciduous trees are still in leaf off condition (e.g., March or April). The timing of the survey should be determined annually based on local conditions.
- An aerial survey will be conducted of the PDA and an area 1 km out from the PDA (the "Search Area")
- Known locations of bald eagle nests will be checked for activity and the Search Area will be scanned for any new nests
- The survey will document nest locations (GPS location), the species, and whether activity was observed (i.e., bird present on/near nest)
- The survey may be coordinated or combined with aerial raptor nest surveys undertaken by MNRF if/as appropriate

There are no thresholds or corrective actions specifically linked to bald eagle monitoring. Rather, the purpose of monitoring is to identify active nest locations to inform the application of mitigation measures.

The Bald Eagle Protection Plan will be updated and revised as required based on monitoring results (e.g., identification of new nest locations or changes in nest activity status) and in anticipation of upcoming Project phases or activities that may occur within 800 m of nests (ex. Development of Pond D1 and WRSA D within 200 m of Nest 271).

G.4 Reporting

Active nests will be reported to the Environmental Superintendent and appropriate staff informed of the mitigation measures associated with the nests. This Plan will be updated as required based on the survey results. New and active nests will be incorporated into this Plan.

The survey results will be reported to relevant agencies (MECP, MNRF, and CEA Agency) and Indigenous communities within 30 days of the survey. Data collected on new and active nests will also be submitted to MNRF through the NHIC submission process.

Any mortality of a bald eagle found at the Project site will be reported to MECP, MNRF (Nipigon District) and Environmental Monitors within two business days.

The survey methods and results as well as information about the implementation of mitigation measures will be documented in the annual Biodiversity Assessment Report (see Section 7.2 of the BMMP).

G.5 References

Armstrong, T. 2014. Management Plan for the Bald Eagle (*Haliaeetus leucocephalus*) in Ontario. Ontario Management Plan Series. Prepared for the Ontario Ministry of Natural Resources and Forestry, Peterborough, Ontario. vii + 53 pp.

Cadman, M. D., D. A. Sutherland, G. G. Beck, D. Lepage and A. R. Couturier (eds.). 2007. Atlas of the Breeding Birds of Ontario, 2001-2005. Bird Studies Canada, Environment Canada, Ontario Field Ornithologists, Ontario Ministry of Natural Resources, and Ontario Nature, Toronto. xxii + 706 pp.

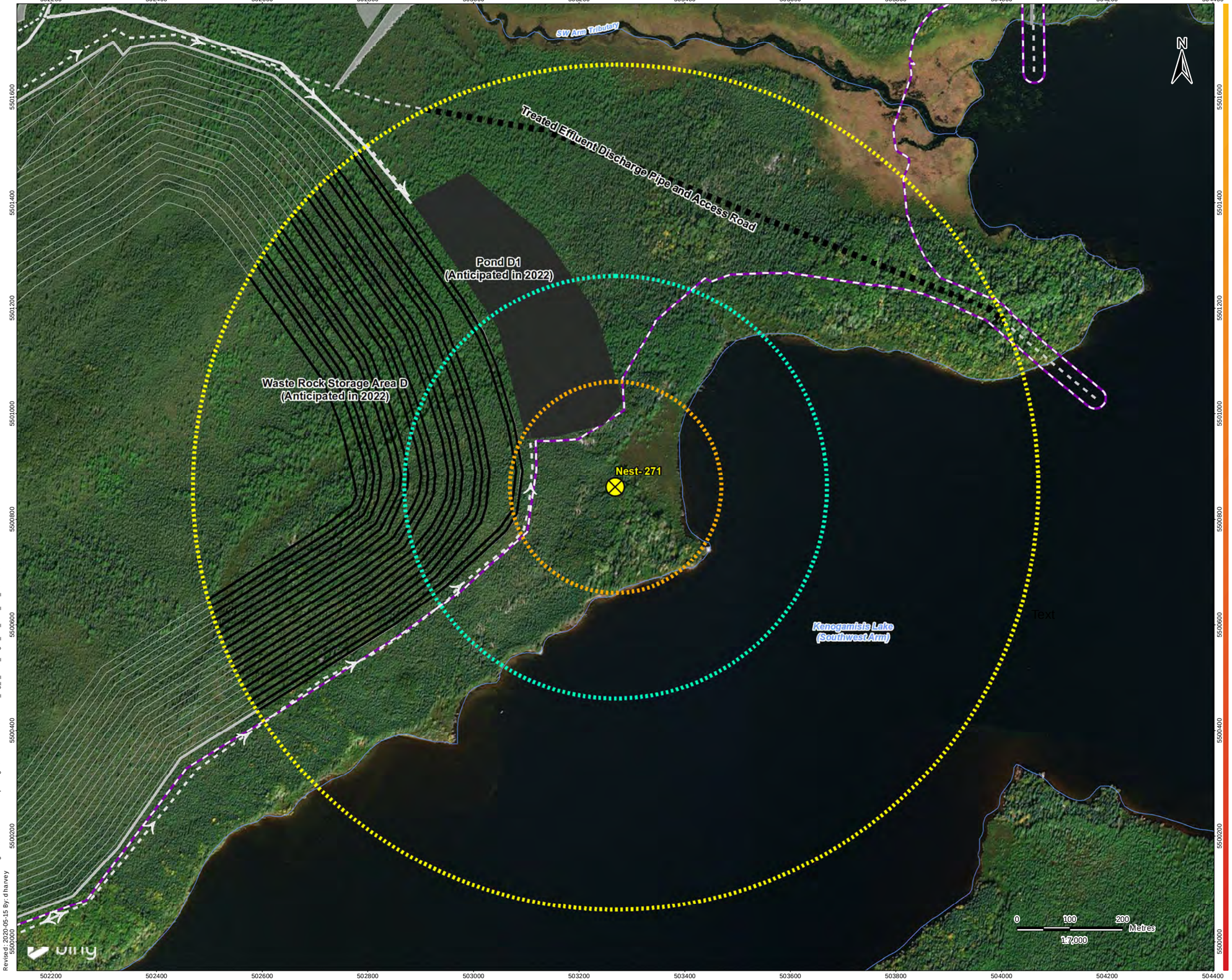
Northern Bioscience. 2019. Greenstone Gold Mine Raptor Nest and Beaver Dam Survey, 2019. 8 pp.

Ontario Ministry of Natural Resources (MNR). (1987). Bald Eagle Habitat Management Guidelines. June 1987. 15 pp.

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

Ontario Ministry of Natural Resources and Forestry (MNRF). (2014). Significant Wildlife Habitat Mitigation Support Tool. 532 pp.

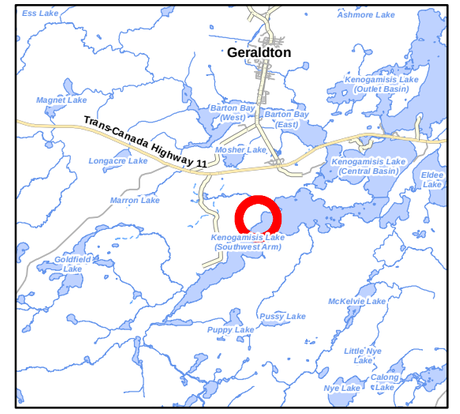
ATTACHMENT G1
FIGURES 1-4: BALD EAGLE NESTS AND BUFFERS



Stantec

Legend

- Project Development Area (Optimized Site Plan, May 2019)
- Bald Eagle Nest
- Bald Eagle Nest 200 m Buffer
- Bald Eagle Nest 400 m Buffer
- Bald Eagle Nest 800 m Buffer
- Highway
- Major Road
- Local Road
- Watercourse- Permanent
- Watercourse- Intermittent
- Waterbody



Notes

1. Coordinate System: NAD 1983 UTM Zone 16N

2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2013.

3. Orthographic Imagery Source: © 2020 Microsoft Corporation © 2020 DigitalGlobe ©CNES (2020) Distribution Airbus DS
Imagery Date- Unknown

May 2020
160961293

Client/Project

Greenstone Gold Mines GP Inc (GGM)
Hardrock Project

Figure No.

1

Title

Bald Eagle Management Plan: Nest 271

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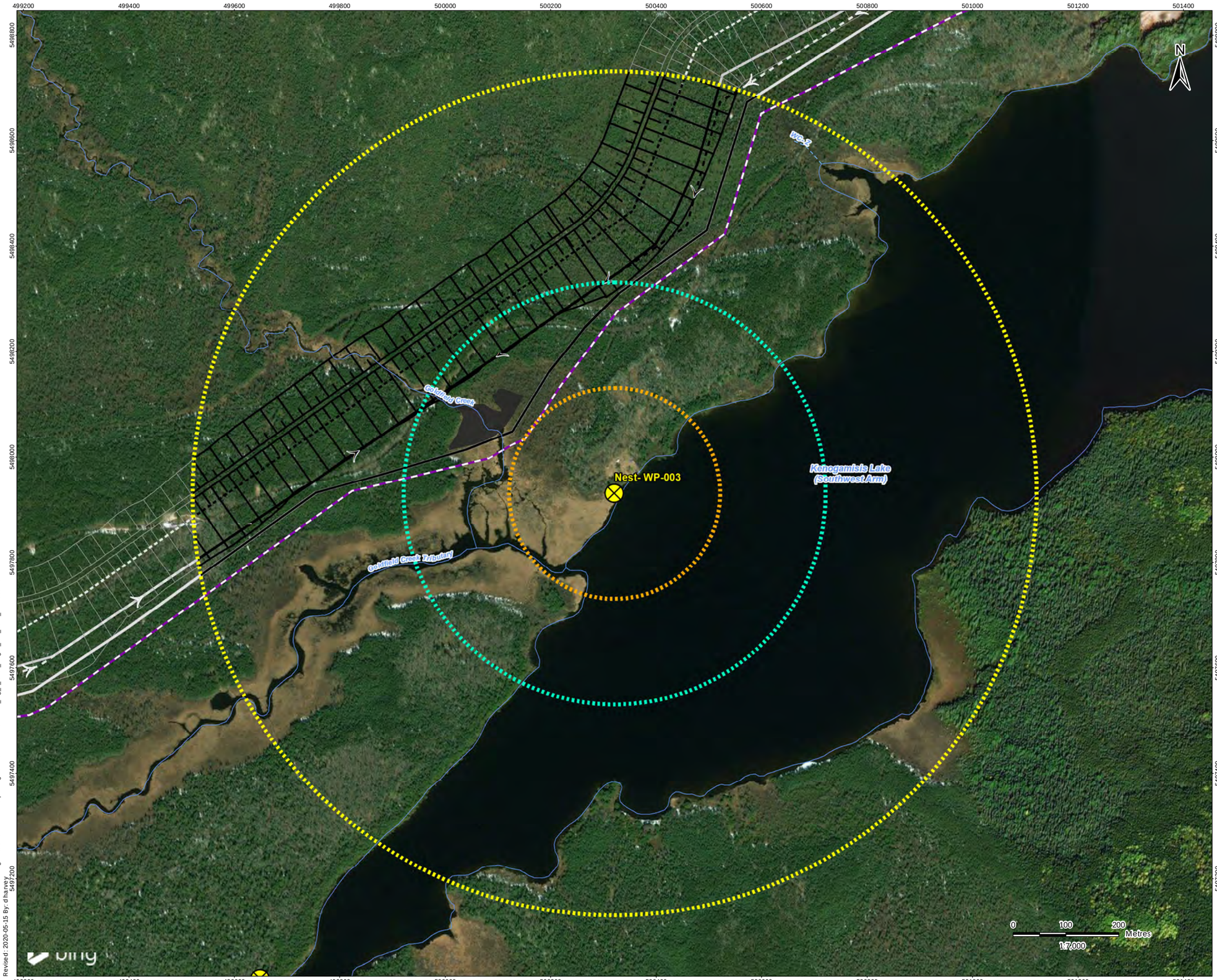
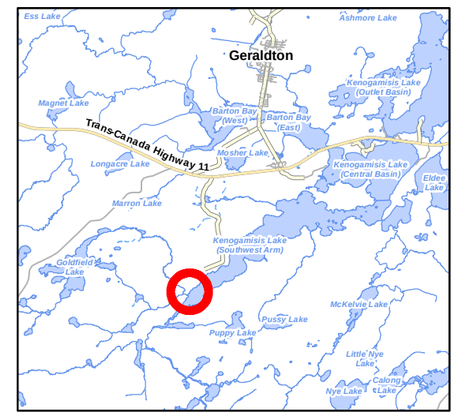
Revised: 2020-05-15 By: dharvey





Legend

- Project Development Area (Optimized Site Plan, May 2019)
- Bald Eagle Nest
- Bald Eagle Nest 200 m Buffer
- Bald Eagle Nest 400 m Buffer
- Bald Eagle Nest 800 m Buffer
- Highway
- Major Road
- Local Road
- Watercourse- Permanent
- Watercourse- Intermittent
- Waterbody

Notes

1. Coordinate System: NAD 1983 UTM Zone 16N

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Imagery Date- Unknown

May 2020
160961293

Client/Project

Greenstone Gold Mines GP Inc (GGM)
Hardrock Project

Figure No.

2

Title

Bald Eagle Management Plan: WP-003

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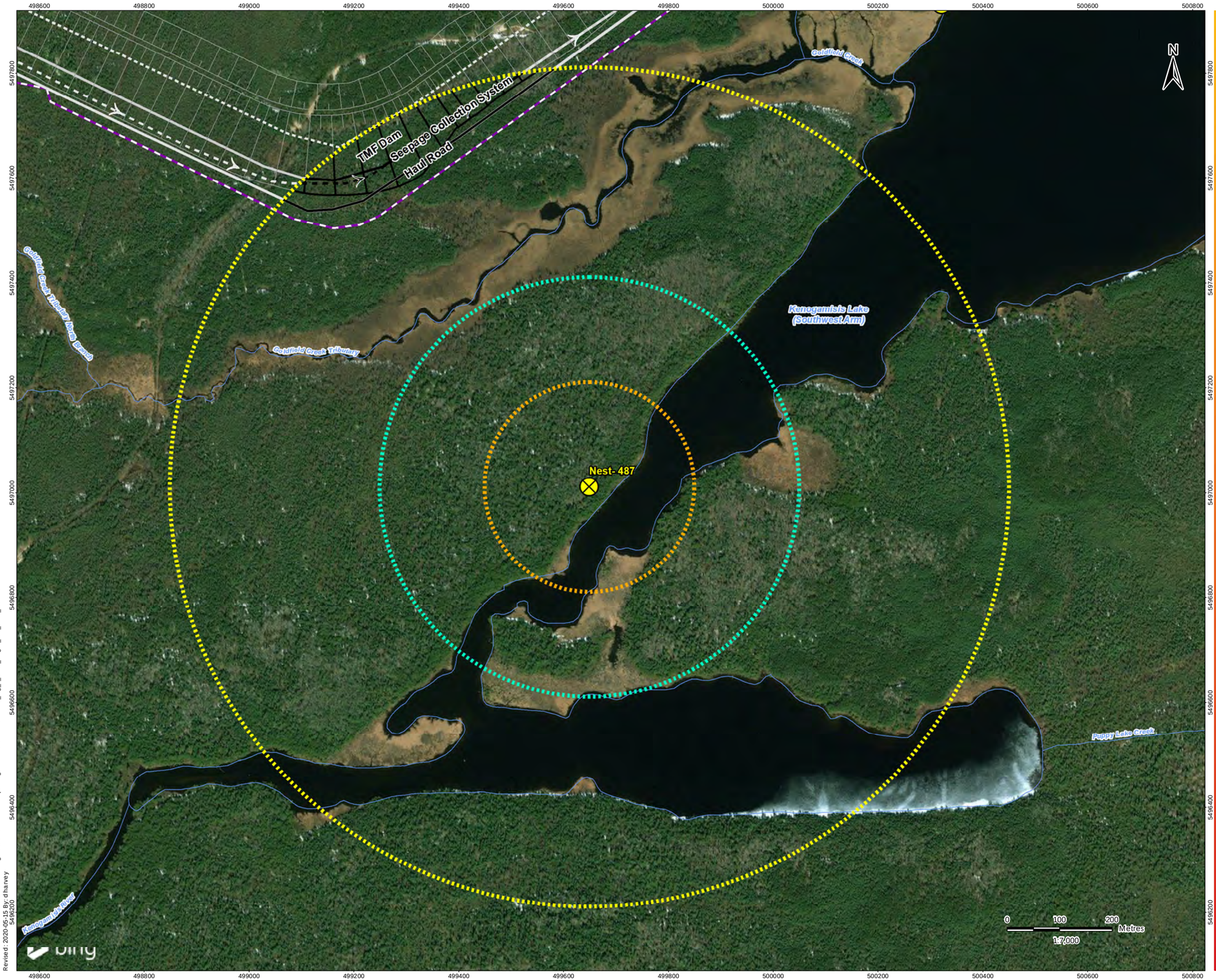
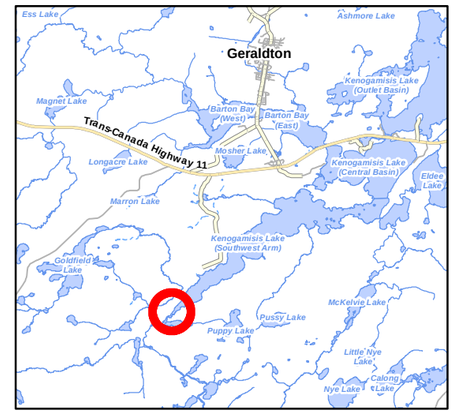


Stantec

Legend

- Project Development Area (Optimized Site Plan, May 2019)
- Bald Eagle Nest
- Bald Eagle Nest 200 m Buffer
- Bald Eagle Nest 400 m Buffer
- Bald Eagle Nest 800 m Buffer
- Highway
- Major Road
- Local Road
- Watercourse- Permanent
- Watercourse- Intermittent
- Waterbody



Notes

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Imagery Date- Unknown

May 2020
160961293

Client/Project

Greenstone Gold Mines GP Inc (GGM)
Hardrock Project

Figure No.

3

Title

Bald Eagle Management Plan:
Nest 487

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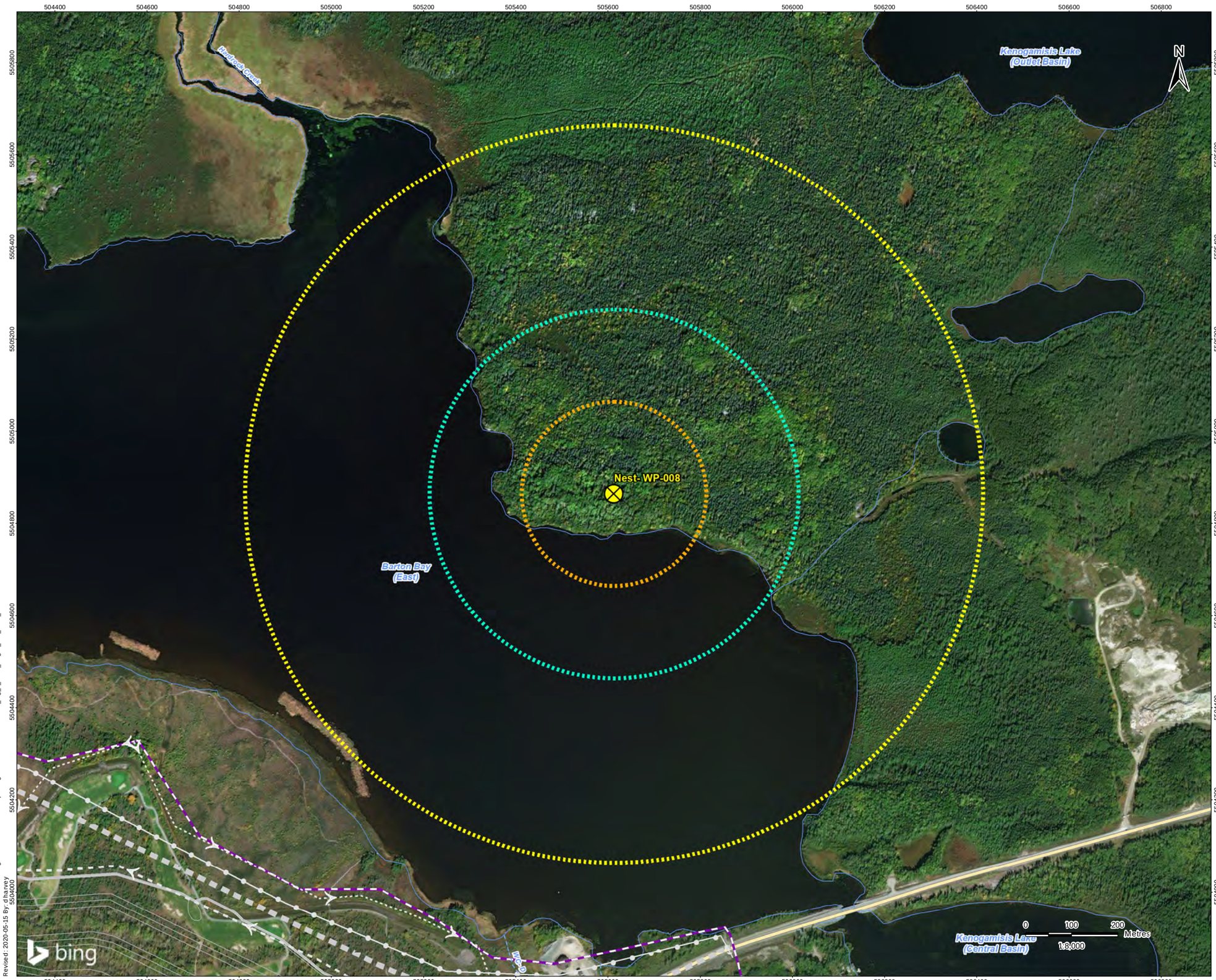
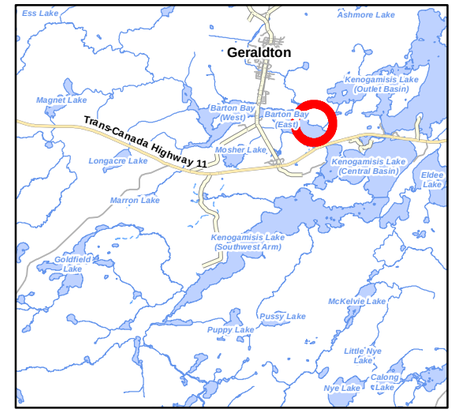
Revised: 2020-05-15 By: dharvey



Stantec

Legend

- Project Development Area (Optimized Site Plan, May 2019)
- Bald Eagle Nest
- Bald Eagle Nest 200 m
- Bald Eagle Nest 400 m
- Bald Eagle Nest 800 m
- Highway
- Major Road
- Local Road
- Watercourse- Permanent
- Watercourse- Intermittent
- Waterbody



Notes

1. Coordinate System: NAD 1983 UTM Zone 16N

2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2013.

3. Orthographic Imagery Source: © 2020 Microsoft Corporation © 2020 DigitalGlobe ©CNES (2020) Distribution Airbus DS
Imagery Date- Unknown

May 2020
160961293

Client/Project

Greenstone Gold Mines GP Inc (GGM)
Hardrock Project

Figure No.

4

Title

Bald Eagle Management Plan: WP-008

V:\01609\active\60960865\drawing\MXD\Terrestrial\ReportFigures\BMMP\160961293_Fig_4_Bald_Eagle_MP_Nest_WP-008.mxd
Revised: 2020-05-15 By: dharvey

APPENDIX H
BREEDING BIRD MONITORING PLAN

Appendix H Breeding Bird Monitoring Plan

H.1 Background

Migratory birds are protected by the *Migratory Birds Convention Act (1994)*. Migratory bird surveys will be conducted to assess changes in migratory birds as a result of the Project. Migratory bird populations are also considered an appropriate biodiversity indicator (European Academies' Science Advisory Council 2004).

H.2 Monitoring

Post-construction surveys to monitor breeding bird populations during the life of the mine will be completed following the methods used during the baseline field data collection program (Stantec 2015, 2016). The target survey locations and parameters are detailed in Table H-1.

Table H-1 Breeding Bird Surveys

Objective	Target Survey Locations[1]	Survey Timing	Evaluation Parameters to be assessed
To provide additional information to assess whether there are changes in wetland communities as a result of indirect Project effects (i.e., drawdown)	-Sparse treed fen (B136) -Wetland communities where groundwater sampling locations also occur, where feasible	Annually for the first five years after the completion of construction	Overall species richness and presence/absence of species representative of wetland communities (including wetland species detected during baseline studies as per Stantec 2015 and 2016)
To validate the predictions of the EIS/EA (i.e., that there will be no significant residual effect on migratory birds, bird species at risk, and bird species of conservation concern) and to assess the breeding bird communities in the Local Assessment Area during Project operation	-Standard point counts will be completed within remaining vegetation within the LAA in major habitat types (i.e., forest [conifer, hardwood and mixed forests], swamp, and non-treed wetland [bog/fen/marsh]). -Point counts will be also be completed in open habitats at dusk to target common nighthawk. -Where baseline point count locations	Annually for the first five years after the completion of construction	Overall species richness; and presence/absence of: • Eastern wood-pewee, Canada warbler, and common nighthawk • Species representative of non-treed wetland habitat and forest/treed wetland habitats (including those species detected during baseline studies as per Stantec 2015 and 2016)

Table H-1 Breeding Bird Surveys

Objective	Target Survey Locations[1]	Survey Timing	Evaluation Parameters to be assessed
	occurred outside the Project footprint but within the LAA, these will be considered for inclusion as feasible and appropriate.		
To assess the breeding bird habitat that is provided by the vegetation restoration activities and by the Goldfield Creek re-alignment	-Along the Goldfield Creek diversion with consideration of repeating baseline point count locations as feasible and available -Within areas that are revegetated during operation, such as the WRDAs and TMF. Within these areas, point counts will be placed within the feature, separated by a distance of 250 m. The number of point counts will be determined in relation to the size of the feature.	Annually for the first five years after the completion of revegetation activities and the Goldfield Creek re-alignment	• Overall species richness; and • Presence/absence and abundance of target indicator species. A list of target indicator species will be developed based on the vegetation community type restoration target(s) with consideration of the bird species local to the area that would be expected in that community type, consultation with stakeholders and bird species of interest to Indigenous communities.

[1] Survey locations will be reviewed and adjusted annually in response to expanding project footprint.

The post-construction breeding bird surveys will be undertaken as follows:

- Surveys will be completed between the end of May and early July, preferably in June. The specific timing will be determined based on annual conditions.
- Point counts will be located more than 250 m apart. Locations will be selected with consideration of the criteria and parameters outlined in Table H-1. Because of the ongoing development and phasing in of the Project, survey locations should be assessed on an ongoing basis and revised in response to the expanding project footprint.

- Ten-minute point counts will be undertaken between 05:00 hours and 10:00 hours at each established site, in suitable weather conditions (i.e., as recommended by the Forest Bird Monitoring Program protocol [Canadian Wildlife Service, 1987] and the Ontario Breeding Bird Atlas protocol [Bird Studies Canada, 2001]).

- Each point count location will be visited twice with a minimum of 14 days between visits to accurately access breeding activity. Birds observed, heard singing or calling, will be noted during each point count. Breeding evidence and species abundances will be recorded according to Ontario Breeding Bird Atlas protocols (Bird Studies Canada, 2001)

- Dusk point count surveys will be undertaken to target common nighthawk (and record other nocturnal calling species). Survey stations will be located on project roads in open areas and spaced at least 500 m apart. Each survey location will be visited twice approximately 8-12 days between visits. Surveys will be completed in accordance with protocols recommended by the Canadian Nightjar Survey Protocol (Knight 2018) or the most recent guidance, as available. Dusk surveys will start approximately 30 minutes before sunset. Each station will be surveyed for 6 minutes. All common nighthawk detected will be recorded with an indication of the approximate distance and direction of calling.

- Audio-recorders (consistent with the baseline monitoring survey program) may also be considered for use.

- Wildlife (or signs of wildlife such as tracks and scat) observed during surveys will recorded. Species, numbers, locations and behaviours will be recorded.

Based on results of these surveys, GGM will determine, in consultation with Indigenous groups and relevant authorities, whether additional surveys are required after the first years years following completion of construction and with what frequency and in which locations these additional surveys shall occur.

There are no thresholds or corrective actions specifically linked to breeding bird monitoring; corrective actions for wetland effects and revegetation are outlined in those sections (Appendix A and Appendix K).

H.3 Reporting

The survey methods and results will be documented in the annual Biodiversity Assessment Report.

H.4 References

Bird Studies Canada (2001). Ontario Breeding Bird Atlas Protocols.

Knight, Elly. (2018). Canadian Nightjar Survey Protocol.

Canadian Wildlife Service (1987). Forest Bird Monitoring Protocols.

European Academies' Science Advisory Council. 2004. A User's Guide to Biodiversity Indicators.

Stantec Consulting Ltd. (2015) Environmental Baseline Data Report – Hardrock Project: Terrestrial. Prepared for: Premier Gold Mines Limited, January 2015.

Stantec Consulting Ltd. (2016) Supplemental 2015 Terrestrial Data Report – Hardrock Project: Terrestrial. Prepared for: Greenstone Gold Mines GP Inc, January 2016.

APPENDIX I
BARN SWALLOW MITIGATION AND RESTORATION RECORD

Appendix I Barn Swallow Mitigation and Restoration Record

I.1 Introduction

The Endangered Species Act (ESA) 2007 was created to protect Species at Risk (SAR) and their habitats in Ontario. Endangered, threatened and extirpated species listed on the Species at Risk in Ontario (SARO) list automatically receive legal protection from harm or harassment and general habitat protection under the ESA 2007.

Barn swallow was added to the SARO List as a Threatened species in May 2011. As such, it is afforded general habitat protection because a species-specific habitat regulation has not yet been developed. The Barn Swallow is an aerial insectivorous bird and, like many other aerial insectivores, has experienced very large population declines since the 1980s. Barn swallows typically nest on man-made structures (e.g., sheds, barns, bridges,) and forage over water and other open areas. A draft recovery strategy has been issued by the Ministry of Natural Resources and Forestry (MNRF) (Heagy, et al. 2014).

When the ESA came into effect in 2007, proponents were required to obtain a permit from the Minister of Natural Resources and Forestry for activities which would contravene the ESA. On July 1, 2013, Section 23.5 of Ontario Regulation 242/08 of the ESA came into force (hereafter referred to as the 'Regulation'). Provisions contained within the Regulation allow individuals and businesses to undertake eligible development activities within the habitat of barn swallow by registering with the MNRF and following the rules outlined within the Regulation.

Through field work, barn swallows were confirmed nesting in two buildings that require removal by GGM.

This activity (building removal) is eligible for the Regulation (as further described in Section I.1.1) and as a result the following Mitigation and Restoration Record (MRR) has been developed. This MRR has been prepared prior to commencing the activity; it was completed on January 29, 2019. As per the requirement of the Regulation, this MRR includes:

- The name and contact information of the person who is proposing to carry out the activity (Section I.2.1)
- A description of the activity including the proposed start and end dates (Section I.2.2)
- A description of the buildings/structures impacted by the project (Section I.2.3; Figure 2, Attachment I2)
- The number, location, and description of barn swallow nests located on the building or structure and the amount of area suitable for nesting that the building or structure provides (Section I.2.4)
- Steps to minimize adverse effects (Section I.3)

This MRR also includes:

- A description of the replacement habitat (Section I.4)
- Details on the monitoring and reporting requirements (Sections I.5 and I.6)

This MRR was developed for Greenstone Gold Mines GP Inc. (GGM) by qualified professionals following the requirements outlined in the Regulation and in accordance with best available scientific knowledge on Barn Swallow nest habitat requirements.

I.1.1 Eligibility for Regulation

Eligible Activities

Activities that are eligible for the barn swallow Regulation include the maintenance, repair, modification, replacement or demolition of a building or structure that provides barn swallow habitat.

GGM requires the removal of two buildings which provide barn swallow habitat.

Notice of Activity Form

In addition to creating an MRR, proponents of eligible activities must submit a Notice of Activity Form to the MECP Registry prior to commencing the activity.

Prior to undertaking the activity (i.e., removing the buildings) a Notice of Activity Form will be submitted to the MECP Registry to enter into the Regulation for barn swallow.

Confirmation of Registration from MNRF

Once received, confirmation of receipt of the Notice of Activity Form from the MECP will be included in Attachment I1.

I.2 Project Activity

I.2.1 Person Conducting the Activity

Primary Contact (i.e. accountable person for the company)

Name:	Steve Lines
Organization:	Greenstone Gold Mines GP Inc.
Mailing Address:	2381 Bristol Circle, Suite B203, Oakville, ON L6H 5S9
Telephone (work):	(514) 604-4459

On-site Contact/ Permitting Coordinator:

Name:	Shane Hayes
Organization:	Greenstone Gold Mines GP Inc.
Mailing Address:	135 Hardrock Road, Geraldton ON, P0T 1M0
Telephone (work):	(807) 228-0373

I.2.2 Description of Activity

Greenstone Gold Mines GP Inc. (GGM) proposes to construct, operate, and ultimately decommission/ close a new open pit gold mine, process plant, and ancillary facilities, collectively known as the Hardrock Project (the Project). As part of the development of the Project, GGM requires the removal of two buildings that provide Barn Swallow habitat (the Activity). Barn swallow nesting was confirmed within two buildings in the Ontario Ministry of Transportation (MTO) Patrol Yard: the dome and a garage.

Location of Activity

Civic Address: #135 Hardrock Road, Geraldton, ON, P0T 1M0

MTO Building UTM Coordinates: NAD 83 Zone 16 U Easting 505501 Northing 5503808

Municipality of Greenstone, Ward of Geraldton

OMNRF District: Nipigon

Ecoregion: 3W

Map of Location of Activity: Figure 1 (Attachment I2)

Proposed Start and Completion Dates of the Activity

The Activity is anticipated to be undertaken in Q1 (January to March) 2021. Removal of the MTO buildings is expected to be completed within XX days/weeks (Placeholder – to be verified during final compilation of Barn Swallow Mitigation and Restoration Record.)

I.2.3 Description of Structure to be Destroyed

The nests were identified within two buildings in the MTO Patrol Yard: the dome and a garage. The dome is a traditional wooden dome structure, used for storage of sand. The structure contains an opening at the front and the roof is lined with wood beams.

The garage is a relatively small structure, with an opening at one end and wood crossbeams across the roof.

A photo log of the structures is provided in Attachment I3.

I.2.4 Description of Barn Swallow Nests

A field investigation was conducted in June 2016 during which a total of 15 active barn swallow nests were identified (two in the MTO garage and 13 in the MTO dome). A total of 14 individuals were observed flying in and out of the two buildings. The location of the nesting structures is shown in Figure 1, Attachment I2.

Given the time between the previous nesting survey (2016) and the proposed removal of the buildings (2021), a survey to document barn swallow nesting activity within the MTO buildings is recommended in 2019 and 2020. The results of these surveys will be used to adjust this MRR as required.

I.3 Steps to Minimize Adverse Effects

The following subsections describe the steps that will be taken to minimize adverse effects of the activity on Barn Swallow nesting habitat.

I.3.1 Mitigation Measures

No part of any activity that is likely to damage or destroy the habitat of barn swallow or kill, harm, and harass barn swallow will occur between May 1 and August 31 of any year. This timing window corresponds with the breeding, nesting, and rearing period for barn swallow, so any potentially harmful activities must not take place while birds are on site.

The removal of the structures is currently anticipated to occur between January and March 2021, outside of the barn swallow breeding window.

I.3.2 Habitat Compensation

Habitat compensation will be provided by the construction and installation of new barn swallow nesting structure(s) with artificial nest cups.

The purpose of installing new barn swallow nesting structure(s) with artificial nest cups is to provide long-term replacement habitat to offset the proposed removal of the MTO buildings. The replacement habitat will be in place prior to May 2021 so that it will be available for the 2021 nesting period. The creation of barn swallow replacement habitat will be undertaken in compliance with the Regulation and based on best available information.

The Regulation requires each lost nest to be replaced with one artificial cup nest, in accordance with the details set out below for a minimum of three years.

At least 15 nest cups will be installed. The number of nest cups may be adjusted based on the results of the 2019 and 2020 monitoring.

I.3.3 Location of Replacement Habitat

The replacement habitat will be located within the Municipality of Greenstone, Ward of Geraldton, Nipigon OMNRF District and EcoRegion 3W.

The Regulation requires that the replacement habitat be located within 1 km of the structure that will be removed and within 200 m of suitable barn swallow foraging habitat.

A 1 km radius from the MTO Patrol Yard buildings is indicated on Figure 1, Attachment I2. The location of the replacement habitat will be determined with consideration of this radius. Placement will also consider ease of access (for construction and monitoring purposes), foraging habitat proximity (Kenogamisis Lake is considered to provide foraging habitat) and maximizing distance from Project-related activities to the extent feasible.

This MRR will be updated with the location of the replacement habitat once it is finalized.

I.3.4 Description of Replacement habitat

Barn swallow nests are predominantly located on artificial structures in rural areas. Suitable artificial structures include: open barns, garages, sheds, verandahs, bridges, road culverts, and houses. These structures provide important nest site characteristics including a horizontal surface (e.g., rafter, ledge) or a vertical face, sheltered by some type of overhang. Suitable nest sites include beams, posts, light fixtures, and ledges over windows and doors (COSEWIC 2011). Nesting structures are often located in proximity to open foraging habitat (e.g., hay and pasture farmland, meadows, wetlands, forest clearings, and parkland) and sites that provide mud for nest building (e.g., creeks, wetlands) (COSEWIC 2011). Recommendations for the replacement habitat were developed based on the Regulation, recovery planning documents, and current scientific literature.

I.3.5 Artificial Nest Structures

Provisioning of the artificial nest structures will be made in accordance with the following parameters as outlined in the Regulation, with additional recommendations as per MNRF's Best Practices for Creating Nesting Habitat for Barn Swallows (MNRF 2014) and Bird Studies Canada's Artificial Nesting Structures guidelines (BSC 2013) included in brackets:

- Provide horizontal ledges or rough vertical surfaces with a sheltered overhang
- Provide surface areas suitable for nest attachment (rough wood is a preferred construction material (smoothly planed or painted wood, aluminum and plastic materials should be avoided as Barn Swallow nests do not usually adhere well to these materials [MNRF 2014]))

- Provide all nest attachment areas at a height that minimizes disturbance and predation to Barn Swallow nests (nest sites >8 ft above ground [BSC 2013], nest cups should be placed so that there is between 2.5 to 6 cm between the top of the nest and the ceiling [MNRF 2014])
- Provide all nest attachment areas in a way that minimizes predation (install baffles, shields or sheet metal cylinders on the poles of the structure [MNRF 2014])
- Allow barn swallows to freely enter and exit nests
- Provide suitable area to accommodate appropriate spacing between nests (see Section I.3.6)
- Be structurally sound, and capable of providing habitat on a long-term basis

I.3.6 Artificial Nest Cups

In addition to providing a suitable nesting structure within the appropriate proximity to required habitat, the Regulation also requires the provisioning of artificial nest cups to substitute for removed nest(s) at a ratio of 1:1. Therefore, to compensate for the removal of 15 nests, at least 15 nest cups will be installed following the parameters detailed in the Regulation, that is:

- On horizontal ledges or rough vertical surfaces with a sheltered overhang
- On surface areas suitable for nest attachment at a height that minimizes disturbance and predation to the nests (see Section I.3.5)
- Installed with appropriate spacing between the nesting cups (2 to 4 m between nests, or can be as close as 60 cm if visual barriers that limit visibility of neighbouring nests are present [MNRF 2014])

I.3.7 Habitat Management

As per the Regulation, the building or structure constructed or modified must be maintained for a period of three (3) years. Installment of the replacement habitat will occur prior to the 2021 nesting season for Barn Swallow as described in Section I.4.

The condition of the replacement habitat will be recorded during monitoring surveys (see Section I.5). Any repair or maintenance required will be reported to the Environmental Superintendent and will be addressed.

I.4 Monitoring

I.4.1 Impact Monitoring

Given the time between the previous nesting survey (2016) and the proposed removal of the buildings (2021), surveys to document Barn Swallow nesting activity associated with the MTO buildings is recommended in 2019 and 2020. The MTO buildings and other buildings suitable for Barn Swallow nesting that require removal for the Project should be monitored during the core breeding season (i.e., June) to document the number of active nests.

The results of these surveys will be used to adjust this MRR as required. Impact monitoring methods will be consistent with the methods described for replacement habitat monitoring in Section I.4.2.

I.4.2 Replacement Habitat Monitoring

This section describes the monitoring that will be undertaken to assess the effectiveness of mitigation efforts and the beneficial actions.

The replacement habitat will be surveyed annually for three years to document nesting activity and structure use. Up to two surveys will be completed by a qualified ecologist, with the first visit occurring during the core breeding period for the species (i.e., June). Timing of the second visit will be decided based on nest status as determined during the first visit, ideally timed to return when young are present such that nest success may be determined (i.e., late June to mid July).

Weather conditions (i.e., precipitation and visibility) on each of the surveys will be within the parameters required by monitoring programs such as Environment and Climate Change Canada's (ECCC) Breeding Bird Survey, the Ontario Breeding Bird Atlas, and the Ontario Forest Bird Monitoring Program. Timing restrictions on surveys are not required as barn swallows are active throughout the day, particularly when adults require constant foraging trips to collect and retrieve food for nestlings.

Each survey will consist of an inspection of the interior of the replacement habitat, recording the following details, as prescribed by the Regulation:

- The number, description and location of new nests created by barn swallows; and
- An estimate of the number of barn swallows using the structure.

Artificial nest cups will be visually inspected (from the ground and/or using a mirror on a pole if required) and all species observed, in addition to barn swallow, will be recorded. Emphasis will be placed on nesting House Sparrow observations, as this species is known to usurp and directly compete with barn swallows for nesting sites, particularly those nesting near barn entrances (COSEWIC, 2011).

The barn swallow nest monitoring is required for three years by the Regulation.

If no nesting is recorded, best available science will be reviewed to determine whether there are any additional actions that could feasibly be implemented to promote nesting (e.g., broadcasting calls).

I.5 Reporting

In accordance with paragraph 23.5 (4) of the Regulation, a Monitoring Record and a report to the Natural Heritage Information Centre (NHIC) must be completed annually for each of the three years of habitat management and monitoring. In addition, in accordance with paragraph 23.5 (11) of the Regulation, the Barn Swallow Mitigation and Restoration Record should be updated "from time to time" (O. Reg. 23(5)(11)).

The reports required in relation to this Activity are described below. These reports will be completed annually for each of the three years of habitat management and monitoring.

1. NHIC Report - A report to the NHIC will be made by completing the Ontario Species at Risk Observation Reporting Form. The report will include the species, number of individuals, date and location of the observations, and all other information requested on the form. The reporting form will be submitted within 3 months of the completion of each year of annual monitoring.
2. Monitoring Record - A record will be kept of the annual monitoring including the number, description and location of new nests created by barn swallow, and an estimate of the number of barn swallow using the structure.
3. MRR Update - This MRR will be updated with:
    - Documentation of all steps taken to minimize adverse effects;
    - Details on artificial nesting structure installation;
    - Details on nest cup installation;
    - Data and information collected during the monitoring program (i.e., the Monitoring Record); and
    - Any changes required to the original MRR.

I.6 Closure

It is the responsibility of Greenstone Gold Mines GP Inc. to follow the Rules in the Regulation contained within Section 23.5 of the Regulation including undertaking the Activity in accordance with this MRR. Further, the following action items will be completed to maintain compliance with the Regulation and under the ESA:

- A copy of this MRR will be retained until at least two years after monitoring is complete.
- A copy of this MRR will be provided to the MECP within 14 days of receiving a request for it.

This MRR was prepared by Stantec Consulting Ltd. on behalf of Greenstone Gold Mines GP Inc.

Person Responsible for Creation of this MRR:

Name:	Melissa Cameron
Organization:	Stantec Consulting Ltd.
Mailing Address:	600-171 Queens Avenue, London ON N6A 5J7
Telephone (work):	(519) 645-2007
Email:	melissa.cameron@stantec.com

Qualifications of the person who prepared this MRR are provided in Attachment I4.

ATTACHMENT I1
MNRF CONFIRMATION OF REGISTRATION

(will be included in final submission)

ATTACHMENT I2
FIGURE 1: BARN SWALLOW MITIGATION

505000

5505000

WC-A

WC-C

Burton Bay (East)

Pond A1

Subsurface Seepage Collection Pond

Ballard

Subsurface Seepage Collection Pond

Overburden Storage Area 1

Trans-Canada Highway 11

Ballard

Subsurface Seepage Collection System

Barrick Drive

Twilight Crescent

WRSA A

Kenogamisis Lake (Central Basin)

Pond A2

Open Pit

Hardrock Road

Hardrock No.2 Shaft

bing

0 250 500 m

1:10,000

505000

V:\01609\active\60960865\drawing\MXD\Terrestrial\ReportFigures\BarnSwallowMitigationRecord\160961254_Fig_1_Barn_SwallowMitigation_20180913.mxd
Revised: 2018-09-18 By: dharvey

N

Stantec

Legend

- Project Development Area
- MTO Patrol Yard (Barn Swallow Habitat)
- MTO Patrol Yard 1 km Buffer
- Contour Line (10 m intervals)
- Highway
- Major Road
- Local Road
- Watercourse- Permanent
- Watercourse- Intermittent
- Waterbody

Notes

1. Coordinate System: NAD 1983 UTM Zone 16N

2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2015.

3. Imagery Sourc: © 2018 Microsoft Corporation © 2018 DigitalGlobe ©CNES (2018) Distribution Airbus DS
Imagery Date: Unknown

September 2018
160961101

Client/Project

Greenstone Gold Mines GP Inc. (GGM)
Hardrock Project
Information Gather Form Figures

Figure No.

1

Title

Barn Swallow Mitigation

ATTACHMENT I3
PHOTOLOG OF THE STRUCTURES TO BE REMOVED

Photo 1: MTO Patrol Yard

Photo 2: Sand Dome exterior

Photo 3: Sand Dome interior

Photo 4: Sand Dome interior. Barn Swallow Nests Visible.

Photo 5: Garage exterior

Photo 6: Garage interior

Photo 7: Garage Interior. Barn Swallow Nest Visible.

ATTACHMENT I4
QUALIFICATIONS

(will be included in final submission)

APPENDIX J
MIGRATORY BIRD NEST MANAGEMENT PLAN

Appendix J Migratory Bird Nest Management Plan

J.1 Background

The Migratory Birds Convention Act (MBCA), 1994 protects migratory birds, their nests and eggs. It prohibits the harming, killing, disturbance or destruction of migratory birds, nests and eggs. Birds not addressed under the MBCA are grouse, quail, pheasants, ptarmigan, hawks, owls, eagles, falcons, cormorants, pelicans, crows, jays, kingfishers, and some species of blackbirds. Most species not protected by the MBCA are protected by the provincial Fish and Wildlife Conservation Act (FWCA). Some species are also protected by provincial and/or federal species at risk legislation.

Birds and their nests and eggs may be inadvertently destroyed through the undertaking of certain industrial activities (e.g. during vegetation clearing). This is referred to as "incidental take". This Migratory Bird Nest Management Plan has been created to reduce the risk of harm to migratory birds due to incidental take related to the construction, operation and closure of the Hardrock Mine. This Plan is intended to apply to native species of bird that nest in Ontario (see Attachment A). This Plan does not apply to European Starling, House Sparrow, Red-winged Blackbird or Rock Pigeon.

Management Plans specific to Bank Swallow, Bald Eagle and Barn Swallow are provided in Appendices F, G and I, and a follow up monitoring plan for breeding birds is provided in Appendix H. Management plans that include supplemental mitigation and management direction relevant to reducing residual impacts on migratory birds include the Wildlife-vehicle monitoring and management plan and the Wildlife-water monitoring and management plan and (Appendices D and E). This Migratory Bird Nest Management Plan is intended to be read and implemented alongside each of these plans. Together, it is expected that implementation of the best management practices contained within the Hardrock Mine BMMP will contribute to the long-term conservation of the local bird communities and their habitats.

J.2 Mitigation

The most effective way to reduce risk of incidental take is to avoid activities that could result in incidental take (e.g., vegetation clearing) during the breeding period for birds. The following mitigation measures will be implemented to reduce the risks to migratory birds and their nests:

- Project personnel and contractors will be educated about the MBCA, the FWCA, the Endangered Species Act, the Species at Risk Act and the protections afforded to birds and their nests under these laws as well as the steps to take if a nest is found.
- Removal of any raptor nests will occur outside of February 1 to July 31 or a period as indicated in any FWCA permits that are obtained.
- Vegetation clearing and site preparation activities that could result in the incidental take of migratory bird nests will occur outside May 1 to August 31 period to the extent feasible.

- If activities that could result in incidental take cannot be avoided between May 1- August 31, a Qualified Biologist will conduct nest surveys in accordance with the methods outlined in Section J.3 and apply a buffer zone around the nest using guidance provided in Section J.4.

- Excavations will commence outside the critical breeding period for common nighthawk (1 May - 15 August) to the extent feasible. If excavations must be commenced during this time period, nocturnal surveys (as detailed in Appendix H.2) or targeted nest searches (see Section J.3) to detect the presence of common nighthawk (and other ground nesting birds such as killdeer) will be conducted prior to excavations starting and a buffer zone established (see Section J.4) where common nighthawk nesting or suspected nesting is detected.

- Deterrents or exclusion measures may be implemented to discourage birds from nesting in areas where project activities are required in the breeding season and which may cause disturbance or destruction of nests. The use of deterrents should primarily be limited to small areas and for short durations as this is generally when they are most effective. Beyond the removal of vegetation, deterrents may include bird spikes, tape, noise makers, regular presence of humans/activity or use of falconry. The implementation of deterrents will be determined on a situation-specific basis by a Qualified Biologist as the effectiveness of deterrents varies depending on the situation and effectiveness can decline over time. Deterrents should be implemented prior to the nesting season and maintained through the season. Monitoring (Section J.3) should occur prior to project activities starting. If nesting does occur, the deterrent should be removed and a buffer zone established around the nest.

- If an active nest (i.e. a nest under construction, a nest containing eggs or young or where an adult is incubating) is discovered during operation, the following steps will be implemented:

    - The Project personnel/contractor will move away as quickly and quietly as possible and contact the Environmental Superintendent with the relevant details (location, species and any details regarding the presence of eggs or nestlings). Personnel will avoid disturbing the surrounding vegetation and avoid making a direct trail to and from the nest.

    - The nest will be protected with a buffer zone that will be determined using guidance provided in Section J.4 and activities within the established buffer zone restricted until the nest is no longer active.

- If an inactive nest is identified, it will reported to the Environmental Superintendent. Direct removal of the nest will be avoided to the extent possible. However, if nest removal cannot be avoided, GGM will obtain relevant permits authorizing its removal if the nest belongs to:

    - a migratory bird species that re-uses nests (e.g., swallows, great blue heron)

    - a species protected by the FWCA (e.g., owls, raptors)

- additional authorizations may be required if the nest belongs to a species at risk.

J.3 Monitoring

J.3.1 Pre-clearing Nesting Surveys

Prior to undertaking activities that may result in incidental take of bird nests (e.g. vegetation clearing, removal of structures that could support nesting), nesting surveys will be conducted. For large areas of complex and/or dense vegetation (e.g. wetlands, woodlands), it is expected that active nests will be present during the active nesting period, however the ability to detect nests is generally considered low, and the nest search process itself may disturb nesting birds (ECCC 2018). Survey methods will be determined by the Qualified Biologist based on the site-specific conditions (habitat size and type) where the activity will occur. Methods employed will include either passive or targeted nest search methods which will be implemented with consideration of the following:

- ***Passive***: Passive searches for evidence of nesting (i.e. behavioural cues) may be undertaken in areas of large and or complex/dense vegetation
- ***Targeted***: Targeted nest searches may be conducted in situations where there is a reasonable expectation of detecting nests without disturbing them. For example:
  - where vegetation removal is limited (e.g. to one or a few trees)
  - open, urban settings
  - structures, buildings or other human habitation
  - for conspicuous nesting species (e.g. raptors, stick or bank colonial nesting species)

For all nesting surveys:

- Nest surveys will be conducted by a Qualified Biologist with familiarity with:
  - the kinds of bird species occurring in the area
  - the kinds of habitats used by the bird species
  - where species nest (e.g., ground, cavity, canopy, shrub, etc.)
  - how to identify species by sight and sound, and recognize behaviours that birds exhibit with regard to breeding
  - experience in the survey methods to be employed

- Nest surveys will be completed as close as possible prior to the start of any project activities that could result in incidental take. Ideally, project activities should commence within a maximum of 72 hours of a nest survey being completed.

- If project activities have not started within 72 hours following the nest survey, the survey must be repeated to determine whether new nests have been established within the survey area.

- The location (i.e. tree, shrub) of the nest should not be directly marked with flagging tape or other markers. The buffer zone around the nest or suspected nest location should be delineated as per the guidance in Section J.4.

Passive Nesting Surveys

- The survey should be completed throughout the area to be cleared, and in any vegetation that occurs within the 30 m of the area to be cleared.

- Surveys will involve a combination of transects and spot-mapping. The surveyor will walk multiple parallel or perpendicular systematic transects through the area to be cleared/disturbed (and the adjacent 30 m area).

- Behaviour cues will be used to determine that an active nest is present. Along each transect, the location and breeding evidence observed for each bird will be recorded. All signs of breeding activity (i.e. breeding evidence in accordance with Ontario Breeding Bird Atlas protocols, 2001) will be recorded and mapped, including:

    - carrying of food, nest materials or fecal sacs, cavity excavations, calling or singing, an active nest (with incubating bird, eggs or nestlings), an adult entering or existing a cavity, singing males and calling males and females within the area, a pair, young begging for food, distraction displays, adults giving alarm calls or exhibiting agitated behavior

    - Spot mapping will be completed. Visual and auditory cues will be used to locate individual birds, and their location will be marked on a map. As individual birds move around or are detected successively, the number of observations may form a cluster on the map. These clusters can indicate a high likelihood of nesting occurring in that area.

    - A determination of nesting presence will be made by the Qualified Biologist and will be based on either the discovery of a nest location, or through lines of evidence that suggest a nest is present (i.e., suspected nest). Evidence of nesting activity and professional judgment will be used to recommend mitigation (e.g., setbacks), even if a nest is not found.

Targeted Nest Search

- Targeted nest searches will involve visually searching select areas (e.g. trees, shrubs, structures, buildings and the ground) for nests or signs of nesting.
- All confirmed or suspected nest locations will be recorded (GPS and/or mapped location). For each nest that is identified, the following information will be recorded:
    - The nest location (UTMs) using a handheld GPS.
    - The species attributable to the nest (if possible).
    - The nest status (e.g., active or inactive)
    - The nest and general habitat characteristics (e.g., tree species, nest height, dbh and position; and dominant vegetation cover),
    - Nest contents if possible (e.g., presence of eggs, young, or empty, or under construction)
    - Adult behaviour (e.g., nest building, incubating, feeding).

J.3.2 Aerial Survey

Throughout the life of the Project an annual survey will be undertaken by air to document and confirm the location of stick nests and their activity. Methods are detailed in Appendix G.

J.4 Buffer Zones

Once a nest (or suspected nest) location is identified, a setback distance will be identified and delineated to create a buffer zone around the nest, in which project activities and human presence will be restricted while the nest is active.

- The buffer zone area will be flagged or staked according to the recommended setback distance (see below). If a suspected nest cannot be visually located, a setback distance around the approximate nest location will still be prescribed, and the area will be flagged or staked. The buffer zone may be delineated by an assigned coloured flagging tape, stakes or plastic fencing.
- The presence of the buffer zone and the restriction on activities will be communicated to relevant Project personnel by the Environmental Superintendent.
- No activities should occur within the buffer zone until the nest is no longer active. The end of nesting may be determined either by:
    - conservatively estimating the timing of when the nesting activity is expected to end based on observational evidence (e.g., nest-building; egg-laying; age of nestlings) and applying this as an end date for restricted activities in the buffer zone, or

- for nests where nesting activity may be monitored from a distance without disturbance to the nest or nesting birds, the status of the nest may be assessed by a Qualified Biologist and the activity restriction removed once the nesting activity has been determined by the Qualified Biologist to be completed (i.e. nestlings have fledged or the nest fails or breeding behaviors are no longer observed). The nest should be monitored following best management practices such as Bird Studies Canada's nest monitoring code of conduct (BSC undated) and the Cornell Lab of Ornithology's Nest Monitor's Manual (Phillips et al 2007).

- Once the nest is no longer active, a new nest search should be undertaken within the buffer zone prior to recommencing any project activities to assess whether any other bird nests have been established.

- If confirmed or suspected nests are identified, the buffer zone will remain in place until all nesting activity is completed.

- If no confirmed or suspected nests are identified project activities may resume within the buffer zone.

Identification of Setback Distances

The distance used to define a setback is measured as a radius around a nest, group of nests, suspected nest or nest tree or structure. Setbacks should be established by a Qualified Biologist based on best available information. Factors that will be taken into consideration when determining what size of setback to implement include:

- The type and duration of activity (e.g., hours or days; use of heavy equipment; number of workers):

    - Low intensity activities may include activities that are infrequent and/or of short-term duration such as very small crews or a single crew member conducting a short-term activity with no or small scale equipment, small vehicle traffic (car, light truck), regular maintenance activities (that do not result in significant noise/vibration).

    - Medium intensity activities may include operating haul trucks or installation of transmission lines.

    - High intensity activities are activities that result in significant noise and/or vibration, such as tree-felling and harvesting, road construction, blasting, drilling, excavation activities, facilities construction, operation of heavy machinery or regular approach by humans/ presence of human activity.

- species sensitivity (flush and alert distances)

- nest location (ground, shrub or tree), nest concealment, and habitat type and topography (as a natural buffer for noise and a visual barrier)

Setback distances will range depending on the species, with the smallest setback distance applied to urban nesting species that are accustomed to human presence and noise (e.g. American robin, mourning dove) and the largest setback distance applied for species that may be sensitive to human presence or noise (e.g. great blue heron, waterfowl or some raptors) or where high intensity activities are planned.

J.5 Reporting

All active and inactive nests will be immediately reported to the Environmental Superintendent for implementation of mitigation measures and appropriate staff informed of the mitigation measures associated with the nests.

All monitoring survey methods and results as well as actions (e.g. application of buffer zones) that are undertaken each year will be documented in the annual Biodiversity Assessment Report (see Section 7.2 of the BMMP). These results will be considered in conjunction with the results of the other relevant bird management plans (i.e. Bank Swallow, Barn Swallow, Bald Eagle and breeding bird follow-up monitoring program) and used to inform updates and modifications to this plan as required.

Details on all active nests that are identified will be also submitted annually to the Ontario Nest Records Scheme/ Project NestWatch (https://birdscanada.org/volunteer/pnw/index.jsp?lang=EN&targetpg=index&lang=EN&targetpg=index)

J.6 References

Bird Studies Canada. Undated. Nest Monitoring Code of Conduct. https://www.birdscanada.org/volunteer/pnw/index.jsp?targetpg=nwcode

Environment and Climate Change Canada. Guidelines to reduce risk to migratory birds. https://www.canada.ca/en/environment-climate-change/services/avoiding-harm-migratory-birds/reduce-risk-migratory-birds.html, Last updated October 30, 2018

Ontario Breeding Bird Atlas Guide for Participants. 2001

Phillips, T., C. Cooper, J. Dickinson, J. Lowe, R. Rietsma, K. Gifford, and R. Bonney. 2007. NestWatch Nest Monitoring Manual. Ithaca, NY: Cornell Lab of Ornithology. http://www.birds.cornell.edu/bbimages/nestwatch/pdf_copy/NestWatchManual.pdf

APPENDIX K
REVEGETATION PLAN

Appendix K Revegetation Implementation and Monitoring Plan

K.1 Introduction

A general revegetation program was developed as part of the Closure Plan to guide site stabilization and revegetation during the life of mine and upon closure. Key objectives of the program are to:

- Stabilize surface materials
- Improve site aesthetics
- Establish self-sustaining vegetation growth within the PDA during and after operation of the mine capable of facilitating colonization of new species and succeeding into mature vegetation communities

Progressive rehabilitation is planned such that revegetation will occur as needed to provide erosion protection as soon as practical after Project components are no longer actively used. Pilot revegetation studies will be undertaken at select locations during mine operations to test seeding, planting, and management approaches to refine the revegetation plan and improve the success and stability of rehabilitation measures at closure in the most logistically and cost-effective manner possible.

Due to the nature of the post-mining landform, some areas of the Hardrock Project site may remain open, such as portions of waste rock areas and tailings dams. These areas will, nevertheless, support recreational land uses (e.g. hunting) and will provide habitat diversity by introducing clearings in an otherwise continuous forested landscape. Furthermore, edge habitat may be favourable to some game species which preferentially travel or forage along forest edges.

The purpose of the revegetation implementation and monitoring plan is to provide a more detailed planting plan along with specific criteria for monitoring, evaluating, and reporting on the status of revegetation in the PDA during operations and upon closure. Monitoring activities are designed to quantify vegetation communities developing in restored areas which will be compared to criteria for measuring revegetation success.

The revegetation implementation plan includes the following elements:

- Principles of the revegetation implementation plan (Section K.2.1)
- Description of target vegetation communities (Section K.2.2)
- Soil stabilization measures to be undertaken during revegetation (Section K.2.3)
- Site preparation techniques to ameliorate the growing medium and facilitate plant establishment (Section K.2.4)

- Planting and seed mix recommendations (Section K.2.5)
- Description of proposed revegetation pilot study (Section K.2.6)
- Opportunities for Indigenous community engagement (Section K.2.7)

The revegetation monitoring plan includes the following elements:

- Performance objectives which describe the expected stages of revegetation and target vegetation communities (Section K.3.1)
- Monitoring and Evaluation (Section K.3.2)
- Data collection procedures (Section K.3.3)
- Criteria for measuring success of vegetation establishment (Section K.3.4)
- A schedule for monitoring during operations and active closure (Section K.3.5)
- Potential corrective actions and adaptive management of the monitoring program (Section K.3.6)

K.2 Revegetation Implementation Plan

The mine site area is to be reclaimed to a naturalized and productive condition at closure (Wood, 2018). Proposed land uses of the rehabilitated mine include recreational activities such as fishing and hunting, as well as other land uses valued by stakeholders and partners (e.g. hiking, snowmobiling, trapping or minnow harvest). Land use commitments are discussed in **Section 11.1** of the Closure Plan (Wood, 2018). Site closure is achieved once revegetated areas are shown to support the designated end use of the site.

K.2.1 Principles of the Revegetation Implementation Plan

The revegetation implementation plan is based on the principles and science of restoration ecology. The core principles applied in the revegetation implementation plan are:

Soil Management: Protect the biota and structure of existing soil through segregated soil stripping (topsoil and overburden), stockpile management, and enhance soil to be used in revegetation with organic matter available on site.

Salvage and Transplant: Where possible, existing native vegetation in areas to be cleared or otherwise disturbed will be salvaged for re-use in revegetation of the mine site. Sods or cuttings of wetland vegetation will be harvested and transplanted where practical to more efficiently establish new wetland communities. Plant species of importance to Indigenous communities will be made available for salvage by local Indigenous community members prior to vegetation clearing.

Native Plant Stock: Only species indigenous to Ontario and appropriate for the growing region will be used in revegetation. No cultivars or exotic varieties will be used, with the exception of short-lived cover crop species (e.g.. oats, annual rye) necessary for soil stabilization. Species not currently found in the Project area such as red and white pine may be climatically appropriate at time of mine closure, due to climate change. Species selection will be evaluated at time of closure for relevance considering changing climate.

Passive and Active Revegetation Techniques: A passive restoration approach involves leaving an area to develop on its own without human intervention. Active restoration involves site preparation, planting, tending, invasive species control, etc. Active restoration in the form of seeding will be the dominant approach of the revegetation implementation plan. However, passive restoration will naturally occur during the rehabilitation period, and will be monitored to determine how these changes may be incorporated into the final revegetation implementation plan.

Passive revegetation will be allowed where soil stabilization through seeding is not required and where the following conditions are met:

- Where ongoing and continued disturbance is expected, and a natural seed source is available without influence from adjacent weed prone areas. These areas would include the periphery of disturbed area away from roads and other areas of historic disturbance (edge zones).
- Areas that are almost entirely encompassed by native communities and are relatively narrow. These areas may include line-of-sight cuts and utility lines corridors where seed sources are very abundant and the distance from seed source is a short distance allowing for airborne, water or gravity dispersal to effectively repopulate disturbed surfaces.
- Areas where surface disturbance is minimal (temporary lay down areas) and existing clusters of vegetation, roots, propagules and seeds remain active and intact.

Active revegetation will occur in most areas as a default treatment and would be associated with areas that are susceptible to weed species colonization, areas of potential erosion concern (wind, water and moderate to steep slope areas), and large areas where passive revegetation would not be effective given limitations of natural seed dispersal and establishment. Where a site has the potential to support forests, active reforestation such as tree planting (or other appropriate reforestation techniques) will occur using site appropriate native tree species (K-6) at appropriate densities to establish communities capable of developing into closed canopy forests representative of those found in the Project Area (K-1). As well, where timber is harvested in support of Project development but does not host infrastructure, the site will be actively reforested using commercially available native planting stock in a timely fashion, to maximize tree establishment success and minimize time required to developed into closed canopy forests. Tree planting activities may occur with participation from local students as part of a GGM run program.

K.2.2 Target Vegetation Communities

At the time of the terrestrial baseline studies, a diverse range of vegetation communities (ecosites) were recorded in the Study Area (Figure K1). Five target vegetation communities have been identified for the

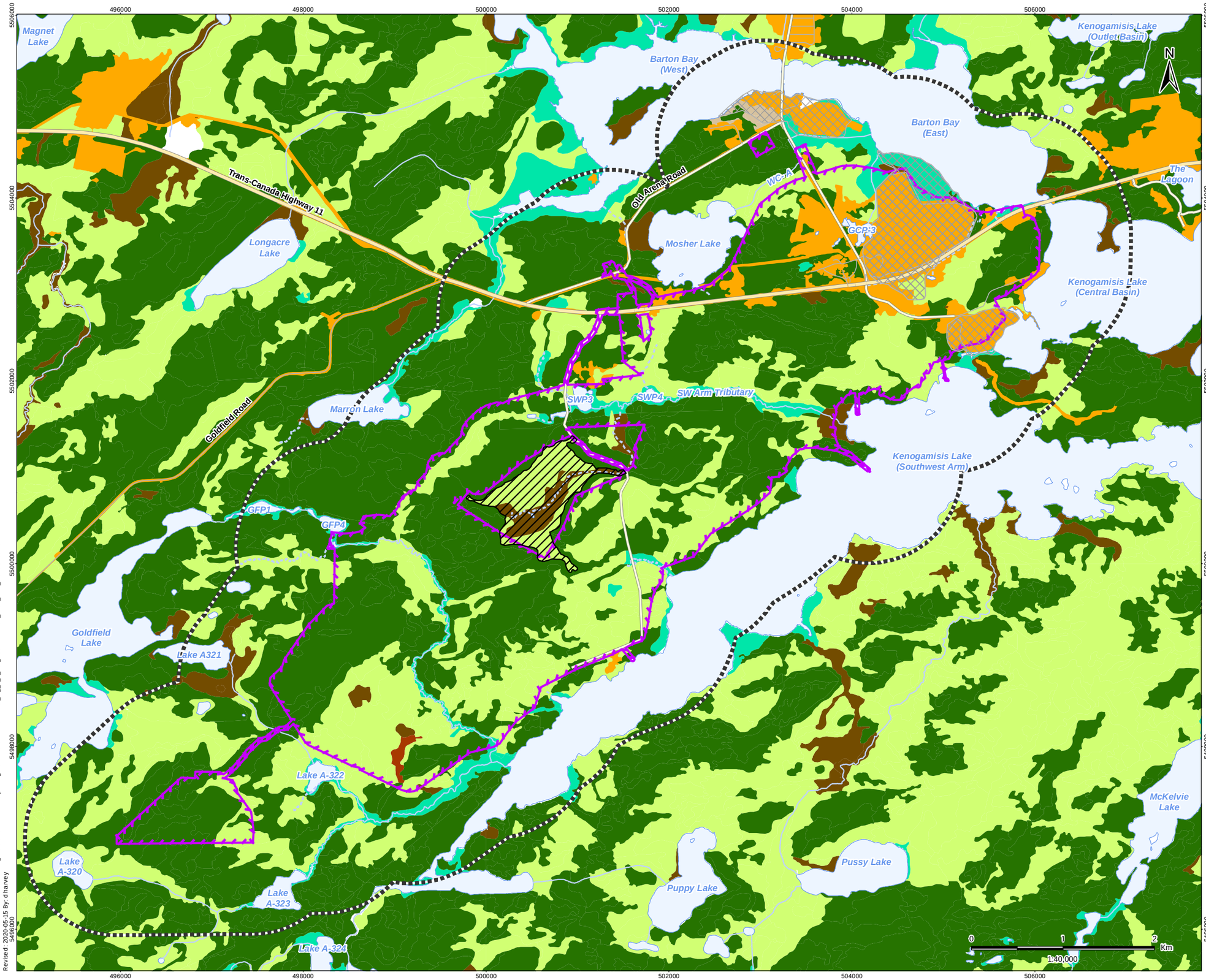
revegetation implementation plan which are both characteristic of the surrounding landscape and consistent with the vegetation present prior to mine development. Depending on, and proximity to existing aquatic or forest habitat, revegetated areas will be planted to assist in the progression toward one of the five communities listed in Table K-1. Species from other vegetation communities which are well-suited to early vegetation establishment will be incorporated into the revegetation plan. Recommended plant species and seed mixes to be incorporated into revegetation are described in Section K.2.5, below.

A conceptual overview of vegetation communities at mine year 36 (16 years after the end of active closure) is shown on Figure K2.

Table K-1: Target Vegetation Communities for Hardrock Mine Revegetation

Target Vegetation Community	Representative Ecosite(s)	Approximate Existing Representation in PDA	Indicator Plant Species	Approximate Area (ha) and Representation in PDA Upon Closure*
Upland Coniferous Forest: Dry upland areas	B034, B035, B049, B050, B065	40 %	Jack Pine, Black Spruce, Paper Birch, Trembling Aspen, White Spruce, Balsam Fir	644 (31 %)
Upland Broadleaf Forest: Dry to Fresh	B055, B104	10%	Trembling Aspen, Paper Birch	95 (5%)
Meadow: Dry upland areas with thin soil or open rock	B110	0 %	Grass or forb-dominated; species composition variable and dependent on time since establishment; may include Timothy, fireweed, Canada blue-joint, sedges, and asters	904 (43 %)
Conifer Swamp: Moist lowland areas	B127, B128, B129, B223	30 %	Black Spruce, Balsam Fir, Tamarack	79 (4 %)
Thicket Swamp and Shallow Marsh: Along watercourses and within the floodplain of waterbodies	B134, B135, B144, B149	6 %	Thicket: Speckled Alder, Red-osier Dogwood, Willow species, Sweet Gale. Marsh: Grass or forb-dominated; may include Canada blue-joint, broad-leaf cattail, wool-grass, and sedges. May include shrubs such as willow species, speckled alder, and sweet gale	93 (4 %)

*Area estimates include actively-restored vegetation communities *and* communities retained undisturbed in the PDA.



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Revised: 2020-05-15 By: dharvey

Stantec

Legend

- Local Assessment Area
- Project Development Area (Optimized Site Plan, May 2019)

Existing Features

- Highway
- Major Road
- Local Road
- Watercourse- Permanent
- Watercourse- Intermittent
- Waterbody
- Sensitive Feature

Upland Vegetation Communities

- Forest
- Meadow

Wetland Vegetation Communities

- Bog
- Fen
- Marsh
- Swamp

Disturbed Vegetation Communities

- Disturbed (Includes Built Up Areas)
- Historical Tailings Area

Notes

1. Coordinate System: NAD 1983 UTM Zone 16N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2015.
3. Vegetation Community Mapping was originally derived from the MNRF Forest Resource Inventory (2008) and has been refined based on field work conducted from 2013-2016.
4. Historical Tailings Areas have been mapped by Stantec based on; historic airphotos, fieldwork, and historic reports.

May 2020
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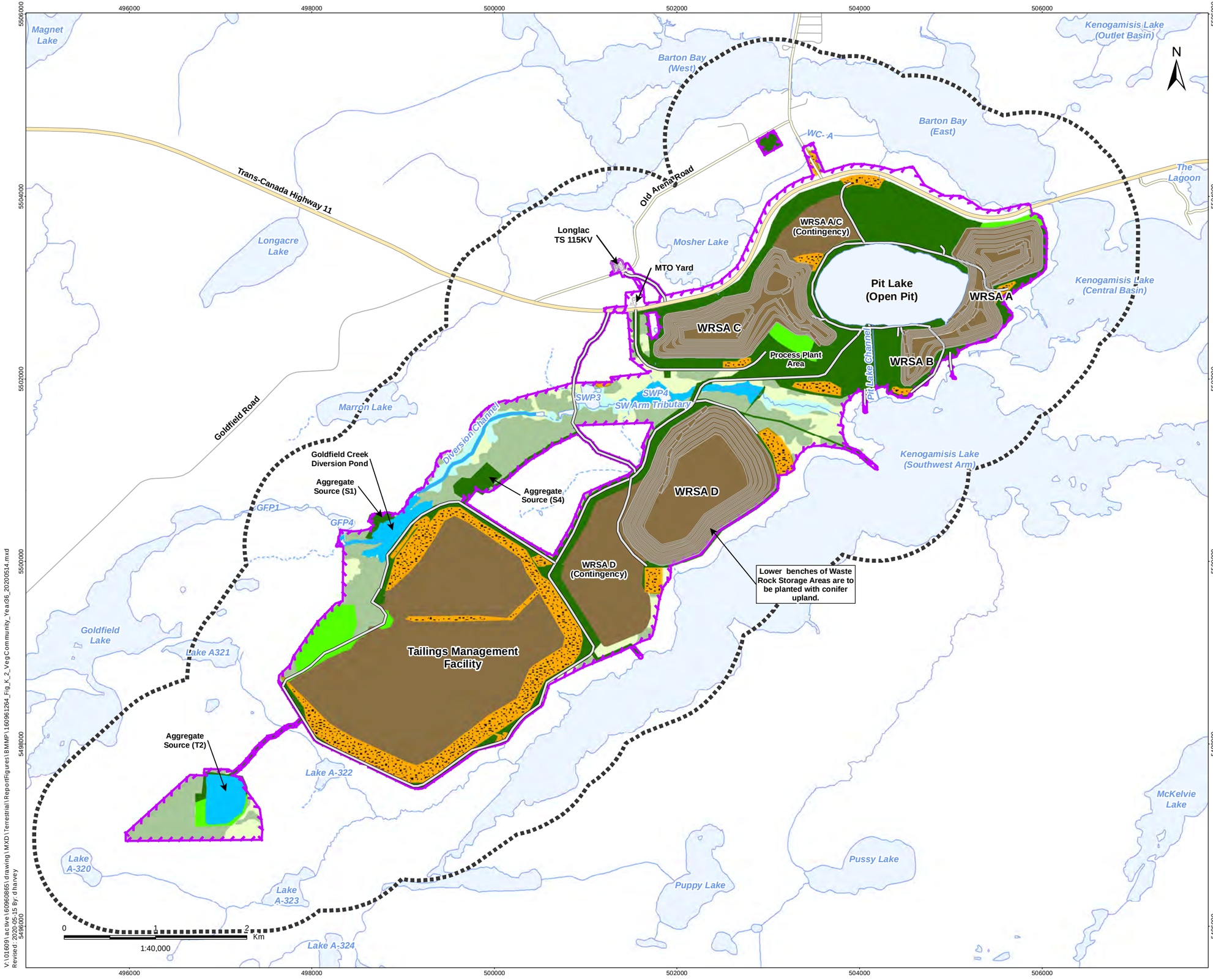
Hardrock Project

Figure No.

K.1

Title

Vegetation Communities in the PDA and LAA



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Revised: 2020-05-15 By: dharvey

Stantec

Legend

- Local Assessment Area
- Project Development Area (Optimized Site Plan, May 2019)
- Site Roads
- Highway
- Major Road
- Local Road
- Watercourse- Permanent
- Watercourse- Intermittent
- Waterbody

Restored Vegetation Communities

- Meadow
- Open Aquatic/ Marsh
- Upland Broadleaf
- Upland Conifer

Existing Vegetation Communities

- Forest
- Marsh
- Swamp/ Fen

Disturbed Vegetation Communities

- Disturbed

Notes

1. Coordinate System: NAD 1983 UTM Zone 16N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2015.
3. Base features have been removed in the PDA to reflect post-construction conditions and are not reflective of current conditions. Historical tailings reflects the residual tailings to remain after construction.
4. Vegetation communities at year 36 are based on the expected conditions of the site allowing for approximately 16 years of growth after active closure and the mitigation as presented in the conceptual closure plan. Changes to vegetation communities outside of the PDA from indirect effects are not shown on this figure. For predicted effects and proposed mitigation related to surface water and ground water changes refer to Section 12.4.4 of EA/EIS
5. Waste Rock Benches will be restored to upland conifer where possible.
6. The Revegetation plan is based on the Optimized Site Plan developed by GGM in May 2019.

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Greenstone Gold Mines GP Inc (GGM)
Hardrock Project

Figure No.

K.2

Title

Conceptual Overview of Vegetation Communities at Year 36 (16 Years after Active Closure Ends).

K.2.3 Soil Stabilization and Management

Soil is an important rehabilitation material as it not only supports a significant diversity of microorganisms which contribute to nutrient cycling, but also contains a bank of native seed which can be used to accelerate natural regeneration of the site. Soil structure and chemistry also play a major role in determining which plant species will colonize and survive in an area. Given the limited depth of topsoil across the PDA, careful management will be necessary to preserve soils for reuse in revegetation.

As soil is stripped, topsoil should be stored separately from overburden, as this organic layer is the most ecologically valuable. Wetland soils should be stored separately from upland soils in piles designated for reuse in wetland areas of the mine site, as these soils will retain seed from wetland-specific plant species. Over time, stockpiled topsoil becomes anaerobic below the surface and total nitrogen and organic carbon content are reduced, affecting the community of soil microorganisms. Topsoil viability within stockpiles can be maintained by reducing stockpile size, minimizing the amount of time soil is stockpiled, and by vegetating the stockpile to promote structural development and an aerobic environment. The following notes apply to soil stabilization and management:

- Soil layers (e.g.. topsoil and overburden) will be stripped and stockpiled separately, to the extent practical.
- Stripped soils will be re-deployed as quickly as possible to nearby appropriate areas requiring reclamation to take advantage of the developed seedbank, vegetative material, and soil microbial communities, increasing natural development of native vegetation communities.
- Stockpiles will be constructed with 3H:1V side-slopes to maximize surface area. To the extent possible, topsoil will be stored in stockpiles less than 3.0 m in height. Stockpiles of mineral subsoil will not be restricted in height due to an absence of seed bank and microorganisms in this soil layer.
- Seed stockpiles with a stabilization seed mix (see Section K.2.5 and Table K-2, below) as soon as possible to prevent erosion or colonization by weedy species. This stabilization mix can later be tilled into the soil to enhance soil organic matter.
- If not reused for revegetation within three to five years, topsoil stockpiles should be turned over and re-piled.
- Stockpiles will be located away from drainage ways or high traffic areas, and sediment barriers will be placed as necessary to preserve the integrity of site soils.

K.2.4 Site Preparation

Prior to planting, stockpiled topsoil will be placed across the revegetation area. Where soil volume is limited, localized areas of deeper soil could be established within the revegetation area to allow for direct tree planting. The finished surface after soil placement should be roughened to provide microtopographic relief, which enhances native seed germination, creates variable moisture regimes to encourage a diversity of plant species, reduces erosion, and provides habitat for small animals and soil fauna (Figure K3). Woody debris remaining from forest clearing can be distributed across the site, and embedded in soil where possible, to further increase microhabitat diversity.

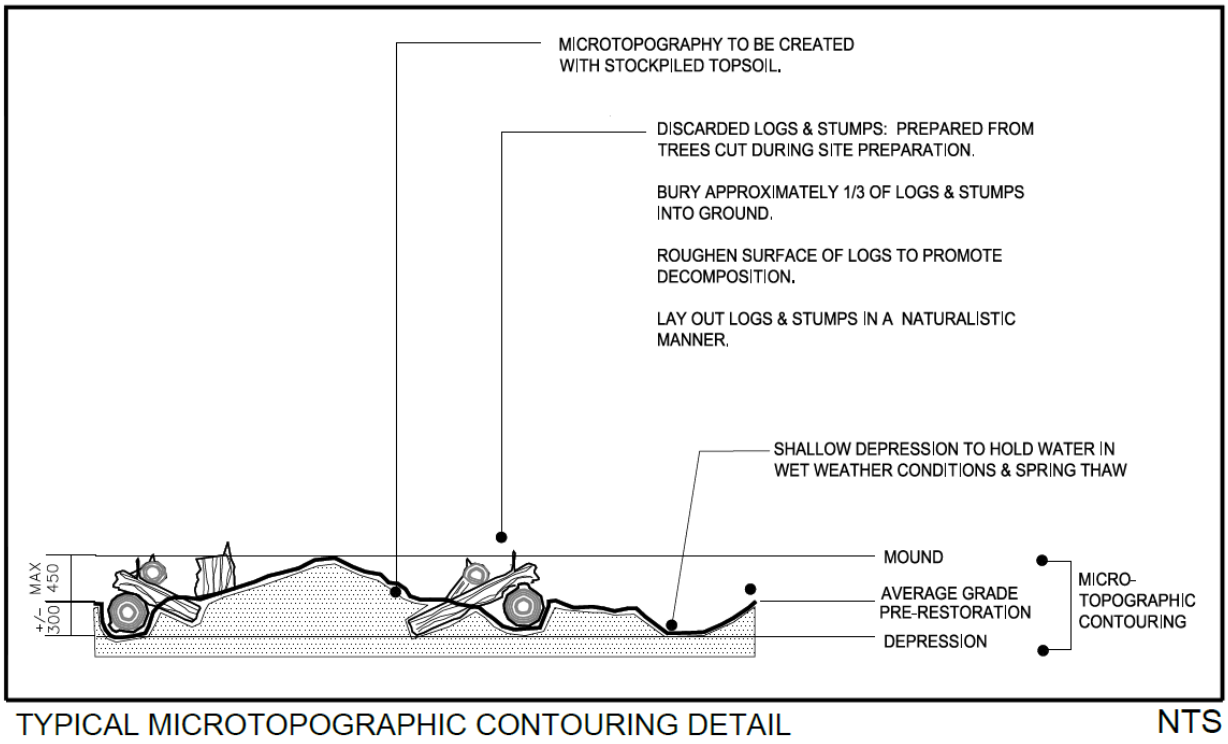

Figure K3. Typical microtopographic contouring detail

K.2.5 Planting and Seeding

Upland and swamp forest areas will be seeded to minimize colonization by non-native weedy species and reduce erosion. In target forest areas, and where sufficient topsoil depth (> 20 cm) is available, planting of conifer seedlings at 1,000 stems per hectare will occur in order to provide permanent cover for ungulates, including caribou. Where soils are too shallow to allow for direct tree planting, tree seeds/cones will be seeded throughout the planting area. Over time, additional trees and shrubs will become established through active (wildlife-assisted) or passive seed dispersal from adjacent forest communities.

Open wetland communities (thicket swamp and marsh) will be established through a combination of placement of topsoil containing a native seed bank (specifically, soil stripped from existing wetland communities), vegetation mat (sod) transplanting, planting live stakes, direct seeding and passive seed/root dispersal. Recommended seed mixes and plant species are provided in Tables K.3 to K.6. Final species lists will depend on climate conditions, cost and availability at the time of planting.

The following notes apply to planting and seeding:

- All proposed new plantings will consist of native species which provide similar species composition to adjacent and nearby natural areas
- Fast-germinating, short-lived (annual) non-native species (e.g. oats) will be used as a cover or nurse crop for soil stabilization.
- Plant material will be sourced from on site to the extent possible, such as transplanting of seedlings, wetland sods, or live stakes of willow and dogwood. Tree seeds and cones should be collected from within the PDA for use in revegetation (see methods by Rantala-Sykes and Campbell 2017), or obtained from commercial forestry stock growers using seed from the local seed zone (15).
- To avoid moisture stress and increase establishment success planting and seeding will occur preferably in May, or September as a secondary option. Where moisture is a concern, all plant materials will be thoroughly watered immediately after installation. If soil moisture is threatening establishment, watering will occur once per week for the first four weeks, and then sufficiently thereafter to maintain optimum growing conditions, until establishment has been deemed self sufficient.
- Plants will not be installed or transplanted during extreme heat, drought, or other undesirable conditions (i.e. during summer months: mid-June to August)
- Sow seed during calm weather (winds less than 10km/h) on bare soil (the seed area has been turned over or scarified)
- Seed mix application will be done in a consistent and thorough fashion covering entire site
- Re-seeding may be required in areas where germination or establishment has failed, or areas have been eroded.

Table K-2: Stockpile Stabilization Seed Mix

Common Name	%
Annual Rye	50%
Oats	25%
Winter Rye	25%

Application: Seed all stockpiles at a rate of 35kg/ha.

Table K-3: Recommended Upland Forest (Conifer and Broadleaf) and Meadow Revegetation Seed Mix

Latin Name	Common Name	% in Seed Mix
Agrostis caespitosa	Creeping Bentgrass	25
Andropogon gerardi	Big Bluestem	25
Asclepias syriaca	Common Milkweed	2
Astralagus canadensis	Canada Milkvetch	2
Bromus inermis	Smooth Brome	20
Epilobium angustifolium	Fireweed	1
Glyceria striata	Fowl Manna Grass	10
Monarda fistulosa	Bergamot	0.5
Oenothera biennis	Evening Primrose	0.5
Rudbeckia hirta	Black Eyed Susan	2.0
Solidago altissima	Tall Goldenrod	0.5
Solidago canadensis	*Canada Goldenrod*	*0.5*
Sorghastrum nutans	Indiangrass	*10*
Symphyotrichum puniceum	*Purple-stemmed Aster*	*1*

Application: Seed all revegetated areas at a rate of 12 kg/ha with a nurse crop of Oats (*Avena sativa*), seeded at a rate of 25kg/ha.

Table K-4: Recommended Swamp Forest Revegetation Seed Mix

Latin Name	Common Name	% in Seed Mix
Elymus canadensis	Canada Wild Rye	15
Anemone canadensis	Canada Anemone	1.5
Asclepias incarnata	Swamp Milkweed	1
Bromus ciliolatus	Fringed Brome	20
Calamagrostis canadensis	Canada Bluejoint	2
Carex intumens	Star Sedge	2
Carex bebbii	Bebb's Sedge	2
Calamagrostis canadensis	Canada Bluejoint	10
Deschampsia caespitosa	Tufted Hairgrass	20
Festuca rubra	Red Fescue	20
Carex vulpinoidea	Fox Sedge	2
Larix laricina	Tamarack	0.5
Symphyotrichum puniceum	Purple-Stemmed Aster	2
Glyceria striata	Fowl Manna Grass	2

Application: Seed all revegetated areas at a rate of 12 kg/ha with a nurse crop of Oats (*Avena sativa*), seeded at a rate of 25kg/ha.

Table K-5: Recommended Thicket Swamp and Shallow Marsh Seed Mix

Latin Name	Common Name	% in Seed Mix
Alnus incana	Speckled alder	0.5[1]
Asclepia incarnata	Swamp milkweed	0.5
Bidens cernua	Nodding bur marigold	2.0
Calamagrostis canadensis	Canada bluejoint	2.0
Carex stricta	Tussock sedge	2.0
Carex bebbii	Bebb's sedge	2.0
Carex intumens	Star sedge	3.0
Carex scoparia	Blunt broom sedge	3.0
Carex vulpinoidea	Fox sedge	35.0
Deschampsia caespitosa	Tufted hairgrass	35.0
Eleocharis palustris	Creeping spikerush	3.0
Eupatorium maculatum	Spotted Joe-Pye-Weed	0.3
Glyceria striata	Fowl Manna Grass	2.0
Glyceria grandis	Tall managrass	2.0
Juncus tenuis	Path rush	1
Iris versicolor	Iris	3.0
Mentha arvensis	Wild Mint	0.2
Scirpus cyperinus	Woolgrass	1.0
Symphyotrichum puniceum	Purple-Stemmed Aster	2.0
Typha latifolia	Broadleaf Cattail	0.5[2]

Application: Seed all revegetated areas at a rate of 12 kg/ha with a nurse crop of Oats (*Avena sativa*), seeded at a rate of 25kg/ha.

[1]For use in thicket swamp only

[2]For use in shallow marsh only

Table K-6: Recommended Tree and Shrub Species

Latin Name	Common Name	Target Community
Abies balsamea	Balsam Fir	Conifer Swamp
Alnus incana+	Speckled Alder	Thicket Swamp
Betula papyrifera	Paper Birch	Upland Broadleaf Forest, Conifer Swamp
Cornus stolonifera+	Red-osier Dogwood	Thicket Swamp
Juniperus communis	Common Juniper	Upland Conifer Forest
Larix laricina	Tamarack	Conifer Swamp
Myrica gale	Sweet Gale	Thicket Swamp, Shallow Marsh
*Picea glauca**	White Spruce	Upland Conifer Forest
*Picea mariana**	Black Spruce	Upland Conifer Forest, Conifer Swamp
*Pinus banksiana**	Jack Pine	Upland Conifer Forest
Pinus resinosa	Red Pine	Upland Conifer Forest
Pinus strobus	White Pine	Upland Conifer Forest
Populus balsamifera+	Balsam Poplar	Conifer Swamp
Populus tremuloides	Trembling Aspen	Upland Broadleaf Forest
Prunus pensylvanica	Pin Cherry	Upland Broadleaf Forest
Rubus idaeus	Raspberry	Upland Conifer Forest
Salix bebbiana+	Bebb's Willow	Thicket Swamp, Shallow Marsh (at low densities)
Salix discolor+	Pussy Willow	Thicket Swamp, Shallow Marsh (at low densities)
Sorbus decora	Showy Mountain-ash	Upland conifer forest, conifer swamp
Sorbus americana	American Mountain-ash	Upland Conifer Forest
*Thuja occidentalis**	Eastern White Cedar	Upland Conifer Forest, Conifer Swamp
Vaccinum angustifolium	Low Sweet Blueberry	Upland Conifer Forest

* Tree species marked with an asterisk to be planted at 1000 seedlings/ha where sufficient depth of topsoil (20cm) is available and site appropriate, depending on availability.

+ Shrub species marked with an asterisk to be planted as live stakes/cuttings

K.2.6 Pilot Studies

Pilot revegetation studies will be undertaken at test locations during mine operations. Revegetation methods tested will vary seeding, planting, and management approaches in order to determine cost-effective techniques to achieve desired restoration outcomes. The pilot revegetation studies will focus on determining the success and stability of areas that are rehabilitated during the operation of the mine.

K.2.7 Indigenous Community Engagement

In the course of vegetation clearing and subsequent revegetation, there are opportunities for engagement with the local Indigenous communities. Community members will be invited to salvage plants of traditional interest before clearing occurs.

K.3 Revegetation Monitoring Plan

K.3.1 Performance Objective

The performance objective of the Revegetation Monitoring Plan is to assess revegetated areas throughout the PDA to determine whether revegetation measures have achieved successful rehabilitation in terms of diversity and ecosystem stability. This will be achieved through:

- Pilot revegetation studies: Monitoring at test locations during mine operation to evaluate the proposed revegetation approach from the Conceptual Closure Plan and develop more prescriptive revegetation methods for closure.
- Active Closure: Conducting monitoring during active closure to document site stability and vegetation establishment.
- Corrective Actions: Implementing measures to improve revegetation success, as needed, during active closure.

K.3.2 Monitoring and Evaluation

Monitoring to determine the success and stability of the areas that are rehabilitated will be conducted in two phases. First, monitoring will be conducted at the pilot revegetation areas located at the TMF (North Cell), WRSA benches and plateaus, GFC diversion channel and aggregate pit S4). Monitoring results will be used in adaptive management to update this Revegetation Plan and inform revegetation targets and plans for closure.

The second phase of monitoring will occur during active closure and occur in all revegetated areas . Results of this phase will be used to evaluate revegetation success and provide corrective actions, if necessary, throughout closure. Each phase is discussed in further detail, below. Monitoring methods and evaluation of revegetation success will be standard across both phases, however the monitoring schedule and corrective actions, if needed, will differ among phases. Invasive plant monitoring (Appendix B) will be coordinated with revegetation monitoring, as feasible. Monitoring of created wetlands along the Goldfield Creek diversion channel will be undertaken as part of the Wetland Monitoring Plan (Appendix A).

K.3.3 Data Collection Procedures

The monitoring program will include both qualitative assessments and quantitative monitoring. Qualitative assessments include visual inspections of revegetated areas and photo-documentation using standardized photos to record groundcover and the community profile. Quantitative methods use fixed monitoring plots to standardize data collection. Monitoring protocols are adapted from guidelines developed by Environment Canada's Ecological Monitoring and Assessment Network (EMAN). Vegetation data collected at each monitoring plot will include the success of regrowth in the area, species

composition, abundance and percent cover, and the presence of invasive species (see also Appendix B). Monitoring parameters for data collection are provided in Table K-7.

Fixed monitoring plots for quantitative assessment will be placed randomly in each distinct revegetated area using the following guidance:

- For areas of one hectare or less, the number of plots selected will sample approximately 2% of the revegetation area.
- For areas between one hectare (ha) and 10 ha, the number of plots selected will sample between 1.5 and 0.5% of the revegetation area.
- For areas greater than 10 ha, the number of plots selected will sample approximately 0.5% of the revegetation area.
- Plots will be established a minimum 15 m from the edge of the revegetation area.
- The minimum distance between plots will be 50 m where feasible. Geographic Information Systems (GIS) software should be used to locate plots.

Circular plots are recommended over quadrats to eliminate the need to mark the corners of the sampling plot. The center point should be fixed permanently in the field with a ground stake to improve comparability of data between sampling events. UTM coordinates of centre stakes should be recorded at installation using a submeter GPS so that they can be easily relocated during future monitoring events. Plots can be established in the field by using a 2.8 m swing around the centre point (2.8 m represents the radius of a circle with an area of approximately 25 m^2). The circular plot can be marked in the field using a series of wire survey flags, flagging tape or other marker which may be removed at the end of each monitoring event.

Photo-documentation should document cover in the ground vegetation layer and the community profile. The monitor should stand at the 2.8 m swing mark on the south side of the plot and capture a photograph with the stake in the exact centre of the frame. The camera zoom should be set to capture the widest possible area in the frame. Multiple photographs should be taken, where at least one picture has clear focus and includes suitable light. Photographs should be catalogued in a digital database and labelled with the plot number and date for future reference.

K.3.4 Monitoring Criteria

Areas revegetated during operations (pilot studies) and active closure will be monitored to assess progression from early vegetation establishment toward one of the five target communities: upland coniferous forest, upland broadleaf forest, meadow, coniferous swamp, and thicket swamp/shallow marsh. Vegetation Establishment is the early development of ground cover to control erosion and provide

a suitable germination environment for native herbaceous and woody plants. Vegetation stablishment for the purpose of erosion control can take one to two years.

Community Establishment is underway once native plant species characteristic of the target community are present and growing. Expected species in the early years of Community Establishment would be those early successional species which tolerate exposed conditions. Evidence of early Community Establishment would typically occur within five years. However, the length of this phase will be highly variable based on the extent of active revegetation (seeding or planting) and site-specific growing conditions.

Monitoring criteria have been developed to document progression, with early criteria focused on ground cover and erosion control and later criteria providing targets for plant community composition and diversity (Table K-7). The establishment or recovery of plants of special interest to Indigenous communities will also be monitored in each vegetation community, such as cedar, willow, birch, pin cherry, Labrador tea, raspberry, yarrow, and strawberry. Plant species of interest for vegetation monitoring will be determined through dialogue with Indigenous communities. A number of these species were identified through the EIS/EA process from project-specific Traditional Knowledge studies and consultation, as listed in Table K-8 (See also Tables 12-4 in EIS/EA).

Table K-7: Vegetation Monitoring Parameters and Criteria by Vegetation Community and Phase

Establishment Phase	Field Monitoring Parameters	Vegetation Community (see Table K-1)	Monitoring Criteria
Vegetation Establishment: Qualitative Assessment	• Estimate of percent barren substrate throughout vegetation area • Document evidence of erosion, including exposed and loose soil, sediment fans, rills and gullies. • Standardized photography to document ground cover	• Upland Coniferous Forest • Coniferous Swamp • Meadow • Thicket Swamp • Shallow Marsh	• Ground cover ≥60% • No indication of surface erosion • Absence of invasive plants (see Appendix B)

Establishment Phase	Field Monitoring Parameters	Vegetation Community (see Table K-1)	Monitoring Criteria
Community Establishment: Quantitative and Qualitative Assessment	• List vascular flora in strata • Relative abundance by species (i.e., dominant, abundant, occasional, rare) • Percent absolute cover—by strata • Plant condition, note evidence of stress • Standardized photography to document ground cover and the community profile	• Upland Coniferous Forest • Upland Broadleaf Forest • Coniferous Swamp	• Presence of tree indicator species (see Table K-1) • Increased # of native species over time • Growth of trees (woody species capable of > 6m) • Establishment of target plants of special interest to Indigenous communities • Absence of invasive plants (see Appendix B)
		• Meadow • Thicket Swamp • Shallow Marsh	• Presence of shrub or herbaceous indicator species (see Table K-1) • Increased # of native species over time • Establishment of target plants of special interest to Indigenous communities • Absence of invasive plants (see Appendix B)

Pilot studies during operations will focus on the achievement of Vegetation Establishment criteria. Revegetation methods which demonstrate a more rapid or reliable progression from Vegetation Establishment toward Community Establishment will be applied or refined, as needed, during active closure.

Table K-8: Plant and Fungi Species of Interest to Indigenous Communities

Plant Species of Interest to Indigenous Communities	Recorded in the PDA and/or LAA during baseline surveys	Habitat
balsam fir	yes	Widespread in bogs, swamps, coniferous and mixed forests
bear root	no	Gravel river bars, roadsides, rocky hillsides and meadows
birch	yes	Found on edges, lakeshores, and roadsides; early colonizer after disturbance (e.g., wind-thrown trees, fire) and typically associated with mixed forests
birch mushroom	no	Grows almost exclusively on birch trees
black ash	no	Swamps; tolerant of standing water
black spruce	yes	Bogs, fens, and swamps, often found in pure stands
blueberries	yes	Fields, woodland clearings, and wet areas

Table K-8: Plant and Fungi Species of Interest to Indigenous Communities

Plant Species of Interest to Indigenous Communities	Recorded in the PDA and/or LAA during baseline surveys	Habitat
Bull rush	no	Open-canopied deciduous and mixed forests that have few shrubs in the understory
cedar	yes	Forests, swamps, and lowlands, often associated with watercourses
chaga	no	Parasitic growth on birch and other trees
chanterelle	no	Commonly found in beech forests (mushroom)
currant	yes	Wetlands, shorelines, rocky outcrops, and forests
ferns	yes	Swamp thickets, streambanks, swamps, woodlands, and bogs
highbush cranberry	yes	Moist woodlands, streambanks, marshes, bogs, and swamps
juniper	no	Woods, alvars, fields, and on rock outcrops along roadsides
Labrador tea	yes	Wetlands, shrub thickets, bogs, and fens
lowbush cranberry	yes	Bogs, fens, barrens, and forest swamps
maple	yes	Forests and ravines
mint	no	Moist areas found in meadows, woodlands, swamps, and along watercourses
mountain ash	yes	Woodland openings, roadsides, and borders of swamps
mushrooms	yes	Damp and sheltered habitats, rotting trees, logs, and detritus
pin cherry	yes	Open forests, rocky outcrops, disturbed sites (e.g., fire) g Lake, along railway corridor and sides of Highway 11
raspberries	yes	Open areas of old fields, meadows, rocky outcrops, disturbed sites, and forests
Saskatoon berry	no	Prairies, meadows, open woodlands and forest edges, rocky outcrops
shaggy mane	no	Common in city and suburban locations, pastures, residential areas; grassy, rocky or hard packed soils
strawberries	yes	Open woodlands and meadows
sweetgrass	no	Moist meadows, bogs, streambanks, and edges of marshes
white spruce	yes	Dry to moist coniferous and mixed forests (white spruce)
willow (white and red)	yes	Edges of wetlands, roadsides
wild rice	no	Slow-moving rivers, ponds, marshes, and lakes
weekay (Sweet Flag)	no	Marshes, edges of streams and ponds
yarrow	yes	Meadows, old fields, woodland openings, roadsides, and disturbed areas

K.3.5 Sampling Schedule

As per requirements of the Mining Act, monitoring will be conducted twice annually (summer/fall) for all revegetated areas (seeded or planted) for the first five years post-planting or until vegetation is successfully established (meeting the Vegetation Establishment criteria, Table K-7).

Once Vegetation Establishment criteria have been met, quantitative and qualitative assessments will take place every two years until the criteria for Community Establishment (Table K-7) have been met, with the exception of test plots in the pilot study which will be monitored annually for the first five years after revegetation. The monitoring schedule for Community Establishment can be modified for the mine or individual mine components if revegetation efforts produce a self-sustaining herbaceous layer that demonstrates little ingress of native woody species. Monitoring frequency and duration during active closure may also be refined based on the results of pilot study.

K.3.6 Corrective Actions

The monitoring program is designed to provide evidence to assess revegetation success or failure. For the Hardrock Project, failure can be defined in two ways: a deficiency in ground cover or evidence of surface erosion (Vegetation Establishment criteria), or, an absence of plants typical of the target community or plant species of interest to Indigenous communities within 6 years (Community Establishment criteria). In the event of failure, or of indication during the monitoring period that the revegetation is not progressing along the desired trajectory, an adaptive management program would be implemented to support revegetation of the site.

Adaptive management of the revegetation program may take place during the pilot study phase (operations) or during active closure. Monitoring during the pilot study will provide a direct means to evaluate and, if necessary, modify revegetation efforts to achieve success. The pilot study approach enables GGM to undertake adaptive management and adjust methods and targets accordingly. Later monitoring results during active closure will be used to further refine management of revegetated areas. Corrective actions, if required, may be implemented at any time during the monitoring period.

Conditions that have the potential to cause vegetation setback or failure include moisture stress, particularly during hot, dry summers and/or physical or chemical characteristics of the substrate. The following additional parameters could be collected and analyzed to identify deficiencies, and inform adaptive management:

- Soil texture and moisture
- Soil pH
- Proximity to native colonizers/natural sources of seed

The cause(s) of vegetation failure should be identified, if possible, through a thorough review of the vegetation monitoring results, surface and groundwater monitoring programs, as well as additional soil parameters. Adaptive management strategies should be designed to address the identified cause(s). Strategies may include:

- Introduction of supplemental vegetation material
- Invasive species management (as described in the Invasive Plants Management Plan)
- Amendments to improve soil moisture or nutrients (e.g., organic inputs)

Implementation of corrective actions may require revisions to the monitoring plan.

K.4 Reporting

All activities undertaken during the implementation of this Plan (revegetation measures, monitoring methods and results as well as any adaptive management actions) each year will be documented in the annual Biodiversity Assessment Report (see Section 7.2 of the BMMP). This plan will be updated on an ongoing basis based on the results of the pilot revegetation studies and regular monitoring during closure.

K.5 References

Rantala-Sykes, B. and D. Campbell. 2017. Simple Protocols for Collecting Wild Plants Native to Northeastern Canada. Vale Living with Lakes Centre, Laurentian University, Sudbury, ON. Available online at: https://docs.wixstatic.com/ugd/17b76b_56cdc94298404bcbb42676fc0c0f3788.pdf

APPENDIX L
GOLDFIELD CREEK REALIGNMENT BIODIVERSITY MONITORING PLAN

Appendix L Goldfield Creek Diversion Biodiversity Monitoring Plan

L.1 Introduction

To compensate for the loss or alteration of fish habitat in Goldfield Creek due to overprinting by the proposed Tailings Management Facility, a diversion and offset plan was developed; *Hardrock Project Fisheries Act, Paragraph 35(2)(b) Authorization, Offset Plan and MDMER Schedule 2 Fish Habitat Compensation Plan TC150320* (Offset Plan; Wood 2019). The Offset Plan includes the development of a new pond, the Goldfield Creek Diversion Pond (GFDP), at aggregate source S1 and construction of a 2.7km Goldfield Creek diversion channel between the GFDP and the existing Southwest Arm Tributary (SWP1).

The Goldfield Creek diversion follows an ecosystem-based approach which will replicate the form and ecological function of the existing creek and its associated floodplain. Enhancement of the floodplain to increase habitat for terrestrial and semi-aquatic wildlife has been incorporated into the design, including construction of vernal and semi-permanent pools, downed woody debris for cover, and retaining de-limbed trees for perching habitat. Organic soils recovered from the existing Goldfield Creek floodplain will be reused along the diversion pond and channel to accelerate rehabilitation through the native seedbank and to return the constructed floodplain to a thicket swamp community. For additional detail on the proposed offset plan, refer to Section 9.2.2 of the Offset Plan (Wood 2019).

In accordance with the *Fisheries Act*, aquatic and riparian habitat created along the pond and diversion channel as part of the offset and compensation plan will be monitored and reported to DFO in accordance with the *Fisheries Act*, Paragraph 35(2)(b) Authorization (Wood 2019). The purpose of this Goldfield Creek Diversion Biodiversity Monitoring Plan is to describe the diversity and abundance of wildlife and vegetation in the restored floodplain (terrestrial) surrounding the newly constructed diversion pond and channel.

L.2 Goldfield Creek Baseline Data

Baseline ecological data obtained during development of the Hardrock Project Environmental Impact Statement / Environmental Assessment (EIS/EA; Stantec 2017) were reviewed in the preparation of this Goldfield Creek Diversion Biodiversity Monitoring Plan so that monitoring methods captured relevant wildlife taxa. The dominant vegetation communities along the existing Goldfield Creek were mineral thicket swamp (ecosite B134) and organic meadow marsh (ecosite B144). These two ecosites have been identified as target communities for restoration along the GFDP and diversion channel. Habitat for breeding birds, amphibians, reptiles and mammals was also identified along the existing Goldfield Creek during baseline inventories. A summary of findings along or in the vicinity of the existing Goldfield Creek for each wildlife taxa is provided in Sections L.2.1 to L.2.4.

L.2.1 Breeding Birds

Breeding birds associated with non-treed wetland habitat, such as that found along Goldfield Creek, observed during baseline ecological inventories included: alder flycatcher, yellow-bellied flycatcher, common yellowthroat, yellow warbler, swamp sparrow, white-throated sparrow, Wilson's snipe and several waterfowl species (Stantec 2017). Suitable habitat for Canada warbler, eastern wood-pewee, common nighthawk, non-treed wetland birds, and waterfowl was observed along Goldfield Creek (Stantec 2017). As vegetation is established along the GFDP and diversion channel, habitat for non-treed wetland breeding birds will likewise become available. Brush piles and larger snags constructed in the floodplain of the diversion channel will also provide perching and nesting habitat for birds (Wood 2019).

L.2.2 Amphibians

Suitable breeding habitat for amphibians was observed in back channels and floodplain pools along Goldfield Creek during baseline ecological inventories. Calling spring peeper and wood frog were recorded during breeding bird surveys, and egg masses of an unknown amphibian species were observed in a roadside ditch pool in the vicinity of Goldfield Creek (Stantec 2015). The construction of wetland edges along the GFDP as well as vernal (seasonal) and semi-permanent pools in the floodplain of the Goldfield Creek diversion channel is expected to provide suitable breeding habitat for amphibians (Wood 2019).

L.2.3 Reptiles

Western painted turtle was observed along the shore of Kenogamisis Lake and in a former gravel pit along Lahtis Road during baseline ecological inventories (Stantec 2015). Although the species was not confirmed within Goldfield Creek, deep (> 2m water depth) pools of existing Goldfield Creek provided suitable biophysical conditions for turtle overwintering and were consequently mapped as habitat in the EIS/EA. The GFDP has been designed to provide suitable habitat for western painted turtle, including construction of upland nesting areas (Wood 2019). Eastern gartersnake was also observed in the Project area during baseline ecological inventories (Stantec 2015). This species feeds primarily on earthworms and frogs (Rowell 2012) and is consequently most often observed in open habitat along the edges of ponds and marshes. Suitable habitat for eastern gartersnake was present along Goldfield Creek and is expected to be present along the GFDP and diversion channel (Wood 2019).

L.2.4 Mammals

Twenty-three mammal species were observed either during baseline ecological inventories or the small mammal trapping program (Stantec 2017). Mammals recorded along Goldfield Creek included moose and beaver, but suitable habitat was present for numerous species of rodent, fur-bearing mammals and bats. Brush and rock piles will be placed in the constructed floodplain of the Goldfield Creek diversion channel to provide cover for small mammals. The establishment of wetland vegetation through planting and re-use of the seedbank will provide foraging opportunities for moose. Beavers are expected to move into the

diversion channel and will be permitted to remain, as long as dam construction does not impact safety and the environment (GGM 2018). Bat boxes will be installed in upland areas within the vicinity of the proposed Goldfield Creek diversion pond to provide summer roosting habitat for Little Brown and Northern Myotis (Wood 2019).

L.3 Monitoring

Monitoring activities involve periodic inspections to track success of the GFDP and diversion channel construction and planting initiatives, as well as to guide the establishment of the created terrestrial habitat. Monitoring methods have been developed for breeding birds, amphibians, reptiles, mammals and vegetation, all of which are appropriate indicators of biodiversity for Goldfield Creek and taxa of interest to Indigenous groups. Detailed monitoring methods are described in Sections L.3.1 to Section L.3.5. A summary of proposed monitoring is provided in Table L.1, Section L.3.6.

In addition to monitoring post-implementation, site inspections during the construction phase of the habitat creation should be undertaken by a qualified professional to confirm plant material is suitable (correct species and appropriate quality) and direct placement of seed mixes and planting procedures.

L.3.1 Breeding Bird Monitoring

Appendix H of the Hardrock Project Biodiversity Mitigation and Monitoring Plan (BMMP; Stantec 2019) includes a monitoring plan for breeding birds throughout the Project area to assess the breeding bird habitat provided by vegetation restoration activities along the Goldfield Creek diversion. Standardized point counts will be located along the diversion channel, separated by a minimum distance of 250 m. Consideration will be given to repeating baseline point count locations as feasible. Monitoring will be conducted for the first five years after completion of revegetation activities along the Goldfield Creek diversion. Refer to Appendix H of the BMMP for more detailed monitoring information.

Incidental observations of breeding birds (e.g., stick nests, waterfowl) made during other aquatic and terrestrial monitoring events will be documented as part of this monitoring program.

L.3.2 Amphibian Monitoring

Both frog call (auditory) and egg mass surveys will be undertaken along the GFDP and diversion channel as outlined below.

L.3.2.1 Frog Call Surveys

Frog call surveys will be conducted at ponds and backwater pools along the GFDP and diversion channel using data collected by Automated Recording Unit (ARU) devices. Surveys will generally follow the Marsh Monitoring Program (BSC 2009), consistent with baseline survey methodology:

- Each location will be surveyed three times in the spring. Surveys should occur when night time air temperatures have generally risen to 6°C, 10°C and 17°C.
- The surveys should follow periods of rain to the extent possible.
- The survey should commence no sooner than 30 minutes after sunset and terminate no later than midnight.
- Within the timing window noted above each monitoring location is surveyed for 3 minutes.

The use of ARU's provides increased flexibility in selecting the best survey conditions (e.g., temperature, weather) and allows for the analysis of additional dates, if required, as compared with traditional field methods. An ARU will be fastened to a tree or pole at each station in proximity to wetland features, in areas with little ground vegetation to minimize background noise. The ARU will be programmed to record daily between mid-April and mid-June, with recording periods which can be used for both amphibian monitoring and to supplement breeding bird surveys. For each day within the schedule period, four 5-minute recording windows will be programmed, starting:

1. 25 minutes before sunrise (pre-dawn)
2. 60 minutes after sunrise (dawn)
3. 30 minutes after sunset (evening)
4. 11:00pm (night)

ARU's will be checked once per month during deployment to ensure sufficient battery power to complete the survey period and collected at the end of June.

L.3.2.2 Data Analysis

Dates for data analysis will be selected by reviewing weather conditions archived from the Environment Canada Geraldton Airport weather station for evenings with light winds, recent but not active precipitation, and appropriate temperatures per the Marsh Monitoring Program (BSC 2005).

Data analysis includes listening to the selected data file from each survey station for three minutes for all calling toads and frogs. Call levels are described using values of 1, 2, or 3: Level 1 indicates that individuals could be counted, and calls were not simultaneous; Level 2 denotes that calls are distinguishable but with some simultaneous calling; and, Level 3 indicates a full chorus where calls are continuous and overlapping.

The level of calling activity for each survey will be compared to previous data. Trends may also be reviewed in comparison to local activity, known trends in northern Ontario and climatic variability.

L.3.2.3 Amphibian Egg Mass Surveys

Amphibian egg mass surveys will be completed to complement the amphibian call surveys, particularly to provide data with respect to usage by blue-spotted salamander (*Ambystoma laterale*). Egg mass surveys provide a quantitative measurement of the potential productivity of the wetlands, and generally can be compared to salamander egg mass surveys from previous years and from other locations.

The egg mass survey will consist of systematically searching vernal pools and shallow margins of ponds within the constructed valley of the Goldfield Creek diversion channel once in May. Tallies will be kept of the number and, where possible, the species of egg masses observed. Characteristics of the location of the egg mass, such as wetland/pool area, water depth and presence of vegetation or woody debris will also be recorded.

L.3.2.4 Reptile monitoring

Two reptiles were recorded within the Project area during baseline inventories: western painted turtle (*Chrysemys picta belli*) and eastern gartersnake (*Thamnophis sirtalis sirtalis*). One other reptile, red-sided gartersnake (*Thamnophis sirtalis parietalis*), has been recorded in the vicinity of the Project area (Ontario Nature 2017) and has the potential to be observed during monitoring.

Monitoring for reptiles will focus on targeted basking surveys for turtles in the period between spring emergence (mid-April or ice-off) and peak nesting (June). Surveys will consist of scanning with binoculars for basking turtles at ponds and backwater pools along the Goldfield Creek diversion channel. Evidence of turtle nesting (i.e. actively nesting turtles, predated nests) in constructed or naturally occurring nest areas will be documented during June breeding bird surveys. The surveyor will scan areas of exposed mineral soil in the vicinity of the constructed diversion pond and channel.

Targeted surveys of snakes are not proposed as part of this monitoring plan, as these species are cryptic and avoid interactions with humans if possible. Observations of eastern gartersnake or red-sided gartersnake made incidentally during all other terrestrial or aquatic monitoring will be documented as part of this monitoring program. Other incidental sightings by GGM staff or contractors near the GFDP and Goldfield Creek diversion channel will also be found in the Wildlife Observation Log (BMMP Section 7.1.2).

For all reptile surveys or observations, the surveyor will record all species observed, along with an estimate of the number of individuals of each species and behaviour observed. Additional information recorded will include:

- Weather conditions
    - Temperature, wind speed (Beaufort scale), % cloud cover and precipitation.
- Date and time of day
- Name of observer

L.3.2.5 Mammal monitoring

Monitoring for mammals will be conducted along the Goldfield Creek diversion concurrent with other surveys (i.e., breeding birds, vegetation). Surveyors will walk the length of the realigned channel, both north and south banks, looking for evidence of mammals or mammal activity (i.e., tracks, scat, dens). Species, number, location and behavior will be recorded.

Bat boxes placed near the constructed pond and channel will be inspected once annually. Inspections will be timed to coincide with breeding bird point counts in late June. Inspections will be external only (i.e. looking for bat guano), to avoid disturbing roosting bats inside the box. Additional data on mammal use of the Goldfield Creek diversion may be obtained by reviewing audio recordings deployed in spring to collect amphibian (i.e., frog and toad) calls as well as through review of the Wildlife Observation Log.

L.3.2.6 Vegetation monitoring

Appendix K of the BMMP (Stantec 2019) includes a monitoring plan for all revegetated areas within the Project area. Revegetation along the GFDP and channel is expected to progress toward one of the five target vegetation communities provided in Table K-1, primarily thicket swamp and shallow or meadow marsh.

Monitoring to determine the success and stability of rehabilitated areas will be conducted twice annually for the first two years following restoration, or until vegetation establishment has been achieved. More detailed monitoring to document community establishment will take place every two years until target criteria have been achieved. Refer to Appendix K of the BMMP (Stantec 2019) for additional detail on monitoring methods. Related monitoring commitments for existing wetlands in the Project area can be found in Appendix A of the BMMP (Stantec 2019). Monitoring for invasive plants will be conducted in accordance with Appendix B of the BMMP (Stantec 2019).

L.3.2.7 Monitoring Summary

Table L-1: Summary of Terrestrial Monitoring Surveys along the Goldfield Creek Diversion Pond and Diversion Channel

Survey type	Description	Earliest recommended date	Latest recommended date	Notes	Monitoring Duration
Breeding birds	Dawn survey for breeding birds (per Appendix H).	June 1	June 30	Could extend window +/- 5 days. Field data may be supplemented by recordings made by ARU.	5 years
Amphibians	Evening survey for calling frogs/toads; observations of eggs masses.	Mid-April (or ice-off)	June 30	Automated recording units recommended; dates for analysis should be selected based on weather conditions.	3 years[1]
Reptiles	Daytime survey for turtles basking in wetland areas; evidence of turtle nesting; incidental snake observations.	Mid-April (or ice-off)	June 30	Survey dates should be selected based on weather conditions; combine with breeding birds if possible.	3 years[1]
Mammals	Daytime survey for evidence of mammals (i.e. tracks, scat, dens).	Mid-April (or ice-off)	September 30	Combine with other surveys.	3 years[1]
Vegetation	Fixed monitoring plots for vegetation and community establishment (per Appendix K of the BMMP).	June 1	September 30	Two monitoring periods (summer and fall) during early establishment, per requirements of the *Mining Act*.	Twice annually for five or until targets achieved.

[1]Further monitoring after the 3-year period subject to discussions with the EAC

L.4 Thresholds and Corrective Actions

Adaptive management of the terrestrial environment along the GFDP and diversion channel may be triggered by insufficient vegetation cover, the presence of unacceptable non-native and invasive species, or failure of the designed floodplain pools to retain water for amphibian breeding during normal seasonal conditions. Corrective actions for vegetation cover and invasive plant management are detailed in Appendix K, the Revegetation Plan, and Appendix B, the Invasive Plants Management Plan of the BMMP (Stantec 2019). Should the vernal and semi-permanent pools fail to provide suitable breeding habitat for amphibians, corrective actions could include: re-grading, lining the pool(s) with compacted clay soil, or enhancing existing amphibian breeding habitat elsewhere along the constructed channel and pond(s).

L.5 Reporting

All activities undertaken during the implementation of this Goldfield Creek Diversion Biodiversity Monitoring Plan (i.e., monitoring methods and results, as well as any adaptive management actions) each year will be documented in the annual Biodiversity Assessment Report (see Section 7.2 of the BMMP). This plan will be updated on an ongoing basis.

L.6 References

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