GOVERBMENT OF THE REPUBLIC OF THE UNION OF MYANMAR

MINISTRY OF NATURAL RESOURCES AND ENVIRONMENTAL CONSERVATION

ENVIRONMENTAL CONSERVATION DEPARTMENT

Environmental Impact Assessment Guidelines for the Mining Sector

MINING EXPLORATION

GUIDELINES FOR PREPARATION OF AN ENVIRONMENTAL MANAGEMENT PLAN

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Environmental Impact Assessment Guidance for the Mining Sector

Environmental impact assessment guidance for the mining sector includes:

- Mining Exploration: Guidelines for Preparation of an Environmental Management Plan
- Mining: Guidelines for Environmental Impact Assessment
- Technical Guidance for Environmental Impact Assessment of Mining
- Guide for Review of Environmental Assessment Documentation
- Guide for Preparing an Environmental Compliance Certificate for a Mining Project
- Guide for Environmental Compliance Monitoring and Inspection

Proponents and their consultants should select guidance that is most relevant to the proposed project, either guidance for exploration, new mines, or existing mines. When conducting the assessment of impacts, the more detailed *Technical Guidance for Environmental Impact Assessment of Mining* should be used as a reference.

Environmental Reviewers including Environmental Conservation Department (ECD) staff, ECD consultants, and members of the Interdepartmental EIA Review Committee should refer to *Guide for Review of Mining Environmental Assessment Documentation*.

ECD staff responsible for preparing Environmental Compliance Certificates should refer to *Guide for Preparing an Environmental Compliance Certificate for a Mining Project*.

ECD staff responsible for compliance monitoring and environmental and social staff of mining companies should refer to *Guide for Environmental Compliance Monitoring and Inspection*.

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Introduction

Under the Myanmar EIA Procedure (2015), neither an IEE or EIA is required for most prospecting and exploration projects. To ensure proper environmental management of prospecting and exploration, an environmental management plan (EMP) is to be prepared.

Purpose

The purpose of this document is to describe the environmental requirements for preparation of a stand-alone environmental management plans for the prospecting, exploration, and feasibility study stage on the mining life cycle. It also prescribes the required set of environment mitigation measures and rehabilitation requirements that must be followed by all projects.

Because the nature of activities involved in prospecting and exploration have become standardized, the environmental impacts of prospecting and exploration are well understood. In some countries, environmental codes of practice have been developed to guide the environmental management of prospecting and exploration.[1] Site specific environmental management plans can be developed from these environment codes of practice.

Environmental Management Plan Contents

The Environmental Management Plan (EMP) has eight (8) parts:

i. Part A: Executive Summary;
ii. Part B: Project Proponent;
iii. Part C: Project Description;
iv. Pact D: Environment Description;
v. Part E: Environmental Impacts and Mitigation Measures;
vi. Part F: Environmental Management System:
vii. Part G: Estimated Cost of Implementation of the Environmental Management; and
viii. Part H: Conclusion.

[1] Exploration Code of Practice: Environmental Management: NSW Department of Planning and Environment, Division of Resources and Geoscience; July 2015; www;planning;nsw;gov;au | www;resourcesandenergy;nsw;gov;au

Environmental Assessment Requirement for Permit Stages

Under the new Myanmar Mining Rules, the initial stages of the mining life cycle are defined as follows:

i. prospecting – up to one years with possibility of a one-year extension;
ii. exploration - up to 3 years with possibility of a two one-year extensions; and
iii. feasibility study – up to 1 year with a possibility of a one-year extension.

In submitting application for a permit, the Project Proponent is required to prepare a stand-alone Environmental Management Plan to assess the environmental and social impacts of all activities to be undertaken. However, the Mining Rules do not provide a specific definition of which are activities are to be permitted at each stage.

Low Impact Activities. Some prospecting and exploration activities are considered to have low potential for environmental and social impacts[2], as long as they do not occur within sensitive environments. Such activities include:

i. Reconnaissance;
ii. Cultural clearance surveys;
iii. Soil sampling;
iv. Geological mapping;
v. Geochemical surveys—surface sampling;
vi. Rock-chip sampling;
vii. Sampling using hand held augers;
viii. Fly camps comprising tents for short periods of time (days);
ix. Small, short term camp sites defined as:
    a. Having a maximum of 5 people;
    b. Required for a maximum time period of one month;
x. Equipment limited to a maximum of two trailers, tents, and generators;
xi. Low impact exploration equipment; and
xii. Use of 4WD vehicles, ATVs and/or Quad bikes on off existing tracks required to conduct the above listed activities.

This guideline provided a standard set of mitigation measures for these low impact activities (Annex A1.1).

[2] Generic program for environment protection and rehabilitation—low impact mineral exploration in South Australia; NOTICE given in accordance with section 70B (8) of the Mining Act 1971 and regulation 66 (1) of the Mining Regulation 2011; South Australian Government Gazette 44:2774–2780 30 June 2011.

Environmental Description. As prospecting is undertaken over large geographic area, it is not practical to gather detailed environmental and social information components. These Guidelines require only a general description of the prospecting area as long as the prospecting only involve low impact activities. However, the environmental description will have to identify important features (e.g., environmentally sensitive areas, culture heritage sites, and communities).

A detailed environment description is needed at exploration stage once the proposed exploration is defined. Similarly, a detailed environment description is needed at feasibility study stage, once the proposed mining is defined.

While actual requirements for the Environmental Management Plan document will depend on the activities planned by the Proponent, the table below give examples of what must be included in the Environmental Management Plan for prospecting, exploration, or a feasibility study.

Indicative Requirements for Prospecting, Exploration, and Feasibility Study Permit

Report Section	Prospecting	Exploration	Feasibility Study
A. Executive Summary	Yes	Yes	Yes
B. Project Proponent	Yes	Yes	Yes
C. Project Description	Low Impact Activities Only	Yes	Yes
D. Environment Description	General Description for Prospecting Area	Detailed Description for Proposed Exploration Area	Detailed Description for Proposed Mining Area
E. Environmental Impacts and Mitigation Measures	Annex A1.1 – only	Annex A1.1 and Annex A1.2 (for relevant activities)	Annex A1.1 and Annex A1.2 (for relevant activities)
F. Environmental and Social Management System	Yes	Yes	Yes
G. Environmental Management Plan, Budget, and Implementation Schedule	Yes	Yes	Yes
H. Conclusion	Yes	Yes	Yes

Instruction for Use

This guideline provides detailed guidance for each section of the EMP Document. Each section has clear instructions (indicated by the heading - **INSTRUCTION**) for information that is to be the prepared and included in the EMP.

Sections on the Project Proponent, the Project Description, and the Environment Description provide templates and checklists to make it easier to provide the required information.

A generic assessment of environmental and social impacts linked to proposed mitigations is provided. A general environmental impact assessment – mitigation matrix is provided in Annex 1. It is divided into two parts.

Table A1.1. *Environmental Impacts and Mitigation Measures for All Exploration and Prospecting Activities* describes potential environmental impacts associated with prospecting and exploration regardless of the exploration method or technique. A generic set of mitigation measures is recommended. These generic measures are required for all projects.

Table A1.2 *Environmental Impacts and Mitigations for Exploration Techniques* the describes the impacts associated specific geological, geochemical, geophysical techniques, and exploratory mining. A set of mitigation measures is recommended for these impacts. The Project Proponent is required select the necessary mitigation measures based on the specific exploration methods and techniques that will be utilized.

A narrative description for the project specific impacts and mitigation measures is required.

If necessary, an environmental quality monitoring program is to be designed. The Environmental Standards to be met all projects are provided.

The Proponent is to establish an environmental and social management system (ESMS) for the implementation, supervision, and monitoring of the environmental management plan. The description of the ESMS should include: (i) the proposed environmental and social staff; (ii) a description of the staff roles and responsibilities; (iii) the procedures for supervision of the implementation, and monitoring compliance with the EMP; (iv) training requirements (if necessary); and (v) monitoring and reporting requirements.

A detailed cost estimate and schedule for implementation of the EMP is required. A sample format for the cost estimate is provided.

The Conclusion should highlight the main environmental and social impacts and describe the mitigation measures and rehabilitation programs to address the impacts. The document must come to conclusion as to whether or not there will be significant adverse impacts

A. Executive Summary

INSTRUCTION*: An Executive Summary is the be prepared. Include as Part A of the Environmental Management Plan Document***.**

The Executive Summary is to summarize each of the major sections (B, C, D, E, F, G, and H). It should highlight the main environmental and social impacts and describe the measures to address the impacts how they will be addressed.

B. Project Proponent

INSTRUCTION: *Complete the Basic Data on the Project Proponent. Include it as Part B of the Environmental Management Plan.*

Basic Data

Project Proponent Name:	[Add Project Proponent Legal Name]
Business Permit No. (if any):	[Add Business Permit No, if available]
Contact person of Project Proponent:	[Add name of Project Proponent contact person]
Project Proponent address for correspondence:	[Add Project Proponent correspondence address]
Telephone (fixed/mobile):	[Add Project Proponent phone number]
Fax:	[Add Project Proponent fax number]
Email address:	[Add Project Proponent email address]
Details of companies that the Project Proponent forms part of:	[Describe the Project Proponent corporate structure and any affiliated companies]

C. Project Description

INSTRUCTION: *Complete the basic data on the Project and include in Part C of the Environmental Management Plan document*

Basic Data

Project Title:	[Include the full Project name]
New/Existing development:	[check the appropriate box] ☐ New Project ☐ Modification, amendment or upgrading project
Stage	☐ Prospecting ☐ Exploration
Minerals Targeted	
Project Location	[Describe the Project geographic location]
Longitude/Latitude of the project:	[Include longitude and latitude]
Size and scale of project components:	[Provide detail on the size and scale of Project components]
Maps and Photographs:	Include a list of maps and photographs Attach maps and photographs as an appendix.

INSTRUCTION: *Complete the following Description of Proposed Exploration Activities. Include in Part C of the Environmental Management Plan document.*

Which prospecting and exploration activities (see Annex 2) will be undertaken?

- ☐ Geological mapping
- ☐ Geochemical sampling
- ☐ Airborne surveys
- ☐ Gravity and magnetic surveys
- ☐ Resistivity, induced polarization and electromagnetic surveys
- ☐ Seismic surveys
- ☐ Drilling (auger, open hole percussion, reverse circulation and rotary air blast drilling, diamond drilling; rotary mud, or wide diameter drilling
- ☐ Costeaning, pitting, and trenching
- ☐ Surface bulk sampling
- ☐ Underground exploration (underground sampling, drilling, blasting, and exploratory adits , as well as associated surface works)
- ☐ Support Activities
- ☐ Access Routes
- ☐ Exploration camps, staging areas, and storage areas
- ☐ Water Supply
- ☐ Solid waste and wastewater management
- ☐ Stakeholder consultation

Note that: depending on the size and scale of proposed activities, surface bulk sampling and underground exploration may require an IEE or EIA under the EIA Procedure (2015).

1. Equipment and personnel requirements

Using the table below, describe the equipment, size and composition of field crews, and proposed working hours/days required to conduct the proposed program.

Type of personnel	**Number**	**Name of contractor (if applicable)**
Geologists		
Land access/environmental		
Field assistants/technicians		
Drilling crew		
Site preparation and rehabilitation (earthmoving)		
Other (provide details)		

Shifts worked per day	**Hours worked per day**	**Days worked per week**

List of Equipment	**Owner/operator**	**Description/capacity**	**Activity/purpose**

2. Seismic and other exploration methods and/or ancillary activities

Are Seismic and any other proposed exploration methods and/or ancillary exploration activities required? If yes, describe the activity(s), site preparation, vegetation clearance, and safety and maintenance requirements.	Yes ☐	No ☐
Add Description:		

3. Drill Site Preparation

If exploration drilling activities are proposed, describe the methods used to prepare sites, including vegetation clearance requirements, site levelling and digging of sumps.
Add Description:

4. Drilling activities

Will exploration drilling activities be conducted? If yes, fill out the below table for each site.	Yes ☐	No ☐

Land Description	Drilling type	Maximum number of drill holes	Maximum drill hole depth (m)	Maximum number of sumps required at each site	Maximum size of sumps (length x depth x width) (m^3)	Average size of each drill pad* (m^2) (no excavation required)	Number of sites requiring pad excavation	Average volume (m^3) of material to be excavated (excluding sumps)
TOTAL								
		(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**

Notes: Column Totals

(1) Total number of drill holes (add each row to calculate the total).
(2) Total meters proposed (maximum number of holes x average depth for each row, then add each row to calculate the total).
(3) Total number of sumps (maximum number of sumps x drill sites for each row, then add each row to calculate the total).
(4) Total volume of sumps (maximum size of sumps x number of sumps for each row, then add each row to calculate the total
(5) Total area of disturbance (number of holes x average size for each row, then add each row to calculate the total).
(6) Total number of pads requiring excavation (add each row to calculate the total).
(7) Total volume of material to be excavated (number of sites requiring excavation x average volume for each row, then add each row to calculate the total).

5. Drill hole construction and decommissioning

Are qualified personnel assigned for implementing the proposed program?	Yes ☐	No ☐
Describe how drill holes will be constructed, including the casing material to be used, depth of casing, if the casing will be cemented, cementing intervals and the class of driller that will install the casing.		
Add Description:		
When describing drill hole decommissioning requirements, include the materials to be used, stratigraphic intervals where cement plugs will be placed, if the casing will be removed and when decommissioning will occur after drilling is completed.		
Add Description:		

6. Costeans and bulk sample disposal pits

Will costeans/bulk sample disposal pits be required for the proposed program? If yes, fill out the table below.	Yes ☐	No ☐

Location	Number of costeans/pits	Size of costean (length x width) (m^2)	Average depth (m)	Volume excavated (m^3)	Total volume excavated (m^3) (number of costeans/pits x volume)	Total area of disturbance* (length x width) (m^2)
TOTAL						
	(1)				**(2)**	**(3)**

Notes: Column Totals

(1) Total number of costeans/pits (add each row to calculate the total).

(2) Total volume of material to be excavated (add each row to calculate the total)

(3) Total area of disturbance (number of costeans/pits x area of disturbance for each row, then add each row to calculate the total). Includes storage of excavated material at the site (e.g. topsoil and subsoil segregation).

7. Costeans and bulk sample disposal pit preparation

If costeans/bulk sample disposal pits are required, describe site preparation methods, vegetation clearance, and safety and maintenance requirements.
Add Description:

8. Sample management

Describe the size of samples collected (including drilling samples and bulk sampling), collection methods, materials used when collecting the sample, sample disposal methods (including removal of sample bags), safety management and any other sample management requirements at the exploration site Include requirements for on-site geological sample management (splitting of archive samples, bag farms, core processing and storage).
Add Description:

9. Access routes to work areas

Provide map or site plan indicating planned access routes. Distinguish between existing and proposed new access tracks.		
Will access off existing tracks be required? If yes, detail the method(s) for gaining access and if vegetation clearance is required. Include the total area of disturbance (includes drill traverses and seismic lines) required off existing tracks (i.e. length (km) and width (m) of new tracks).	Yes ☐	No ☐
Add Description:		
Will existing tracks require upgrading and/or maintenance? If yes, detail the work required to upgrade/maintain existing tracks.	Yes ☐	No ☐
Add Description:		

10. Water supply and management

Will camp and/or drilling water be required? If yes, describe how and where water will be sourced for drilling, track maintenance and camping purposes (e.g. groundwater, surface water, mains). Provide details on the volume of water required and how wastewater or runoff water will be managed.	Yes ☐	No ☐
Add Description:		
If surface water will be used as a water source and/or if mineral drill holes will be used as a water supply well, indicate if a licence for water extraction/usage is required. If yes, attach a copy of the licence. Where a licence has not been obtained, include a statement confirming a licence will be obtained before the extraction and/or usage of water.	Yes ☐	No ☐
Add Description:		

11. Activities affecting water resources

Will any activities affecting water resources be undertaken? If yes, attach a copy of the permit. If a permit has not been obtained, include a statement confirming that a permit(s) will be obtained and provide a description of the site preparation, vegetation clearance, and safety and maintenance requirements.	Yes ☐	No ☐
Add Description:		

12. Management of radioactive or hazardous materials

Will activities be conducted in areas of known uranium and thorium mineralisation? If yes, attach a Radiation Management Plan.	Yes ☐	No ☐
Will any other hazardous material be encountered when exploring in the area? If yes, list the types of hazardous materials and provide a management plan on how these materials will be managed.	Yes ☐	No ☐
Add Description:		

13. Campsites, storage and equipment staging areas

Using the tables below, provide a description of campsites, storage, and staging areas required. Indicate the campsite and storage and staging area on a locality plan.

Campsite details		
Is a campsite required? If no, no further information is required.	Yes ☐	No ☐
What is the maximum number of personnel the campsite will accommodate?		
What will be the total area (ha) of vegetation clearance for the campsite?		
If vegetation clearance is required, describe the methods used to prepare the site?		
Add Description:		
What will be the total area (ha) of disturbance for the campsite(s)?		
Will any excavations be required? If yes, describe the purpose of the excavation and the maximum volume (m^3) of material to be excavated.	Yes ☐	No ☐
Add Description:		
Will the proposed ablution facilities be endorsed/approved for use by the Department of Health or local council, where applicable? If no, provide a reason?	Yes ☐	No ☐
Add Description:		
Provide a description and justification of the camp location (e.g. previously cleared areas etc.), and any other relevant information if required.		
Add Description:		

Storage and staging area details		
Will storage and staging areas be required? If no, no further information is required.	Yes ☐	No ☐
List Storage Areas	Number	Capacity
Oil, Fuel, and Chemical Storage areas		
Water Storage areas		
Other Storage and Staging Areas		
Will the storage and staging area(s) be located at the same location as the campsite?	Yes ☐	No ☐
What will be the total area (ha) of vegetation clearance for storage areas		
If vegetation clearance is required, describe the methods used to prepare the site?		
Add Description:		
What will be the maximum area of disturbance (ha) for the storage and staging area(s)?		
Will any excavations be required? If yes, describe the purpose of the excavation and volume (m^3) of material to be excavated.	Yes ☐	No ☐

D. Environmental Description

INSTRUCTION: *Completion the Environment Description. Include as Part D of the Environmental Management Plan Document.*

1. Proximity to infrastructure and housing

Describe the existing infrastructure (both public and private) may be affected by the Project to determine the extent of impact on the public from noise, dust etc. The following is required: • Settlements – indicate the name and distance of the nearest town, and distance to houses and homesteads from the proposed exploration activity. • Other human infrastructure (e.g. schools, hospitals, commercial or industrial sites, roads, sheds, bores, dams, ruins, pumps, scenic lookouts, railway lines, transmission lines, gas and water pipelines, communication lines (e.g. fibre optic cables)) should be considered if these may be impacted by the exploration activity.
Add Description:

2. Landform and topography

Describe the topography of the area affected by the exploration program. Include susceptibility to erosion and visual attributes (e.g., steep or undulating slopes, plains, rocky outcrops).
Add Description:

3. Soil and surface cover

Describe soil types and soil surface cover in the general area affected by the exploration program. Include details on the susceptibility to compaction, erosion, dust, runoff and any other aspects that may be an issue for disturbance and rehabilitation.
Add Description:

4. Hydrology

Will the proposed program interfere with natural drainage (e.g. drainage lines, creeks, floodplains)? If yes, describe the potential interference.	Yes ☐	No ☐
Add Description:		
Is the program area located within water protection areas? If yes, provide the name(s).	Yes ☐	No ☐
Add Description:		

5. Groundwater

Is groundwater likely to be intersected when conducting the exploration program? If yes, use the table below to describe the expected groundwater (hydrogeological) conditions, and identify groundwater aquifers in the exploration area(s) that may be affected	Yes ☐	No ☐

Description of the locality/area where different groundwater conditions may be encountered					
Add Description:					
Formation age and/or stratigraphic unit	Stratigraphic intervals (depth range) (m)	Aquifer formation name	Aquifer interval/thickness (from–to) (m)	Type of aquifer(s) intersected (e.g. unconfined, confined, artesian)	Provide aquifer salinity, depth to water level and any other relevant comments

6. Natural vegetation

Will you be working within areas of natural vegetation? If yes, provide the following information: • description of the formation and structure of vegetation in the area (e.g. forest, shrubland, grassland) • list of the dominant species.	Yes ☐	No ☐
Add Description:		

7. Significant habitats and flora

Use the table below to list any significant natural habitats and any rare or endangered flora species located or reported to have been in the area that may be impacted by the proposed program. Include known sightings of listed species on a site plan or map.

Species/habitat	**Common name**	**Conservation Status ***

* For species, Conservation status includes extinct, endangered, vulnerable, threatened and rare.

8. Weeds, plants and pathogens

Provide information of the area is affected or potentially affected by pathogens and weeds).
Add Description:

9. Fauna

Describe native and feral fauna that may be present in the area, including feral species.
Add Description:

10. Significant fauna

Use the table below, list any rare or endangered fauna species located or reported to have been in the area that may be impacted by the proposed program. Include known sightings of listed species on a locality plan/map

Species	Common name	Conservation Status*

* For species Conservation status includes extinct, endangered, vulnerable, threatened and rare.

11. Environmentally sensitive locations

Are there any environmentally sensitive locations* within or close to the proposed exploration area. If yes, describe environmentally sensitive locations. Mark these areas on a site plan to identify any areas of conflict so that access roads or other activities can be planned and located effectively.	Yes ☐	No ☐
Add Description:		
Are you likely to impact on the environmentally sensitive area? If yes, detail the likely effects the proposed program may have.	Yes ☐	No ☐
Add Description:		

*Environmental sensitive locations include (i) a forest conservation area (including a biodiversity reserved area); (ii) a public forest; (iii) a park (including marine parks); (iv) a mangrove swamp; (v) any other sensitive coastal area; (vi) a wildlife sanctuary; (vii) a scientific reserve; (viii) a nature reserve; (ix) a geophysically significant reserve; (x) any other nature reserve nominated by the Minister; (xi) an important bird area; and (xii) a key biodiversity area.

12. Cultural Heritage and Archaeological site

Are there any cultural heritage sites or archaeological sites or sites of historical significance within or close to the proposed exploration area. If yes, provide a description of identified cultural heritage or archaeological sites. Mark these areas on a locality plan to identify any areas of conflict so that access roads or other activities can be planned and located effectively.	Yes ☐	No ☐
Add Description:		
Are you likely to impact on the cultural heritage or archaeological sites? If yes, detail the likely effects the proposed program may have.	Yes ☐	No ☐
Add Description:		

E. Environmental Impacts and Mitigation Measures

1. Impacts

Most initial exploration activities are relatively non- intrusive and have limited, short-term impacts on the environment. The main environmental concerns are summarized in Table E.1

Access during initial exploration is seldom intensive and work camps are normally tent based, supporting a few people for short periods of time; In most areas, the main environmental effect associated with initial exploration is noise from aircraft during airborne surveys, which can affect wildlife; Line cutting for geophysical surveys results in environmental effects of varying magnitude, depending on the width of the cut lines that are cut and the number of lines.

The risk of environmental effects increases as exploration becomes more intensive; Diamond drilling is generally more extensive during advanced exploration, leading to increased risk of effects on the environment. For example, access roads may be required; Drilling also requires the preparation of drill sites; the transportation, storage and handling of fuel; and the establishment of campsites for drilling and geological crews, facilities to deal with drilling waste, and an infrastructure to manage and supply the camp.

In addition, the collection of bulk samples may result in the release of contaminants to water and air, as well as noise and vibrations that may affect wildlife; The accommodation and infrastructure requirements of advanced exploration programs can also have effect. Though bulk sampling is an advanced exploration activity, it has the potential to generate environmental effects similar to those of the mine operations phase.

2. Low Impact Exploration Activities

Some exploration activities are considered to have low potential for environmental and social impacts[1], as long as they do not occur within sensitive environments. Such activities include:

i. Reconnaissance;
ii. Cultural clearance surveys;
iii. Soil sampling;
iv. Geological mapping;
v. Geochemical surveys—surface sampling;
vi. Rock-chip sampling;
vii. Sampling using hand held augers;
viii. Fly camps comprising tents for short periods of time (days);
ix. Small, short term camp sites defined as:
    a. Having a maximum of 5 people;

[1] Generic program for environment protection and rehabilitation—low impact mineral exploration in South Australia; NOTICE given in accordance with section 70B (8) of the Mining Act 1971 and regulation 66 (1) of the Mining Regulation 2011; South Australian Government Gazette 44:2774–2780 30 June 2011.

b. Required for a maximum time period of one month;

x. Equipment limited to a maximum of two trailers, tents, and generators;

xi. Low impact exploration equipment; and

xii. Use of 4WD vehicles, ATVs and/or Quad bikes on off existing tracks required to conduct the above listed activities.

Table E.1 Main Environmental Concerns During Exploration

Activity	Potential Environmental Concerns
Access Line Cutting	• Impacts on soils and vegetation • Possible concerns with terrestrial/wildlife habitat and stream crossings
Field Camps	• Sewage and garbage disposal, water supply, fuel storage • Impacts on soils and vegetation • Impacts on terrestrial/wildlife habitat, access to remote areas
Airborne Geophysical Surveys	• Possible impacts on wildlife from airborne surveys
Trenching/Pitting	• Impacts on soils and vegetation • Physical scarring/land disturbance • Acid generation from exposed sulphide minerals • Metal leaching • Sediment erosion • Impacts on wildlife of blasting
Drilling	• Water supply, drilling fluid disposal, fuel storage/risk of spills, groundwater contamination • Impacts on soils and vegetation • Physical scarring/land disturbance • Acid generation from exposed sulphide minerals • Release of metal-bearing groundwater
Bulk Sampling	• All of the above impacts - but potentially greater impacts are possible, and reclamation needs to be considered • Dewatering of historic mine workings may have impacts on receiving water quality
Exploratory Mining	• Potential impacts can occur that are similar to those during full-scale mining operations, although of a smaller scale

Source: Environment Canada, 2009. Environmental Code of Practice for Metal Mines

3. Impact Assessment and Mitigation Measures

A general environmental impact assessment – mitigation matrix is provided Annex 1. It is divided into two parts. Table A1.1. *Environmental Impacts and Mitigation Measures for All Exploration and Prospecting Activities* describes potential environmental impacts associated with exploration regardless of the exploration method or technique. A generic set of mitigation measures is recommended. These generic measures are required for all exploration projects.

Table A1.2 *Environmental Impacts and Mitigations for Exploration Techniques* the describes the impacts associated specific geological, geochemical, geophysical techniques, and exploratory mining. A set of mitigation measures is recommended for these impacts. The Project Proponent is required select the necessary mitigation measures based on the specific exploration methods and techniques that will be utilized.

INSTRUCTION: *Prepare a combined impact-mitigation table by combining all of Table A1.1 with impacts and mitigation measures associated specific exploration methods and techniques (Table A2.1) that will be utilized by the Project. Include the Table in Part E of Environmental Management Plan Document.*

4. Narrative Description of the Impacts and Proposed Mitigation Measures.

INSTRUCTION: *Based on the Combined Impacts-Mitigation Table, provide a narrative description of the each of the impacts and the proposed mitigation measures for the Project. Include in Part E of Environmental Management Plan Document.*

The narrative description should describe site specific mitigation measures to taken to avoid, prevent, and minimize impacts as well as measures for site rehabilitation. The narrative description should describe measures (see Table E.2) for:

i. Site Photography and Inspection;
ii. Stakeholder Communication;
iii. Community Health and Safety;
iv. Occupation Healthy and Safety;
v. Dust and Noise;
vi. Waste management;
vii. Environmental Protection and Conservation;
viii. Community Development;
ix. Social and Cultural Heritage;
x. Emergency Response; and
xi. Rehabilitation.

Table E.2. Required Environmental Management and Rehabilitation Measures

Environmental Management Measures	Objective	Main Elements to detailed in the Narrative Description
Site Photography and Inspection	Document changes in environmental conditions of the site. Demonstrate the success of rehabilitation activities	Before and after exploration, the site must be photographed as proof of the site condition prior to disturbance Filing and dating of all reports (including photographic documentation of rehabilitation initiatives) A final site inspection to be conducted and documented 6 months after all activities associated with the exploration initiative has been competed
Stakeholder communication	Provide a platform for stakeholders to raise grievances and receive feedback and hence minimize negative conflict	Communication Plan Communication plan to indicate the future of the project (i.e. further drilling activities and/or an Application for a Mining License) Access Agreements Safety and Security Measures
Community Health and safety	Safeguard health and safety of the general public	Road Safety and Traffic Management Fire Safety Site Access Restrictions
Occupational Health and Safety	Safeguard health and safety of staff	Occupation Health and Safety Training Personal Protective Equipment Safety around drill holes and other work areas Worker Accommodations
Dust and noise	Avoid and where not possible minimise dust and noise	Dust control Noise Control
Waste management	Avoid and where not possible minimise all pollution associated with exploration	Hazardous materials handling, storage, and disposal Domestic wastewater from exploration camps Solid waste management and disposal Residual sample disposal

Environmental Management Measures	Objective	Main Elements to detailed in the Narrative Description
Environmental protection and conservation	Minimise exploration activity footprint and safeguard biodiversity in ecologically sensitive areas	Awareness training regarding the provisions of the EMP as well as the importance of protecting environmental resources Protection and Conservation of Vegetation Protection and Conservation of Soils Protection and Conservation of Fauna Selection of Drill Site Locations Disposal of Drilling Fluids, drill cutting, and produced water Rehabilitation
Community Development	Ensure due consideration is given to matters regarding the general well-being of any communities Provide for community benefits to offset adverse impacts	
Cultural Heritage	Ensure due consideration is given to matters regarding the cultural and general well-being of the affected community	Avoidance and protection of Archaeology Sites Avoidance and protection of cultural heritage sites
Emergency Response	To respond quickly and effectively to fire and other emergencies	Ensure that the relevant staff are informed and fully trained with respect to local fire hazard conditions, fire susceptibility and emergency procedures. Appropriate fire-fighting equipment should be maintained at the site and fitted to all exploration vehicles and machinery Familiarization of all staff with Emergency Response Procedures
Rehabilitation Plan	To return site to original environment conditions	Filling of all drill holes Closing or covering of all adits, shafts, test pits and trenches Revegetation Removal of all support infrastructure Removal of surface equipment and machinery Removal of underground equipment and machinery

5. Environmental Quality Monitoring Programs.

INSTRUCTION: *Where necessary, prepare the environmental quality monitoring programs and include in Part E of Environmental Management Plan Document*.

In some exploration projects, it will be necessary to monitor air quality, water quality, noise, and/or biological components. An indicative environmental quality monitoring program is presented in Table E.3. The Project Proponent should contract a qualified third party environmental monitoring consultant to design and conduct the monitoring.

Table E.3. Indicative Environmental Quality Monitoring Program

Environmental Component	Locations	Monitoring Method	Monitoring frequency and timing	Monitoring Responsibility
Surface Water Quality	At water bodies affected by exploration activities	**Parameters:** Temperature, Suspended particulates, BOD, COD, pH, Hydrocarbons **Standards;** Myanmar Environmental Quality (Emission) Standards	*Project dependent*	Exploration Manager
Air Quality	At key receptors: e.g., residential, education, religious and healthcare sites within or the exploration area	**Parameters:** Suspended particles (dust), NOx, SOx, CO **Standards;** Myanmar Environmental Quality (Emission) Standards	*Project dependent*	Exploration Manager
Noise	At key receptors: e.g., residential, education, religious and healthcare sites within or near the exploration area	**Parameters:** Db(A) at receptors outside and inside. **Standards;** Myanmar Environmental Quality (Emission) Standards	*Project dependent*	Exploration Manager

F. Environmental and Social Management System

The Proponent is to establish an environmental and social management system for the implementation, supervision, and monitoring of the environmental management plan (EMP).

INSTRUCTION: *The description of the Environmental and Social Management System is to be included in Part F of Environmental Management Plan Document.*

The description of the ESMS should include: (i) the proposed environmental and social staff; (ii) a description of the staff roles and responsibilities; (iii) the procedures for supervision of the implementation, and monitoring compliance with the EMP; (iv) training requirements (if necessary); and (v) monitoring and reporting requirements.

1. Recommended Roles and Responsibilities for Implementation of the EMP

a) Environmental Coordinator

It is recommended that the Proponent appoint an Environmental Coordinator. The Environmental Coordinator will inspect the exploration area every three months[2] to ensure compliance with the EMP. The duties of the Environmental Coordinator are to:

i. Advise the Exploration Team on the implementation of the EMP;
ii. Conduct sire visits to ensure all work in compliance with the EMP;
iii. Conduct site inspection every three months:
iv. Conduct inspections of rehabilitation areas and give guidance on rehabilitation measures;
v. Prepare quarterly environmental reports and on EMP implementation including the status of all rehabilitation measures; and
vi. Submit semi-annual environmental monitoring report to Environmental Conservation Department and Department of Mines of the Ministry.

b) Exploration Manager

The duties of the Exploration Manager (EM) and/or his designated staff are to:

i. Familiarize themselves with the requirements of the EMP,
ii. Monitor employees' and contractors' compliance with the EMP and enforce adherence;
iii. Maintain a record of activities relevant to environmental management;
iv. Communicate all environment related incidents with the Environmental Coordinator and take correct action to avoid repeat problems; and
v. Prepare monthly report on compliance with the EMP for submission to the Environmental Coordinator.

[2] If there is no prospecting or exploration activity during the rainy season, there may be no need for inspection during the rainy season. However, it is recommended that quarterly inspection be undertaken when prospecting and exploration is ongoing.

The exploration manager shall be responsible for monitoring and the enforcement of the environmental management plan measures on a day-to -day basis. Any non- compliance with the EMP is to be recorded and corrective action undertaken and documented.

c) Proponent's Senior Personnel and Contractors

The duties of the senior personnel/ contractors are:

i. Familiarize themselves with the requirements of the EMP;
ii. Ensure that all team members are familiar with the requirements of the EMP; and
iii. Comply with the requirements of the EMP.

2. Proponents Financial Commitment.

INSTRUCTION: *Include the following paragraph in Part F of Environmental Management Plan Document*.

"The Project Proponent agrees to provide sufficient human resources and financial commitments for (i) the implementation of all of the activities described in this EMP. and (ii) supervision, monitoring, and reporting on the project implementation".

3. Compliance with Environmental Quality Standards

INSTRUCTION: *Include the following paragraphs on Environmental Quality Standards in Part F of Environmental Management Plan Document*.

a) Effluent Standards for Mining Sites

The following standards apply to all mining activities including runoff and discharges from drill sites, sumps, pit, trenches, bulk sampling, underground exploration mining and waste rock. The standards also apply to runoff and discharges from roads, construction work sites and temporary sedimentation ponds.

Table F.1. Effluent limit values for exploration and mining sites

Parameter	Unit	Effluent Limit Value	Reference
Arsenic	mg/l	0.1	Myanmar National Environmental Quality (Emission) Guidelines, December 2015.
Cadmium	mg/l	0.05	As above
Chemical oxygen demand	mg/l	150	As above
Chromium (hexavalent)	mg/l	0.1	As above
Copper	mg/l	0.3	As above
Cyanide	mg/l	1	As above
Cyanide (free)	mg/l	0.1	As above
Cyanide (weak acid dissociable)	mg/l	0.5	As above
Iron (total)	mg/l	2	As above
Lead	mg/l	0.2	As above
Mercury	mg/l	0.002	As above
Nickel	mg/l	0.5	As above
pH	S.U.[a]	6-9	As above
Temperature	°C	<3 degree differential	As above
Total suspended solids	mg/l	50	As above
Zinc	mg/l	0.5	As above

b) Effluent Standards for Work Camps, Sanitary Facilities, Domestic Wastewater

The following standards apply to domestic wastewater, and discharges, drainage and runoff from work camps, sanitation facilities and landfills.

Table F.2. Wastewater, Storm Water Runoff, Effluent and Sanitary Discharges

Parameter	Unit	Guideline Value	Reference
5-day Biochemical oxygen demand	mg/l	50	National Environmental Quality (Emission) Guidelines, December 2015
Ammonia	mg/l	10	As above
Arsenic	mg/l	0.1	As above
Cadmium	mg/l	0.1	As above
Chemical oxygen demand	mg/l	250	As above

Chlorine (total residual)	mg/l	0.2	As above
Chromium (hexavalent)	mg/l	0.1	As above
Chromium (total)	mg/l	0.5	As above
Copper	mg/l	0.5	As above
Cyanide (free)	mg/l	0.1	As above
Cyanide (total)	mg/l	1	As above
Fluoride	mg/l	20	As above
Heavy metals (total)	mg/l	10	As above
Iron	mg/l	3.5	As above
Lead	mg/l	0.1	As above
Mercury	mg/l	0.01	As above
Nickel	mg/l	0.5	As above
Oil and grease	mg/l	10	As above
Ph	S.U.[a]	6-9	As above
Phenols	mg/l	0.5	As above
Selenium	mg/l	0.1	As above
Silver	mg/l	0.5	As above
Sulphide	mg/l	1	As above
Temperature increase	°C	<3[b]	As above
Total coliform bacteria	100 ml	400	As above
Total phosphorus	mg/l	2	As above
Total suspended solids	mg/l	50	As above
Zinc	mg/l	2	As above

[a] Standard unit

[b] At the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity; when the zone is not defined, use 100 meters from the point of discharge.

c) Ambient Air Quality Standards

Air quality should not exceed the levels presented in Table F.3.

Table F.3. Ambient air quality standards

Substance	Averaging Period	Standard µg/m^3	Reference
Sulphur dioxide	24 hours 10 minutes	20 500	Myanmar National Environmental Quality (Emission) Guidelines, December 2015.
Nitrogen dioxide	1 year 1 hour	40 200	As above
Particulate matter PM_{10}	1 year 24 hours	20 50	As above
Particulate matter $PM_{2.5}$	1 year 24 hours	10 25	As above
Ozone	8-hour daily maximum	100	As above

d) Ambient Noise Standards

Noise impacts should not exceed the levels presented in Table F.4, or result in a maximum increase in background levels of 3 dB at the nearest receptor location off-site.

Table F.4. Ambient noise standards

Receptor	One Hour L_{Aeq} (dBA)		Reference
	Daytime 07:00-22:00	Nighttime 22:00-07:00	
Residential, institutional, educational	55	45	Myanmar National Environmental Quality (Emission) Guidelines, December 2015.
Industrial, commercial	70	70	As above

e) Air Blasting[3]

The maximum level for air blasting is 115 dB Linear. The level of 115 dB Linear may be exceeded on up to 5% of the total number of blasts over a period of 12 months; however, the level should not exceed 120 dB Linear at any time. Blasting is only permitted during daylight hours.

The recommended maximum level for ground vibration is 5 mm/s (peak particle velocity ppv). The ppv level of 5 mm/s may be exceeded on up to 5% of the total number of blasts over a period of 12 months. The level should not exceed 10 mm/s at any time.

[3] Australian and New Zealand Environment Council (ANZEC) Guidelines, 1990 and Best Practice Environmental Management in Mining, Noise, Vibration and Air Blast Control, Environment Australia, 1998.

G. Environmental Management Plan Budget and Implementation Schedule

1. Budgeting

INSTRUCTION: *Prepare the cost estimate for the Environmental Management Plan. Include in Part G of Environmental Management Plan Document.*

Environmental management costs need to be carefully estimated. Costs are to be included in the overall Exploration Project Budget (see example – Table G.1). Costs include:

i. Cost of all mitigation measures;
ii. Cost of all rehabilitation measures;
iii. Cost of all environmental monitoring programs;
iv. Costs of all environmental staff of the contractor, exploration team, Proponent Environmental Coordinator; and
v. Costs of all training programs

Table G.1 Indicative Environmental Management Plan Cost Estimate

Item	Cost	Comment
Mitigation Measures		
Measure 1		
Measure 2		
Rehabilitation Measures		
Measure 1		
Measure 2		
Measure 3		
Environmental Monitoring Programs		Normally contracted out to qualified environmental monitoring agencies. However, the cost must be estimated.
Program 1		
Program 2		
Environmental Staff		
Contractor		e.g., x person months
Exploration Team (e.g., Exploration Manager, Environment Officer, Senior Staff		e.g., x person months
Proponent Environmental Coordinator		e.g., x person months
Training Programs		
Vehicles and Equipment		If necessary
Subtotal		
Contingency (10% of subtotal cost)		
TOTAL COSTS		To be included in project costs.

2. Scheduling

INSTRUCTION: *Prepare the Schedule for Implementation of the Environmental Management Plan. Include in Part G of Environmental Management Plan Document*.

Implementation of the mitigation and rehabilitation measures and the environmental monitoring requirements need to be planned to coincide with the project schedule. Environmental staff mobilization and training programs needs be included in the schedule. Environmental Monitoring reports on implementation of the EMP need to be scheduled as well.

Scheduling Guidelines. Environmental staff should be in place prior to the start of the Project. Environmental staff of the contractor should be trained prior to the start of work.

Implementation of the environmental mitigation measures needs precede or coincide with relevant exploration activities. Rehabilitation programs should begin as soon as possible after the completion of an exploration activity.

Environmental quality monitoring programs should be scheduled taking into account the exploration program scheduling and seasonal characteristics.

H. Conclusion

INSTRUCTION: *Prepare the Conclusion Section of the Environmental Management Plan. Include in Part H of Environmental Management Plan Document.*

The Conclusion should highlight the main environmental and social impacts and describe the mitigation measures and rehabilitation programs to address the impacts.

The Environmental and Social Management System for implementation, supervision, and monitoring of the environmental management plan (EMP) is to be described.

The budgeted amount for the EMP is to be included.

This section should come to a conclusion as to whether or not the project can be implemented without *significant adverse environmental and social impacts*.

Annex 1 – Environmental and Mitigation Measures

Table A1.1. Environmental Impacts and Mitigation Measures Required for All Exploration and Prospecting Activities

Environmental and Social Components	Potential impacts	Mitigation Measures	Ref.
Stakeholders: Landholders Communities Forest Department/MONREC State/Regional Government DGSE/MONREC	Interference to: Existing or permissible land use (includes loss of income, noise, dust, light and other emissions). Buildings, structures, existing roads and roads and tracks or other infrastructure. Aesthetic values of an area. Damage to infrastructure and loss of income through fire Noncompliance with Mining Law and Environmental Conservation Law	Consultation and liaison with landholders including clear and open discussions regarding access Obtain necessary agreements approvals and authorizations Compensation program for damage	GEMP
Flora and Fauna, especially protected species	Loss modification of natural vegetation and associated habitat Loss/modification of the environment (biological, social and economic) through the introduction of weeds and pathogens. Degradation caused by third party access (includes previously closed and rehabilitated access roads and tracks).	Appropriate fire control strategies Use existing roads and tracks where possible Prevent third party excess by disguising entry and exit point to off track exploratory areas All garbage (including food waste) is to be removed exploration areas – reducing likelihood of attracting scavenging animals Vehicles and equipment must be thoroughly cleaned prior to entry into exploration areas from existing roads and tracks - to prevent spread of weeds and soil/plant diseases	GEMP

Environmental and Social Components	Potential impacts	Mitigation Measures	Ref.
Farmland/ Landholders	Loss or damage to crops	Appropriate fire control strategies Use existing roads and tracks where possible Vehicles must be thoroughly cleaned prior to entry into exploration areas from existing roads and tracks - to prevent spread of weeds and soil/plant diseases Adhere to agreements with Landholders Compensation program for losses	GEMP
Farmland/ Landholders	Loss of livestock	No pets allowed on site. Appropriate speed limits are to be adhered to Consultation and liaison with landholders including clear and open discussions regarding access Compensation program for losses	GEMP
Soil and Water Bodies	Disturbance to the soil profile and topography, and accelerated soil erosion caused by ground compaction at laydown areas and camps	Revegetation of disturbed areas	
Soil and water bodies	Soil and water erosion Degradation caused by third party access (includes previously closed and rehabilitated access roads and tracks).	Prevent third party excess by disguising entry and exit point to off track exploratory areas Select appropriate vehicles for the activity requirements Use existing roads and tracks where possible Appropriate speed limits are to be adhered to Avoid stream crossings Reduce or stop vehicle movements during rainy season	GEMP

Environmental and Social Components	Potential impacts	Mitigation Measures	Ref.
Soil and water bodies	Soil and water contamination due to operation of exploration camps. Disturbance to soil profile and topography, and accelerated soil erosion caused by ground compaction at laydown areas and camps	All domestic and industrial waste is disposed at designated disposal sites. Fuel and hazardous chemicals to be stored in bunded[1] areas Soil rehabilitation and revegetation of disturbed areas	GEMP
Cultural heritage sites	Damage or disturbance to cultural heritage.	Locate all sites on a map; create a buffer zone to avoid impact Employees, contractors, and visitors to take an induction program on heritage protection measures.	GEMP
Archaeological Sites	Damage or disturbance to archaeological	Locate all sites on a map; create a buffer zone to avoid impact Implement a chance find procedure	RRE
Communities	Risks to community health and safety	Use appropriate warning signage when working in areas accessible to the public Avoid working in publicly accessible areas during peak tourist times Adopt appropriate traffic management strategies	GEMP
General public, employees, contractors and the environment	Contamination of the environment when exploring for known uranium and thorium deposits. Public and employee/contractor exposure to low level radiation.	Use appropriate warning signage when working in areas accessible to the public	GEMP

GEMP - Generic program for environment protection and rehabilitation—low impact mineral exploration in South Australia; NOTICE given in accordance with section 70B (8) of the Mining Act 1971 and regulation 66 (1) of the Mining Regulation 2011; South Australian Government Gazette 44:2774–2780 30 June 2011.

[1] A bunded area is a storage site with a constructed retaining wall around storage "where potentially polluting substances are handled, processed or stored, for the purposes of containing any unintended escape of material from that area until such time as remedial action can be taken.

Annex 1 – Environmental Impacts and Mitigation Measures

Table A1.2 Environmental Impacts and Mitigation Measures for Exploration Techniques

Exploration Techniques	Potential impacts	Mitigation Measures	Ref.
1. Geological Mapping	Low impact - associated with markers, marker tape, and access by vehicles along pre-existing roads and tracks	Restrict the use of marker tape to a minimum. Markers should be removed from the area at the completion of the survey	VEMG
2. Geochemical Sampling	Low impact – soil sampling either grid or irregular associated with markers, marker tape, and access by vehicles along pre-existing roads and tracks	Restrict the use of grid markers to the minimum required to conduct the survey. Sample points should be rehabilitated after samples are taken by filling holes with soil from the immediate area, and covering with leaf or ground litter. Markers should be removed from the area at the completion of the survey Care should be taken when accessing and sampling a stream to minimize disturbance to banks, riparian and aquatic vegetation, and the stream bed	VEMG
3. Geophysical Surveys			
3.1 Airborne Surveys	Short disturbance due to use of low flying aircraft.	Prior to the commencement of surveys, notice should be either in person or by way of advertisement in the local newspaper, in the intended area of flying. The information provided should include details of the proposed work program, it timing, and likely duration.	VEMG
3.2 Gravity and Magnetic Surveys	The impact of such surveys is generally negligible. Undertaken with small readily portable instruments. Surveys are usually carried out by a team of up to three persons who take readings across a grid.	None required.	VEMG

Exploration Techniques	Potential impacts	Mitigation Measures	Ref.
3.3 Resistivity, Induced Polarization and Electromagnetic Surveys	Excavation of small shallow holes up to 500mm deep and 1m square. Electrical hazard to people livestock and wildlife	Care should be taken when laying out and retrieving cables so that damage to vegetation is kept to a minimum. When conducting surveys involving cables which carry high currents, require that all reasonable measures be taken to prevent harm to people, livestock and wildlife (e.g., provide warning signs near the survey area boundaries)	VEMG
3.4 Seismic surveys	Noise and ground vibration resulting from the sub-surface detonation of small explosive charges. Access Vegetation Clearing	Require that charge sizes be kept to the minimum necessary Transport, handling, loading and detonation of explosives be in accordance with the relevant government regulations Require that the detonation of explosive charges, whenever reasonably possible, be restricted to such times as will not unduly annoy or disturb people in the area Require that auger and detonation holes be rehabilitated and made safe by refilling with topsoil and subsoil as soon as practicable after the survey is completed.	VEMG
3.5 Drilling – General	Impacts arise from drill pad construction, access to the drill site, sump construction, temporary noise, and intersection of groundwater. Loss/modification of natural vegetation and associated animal habitats through the clearance of vegetation Entrapment of fauna through open drill holes and excavations. Soil/vegetation contamination (e.g. hydrocarbons, rubbish, drill	Drill sites be confined to the smallest area in which it is reasonably practicable to conduct operations. Topsoil is to be removed during drill pad preparation, this be stockpiled for use when rehabilitating the site. At the completion of drilling, the topsoil is to be re spread and, where appropriate, the area revegetated with species consistent with the surrounding vegetation. In all drilling samples taken from the drill holes are either placed back down the drill holes, removed from the site or blended in with the topsoil in the vicinity of the drill hole.	VEMG

Exploration Techniques	Potential impacts	Mitigation Measures	Ref.
	samples/cuttings, domestic wastewater, other sources). Disturbance to the soil profile and topography, and accelerated soil erosion caused by exploration activities (e.g. construction of sumps, new roads and tracks and drill pads. Groundwater contamination: • contamination of aquifers through entry of pollutants from the surface water • interconnection between aquifers • degradation of natural hydrostatic conditions (maintain pre-drilling pressures). Impacts on Soil/vegetation/fauna due to discharges of groundwater into the surrounding environment Interference to existing water users when extracting ground water from existing dams, water bores or mineral drill holes.	For downhole logging methods using a low emission radiation source housed in the probe, comply with regulations covering the use, handling and transport of radiation source. In the case of a radiation source lost down a drill hole, all reasonable steps to ensure that the source is recovered. If recovery is impracticable, the source may be sealed down the drill hole with the permission of Department of Mines. Rehabilitation of the drill pad may require ripping where the ground has become compacted during operations. On cleared land, further tillage may also be required. In areas supporting native vegetation, tillage and seeding with species native to the area may be needed. Re-contouring may also be required, to return the land as near as practicable to the original topography. Where a drill hole intersects an aquifer or stratigraphic layer containing significant groundwater, notification of the of MONREC of the existence of, and depth to the groundwater layer. If substantial quantities of groundwater are encountered and the flow of water cannot be contained within the rig circulatory system, cease until arrangements are made for a suitable disposal method as approved by the relevant authorities.	
3.5.1 Auger Drilling	Low impact	Auger holes to be rehabilitated and made safe by refilling with topsoil and subsoil.	VEMG
3.5.2 Open Hole Percussion, Reverse Circulation and Rotary Air Blast Drilling	The noise of such drilling may be high in the immediate vicinity of the rig. Some dust may also be generated by this drilling method.	There is usually little evidence that the drill hole has been drilled after the rig has left, and the drill hole filled in. In instances where groundwater is encountered, or where water needs to be injected down the drill hole	VEMG

Exploration Techniques	Potential impacts	Mitigation Measures	Ref.
		to recover the samples, the sample collecting container should be of sufficient size to allow decanting of the water while retaining the sample, rock chips etc.	
3.5.3 Diamond Drilling	See General Drilling	Portable, self-contained sumps should be used. Where this is not practicable, a sump may need to be excavated. The excavated sump be of sufficient size to contain drilling fluids, well-constructed, and lined with a suitable impermeable membrane such as plastic. Topsoil be stockpiled separate from the subsoil, adjacent to the sump excavation. At the completion of drilling, the sump is to be drained, the liner removed and the sump excavation filled in, with the subsoil replaced first and the topsoil replaced last. Liners and sump contents be disposed of at a site approved for the disposal of such waste	VEMG
3.5.4 Rotary Mud	See General Drilling	Portable, self-contained sumps should be used. Where this is not practicable, a sump may need to be excavated. The excavated sump be of sufficient size to contain drilling fluids, well-constructed, and lined with a suitable impermeable membrane such as plastic. Topsoil be stockpiled separate from the subsoil, adjacent to the sump excavation. At the completion of drilling, the sump is to be drained, the liner removed and the sump excavation filled in, with the subsoil replaced first and the topsoil replaced last. Liners and sump contents be disposed of at a site approved for the disposal of such waste	VEMG

Exploration Techniques	Potential impacts	Mitigation Measures	Ref.
3.5.5 Wide Diameter Drilling	See General Drilling	Standard license conditions require that drill holes be back filled and samples removed from the surface at the completion of drilling. Samples which are not required should be used as back fill. Supplementary back fill material, from off-site, may be needed to completely fill the drill hole.	VEMG
3.6.1 Costeaning, Pitting, and Trenching	Impacts of trenching are erosion on steeper slopes, damage to vegetation through excavation or clearing for equipment access and mixing of topsoil with the subsoil Loss/modification of natural vegetation and associated animal habitats through the clearance of vegetation Entrapment of fauna through open drill holes and excavations. Alteration to surface hydrology – interference to surface drainage	Unnecessary removal of vegetation should be avoided. Where it is necessary to remove vegetation, trees should be cut rather than removed (see 2.4). Trenches should be sited to minimize damage to the roots of large trees (as a rule of thumb the roots can be assumed to extend as far laterally as the crown). Trenching should not be carried out on slopes greater than 10 degrees without prior written approval of the Department of Mines. Trenches, other than ditch witch trenches, excavated topsoil and subsoil be stockpiled separately Trenches are to be refilled and compacted. This should be undertaken as soon as practicable after excavation and preferably within 24hours. Where trenches are left open for longer than 24 hours and the safety of the public is at risk, temporary fencing should be erected. Where trenches are left open for longer than 24 hours, one end should be gently sloped to allow trapped animals to escape. Trenches should initially be refilled to above the natural ground level to allow for settlement. Subsoil is to be replaced first and the topsoil is to be replaced last and that rehabilitation be undertaken to achieve final revegetation with species consistent with the surrounding vegetation As refilled trenches have a tendency to settle over time, trenches should be checked and maintained	VEMG

Exploration Techniques	Potential impacts	Mitigation Measures	Ref.
		regularly during the term of the license. Additional topsoil may be required to top up the level in trenches which have settled to below the natural ground surface.	
3.6.2 Surface Bulk Sampling	Involves the removal of large quantities of material from the site. Loss/modification of natural vegetation and associated animal habitats through the clearance of vegetation The possible impacts of bulk sampling are erosion on steeper slopes, damage to vegetation through excavation or clearing for equipment access and mixing of topsoil with the subsoil Entrapment of fauna through open drill holes and excavations Alteration to surface hydrology – interference to surface drainage Groundwater contamination: • contamination of aquifers through entry of pollutants from the surface water • interconnection between aquifers • degradation of natural hydrostatic conditions (maintain pre-drilling pressures).	Where bulk sampling is proposed, an IEE or EIA may be needed under the EIA Procedure (2015). Excavated topsoil and subsoil be stockpiled separately Where excavations are left open for longer than 24 hours and the safety of the public is at risk, temporary fencing should be erected. Standard license conditions provide that the Where excavations are left open for longer than 24 hours, one end should be gently sloped to allow trapped animals to escape. The removal of material from bulk sampling sites will often result in insufficient material to completely refill the excavation. Wherever possible excavations should be backfilled to surface. This can be achieved by importing clean fill from elsewhere on the site or from a location convenient for back loading of trucks. Where back filling is not possible, standard license conditions require that rehabilitated excavations be battered to slopes not exceeding 1v:3h. Wherever possible, unfilled excavations should be self-draining. Where complete or partial refilling is required using local or imported fill material, excavations should initially be refilled to above the natural ground level to allow for settlement. Excavations are to be refilled such that subsoil is replaced first and the topsoil is replaced last and that rehabilitation be undertaken to obtain final	VEMG

Exploration Techniques	Potential impacts	Mitigation Measures	Ref.
		revegetation with species consistent with the surrounding vegetation. Where there is potential for erosion, as on steeper slopes, erosion control measures such as cut-off drains and silt traps should be constructed. As refilled excavations have a tendency to settle over time, they should be checked and maintained regularly during the term of the license. Additional topsoil may be required to top up the level in excavations which have settled to below the natural ground surface	

Exploration Techniques	Potential impacts	Mitigation Measures	Ref.
Underground Exploration	Waste rock Mine wastewater Loss/modification of natural vegetation and associated animal habitats through the clearance of vegetation Soil/vegetation contamination (e.g. hydrocarbons, rubbish, drill samples/cuttings, domestic wastewater, other sources). Alteration to surface hydrology – interference to surface drainage Groundwater contamination: • contamination of aquifers through entry of pollutants from the surface water interconnection between aquifers • degradation of natural hydrostatic conditions (maintain pre-drilling pressures). • Impacts on oil/vegetation/fauna due to discharge of groundwater into the surrounding environment	On completion of underground exploration and development works surface access (shaft, adit or decline), if no longer required, be permanently closed off and the site made safe for the public. Access points may be capped and/or back filled. Surface facilities associated with underground works, if no longer required, must be removed and the disturbed surface area rehabilitated.	VEMG

VEMG - Exploration and rehabilitation of mineral exploration sites. Guidelines for Environmental Management in Exploration and Mining. Minerals and Petroleum Division, Earth Resources. Government of Victoria, Australia.

http://earthresources.vic.gov.au/earth-resources-regulation/licensing-and-approvals/minerals/guidelines-and-codes-of-practice/exploration-and-rehabilitation-of-mineral-exploration-sites

Annex 2 – Prospecting and Exploration Techniques

1. Geological Mapping

Geological mapping involves the search for and examination of rock outcrops and exposures within the license area. It is usually carried out on foot, and may involve taking small rock samples using a geological hammer. Sample sites or sites of interest may be tagged using colored tape or other means. Access to the mapping area is usually by conventional two- or four- wheel drive vehicle along pre-existing roads and tracks.

2. Geochemical Sampling

Geochemical sampling may be divided into two categories: surveys where samples are collected from intervals in a regular grid pattern, and surveys where samples are taken in an irregular pattern, such as in stream sampling. Small samples are taken using a variety of hand tools, including hand augers.

a) Regular Grid Surveys

Surveys involving a regular grid usually utilize a system of marker pegs or other means of identifying grid positions. As they are regularly spaced, the markers are often visible, particularly looking along grid lines. Minor vegetation trimming or removal may be required. Surveys usually involve a survey team to lay out the grid, and may involve a second team to collect the samples. Access to the area is generally by conventional two- or four-wheel drive vehicle using pre-existing tracks.

Sampling usually involves taking small soil samples from locations on the grid, using hand tools such as a shovel or small diameter hand auger. The impact of sampling is normally very small, and the sample sites are usually difficult to find after the sample has been taken, except for the existence of the marker tape or peg. To minimize the impact, licensees should restrict the use of grid markers to the minimum required to conduct the survey. Sample points should be rehabilitated after the sample is taken by refilling the hole with soil from the immediate area, and covering with leaf or ground litter. Markers should be removed from the area at the completion of the survey.

b) Irregular Sampling Surveys

Irregular sampling surveys, usually involve sampling of stream sediments and the taking small samples from the stream bed, by one or two persons on foot. Sample size is usually about 1kg. Access to the area is by vehicle, usually using pre-existing tracks, and impact on the area is minimal. Marker tape may be used to indicate where a sample was taken, and is usually attached to vegetation on the adjacent stream bank.

3. Geophysical Surveys

Geophysical surveys are carried out to measure physical properties of subsurface rocks using various types of electronic equipment. Geophysical surveys can be either airborne or ground surveys. In most cases, geophysical ground surveys will also involve placing marker pegs in a grid pattern.

a. Airborne Surveys

Airborne surveys include aerial photography and aerial geophysical surveys. These activities may cause short term annoyance through the use of low flying aircraft. Prior to the commencement of surveys, licensees should contact municipalities and owners, either in person or by way of advertisement in the local newspaper, in the intended area of flying. The information provided should include details of the proposed work program and its likely duration.

c) Gravity and Magnetic Surveys

Gravity surveys are carried out using a gravimeter, while magnetic surveys use a magnetometer. These are usually small readily portable instruments. Surveys are usually carried out by a team of up to three persons who take readings across a grid. The impact of such surveys is generally negligible.

d) Resistivity, Induced Polarization and Electromagnetic Surveys

These surveys are carried out using equipment with interconnecting cable arrays. Electricity is required and is supplied by a generator which is sometimes vehicle mounted. Surveys are carried out on a grid pattern, and may require the excavation of shallow holes up to 500mm deep and 1m square, though usually much smaller, or the temporary insertion of metal probes. Aluminum foil is sometimes used to line the holes. The impact of such surveys is generally small, and temporary.

e) Seismic Surveys

Seismic surveys involve the laying out of an array of geophones connected by cable to measuring instruments mounted in a vehicle. Either a small explosive charge detonated below ground, a hand-held mechanical hammer or a vehicle mounted weight is used to generate shock waves in the ground. The time delay for the waves to reach the geophones is measured. This type of survey may require the drilling of shallow auger holes, usually with a hand-held power auger, and access for light vehicles.

Seismic surveys typically involve several people and a small number of light vehicles. The geophones are placed directly on the ground, and do not require any excavation. When required, the auger hole for the explosive is typically only a few meters in depth.

f) Drilling

Drilling is the process of subsurface sampling to determine the nature and structure of the material below the surface. There are a variety of drilling methods, most of which utilize equipment which is vehicle mounted. In general terms, the size of the equipment will vary, and the larger the drill rig, the greater will be its environmental disturbance. Drilling is relatively expensive, and is not usually undertaken unless there are encouraging results from other, less expensive methods. In some cases, existing tracks will need to be upgraded, or new tracks constructed in order to gain access for the drill rig.

Auger Drilling. This is usually restricted to shallow drilling, using either a hand-held power auger or a rig mounted on a small vehicle. Support vehicles are not normally required, and the impact is generally small.

Open Hole Percussion, Reverse Circulation and Rotary Air Blast Drilling. These drilling methods usually involve a truck mounted rig and at least one support vehicle. A compressor may be required to supply compressed air for drilling and sample recovery.

Diamond Drilling. This method involves the extraction of a continuous cylindrical core of rock. It is usually the slowest, and most expensive form of drilling. It often requires some site preparation, a supply of water and sumps for mixing and recovering drilling muds or fluids. The method generally requires the use of a vehicle mounted drilling rig and support vehicle.

Rotary Mud. Rotary mud drilling is most commonly used for deep stratigraphic investigation and petroleum exploration drilling. The method involves circulation of thick drilling muds for drill hole stability and recovery of samples. It uses substantial quantities of mud, and requires water and sumps. The rigs used are mounted on a truck or trailer, and often require a support vehicle.

Wide Diameter Drilling, Wide diameter drilling is most commonly used in sampling of shallow alluvial deposits, from which large samples are needed to give a reliable estimate of ore reserves. The method utilizes bucket auger drilling equipment, which is usually truck mounted. Drill hole sizes are commonly up to 1.2m diameter and up to 30m deep. The boring bucket is a cylindrical bit into which the sample is forced as the bit rotates. When full, the bucket is hoisted from the drill hole and the sample dumped on the surface. Drilling is usually conducted without drilling fluids, although water or drilling mud may be added to stabilize the drill hole.

g) Trenching and Bulk Sampling

Costeaning and Trenching. These exploration techniques involve the mechanical excavation of trenches (also known as costeans) to expose ground for the observation of geological features and for sampling. Trench dimensions can vary from as small as 150mm in width to as large as the available earth moving equipment.

Very narrow and shallow trenches are often excavated using a rapid trenching machine or ditch witcher. Ditch witch trenching distributes the excavated material along each side of the trench, from where it can be sampled. (The method is similar to that commonly used in laying telephone cables. Larger trenches are usually made using an excavator or backhoe. This method accommodates separation of topsoil more easily than the ditch witch method but disturbs a larger area.

Surface Bulk Sampling. Surface bulk sampling is distinguished from other forms of exploration by the removal of significant quantities of material from the site. Large scale trenching, such as that involving a bulldozer, would also be regarded as bulk sampling. Where bulk sampling is proposed, an IEE or EIA may be needed under the EIA Procedure (2015).

4. Underground Exploration

Underground exploration includes underground sampling, drilling, and exploratory adits, as well as associated surface works. It does not include commercial mining.