HARDROCK PROJECT
CONCEPTUAL AIR QUALITY MANAGEMENT PLAN

Greenstone Gold Mines GP Inc.
365 Bay Street, Suite 500
Toronto, Ontario
M5H 2V1

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Table of Contents

List of Tables

List of Figures

1.0 INTRODUCTION AND ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN OVERVIEW

Greenstone Gold Mines (GGM) is committed to minimizing environmental effects through the implementation of mitigation measures, monitoring and adaptive management for the Hardrock Project (the Project) within Environment Management and Monitoring Plans (EMMPs) for construction and operation. 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 and GGM corporate policies;
- Measures to mitigate environmental effects are documented;
- Benefits from the Project are enhanced; and
- Reporting is structured to inform adaptive management and continual improvement.

The EMMPs guide environmental management for the Project and are progressively developed as the Project moves through the EIS/EA, permitting, and construction, and updated based on continual improvement during operations through adaptive management.

EMMP development begins during the EIS/EA stage with the preparation of Conceptual Environmental Management Plans. These EMMPs are broad in their level of detail, commitment-based and focused on the construction and operation phases of the Project. They include input received from consultation during the Draft EIS/EA stage. The closure phase is addressed in the Conceptual Closure Plan. The level of detail in the EMMPs advance as the Project moves through more detailed engineering and planning and as permit/regulatory requirements are available.

1.1 Environmental Management and Monitoring Plans

The Project's Environmental Management System, includes a comprehensive set of management and monitoring plans collectively referred to as Environmental Management and Monitoring Plans (EMMPs). The EMMPs outline environmental protection measures to mitigate potential environmental effects.

The EMMPs include:

- Water Management and Monitoring Plan;
- Conceptual Waste Rock Management Plan;
- Conceptual Emergency Response Plan;
- Conceptual Waste Management Plan;
- Conceptual Erosion and Sediment Control Plan;
- Conceptual Greenhouse Gas Management and Monitoring Plan;
- Conceptual Air Quality Management and Monitoring Plan;

- Conceptual Spill Prevention and Response Plan;
- Conceptual Soil Management Plan;
- Conceptual Noise and Vibration Management and Monitoring Plan;
- Conceptual Explosives and Blasting Management Plan;
- Conceptual Aquatic Management and Monitoring Plan;
- Conceptual Biodiversity Management and Monitoring Plan; and
- Conceptual Archaeology and Heritage Resource Management Plan.

These Plans are considered "living" documents and will be updated as needed in support of environmental management activities during future permitting, development and operation phases.

2.0 PROJECT SUMMARY

Mining of the Hardrock deposit has been designed as an open pit. The process plant will operate 365 days per year with a Life of Mine (LOM) of approximately 15 years. The mill throughput ranges from 24,000 tonnes per day (tpd) for approximately the first two years of operation (i.e., Mill Phase 1), increasing to 30,000 tpd for the balance of operation (i.e,. Mill Phase 2). The overall Project development schedule will consist of the following main phases, during which various Project activities will be completed:

- Construction: Years -3 to -1 with early ore stockpiling commencing after the first year of construction.
- Operation: Years 1 to 15, with the first year representing a partial year as the Project transitions from construction to operation.
- Closure:
  - Active Closure: Years 16 to 20, corresponding to the period when primary decommissioning and rehabilitation activities are carried out.
  - Post-Closure: Years 21 to 36, corresponding to a semi-passive period when the Project is monitored and the open pit is allowed to fill with water creating a pit lake.

The key components of the Project are as follows:

- open pit
- waste rock storage areas (WRSAs) (designated as WRSA A, WRSA B, WRSA C and WRSA D)
- topsoil and overburden storage areas
- ore stockpile
- crushing plants and mill feed ore storage area
- process plant
- tailings management facility (TMF)
- water management facilities for contact water including collection ditches and ponds

- power plant and associated infrastructure
- liquefied natural gas plant
- explosives facility
- buildings and supporting infrastructure
- water supply and associated infrastructure
- sewage treatment plant
- effluent treatment plant
- lighting and security
- site roads and parking areas
- watercourse crossings and habitat compensation/offsets
- Goldfield Creek diversion
- onsite pipelines
- fuel and hazardous materials
- aggregate sources
- temporary camp

Project activities include the relocation of existing infrastructure currently located within the PDA, including a portion of Highway 11, a Ministry of Transportation (MTO) Patrol Yard, and Hydro One Networks Inc. (Hydro One) facilities.

3.0 MANAGEMENT AND MONITORING PLAN PURPOSE

3.1 Purpose

The purpose of the GGM Hardrock Project Conceptual Air Quality Management Plan (AQMP) is to:

- describe requirements for the routine management of sources of airborne dust during construction and operation.
- describe requirements for monitoring ambient air quality and meteorological conditions in and near the Hardrock site as the basis for assessing potential air quality impacts that may be attributable to the Project on surrounding areas.
- track air quality performance and provide feedback to the Environment Manager which may be used to refine the dust suppression program and other potentially significant air quality sources.
- describe requirements for provincial and federal air quality and emissions reporting.

The Conceptual AQMP applies only to the Hardrock Project activities and addresses only ambient air quality management issues. Workplace air quality and worker exposure assessments, controls, and mitigation measure will be addressed separately. Greenhouse gas (GHG) related

issues are addressed in the GGM Hardrock Project Conceptual Greenhouse Gas Management Plan.

3.2 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 (to work to prevent or mitigate any environmental impacts, meet or exceed regulatory requirements and strive to continually improve our environmental practices and performance), GGM has established the following performance objectives for the Conceptual AQMP that considers key Project interactions and compliance obligations:

- monitor air quality in sensitive areas including residential areas and locations of traditional land use
- monitor off-property air quality and compare measured concentrations to the relevant federal and provincial criteria

4.0 SCOPE

The scope of the Conceptual AQMP applies to the area of the Project that will undergo changes through construction and/or operation to accommodate the advancement of Project and associated monitoring. The AQMP applies to the construction and operation phases of the Project with closure phase included in the Conceptual Closure Plan.

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

GGM will make reasonable efforts that suitably qualified (licenced where applicable) contractors are used for the transport of materials, supplies and waste materials, and that contractors have appropriate controls and management plans in place to reduce the likelihood of incidents during transport. Similarly, Project components under the management and maintenance by third parties are outside the scope of this EMMP. The scope of the Conceptual AQMP applies to Project infrastructure and management under the care and maintenance of GGM.

5.0 PLANNING

5.1 Organizational 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 AQMP. Table 5-1 outlines roles and responsibilities for AQMP activities:

Table 5-1: Conceptual Roles and Responsibilities

Role	Responsibility
Construction Manager (for construction phase) Mine Manager (for operation phase)	• Collaborate with the Environment Manager to plan and implement air quality effect management during construction activities. • Collaborate with the Environmental Manager to plan and implement air quality effect management during operation phases. • Collaborate with the Environmental Manager to provide air quality awareness and safety training to Project personnel and contractors.
Environment Manager	• Collaborate with the Construction Manager and General Manager, as described above. • Collaborate with the Construction Manager and General 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.
Technician	• Comply with EMMP requirements as directed with Construction, Operation or Environmental Managers
Equipment Operator	• Comply with EMMP requirements as directed with Construction, Operation or Environmental Managers
Employees / Contractors	• Follow outlined compliance obligations related to EMMP, including air quality reporting requirements.

5.2 Compliance Obligations

The Conceptual AQMP is developed and implemented to comply with applicable legislative, regulatory, permit and other relevant obligations, outlined in the following sections.

5.2.1 Environmental Assessment Process Requirements

5.2.1.1 Provincial Terms of Reference

As described in the Approved Terms of Reference, the EA includes a variety of environmental protection and management measures to guide the planning, design, construction, operation and closure of the Project (section 4.1.4) and identification of a monitoring framework related to compliance and effects monitoring (section 8.2).

5.2.1.2 Federal Environmental Impact Statement Guidelines

The EIS Guidelines for the Hardrock Project include development and implementation of follow-up and monitoring programs (section 8.0). The follow-up program verifies the accuracy of the effects assessment and the effectiveness of the measures implemented to mitigate the adverse effects of the Project. The goal of a monitoring program is to ensure that proper measures and controls are in place in order to decrease the potential for environmental degradation during all

phases of the Project and to provide clearly defined action plans and emergency response procedures to account for human and environmental health and safety.

5.2.1.3 Draft EIS/EA Report

Section 24 of the Draft EIS/EA includes a listing of proposed Follow-up Monitoring and Environmental Management Plans, which included a commitment to produce a Conceptual AQMP. This plan is intended to outline an ambient monitoring plan to meet the requirements described MOECC's Operations Manual for Air Quality Monitoring in Ontario (MOE 2008) (Operations Manual). The Conceptual AQMP will also include duration of the monitoring program, air emission source(s), receptors, location of monitoring sites, monitoring methods equipment and procedures, and dispersion model. Standard management plans for control of fugitive dust emissions from the Project will be addressed and developed following MOECC requirements provided in Appendix B of MOECC Guideline A-10.

Subsequent to the draft EIS/EA submission, comments were raised by several parties requesting additional clarification on the parameters to be included in the monitoring program and dust management. Available information has been incorporated to develop this Conceptual Air Quality Management and Monitoring Plan.

5.2.1 Regulatory Requirements

5.2.1.1 Federal Regulatory Requirements

Federal air quality criteria applicable to the Project include: National Ambient Air Quality Objectives (NAAQOs) (Canada Gazette 1989), Canada Wide Standards (CWS) and the Canadian Ambient Air Quality Standards (CAAQS). The NAAQOs were established by the federal government in the early 1970s to protect human health and the environment by setting objectives for the following common air pollutants: carbon monoxide, nitrogen dioxide, ozone, sulphur dioxide and total suspended particulates. The objectives are denoted as "Desirable", "Acceptable" and "Tolerable". The Federal Objectives are defined as follows:

- the Maximum Desirable Level is the long-term goal for air quality and provides a basis for anti-degradation policy for unpolluted parts of the country, and for the continuing development of control technology
- the Maximum Acceptable Level is intended to provide adequate protection against effects on soil, water, vegetation, materials, animals, visibility, personal comfort and well-being
- the Maximum Tolerable Level denotes time-based concentrations of air contaminants beyond which, due to a diminishing margin of safety, appropriate action is required to protect the health of the general population.

The CWS are based on intergovernmental agreements developed under the Canadian Council of Ministers of the Environment (CCME) Canada-wide Environmental Standards Sub-Agreement, which operates under the broader CCME Canada-wide Accord on Environmental Harmonization.

The CAAQS for $PM_{2.5}$ and ozone were developed through a collaborative process involving the federal, provincial and territorial governments and stakeholders, as directed by the CCME (CCME 2012). The CAAQSs have replaced the CWS for $PM_{2.5}$ and ozone. CAAQSs for $PM_{2.5}$ and ozone have been developed for years 2015 and 2020 as shown in Table 5-2. On October 3, 2016, the

CCME announced a new CAAQS for SO_2 with effective dates of 2020 and 2025. These values are also shown in Table 5-2. The CCME is in the process of developing and releasing a new CAAQS for NO_2, which will also have effective dates of 2020 and 2025, when announced these levels may also apply to the Project.

A summary of the NAAQOs, CWS and CAAQS applicable to the Project are presented in Table 5-2.

Table 5-1: Summary of Federal NAAQOs, CWS and CAAQSs

Pollutant and units (alternative units in brackets)	Averaging Time Period	Canada Wide Standards	Canadian Ambient Air Quality Standards	National Ambient Air Quality Objectives		
				Maximum Desirable	Maximum Acceptable	Maximum Tolerable
Sulphur dioxide µg m^{-3} (ppb)	1 hour	-	200 (70) [D] 186 (65) [E]	450 (158)	900 (315)	-
	24 hour	-		150 (53)	300 (105)	800 (280)
	Annual	-	14.3 (5) [D] 11.4 (4) [E]	30 (11)	60 (21)	-
Nitrogen dioxide µg m^{-3} (ppb)	1 hour	-		-	400 (195)	1,000 (487)
	24 hour	-		-	200 (97)	300 (146)
	Annual	-		60 (29)	100 (49)	-
Carbon Monoxide mg m^{-3} (ppm)	1 hour	-		15 (12)	35 (28)	-
	8 hour	-		6 (5)	15 (12)	20 (16)
Total Suspended Particulate Matter (TSP) µg m^{-3}	24 hour	-		-	120	400
	Annual	-		60	70	-
$PM_{2.5}$ µg m^{-3}	24 hour	30[A]	28 [B] 27 [C]	-	-	-
	Annual		10.0 [B] 8.8 [C]			

NOTES:

A CCME (2000), Canada-Wide Standards for Respirable Particulate Matter and Ozone, effective by 2010. The Respirable Particulate Matter Objective is referenced to the 98th percentile over three consecutive years; the Ozone Objective is referenced to the on 4th highest 8-hour average annual value, averaged over three consecutive years.

B CCME (2012), CAAQS for $PM_{2.5}$ and ozone for 2015. The 24-hour standard is referenced to the 98th percentile over three consecutive years, and the annual standard is referenced to the 3-hear average of the annual average concentration. The Ozone Objective is referenced to the on 4th highest 8-hour average annual value, averaged over three consecutive years.

C CCME (2012), CAAQS for $PM_{2.5}$ and ozone for 2020. The 24-hour standard is referenced to the 98th percentile over three consecutive years, and the annual standard is referenced to the 3-hear average of the annual average concentration. The Ozone Objective is referenced to the on 4th highest 8-hour average annual value, averaged over three consecutive years.

D CCME (2016). CAAQS for SO_2 effective 2020. The 1-hour standard is referenced to the 3-year average of the annual 99th percentile of the SO_2 daily maximum 1-hour average concentrations. The annual standard is the arithmetic average of 1-hour average SO_2 concentrations.

E CCME (2016). CAAQS for SO_2 effective 2025. The 1-hour standard is referenced to the 3-year average of the annual 99th percentile of the SO_2 daily maximum 1-hour average concentrations. The annual standard is the arithmetic average of 1-hour average SO_2 concentrations.

In addition to air quality criteria, there are federal reporting requirements that will apply to the Project. The Project will be required to report on an annual basis to the National Pollutant Release Inventory (NPRI) which is mandatory under the *Canadian Environmental Protection Act, 1999* (CEPA 1999). For NPRI substances, the amount that was manufactured, processed, or otherwise used at the facility during each calendar year will have to be reported. Reports are required to be submitted for each calendar year by the end of May of the following year.

5.2.1.2 Provincial Regulatory Requirements

The provincial Ambient Air Quality Criteria (AAQC) relevant to the Project are prescribed in Ontario Regulation 419/05 (O. Reg. 419). The Project will be considered to be a new facility under O. Reg. 419, and as such, the Schedule 3 standards will apply. Where no O. Reg. 419 Schedule 3 standards are available, Ontario AAQCs and Jurisdictional Screening Levels (JSL) are considered (MOECC 2008a). A summary of the pertinent air quality objectives, guidelines, and standards is presented in Table 5-3 for CACs. Proposed changes to AAQC in O. Reg. 419 were also considered and included in the table.

Table 5-2: Summary of Applicable Provincial Air Quality Standards

Contaminant	Chemicals Abstracts Services Number (CAS No.)	O. Reg. 419 – Schedule 3			Ontario AAQC		
		1-Hour ($\mu g/m^3$)	24-Hour ($\mu g/m^3$)	Other time Period ($\mu g/m^3$)	1-Hour ($\mu g/m^3$)	24-Hour ($\mu g/m^3$)	Other time Period ($\mu g/m^3$)
Sulphur dioxide	7446-09-5	690	275		690	275	55
Nitrogen oxides[A]	10102-44-0	400	200		400	200	
$PM_{2.5}$	N/A					27 [B-1]	8.8; annual [B-2]
PM_{10}	N/A					50 [B-3]	
TSP	NA		120			120	60: annual
Dustfall	N/A						7 g/m^2; 30-day 4.6 g/m^2; (Annual geometric mean)
Carbon monoxide	630-08-0			6000; ½-hour	36,200		15,700; 8-hour

NOTES:

A The Schedule 3 standards for NOx are based on health effects of NO_2, as NO_2 has adverse health effects at much lower concentrations than NO. Therefore the standard was compared to NO_2 in this report. However, as per the current April 2012 version of O. Reg. 419 Summary of Standards and Guidelines, the standard was also compared to the monitored NOX.

B-1Canadian Ambient Air Quality Standards (CAAQS) for Respirable Particulate Matter and Ozone, effective by 2020 (CCME, 2012). The Respirable Particulate Matter Objective is referenced to the 98th percentile daily average concentration averaged over 3 consecutive years.

B-2 Annual Canadian Ambient Air Quality Standard for Respirable Particulate Matter, effective by 2020. The Respirable Particulate Matter Objective is referenced to the 3-year average of the annual average concentrations.

B-3 AAQC for PM_{10} is an interim AAQC provided as a guide for decision making.

The Project will be required to report to the Ontario Toxics Reduction Program under O. Reg. 455/09 of the Toxics Reduction Act (TRA). Facilities who have substances which meet the thresholds of the federal NPRI program are required to submit an annual report of those substances to the MOECC at the same time as the NPRI reporting at the end of May (for the

previous year). For substances that the Project reports to the MOECC under this program is also required to have a certified Toxic Substance Reduction Plan that is updated every five years.

5.2.1.2.1. ECA Requirements

It is expected that the Environmental Compliance Approval (ECA) for the GGM Hardrock Project, will contain specific terms and conditions with respect to ambient monitoring, reporting, source testing, complaint resolution, etc. This section of the Conceptual AQMP will be updated upon receipt of the ECA to reflect the terms and conditions.

5.2.1.3 Municipal Regulatory Requirements

There are no known local/municipal regulatory requirements related to air quality.

6.0 SUPPORT

6.1 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 protects the environment. The following actions will be established to provide worker competency, training and awareness:

- Personnel assigned to emissions mitigation activities are expected to have met the educational, work experience, responsibility, personal attributes and training requirements for their positions.
- Appropriate training will be provided to employees supporting the Hardrock Project Ambient Air Quality Monitoring Program (AAQMP), commensurate with their duties. Such training may consist of classroom lectures, workshops, teleconferences or on-the-job training.
- An annual review of this EMP and appendices will be conducted with the appropriate GGM personnel.

6.2 Communication

6.2.1 Notification of Exceedances to Triggers

If the applicable criteria are exceeded for one or more contaminants, then the MOECC will be notified and an investigation into the root cause will be undertaken, as there may be several potential explanations for an exceedance other than the Hardrock Project emissions (e.g. other emissions sources, instrument malfunction, field handling/laboratory analysis errors, etc.). The notification of exceedances of applicable air standards for ambient air quality criteria will be reported to the MOECC District Manager within 7 days of the exceedance(s) being identified.

If it is determined that GGM was the likely cause, for example through review of facility operations during that period, then the MOECC will be formally notified as per the requirements of Section

28 of O. Reg. 419/05. Appropriate corrective actions will be undertaken in following the requirements of Section 28 of O. Reg. 419/05.

7.0 Implementation of Mitigation Measures

7.1 General Approach

The Conceptual AQMP includes design and operational requirements for efficient control of emission sources and to reduce emissions. The technical solutions and measures adopted in the Plan are consistent with the best practices applicable to environmental protection. The Project will have multiple emissions sources which will have mitigation measures applied to them. This section of the AQMP describes the required controls, minimum control efficiencies and operational requirements for the construction and operation phases of the Project.

7.1.1 Construction

During construction, cleared vegetation would be either mulched and stored within an overburden/topsoil storage area or buried in WRSAs as per the Conceptual Waste Management Plan. To reduce the potential for wind-blown dust under dry, windy conditions, the following mitigation measures would be used:

- Use of dust suppressants (e.g., water) during situations that have an increased potential to generate airborne dust.
- Limit vehicle speeds.
- Effective and timely equipment maintenance to maintain mining equipment in good working condition.
- Where possible, reduce haul routes to and within the PDA.
- Administrative controls, including a no idling policy to reduce mobile equipment and other-use vehicle emissions.

7.1.2 Operation

7.1.2.1 Emissions Management

The following gas and odour management control strategies for the process plant includes:

- Continual monitoring of pH of cyanide mixing / storage tanks to maintain alkaline solution.
- Adherence to the International Code for Cyanide Management.
- Using a scrubber on the induction furnace to control emission
- Kiln operators will regularly review the operational performance data of the kiln and associated equipment.
- CAC emissions from mobile road and non-road equipment will be controlled through the application of the following practices:
  - New mobile equipment onsite will meet applicable Transport Canada off-road vehicle emission requirements. Tier 4 emissions standards are anticipated to come into effect in

2018, coinciding with early Project construction. GGM will look to acquire equipment that meets the new standard where available and feasible.

- Effective and timely equipment maintenance to maintain the mining equipment in good working condition.

7.1.2.2 Dust Management

During operation, the following mitigation measures would be used:

- Effort will be made to use recycled or reclaimed water as much as possible based on water quality and intended use as per the Conceptual Water Management Plan. Water for use in Project operation, including truck washing, dust suppression, and drill water will be obtained from alternative sources to municipal water, where possible. Alternative sources may include, treated water from the ETP and surface water from Kenogamisis Lake.
- Water will be utilized on grading and bulldozing operations as required. Loading of haul trucks will be performed within the open pit using hydraulic shovels. The open pit will reduce dust emissions from the Project and to further reduce fugitive dust from this activity, the drop distance between the bucket and the bed of the haul truck will be minimized by the equipment operator or as much as possible.
- Equipping primary crusher with a dust collection system (baghouse or equivalent) to control fugitive emission during ore crushing.
- Equipping secondary crusher with a dust collection system (baghouse or equivalent) and protective covers, to control potential dust emissions during secondary crushing and ore transferring.
- Enclosing mill feed ore storage area.
- Equipping high pressure grinding rolls (HPGR) with wet scrubbers (or equivalent) to control dust emissions from the grinding operations.
- Using a wet scrubber (or equivalent) on the induction furnace to control emissions.
- A dust collector will be used to control dust from the lime silo during loading. A dust collection system will be used in the lime preparation area to control emissions from the lime storage tank.

The following measures will be used to control dust from un-paved roads:

- Where possible, minimize haul routes to, and within, the Project
- Fugitive dust emission control from road ways, material handling and stockpiles including, but not limited to, application of water sprays, chemical suppression, dust sweeping, wind breaks/shelters, gravel application, truck wheel washing stations, and enclosure of dust sources. The site roadways will be maintained in good condition, with regular visual examination and maintenance to reduce the loose dust on the roads
- Enforcing speed limits on on-site unpaved roads
- A buffer of existing vegetation will be maintained on each side of internal unpaved haul roads where feasible

- Wind sheltering (wind screens or berms) may be employed along selected haul routes as required
- Unpaved road surfaces will be watered as required to reduce dust during periods of use (depending on weather conditions)
- The actual watering rate will vary, depending on surface moisture conditions and traffic levels, and will be triggered whenever the Operations Manager or water truck operator deem appropriate, based on visual observations of dust emissions and surface moisture content
- Watering may be supplemented with the use of MOECC approved dust suppressants.
- Wetting or covering of transported material (aggregate, borrow, or historical tailings)

The following measures will be used to control dust from the TMF:

- Under very dry meteorological conditions dust may be generated from dried tailings. As needed, tailings spigot discharge can be adjusted to provide adequate wetting of the tailings to suppress dust generation
- Progressive restoration of TMF cells will be conducted as cells are closed during the operations phase.

7.1.2.3 Lighting Management

Lighting fixtures used during the Project construction, operation and active closure phases will be designed to mitigate potential effects including:

- Construction lighting will be specified to use only as much lighting as is necessary for safe and efficient construction activities, and locate portable lighting equipment where, to the extent feasible, it is not visible at nearby receptors
- Exterior lighting systems for Project will be guided by widely accepted standards and guidelines, including directional lighting to limit light trespass and to avoid glare. Proper shielding via the use of horizontal cutoff fixtures will also be incorporated into the Project lighting plan (where practicable), and portable lighting will be positioned to limit visibility at surrounding residences
- Most of the routes for haul trucks and service vehicles onsite will be shielded by topography and vegetation along their length, and no street lighting is currently planned for these areas
- Lighting of the re-aligned Highway 11 will be implemented according to current MTO standards.

7.2 Closure

Mitigation and monitoring activities associated with decommissioning, reclamation and rehabilitation during the closure phase is presented in the Conceptual Closure Plan. Mitigation measures applicable to the construction phase would apply during active closure and it is anticipated that mitigation during the post closure phase will not be required.

8.0 MONITORING, EVALUATION AND REPORTING

8.1 Monitoring, Measurement, Analysis and Evaluation

An ambient air quality monitoring program will be implemented to regularly sample air quality at key locations on and adjacent to the Project. The program is designed to measure the effectiveness of control measures, evaluate air quality at nearby receptors and ensure compliance with environmental compliance approval conditions, relevant regulatory standards and corporate requirements. The air quality monitoring program will be in place during construction and will continue and be adjusted as needed through operation.

The minimum air quality monitoring program will be comprised of a combination of high volume air samplers (or equivalent), dust deposition gauges and real time particulate monitors. Air quality monitoring stations will be installed to measure both the background (predominantly upwind) ambient particulate matter and that from the Project operations. The number and location of the ambient monitoring stations will be determined during the permitting phase of the Project. A meteorological monitoring station will be installed and maintained to provide real time and periodic meteorological data to assist in day-to-day operational measures and for data interpretation. The location/siting criteria for the meteorological tower will be reviewed with the MOECC prior to installation and start of Project construction. The air quality monitoring program is outlined in Table 8-1.

Table 8-1: Summary of Air Quality Compliance Monitoring Program

Parameter	Monitoring Method	Frequency	Location	Responsibility
TSP Deposition	Dustfall Jars	TBD	4-5 locations (to be determined)	Environment Manager
TSP	Hi-vol air sampler or equivalent	TBD	1 upwind 2 downwind (to be determined)	Environment Manager
PM_{10}	BAM or equivalent	TBD	1 upwind 2 downwind (likely Rosedale Point and MacLeod Provincial Park)	Environment Manager
Meteorology 1. wind speed 2. wind direction 3. temperature 4. rainfall 5. relative humidity	meteorological tower	TBD	To be determined	Environment Manager

Further details of the air quality compliance monitoring program are provided in the Conceptual Ambient Monitoring Plan in Appendix A.

8.2 Reporting

The form and frequency of follow-up reporting will be determined as the Project progresses through permitting, however, it is anticipated that those elements relevant to the Conceptual AQMP will be assembled into a formal report and made available to interested parties on an annual basis during construction and operation and during closure in years when monitoring is carried out. Receiving, documenting and responding to communication from external interested parties, including complaints, will also form part of reporting under this Plan.

8.2.1 Ambient Air Quality

Annual reports will be generated that include the results of the ambient monitoring program. Should a validated exceedance of O.Reg.419/05 criteria occur, it will be reported.

Annual reports include both a summary and analysis of the ambient monitoring program for the previous year as required by the MOECC Operations Manual (MOECC, 2017). Annual reports are due to the MOECC by May 15th of the year following the reporting year.

8.2.2 NPRI and TRA

On an annual basis the Project will be required to report to the NPRI, which is Canada's legislated inventory of pollutant releases (to air, water and land), disposals and transfers for recycling. Reports to the NPRI are typically due on June 1st of the year following the reporting calendar year (e.g., the deadline for reporting to the NPRI for the 2016 calendar year is June 1, 2017. Updates to NPRI reporting requirements are published as NPRI Notices in the Canada Gazette. GGM will check for updates in the Canada Gazette annually (which can be searched for on the Environment and Climate Change Canada (ECCC) website).

The Project will be required to report the amount of each NPRI substance at the facility which either was manufactured, processed or otherwise used at the facility during the year, if the quantities meet their respective reporting thresholds. Reporting is required for facilities where pit or quarry operations occur regardless of the employee hours worked threshold of 20,000 hrs which will be exceeded. The NPRI substances are grouped into five parts, each representing a different category of substance and with specific thresholds and reporting requirements.

Furthermore, for substances that meets the thresholds of the federal NPRI reporting program, GGM will also report the substance to Ontario's Toxics Reduction Program under O. Reg. 455/09 of the TRA. Through this program GGM will:

- Submit an annual report of the substance to the MOECC by June 1st of every year for the previous year. Parts of the report will be made available to the public and GGM employees will be informed when the report is publicly available.
- Prepare a Toxic Substance Reduction Plan (TSRP) by December 31st of the same year that the substance is reported to the MOECC. One plan will be produced for applicable substances and each plan will be certified by a Toxic Substance Reduction Planner licensed by the MOECC. These plans will be reviewed and updated every five years on the MOECC's schedule which currently requires updates in 2018, 2023, 2028 etc.

8.1 Continual Improvement

Adaptive management is a planned and systematic process for continuously improving environmental management practices by learning from their 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 and lasting measures aimed to prevent reoccurrence and/or similar occurrences. The Adaptive Management Framework (Figure 8-1), 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 corrective and preventive actions; and
- continue monitoring and update relevant EMMPs.

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 the Conceptual AQMP.

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

Figure 8-2 presents the overall approach to developing and advancing the EMMPs from the final EIS/EA to the construction Phase of the Project. The first stage of EMMP development begins with preparation of Conceptual Environmental Management Plans as part of the final EA/EIS. These Conceptual EMMPs are commitment-based and broad in their level of detail. The EMMPs guide environmental management for the Project and are progressively developed as the Project moves through the EA/EIS, permitting, and construction, and updated based on continual improvement during operations through adaptive management.

9.0 REFERENCES

Ministry of the Environment and Climate Change (MOECC). 2008a. Jurisdictional Screening Level (JSL) List, A Screening Tool for Ontario Regulation 419: Air Pollution – Local Air Quality.

Ministry of the Environment and Climate Change (MOECC). 2008b. Operations Manual for Air Quality Monitoring in Ontario (PIBs 6687E).

Ministry of the Environment and Climate Change (MOECC). 2012a. Summary of Standards and Guidelines to Support Ontario Regulation 419: Air Pollution — Local Air Quality (PIBs 6569e01).

Ministry of the Environment and Climate Change (MOECC). 2012b. Ontario's Ambient Air Quality Criteria. Standards Development Branch.

10.0 FIGURES

Figure 8-1: Hardrock Project Adaptive Management Framework

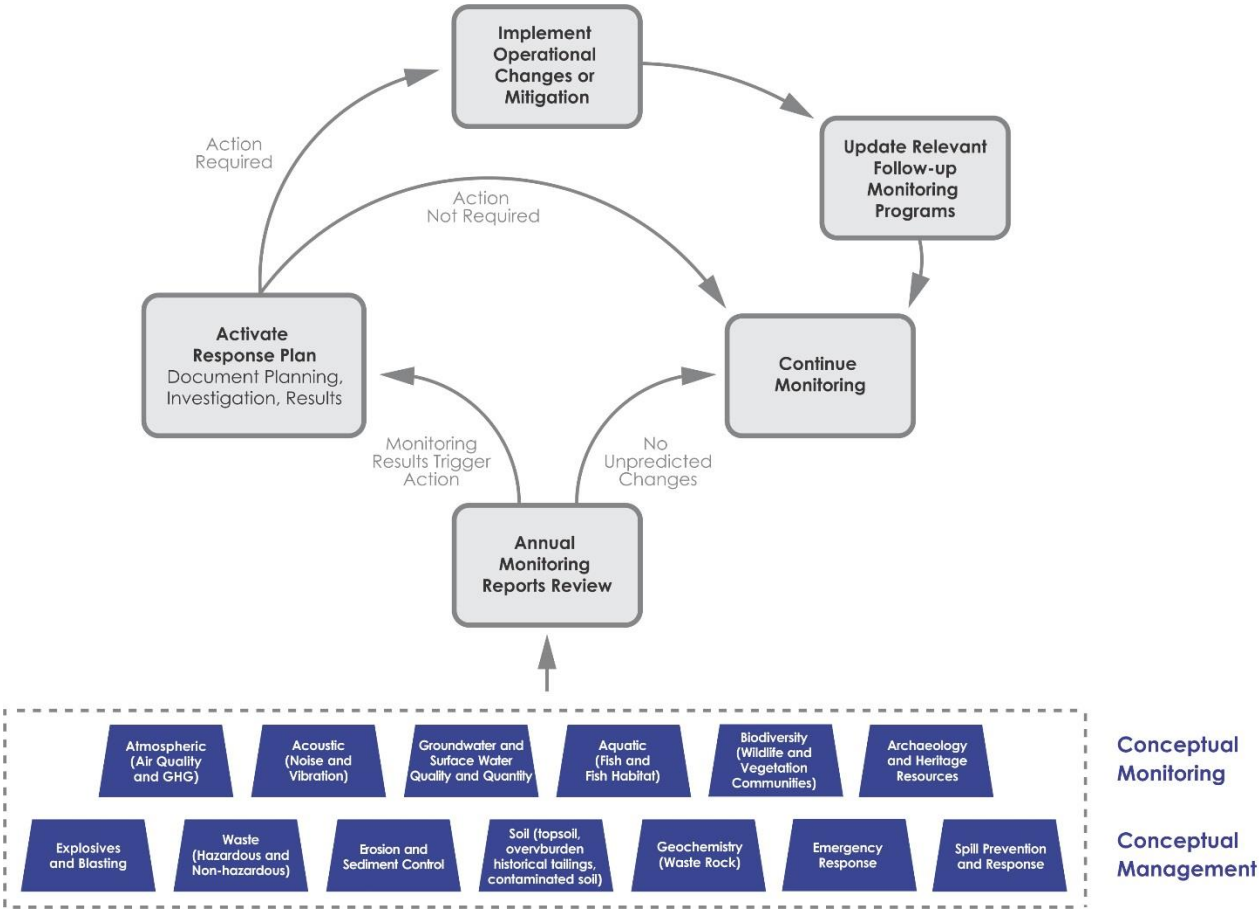
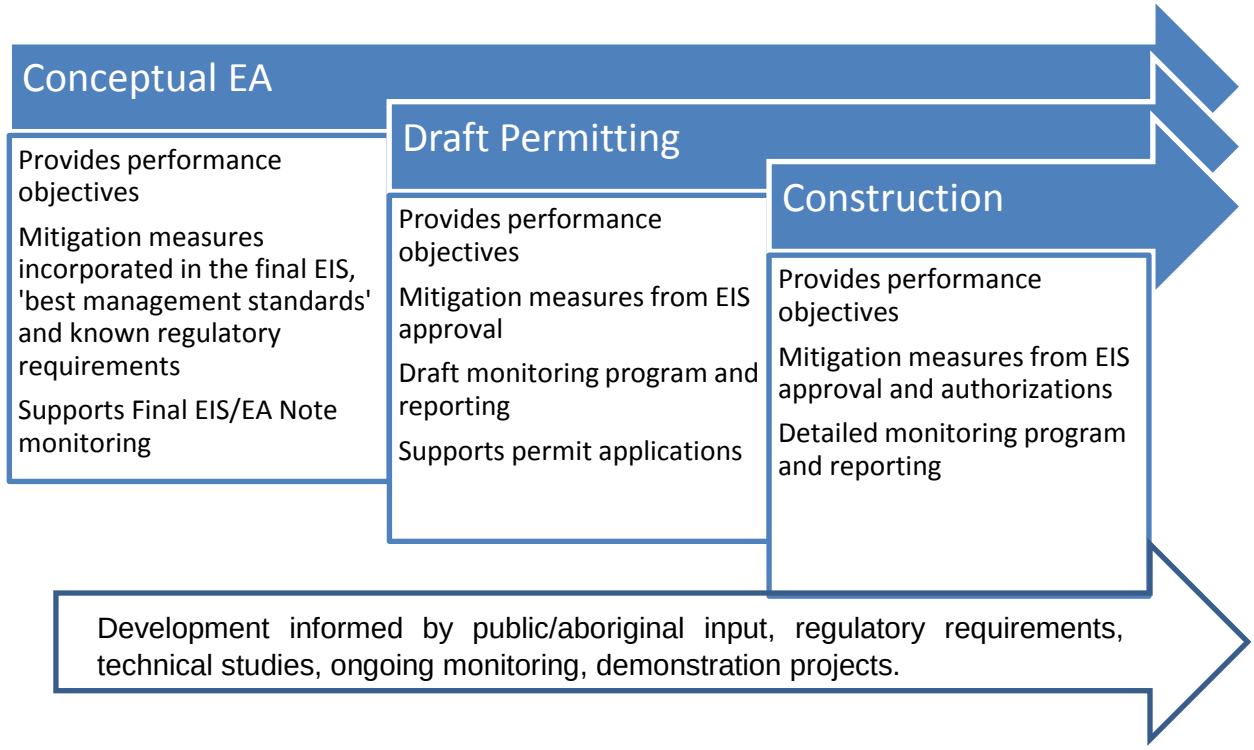


Figure 8-2: Environmental Management and Monitoring Plan Development EA to Construction



APPENDIX A: CONCEPTUAL AMBIENT MONITORING PLAN (AMP)

APPENDIX A - CONCEPTUAL AMBIENT MONITORING PROGRAM

The following Conceptual Ambient Monitoring Plan (AMP) summarizes the parameters to be monitored, location and frequency of monitoring, sampling and calibration, data acquisition and validation, reporting requirements, records management, and (when required) corrective and preventive action.

1.0 GENERAL SITING CONSIDERATIONS

1.1 Scales of Representativeness

Proper siting of monitoring stations requires a precise specification of the monitoring objective, which usually includes a desired spatial scale of representativeness. The spatial scale of representativeness is described in terms of the physical dimensions of the air parcel nearest to a monitoring station through which the pollutant concentration is reasonably uniform. The goal in siting monitoring stations is to correctly match the spatial scale represented by the sample of monitored air with the monitoring objective of the station. The scales of representativeness of most interest for local air monitoring are:

- Microscale – defines concentrations in air volumes associated with area dimensions ranging from several metres up to about 100 m.
- Middle Scale – defines the concentration typical of areas ranging in size from about 100 m to 0.5 km.
- Neighbourhood Scale – defines concentrations within extended areas with relatively uniform land use with dimensions of 0.5 to 4.0 km.
- Urban Scale – defines overall city-wide conditions with dimensions on the order of 4 to 50 km.

US Consolidated Federal Regulations, Section 40, Part 58 (40CFR Part 58), (US EPA, 2010) provide guidelines on the scales of representativeness required for specific monitoring objectives. The objective of monitoring source impact is associated with micro, middle and neighbourhood scales. Monitoring for background concentrations requires neighbourhood or regional scales of representativeness. This monitoring plan has been developed to meet the objective of source impacts in the area. Based on this objective, the monitors would be situated to capture middle to neighbourhood scales of representativeness (hundreds of metres to 4 km). The dispersion modeling results show the maximum predicted concentrations occur within this range.

1.2 Siting Requirements

Table A.1-1 provides a summary of siting requirements listed in the MOECC's Operations Manual (MOECC, 2016) that will be followed as closely as possible for the siting of the monitoring stations, however the location of the stations will be constrained to sites with adequate security (within a secured, fenced area), vehicle access, set-back from roadways, and access to power.

Table A.1-1: Summary of Siting Criteria for Ambient Monitors

Contaminant	Height Above Ground (metres)	Distance from Supporting Structure (metres)		MOECC Recommended Criteria
		Vertical	Horizontal	
Total Suspended Particulate (TSP)	2 to 15	>1	>2	Greater than 20 metres from trees
				Distance from sampler to air flow obstacle, i.e., buildings, terrain features, must be >2x height of obstacle above the sampler
				Airflow must be unrestricted through an arc of at least 270 degrees
				No nearby furnace or incineration flues
				Distance from sampler to roadway > 20-25 m for sampler inlet heights of 2-5 m
Dustfall	3	-	-	No nearby unpaved roadways, parking lots, etc.
				Greater than 20 meters from obstacles (buildings, trees, terrain features)
				Unrestricted air flow in 3 of the 4 wind quadrants
				No nearby chimneys or flues that could emit coarse particulate (soot/coal)
				Avoid building wake wind effects from rooftop installations
PM_{10} (continuous sampler)	2 to 15	>1	>2	Greater than 20 metres from trees
				Distance from sampler to air flow obstacle, i.e., buildings, terrain features, must be >2x height of obstacle above the sampler
				Unrestricted air flow in 3 of the 4 wind quadrants
				> 5 m from chimneys with natural gas combustion emissions
				> 20 - 25 metres from major roadways

2.0 CONTAMINANTS AND LOCATIONS FOR MONITORING

2.1 Contaminants to be Monitored

The main contaminant associated with mining activities is dust (particulate), which includes total suspended particulate matter (TSP), particulate matter less than 10 microns in diameter (PM_{10}) and particulate matter less than 2.5 microns in diameter ($PM_{2.5}$). TSP is a measure of the particles in the atmosphere that are too small to settle out quickly, but remain suspended for significant periods of time. Generally, this means particles with an aerodynamic diameter of less than 44 µm. Although total suspended particulate matter is an excellent measure of the loading of particulate matter in the air, it does not necessarily reflect the health risks of particulate matter. Inhalable particulate (aerodynamic particles in the PM_{10} range) are trapped by the upper airways, and do not enter the lungs, while respirable particulate ($PM_{2.5}$) can make their way deep into the lungs, and may become lodged there.

Other aspects related to the effects of dust generated by mining activities on human health derive from its chemical composition. Dust may contain metals such as arsenic, cadmium, cobalt, lead, manganese, nickel, vanadium, zinc etc. The composition and relative concentrations of metals in dust/particulate will depend on its source – ore, waste rock, overburden, etc.

The AMP focuses on the main contaminant of concern from mining activities, which is particulate. Dust generated at the site has not been identified as having contaminant levels that would cause health or environmental impacts nor have a detrimental impact on flora or fauna in the vicinity of the Project. Minimization of Project particulate emissions will inherently reduce the impact of metals emissions in the surrounding area. The monitoring program will be conducted to measure off property ambient air concentrations at locations around the Project site of the following contaminants:

- TSP
- PM_{10}
- Dustfall

2.2 Number of Monitors and Location

Ambient air monitoring for TSP, PM_{10}, and dustfall will be conducted at three sites near the Hardrock Project property. One site will be located at a predominantly upwind location from the Project (west of the TMF), and two located at predominantly downwind locations in the vicinity of inhabited areas (Rosedale Point neighborhood and Macleod Provincial Park). The precise locations of the stations will be determined considering the availability of power and the MOECC siting requirements outlined in Table A.1-1.

Dustfall measurements alone will be conducted at additional locations expected to be:

- in the vicinity of a Traditional Land Use area
- along the south-east Project boundary to identify maximum downwind impacts
- within the Town of Geraldton to quantify dustfall in a populated area unaffected by dustfall from the Hardrock Project.

The general locations for the proposed monitoring sites are presented in Table A.2-1.

The number and type of monitoring locations proposed in this AMP is commensurate with the scale of the Hardrock Project operations, the level of monitoring at other mine and quarry sites in Ontario and with consideration of the proximity of the Project to populated areas.

A summary of how the proposed ambient monitoring locations will meet the probe siting criteria for middle to neighbourhood scale ambient monitoring objectives is presented in Table A.2-2. The table will be updated once specific locations had been selected.

Table A.2-1: Proposed Monitoring Locations

Monitoring Location	Parameters Measured	UTM Zone	Easting (m)	Northing (m)	Predominantly Upwind (U) or Downwind (D)	Rationale for Location
A	PM_{10}/TSP/Dustfall	16 U	TBD	TBD	U	Predominantly upwind station – located to the west of the TMF. Location will be dependent on the availability of power in this area.
B	PM_{10}/TSP/Dustfall	16 U	TBD	TBD	D	Predominantly downwind station located in the vicinity of the nearest residential area to the Project – the Rosedale neighborhood. This location will also provide a conservative estimate of exposure in the Town of Geraldton which is further removed from the Project.
C	PM_{10}/TSP/Dustfall	16 U	TBD	TBD	D	Predominantly downwind station located in the vicinity of MacLeod Provincial Park . Location will be dependent on the availability of power in the park.
D	Dustfall	16 U	TBD	TBD	D	Located in a predominantly downwind location, in the vicinity of the nearest Traditional Land use to the Project.
E	Dustfall	16 U	TBD	TBD	D	Located in a predominantly downwind location along the south-west Project boundary to capture maximum off-property dustfall levels.
F	Dustfall	16 U	TBD	TBD	D	Located in a predominantly downwind location along the south-west Project boundary to capture maximum off-property dustfall levels.
G	Dustfall	16 U	TBD	TBD	D	Located in a predominantly downwind location in the Town of Geraldton to provide an indication of dustfall levels in a populated area further away from the Project than the other measurement locations.

Table A.2-2: Comparison of Proposed Monitoring Locations to Probe Siting Criteria

Contaminant	MOECC Spacing Criteria	Proposed Monitoring Station Location						
		A	B	C	D	E	F	G
TSP	a. 2 to 15 m above ground				-	-	-	-
	b. > 1 m vertically from support structure				-	-	-	-
	c. > 2 m horizontally from support structure				-	-	-	-
	d. Greater than 20 metres from trees				-	-	-	-
	e. Distance from sampler to air flow obstacle, i.e., buildings, terrain features, must be >2x height of obstacle above the sampler				-	-	-	-
	f. Airflow must be unrestricted through an arc of at least 270 degrees				-	-	-	-
	g. No nearby furnace or incineration flues				-	-	-	-
	h. Distance from sampler to roadway > 20-25 m for sampler inlet heights of 2-5 m				-	-	-	-
Dustfall	a. 3 m above ground							
	b. No nearby unpaved roadways, parking lots (separation distance depends on monitoring objectives)							
	c. Greater than 20 meters from obstacles (buildings, trees, terrain features)							
	d. Unrestricted air flow in 3 of the 4 wind quadrants							
	e. No nearby chimneys or flues that could emit coarse particulate (soot/coal)							
	f. Avoid building wake wind effects from rooftop installations							
PM_{10}	a. 2 to 15 m above ground				-	-	-	-
	b. > 1 m vertically from support structure				-	-	-	-
	c. > 2 m horizontally from support structure				-	-	-	-
	d. Greater than 20 metres from trees				-	-	-	-
	e. Distance from sampler to air flow obstacle, i.e., buildings, terrain features, must be >2x height of obstacle above the sampler				-	-	-	-
	f. Unrestricted air flow in 3 of the 4 wind				-	-	-	-

Table A.2-2: Comparison of Proposed Monitoring Locations to Probe Siting Criteria

Contaminant	MOECC Spacing Criteria	Proposed Monitoring Station Location						
		A	B	C	D	E	F	G
	quadrants							
	g. > 5 m from chimneys with natural gas combustion emissions				-	-	-	-
	h. > 20 - 25 metres from major roadways				-	-	-	-

3.0 INSTRUMENTATION AND DATA ACQUISITION

The measurement program at selected monitoring sites will include continuous monitors for PM_{10} and non-continuous monitors for TSP and dustfall. Monitoring will be conducted per the methodologies and analysis recommended by the MOECC Operations Manual (MOECC, 2016).

The following sections detail the continuous and non-continuous monitors proposed for this sampling program.

3.1 Continuous Ambient Monitors

3.1.1 Particulate Matter (PM_{10})

Each continuous PM_{10} sampler will consist of a BAM 1020 (or equivalent). The sampler uses beta ray attenuation to measure particulate concentrations.

Principle of Operation: Beta Ray Attenuation

Range: 1 mg (1000 µg) default setting. Settable from 0.1 mg to 10 mg

Measurement Cycle Time: 1 hour

Each monitor will be contained in a heated/air conditioned enclosure and equipped with a cellular modem to allow remote downloading of the unit's memory on an hourly) basis.

3.2 Non-Continuous Ambient Monitors

3.2.1 Total Suspended Particulates (TSP)

Total suspended particulate matter (TSP) will be collected onto pre-weighed, conditioned Teflon coated glass fibre filters for a 24-hour period using a Tisch Environmental TE-5170 volumetric-

flow high volume sampler (or equivalent) measuring TSP. This monitor operates by continuously drawing a sample of ambient air through a filter onto which particulate matter is deposited. The sampling schedule will correspond with the MOECC's province-wide ambient sampling schedule (one sample taken every six days).

3.2.2 Dustfall

Dustfall will be measured using standard dustfall jars - open-topped cylinders 18.5 inches in height and 6 inches in diameter. The Standard Test Method for Collection and Measurement of Dustfall (Settleable Particulate Matter, ASTM D1739-98) will be employed to conduct the sampling and analysis procedures. The dustfall jars will be supported at a height of approximately 3 meters above ground level. The duration of each dustfall sample collection period will be 30 days ± 3 days with sample changeover occurring as close as possible to the beginning of each month.

3.3 Meteorological Tower

GGM will operate a meteorological tower at one of the air monitoring sites. The tower instrumentation will measure horizontal wind speed, wind direction, ambient temperature, relative humidity, barometric pressure, and rainfall. The meteorological sensors will be mounted on a tower. The proposed meteorological equipment will be:

- Wind Speed/Wind Direction: Met One Instruments Inc. Model 034B (or equivalent)
- Temperature: Campbell Scientific Model 107 (or equivalent)
- Relative Humidity: Campbell Scientific Model HMP60 (or equivalent)
- Atmospheric Pressure: Campbell Scientific Model CS106 (or equivalent)
- Rainfall: Texas Electronic TE525M (or equivalent)
- Data Logger Campbell Scientific CX-1000 (or equivalent)

4.0 LABORATORY ANALYTICAL PROCEDURES

Samples will be obtained and analyzed following US EPA reference or equivalent methods, as per the MOECC Operations Manual (MOECC, 2016). A summary of the contaminants to be assessed by laboratory analytical procedures during this monitoring program and their laboratory reference methods is provided in Table A.4-1.

Table A.4-1: Summary of Laboratory Reference Methods

Contaminant	Laboratory Reference Method
Total Suspended Particulate (TSP) and Metals	US EPA Manual Reference Method: 40 CFR Part 50, Appendix B
Dustfall	Settleable Particulate Matter, ASTM D1739-98

Samples will be sent to a Canadian Association for Laboratory Accreditation (CALA) certified laboratory for analysis.

5.0 QUALITY ASSURANCE PROCEDURES

5.1 Operator Requirements

Appropriate training will be provided to employees supporting the AMP, commensurate with their duties. Such training may consist of classroom lectures, workshops, teleconferences or on-the-job training.

The operation and maintenance of the monitoring program will include the following general provisions:

- field activities will be recorded in standardized field notes. Hi-vol data sheets will include initial and flow measurements for each sample
- chain of custody forms will be completed and submitted along with exposed samples to the CALA laboratory used for analysis
- original containers will be used when submitting filters for analysis to avoid cross-contamination of samples, which will be recorded in the chain of custody forms
- maintaining training records for personnel involved in the project.

5.2 Instrumentation Calibration and Maintenance

Samplers will be bench-tested and calibrated prior to their installation in the field. If required, the samplers will be re-calibrated once installed before their first use. On-going calibration of the samplers will follow the recommended calibration schedule listed in the MOECC Operations Manual (MOECC, 2016). Equipment maintenance will be carried out following the manufacturer recommended schedule.

5.3 Accuracy Checks for Analysis Techniques

Travel and field blank samples will be submitted to the CALA accredited laboratory to confirm the accuracy of the analytical techniques used for TSP/metals sampling. Blank samples will account for about ten percent (10%) of total submitted samples.

5.4 Sample Collection and Transportation

Samples will be properly handled such that there is no contamination. For filters this entails the use of surgical gloves to avoid contamination. Samples will be carefully removed from the monitoring device by a trained operator, and placed in sealed, non-reactive containers. Filters will be placed in a folder and envelope while dustfall containers will be placed in protective cases for protection from breakage, contamination, or loss during transportation.

Quality records for sample collection will be maintained. The quality record will include at least the following parameters:

- Station ID
- Station name/location
- Filter/canister ID
- Sample start date/time
- Sample end date/time or elapsed time
- Date/time sample collected
- Technician name
- Meteorological conditions during sampling
- Comments on visual examination of filters/canisters prior to and after sampling.

5.5 Data Review and Validation

Data collected from the continuous and non-continuous monitors will be screened for suspicious data including outliers, instrumentation drift and missing data following MOECC protocols given in the MOECC Operations Manual (MOECC, 2016). In general, the Operations Manual states that at a minimum, the required rate of recovery of valid data for both continuous non-continuous monitors is 75% (both seasonally and annually), with continuous monitors generally capable of greater than 90% data recovery rates.

6.0 REAL TIME DUST MONITORING

An automated software system will be used to download the most recent hourly and rolling 24-hour average PM_{10} data from the continuous PM_{10} monitors on an hourly basis. Current weather

data (including wind speed, wind direction and relative humidity) from the meteorological tower will also be downloaded at hourly intervals. This data will be made available to appropriate GGM personnel for use in proactively assessing the efficiency of dust mitigation measures currently being employed and the need for additional measures to be implemented.

7.0 REPORTING REQUIREMENTS

Both quarterly and annual reports will be generated that include the results of the ambient monitoring program. The quarterly reports will follow a standardized format and will include the following statistical information as required by the MOECC (MOECC, 2016):

For Continuous Monitors:

- Arithmetic Mean
- Monthly Arithmetic Mean
- Maximum for averaging period used for comparison to statutory or regulatory limits
- Maximum 24-hour, or other averaging period as appropriate
- Percentage of valid hours

For Non-Continuous Monitors:

- Nunber of valid samples
- Percentage of valid data
- Period arithmetic mean
- Period geometric mean (TSP only)
- Maximum 24-hour value
- Maximum monthly value
- Sampling dates (start and end)

In addition, should a validated exceedance of O.Reg.419/05 criteria occur, it will be reported. For quarterly report submissions non-continuous data will be submitted electronically (Excel format) along with the report. Edit logs for non-continuous monitors will be provided in the quarterly reports.

Annual reports will follow a similar format to the quarterly reports, and will include both a summary and analysis of the AMP of the previous year. In addition to the required sections as detailed for the quarterly report, the annual report will include the following:

- a map showing the location of emitting sources, property boundaries, major structures on site and monitoring stations. Also included on the map will be a distance scale, north arrow and marked locations of nearby significant receptors
- a summary of overall operations, e.g., summary of parameters monitored and equipment/model numbers, frequency of site visits and calibrations, confirmation of data backups and/or archiving, list of problems that resulted in significant losses of data along with remedial actions
- a summary of audits and audit outcomes
- Summary statistics, including:
    - Annual Arithmetic Mean
    - Annual Geometric Mean (TSP only)
    - Maximum 1-hour concentration (continuous data only)
    - Maximum 24-hour concentration
    - Number of valid hours or sampling periods
    - Percent of valid data
- A summary of exceedances of O.Reg.419/05 or other applicable criteria for each applicable averaging period and the number of times exceedances occurred
- An analysis of exceedances evaluated by wind speed/direction data for source contribution assessment
- A comparison to historical data collected at the monitoring station.
- Further requirements for both the quarterly and annual reports can be found in the MOECC Operations Manual (MOECC, 2016).

The quarterly and annual reports and data collected from the monitoring program will be made available to the MOECC per the requirements of the MOECC Operations Manual (MOECC, 2016). GGM will make the monitoring data, quarterly and annual reports accessible to the public upon request in a timely manner.

8.0 REFERENCES

Operations Manual for Air Quality Monitoring in Ontario, Ministry of the Environment, Operations Division, Technical Support Section, Draft November 2016, PIBS 6687e

US Consolidated Federal Regulations, Section 40, Part 58 (40CFR Part 58). Title 40: Protection of Environment, Part 58-Ambient Air Quality Surveillance, Subpart G-Federal Monitoring Appendix E to Part 58 – Probe and Monitoring Path Siting Criteria for Ambient Air Quality Monitoring

Stantec Consulting Ltd. (Stantec). 2017. Technical Data Report – Hardrock Project: Atmospheric Environment. Prepared by Stantec Consulting Ltd.