



APPENDIX N

Preliminary Hazard Analysis

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1 INTRODUCTION

The Dendrobium Mine – Plan for the Future: Coal for Steelmaking (the Project) is a proposed extension of the Dendrobium Mine (Approved Mine) to gain access to additional coal in two proposed future underground mining areas. The Project is situated approximately 8 kilometres west of Wollongong, in the Southern Coalfield of New South Wales (NSW) (Figure 1). The Project is owned and operated by Illawarra Coal Holdings Pty Ltd (Illawarra Coal), a wholly owned subsidiary of South32 Limited (South32).

South32 is seeking approval from the Independent Planning Commission for a Development Consent under Division 4.7 of Part 4 of the *Environmental Planning and Assessment Act, 1979* for the Project.

This document is a Preliminary Hazard Analysis (PHA) for the Project.

The Secretary of the Department of Planning and Environment (DPE) has provided the following requirements that may be relevant to the PHA:

Hazards – including an assessment of the likely risks to public safety, paying particular attention to potential bushfire risks, and the handling and use of any dangerous goods.

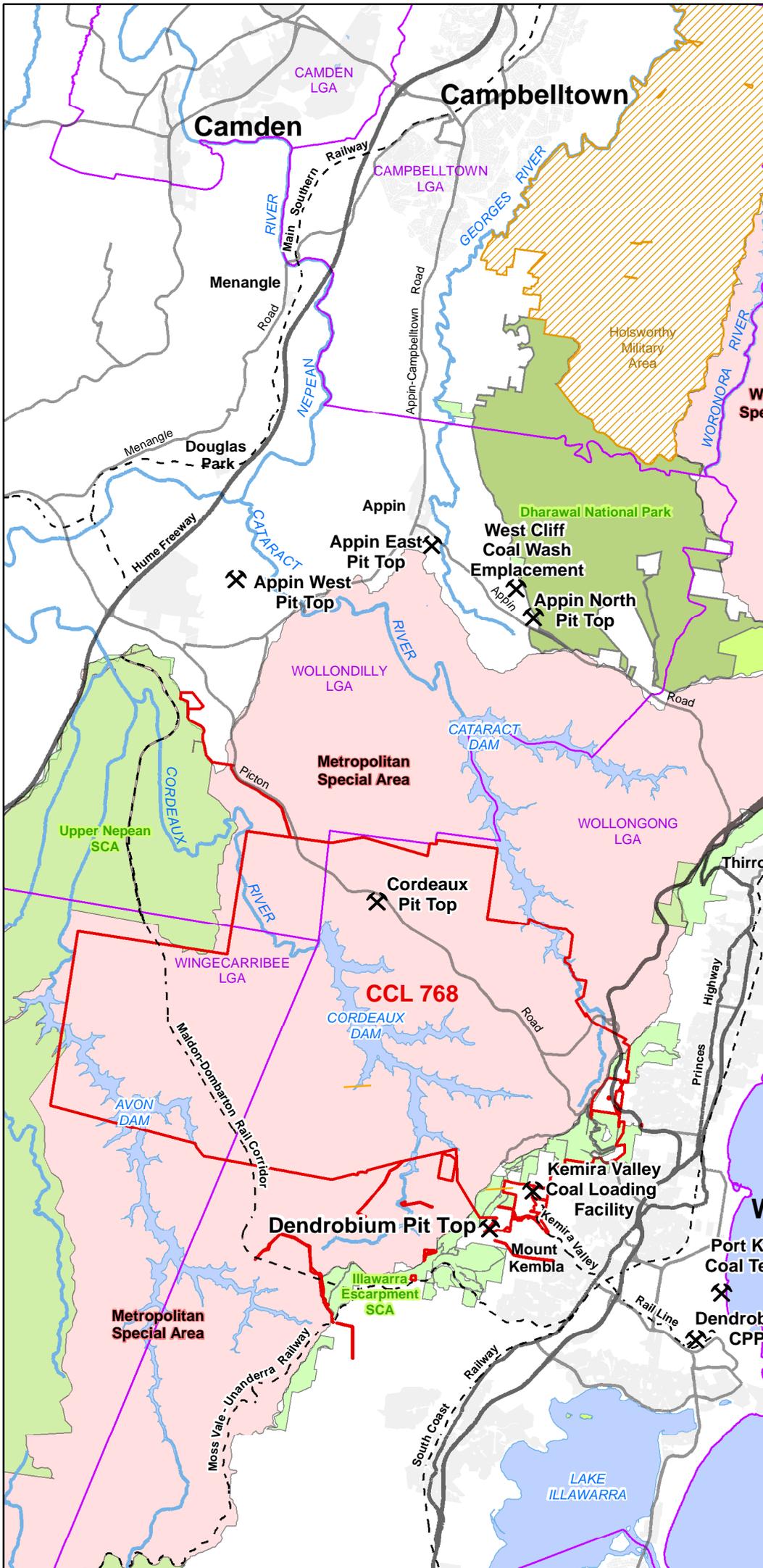
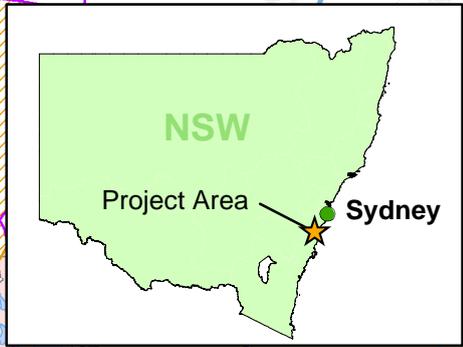
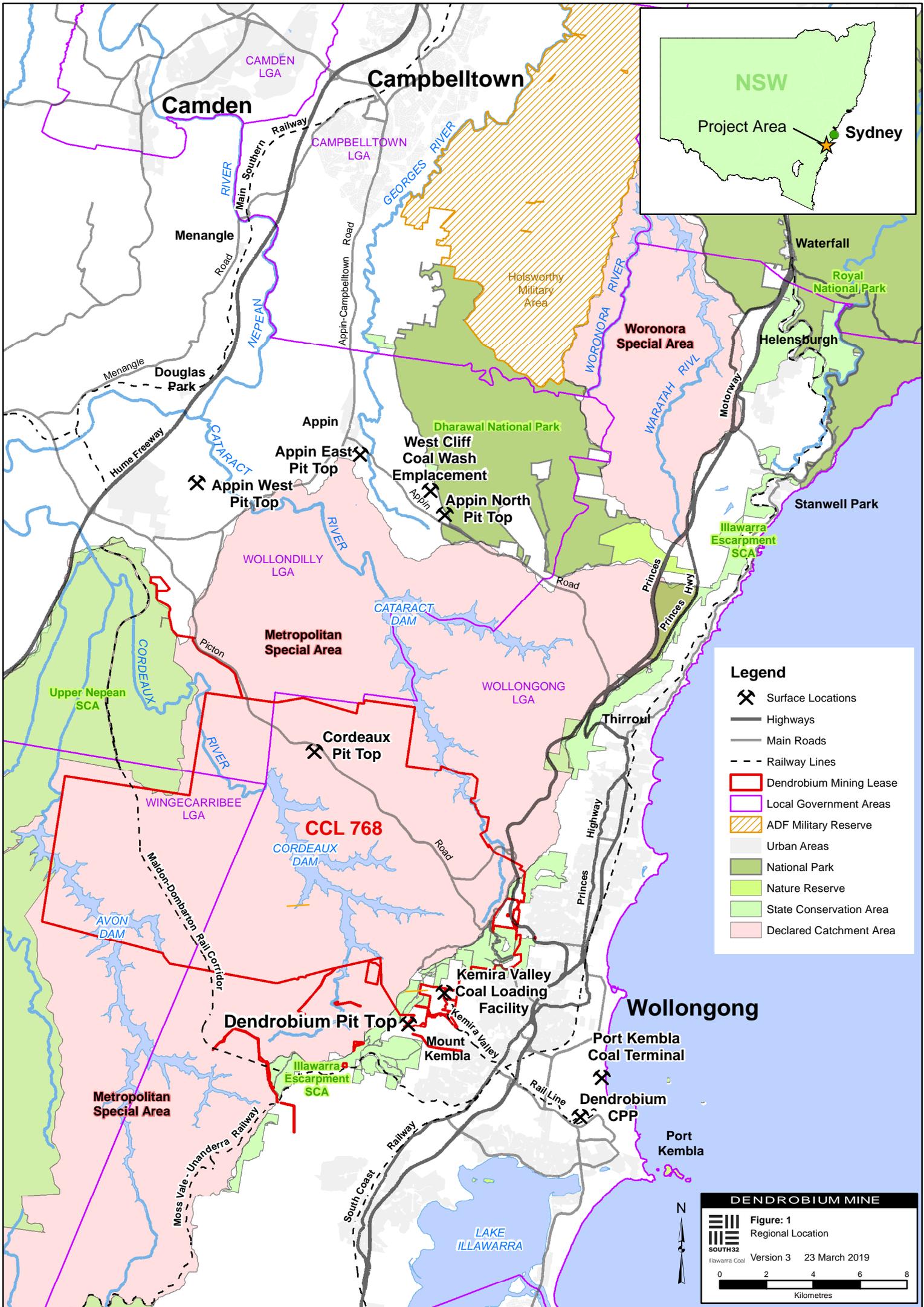
Consistent with the Secretary's Environmental Assessment Requirements (SEARs), this PHA addresses hazards relating to dangerous goods and bushfire. Risks to public safety associated with subsidence are considered in the Subsidence Assessment (Appendix A) and the Environmental Risk Assessment (Appendix M).

This PHA has been conducted to evaluate the hazards associated with the Project in accordance with the general principles of risk evaluation and assessment outlined in the NSW Department of Planning and Infrastructure (DPI) (now DPE) *Assessment Guideline: Multi-level Risk Assessment* (DPI, 2011). This PHA also addresses the requirements of *State Environmental Planning Policy No. 33 – Hazardous and Offensive Development* (SEPP 33) within the *Hazardous and Offensive Development Application Guidelines: Applying SEPP 33* (Department of Planning [DoP], 2011a). The PHA has been documented in general accordance with *Hazard Industry Planning Advisory Paper No.6: Hazard Analysis* (DoP, 2011b).

Assessed risks are compared to qualitative measures of consequence, likelihood and risk developed in accordance with Australian Standard/New Zealand Standard International Organisation for Standardisation (AS/NZS ISO) 31000:2009 *Risk Management – Principles and Guidelines*. Further, this PHA considers criteria provided within *Hazardous Industry Planning Advisory Paper No. 4: Risk Criteria for Land Use Safety Planning* (DoP, 2011c).

1.1 OBJECTIVE AND SCOPE

For this PHA, the 'site' is considered to comprise the extent of surface facilities and underground mining areas proposed to be used as part of the Project.



The objective of this PHA is to identify the off-site risks posed by the Project to people, their property and the environment, and assess the identified risks using applicable qualitative criteria. The *Assessment Guideline: Multi-level Risk Assessment* (DPI, 2011), states:

These guidelines specifically cover risks from fixed installations and do not encompass transportation by pipeline, road, rail or sea.

The PHA, therefore, considers off-site risks to people, property and the environment (in the presence of controls) arising from atypical and abnormal hazardous events and conditions (i.e. equipment failures, operator error and external events), with specific focus on fixed installations on-site. This assessment does not consider risks to Illawarra Coal employees or Illawarra Coal owned property, or risks that are not atypical or abnormal (e.g. long-term effects of typical dust emissions).

On-site environmental risks and potential long-term impacts are considered in the Environmental Risk Assessment (Appendix M of the Environmental Impact Statement [EIS]) and, where relevant, in the following studies included in the EIS:

- Appendix A – Subsidence Assessment.
- Appendix B – Groundwater Assessment.
- Appendix C – Surface Water Assessment.
- Appendix D – Biodiversity Assessment Report and Biodiversity Offset Strategy.
- Appendix E – Aquatic Ecology Assessment.
- Appendix F – Aboriginal Cultural Heritage Assessment.
- Appendix G – Historical Heritage Assessment.
- Appendix H – Road Transport Assessment.
- Appendix I – Air Quality and Greenhouse Gas Assessment.
- Appendix J – Noise and Blasting Assessment.
- Appendix K – Social Impact Assessment.
- Appendix L – Economic Assessment.
- Appendix O – Land Contamination Assessment.
- Appendix P – Geological Structure Review.

1.2 PRELIMINARY SCREENING PROCESS

Preliminary screening to determine the requirement for a PHA was undertaken for the Project, taking into account broad estimates of possible off-site effects or consequences from hazardous materials present on-site and their locations. Potentially hazardous industry is defined by the DPI (2011) as having "*potential for significant injury, fatality, property damage or harm to the environment in the absence of controls*".

In accordance with *Assessment Guideline: Multi-level Risk Assessment* (DPI, 2011), it was determined that the Project is potentially hazardous, as the possibility of harm to the off-site environment in the absence of controls could not be discounted.

According to *Assessment Guideline: Multi-level Risk Assessment* (DPI, 2011), a Level 1 assessment (qualitative analysis) can be justified if the analysis of the facility demonstrates that there are no major off-site risks, the technical and management controls are well understood, and there are no sensitive surrounding land uses.

The PHA review team (Section 1.3.1) considered this screening process and concluded that there is limited potential for scenarios with significant off-site consequences, the technical and management controls are well understood and there are no sensitive surrounding land uses. Accordingly, the team implemented a Level 1 assessment (qualitative analysis) for this PHA.

1.3 STUDY METHODOLOGY

The methodology employed during the preparation of this PHA was as follows:

- (i) Identify the hazards associated with the Project.
- (ii) Analyse the consequence of identified hazardous events.
- (iii) Qualitatively estimate the likelihood of hazardous events.
- (iv) Propose risk treatment measures.
- (v) Qualitatively assess risks to the environment, members of the public and their property arising from atypical and abnormal events and compare these to the risk criteria outlined in *Hazardous Industry Planning Advisory Paper No. 4: Risk Criteria for Land Use Safety Planning* (DoP, 2011c).
- (vi) Recommend further risk treatment measures, if necessary.
- (vii) Qualitatively determine the residual risk assuming the implementation of the risk treatment measures.

1.3.1 Preliminary Hazard Analysis Review Team

The above methodology was implemented in December 2017 during a PHA team-based risk review. The review participants included technical advisors from South32 including:

- Gary Brassington – Illawarra Coal, Principal Approvals.
- Peter McMillan – Illawarra Coal, Environment Supervisor.

1.3.2 Risk Management Process

This PHA has been undertaken with regard to the risk management process described in AS/NZS ISO 31000:2009. The risk management process is shown schematically on Figure 2 and includes the following components:

- Establish the context – Sections 1 and 2.
- Identify risks – Section 3.2 and Attachment A.
- Analyse risks – Section 4 and Attachment A.
- Evaluate risks – Section 4 and Attachment A.
- Treat risks – Sections 3.2.3 and 4 and Attachment A.

1.3.3 Risk Criteria

This PHA considered the following qualitative criteria (DoP, 2011c):

- All 'avoidable' risks should be avoided. This necessitates investigation of alternative locations and technologies, wherever applicable, to ensure that risks are not introduced in an area where feasible alternatives are possible and justified.*
- The risks from a major hazard should be reduced wherever practicable, irrespective of the value of the cumulative risk level from the whole installation. In all cases, if the consequences (effects) of an identified hazardous incident are significant to people and the environment, then all feasible measures (including alternative locations) should be adopted so that the likelihood of such an incident occurring is made very low. This necessitates the identification of all contributors to the resultant risk and the consequences of each potentially hazardous incident. The assessment process should address the adequacy and relevance of safeguards (both technical and locational) as they relate to each risk contributor.*
- The consequences (effects) of the more likely hazardous events (i.e. those of high probability of occurrence) should, wherever possible, be contained within the boundaries of the installation.*
- Where there is an existing high risk from a hazardous installation, additional hazardous developments should not be allowed if they add significantly to that existing risk.*

1.3.4 Qualitative Measures of Consequence, Likelihood and Risk

When undertaking a qualitative risk assessment, it is useful to define (in a descriptive sense) the various levels of consequence of a particular event, and the likelihood (or probability) of such an event occurring. Standard South32 risk matrices were reviewed during the 'Establish the Context' phase of the Risk Management Process (Section 1.3.2).

In accordance with AS/NZ ISO 31000:2009, Tables 1, 2 and 3 were reviewed by the team and were considered to be consistent with the specific objects and context of this PHA.

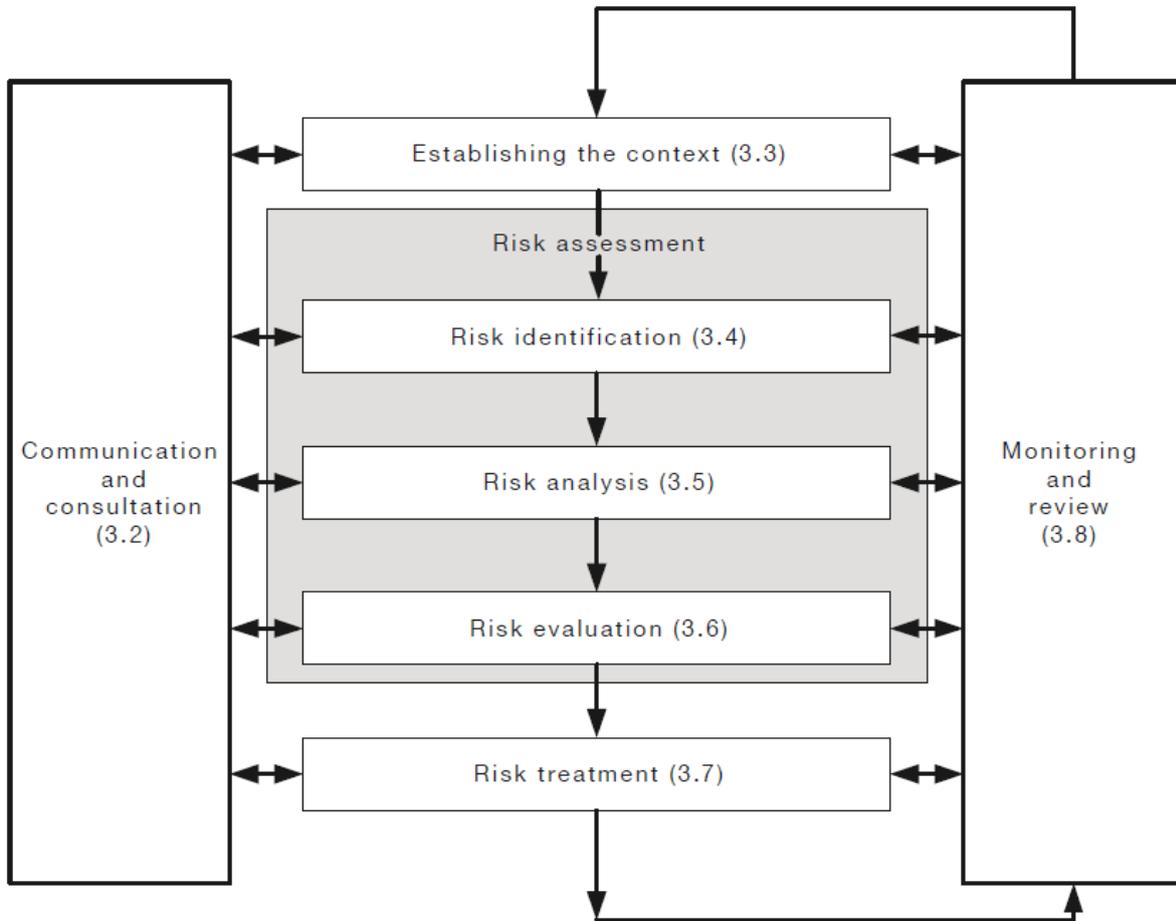


Figure 2 – Risk Management Process

Source: Handbook (HB) 203:2012 *Managing environment-related risk*.

**Table 1
Qualitative Measures of Probability**

Event	Likelihood	Description
10	Almost Certain	Could be expected to occur more than once during the study or project. Could occur once per year.
3	Likely	Could easily be incurred and has generally occurred in similar studies or projects. Could be incurred in 1 to 2 years.
1	Possible	Incurred in a minority of similar studies or projects. Could be incurred within a 5 year strategic budget period.
0.3	Unlikely	Known to happen, but only rarely. Could be incurred within a 5 to 20 year timeframe.
0.1	Rare	Has not occurred in similar studies or projects, but could. Could be incurred in 20 to 50 years.
0.03	Very Rare	Conceivable, but only in extreme circumstances. Has not happened in industry in the last 50 years.

Table 2
Qualitative Measures of Maximum Reasonable Consequence

Estimated Level of Consequence	Area of Effect			
	Harm to People	Environmental	Community	Financial
1	Low-level short-term subjective symptoms or inconvenience. No medical treatment.	Low-level impact to land, biodiversity, ecosystem services, water resources or air.	Single low-level community health, safety or security impact, low-level inconvenience <2 weeks, minor, low-level disturbance to a single house or structure.	<US\$500,000 loss or production delay.
3	Objective but reversible impairment. Medical treatment, injury or illness.	Minor impacts (<3 months) to land, biodiversity, ecosystem services, water resources or air.	Minor community health, safety or security impacts (<10 households) or human rights infringements, inconvenience to livelihoods <6 months, moderate damage to <50 houses or community infrastructure.	US\$5,000,000 to >US\$500,000 loss or production delay.
10	Permanent impairment <30% of body to one or more persons.	Moderate impacts (<1 year) to land, biodiversity, ecosystem services, water resources or air.	Moderate community health, safety or security impacts (<50 households). Single allegation of human rights violations, moderate disruption to people's lives (<50 households).	US\$25,000,000 to >US\$5,000,000 loss or production delay.
30	Single fatality. Permanent impairment >30% of body to one or more persons.	Major impacts (<5 years) to land, biodiversity, ecosystem services, water resources or air.	Serious community health, safety or security impacts (<50 households). Multiple allegations of human rights violations, extended disruption to people's lives (>50 households).	US\$100,000,000 to >US\$25,000,000 loss or production delay.
100	2-20 fatalities. Permanent impairment >30% of body to more than 10 persons.	Serious or extensive impacts (<20 years) to land, biodiversity, ecosystem services, water resources or air.	Serious community health, safety or security impacts (>50 households) or human rights violation, extended disruption to people's lives (>200 households).	US\$250,000,000 to >US\$100,000,000 loss or production delay.
300	>20 fatalities. Permanent impairment >30% of body to more than 100 persons.	Severe impacts (>20 years) to land, biodiversity, ecosystem services, water resources or air.	Extensive community health, safety or security impacts (>200 households) or human rights violations, extended serious disruption to people's lives (>1000 households).	>\$250,000,000 loss or production delay.

**Table 3
Risk Ranking Table**

Likelihood	Consequence					
	Low 1	Minor 3	Moderate 10	Significant 30	Major 100	Catastrophic 300
10 Almost Certain	10	30	100	300	1,000	3,000
3 Likely	3	9	30	90	300	900
1 Possible	1	3	10	30	100	300
0.3 Unlikely	0.3	0.9	3	9	30	90
0.1 Rare	0.1	0.3	1	3	10	30
0.03 Very Rare	0.03	0.09	0.3	0.9	3	9

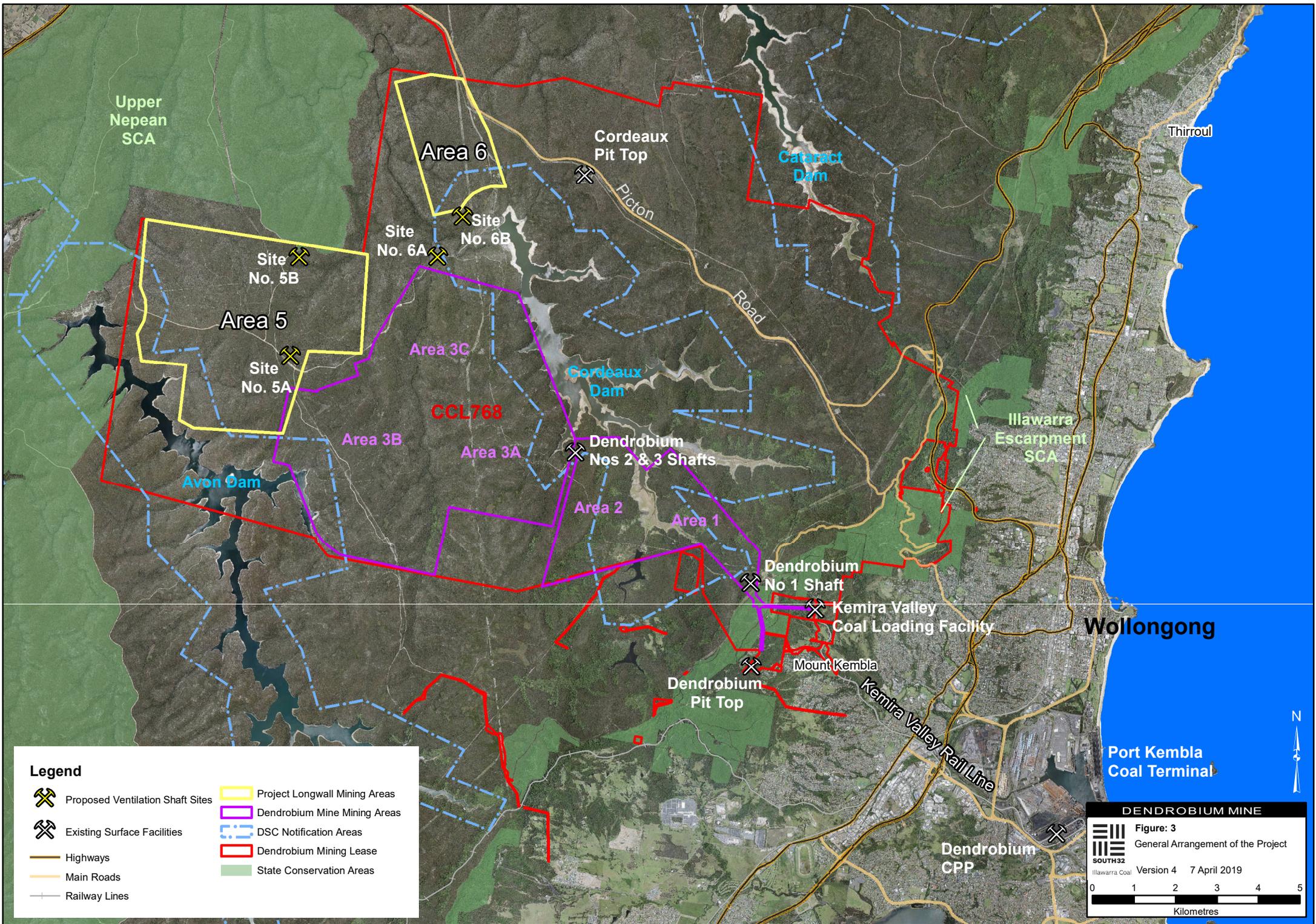
2 PROJECT OVERVIEW

The main activities associated with the development of the Project would include:

- longwall mining of the Bulli Seam in a new underground mining area (Area 5);
- longwall mining of the Wongawilli Seam in a new underground mining area (Area 6);
- development of underground roadways within the Bulli Seam, Wongawilli Seam and adjacent strata to access mining areas;
- use of existing underground roadways and drifts for personnel and materials access, ventilation, dewatering and other ancillary activities related to Areas 5 and 6;
- development of surface infrastructure associated with mine ventilation and gas management and abatement, and other ancillary infrastructure;
- handling and processing of up to 5.2 million tonnes per annum of run-of-mine (ROM) coal;
- use of the existing Dendrobium Pit Top, Kemira Valley Coal Loading Facility, Dendrobium Coal Preparation Plant (CPP) and Dendrobium Shafts with minor upgrades and extensions;
- use of the Cordeaux Pit Top for mining support activities;
- augmentation of mine access arrangements, including upgrades to, and the use of, the Cordeaux Pit Top;
- transport of sized ROM coal from the Kemira Valley Coal Loading Facility to the Dendrobium CPP via the Kemira Valley Rail Line;
- delivery of product coal from the Dendrobium CPP to the Port Kembla Steelworks for domestic use or to the Port Kembla Coal Terminal for export;
- transport of coal wash by road to customers for engineering purposes (e.g. civil construction fill), for other beneficial uses and/or for emplacement at the West Cliff Stage 3 and Stage 4 Coal Wash Emplacement;
- development and rehabilitation of the West Cliff Stage 3 Coal Wash Emplacement;
- progressive development of sumps, pumps, pipelines, water storages and other water management infrastructure;
- controlled release of excess water in accordance with the conditions of Environmental Protection Licence 3241 and/or beneficial industrial re-use;
- monitoring, rehabilitation and remediation of subsidence and other mining effects; and
- other associated minor infrastructure, plant, equipment and activities.

An indicative Project general arrangement is provided on Figure 3.

A description of the Project is provided in Section 3 of the Main Report of the EIS.



Legend

-  Proposed Ventilation Shaft Sites
-  Existing Surface Facilities
-  Highways
-  Main Roads
-  Railway Lines
-  Project Longwall Mining Areas
-  Dendrobium Mine Mining Areas
-  DSC Notification Areas
-  Dendrobium Mining Lease
-  State Conservation Areas

DENDROBIUM MINE

Figure 3
General Arrangement of the Project

Version 4 7 April 2019

0 1 2 3 4 5
Kilometres

3 HAZARD IDENTIFICATION

The Project's potential hazards include the handling of hydrocarbons, chemicals and explosives. A brief description of these materials is presented below. The description below focuses on the existing facilities associated with the Dendrobium Mine that would continue to be used for the Project, and additional facilities proposed for the Project where relevant.

In addition, the stockpiling of ROM and product coal has also been considered in this PHA.

3.1 DESCRIPTION OF HAZARDOUS MATERIALS

The transportation, handling and storage of all dangerous goods for the Project would be in accordance with the NSW *Work Health and Safety Regulation, 2017*.

3.1.1 Hydrocarbons

Hydrocarbons used on-site would include fuels (i.e. diesel and petrol), oils, greases, degreaser and kerosene.

Hydrocarbon storage facilities would be operated in accordance with the requirements of AS 1940:2004 *The Storage and Handling of Flammable and Combustible Liquids*.

The storage and handling of diesel, petrol and oil would be in accordance with AS 1940:2004, dependent on their classification. Diesel is classified by AS 1940:2004 as a combustible liquid (Class C1) for the purpose of storage and handling. For transport purposes, diesel is not classified as a dangerous good by the criteria set in the Australian Dangerous Goods Code (ADG Code), as it has a flashpoint between 60 and 150 degrees Celsius (National Transport Commission, 2017). Petrol is classified as a flammable liquid (Class 3) by AS 1940:2004 and is, therefore, a dangerous good, according to the criteria of the ADG Code. Oil is classified by AS 1940:2004 as a combustible liquid (Class C2).

There are three existing bunded areas for hydrocarbon storage at Dendrobium Pit Top that would be used for the Project. Two bulk chemical storage containers within the bunded areas, one for hydraulic oil storage and one for diesel storage, would be utilised by the Project.

Two existing hydrocarbon bunded areas at the Dendrobium CPP would continue to be used, including a Methyl iso-Butyl Carbinol storage tank and a diesel storage tank. A small grease and oil storage area is also maintained within the main Dendrobium CPP building.

The existing underground bulk diesel storage tank at the Cordeaux Pit Top would continue to be used for the Project. The storage tank would be managed in accordance with the *Protection of the Environment Operations (Underground Petroleum Storage Systems) Regulation, 2014* (or equivalent).

In addition to the permanent bunded areas, portable bunds would be utilised for the transportation or transient storage of fuels and oils around the site. The usage of petrol on-site would be minor and petrol-fuelled vehicles would primarily be refuelled off-site at local service stations.

The type and quantities of hydrocarbons stored on-site would continue to be documented in the relevant Pollution Incident Response Management Plan prepared under the *Protection of the Environment Operations (General) Regulation, 2009*.

3.1.2 Chemicals

The management and storage of chemicals for the Project would be conducted in accordance with Illawarra Coal's prescribed management procedures, Australian Standards and Codes.

Chemical storage areas would be separated according to chemical type and storage requirements. Illawarra Coal would continue to assess new substances before their use on-site by completing a substance evaluation and risk assessment. Safety Data Sheets and substance evaluations would be available to site personnel.

All chemicals brought on-site are recorded in a register, which identifies the type of product, dangerous goods class, liquid class, hazardous chemical class and the quantity held on-site. The inventory register also identifies the compatibility of materials and the emergency response procedures in the event of a spill.

3.1.3 Explosives

Explosives would be stored in existing explosive storage facilities at the Dendrobium Pit Top and Cordeaux Pit Top for designated uses if the operations or an emergency required the use of explosives.

Explosives storage would be conducted in accordance with the NSW *Explosives Act, 2003* and *Explosives Regulation, 2013*. The *Explosives Regulation, 2013* details the requirements for the safe storage, land transport and handling, and disposal of the explosive, with reference to AS 2187.2:2006 *Explosives – Storage and Use – Use of Explosives* for specific guidelines.

The storage of explosives on-site would be in limited quantities and within the conditions under the Licence to Store Explosives currently in place at the Approved Mine.

3.1.4 Liquid and Non-Liquid Wastes

Solid and hazardous waste generated at the Approved Mine is removed from the site and disposed of by a licensed contractor. Contaminated waste or asbestos (if identified) would require further assessment and advice to be sought regarding waste classification, handling, treatment, disposal and reporting requirements prior to appropriate licenced disposal.

General solid waste (e.g. timber, paper, steel, food waste, etc.) produced by the Project at surface facilities will be disposed of by a licensed waste contractor, and waste produced at the underground mining areas would be transported to an off-site approved waste handling facility for sorting and recycling or disposal.

Used tyres would be segregated and collected either for repairs (if possible) or for disposal by a licensed waste contractor.

Sewage and effluent would continue to be plumbed into the town sewerage system from the Dendrobium Pit Top and Dendrobium CPP. Remaining sewage and effluent produced on-site will be held in the sewage holding tank, prior to being removed by a licensed waste contractor.

Wastewater from bathhouses at the Dendrobium Pit Top would be treated at the on-site water treatment facility. Treated bathhouse water would be recycled on-site.

3.2 HAZARD IDENTIFICATION PROCESS

3.2.1 Project Components

As this assessment specifically covers risks from fixed installations (Section 1.1), the main focus of this assessment is on on-site storages, coal stockpile areas and water management structures. Some additional risks relating to mining operations (e.g. unplanned/unauthorised movement of mobile plant off-site) were identified and included in this PHA.

3.2.2 Incident Classes

The following generic classes of incidents were identified:

- leak/spill;
- fire;
- explosion;
- theft;
- unplanned/unauthorised movement of mobile plant;
- release of noxious gases to atmosphere; and
- equipment/mine infrastructure malfunction.

These incident classes were applied to the Project component areas to identify scenarios for which treatment measures were developed.

3.2.3 Project Risk Treatment Measures

Illawarra Coal implements a safety management system at the Approved Mine to manage risks to health and safety in accordance with the requirements of the *Work Health and Safety (Mines and Petroleum Sites) Act, 2013* and the *Work Health and Safety (Mines and Petroleum Sites) Regulation, 2014*. Illawarra Coal would continue to meet these obligations for the Project.

In addition, hazard control and mitigation measures are also described in the following existing management documents and systems which would be relevant to, and revised for, the Project:

- Water Management Plan, including:
 - Site Water Balance;
 - Erosion and Sediment Control Plan;
 - Surface Water Monitoring Program; and
 - Surface and Groundwater Response Plan.
- Landscape Management Plan;
- Mining Operations Plan;
- Pollution Incident Response Management Plan;
- Air Quality Monitoring Program;
- Bushfire Management Plan; and
- Waste Management Plan.

The following hazard control and mitigation measures would be adopted for the Project:

- **Maintenance** – Ongoing and timely maintenance of all mobile and fixed plant and equipment in accordance with the recommended maintenance schedule, and consistent with the maintenance schemes required by legislation.
- **Staff Training** – Operators and drivers would be trained and (where appropriate) licensed for their positions. Only those personnel licensed to undertake skilled and potentially hazardous work would be permitted to do so.
- **Engineering Structures** – Mining and civil engineering structures would be constructed in accordance with the applicable codes, guidelines and Australian Standards. Where applicable, Illawarra Coal would obtain the necessary licences and permits for engineering structures.
- **Contractor Management** – All contractors employed by Illawarra Coal would be required to operate in accordance with the relevant Australian Standards and NSW legislation.
- **Water Management** – As reported in Appendix C of the EIS, water management structures would be constructed to generally separate runoff from undisturbed areas and disturbed areas.
- **Storage Facilities** – Storage and usage procedures for potentially hazardous materials (i.e. fuels, lubricants and chemicals) would be developed in accordance with Australian Standards and relevant legislation. A register of chemicals and dangerous goods stored on-site would be kept up-to-date via a tracking, storage and chemical information management system.
- **Emergency Response** – Emergency response procedures, manuals and systems would continue to be implemented.
- **Waste Management System** – Waste would be managed according to a hierarchy of waste control (avoidance, resource recovery and disposal). Waste disposal measures and a monitoring program are described in the Waste Management Plan.

4 RISK MANAGEMENT AND EVALUATION

Attachment A presents a qualitative assessment of risks associated with the operation of the Project. As described in Section 1.1, the assessment particularly evaluates the off-site risks of fixed installations at the Project to people, their property and the environment arising from atypical and abnormal hazardous events and conditions.

Hazard treatment measures have been proposed, where required, to produce a tolerable level of risk in accordance with the risk acceptance criteria described in Section 1.3.3. Proposed risk treatment measures are identified in Section 3.2.3.

The Level 1 assessment conducted is justified, as this PHA demonstrates a societal risk in the negligible zone and there are no potential scenarios with significant off-site consequences in accordance with *Multi-level Risk Assessment* (DPI, 2011) (Section 1.2).

5 REFERENCES

- Department of Planning (2011a) *Hazardous and Offensive Development Application Guidelines: Applying SEPP 33*.
- Department of Planning (2011b) *Hazardous Industry Planning Advisory Paper No. 6: Hazard Analysis*.
- Department of Planning (2011c) *Hazardous Industry Planning Advisory Paper No. 4: Risk Criteria for Land Use Safety Planning*.
- Department of Planning and Infrastructure (2011) *Assessment Guideline: Multi-Level Risk Assessment*.
- National Transport Commission (2017) *Australian Code for the Transport of Dangerous Goods by Road & Rail*.

ATTACHMENT A
HAZARD IDENTIFICATION AND ANALYSIS TABLE

**Table A-1
Hazard Identification and Analysis**

Project Component	Incident Type	Scenario	Existing and Proposed Treatment Measures	Likelihood ¹	Consequence ²	Risk ³
On-Site Storage Hydrocarbons (i.e. fuels [diesel and petrol], Liquefied Petroleum Gas (LPG), oils, greases, degreaser and kerosene), explosives and chemicals.	Leak/Spill	Failed tank or associated fittings, pump or pipe work, or operator error leading to off-site impacts including chemical or fuel contamination.	<ul style="list-style-type: none"> • Design and construction of storage facilities (including bunding) and structures/tanks/pipes to relevant standards and legislation. • Storage tanks and facilities positioned to minimise potential impacts of leaks/spills. • Area around above-ground tanks sealed, preventing land contamination. • Regular inspections and maintenance (where required). • Operator training and operational procedures. • Spill management equipment (i.e. spill kits), procedures and training. • Dangerous goods register (Safety Data Sheets [SDS]). • Emergency Response Systems. • Pollution Incident Response Management Plan. 	1	3	3

**Table A-1 (Continued)
Hazard Identification and Analysis**

Project Component	Incident Type	Scenario	Existing and Proposed Treatment Measures	Likelihood ¹	Consequence ²	Risk ³
On-Site Storage Hydrocarbons (i.e. fuels [diesel and petrol], LPG, oils, greases, degreaser and kerosene), explosives and chemicals. (Cont.)	Leak/Spill (Cont.)	Failed storage vessel due to mechanical impact or corrosion leading to off-site impacts including chemical or fuel contamination.	<ul style="list-style-type: none"> • Design and construction of storage facilities (including bunding) and structures/tanks/pipes to relevant standards and legislation. • Storage tanks and facilities positioned to minimise potential impacts of leaks/spills. • Area around above-ground tanks sealed, preventing land contamination. • Regular inspections and maintenance (where required). • Protection of storage facilities from collision (e.g. bollards). • Separation of tanks from refuelling areas. • Operator training and operational procedures. • Spill management equipment (i.e. spill kits), procedures and training. • Dangerous goods register (SDS). • Emergency Response Systems. • Pollution Incident Response Management Plan. 	1	3	3

**Table A-1 (Continued)
Hazard Identification and Analysis**

Project Component	Incident Type	Scenario	Existing and Proposed Treatment Measures	Likelihood ¹	Consequence ²	Risk ³
On-Site Storage Hydrocarbons (i.e. fuels [diesel and petrol], LPG, oils, greases, degreaser and kerosene), explosives and chemicals. (Cont.)	Fire	Poor maintenance, poor design, collision, human error, or incorrect storage of chemicals leading to off-site fire-related impacts.	<ul style="list-style-type: none"> • Appropriate storage of fuel, gas, explosives, chemicals, and dangerous substances as required by relevant standards and legislation. • Storage tanks and facilities positioned to minimise potential impacts of leaks/spills and fire. • Protection of storage facilities from collision (e.g. bollards). • Emergency Response Systems. • Firefighting equipment and spill kits located in on-site vehicles and infrastructure where required. • Regular inspections and maintenance of firefighting equipment. • Regular maintenance of fire breaks to slow fire spread. • Liaison with Rural Fire Service for quick response. • Bushfire Management Plan. 	0.3	10	3

**Table A-1 (Continued)
Hazard Identification and Analysis**

Project Component	Incident Type	Scenario	Existing and Proposed Treatment Measures	Likelihood ¹	Consequence ²	Risk ³
On-Site Storage Hydrocarbons (i.e. fuels [diesel and petrol], LPG, oils, greases, degreaser and kerosene), explosives and chemicals. (Cont.)	Explosion	Explosives, fuel or gas detonates by lightning strike or human error, leading to off-site explosion/fume emissions-related impacts.	<ul style="list-style-type: none"> • Appropriate storage of fuel, gas, explosives, chemicals, and dangerous substances as required by relevant standards and legislation. • Design and construction of storage facilities (including bunding) and structures/tanks/pipes to relevant standards and legislation. • Separation of tanks from refuelling areas. • Emergency Response Systems. • Firefighting equipment and spill kits located in on-site vehicles and infrastructure where required. • Regular inspections and maintenance of firefighting equipment. • Operator induction, awareness of explosives and ongoing training. • Only authorised personnel with appropriate licences to handle explosives. • Bushfire Management Plan. 	0.1	30	3
	Theft/vandalism	Theft or a malicious act resulting in off-site impacts.	<ul style="list-style-type: none"> • Installation of adequate lighting around storage facilities. • Perimeter fencing to reduce ease of access to the Dendrobium Pit Top and Cordeaux Pit Top. • Restriction of access to storage facilities. • CCTV camera surveillance on-site. • Restricted access to authorised personnel. • Emergency Response Systems. 	1	3	3

**Table A-1 (Continued)
Hazard Identification and Analysis**

Project Component	Incident Type	Scenario	Existing and Proposed Treatment Measures	Likelihood ¹	Consequence ²	Risk ³
On-Site Storage Run-of-mine (ROM) and product coal	Fire	Operator error or spontaneous combustion event leads to off-site fire-related (i.e. fume/emissions) impacts.	<ul style="list-style-type: none"> • Design and management of coal stockpiles (i.e. size, shape and age tracking of stockpile). • Regular monitoring and communication of stockpile status and active management. • Stockpile and belt dust suppression. • Spontaneous combustion propensity testing to inform management decisions and measures. • Regular inspections and maintenance of firefighting equipment, including a deluge system at the ROM coal loading area. • Firefighting equipment and spill kits located in on-site vehicles and infrastructure where required. • Operator training and operational procedures. • Removal of hazardous items and regular cleaning around the site. 	0.1	10	1
	Equipment Malfunction	Malfunction of dust suppression equipment combined with unfavourable weather conditions resulting in significant off-site dust emissions.	<ul style="list-style-type: none"> • Regular inspections of stockpiles. • Regular maintenance of dust suppression equipment. • Employment of additional/supplementary dust control methods. • Air Quality Monitoring Program. 	1	1	1

**Table A-1 (Continued)
Hazard Identification and Analysis**

Project Component	Incident Type	Scenario	Existing and Proposed Treatment Measures	Likelihood ¹	Consequence ²	Risk ³
Construction/Development Activities	Spill/Leak	Spill of diesel, oils, chemicals, sewage, construction materials or untreated water, leading to impacts on surrounding watercourses.	<ul style="list-style-type: none"> Fuels, oils and lubricants stored in accordance with relevant standards and legislation. Dangerous goods register (SDS). Construction-specific environmental controls. Site runoff control (i.e. drains and sumps). Operator training and operational procedures. Spill management equipment (i.e. spill kits), procedures and training. Emergency Response Systems. Water Management Plan. Waste Management Plan. Pollution Incident Response Management Plan. 	1	3	3
	Fire	Poor storage of chemicals/fuel results in fire, leading to off-site bushfire.	<ul style="list-style-type: none"> Fuels, oils, lubricants and chemicals stored in accordance with relevant standards and legislation. Removal of hazardous items and regular cleaning around the site. Firefighting equipment and spill kits located in on-site vehicles. Regular inspections and maintenance of firefighting equipment. Regular maintenance of fire breaks to slow fire spread. Operator training and operational procedures. Emergency Response Systems. Liaison with Rural Fire Service for quick response. Bushfire Management Plan. 	0.3	10	3

**Table A-1 (Continued)
Hazard Identification and Analysis**

Project Component	Incident Type	Scenario	Existing and Proposed Treatment Measures	Likelihood ¹	Consequence ²	Risk ³
Construction/Development Activities (Cont.)	Fire (Cont.)	Vehicle fire or electrical fire leading to off-site bushfire.	<ul style="list-style-type: none"> Regular inspections and maintenance of firefighting equipment. Regular inspections and maintenance of site infrastructure, equipment and machinery. Firefighting equipment and spill kits located in on-site vehicles and infrastructure where required. Regular maintenance of fire breaks to slow fire spread. Operator training and operational procedures. Liaison with Rural Fire Service for quick response. Bushfire Management Plan. 	0.3	10	3
	Explosion	Malicious act, operator error or lightning strike ignites stored chemicals/fuel/gas cylinders.	<ul style="list-style-type: none"> Appropriate storage of fuel, gas, explosives, chemicals, and dangerous substances as required by relevant standards and legislation. Access only for authorised personnel with appropriate licence, and display of restricted area signage. Firefighting equipment and spill kits located in on-site vehicles. Operator training and operational procedures. Emergency Response Systems. Liaison with Rural Fire Service for quick response. Bushfire Management Plan. 	0.1	30	3

Table A-1 (Continued)
Hazard Identification and Analysis

Project Component	Incident Type	Scenario	Existing and Proposed Treatment Measures	Likelihood ¹	Consequence ²	Risk ³
Construction/Development Activities (Cont.)	Theft	Theft of construction material or equipment, leading to an off-site event causing injury.	<ul style="list-style-type: none"> Perimeter fencing to reduce ease of access to construction sites. Restricted access to authorised personnel. Installation of adequate lighting around construction activities. Site security procedures (i.e. restricted access). 	1	3	3
	Uncontrolled/Unauthorised Movement	Unauthorised access to site, leading to personal injury.	<ul style="list-style-type: none"> Perimeter fencing to reduce ease of access to construction sites. Restricted access to authorised personnel. Installation of adequate lighting around construction activities. Site security procedures (i.e. restricted access). 	1	3	3
Underground Mining Operations	Leak/Spill	Spill of oils, diesel or chemicals, leading to off-site impacts.	<ul style="list-style-type: none"> Underground operations restricted to minor maintenance and services. Operator training and operational procedures. Fuels, oils and lubricants managed in accordance with relevant standards and legislation. Spill management equipment (i.e. spill kits), procedures and training. Emergency Response Systems. 	0.3	3	0.9

**Table A-1 (Continued)
Hazard Identification and Analysis**

Project Component	Incident Type	Scenario	Existing and Proposed Treatment Measures	Likelihood ¹	Consequence ²	Risk ³
Underground Mining Operations (Cont.)	Fire	Malfunction of gas management/flaring facilities, resulting in off-site fire-related impacts.	<ul style="list-style-type: none"> • Use of enclosed flares. • Maintenance of sufficient fire breaks around gas flares. • Regular inspections and maintenance of site infrastructure and equipment. • Regular inspections and maintenance of firefighting equipment. • Operator training and operational procedures. • Dedicated on-site fire response equipment and team. • Emergency Response Systems. • Bushfire Management Plan. 	0.3	10	3
	Release of Noxious Gases to Atmosphere	Failure of gas drainage/ventilation infrastructure or an underground fire/explosion produces emissions, causing off-site impacts.	<ul style="list-style-type: none"> • Adequate gas testing and design of ventilation and gas management infrastructure. • Regular inspections and maintenance of site infrastructure and equipment. • Continuous monitoring of gas levels/alarm. • Pollution Incident Response Management Plan. 	0.3	3	0.9
Other Infrastructure and Supporting Systems	Leak/Spill	Leak or spill from water management system leading to impacts on surrounding watercourses.	<ul style="list-style-type: none"> • Design of water management structures in accordance with relevant standards and guidelines. • Regular inspections of water containment structures and pipelines for structural integrity, effectiveness and maintenance to maintain their function. • Operator induction and ongoing training. • Water Management Plan. • Pollution Incident Response Management Plan. 	1	3	3

**Table A-1 (Continued)
Hazard Identification and Analysis**

Project Component	Incident Type	Scenario	Existing and Proposed Treatment Measures	Likelihood ¹	Consequence ²	Risk ³
Other Infrastructure and Supporting Systems	Leak/Spill	Unplanned off-site discharge of coal.	<ul style="list-style-type: none"> Design of water management structures in accordance with relevant standards and guidelines. Regular inspections and maintenance of site infrastructure, equipment and machinery. Operator induction and ongoing training. Pollution Incident Response Management Plan. 	3	1	3
	Fire	Malfunction of on-site power reticulation resulting in off-site fire.	<ul style="list-style-type: none"> Power reticulation designed to Australian Standards and legislation – including security measures. Removal of hazardous items and regular cleaning around the site. Power usage monitoring and alarms. Firefighting equipment and spill kits located in on-site vehicles and infrastructure where required. Regular inspections and maintenance of firefighting equipment. Operator induction and ongoing training. Dedicated on-site fire response equipment and team. Liaison with Rural Fire Service for quick response. Bushfire Management Plan. 	0.3	10	3

**Table A-1 (Continued)
Hazard Identification and Analysis**

Project Component	Incident Type	Scenario	Existing and Proposed Treatment Measures	Likelihood ¹	Consequence ²	Risk ³
Other Infrastructure and Supporting Systems (Cont.)	Fire (Cont.)	Spontaneous combustion, dust and/or fire explosion at Kemira Valley Coal Loading Facility, leading to off-site fire-related impacts.	<ul style="list-style-type: none"> • Appropriate storage and transportation of fuel, gas, explosives, chemicals, coal and dangerous substances to relevant standards and legislation. • Removal of hazardous items and regular cleaning around the site. • Stockpile dust suppression. • Spontaneous combustion propensity testing to inform management decisions and measures. • Regular inspections and maintenance of firefighting equipment, including a deluge system at the ROM coal loading area. • Firefighting equipment and spill kits located in on-site vehicles. • Operator induction, ongoing training and operational procedures. • Dedicated on-site fire response equipment and team. • Liaison with Rural Fire Service for quick response. • Air Quality Monitoring Program. • Bushfire Management Plan. 	0.3	10	3

**Table A-1 (Continued)
Hazard Identification and Analysis**

Project Component	Incident Type	Scenario	Existing and Proposed Treatment Measures	Likelihood ¹	Consequence ²	Risk ³
Other Infrastructure and Supporting Systems (Cont.)	Fire (Cont.)	Spontaneous combustion, dust and/or fire explosion at Dendrobium Coal Preparation Plant leading to off-site fire-related impacts.	<ul style="list-style-type: none"> • Appropriate storage and transportation of fuel, gas, explosives, chemicals, coal and dangerous substances to relevant standards and legislation. • Removal of hazardous items and regular cleaning around the site. • Stockpile dust suppression. • Spontaneous combustion propensity testing to inform management decisions and measures. • Regular inspections and maintenance of firefighting equipment. • Firefighting equipment and spill kits located in on-site vehicles. • Operator induction, ongoing training and operational procedures. • Dedicated on-site fire response equipment and team. • Liaison with Rural Fire Service for quick response. • Air Quality Monitoring Program. • Bushfire Management Plan. 	0.3	10	3

¹Refer to Table 1.

²Refer to Table 2.

³Refer to Table 3.