

# Chapter 22
# Hazards, health and safety

ESMERALDA GRAPHITE PROJECT

aarc ENVIRONMENTAL SOLUTIONS
APEM Group

GRAPHINEX

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# Glossary, acronyms and abbreviations

| Acronym or Abbreviation | Meaning |
|---|---|
| AEP | Annual Exceedance Probability |
| AHD | Australian Height Datum |
| AMD | Acid mine drainage |
| ANCOLD | Australian National Committee on Large Dams |
| ANZS | Australian/New Zealand Standard |
| ARI | Average recurrence interval |
| AS | Australian Standard |
| BMP | Bushfire Management Plan |
| CLR | Contaminated Land Register |
| DAF | Department of Agriculture and Fisheries |
| DETSI | Department of the Environment, Tourism, Science and Innovation |
| DG | Dangerous Class |
| DIDO | drive-in-drive-out |
| DILGP | Department of State Development, Infrastructure, Local Government and Planning |
| DNRME | Department of Natural Resources, Mines and Energy |
| EIS | Environmental Impact Statement |
| EMR | Environmental Management Register |
| EP Act | *Environmental Protection Act 1994* |
| EP Regulation | Environmental Protection Regulation 2019 |
| ERP | Emergency Response Plan |
| ESC | Erosion and Sediment Control |
| FIFO | fly-in-fly-out |
| ISO | International Organisation for Standardisation |
| MIA | Mine infrastructure area |
| MLA | Mining Lease Application |
| MPP | Mineral Processing Plant |
| MQSH Act | *Mining and Quarrying Safety and Health Act 1999* |
| NORM | Naturally Occurring Radioactive Material |
| NRM | Natural resource management |

| Acronym or Abbreviation | Meaning |
|---|---|
| NZS | New Zealand Standards |
| OHS | Operational Health and Safety |
| PAA | Priority Agricultural Areas |
| PAF | Potentially Acid Forming |
| PLA | Priority Living Areas |
| PMF | Probable Maximum Flood |
| PPE | Personal Protective Equipment |
| QFES | Queensland Emergency Risk Management Framework |
| RFD | Royal Flying Doctor Services |
| ROM | Run-of-Mine |
| SCA | Strategic Cropping Areas |
| SEA | Strategic Environmental Areas |
| SHMS | Safety and Health Management System |
| SSE | Site Senior Executive |
| STP | Sewage Treatment Plant |
| TOR | Terms of Reference |
| TSF | Tailings Storage Facilities |
| UN | United Nations |
| WRD | Waste rock dump |

# 22 Hazards, health and safety

This chapter identifies and describes the potential hazards and risks to people and property which may result from the construction, operation, decommissioning and final rehabilitation phases of the Project. This includes the risk of potential adverse impacts to the community surrounding the Project as well as the Project workforce. A risk assessment has been undertaken, and the possible consequences and likelihoods of hazards have been rated to determine a ranking for each identified risk. Mitigation measures appropriate to the potential hazards are proposed. Relevant management plans and procedures for the Project are referenced where applicable.

## 22.1 Scope

This chapter addresses the ToR requirements relating to hazards and safety. The assessment targets potential risks to public safety, employees, property and key environmental values, taking into consideration:

- statutory requirements;
- community consultation;
- advice and resources provided by government agencies;
- Queensland government guidelines; and
- information collected from the Project area.

## 22.2 Objectives and performance outcomes

This chapter has been prepared to assist the DETSI in carrying out the environmental objective assessment in respect of the following environmental objectives as stated in the Project TOR:

The construction and operation of the Project objectives and performance outcomes are to ensure:

- the risk of, and the adverse impacts from, natural and man-made hazards are avoided, minimised or mitigated to protect people and property;
- the community's resilience to natural hazards is maintained or enhanced;
- developments involving the storage and handling of hazardous materials are appropriately located, designed and constructed to minimise health and safety risks to communities and individuals and adverse effects on the environment;
- that any risk associated with explosives use, transportation, storage or manufacturer is within an acceptable level, in accordance with the *Explosives Act* 1999 and codes and standards, including the Australian Standard AS2187 Explosives Storage, transport and use;
- the proposed Project prevents or minimises the production of hazardous contaminants and waste; and
- if the production of hazardous contaminants and waste is unavoidable, how the proposed project treats and/or contains hazardous contaminants until their disposal at an approved facility.

The assessment risks to health and safety, and development of risk controls considers the following guidance material;

- Queensland Government, Queensland Emergency Risk Management Framework Risk Assessment Process Handbook, 2018
- Queensland Government, Health considerations – Environmental Impact Statement – Guidelines for Proponents, 2016
- Queensland Government, Guideline: Dam Safety Management, 2024
- Queensland Government, Regulated structures – EIS information guideline, ESR/2020/5307

- Queensland Government, Structures which are dams or levees constructed as part of environmentally relevant activities, ESR/2016/1934
- Queensland Government, Guideline for failure impact assessment of water dams, 2018
- Standards Australia, Risk Management – Guidelines (Australian Standard ISO 31000:2018)
- Standards Australia, Managing environmental-related risk (Australian Standard HB203:2006)
- Queensland Government, QGL 1: Guideline for management of Naturally Occurring Radioactive Material (NORM) in metalliferous mines, 2014
- Queensland Government, Land contaminated by radioactive material - A guide to assessment, management and remediation, 2020
- Queensland Government, Business Queensland, Recognised standards, guidelines and guidance notes relating to mining and quarrying activities in Queensland (website)

The Queensland Government, Business Queensland Recognised Standard 02 (R2) and Australian Standard ISO 31000:2018) describe the essential features of risk management in a mining context. These recognised standards apply the formal risk management activities conducted in accordance with the *Mining and Quarrying Safety and Health Act* (Qld) *(*1999). The steps in the process are;

- establish the context (Existing environment) for the mining environment, mining activities and persons;
- risk Identification to identify both potential and actual risks;
- risk analysis and evaluation that includes the risk analysis methodology, assessment and the identification of unacceptable risks;
- risk treatment that include actions to reduce risk, implementation plans, and persons responsible and accountable for the implementation;
- monitoring and review to assess the effectiveness of risk controls; and
- continual improvement of risk management.

## 22.3 Risk assessment methodology

This section describes the methodology used to identify, assess and control potential hazards and risks to people, environmental values or community resulting from the Project's construction, operation, decommissioning and rehabilitation phases. A risk assessment has been prepared to identify the potential hazards and risks that considered stakeholders, Project processes and assets, environmental and external factors, relevant legislation, standards, and guidelines. Key guidance includes;

- AS/NZS ISO 31000:2018 'Risk Management – Guidelines';
- HB 203:2012 'Managing Environment-related Risk';
- Mining and Quarrying Safety and Health Act 1999 (MQSH Act); and
- The Queensland Emergency Risk Management Framework (QFES 2020).

### 22.3.1 Risk Identification

Risks are identified through a structured evidence based process that draws upon mine planning, technical studies, stakeholder engagement and known risks within the mining industry. Risks to people and the environment from the Project consider the existing conditions and potential exposure to additional or cumulative risks. The risk context includes consideration of risk in terms of;

- location;

- climate;
- flooding;
- bushfire;
- wind;
- land;
- flora, fauna and disease vectors;
- anthropogenic risks; and
- cumulative risks where multiple risks may exist.

### 22.3.2 Risk analysis and evaluation

A risk assessment process was undertaken to analyse and evaluate the risks and hazards identified with the following process steps established:

- The basis and purpose of the risk identification was discussed and agreed, as well as the process used to develop the risk scenarios, causes and impacts proposed in the risk assessment template.
- The risk assessment scheme, including the consequence descriptors for each consequence type, the likelihood classifications and the control effectiveness rankings were evaluated and agreed.
- Each of the identified risk scenarios or descriptions was then considered in turn. In most cases, one or more of the 'risk/hazard title', 'causes' and 'impacts' proposed were refined resulting from the discussion.
- Risks identified are inherent risks assumed to have standard controls.
- The risk controls expected to be in place were nominated and a 'control effectiveness' ranking was agreed on for each control.
- The likelihood of each risk/hazard, subject to the expected control level, was then considered and a ranking was provided in accordance with the consensus view of the panel.
- The consequence category for the relevant impact or impacts was similarly assessed and ranked.
- The risk class was then determined based on the risk matrix in use.
- For risks and hazards determined as being of Class III, additional control measures were identified and assessed and, where effective and appropriate, proposed.

### 22.3.3 Risk assessment scheme

The most likely and highest impact consequences posed by identified hazards have been assessed according to consequence and likelihood criteria matrices shown in Table 22-1 and Table 22-2. More detailed qualitative descriptors to assist in classifying the consequence(s) specific to the identified impact type are shown in Table 22-1.

The maximum reasonable consequence from the occurrence of each hazard event has been determined assuming the effective application of standard and expected controls. The likelihood categories have been applied based on either a frequency or probability scale.

Risk severity rankings have been reviewed against Table 22-3 to determine the requirement for additional controls that might be considered necessary depending on the final risk ranking.

More detailed qualitative descriptors to assist in classifying the consequence(s) specific to the identified impact type are shown in Table 22-4.

*Table 22-1: Consequence of impact*

| Consequence rating | Impact on health and safety | Impact on infrastructure or property | Impact on natural environment | Impact on community |
|---|---|---|---|---|
| **1 (Insignificant)** | Minor injury with temporary impact on individual health | Damage that can be easily rectified | Negligible/minor effects on biological or physical environment | Minor medium-term social impacts on local population-mostly repairable |
| **2 (Minor)** | Significant reportable injury with major impact | Superficial damage to infrastructure | Moderate, short-term effects but not affecting ecosystem functions | Ongoing social issues<br>Permanent damage to items of cultural significance |
| **3 (Moderate)** | Major injury with severe impacts on one or more people | Moderate damage to infrastructure | Serious medium-term environmental effects | Ongoing serious social issues<br>Significant damage to structures/items of cultural significance |
| **4 (Major)** | Single fatality or severe permanent impairment | Major damage to infrastructure | Very serious, long-term environmental impairment of ecosystem functions | Ongoing severe social issues<br>Severe damage to structures/items of cultural significance |
| **5 (Severe)** | Multiple fatalities or permanent impacts on the health of a large number of people | Infrastructure severely affected | Extremely serious, long-term, potentially irreversible, environmental impairment of ecosystem functions | Irreparable damage to community |

*Table 22-2: Likelihood of impact*

| Score | A (Almost certain) | B (Likely) | C (Possible) | D (Unlikely) | E (Rare) |
|---|---|---|---|---|---|
| **Description** | The event will occur often. | The event could easily happen. | The event could happen and has happened elsewhere. | The event has not happened but could. | Conceivable but only in extreme circumstances. |
| **Frequency** | Occurs more than once every year. | Occurs about once every year. | Occurs at least once every three years. | Occurs at least once every 10 years. | Occurs less than once every 30 years. |
| **Probability** | >95% | 60–95% | 30–60% | 5–30% | <5% |

*Table 22-3: Risk level actions*

| Risk ranking | Risk level actions |
|---|---|
| Very high risk | Board and/or board-level committee attention required; action plans and management responsibility specified |
| High risk | Senior executive management attention required; action plans and management responsibility specified |

| Risk ranking | Risk level actions |
|---|---|
| Medium risk | Manage by specific monitoring or response procedures, with management responsibility specified |
| Low risk | Manage by routine procedures—unlikely to need specific application of resources |

*Table 22-4: Consequence classification*

| Consequence type | Consequences | | | | |
|---|---|---|---|---|---|
| | **Very low** | **Low** | **Moderate** | **High** | **Very high** |
| **Greenhouse gas emission** | <0.6% | 0.6–2.5% | 2.5–7.5% | 7.5%–15% | >15% |
| **Health** | • Reversible health effects of little concern<br>• First aid treatment | • Reversible health effects of concern<br>• Medical treatment | • Severe reversible health effects of concern<br>• Lost time illness | Single fatality or irreversible health effects or disabling illness | Multiple fatalities or serious disabling illness to multiple people |
| **Psychosocial** | • Unlikely to cause harm | • Some hazards exist but are unlikely to cause noticeable strain | • Early signs of stress, fatigue or conflict | Likely to cause harm signs of burnout, distress and reduced performance | Psychological injury is occurring or imminent. Hazards are almost certain to cause harm. |
| **Safety** | • Low-level, short-term subjective inconvenience or symptoms<br>• First aid treatment | • Reversible injury requiring treatment but does not lead to restricted duties<br>• Medical treatment | • Reversible injury or moderate irreversible damage or impairment to one or more persons<br>• Lost time injury | Single fatality and/or severe irreversible damage or severe impairment to one or more persons | Multiple fatalities or permanent damage to multiple people |
| **On-site Environment** | Near-source confined and promptly reversible impact (typically, a shift) | Near-source confined and short-term reversible impact (typically, one week) | Near-source confined and medium-term recovery impact (typically, one month) | Impact that is unconfined and requiring long-term recovery, leaving residual damage (typically, years) | Impact that is widespread, unconfined and requiring long-term recovery, leaving major residual damage (typically, years) |
| **Off-site Environment** | Not applicable | Near-source confined and promptly reversible impact (typically, a shift) | Near-source confined and short-term reversible impact (typically, one week) | Near-source confined and medium-term recovery impact (typically, one month) | Impact that is unconfined and requiring long-term recovery, leaving residual damage (typically, years) |
| **Community trust** | Tangible expressions of trust/mistrust among a handful of community members, with no influence on public opinion or decision-makers | Tangible expressions of trust/mistrust among a few community members, with some influence on public opinion and decision-makers | Tangible expressions of trust/ mistrust among some community members, with moderate influence on public opinion and decision-makers | Tangible expressions of trust/ mistrust among most community members, with significant influence on decision-makers | Widespread loss/gain of trust across the community setting the agenda for decision-makers and key stakeholders |

| Consequence type | Consequences | | | | |
|---|---|---|---|---|---|
| | **Very low** | **Low** | **Moderate** | **High** | **Very high** |
| **Compliance** | • Non-conformance with internal requirements and very low potential for impact<br>• Non-compliance with community commitment and goes unnoticed by external party/parties<br>• Minimal effort to correct | • Non-compliance with external or internal requirements and low potential for impact<br>• Formal censure<br>• Non-compliance with community commitment<br>• Limited effort to correct | • Non-compliance with internal or external requirements and moderate impact<br>• Moderate penalties for breach of legislation, contract, permit or licence<br>• Non-compliance with community commitment requiring reporting formally<br>• Significant effort to correct | • Breach of licence(s), legislation, regulation-high potential for prosecution<br>• Contract breach-significant penalty<br>• Systemic internal standards breach-high impact<br>• Community commitment breach-high potential business impact<br>• Significant effort to fix | • Suspended or severely reduced operations imposed by regulators<br>• Breach of community commitment resulting in direct loss of established consents with widespread secondary effects |
| **Stakeholders** | Key civil/political stakeholder(s) express support/dissatisfaction informally | Key civil/ political stakeholder(s) express support/dissatisfaction formally | Key civil/political stakeholder(s) threaten to oppose or disengage/ strengthen offers to support or engage | Key civil/political stakeholder(s) actively oppose or actively refuse to engage/actively support and engage | Key civil/political stakeholder(s) actively get others to oppose/engage |
| **Cultural Heritage** | Reparable damage to site or item of low cultural significance | Irreparable damage to site or item of low cultural significance | Repairable damage to site or item of cultural significance | Irreparable damage to site or item of cultural significance | Irreparable damage to site or item of international cultural significance |

### 22.3.4 Risk controls development

Risk controls are developed through a structured, evidence-based process following identification and assessment. Once the potential consequence and likelihood is understood, controls are developed by applying the hierarchy of controls. The hierarchy prioritises the most effective measures such as elimination or substitution rather than lower-level controls such as administration.

Controls are developed in consultation with workers, technical experts and through reviewing incident data, regulatory requirements and considering industry best practice. Controls for the Project have been developed through a risk assessment process applying these principles.

## 22.4 Risk Identification

### 22.4.1 Existing Environment

This section describes inherent risks in the environment and identifies the risks to people and environment from the Project. The proposed Project will be an open-cut mining operation focused on the extraction and processing of graphite ore in northern Queensland. The Project will progress through construction, operational, and rehabilitation and closure phases, each involve complex and potentially hazardous activities undertaken by a multidisciplinary workforce of professionals, tradespeople and technical specialists.

Mining activities inherently involve the control of risks and hazards to personnel, the environment and surrounding communities. In addition, environmental conditions and natural hazards can pose a risk to the health and safety of workers on site.

#### 22.4.1.1 Remote location with limited services

The Project area is remote and has limited access options. The Project is located west of Townsville in north Queensland, approximately 70 km south of the small regional town of Croydon, Queensland, Australia. Croydon has limited emergency facilities, typical of a remote town and has a population of up to approximately 300 people. Access from the Project area to the Flinders Highway is mainly limited to unsealed roads. Surrounding regional aerodromes or airports may be considered for occasional transportation of the non-local workforce, contractors or consultants.

The introduction of additional people to the area and the methods of transport, potentially impact on the availability and standard of services, accommodation and infrastructure. Potential risks are associated with travelling to and from site. Workers will either fly (95%) or drive (5%) to and from the Project. FIFO workers will travel and be accommodated on site with all facilities supplied for the duration of their time on site. DIDO workers will also be accommodated on site and will either use their private vehicle or a company supplied vehicle. Some workers will be working outside or in remote areas.

The Croydon hospital is the nearest hospital to the Project and has limited opening hours except for emergencies. The Croydon Shire Council also operates the Local Disaster Management service that responds to local disasters such as bushfire, flood and storms, rescue, power interruptions and vehicle crashes.

#### 22.4.1.2 Climate and climate change

The Project is within an area that periodically experiences heatwave conditions. Temperatures and rainfall in the Project area are extreme. The nearest town to the Project is Croydon that has a hot semi-arid climate with distinct dry and wet seasons. Croydon temperatures recorded are include maximum 43.9°C and minimum of 2.6°C. The wet season runs from December to March, with an average rainfall of 160 mm during that period. The dry season runs from April to November with average maximum daily temperatures of 33 °C. Extremely hot days and extended heat waves are experienced in the area.

Heatwaves will potentially disrupt the Project through direct health and safety impacts on staff and additional stress on Project infrastructure. The safety and hazard implications for the Project and regional community in general are related to the potential increase in the frequency and intensity of natural hazards, including bushfire

and flooding. Climate change is discussed in further detail in Chapter 23, Air Quality. Climate change considerations of assessment of potential flooding impacts are detailed in Chapter 16, Flooding and regulated structures.

The climate of the region is predicted to become warmer and drier along with more extreme storms and flooding as a consequence of climate change.

For Northern Qld, the effects of climate change are generally acknowledged to result in:

- increasing average temperatures;
- changes to rainfall patterns; and
- an increase in extreme weather driven events (e.g. storms, drought and flooding).

#### 22.4.1.3 Flooding

The Project is within an area that is prone to flooding. It is located immediately north of Warrigal Creek and the Borer River. Topography surrounding the Project area is very flat which results in widespread flooding with interactions between the major waterways during significant flood events.

Access to the Project may be restricted in extreme flood events. Flooding has been assessed and is included in Chapter 16, Flooding and Regulated Structures. The peak flood maps for the 0.1% AEP is provided in the assessment and shows that in extreme events, the area surrounding the Project will be flooded (refer Figure 22-1).

The existence of the Project has the potential to impact flooding risk through the modification of drainage pathways on the Project area. This flooding risk is discussed in Chapter 16, Flooding and Regulated Structures.

#### 22.4.1.4 Bushfire

The Project area is described by the Queensland Fire and Emergency Service as an area that could be at risk of a dangerous fire (refer Figure 22-2). This assessment shows potential for a bushfire to take hold, spread and do damage, if one started in the area. This description considers local conditions such as vegetation type, topography and other indicators (Queensland Fire Department n.d.).

The assessment is based on a 1:20 average recurrence interval (ARI) assessment of bushfire weather, as identified in the Bushfire Resilient communities Technical Reference Guide (QFES 2019). The underlying 1979–2011 BoM weather grid data utilised in producing this assessment was adjusted for a 2050 climate scenario whereby continued intensive fossil fuel use occurs (IPCC A1FI), before the 5% AEP value was calculated. Therefore, the "1:20 ARI" assessment presents a forward-projected severe event which considers significant climate change and is therefore anticipated to be more conservative than existing 1-in-20-year event scenarios.

The mine infrastructure area (MIA), including the accommodation camps and hazardous materials storage areas, are to be located within areas which will be cleared of vegetation as a bushfire risk mitigation measure. Fire detection and suppression will be provided site-wide across all building areas and for the process plant area and surrounds. Fire detection for process and non-process buildings has been included within the building footprints. Additional buffers between vegetation and infrastructure will be maintained to ensure that all facilities are protected from radiant, bushfire heat – as well as to reduce the likelihood of ignition sources from the Project reaching fuel loads. The on-site availability of firefighting equipment, water trucks and earth moving machinery will contribute to bushfire control on-site, and bushfire management will be addressed in the Emergency Response Plan (ERP) to be prepared for the Project.

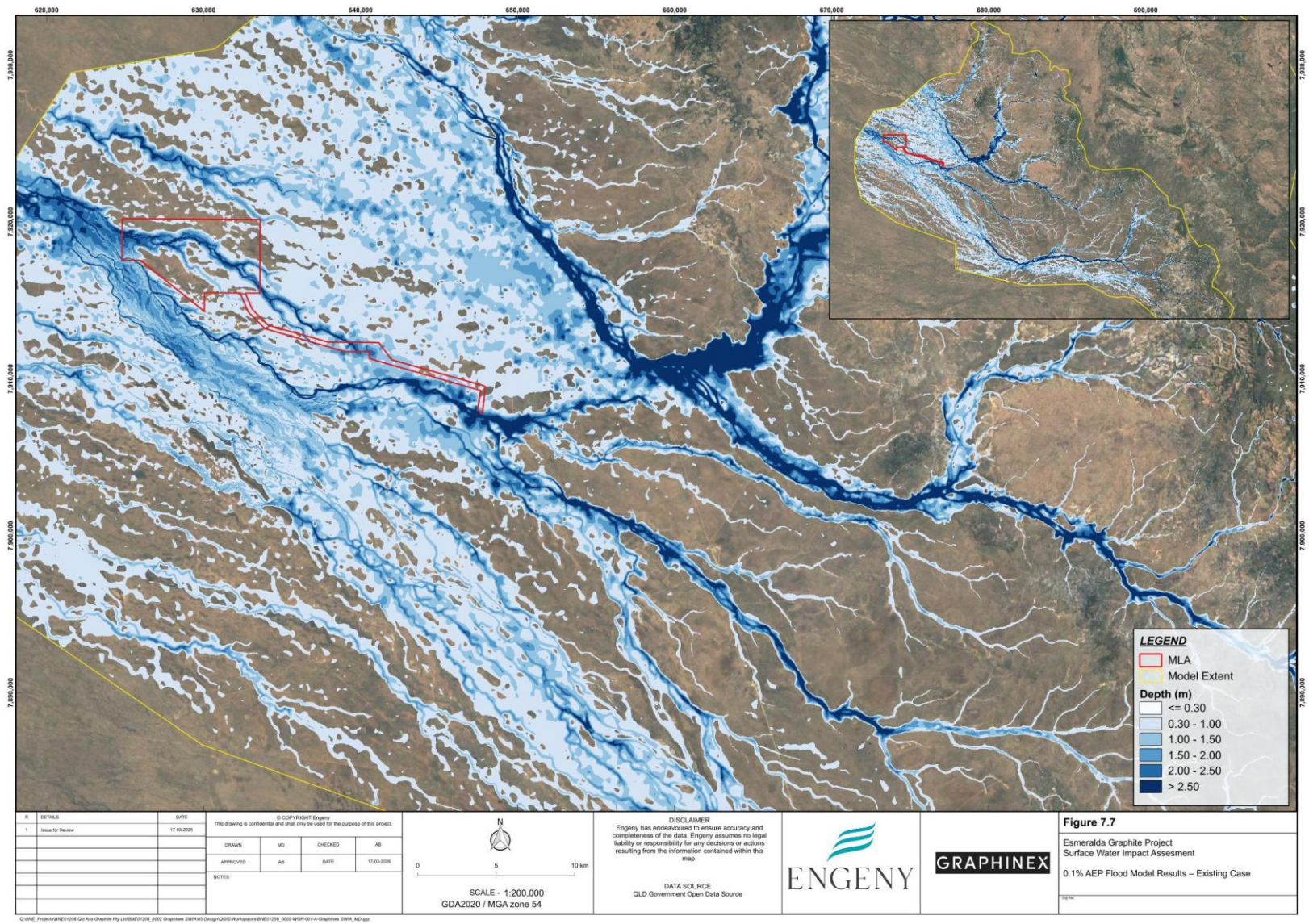



*Figure 22-1: Peak flow reporting locations (Existing 0.1% AEP flood depth)*

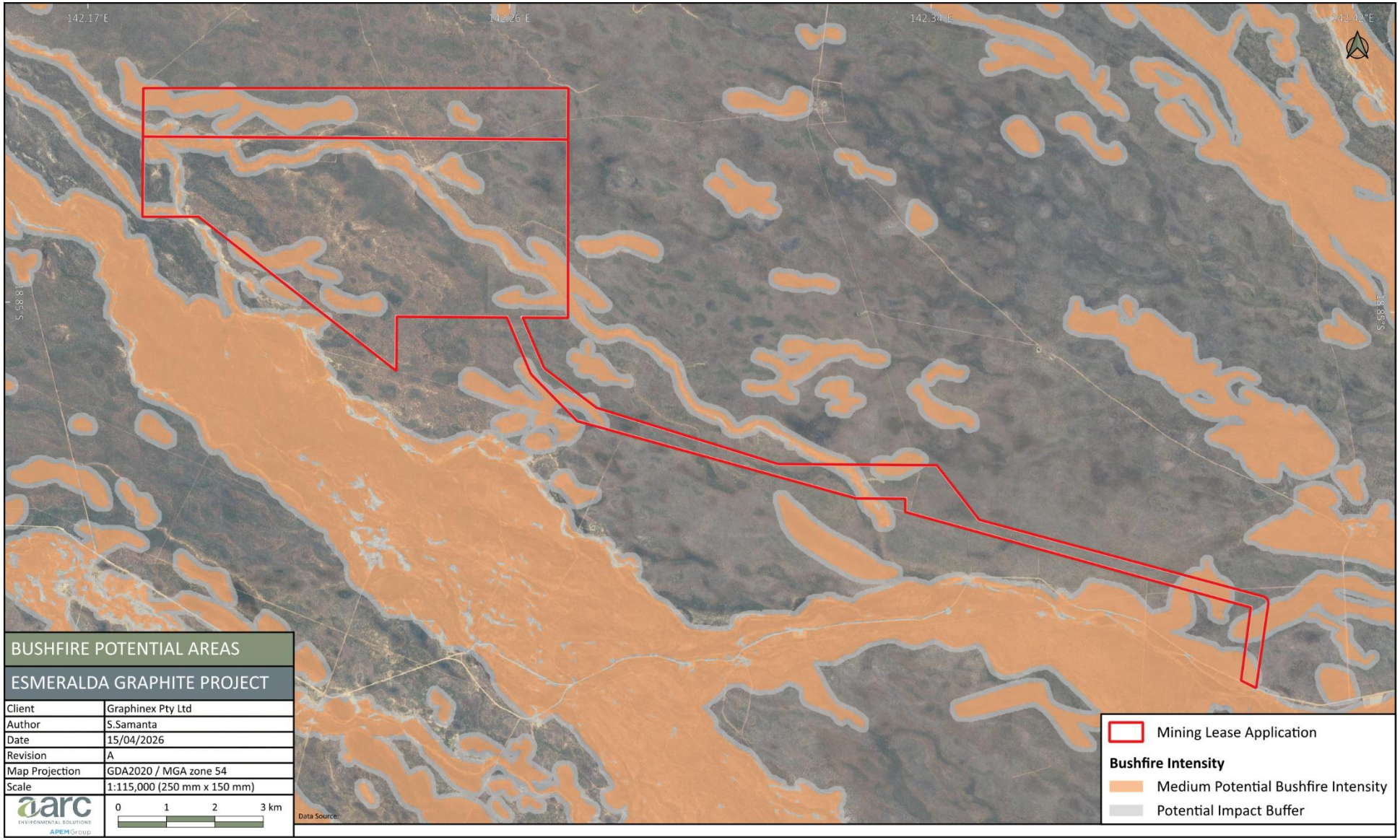



*Figure 22-2*: *Bushfire Risk*

#### 22.4.1.5 Cyclone and severe wind hazard

The Project is located within the non-cyclonic wind region A4 (greater than 100 km from the coastline) as defined by the Australian/New Zealand Standard 'Structural design actions Part 2: Wind actions' (ANZS 2011). This region may experience indirect impacts from cyclones and significant rainfall and flooding from ex-tropical cyclones and tropical lows.

Severe weather events with damaging winds, heavy rain, very large hail and cyclones occur throughout Queensland and could occur in the locality of the Project (QFES 2017). Severe weather events can cause localised power outages, communication disruptions, disruptions to transport and damage to property or personnel health and safety.

#### 22.4.1.6 Land

The Project sits within the Southern Gulf natural resource management (NRM) region. The land surrounding the Project is primarily used for low intensity cattle grazing of native pastures and resource exploration activities. Land within the Project MLAs is currently used for grazing with little attempts at pasture modification.

The land is not currently utilised for cropping or other higher production land uses. Built infrastructure in the local area consists of unsealed access tracks, stock fencing and stock watering dams. The Project is not located on any Strategic Cropping Areas (SCA), Strategic Environmental Areas (SEA), Priority Agricultural Areas (PAA) or Priority Living Areas (PLA).

The Environmental Management Register (EMR) and Contaminated Land Register (CLR) were utilised to determine the presence or absence of contaminated land on the properties underlying the Project site. The EMR identifies properties that are at risk of being contaminated due to notifiable activities having been undertaken. The CLR identifies properties that have been established as contaminated through scientific investigation and remediation requirements (if applicable). No contaminated sites were recorded in the registers (Attachment 1, Contaminated Land Register).

No storm tide or erosion prone areas are identified around the Project area. The 'State Planning Policy—state interest guideline: Natural hazards, risk and resilience' (DILGP, 2017c) 'Natural Hazards Risk and Resilience' mapping layer published through the 'Development and Assessment Mapping System' (DILGP 2017d) was reviewed to determine natural risks relevant to the Project area and surrounding community. The review identified the Project area as outside the tidal zone, storm tide and erosion prone areas.

#### 22.4.1.7 Landslide

The existence of the Project has the potential to increase localised landslide risk through modification of the landform, including the excavation of the mine pit and construction of dumps and rehabilitated landforms.

The topography of the land within and surrounding the Project site is described in Chapter 28 Visual Amenity, as relatively flat with only slight undulations present. While the existence of the Project may increase the likelihood of localised landslide risk through modification of the landform, such as from the excavation of the open-cut pit and the construction of the waste rock dump, the likelihood of a mining induced landslide is negligible due to the relatively flat nature of the land. As such, the existing risk of a landslide is negligible.

#### 22.4.1.8 Visual Amenity

There are three isolated residences in the vicinity of the Project, as follows:

- Esmeralda homestead, approximately 18 km east of the MLAs;
- Prospect homestead, approximately 5 km south-west of the MLAs; and
- Homestead, approximately 16 km west of the MLAs.

The homestead located 5 km from the Project has been identified as a sensitive receptor. There are no additional sensitive receptors identified. No tourism or recreational facilities, or any planned developments are present or

proposed in the Project area. The Project area is considered rural, and the number of potential observers of the mining development will remain consistently low for the duration of the Project.

Landscape character around the Project site will alter over the course of the Project, including where the highest part of Project operations, the out-of-pit waste rock dump (WRD), will increase in elevation as the operation activities progress, to heights between 215 - 235 mAHD approximately, over the life of the mine. The predominant land use is cattle grazing. Upon decommissioning and closure, the WRD, along with the Project site, will be rehabilitated and returned to a landform similar to the existing pre-mining landscape.

#### 22.4.1.9 Flora, fauna and disease vectors

The regional environment surrounding the Project area support a diverse assemblage of native and introduced species. Vegetation communities in this part of the Gulf Savanna provide habitat for a range of species, with some being protected under various laws. Introduced species such as cattle, pigs, donkeys and camel are also present in the area. Flora and Fauna are described in Chapter 18.

The construction and operational workforce may encounter potentially dangerous wildlife such as snakes, pigs and venomous insects. Some species are attracted to work areas, particularly waste areas or water sources. Interactions on roads can cause accidents and death or injury to wildlife. Movement of goods, plants and equipment can transport weeds and pathogens.

Disease vectors are living organisms that can transit infectious pathogens between humans or from animals to humans. Vector borne diseases are human illnesses caused by parasites, viruses and bacteria that are transmitted by vectors. Potential disease vectors of consideration for the Project include vermin and mosquitoes. Mosquitoes have the potential to transmit a variety of diseases to humans such as Ross River Virus, Barmah Forest Virus and Dengue Fever (Queensland Health 2019a).

The Project site is located within the cattle tick biosecurity zone (DAF & DNRME 2020). While the surrounding land use is dominated by cattle grazing, the likelihood of the Project personnel contracting cattle tick is considered low given the management measures that will be in place. Further details of pests and potential impacts will be provided in Chapter 19, Biosecurity.

The workforce may be exposed to pathogens and aerosols from dispersed effluents used for the spray irrigation system deployed at the Sewage Treatment Plant (STP). Mitigation measures such as reduction of the production of aerosols during irrigation, access restrictions to the irrigation area and buffer zones will be implemented. Further details can be found in Appendix M, Land-based Effluent Disposal Assessment Report.

Suitably trained personnel will be available to ensure that any incidents concerning dangerous wildlife can be appropriately managed following the hierarchy of controls - in most cases, through avoidance, removal or containment of the dangerous wildlife. Any associated injuries or health consequences for personnel will be managed in accordance with established first aid, medical and emergency response procedures.

The construction and operation of the Project is not expected increase the risk of disease vectors. Site management planning will incorporate measures targeting good hygiene, vermin and mosquito control to aid in the prevention of the spread of viruses and diseases on-site and throughout the surrounding community. Key strategies include:

- materials storage protocols;
- housekeeping standards;
- personal hygiene standards;
- water management protocols;
- waste management protocols;
- inspections and monitoring; and
- eradication programs.

## 22.4.2 Anthropogenic risks

#### 22.4.2.1Site worker health and safety

On-site incidents have the potential to cause injury to personnel and harm to the environment. The management of health and safety incidents will be undertaken in accordance with the requirements of the *Work Health and Safety Act 2011* (Qld) and will include the development and implementation of a mandatory Safety and Health Management System (SHMS).

A risk-based environmental management system will be developed to identify and manage the environmental hazards associated with site mining operations. Both the SHMS and environmental management system will include procedures and systems for risk minimisation, as well as emergency response and clean-up procedures.

Potential health and safety hazards associated with normal activities during planning and design of the Project and the proposed risk control measures are detailed in Table 22-5.

*Table 22-5: Hazard identification for site workers' health and safety*

| Hazard | Risk factors | Consequence | Risk treatment measures |
|---|---|---|---|
| Mobile equipment | Driving or maintaining vehicles, fatigue, weather conditions | Serious injury or fatality | Training<br>Authorisation systems<br>Vehicle inspections<br>Traffic management systems |
| Manual handling tasks | Incorrect handling | Injury | Use approved safe work methods<br>Training and competency assessment<br>Provide equipment fit-for-purpose<br>Suitable allocation of resources. |
| Slips and trips | Water or oil on ground, uneven surfaces, access and egress from equipment | Injury | Safe work approval measures<br>PPE |
| Interactions with external property users | Property usage and activities (mustering, gunfire, vehicles) | Injury | Landowner contact protocols<br>Communication with neighbouring landowners/users |
| Working at heights | Appropriateness of work area, staff competence | Serious injury or fatality | Barricading<br>Safe work approval measures<br>PPE |
| Working with electrical equipment | Standards of equipment<br>Staff competence | Serious injury or fatality | Qualified staff<br>Safe work approval measures<br>Equipment standards<br>Maintenance and inspection of equipment<br>Test tagging procedures, isolation protocols |
| Equipment with moving parts | Unguarded areas near moving equipment<br>Staff competence | Serious injury or fatality | Equipment guarding<br>Maintenance and inspection of equipment<br>Isolation protocols |

| Hazard | Risk factors | Consequence | Risk treatment measures |
|---|---|---|---|
| Falling objects | Guarding exposed areas | Injury | Barricading<br>Approved safe work methods<br>PPE |
| Pinch points | Unguarded areas<br>Staff competence | Serious injury or fatality | Barricades and guards<br>Approved safe work methods<br>Signage<br>PPE |
| Heavy rain, storms, lightning | Work in exposed locations during inclement weather | Fatality | Safe work approval measures |
| Wildlife hazards | Interactions with fauna | Fatality | Staff competency when interacting with fauna<br>PPE |
| Infectious disease | Staff travel<br>Disease vector breeding<br>COVID-19 or flu outbreaks | Serious injury or fatality | Water bodies managed to avoid mosquito breeding<br>Adherence to health department guidelines |
| Dust<br>Graphite dust<br>Respirable crystalline silica | Works disturbing fine particles | Chronic health consequence | Active dust suppression<br>Vehicle dust exclusion<br>PPE |
| Noise | Heavy equipment usage | Chronic health consequence | Noise barriers<br>Equipment maintenance<br>PPE |
| Dehydration, heat stress and sunburn | Working in hot conditions | Injury | Safe work approval measures<br>Training<br>PPE |
| Welding and cutting | Fumes<br>Hot materials<br>Sparks | Injury | Staff competency and training<br>Safe work approval measures<br>PPE |
| Exposure to hazardous substances | Spill events<br>Insufficient storage measures<br>Insufficient handling methods | Injury | Standards and procedures for storing, transporting and handling hazardous substances<br>Safety data sheet register maintenance<br>PPE<br>Respiratory health surveillance |
| Fire | Exposure to smoke<br>Burns | Serious injury or fatality | Emergency exits<br>Fire alarms and extinguishers<br>Staff training<br>Emergency Response Plan |

| Hazard | Risk factors | Consequence | Risk treatment measures |
|---|---|---|---|
| Geotechnical structure collapse | Weather conditions | Serious injury or fatality | Staff competency and training<br>Safe work approval measures |

#### 22.4.2.2 Hazardous materials and dangerous goods

Project construction, mining activities and ore handling and processing require the use and storage of dangerous goods and hazardous substances. These materials may pose a risk to human and wildlife health and safety and the environment through characteristics such as flammability, explosive or corrosive potential, toxicity and/or radioactivity.

The principal hazardous substances anticipated to be present during the lifecycle of the Project will include:

- explosives;
- fuels;
- lubricants;
- minor quantities of various construction and maintenance related chemicals (e.g. solvents, degreasers and paints);
- mining and processing wastes; and
- wastes from ancillary activities.

The Project was assessed against the major hazard facility criteria from the *Work Health and Safety Regulation 2011* (Qld) and is not expected to meet the definition of a major hazard facility. At appropriate intervals, an assessment will be made to determine whether more than 10% of the threshold for any Schedule 15 chemical is likely to be present for the remaining life of the Project and, should this occur, undertake the required notification. Table 22-6 lists the hazardous substance types and quantities expected to be used and stored on-site during the Project lifecycle. The Project is undertaking a detailed feasibility study for the processing of materials, and therefore storage or consumption quantities may be revised prior to Project commencement.

*Table 22-6: Anticipated hazardous materials and dangerous goods*

| Hazardous substances | DG class[1] | UN Number [2] | Packing group[3] | Maximum quantity stored | Annual rate of use | Purpose/use |
|---|---|---|---|---|---|---|
| Ammonium nitrate | 1.1D | 0241 | N/A | ~ 300 t | < 2,000 t | Mining activities (i.e. blasting) |
| Acetylene | 2.1 | 1001 | N/A | < 75 kg | < 300 kg | Welding and cutting |
| Liquified petroleum gas | 2.1 | 1075 | N/A | < 300 kg | < 1,500 kg | Fuel for forklifts |
| Diesel oil/fuels | 3 | 1202 | III | < 2,000 kL | < 10,500 kL | Fuel for vehicles and equipment and explosives use |
| Methyl Isobutyl Carbinol | 3 | 2053 | III | ~ 50 t | ~ 273 t | Reagent for mineral processing |
| Lubricating oils, grease and waste oil | 9 | 3082 | III | < 25 kL | <1,000 kL | Used to lubricate vehicle engine and hydraulic machines |
| Oils rags | 4.22 | 1856 | N/A | < 5 t | < 10 t | Waste products |

| Hazardous substances | DG class[1] | UN Number [2] | Packing group[3] | Maximum quantity stored | Annual rate of use | Purpose/use |
|---|---|---|---|---|---|---|
| Acetone | 3 | 1090 | II (if quantity stored is > 1L) | < 30 kg | < 75 kg | Used as a solvent, degreasing agent and paint thinner |
| Chlorine | 2.3 (5.1, 8) | 1017 | N/A | < 150 L | < 20,000 L | Water treatment |
| Sodium hydroxide (caustic soda) | 8 | 1823 | II | < 1,000 kg | < 2000 kg | Degreasing agent and sewage treatment |
| Paints | 3 | 1263 | I | < 500 L | < 1,000 L | Paint during construction and operations |

[1] DG class: Dangerous Goods class means the hazard class of the dangerous goods as stated in the Australian Dangerous Goods Code.
[2] UN number: A number that identifies hazardous substances and articles (such as explosives, flammable liquids, toxic substances, etc.) in the framework of international transport. UN numbers are assigned by the United Nations Committee of Experts on the Transport of Dangerous Goods.
[3] Packaging group: Assigned to dangerous goods (other than Classes 1, 2 and 7) according to the degree of risk the goods present (I = great danger, II = medium danger and III = minor danger)

#### 22.4.2.3 Explosives

The Project will utilise bulk explosives during the operational phase - primarily ammonium nitrate mixed with fuel oil and, where wet conditions are encountered, emulsion explosives. Other related explosives materials such as detonators, boosters and detonation cord will also be used in blasting activities. An explosives store (magazine) will be established on-site for storage of ammonium nitrate, fuel oil, and ancillary explosives requirements. The explosives store will be located in accordance with prescribed regulations and with a separation distance of over 1 km from the mineral processing plant, mine pit, and accommodation facility. Explosives materials will be transported to site as required to maintain sufficient stock for operations.

#### 22.4.2.4 Fuel

Diesel will be the primary fuel used on-site throughout the Project life, unless decarbonisation alternatives are implemented, and will be the only fuel to be stored on-site in bulk. Diesel will be sourced from Townsville and transported to the site by authorised contractors/suppliers via road. Diesel storage will be located within the MIA and at the explosives mixing site. Appropriate aprons and hardstands for fuel transfer will be provided to contain hydrocarbons and will be equipped with required safety signage, emergency information, spill clean-up equipment and fire extinguishers. Diesel storage is not expected to exceed 2,000 kL.

All personnel involved in fuel storage and handling activities will be trained in the safe operation of equipment. Training will include operating procedures for the refilling and maintenance of fuel storage tanks and mine vehicles and the relevant emergency response procedures in the event of an incident. Regular inspection programs will be undertaken to monitor the structural integrity of fuel tanks and bunds.

#### 22.4.2.5 Lubricants

Large quantities of lubricating and hydraulic oils are required for use during operation of the Project. Storage of these materials will utilise secondary collection and storage such as bunded pallets or self-bunded shipping containers. The maximum total quantity to be held on-site will be approximately 2,000 kL of lubricating oil, hydraulic oil and waste oil. Bulk storage facilities will be located within the MIA. Storage areas will be designed to comply with AS1940 requirements with appropriate aprons and hardstands for lubricant transfer and will include emergency information, spill clean-up equipment and fire extinguishers. Other lubricants (and materials such as engine coolant and detergents) will be stored in containers up to 1,000 L within the workshop area. Spill clean-up

equipment will be maintained throughout the workshop. The MIA and workshop will include a stormwater management system which incorporates oil/water separation systems to ensure potentially contaminated water is appropriately collected and disposed of off-site.

#### 22.4.2.6 Ore processing reagents

Graphite ore will be processed in the Mineral Processing Plant (MPP). The processing process requires the addition of reagents (floatation agents, flocculants and coagulants) to separate the graphite ore from waste materials (rejects). Based on available ore quality and feasibility analysis, the likely reagents to be used will include methyl isobutyl carbinol and diesel-based floatation agents, flocculants and dispersants. The reagents will require bulk storage around the MPP. Storage will utilise secondary collection and storage such as bunded pallets or self-bunded shipping containers constructed and operated in accordance with AS1940. Appropriate aprons and hardstands for reagent transfer will be provided and will include spill clean-up equipment and fire extinguishers.

#### 22.4.2.7 Other hazardous materials

Small quantities of other hazardous materials and dangerous goods may be used and stored during the lifecycle of the Project; such materials include:

- welding and metal cutting gases;
- cleaning solvents;
- radioactive sources (used in laboratory instruments and testing equipment); and
- corrosives (e.g. acids).

All substances will be stored and handled in accordance with the relevant standards, label instructions and material safety data sheets. It is therefore not expected that they will present a significant risk to the workforce or surrounding community.

#### 22.4.2.8 Hazards and risks associated with the Mineralogy of the area

The Project is located within an area known for graphite-bearing metamorphic rocks and associated mineral assemblages. Graphite is proposed to be extracted from open cut pits using drill and blast, then truck and shovel methodologies. Graphite itself is chemically stable, however, fine graphite dust, generated during blasting, crushing and processing can pose respiratory hazard to workers if not controlled. Chronic inhalation of carbonaceous dusts is associated with respiratory irritation and may contribute to a range of chronic respiratory conditions. The Project's processing facilities and stockpiles are expected to generate airborne particulates, requiring dust suppression and personal protective equipment to manage. Dust from graphite mining can also be a fire hazard. Adequate ventilation systems will be installed to help control dust and maintain air quality to prevent accidents and respiratory issues amongst the workforce.

The broader mineralogy of the region may also include silica bearing host rocks, which introduce a risk of crystalline silica dust exposure during excavation and handling. Silica is a known occupational hazard linked to silicosis and other chronic respiratory disease. Additionally, metamorphic terrains in northwest Qld can contain sulphide minerals such as pyrite or pyrrhotite. These hazards are discussed in Appendix U, Geochemistry Assessment of Mine Materials and Tailings.

The Esmeralda Graphite deposit was confirmed by historical drilling. Exploration drilling has been extensively undertaken across the proponent held exploration tenure from the 1970s to 2025 (detailed in Chapter 4, Project Description). Drilling primarily targeted metalliferous/gold mineralisation. Results of previous drilling indicated concentrations of combined niobium and tantalum pentoxide and molybdenum, and anomalous concentrations of other metals. In 2015, drill holes intersected graphite mineralisation in the Esmeralda Granite area, confirming graphite occurrences.

*Naturally occurring radioactive materials*

Naturally occurring radioactive material (NORM) testing on the mine materials was undertaken by RGS (2026a). Granite rocks in Australia naturally contain higher concentrations of radioactive elements such as potassium (K), uranium (U), and thorium (Th) as they cool from magma and bind to rare minerals such as monazite and zircon. The Esmeralda Supersuite, the geology upon which the Project is located and will target for resource extraction, is believed to have been derived from the partial melting of metasedimentary rocks and is not known in literature to have anomalous radioactivity (Appendix U). Further to the east, granites in the Georgetown-Cairns-Charters Towers region shows mild enrichment in U content compared to other types of granites. Geochemical data from Schofield (2009), suggests these concentrations can be above 20 mg/kg in some locations. By comparison, solid multi-element U concentrations for the Esmeralda Project are much lower - approximately 5 to 6 mg/kg in the orebody, and 4 to 5 mg/kg in tailings (RGS 2026a). NORM concentrations do not pose a significant threat to human health or to the environment.

#### 22.4.2.9Tailings

A total of 159.85 Mt of tailings is estimated to be produced by the Project as a biproduct of mineral processing. Tailings will be stored in four purpose-built tailings storage facilities (TSFs) over the life of the mine. A TSF concept study was undertaken based on ANCOLD Guidelines. The tailings are classified as Potentially Acid Forming (PAF) and enriched, above normal background levels, with a range of metal elements including Copper (Cu) Molybdenum (Mo), Rhenium (Re) Sulphur (S) and Tellurium (Te). Potential seepage from TSFs may allow contaminants to migrate into surrounding soils and groundwater, posing environmental risks if not properly contained.

#### 22.4.2.10 Flood levee and waterway diversion

The Project site is historically prone to overland and breakout flooding from Warrigal Creek and the Yappar River flowing in the unnamed Stream Order 3 waterway, intersecting the site from the east. This waterway is required to be diverted around the proposed mining pit extent with consideration of breakout flows from Warrigal Creek. The diversion has been designed in accordance with engineering standards and hydraulic modelling undertaken by Engeny and will support the continuity of aquatic ecological values including fish passage.

A flood protection levee will also be developed to provide additional protection to operational mining areas, including the pit and central mine infrastructure area. The levee is expected to be deemed a regulated structure under the Manual for Assessing Consequence Categories and Hydraulic Performance of Structures. This is discussed further in Chapter 16, Flooding and Regulated Structures.

## 22.5 Impact Assessment

A risk assessment has been prepared to describe the potential risks to people, property and environmental values that may be impacted by the Project. The risk assessment considers the risk context of the existing environment described for each stage of the Project. The assessment includes:

- identification of potential hazards and estimated probabilities of occurrence, including consideration of Project activities and disturbance;
- consideration of natural events (e.g. storms, cyclones, flooding, bushfires, extended heat, landslides) that may affect the site with at least a one per cent annual exceedance probability or 100-year average reoccurrence interval level;
- consideration of the mineralogy of the project footprint and surround area;
- consideration of all hazardous substances (including fuels, chemicals, hazardous waste and explosives) to be used, transported, stored, processed or produced);
- consideration of whether the site or operation will meet the threshold of a major hazard facility either temporarily or permanently;
- consideration of potential hazards associated with dam failure, petroleum and gas pipelines, abandoned mines, explosive magazines;

- consideration of hazards posed by wildlife interactions (including mosquitos);
- consideration of hazards away from the Project footprint where hazard characteristics may be changed by the project;
- consideration of the cumulative impact of several natural hazards occurring at the one time;
- mapping of potential hazard areas within the project footprint; and
- hazard analysis and risk assessment in accordance with relevant guidelines and standards.

A summary of outcomes from the detailed risk assessment is provided as Table 22-7 and Table 22-8. The summary describes the residual risk. Residual risk describes the inherent risk (existing environment) with the addition of standard and proposed risk controls. Of the total residual risks identified and assessed, no Class IV (Very High) risks were identified while 4 Class III (High) risks were identified.

*Table 22-7: Identification of Class III and IV risks*

| Risk or hazard title | Causes (triggers &/or indicators) | Potential impacts (consequences) | Inherent risk with assumed expected or standard controls | Residual Risk ranking | | | Risk mitigation approach |
|---|---|---|---|---|---|---|---|
| | | | | Health & safety | Environment | Community trust | |
| Safety: Increased risk of motor vehicle incidents | Increased light and heavy vehicle movements associated with the Project | Ranges from inconvenience to fatality | Road access design (subject to regulatory controls) and public road controls | III | | | Fatigue management/fitness for work<br>Alcohol and drug testing<br>Road safety awareness training |
| Operational OHS hazards | Construction, mining and industrial activities | Health and safety<br>Operational costs | Staff awareness and training<br>Safety management system | III | | | OHS performance to be closely monitored and assessed and, when required, individual, issue-specific risk assessments to be undertaken to identify fit-for-purpose safety initiatives |
| Hazardous materials: Storage and use of explosives | Incorrect storage<br>Accidental incidents | Noise/vibration<br>Fly rock<br>Unplanned explosion | Appropriate storage and handling of explosives<br>Staff training | III | | | Employee training<br>Supervision<br>Critical controls relating to blast management |
| Land disturbance: Direct clearing, topsoil removal and earthworks | Soil characteristics<br>Weather<br>Unexpected flora/fauna impacts | Erosion<br>Damage to environmental values<br>Dust | ESC practices followed<br>Spotter catchers employed when necessary | | III | | Sediment dams<br>ESC controls<br>Rapid revegetation and ongoing maintenance |
| Air quality: Dust impacts to sensitive receptors | Equipment, processes and vehicle movements on unsealed roads<br>Increased bare areas (waste rock dumps) | Annoyance<br>Amenity (sensitive receptors)<br>Harm to wildlife<br>Crop impact<br>Contamination of water tanks | Distance from source<br>Routine haul road watering<br>Progressive rehabilitation<br>Vehicle speed limits | | | III | Dust suppression /treatment of haul roads<br>Rescheduling of blasting operations<br>Reactive dust control measures |

| Risk or hazard title | Causes (triggers &/or indicators) | Potential impacts (consequences) | Inherent risk with assumed expected or standard controls | Residual Risk ranking | | | Risk mitigation approach |
|---|---|---|---|---|---|---|---|
| | | | | Health & safety | Environment | Community trust | |
| Impacts on fauna (wildlife interactions) | Driving conditions<br>Workers interacting with wildlife | Vehicular accident<br>Site work injury | Staff training to operate vehicles defensively<br>Staff awareness | | III | | Monitor fauna interactions via incident reporting;<br>If required, introduce additional controls (e.g. fencing, ultrasonic deterrent devices etc. |

*Table 22-8: Class III assessed risks*

| Risk/hazard title physical environment | Causes (triggers/indicators) | Impacts (consequences) | Available/additional control measures | Risk management class |
|---|---|---|---|---|
| **On-site environment** | | | | |
| Impacts on water | Loss of containment of tailings (seepage) | Contamination; contamination to environmental | Tailings thickened to 60% solids stored in lined TSF cells; embankments raised progressively; remaining cell will be capped, and inundated for AMD management | III |
| OHS consequences | Design failure of levees (overtopping) | Contamination; contamination to waterways; community safety and trust | Comply with hydraulic design criteria, dams positioned up slope of mining pit, mine pit has excess storage capacity, baseline, construction and operational monitoring in place | III |
| **Occupational health and safety** | | | | |
| OHS consequences | Construction, mining and industrial activities | Health, safety; operational cost | OHS performance to be closely monitored and assessed and, where required individual, issue specific risk assessments to be undertaken to identify fit-for purpose safety initiatives | III |
| **Air quality** | | | | |
| Dust impacts to sensitive receptors | Equipment and vehicle movements on unsealed roads, and increased areas of disturbance (e.g. WRD) | Annoyance, amenity (sensitive receptors), impact to grazing land | Surface treatment of haul roads, weather dependent scheduling of blasting operations, reactive dust control measures | III |

## 22.6 Consultation

Comprehensive stakeholder engagement for the Project has been conducted to disseminate Project specific information and seek feedback on key matters. Consultation feedback provides information on matters that are important to the community and identifies expectations that assists decision making and Project planning.

This consultation has identified potential opportunities to ensure the Project operates in a safe manner and that ERP will be suitable for purpose, including:

Hazards, health and safety are key matters raised during all stakeholder consultation. Consultation with key community and local emergency response organisations has been undertaken by the Proponent and is recorded in a communications register. Matters raised during consultation activities has included:

- local health services;
- local emergency services; and
- Croydon Shire Council.

Consultation with relevant emergency services, the Croydon Shire Council, and other government bodies, will be undertaken specifically to establish clear arrangements in the event of an emergency, and support the development of management plans.

## 22.7 Mitigation Measures

The Project is designed to avoid or mitigate Project related risks to people, property and environmental values. The following processes and measures will be implemented in addition to expected and standard controls to reduce the risk of impacts associated with Class III identified risks on health, safety and the environment associated with the Project:

- Occupational health and safety performance to be closely monitored and assessed and, where required, individual issue specific risk assessments to be undertaken to identify fit-for-purpose safety initiatives.
- Routine watering of haul roads, scheduling of blasting operations and reactive dust control measures to be utilised to manage dust impacts to sensitive receptors.

### 22.7.1 Inherent mitigation measures

The Project location and proposed layout is presented in Chapter 4, Project Description. The mining layout, including location of the open-cut pit, and mine infrastructure, has been designed with the following considerations:

- efficient access to the targeted mineral resource;
- minimising potential impact to environmental values; and
- consideration of environmental risks.

The open-cut pit design is based on the presence and quality of the defined resource and enables conventional truck and excavator mining methods. Extracted ROM ore will be hauled to the MPP for stockpiling and processing via conventional floatation methods. The pit location also considers constraints associated with the flood risk assessment of the site. All Project infrastructure and operations, with the exception of the infrastructure associated with the access corridor, are located outside of the Probable Maximum Flood (PMF) extent. A flood levee will be required that will be designed to withstand a 1% AEP flood event. Details of the flood levee are included in Chapter 16, Flooding and Regulated structures. Details of TSF management are included in Chapter 13, Rehabilitation and Chapter 17, Waste.

The on-site accommodation for the Project workforce will reduce travel time and frequency, and subsequently mitigate risks associated with fatigue and increased traffic on public roads.

The establishment of a buffer from Project infrastructure to the maximum disturbance extent facilitates the effective control of vegetation and fuel loads, such that fire risk is mitigated. Not all vegetation within the maximum disturbance extent is proposed to be cleared, however during assessment of fire and bushfire risk, and health and safety, vegetation may be removed. This is detailed further in Section 22.7.5.

### 22.7.2 Safety and Health Management System (SHMS)

In accordance with the requirements of the MQSH Act, the Project will adopt a SHMS. The SHMS will be based on AS/NZS ISO 45001:2018 ‘Occupational Health and Safety Management Systems’ and incorporate risk management elements and practices with clearly defined and measurable objectives.

The SHMS will document the standards, methods and procedures necessary to mitigate risks relevant to the stages of the Project and ensure legislative compliance. Strict adherence to the SHMS will be required by all personnel who enter the site (i.e. workforce, contractors, and visitors).

A detailed hazard and opportunities assessment will be undertaken as a part of the final planning process. The assessment will build upon the preliminary hazard and risk assessment as discussed in previous sections of this chapter and identify the principal hazards for management focus during each phase of the Project.

The objectives of the SHMS will include but not limited to:

- compliance with regulatory requirements;
- leadership accountability at all levels;
- commitment to effectively communicate expectations and requirements;
- commitment to provide adequate resources, support and training;
- initiatives to actively involve and consult employees, contractors and other stakeholders;
- commitment to keep personnel informed and provide open communication;
- commitment to investigate all incidents and take necessary corrective actions to prevent recurrence;
- occupational rehabilitation programs;
- commitment to monitor, measure, review and audit SHMS adequacy and compliance with objectives;
- initiatives to implement changes to the SHMS based on monitoring and review outcomes; and
- commitment to foster continuous improvement.

### 22.7.3 Hazardous materials

Mitigation measures proposed limit the release of hazardous materials include but not limited to the following:

- In the fuel and lubricant storage facilities, appropriate aprons and hardstands, spill clean-up equipment and fire extinguishers will be placed.
- Staff involved in fuel storage and handling activities will be trained in the operation of the refuelling equipment, spill clean-up equipment and response in the event of an emergency incident.
- Staff involved in handling, storage, and transport of graphite concentrate will be trained in the use of PPE, respirators and controls associated with reducing the potential for exposure to fumes and dust from the mineral processing circuit.
- The fuel storage facility will be constructed and operated in accordance with AS 1940 'The Storage and Handling of Flammable and Combustible Liquids'. Regular inspections will be conducted to monitor the structural integrity of the fuel storage facility.
- A secondary containment system will be in place for the storage of hazardous materials, including drainage or bunds around fuel and hazardous liquids, and containers for hazardous substances detailed in Table 22-6.
- Modelling determines that no hazardous materials will be located in areas prone to flooding – riverine or as a result of overland flow.
- The quantity of lubricants to be stored on-site at any one point will be limited, and the storage will utilise secondary collection and storage measures, such as bunded pallets or self-bunded shipping containers.
- All other hazardous substances will be stored and handled in accordance with relevant standards, label instructions and material safety data sheets. It is therefore not expected that hazardous chemicals will present a significant risk to the workforce, surrounding community or receiving environment.

The transport, handling, and storage of hazardous materials will be undertaken in a manner that prevents theft and unlawful access and reduces the likelihood of negative incidents occurring. This includes storage in secure locations, using fencing, access control, or CCTV as required, and operational measures including supervision of access. Theft or loss of hazardous materials including explosives will be reported to the Queensland Police Service.

Impacts to road conditions which may make access unsafe, including flooding, inclement weather, or deteriorated roads, will halt transport of hazardous materials.

Further details on the mitigation measures relevant to hazardous materials, including waste, are discussed in Chapter 4, Project Description, and Chapter 17, Waste Management.

### 22.7.4 Emergency response and management plans

*Work Health and Safety Regulation 2011* (Section 24) stipulates that all workplaces must have a written emergency plan. An ERP will be prepared for all phases of the Project and will:

- provide contact details relevant to emergency management;
- detail the roles and responsibilities of site personnel including, but not limited to, the:
    - Incident Commander (Project Manager/Site Senior Executive [SSE]);
    - Incident Controller;
    - Emergency Response Team;
    - Supervisors; and
    - mine workers.
- include the potential emergency situations that could occur as identified by the risk assessment;
- detail the equipment available to emergency responders;
- provide for emergency response training;
- provide for regular testing of the site's emergency response capability;
- outline the emergency response procedure to be followed, including raising the alarm and summoning of emergency assistance, and the termination of emergency response;
- identify emergency communications protocols, including requests for assistance from external emergency services (e.g. Queensland Mines Rescue Service, Queensland Fire and Emergency Service, Queensland Police);
- outline fire response procedures;
- detail evacuation procedures and muster points;
- include maps and relevant Global Positioning System information; and
- include duty cards detailing the roles and responsibilities of the Incident Commander, Incident Controller, Emergency Response Team, supervisors and mine workers.

Development of the ERP will occur prior to Project commencement, and include consultation with key external bodies involved in emergency response relating to site activities, including:

- Queensland Fire and Emergency Services;
- Queensland Mines Rescue Service
- Queensland Police Service;
- Rural Fire Service;
- Rescue Helicopter Services (Rescue 510), Qld Government Air;
- Royal Flying Doctor Services (RFD); and
- Croydon Shire Council (relative to regional emergency plans).

Relevant consultation channels to liaise with key community members has been established by the Proponent. These are further discussed in the Public Consultation Report (Appendix C).

Access disruptions due to, for example, flooding will be considered during ERP development, as will potentially mine accommodation evacuation requirements. An outline of key events to be addressed by the ERP are provided in Table 22-9.

*Table 22-9: Key elements of the Emergency Response Plan*

| Event | Location | Potential response and resources | Coordination of response |
|---|---|---|---|
| Severe injury or illness | On-site | On-site: emergency response and rescue<br>External: ambulance from Queensland ambulance service, rescue helicopter from Capricorn Helicopter Rescue | Site delegate |
| Vehicle/ machinery collision | On-site | On-site: emergency response and rescue.<br>External: recovery equipment from Queensland Fire and Emergency Services, ambulance from Queensland ambulance service, rescue helicopter from Rescue 510 or RFD | Site delegate |
| Vehicle collision | Off-site in the area of the Project | On-site: emergency response if required as first respondent.<br>External: Queensland Police Service, recovery equipment from Queensland Fire and Emergency Services, ambulance from Queensland Ambulance Service, rescue helicopter from Rescue 510 or RFD. | Queensland Police Service, Queensland Fire and Emergency Services, Queensland Ambulance Service |
| Chemical/fuel spill | On-site | On-site: emergency response and rescue, firefighting equipment, spill clean-up equipment | Site delegate |
| Fire | On-site | On-site: emergency response and rescue. Water truck, firefighting equipment, spill clean-up equipment<br>External: firefighting equipment from Queensland Fire and Emergency Services, (if required) | Site delegate |
| Bushfire | On-site and off-site | On-site: water truck, grader, dozer, firefighting equipment.<br>External: mine site water truck, grader, dozer, firefighting equipment from Queensland Fire and Emergency Services | Site delegate for on-site response<br>Queensland Fire and Emergency Services for off-site response |

## 22.7.5 Bushfire management plan

The Emergency Response Plan (ERP) will include a Bushfire Management Plan (BMP). The BMP will outline the response to fires, including bushfires. The response will outline roles and responsibilities in the event of a bushfire and the training and resources required to perform duties involved in the response. The BMP will be developed upon approval of the Project.

The BMP component of the ERP will be developed in consultation with the QFES and reviewed by the responsible site representative (Mine Manager) prior to each bushfire season. With reference to and in alignment with the Queensland Bushfire Plan (QFES 2020), the BMP section of the ERP will include:

- a bushfire hazard analysis and risk assessment for the approaching season;
- fire regimes for vegetation communities;
- detailed bushfire mitigation strategies, including:
    - management of fuel loads in the Project area, including the removal or control of vegetation;
- identification of fire management zones;
- identification of existing and proposed firebreaks and fire management lines;
- assessment of any proposed vegetation clearings for fire control;

- fire protection controls and maintenance of controls;
- specification of firefighting equipment;
- strategies to achieve development outcomes in Part E of the State Planning Policy – Natural Hazards, Risk and Resilience are to;
    - avoid activities in bushfire hazard areas of the Project when practical;
    - support the Queensland Fire and Emergency Services;
    - avoid an increase in the severity of bushfire hazard;
    - avoid risk to public safety from hazardous materials; and
    - maintain natural bushfire processes as applicable.
- proposed monitoring and auditing of the BMP; and
- detailing emergency contact information.

## 22.8 Effectiveness of risk controls

The Project will incorporate a comprehensive set of risk controls that will be managed in a risk database. Key controls will be reviewed on a regular basis in accordance with a risk review audit schedule. Critical controls to manage risks with higher risk ratings will be reviewed more regularly and reported to senior management on their effectiveness. The accountability for key risk controls will be assigned to senior roles to ensure they remain a priority. The effectiveness of all risk controls will be audited by internal and external auditors on a routine basis, who will provide recommendations on risk control improvements as required.

## 22.9 Meeting environmental objectives and performance outcomes

The objectives and performance outcomes are described in Section 22.2. The Project will meet these objectives and performance outcomes by:

- applying as structured, sequenced approach to identify, assess and propose controls for each risk;
- engage a range of stakeholders to participate in the risk assessment process so that diverse perspectives, skills and experience can be applied to the process;
- review legal requirements to ensure both the process and context is applied correctly;
- review best practice guidance material and other sites actual experience in developing appropriate risk controls.
- maintain document registers that ensure the quality of data is maintained;
- develop and apply roles and responsibilities that document individual and team accountabilities to ensure risks are identified, correctly assessed and that risk controls are effective.
- ensure sufficient resources (people) and training is available and maintained to enable effective risk management;
- conduct external and internal audits of the Safety and Environment Management system that include recommendation on improvements to risk control measures if they are not effective; and
- internal reporting mechanisms to ensure senior managers are aware of risk control effectiveness and are adequately resourced to ensure continuous improvement.

## 22.10 Monitoring, auditing and reporting

Monitoring of the effectiveness of the Safety and Environmental Management systems will be regularly undertaken by a suitably qualified person (SQP), to ensure the effectiveness of the developed systems. This will include verification that safety measures are in place and functional (i.e. security access, fire alarms, equipment). Audits of system implementation and personnel will also form a component of the monitoring program.

Monitoring information will be provided for management team review as a report, and corrective actions will be implemented as required to ensure that management is preventative, and not solely reactive to emergency incidents. Corrective actions will include reviews of relevant policies, plans and procedures.

## 22.11 TOR Reconciliation table

| Terms of reference - Content requirements of the EIS | | EIS Section |
|---|---|---|
| **Section 22 - Hazards, health and safety** | | |
| 22.1 | The following guidance is relevant for the assessment of hazards, health and safety:<br>(a) Queensland Government, Queensland Emergency Risk Management Framework Risk Assessment Process Handbook, 2018<br>(b) Queensland Government, Health considerations – Environmental Impact Statement – Guidelines for Proponents, 2016<br>(c) Queensland Government, Guideline: Dam Safety Management, 2024<br>(d) Queensland Government, Regulated structures – EIS information guideline, ESR/2020/5307<br>(e) Queensland Government, Structures which are dams or levees constructed as part of environmentally relevant activities, ESR/2016/1934<br>(f) Queensland Government, Guideline for failure impact assessment of water dams, 2018<br>(g) Standards Australia, Risk Management – Guidelines (Australian Standard ISO 31000:2018)<br>(h) Standards Australia, Managing environmental-related risk (Australian Standard HB203:2006)<br>(i) Queensland Government, QGL 1: Guideline for management of Naturally Occurring Radioactive Material (NORM) in metalliferous mines, 2014<br>(j) Queensland Government, Land contaminated by radioactive material - A guide to assessment, management and remediation, 2020<br>(k) Queensland Government, Business Queensland, Recognised standards, guidelines and guidance notes relating to mining and quarrying activities in Queensland (website), available at: www.business.qld.gov.au/industries/mining-energy-water/resources/safety-health/mining/legislation-standards/recognised-standards. | Section 22.1,<br>Section 22.2 |
| **Hazards, health and safety - Existing environment** | | |
| 22.2 | Describe the likelihood and severity of hazards, health, and safety risks in the project footprint and surrounding area, including but not limited to, storms, floods, bushfires, drought, earthquakes, landslides, and heatwaves. Evaluate hazard-related vulnerabilities, constraints and considerations in the area, which are relevant for the impact assessment. | Section 22.4.1 |
| 22.3 | Describe the likelihood and severity of hazards, health, and safety risks due to the mineralogy of the project footprint and surrounding area. | Section 22.4.2 |

| Terms of reference - Content requirements of the EIS | | EIS Section |
|---|---|---|
| **Hazards, health and safety - Impact assessment** | | |
| 22.4 | Prepare a risk assessment and describe the potential risks to people, property, and environmental values that may be impacted by the project taking into account climate projections for the region, for all components and stages of the project. The assessment is to include: | Section 22.4 and 22.5 |
| | (a) identification of potential hazards and estimated probabilities of occurrence, including: | Section 22.4 |
| | (i) consideration of project activities and disturbance | Section 22.4.1 |
| | (ii) consideration of natural events (e.g. storms, cyclones, flooding, bushfires, earthquakes, heatwaves, landslides) that may affect the site with at least a one per cent annual exceedance probability or 100-year average reoccurrence interval level | Section 22.4.1 |
| | (iii) consideration of the mineralogy of the project footprint and surround area | Section 22.4.2.9 |
| | (iv) consideration of all hazardous substances (including fuels, chemicals, hazardous waste and explosives) to be used, transported, stored, processed or produced | Section 22.4.2 |
| | (v) consideration of whether the site or operation will meet the threshold of a major hazard facility either temporarily or permanently | Section 22.4.2 |
| | (vi) consideration of potential hazards associated with dam failure, petroleum and gas pipelines, abandoned mines, explosive magazines | Section 22.4.2 |
| | (vii) consideration of hazards posed by wildlife interactions (including mosquitos) | Section 22.4.1 |
| | (viii) consideration of hazards away from the project footprint where hazard characteristics may be changed by the project | Section 22.4.1 |
| | (ix) consideration of the cumulative impact of several natural hazards occurring at the one time | Section 22.5 |
| | (b) mapping of potential hazard areas within the project footprint | Section 22.4 |
| 22.5 | Detail any consultation undertaken with the relevant state, district and local emergency response authorities and organisations (including local disaster management groups, where relevant) to support the risk assessment and proposed mitigation measures. | Section 22.6 |
| 22.6 | Demonstrate compliance with the provisions of the Explosives Act 1999, the Mining and Quarrying Safety and Health Act 1999 the Radiation Safety Act 1999 and if applicable, Part 7 Subdivision 4 – Major hazard facilities of the Mining and Quarrying Safety and Health Regulation 2017. Discuss the contents and implementation of the relevant safety and health management system(s), including any engagement with Resources Safety and Health Queensland. | Section 22.9 |
| **Hazards, health and safety - Mitigation measures** | | |
| 22.7 | Describe how the project has been designed to avoid or mitigate project-related risks to people, property, and environmental values, including the need for fire breaks, overland flow and flood zones, no-go areas etc. | Section 22.7 |
| 22.8 | Detail safeguards and mitigation measures that will reduce the likelihood and severity of hazards, consequences and project-related risks to people, property, and environmental values. Identify the residual risk following the application of mitigation measures. Present an assessment of the overall acceptability of residual project risks with consideration of uncertainties and risk profiles. | Section 22.7 |

| Terms of reference - Content requirements of the EIS | | EIS Section |
|---|---|---|
| 22.9 | Where emergency response or hazard management plans are proposed to address scenarios and hazards identified in the risk assessment, provide a plan outline, including key measures and procedures, and consultation with relevant groups. As part of the emergency response plan, include the following: | Section 22.7 |
| | (a) a bushfire management plan, certified by a suitably qualified person, in consultation with the Queensland Fire Department and Rural Fire Service Queensland addressing construction and operations, and including the following information at a minimum: | Section 22.7.5 |
| | (i) a bushfire hazard analysis | Section 22.4.1.4 |
| | (ii) mitigation strategies to achieve the relevant development outcomes in Part E of the State Planning Policy– Natural Hazards, Risk and Resilience | Section 22.7.5 |
| | (iii) provides details of the proposed ongoing management of fuel loads across the subject site through grazing or mechanical means including the asset protection zone proposed | Section 22.4.1.4 |
| | (b) a safety and emergency management plan addressing construction and operations, and including the following information at a minimum: | Section 22.7 |
| | (i) evacuation plans for the construction and operation phases of the development | Section 22.7.4 |
| | (ii) safety management plans and emergency response procedures in consultation with the state and regional emergency service providers (including Queensland Fire Department and Rural Fire Service Queensland) and provide an adequate level of training to staff who will be tasked with emergency management activities. | Section 22.7.2 |
| 22.10 | Demonstrate how the project will meet the environmental objectives and performance outcomes in Schedule 8 of the EP Regulation. | Section 22.9 |
| 22.11 | Describe how risk management would be monitored, audited, and reported. Detail how corrective/preventative actions and continual improvement would be managed. | Section 22.10 |