CHAPTER 7
PUBLIC SAFETY

BIRD IN HAND GOLD PROJECT
MINING LEASE PROPOSAL

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Master Document Information			
Document Number	File Path	Format	Last Modified
BIHMLP_V2	O:\Technical\Bird In Hand\Regulatory\DSD\ML Application\BIHMLP_V2	PDF	18/6/2019

If you become aware of any changes or corrections that are required please photocopy this page and the relevant page(s) requiring changes, note the corrections, and email them to the Document Controller:

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Distribution Electronic Copies (Body and Appendices)

Document Number	Issued To	Format	Date
BIHMLP_Draft_V1	DEM	Adobe	18/12/2017
BIHMLP_V2	DEM (45 copies)	PDF	21/6/2019
BIHMLP_V2	DEM (5 copies)	Hard Copy	21/6/2019

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All maps presented in this chapter are in GDA94 / MGA zone 54 (EPSG: 28354) unless otherwise stated.

7 PUBLIC SAFETY

This chapter provides an overview of the existing environment relevant to public safety including a review of the identified potentially impacting events which could impact public safety if not adequately managed at the Bird in Hand Gold Project ('the Project' or 'BIHGP').

Construction, operation and closure of the proposed Project has the potential to create hazardous situations for the public through increased traffic movements, the introduction of additional ignition sources, emissions to air and water and alterations to the existing landform through the establishment of the underground mine workings and integrated mullock landform. The scale of effects on public safety is discussed and, where relevant, management and/or mitigation measures that would minimise impacts and risks are identified.

7.1 APPLICABLE LEGISLATION AND STANDARDS

The relevant legislation relating to public safety at the proposed mine is as follows:

- *Mine and Works Inspection Act 1920;*
- *Work Health and Safety Act 2012* (WHS Act)*; and*
- *South Australian Environmental Protection (Air Quality) Policy 2016* (Air Quality EPP).

Further information regarding the requirements and relevance of the legislation is provided in Chapter 4. Specifically, the following standards provide a range of criteria relevant to public safety:

- SafeWork Australia *Workplace Exposure Standards for Airborne Contaminants;*
- National Environment Protection (Assessment of Site Contamination) Measure 1999;
- National Environment Protection (Ambient Air Quality) Measure 2003;
- NSW Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales;
- AS 2187.2-2006: Explosives: Storage and use – Use of explosives;
- AS 1692-2006: Steel tanks for flammable and combustible liquids;
- AS 1940-2004: The storage and handling of flammable and combustible liquids; and
- AS 1725-2003: Chain-link fabric security fences and gates.

The National Environment Protection Council's (1999) National Environment Protection (Assessment of Site Contamination) Measure 1999 (NEPM) was established to provide a nationally consistent approach to identifying and managing site contamination. The NEPM refers to three different types of investigation levels: Ecologically-based Investigation Levels (EILs), Health-based Investigation Levels (HILs) and Groundwater Investigation Levels (GILs) which provides criteria (concentrations of contaminants) to guide the assessment of risks to human health and the environment. This approach ensures sound environmental management practices are adopted by all stakeholders when managing site contamination. Further information relating to site contamination can be found in Chapter 14.

The National Environment Protection (Ambient Air Quality) Measure 2003 outlines the ambient air quality standards adopted at the proposed mine for PM_{10} emissions. Predicted levels of emissions and the implications for air quality are discussed in detail in Chapter 15.

The nominated Australian standards each have specific design criteria that will be incorporated into mine design to protect public safety.

7.2 ASSESSMENT METHOD

A desktop review of existing public safety hazards was undertaken to determine positive or negative effects resulting from the construction, operation and closure of the mine. Desktop studies were supplemented with site-based investigations undertaken by various technical experts to verify findings. The following information sources were utilised:

- Historical significant fire events reported by the WMLR NRM;
- Air Quality Impact Assessment, AECOM 2017, Appendix N3;
- Traffic Assessment, Tonkin 2017, Appendix F1;
- Geotechnical Assessment, Mining One 2017, Appendix M1;
- Site Contamination Assessment and Site Contamination Management Plan, Golder Associates, 2017, Appendix L2 and L3; and
- Blasting Impact Assessment, SAROS 2017, Appendix P1.

7.3 EXISTING ENVIRONMENT

This section provides an overview of the existing environment within the proposed Mining Lease (ML) (the site) in relation to public safety. Many aspects of public safety are not linked to the existing environment, as the Project would be creating a new source – such as the risk of fire within the underground workings. All new sources are discussed in the impact and risk assessment section of this chapter (section 7.7). Existing environmental conditions include: existing fire hazards, air quality, seismic events (earthquakes), contaminated land and geochemical properties of existing material onsite.

Further detailed descriptions of the existing environment in relation to groundwater, air quality, earthquakes and seismicity, and contaminated land are provided in Chapters 10, 15, 14 and 13, respectively.

7.3.1 FIRE HAZARD

Bushfire is a natural part of the South Australian landscape. Research undertaken indicates that South Australia can expect serious fires somewhere in the State in 6 or 7 years out of every 10 (R. H. Luke, 1978). South Australians should be alert to the possibility of bushfire, particularly during the summer months and on days with high temperatures, wind and low humidity. During the Fire Danger Season, generally from 15 November to 30 April, there are strict conditions for lighting any fires. On Total Fire Ban Days all fires are banned (Bushfire Management Plan Committee, 2016).

The Adelaide Hills is contained within the Mount Lofty Ranges Fire Ban District (region 1), as defined by the South Australian Country Fire Service. Region 1 covers an area of 10 000 square kilometres of the Adelaide Hills, Fleurieu Peninsula and Kangaroo Island. The Goldwyn property is located within a “medium” fire risk area, as defined by the Adelaide and Mount Lofty Ranges Bushfire Management Plan (Bushfire Management Plan Committee, 2016).

Table 7-1 outlines significant bushfire events within the Mount Lofty Ranges district’s history (Bushfire Management Plan Committee, 2016).

TABLE 7-1 | SIGNIFICANT BUSHFIRES WITHIN THE MOUNT LOFTY RANGES AREA (BUSHFIRE MANAGEMENT PLAN COMMITTEE, 2016).

Year	Location	Notes
1938-1939	Adelaide Hills	£650 000, 90 houses
1943-1944	Adelaide Hills	
1948-1949	Bridgewater, Mount barker	
1950	Mount Lofty	
1951	Adelaide Hills, Woodside, Stirling, Lenswood	
1955	Adelaide Hills	Black Sunday - 40,000ha, 2 firefighters, $4,000,000
1980	Adelaide Hills	Ash Wednesday I - 3,770ha, 50 homes
1983	Adelaide Hills	Ash Wednesday II - 12 deaths, 120 homes, historic buildings.
1985	Adelaide Hills	
1987	Morialta	300 Ha
1988	Kersbrook	400 Ha
1995	Heathfield	450 Ha
2000	Brownhill Creek	1000 Ha
2001	Hillbank	350 Ha
2003	Morphett Vale	300 Ha
2005	Mount Osmond	120 ha, 3 buildings, 4 vehicles, 4 km fencing.
2007	Mount Bold	2,000ha, numerous sheds, livestock and equipment fire damaged.
2014	Eden Valley	25,000ha, 4 houses, multiple sheds, livestock, native fauna, 100s x km fencing
2015	Sampson Flat	12,600ha, 24 houses, 103 sheds, 62 firefighter injuries, $13 million.

Various ignition sources exist within the local area based on the current land use (predominately agricultural activity). These ignition sources include:

- Burn offs (both vegetation and rubbish);
- Harvester fires through material collecting on hot engine parts;
- Hay cutting and carting through hot exhaust on dry grass or spontaneous combustion;
- Cutting, welding and grinding equipment;
- Powerlines not appropriately cleared of vegetation;
- Electric fencing in the presence of dry vegetation; and
- Lightning strikes.

During 2015 and 2019, two landholders within the Mineral Claim (MC) have experienced small grassfires.

7.3.2 AIR QUALITY

AECOM were engaged by Terramin to undertake an Air Quality Impact Assessment (AQIA). This AQIA is located in Appendix N3.

Particulate matter refers to the many types and sizes of particles suspended in the air we breathe. Particles with an aerodynamic diameter of less than or equal to 50 µm are collectively referred to as Total Suspended Particles (TSP). TSP primarily causes aesthetic impacts associated with coarse particles (particles >10 µg) settling on surfaces, which also causes soiling and discolouration. These large particles can cause some irritation of mucosal membranes and can increase health risks from ingestion if contaminated. PM_{10} (particles < 10 µg) and $PM_{2.5}$ (particles (<2.5 µg) tend to remain suspended in the air for longer periods than larger particles and can penetrate human lungs.

Exposure to particulate matter has been linked to a variety of adverse health effects, including respiratory problems (e.g. coughing, aggravated asthma, chronic bronchitis) and heart attacks. If the particles contain toxic materials (such as lead, cadmium, zinc) or live organisms (such as bacteria or fungi), toxic effects or infection can occur from the inhalation of the dust.

Conversely, the impact of deposited dust is generally classified as nuisance only and does not directly affect human health. However, deposited dust on grape vine leaves has the potential to inhibit photosynthesis by blocking sunlight.

Particulate matter is unique among atmospheric pollutants in that it is not defined on the basis of its chemical composition; it includes a broad range of chemical species. Particulate matter can be emitted from natural sources (bushfires, dust storms and pollens) or as a result of human activities such as combustion activities (motor vehicle emissions, power generation and incineration), excavation works, bulk material handling, crushing operations, unpaved roads and use of wood heaters. For BIHGP, particulate matter will be emitted from a limited number of construction and operational activities including disturbance of soil and rock, traffic on haul roads, movement of fill materials, wind-blown dust from exposed surfaces, and exhaust emissions from vehicles and mobile plant.

A statistical summary of background TSP and PM_{10} is included below in

Table 7-2, Table 7-3 and Table 7-4, however, a more detailed discussion on the existing environment is included in Chapter 15.

TABLE 7-2 | 2014-2017 TSP STATISTICS

Monitoring year	Site	Number of valid samples	TSP Concentration (ug/m3)	
			Average	Maximum
2014	Site 1	23	27.8	48.1
2015	Site 1	27	18.6	64.0
2016	Site 6	27	28.9	111.0
2017	Site 6		33.2	43.2
NSW *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales**			90	

* No South Australian assessment guideline exists. The NSW guidelines are commonly used throughout industry as best practice

TABLE 7-3 | 2014-2015 PM10 STATISTICS

Monitoring year	Site	Corrected data capture	PM10 concentrations (ug/m3)			
			Average	70th Percentile	95th Percentile	Maximum
April 2014 to May 2015	Site 1	97%	8.6	10.4	16.0	47.4

Environmental Protection (Air Quality) Policy 2016 Guideline*	50

* Refers to the National Environment Protection (Ambient Air Quality) Measure 2003

TABLE 7-4 | 2017 PM10 STATISTICS

Monitoring year	Site	Number of valid samples	PM10 concentrations (ug/m3)			
			Average	70th Percentile	95th Percentile	Maximum
2017	Site 6	25	32.7	39.1	74.1	78.1
Project Objective			50			

7.3.3 MAJOR SEISMIC EVENTS

The Mount Lofty Ranges are the result of neotectonic movements that occurred in three principal stages associated with specific tectonic regimes: 1) Extensional Stage (Middle Eocene to Middle Miocene); 2) Transitional Stage (Late Miocene to Early Pleistocene); and 3) Compressional Stage (Early Pleistocene to the Present).

The major neotectonic structures in the region are the Meadows and Bremer Faults which are respectively located 4.7 kilometres to the east and 11.0 kilometres to the west of the BIHGPThe second order Nairne Fault is located 2.3 kilometre to the west of the BIHGP, Figure 1.

With the exception of the 5.6 magnitude earthquake of 1954 that was centered beneath Darlington, south of Adelaide no earthquake greater than magnitude 4 has occurred within 50 km of BIHGP since 1866, Figure 7-2.

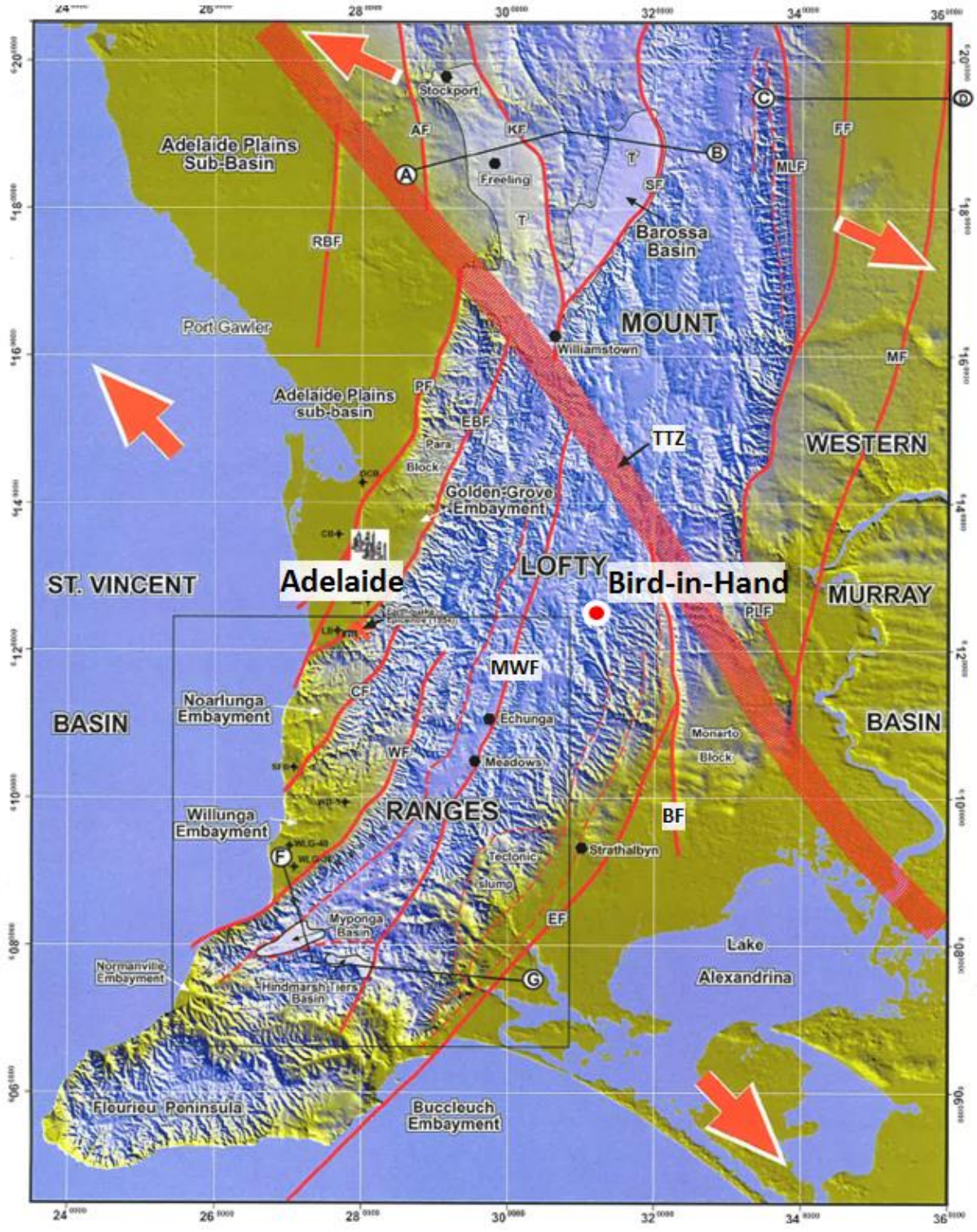

FIGURE 7-1 | NEOTECTONICS OF THE MOUNT LOFTY RANGES-MEADOWS FAULT- MWF, BREMER FAULTS – BF AFTER TOKAREV

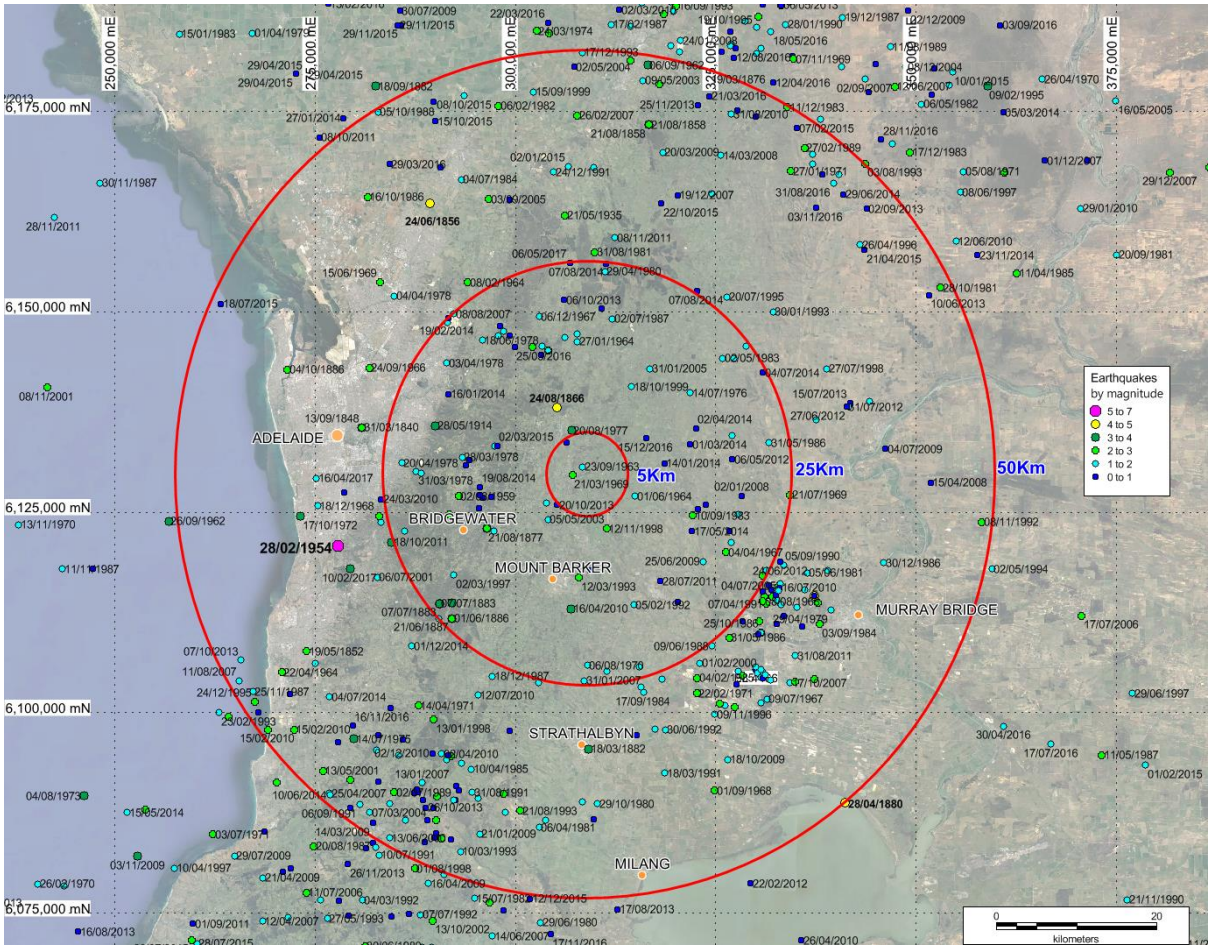

FIGURE 7-2 | LOCATION OF EARTHQUAKE EPICENTRES AND THEIR MAGNITUDE

Earthquake Hazard Risks for Australia are based on earthquake measurements taken from the Geoscience Australia Earthquake Database. Earthquake acceleration coefficients are derived for the structural design of buildings and infrastructure and determine the amount of weight that can be applied horizontally during an earthquake. The higher the value of this coefficient, the greater the risk of an earthquake occurring. The earthquake hazard map (Figure 7-3) shows the peak acceleration coefficient from earthquakes which have an annual exceedance probability of 1 in 500. Thus a value of 0.05 as an example means that in any 50 year period, there is a 90% chance that the peak ground acceleration will not exceed 0.05.

In Australian terms, the Project area is relatively seismically active, and there is a moderate risk of a low order earthquake. The Project has a probability of exceedance of 0.08g which is comparable to most Australian capital cities; Adelaide 0.08 g, Melbourne 0.08 g, Perth 0.09 g and Sydney 0.08 g (Burbidge, 2012).

To ensure the stability of engineered structures Terramin has, and is continuing to address the potential risks associated with both seismic activity and reactive soils. Engineered structures are developed under stringent modelling assumptions for seismic activity and reactive soils. Earthquake damage to the proposed mine installations would be minimal due to the small scale nature of fixed plant and infrastructure proposed. Relevant ANCOLD guidelines will be applied to the design requirements for the Project.

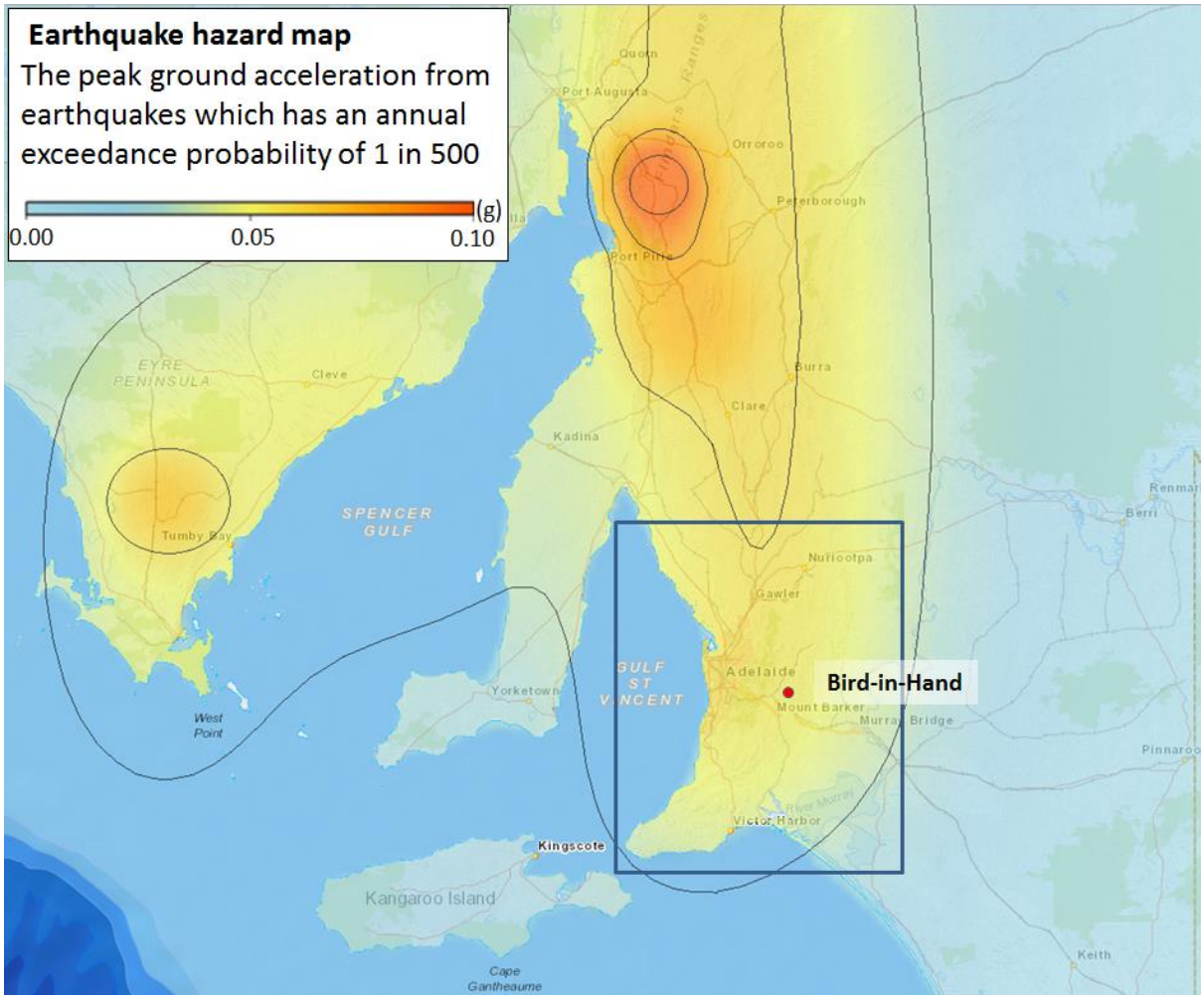

FIGURE 7-3 | SELECTED AREA FROM AUSTRALIAN GOVERNMENT - GEOSCIENCE AUSTRALIA 2012 AUSTRALIAN EARTHQUAKE HAZARD MAP

7.3.3.1 LANDSLIPS

No landslides have been recorded within or immediately adjacent to the proposed ML area (GA 2000a). The area within the proposed ML is characterised by gently undulating topography with low relief and slope gradients. No impacts (direct or indirect) to this environment are anticipated as a result of activities within this proposed ML.

7.3.4 CONTAMINATED LAND

To better understand the extent of any existing contamination on Terramin's Goldwyn property Terramin engaged Golder Associates Pty Ltd (Golder) to undertake a contaminated soil investigation in November 2016. The survey included the drilling of 34 soil bores across the site to a maximum depth of 3.2 metres below ground level. Representative soil samples were chemically tested based on the potential contaminants of concern identified in the site history investigation and Golder's field observations (Appendix L2 and L3).

Based on the results of the desktop study, field observations and the laboratory testing program undertaken, Golder conclude the following:

- The available site history information indicated that the site has been used for:

    - Mining and extractive activities, during late 1800s and early 1900s.
    - Farming activities, including crop growing and dairy farming.
- Elevated concentrations of metals (copper, zinc, lead, mercury) and/or cyanide are present within localised areas of shallow site soils associated with historic mining activities, in particular the tailings stockpile near the eastern boundary, the constructed swale south of the creek, the Lone Hand processing area and the Blackbird mine workings.
- No significant soil contamination has been identified associated with agricultural use of the site.
- Elevated concentrations of lead in some shallow soils may pose a risk to human health with respect to 'open space' land uses, if exposure to the contaminants were to occur.
- There is no evidence to indicate that the metals present in shallow site soils are significantly leachable. It's unlikely that metal impacts would penetrate far into deeper natural soils or impact underlying groundwater.
- Laboratory testing results for creek sediment samples indicated some elevated concentrations of metals. However, these concentrations did not exceed soil quality guidelines. Metals concentrations generally reduced from the upstream site boundary towards the downstream boundary. No significant metal or total recoverable hydrocarbon (TRH) impact was identified in the sediment from the wastewater ponds associated with the dairy.
- Concentrations of other potential contaminants of interest (including organochlorine and organophosphorus pesticides) were below the health and ecological screening guidelines.
- Concentrations of dissolved metals in surface water sampled from on the site (Goldwyn Creek) were found to exceed ANZECC (freshwater ecosystem) guidelines for copper, lead and zinc. However, concentrations of copper, lead and zinc were also found to be elevated above the ANZECC guidelines in surface water samples from upstream and downstream locations, indicating that the presence of elevated metals in surface water may not be directly attributed to the site. It is possible that the elevated metals concentrations are associated with natural mineralisation in the local environment.
- Concentrations of metals in groundwater extracted from two wells were found to exceed ANZECC (freshwater ecosystems) guidelines for zinc. However, concentrations of all metals tested did not exceed applicable potable or irrigation screening guidelines. Elevated concentrations of zinc may be attributed to naturally elevated background concentrations in the regional water system.

The site contamination assessment undertaken by Golder can be found in Appendix L2 and L3.

7.3.5 GEOCHEMICAL ASSESSMENT OF ALL ROCK TYPES THAT ARE PROPOSED TO BE DISTURBED

Please refer to Chapter 14: Geochemistry and Geohazards.

7.4 SENSITIVE RECEPTORS

Sensitive receptors relevant to public safety have been identified below in Table 7-5.

TABLE 7-5 | IDENTIFIED SENSITIVE RECEPTORS

Sensitive Receptor	Summary	Impact ID
Neighbouring residents	Residents located directly adjacent to the proposed underground workings and operating area.	PIE_7_02
Members of public / Local community	Any member of public who accesses the local area close to the underground workings and/or operating area.	PIE_7_01 PIE_7_03 PIE_15_20 PIE_15_21

7.5 POTENTIALLY IMPACTING EVENTS

Confirmed source-pathway-receptor (S-P-R) relationships relating to public safety that have been identified in this chapter include:

- Health impacts to local community as a result of air quality emissions which could disperse from an uncontrolled underground fire;
- Injury/fatality of member of the public caused by flyrock during construction;
- Unauthorised access to the mining lease results in injury or fatality of a member of the public
- Health impacts to neighbouring residents caused by blasting (air overpressure).

All public safety potential impacting events associated with groundwater are discussed in Chapter 10, those associated with geotechnical are discussed in Chapter 13, and those associated with site contamination are discussed in Chapter 14 in order to avoid duplication. Health impacts which arise from dust deposition have been included in chapter 15: Air quality, as air quality control measures have been discussed at length in that chapter.

As outlined below, a number of potential impact events were not considered further, as there is no confirmed S-P-R linkages. These include:

- Health impacts to local community from fine particulate matter post-closure, as there is no identified source,
- Heath impacts to local community from blasting emissions or onsite vehicle exhausts, as independent air quality experts do not consider this to be a credible source or pathway.

TABLE 7-6 | IDENTIFIED POTENTIALLY IMPACTING EVENTS

Potentially Impacting Events	Mine Life Phase	Source	Potential Pathway	Sensitive Receptors	Confirmation of S-P-R	Impact ID
Member of the public is injured by fly rock or air blast from blasting	Operation	Fly rock from mine blasting	Air	Member of public	Uncertain	PIE_7_01
Air Overpressure impact to local residents as a result of blasting operations (health)	Operation	Blasting operations	Air-overpressure	Neighbouring residents	Yes	PIE_7_02
Unauthorised access to the mining lease results in injury or fatality of a member of the public	Construction, Operation	Mine site	Land (through unrestricted access)	Member of public	Uncertain	PIE_07_03

Potentially Impacting Events	Mine Life Phase	Source	Potential Pathway	Sensitive Receptors	Confirmation of S-P-R	Impact ID
Uncontrolled fire underground in magazine results in emissions emanating from vent rise and decline/portal causing public health impacts	Construction, Operation	Emissions from fire in magazine	Air and prevailing wind	Local community	Yes	PIE_15_20
Uncontrolled fire underground (not in magazine) results in emissions emanating from vent rise and decline/portal causing public health impacts	Construction, Operation, Closure	Emissions from underground fire	Air and prevailing wind	Local community	Yes	PIE_15_21

7.6 CONTROL MEASURES TO PROTECT ENVIRONMENT

7.6.1 DESIGN MEASURES

Design measures that mitigate the potential public safety impact events are summarised in Table 7-7, and have are discussed below.

Specific design measures have been considered through the development of the Project in regard to air quality impacts. The most significant of these include the sealing of the vast majority of internal roads (excluding fire access tracks) and the location of the primary vent rise. The decision to locate the vent rise within Goldwyn was largely in response to air quality considerations, and hence the mine plan was altered to ensure the location has minimal impact on both the surrounding residence and the native vegetation located within the vegetation heritage agreement area. Alternate vent rise locations that were considered and ruled out included the SA water property, on the native vegetation block, and within the property boundary of Goldwyn.

Detailed air quality design measures are located in Chapter 15.

Detailed air over pressure control measures are located in Chapter 17.

Control measures on geotechnical stability are located in Chapter 13.

Control measures on contaminated land are located in Chapter 14.

TABLE 7-7 | IDENTIFIED DESIGN MEASURES

Design Measures	Impact ID
Fire hydrants and tanks located onsite	PIE_15_20 PIE_15_21
Fire access tracks located around operating area and vegetation	PIE_15_20 PIE_15_21
Emergency access on Bird in Hand Road (secondary access)	PIE_15_20 PIE_15_21
Fire suppressant systems in underground magazine	PIE_15_20 PIE_15_21
Dust suppression through site design – see Chapter 15 for details.	

Design Measures	Impact ID
Fencing, access control at entry and warning signs (to prevent unauthorised access)	PIE_07_03
Security cameras onsite	PIE_07_03

7.6.2 Management Strategies

Management measures to further mitigate potential public safety impact events with a confirmed Source-Pathway-Receptor are summarised in Table 7-8.

Management strategies to control air quality through the life of mine include water trucks and sprinkler system(s) through construction, as well as spray seeding newly constructed and disturbed soils as soon as practical after construction. Asphalting of roads as outlined in the site design will also be a priority, including the access road, car park, roads around the ore silo, and for deliveries. A permanent sprinkler system is proposed for the Integrated Mullock Landform (IML).

An Air Quality Management Plan would be developed through the PEPR stage and would cover construction, operations, and any proposed closure earthworks. A draft version of the Trigger Action Response Plan (TARP) for air quality has been included in Appendix N5 and outlines the actions and responses the Company would take in response to certain impact events – such as short term-high impact events. The final version of the TARP would be part of the Air Quality Management Plan submitted with the PEPR.

More detailed air quality management strategies are located in Chapter 15.

Control measures on geotechnical stability are located in Chapter 13.

7.6.2.1 ORE MATERIAL

As discussed in Chapter 13, the ore material contains higher concentrations of lead than the existing environment. No other hazardous sources have been identified during analysis of the ore. For this reason, design and management strategies have been incorporated into the Project. The potential hazard of lead dust will be managed through the;

- Wetting down of ore;
- Enclosed ore loading bay;
- Ore storage in silos; and
- Covered loads.

Additionally, the air quality monitoring (measurable criteria and leading indicator criteria) will include lead in the range of anolytes monitored in order to detect the effectiveness of the control measures.

7.6.2.2 AIR QUALITY

A permanent sprinkler system is proposed for the IML to reduce dust impacts associated with moving mullock both from the mine void, and also back into the mine void as backfill.

An Air Quality Management Plan will be developed through the PEPR stage and will cover construction, operations, and any proposed closure earthworks.

In regards to air quality emissions emanating from the vent rises, a Blast Management Plan will be developed through the PEPR stage, as well as an Underground Air Quality monitoring plan, as this reduces the potential for higher than necessary blast fumes to be emitted. The Underground Air Quality monitoring plan will form part of the OHS requirements for underground workers and safe working spaces.

A draft version of the Trigger Action Response Plan (TARP) for air quality has been included in Appendix N5 and outlines the actions and responses the Company would take in the case of certain impact events. The final version of the TARP will be submitted with the PEPR.

Detailed air quality management strategies are included in Chapter 15.

Detailed air over pressure control measures are located in Chapter 17.

TABLE 7-8 | IDENTIFIED MANAGEMENT STRATEGIES

Management Strategies	Impact ID
Equipment maintenance schedule to reduce fire risk associated with equipment	PIE_15_20 PIE_15_21
Fire suppression equipment located within all LVs and HVs and at points onsite	PIE_15_20 PIE_15_21
Hot Work Permits to reduce bushfire risk	PIE_15_20 PIE_15_21
Fuel reduction strategies included in the Biodiversity Management Plan	PIE_15_20 PIE_15_21
Site based water truck for rapid response	PIE_15_20 PIE_15_21
Training of personnel for emergency situations including bushfire	PIE_15_20 PIE_15_21
Emergency Response Plan	PIE_15_20 PIE_15_21
PIE_15_20	PIE_15_20

7.7 IMPACT ASSESSMENT

An assessment of all impacts and risks to public safety associated with traffic has been included in Chapter 8.

7.7.1 FIRE RISK

The consequence of a bushfire event could be considered **major to catastrophic**. However, the most credible worst case likelihood of the fire originating onsite is considered as **rare**. Management strategies are imperative in preventing fire risk. Design measures are in place for rapid response in the unlikely event of fire. These design measures include fire hydrants and extinguishers, the water truck onsite, and operational fire suppressant systems.

In regards to an impact to public health and safety from emissions through the ventilation raise during a fire, design measures such as fire suppressant systems have been put in place in the underground magazine. A 5m designed ventilation raise evasse will disperse the emissions. After mitigation, the residual risk is considered to be **moderate** if an underground fire were to occur.

7.7.2 Air Overpressure and Fly Rock

Providing design and management strategies are adhered to during construction and the very early stages of decline development, there are **negligible** impacts to public safety expected from air overpressure or flyrock. This is due to the relatively small blast sizes, and the standard safety measures in place. Blasting practices require some movement of rock to facilitate the excavation process. The extent of movement is dependent on the scale and type of operation. The surface blasting proposed for the Bird In Hand Project would be in line with a construction or small scale quarrying operation and is only very short term during the initial construction phase.

Overpressure levels will attenuate as the decline progresses underground. Previous investigations have indicated that levels can reduce by around 5dB(L) when 300 metres into the portal. Once the underground operation is established and blasting is occurring well down in the workings, air overpressure from production blasting should pose no issues and is unlikely to reach the surface. Air overpressure is regulated by Australian Standard 2187.2 – 2006. These standards are designed to limit human discomfort at a sensitive sites and generally form the basis for compliance criteria relating to long term blasting activities. Modelled air overpressure is from mining activities is significantly below levels which could impact human health. Both the mining method and blasting approach have been designed to these standards, and based on the modelling of ground vibration and air overpressure impacts. The proposed blasting practices, both at the surface and underground, can be successfully undertaken throughout the mine without the potential for any public safety impacts as a result.

Key design and implementation factors which prevent a pathway to the receptors include the following:

- adequate confinement of explosives with respect to both stemming heights and burdens to be maintained at all times;
- downloading of blastholes if minimum burden requirements are not met;
- accurate loading of charge weights ensuring holes are not overloaded;
- appropriate distribution of the energy within the blast;
- depth to the top of the explosive column to be checked with explosive product to be removed from overloaded holes prior to adding stemming material;
- use of appropriate stemming material;
- additional control measures to be applied when assessed as necessary;

The processes which control air overpressure levels and flyrock are the same and therefore, the proposed measures should in turn act as a safety control, restricting the extent of rock displacement.

The air-overpressure compliance criteria zone for the surface construction blasts proposed, indicated in green below, are largely located within the Goldwyn boundary and Terramin do not expect any flyrock to impact any identified receptor, as the zone of immediate impact is localised – as can be seen in Figure 7-4.

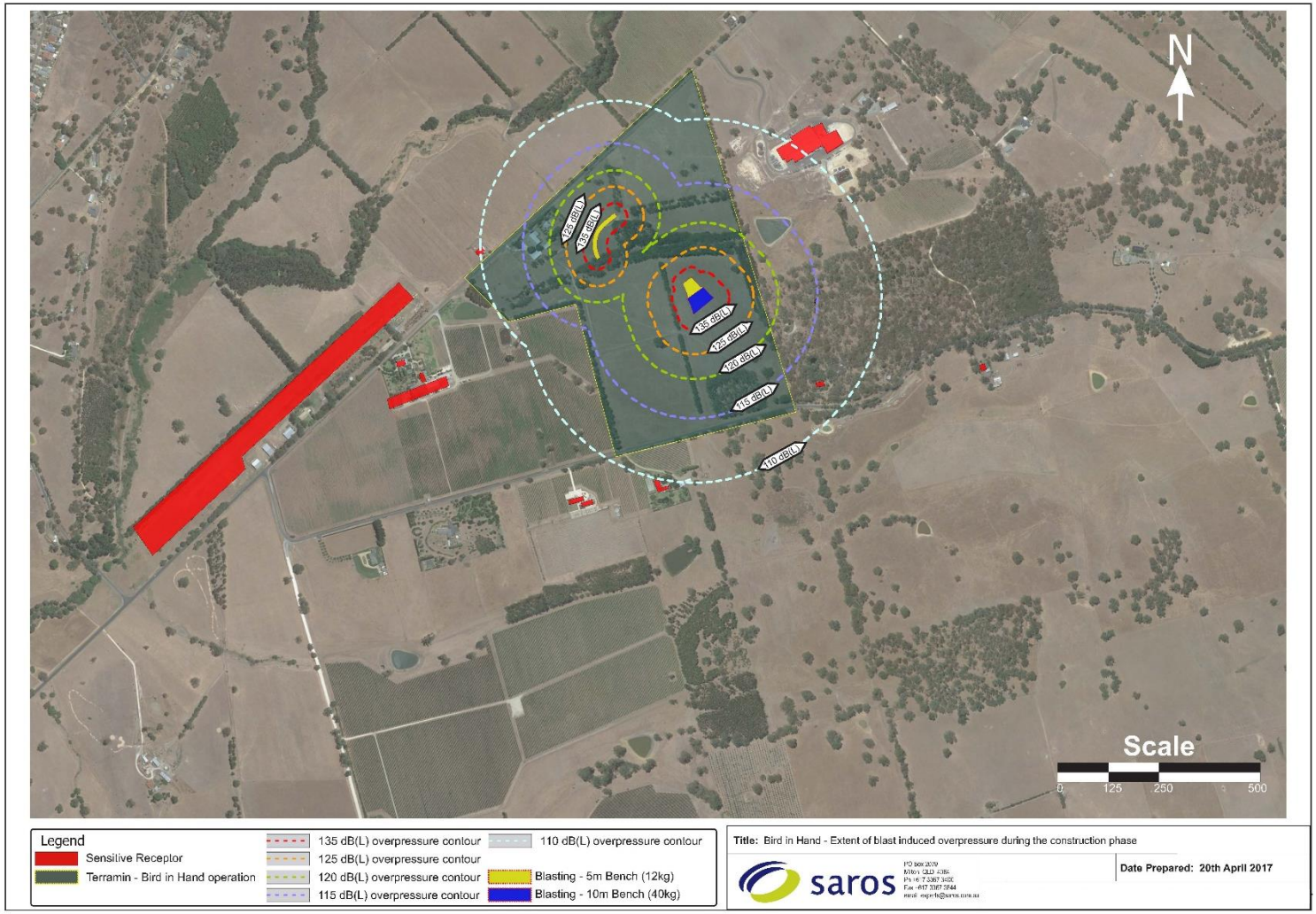

FIGURE 7-4 | EXTENT OF BLAST INDUCED OVERPRESSURE DURING THE CONSTRUCTION PHASE

7.7.3 Air Quality

The Air Quality Impact Assessment for the BIHGP contains modelling results for the construction and operation of the Project. Closure earthworks are considered to be significantly less that the construction earthworks, and for this reason, the construction scenario modelling should be considered as significantly conservative in regards to closure earthworks.

All considered impacts are discussed in chapter 15: Air quality and in the assessment are included in the Air Quality Impact Assessment located in Appendix N3.

Terramin do not expect any impact to public safety in regard to air quality from the mining operation.

The applicable project guidelines and air quality criteria have been developed by the South Australian EPA, NSW EPA, and the National Environmental Protection Measures and are considered to be safe air quality levels for communities.

The Air Quality Impact Assessment concluded the following:

- No exceedances of the Project Objectives were predicted at any offsite sensitive receptors for any of the pollutants of interest.
- The 24 hour average PM10 Project objective was approached (98% of the project objective) but not exceeded at Receptor 7 in the construction scenario.
- All predicted 24 hour average and annual average PM2.5 concentrations were well below the Project Objective for both construction and operation.
- No exceedances of the dust deposition Project Objectives were predicted at any sensitive receptor.
- Mitigation strategies were identified to be included in an air quality management plan. The mitigation strategies combined with a dust monitoring program is anticipated to allow compliance with the Project Objectives throughout the life of Bird in Hand Mine.

Overall, Terramin do not expect there will be any public health and safety impact arising from emissions from the mining operation.

7.8 DRAFT OUTCOME(S) AND MEASUREMENT CRITERIA

In accordance with the methodology presented in Chapter 6, an outcome has been developed for public safety impact events with a confirmed S-P-R linkage, see Table 7-9.

All outcomes are supported by draft measurement criteria which will be used to assess compliance against the proposed outcomes during the relevant phases (construction, operation and closure) and where relevant draft leading indicator criteria. These measurement criteria and leading indicators are indicative only and will be developed further through the PEPR.

All Outcomes for the entire project are presented in Appendix D1.

TABLE 7-9 | DRAFT OUTCOMES AND MEASUREMENT CRITERIA

Draft Outcome	Draft Measurement Criteria	Draft Leading Indicator Criteria
No public health impacts to local residents from dust generated by construction, mining or closure activities.	Dust generated from the mining lease during operation activities, measured live at predefined monitoring points[1] demonstrates PM_{10} at sensitive receivers is in accordance with the Air Quality Impact Assessment using a BAM unit and demonstrates that 24-hour average PM_{10} concentration does not exceed 50 µg/m^3 to ensure no public health impacts to local residents from dust generated by construction, mining or closure activities.	Annual public safety review does not identify additional actions that could reasonably be taken to reduce risks to the public.
No public injuries or deaths as a result of fires originating in the proposed mining lease that could have been reasonably prevented.	Independent investigation of all incidents that result in injury or death of the public are completed within 14 days, or as agreed with the Chief Inspector of Mines and demonstrate that the mine operator could not have reasonably prevented the incident from occurring.	Annual public safety review does not identify additional actions that could reasonably be taken to reduce risks to the public.
No adverse impact on public health or amenity from flyrock, vibration or air-overpressure caused by blasting.	All exploration holes and historic workings kept in database and part of blast design. If considered high risk for fly rock, exclusion zone put around and checked afterwards.	Annual public safety review does not identify additional actions that could reasonably be taken to reduce risks to the public.
No adverse impact on public health or amenity from flyrock, vibration or air-overpressure caused by blasting.	All blasting in accordance with Australian Standard AS2187.2.2006 'Use of explosive' and demonstrates peak air-overpressure level caused by blasting are less than 115 dBL at the nearest sensitive receptor for 95% of blasts per year, with a maximum of 120 dBL or higher limit as agreed with individual sensitive receptors.	All complaints acknowledged in 48 hours and closed out within 14 days to the satisfaction of the complainant or as agreed with the Chief Inspector of Mines.
No public injuries or fatalities as a result of unauthorised access to the mining lease.	Independent investigation of all incidents that result in injury or death of the public are completed within 14 days, or as agreed with the Chief Inspector of Mines and demonstrate that the mine operator could not have reasonably prevented the incident from occurring.	Annual public safety review does not identify additional actions that could reasonably be taken to reduce risks to the public.
No public injuries and/or deaths resulting from unauthorised entry to the operating site	All unauthorised entries to the operating site are investigated and investigations demonstrate all reasonable and practical measures were in place to prevent entry (and injury, if applicable).	Monthly check of perimeter security fencing around operating site and any evasses (ventilation and/or secondary egress)

7.9 FINDINGS AND CONCLUSIONS

Construction, operation and closure of the proposed BIHGP has the potential to create hazardous situations for the public through increased traffic movements, the introduction of additional ignition sources, emissions to air and water and alterations to the existing landform through the establishment

of the underground mine workings and integrated mullock landform. The scale of effects, or impacts on public safety regarding fire, emissions, flyrock, and unauthorised access have been assessed to be **negligible**, or of a scale where the pathway or source is not credible.