STRATFORD MINING COMPLEX
Blast Management Plan

STRATFORD MINING COMPLEX
(STRATFORD EXTENSION PROJECT)
BLAST MANAGEMENT PLAN

Revision Status Register

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1 INTRODUCTION

1.1 STRATFORD MINING COMPLEX

Stratford Coal Pty Ltd (SCPL), a wholly owned subsidiary of Yancoal Australia Limited (Yancoal), owns the Stratford Coal Mine (SCM), which is located approximately 100 kilometres (km) north of Newcastle, New South Wales (NSW) (Figure 1). SCPL also owns the Bowens Road North Open Cut (BRNOC), located to the immediate north of the SCM. The SCM and BRNOC are collectively referred to as the Stratford Mining Complex (SMC).

Yancoal also owns the Duralie Coal Mine (DCM), which is located approximately 20 km south of the SMC (Figure 1). Run-of-mine (ROM) coal from the DCM is transported by rail to the SMC for processing and export.

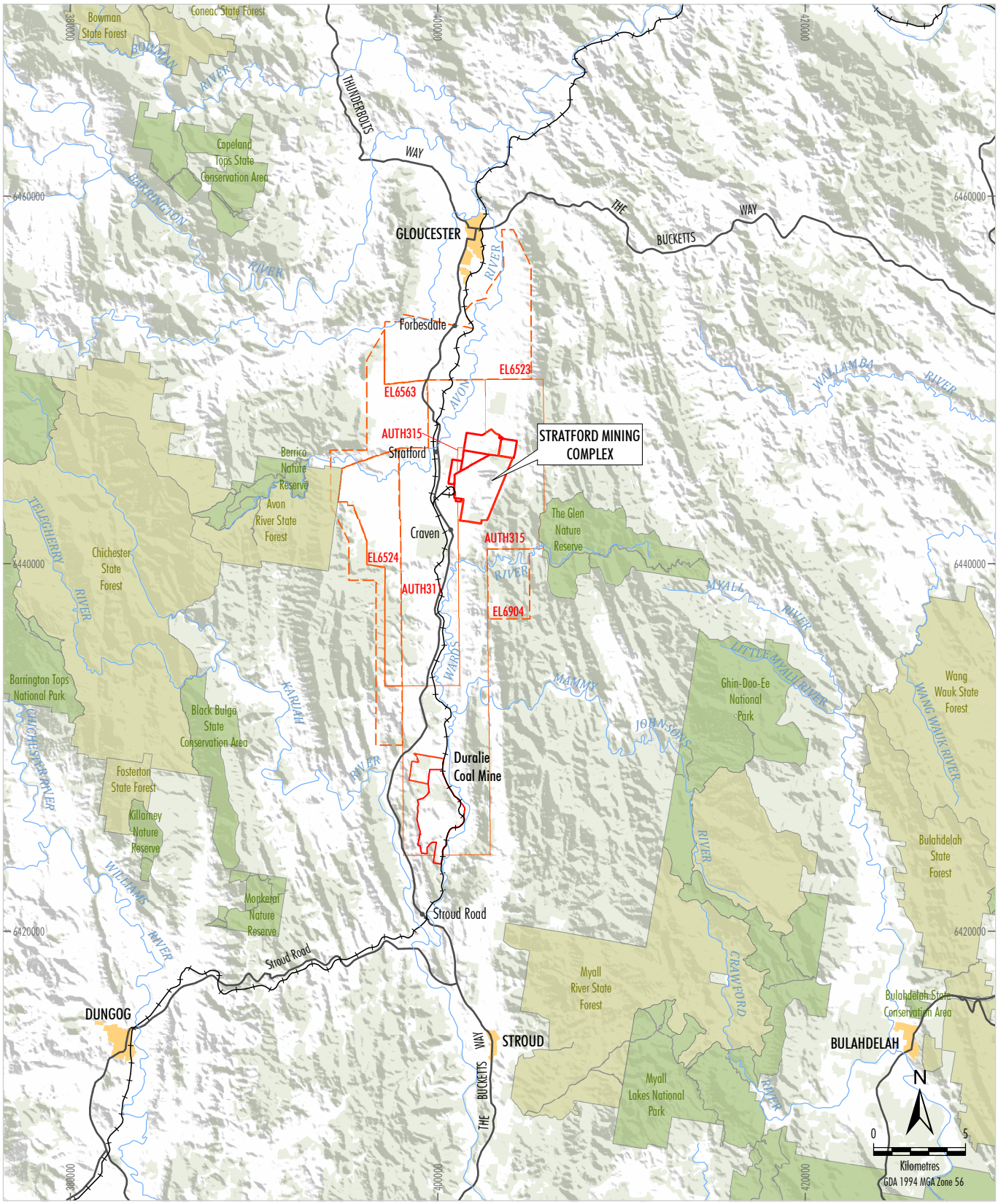
Mining activities approved under the SCM Development Consent and the BRNOC Development Consent were suspended in mid-2014, however, processing of ROM coal from the DCM and the export of product coals has continued under the SCM Development Consent.

The Development Consent SSD-4966 for the Stratford Extension Project (SEP) was granted on 29 May 2015 and involves the extension and continuation of mine operations at the SMC[1], including (among other things):

- mining of up to 2.6 million tonnes of ROM coal per annum;
- continuation of mining in the BRNOC; and the extension of mining into three new open cut mining areas:
  - Roseville West Pit Extension;
  - Avon North Open Cut; and
  - Stratford East Open Cut.
- progressive backfilling of mine voids with waste rock behind the advancing open cut mining operations;
- continued and expanded placement of waste rock in the Stratford Waste Emplacement and Northern Waste Emplacement;
- coal processing at the existing Coal Handling and Preparation Plant (CHPP);
- stockpiling and loading of product coal to trains for transport on the North Coast Railway to Newcastle;
- disposal of CHPP rejects via pipeline to the existing co-disposal area in the Stratford Main Pit and, later in the mine life, the Avon North Open Cut void;
- continued use of existing water storages/dams and progressive development of additional sediment dams, pumps, pipelines, irrigation infrastructure and other water management equipment and structures;
- other associated minor infrastructure, plant, equipment and activities and minor modifications to existing structure, plant and equipment and activities; and
- rehabilitation of the site.

The general arrangement of the approved SMC is provided in Figure 2. The approximate extent of the initial activities is shown on Figure 3.

[1] A copy of the Development Consent (and other statutory State and Federal licenses and approvals) is available on the Stratford Coal website (www.stratfordcoal.com.au).



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LEGEND

- Mining Lease Boundary
- Exploration Licence Boundary
- NSW State Forest
- National Park, Nature Reserve or State Conservation Area

Source: Geoscience Australia (2006); NSW Department of Planning & Environment (2017)

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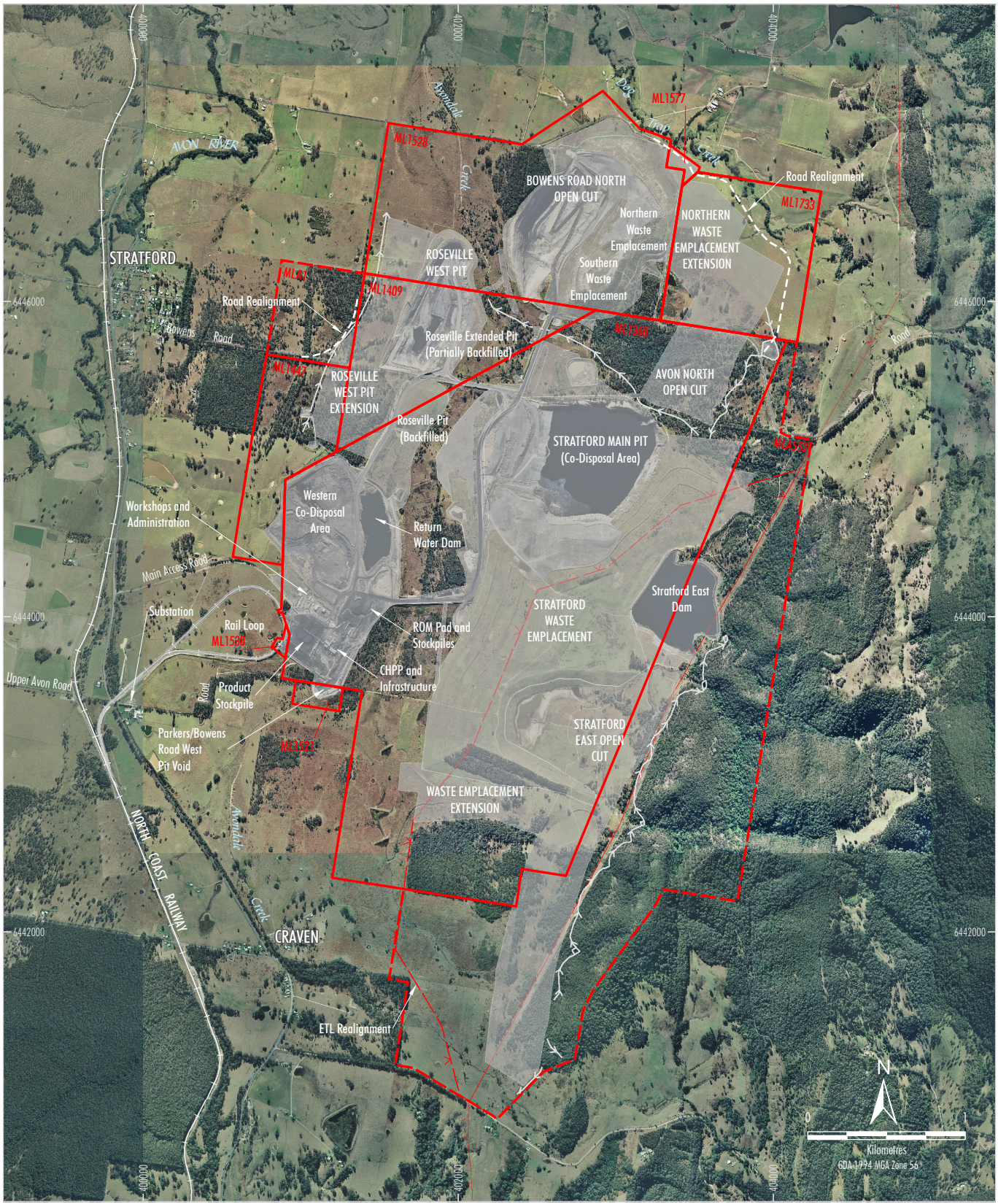
STRATFORD EXTENSION PROJECT

Regional Location

Figure 1



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LEGEND

- Mining Lease Boundary
- Mining Lease Application Boundary
- Electricity Transmission Line
- Approximate Extent of Existing/Approved Surface Development
- Conceptual Up-Catchment Diversion

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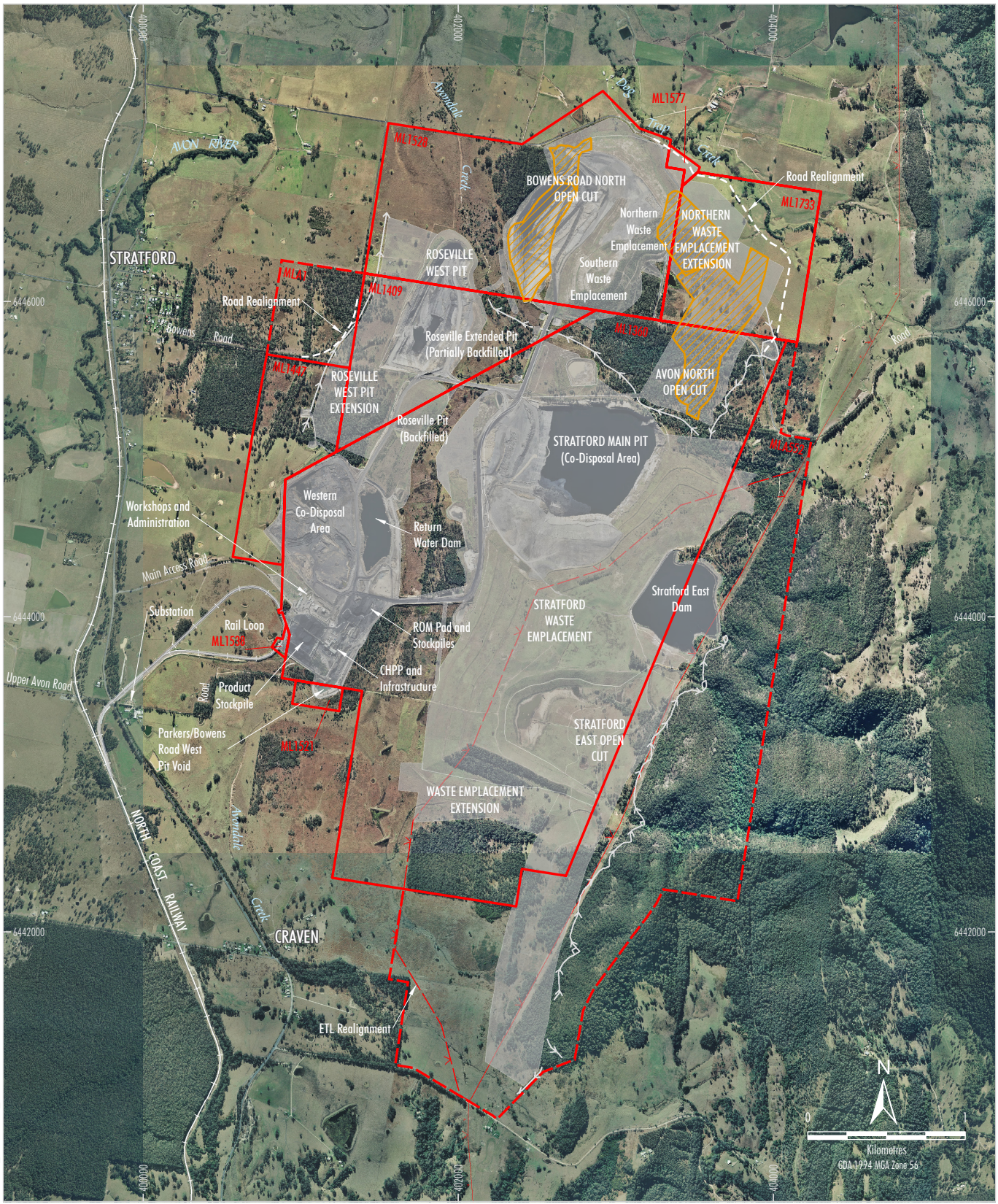
STRATFORD EXTENSION PROJECT

Approved General Arrangement

Source: Orthophoto - Yancoal (July 2014); LPI (2016); NSW Department of Planning & Environment (2017)

Figure 2



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LEGEND

- Mining Lease Boundary
- Mining Lease Application Boundary
- Electricity Transmission Line
- Approximate Extent of Existing/Approved Surface Development
- Conceptual Up-Catchment Diversion
- Stratford Extension Project Start-up Components

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STRATFORD EXTENSION PROJECT

Initial Stage

Source: Orthophoto - Yancoal (July 2014); LPI (2016); NSW Department of Planning & Environment (2017)

Figure 3

1.2 PURPOSE AND SCOPE

This Blast Management Plan (BLMP) has been prepared for the SMC in accordance with the requirements of Condition 16, Schedule 3 of Development Consent SSD-49662 and relevant conditions of Environment Protection Licence EPL 5161 (as varied[3]).

The overall objectives of the BLMP are to:

- ensure the safety of members of the public during blasting;
- ensure the protection of livestock and animals during blasting;
- prevent damage to private or public property as a result of blasting; and
- minimise any nuisance to the public as a result of blasting.

This BLMP has been prepared to manage blasting in the Avon North Open Cut and BRNOC only.

This BLMP will be updated prior to blasting in the Stratford East Open Cut and/or the Roseville West Pit Extension, in accordance with Condition 15, Schedule 2 of SSD-4966.

1.3 STRUCTURE OF THE BLMP

The remainder of the BLMP is structured as follows:

Section 2: Outlines the statutory requirements applicable to this BLMP

Section 3: Details the blasting criteria and performance indicators that will be used to assess blasting impacts at the SMC.

Section 4: Outlines the existing environment.

Section 5: Describes the blasting management measures.

Section 6: Describes the blasting monitoring program.

Section 7: Provides response protocols and a contingency plan to manage any unpredicted impacts and their consequences.

Section 8: Describes the annual review and improvement of environmental performance process.

Section 9: Describes the management and reporting of incidents, complaints and non-compliances.

1.4 CONSULTATION

This BLMP has been provided to the NSW Environmental Protection Authority (EPA) for their review and comment. The EPA confirmed, via a letter dated 8 March 2018, that it had no comments on the BLMP.

2 STATUTORY REQUIREMENTS

SCPL's statutory obligations are contained in:

(i) the conditions of the NSW Development Consent SSD-4966;

(ii) the conditions of the Commonwealth Approval (EPBC 2011/6176);

(iii) the conditions of EPL 5161;

(iv) relevant licences and permits, including conditions attached to mining leases; and

(v) other relevant legislation.

Obligations relevant to this BLMP are described below.

[2] This BLMP supersedes previous BLMPs prepared for the SMC under development consent DA 23-98/99 and DA 39-02-01.

[3] In December 2017 SCPL applied to vary EPL 5161 for the SCM to encompass the entirety of the SMC including the SEP.

2.1 EP&A ACT DEVELOPMENT CONSENT

Blast Management Plan

Condition 16, Schedule 3 of the Development Consent SSD-4966 requires the preparation of a BLMP for the SMC. Table 1 presents these requirements and indicates where they are addressed within this BLMP.

Table 1
Development Consent SSD-4966 Requirements Relevant to this BLMP

Development Consent SSD-4966 Condition	BLMP Section
Condition 16, Schedule 3	
16. The Applicant shall prepare and implement a BLMP for the development to the satisfaction of the Secretary. This plan must:	
(a) be prepared in consultation with the Environmental Protection Authority (EPA) and submitted to the Secretary for approval at least 3 months prior to the commencement of mining operations in the new mining areas, unless otherwise agreed by the Secretary;	Section 1.4
(b) describe the measures that would be implemented to ensure compliance with the blasting criteria and operating conditions of this consent;	Section 5
(c) propose and justify any alternative ground vibration limits for public infrastructure in the vicinity of the site (if relevant);	N/A
(d) include a monitoring program for evaluating and reporting on compliance with the blasting criteria and operating conditions; and	Section 6
(e) include a specific blast fume management protocol to demonstrate how emissions will be minimised including risk management strategies if blast fumes are generated.	Section 5.5

Blasting criteria and blasting condition requirements under the NSW Development Consent are described in Section 3.

Management Plan Requirements

Condition 3, Schedule 5 of the NSW Development Consent outlines the management plan requirements that are applicable to the preparation of the BLMP. Table 2 indicates where each relevant component is addressed within this BLMP.

Table 2
Management Plan Requirements

Development Consent SSD-4966 Condition	BLMP Section
Condition 3, Schedule 5	
3. The Applicant shall ensure that the management plans required under this consent are prepared in accordance with any relevant guidelines, and include:	
(a) detailed baseline data;	Section 4
(b) a description of:	Sections 2 and 3
• *the relevant statutory requirements (including any relevant approval, licence or lease conditions);*	
• *any relevant limits or performance measures/criteria;*	
• *the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the development or any management measures;*	
(c) a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;	Section 5
(d) a program to monitor and report on the:	Section 6
• *impacts and environmental performance of the development;*	
• *effectiveness of any management measures (see c above);*	
(e) a contingency plan to manage any unpredicted impacts and their consequences;	Section 7.1

Table 2 (Continued)
Management Plan Requirements

Development Consent SSD-4966 Condition	BLMP Section
(f) a program to investigate and implement ways to improve the environmental performance of the development over time;	Section 8
(g) a protocol for managing and reporting any; • *incidents;* • *complaints;* • *non-compliances with statutory requirements; and* • *exceedances of the impact assessment criteria and/or performance criteria; and*	Section 9 and SMC Environmental Management Strategy
(h) a protocol for periodic review of the plan.	Section 8

2.2 LICENCES, PERMITS AND LEASES

In addition to the NSW Development Consent and Commonwealth Approval (EPBC 2011/6176), all activities at or in association with the SMC will be conducted in accordance with a number of licences, permits and leases which have been issued or are pending issue.

Key licences, permits and leases pertaining to the SMC include:

- The conditions of EPL 5161 administered by the EPA under the NSW *Protection of the Environment Operations Act, 1997* (PoEO Act). The conditions in EPL 5161 relevant to blasting are provided in Section 3.2.
- The conditions of the Mining Leases (MLs) 1360, 1409, 1447, 1538, 1521, 1577, 1528 and 1733 issued under the NSW *Mining Act, 1992*.
- Water licenses and approvals issued under the NSW *Water Management Act, 2000.*

2.3 OTHER LEGISLATION

Other NSW legislation that may be applicable to blasting at the SMC include, but are not limited, the:

- *Dangerous Goods (Road and Rail Transport) Act, 2008*;
- *Explosives Act, 2003;*
- *Roads Act, 1993*; and
- *Work Health and Safety (Mines) Act, 2013.*

Relevant licences or approvals required under these Acts will be obtained as required.

2.4 COMPLIANCE STANDARDS AND GUIDELINES

Blasting will be conducted in accordance with the following:

- Australian Standard (AS) 2187:2006 *Explosives Storage Transport and Use*.
- Australian and New Zealand Environment Council (1990) *Technical Basis for Guidelines to Minimise Annoyance Due to Blasting Overpressure and Ground Vibration*.
- Australian Explosives Industry and Safety Group Inc. (2011) *Code of Practice: Prevention and Management of Blast Generated NOx Gases in Surface Blasting*.

3 BLASTING CRITERIA AND PERFORMANCE INDICATORS

3.1 DEVELOPMENT CONSENT CONDITIONS

3.1.1 Blasting Criteria

Blasting criteria is provided in Condition 9, Schedule 3 of Development Consent SSD-4966:

Blasting Criteria

9. The Applicant shall ensure that blasting on site does not cause any exceedance of the criteria in Table 5.

Table 5: Blasting criteria

Location	***Airblast overpressure (dB(Lin Peak))***	***Ground vibration (mm/s)***	***Allowable exceedance***
Residence on privately-owned land	*120*	*10*	*0%*
	115	*5*	*5% of the total number of blasts over a period of 12 months*
All public infrastructure	*-*	*50 (or a limit determined by the structural design methodology in AS 2187.2-2006, or its latest version, or other alternative limit for public infrastructure, to the satisfaction of the Secretary)*	*0%*

However, these criteria do not apply if the Applicant has a written agreement with the relevant owner to exceed these criteria, and the Applicant has advised the Department in writing of the terms of this agreement.

3.1.2 Blasting Hours and Frequency

Blasting hours and frequency of blasting are provided in Conditions 10 and 11, Schedule 3 of Development Consent SSD-4966:

Blasting Hours

10. The Applicant shall only carry out blasting on the site between 9 am and 5 pm Monday to Saturday inclusive. No blasting is allowed on Sundays, public holidays, or at any other time without the written approval of the Secretary.

Blasting Frequency

11. The Applicant may carry out a maximum of:

(a) 1 blast per day on site; and

(b) 3 blasts per week, averaged over a calendar year.

This condition does not apply to blasts required to ensure the safety of the mine or its workers.

Note: For the purposes of this condition a blast refers to a single blast event, which may involve a number of individual blasts fired in quick succession in a discrete area of the mine.

3.1.3 Property Inspections and Investigations

Conditions 12 and 13, Schedule 3 of Development Consent SSD-4966 describe the procedures to be implemented by SCPL regarding the inspection and investigation of buildings and/or structures on privately-owned land for blasting impacts:

Property Inspections

12. If the Applicant receives a written request from the owner of any privately-owned land within 2 kilometres of any approved open cut pit on site for a property inspection to establish the baseline condition of any buildings and/or structures on his/her land, or to have a previous property inspection report updated, then within 2 months of receiving this request the Applicant shall:

(a) commission a suitably qualified, experienced and independent person, whose appointment is acceptable to both parties, to:

- *establish the baseline condition of any buildings and/or structures on the land, or update the previous property inspection report; and*
- *identify any measures that should be implemented to minimise the potential blasting impacts of the development on these buildings and/or structures; and*

(b) give the landowner a copy of the new or updated property inspection report.

If there is a dispute over the selection of the suitably qualified, experienced and independent person, or the Applicant or landowner disagrees with the findings of the independent property investigation, either party may refer the matter to the Secretary for resolution.

Property Investigations

13. If any owner of privately-owned land claims that the buildings and/or structures on his/her land have been damaged as a result of blasting on site, then within 2 months of receiving this claim in writing from the landowner, the Applicant shall:

(a) commission a suitably qualified, experienced and independent person, whose appointment is acceptable to both parties, to investigate the claim; and

(b) give the landowner a copy of the property investigation report.

If this independent property investigation confirms the landowner's claim, and both parties agree with these findings, then the Applicant shall repair the damages to the satisfaction of the Secretary.

If there is a dispute over the selection of the suitably qualified, experienced and independent person, or the Applicant or landowner disagrees with the findings of the independent property investigation, either party may refer the matter to the Secretary for resolution.

3.1.4 Operating Conditions

Conditions 14 and 15, Schedule 3 of Development Consent SSD-4966 outline the operating conditions relating to blasting:

14. The Applicant shall:

(a) implement best practice to:

- *protect the safety of people and livestock in the surrounding area;*
- *protect public infrastructure and private property in the surrounding area from any damage; and*
- *minimise the dust and fume emissions of any blasting;*

(b) ensure that blasting on the site does not damage Aboriginal cultural heritage site CTS-1;

(c) minimise the frequency and duration of any required road closures; and

(d) operate a suitable system to enable the public to get up-to-date information on the proposed blasting Schedule on site,to the satisfaction of the Secretary.

15. The Applicant shall not undertake blasting within 500 metres of:

(a) any public road; or

(b) any land outside of the site not owned by the Applicant, unless the Applicant has:

- *Demonstrated to the satisfaction of the Secretary that the blasting can be carried out closer to the road or land without compromising the safety of people or livestock, or damaging buildings and/or structures; and*
- *Updated the Blast Management Plan to include the specific measures that would be implemented while blasting is being carried out within 500 metres of the land or road; or*
- *A written agreement with the landowner or GSC (in the case of any public road) to allow blasting to be carried out closer to the land or road, and the Applicant has advised the Department in writing of the terms of this agreement.*

3.2 EPL CONDITIONS

The conditions in EPL 5161 relevant to blasting are provided in Table 3 below.

Table 3
EPL Conditions Relevant to Blasting

Licence	Condition	Condition Requirement
EPL 5161	*L3.1*	*The overpressure level from blasting operations carried out in or on the premises must not:* *a) exceed 115 dB(L) for more than 5% of the total number of blasts carried out on the premises within the 12 months annual reporting period; and* *b) exceed 120 dB(L) at any time at any residence or noise sensitive location (such as a school or hospital) that is not owned by the licensee or subject of a private agreement between the owner of the residence or noise sensitive location and the licensee as to an alternative overpressure level.*
	L3.2	*The ground vibration peak particle velocity from blasting operations carried out in or on the premises must not:* *a) exceed 5mm/second for more than 5% of the total number of blasts carried out on the premises within the 12 months annual reporting period; and* *b) exceed 10mm/second at any time at any residence or noise sensitive location (such as a school or hospital) that is not owned by the licensee or subject of a private agreement between the owner of the residence or noise sensitive location and the licensee as to an alternative ground vibration level.*
	L3.3	*The Licensee must not carry out more than:* *a) 1 blast on each day unless an additional blast is required due to a misfire; and* *b) 3 blasts a week, averaged over any 12 month period.*
	L3.4	*Blasting operations at the premises may only take place between 9am and 5pm Monday to Saturday inclusive. Where compelling reasons exist the EPA may approve in writing a blast to occur outside the abovementioned hours.*
	M7.1	*The licensee must monitor all blasts carried out in or on the premises at or near the nearest residence or noise sensitive location (such as a school or hospital) that is likely to be most affected by the blast and that is not owned by the licensee or subject of a private agreement between the owner of the residence or noise sensitive location and the licensee relating to alternative blasting limits.*
	M7.2	*All blasting shots on the premises must be recorded on video from a position allowing the collars of the shot, and where possible, any face, or toe, to be seen.*
	R4.1	*The licensee must report any exceedance of the licence blasting limits to the regional office of the EPA as soon as practicable after the exceedance becomes known to the licensee or to one of the licensee's employees or agents.*

3.3 PERFORMANCE INDICATORS

The extent of compliance with the above criteria and requirements will be measured by the following performance indicators:

- compliance with the relevant criteria at monitoring locations;
- compliance with the performance indicator for heritage site CTS-1 of 80 mm/s;
- compliance with blast restrictions; and
- compliance with this plan, as indicated through annual reporting (Section 8).

Performance measures relating to blast fumes are as per the Blast Fume Management Procedure (Attachment 1).

4 EXISTING ENVIRONMENT

4.1 BASELINE DATA

4.1.1 Blast Impact Assessment

A blast impact assessment was undertaken by SLR (2012) for the SEP Environmental Impact Statement (EIS). This assessment investigated ground vibration and airblast overpressure levels arising from blasting. Historic monitoring data collected as part of the blast monitoring programs for the SCM and BRNOC was collected and analysed to determine conservative 50% and 5% exceedance ground vibration and airblast overpressure site laws (i.e. site-based prediction equations).

The site laws were then used to predict vibration and airblast emissions at the nearest privately-owned receivers, SCPL-owned receivers and Aboriginal heritage site CTS-1 and to determine safe working distances.

4.1.2 Historical Blast Monitoring Results

All blasts at the SMC are monitored with blast monitoring results published in the SMC Annual Review.

No blasting activities have been undertaken at the SMC since June 2014.

All blasts recorded during the reporting periods for the 2012, 2013 and 2014 annual reviews were (SCPL, 2012b; 2013; 2014):

- below 115 dB(Lin Peak) for airblast overpressure at sensitive receivers; and
- below 5 mm/s for ground vibration at sensitive receivers.

4.1.3 Meteorological Monitoring

Meteorological monitoring is undertaken at the SMC in accordance with the requirements of Development Consent SSD-4966 (and prior consents). The on-site weather station monitors a number of meteorological parameters, including daily rainfall and temperature, solar radiation, wind speed and wind direction.

A summary of monthly meteorological conditions is provided in the SMC Annual Reviews each year (http://www.stratfordcoal.com.au/page/environment/annual-reviews/).

4.2 SENSITIVE RECEIVERS

There is no privately-owned land within 500 m of the Avon North Open Cut and BRNOC. The closest privately-owned receiver is located approximately 1.5 km to the east of the Avon North Open Cut, and the village of Stratford is located approximately 3 km to the west of the Avon North Open Cut.

5 BLAST MANAGEMENT

5.1 BLAST MANAGEMENT AND CONTROL MEASURES

The following blast management and control measures are undertaken to minimise impacts of blasting at the SMC:

- Ongoing review of "site laws" (i.e. site based prediction equations) developed for ground vibration and airblast.
- Safety control measures and notification/closure procedures in relation to blasting within 500 m of Bowens Road, Wenham Cox Road, Wheatleys Lane and Glen Road (including providing 24 hours notice of blast-related closures to relevant residences located on these roads).
- Management of potential flyrock impacts at any privately-owned properties during blast events within 500 m of the property boundary[4].
- Extension of the blast notification list to include any new landowners within 2 km of blasting areas, including properties within 2 km that do not have residences within 2 km.
- Safety control measures and notification procedures for property managers regarding livestock in proximity to blasting activities.
- Only blasting[5] in accordance with the times and frequencies described in Section 3.1.2, unless otherwise approved by the Secretary as may be required from time to time for safety purposes (e.g. it may be preferential to blast after hours rather than delaying a prepared blast due to rainfall to minimise the risk of blast fume generation).

Mitigation measures implemented for blasts are recorded, and reviewed, allowing for refinement of blasting practices.

5.2 BLASTING AND LOCAL RESIDENCES

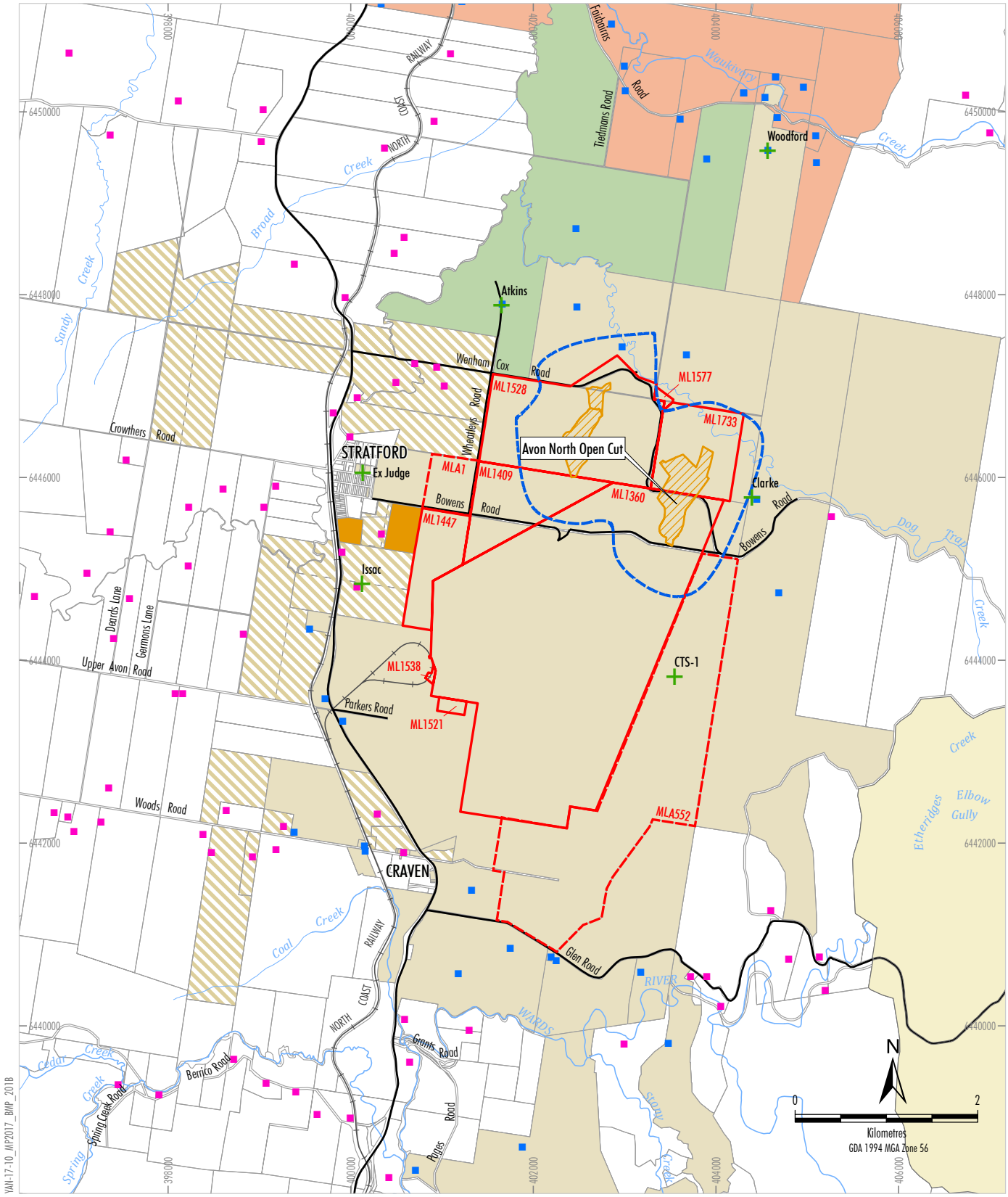
Blasting at the Avon North Open Cut and BRNOC will not occur within 500 m of any privately-owned property (Figure 4).

The occupants of residences within 2 km of blasting activities will be notified to advise that they are entitled to a structural inspection by a suitably qualified, experienced and independent person.

This BLMP will be updated to include specific measures that will be implemented while blasting is being carried out within 500 m of privately-owned land prior to the commencement of operations in the Roseville Pit Extension and Stratford East Open Cut.

[4] Blasting at the Avon North Open Cut will not occur within 500 m of any-privately owned residences.

[5] A blast refers to a single blast event, which may involve a number of individual blasts fired in quick succession in a discrete area of the mine.



LEGEND

- Mining Lease Boundary
- Mining Lease Application Boundary
- Yancoal Owned Land
- GRL Owned Land or Under Option
- AGL Owned Land
- Private Landholders - Yancoal Agreement
- Crown Land
- Privately Owned Dwelling
- Resource Company Owned Dwelling
- 500 Metre Blast Management Zone
- Stratford Extension Project Start-up Components
- Blast Monitoring Site

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Blast Monitoring Sites

Source: Orthophoto - Yancoal (July 2014); LPI (2016); NSW Department of Planning & Environment (2017)

Figure 4

5.2.1 Notification of Blasting and/or Road Closure

A “Blasting Information Hotline” (02 6538 4253) has been established to provide the public with up-to-date information on the blasting schedule and road closures at the mine.

The “Blasting Information Hotline” is advertised in the Dungog Chronicle and the Gloucester Advocate biannually. The “Blasting Information Hotline” is also listed in the “Pink Pages” local telephone directory issued by each local newspaper as well as in the Sensis White Pages Directory (Newcastle and Kempsey Directory areas).

Where there are known user(s) of an infrequently used road subject to road closure (e.g. a local landowner), such a road user will be informed by notice at the property gate or a telephone call of the proposed blast/road closure if they wished to be so advised.

Sentries will be employed at the SMC to ensure that the 500 m Blast Management Zone is maintained around each blast until re-entry is deemed safe by the shotfirer. The location of sentries will be determined by the shotfirer in charge and SCPL’s Open Cut Examiner (OCE) before each blast.

Further details of notification of road closures are provided in Section 5.3.1.

5.2.2 Property Inspections

If SCPL receives a written request from the owner of any privately-owned land within 2 km of an approved open cut mining pit at the SMC for a property inspection to establish the baseline condition of any buildings and/or structures on his/her land, or to have a previous property inspection report updated, then within 2 months of receiving this request, SCPL will:

(a) commission a suitably qualified, experienced and independent person, whose appointment is acceptable to both parties, to:

- establish the baseline condition of any buildings and/or structures on the land, or update the previous property inspection report;
- identify any measures that should be implemented to minimise the potential blasting impacts of the SMC on these buildings and/or structures; and

(b) give the landowner a copy of the new or updated property inspection report.

If there is a dispute over the selection of the suitably qualified, experienced and independent person, or SCPL or the landowner disagrees with the findings of the independent property investigation, either party may refer the matter to the Secretary of the DP&E for resolution.

5.2.3 Property Investigations

If the owner of any privately-owned land claims that the buildings and/or structures on his/her land have been damaged as a result of blasting at the SMC, then within 2 months of receiving this claim in writing from the landowner, SCPL will:

(a) commission a suitably qualified, experienced and independent person, whose appointment is acceptable to both parties, to investigate the claim; and

(b) give the landowner a copy of the property investigation report.

If this independent property investigation confirms the landowner’s claim, and both parties agree with these findings, then SCPL will repair the damages to the satisfaction of the Secretary of the DP&E.

If there is a dispute over the selection of the suitably qualified, experienced and independent person, or SCPL or the landowner disagrees with the findings of the independent property investigation, then either party may refer the matter to the Secretary of the DP&E for resolution.

5.2.4 Blasting within 500 m of land not owned by SCPL

Blasting at the Avon North Open Cut and BRNOC will not occur within 500 m of any privately-owned property (Figure 4).

This BLMP will be updated to include specific measures that will be implemented while blasting is being carried out within 500 m of privately-owned land prior to the commencement of operations in the Roseville Pit Extension and Stratford East Open Cut.

5.3 BLASTING WITHIN 500 M OF PUBLIC INFRASTRUCTURE

SCPL will not blast within 500 m of any public road unless:

- SCPL has a written agreement with the MidCoast Council to allow blasting to be carried out closer to the road, and SCPL has advised the DP&E in writing of the terms of this agreement; or
- SCPL has demonstrated to the satisfaction of the Secretary of the NSW DP&E that the blasting can be carried out closer to the road without compromising the safety of people or livestock on the road (Section 5.8); and
- SCPL has implemented the specific management measures (described in Section 5.3.1 below) while blasting is being carried out within 500 m of the road.

5.3.1 ROAD CLOSURE PROTOCOL

Wenham Cox Road may be subject to road closure due to blasting in the Avon North Open Cut. Figure 4 outlines sections of Wenham Cox Road subject to closure determined based on the maximum extent of the Blast Management Zone (i.e. a 500 m offset from an open cut pit).

The purpose of road closure (and the Blast Management Zone) is to remove from, or prevent entry to, the area of road subject to closure, persons or vehicles which may be injured or damaged respectively as a result of blasting.

The primary objective of the road closure protocol is to provide a framework to coordinate safe and efficient road closures when blasting occurs within 500 m of Wenham Cox Road.

Fundamental to achieving this objective is to:

- ensure safety and protection of potentially affected persons, property and livestock;
- minimise road closure periods;
- minimise potential impacts on road users and local residents;
- notify in advance relevant stakeholders, including the public, of blasts that will temporarily close Wenham Cox Road; and
- ensure that emergency service activities are not restricted by road closure events.

Road closures will occur prior to every blast within 500 m of Wenham Cox Road within the Blast Management Zone. Closures will occur just prior to the blast, and reopening will occur only after a thorough safety inspection has been completed.

SCPL's road closure procedure includes:

- The shotfirer will, as part of preparation for a given blast, determine the need for road closure on the basis of whether the public road is within the maximum extent of the Blast Management Zone (i.e. a 500 m offset from an open cut pit).
- The shotfirer in charge and SCPL's OCE will determine the affected road(s) and appropriate locations along those road(s) at which to post sentries.

- The shotfirer in charge and SCPL's OCE will organise the appropriate number of blast sentries to occupy nominated locations on the road(s) to be closed during blasting.
- The sentries will operate from motor vehicles fitted with two-way radios capable of communicating with the shotfirer.
- The sentries will ensure they are in position at least 10 minutes prior to the initiation of a blast.
- Once a sentry has occupied his/her position, the sentry will not allow any person to pass that position without the permission of the shotfirer.

Public notification of road closures will generally be undertaken using existing blast notification mechanisms (Section 5.2.1).

Emergency services including Gloucester Ambulance Service, Rural Fire Service, Police and State Emergency Service will be advised of planned road closures, including proposed times, as determined in consultation with each authority. In the event that emergency services vehicles require immediate access through the closed road, the sentry will immediately communicate with the shotfirer to ensure a safe thoroughfare is provided for emergency services vehicles. All attempts will be made to provide rapid passage for the emergency services vehicle through the closed section of road subject to safety considerations.

On completion of a blast, the roads will be subjected to a thorough safety inspection by the blast sentries. If fly rock or other debris has been emitted onto the road during the blast, the material will be removed (either by the sentries or mechanical means, depending on the size of the debris) prior to the declaration of a safe thoroughfare.

Once the road has been inspected and declared safe, the shotfirer will advise the sentries that the road can be reopened to through traffic.

All complaints received in relation to road closure and/or blasting will be responded to in accordance with SCPL's complaints handling procedure (Section 9).

5.4 CULTURAL HERITAGE SITES

An Aboriginal heritage site (i.e. CTS-1) is located outside of the SMC MLs and Development Approval DA boundary, approximately 1.5 km south of the Avon North Open Cut (Figure 4). The site contains physical attributes (i.e. rock formations) which may be potentially susceptible to damage from blast vibration.

The blast impact assessment prepared by SLR Consulting Australia Pty Ltd for the SEP Environmental Impact Statement (SCPL, 2012) concluded that vibration velocity at the Aboriginal heritage site CTS-1 is predicted to be less than a nominated archaeological/geological vibration damage criteria of 80 mm/s (SLR Consulting, 2012).

Blast monitoring will be conducted at CTS-1 when blasting is scheduled to occur within 1 km of the site, to ensure that blasting does not damage the site in accordance with Condition 14, Schedule 3 of Development Consent SSD-4966.

5.5 FUME MANAGEMENT

Blasting has the potential to generate nitrogen oxide (NOx) fumes and result in fugitive fume emissions (e.g. when the explosive product is incorrectly formulated [Australian Explosives Industry and Safety Group Inc., 2011]). The management of blast fume is described in the SMC Blast Fume Management Procedure (SCPL, 2017).

Measures to minimise or avoid generation of NOx blast fumes will be implemented in accordance with the SMC Blast Fume Management Procedure and the Code of Practice: Prevention and Management of Blast Generated NOx Gases in Surface Blasting (Australian Explosives Industry and Safety Group Inc., 2011). This will include:

- Conduct of a risk assessment prior to blasting that will review factors such as:
  - geological conditions;
  - ground conditions (e.g. presence of clay or loose/broken ground of heavily rain affected ground);
  - presence of groundwater;

  - location of the blast relative to previous blasts which may have triggered fume events;
  - forecast meteorological conditions; and
  - blast product selection.

- Based on outcomes of the risk assessment, the blasting method will be reviewed and where necessary amended in consideration of the following:
  - minimising the time between drilling and loading, and loading and shooting of the blast;
  - formulation of explosive products to an appropriate oxygen balance to reduce the likelihood of fumes; and
  - forecast meteorological conditions in blast scheduling.

Risk Assessment factors outlined above are assigned a score which corresponds to the likelihood of fume generation (1=rare to 5=almost certain). The score assigned to each of the parameters is then multiplied by the full time weighting of each parameter. The sum of the resulting scores then determines the overall likelihood of fume generation.

The outcome of the risk assessment determines the guidelines for product selection and sleep time (i.e. the amount of time a charge is located within the blast hole prior to detonation).

Where particular circumstances are known to increase the likelihood of a blast producing unacceptable fumes and/or odours (i.e. prevailing wind direction indicates that any potentially generated fume will be carried to a potential receiver), control measures will be implemented to avoid those operational circumstances where practicable.

In the interest of the minimisation of fume generation to the greatest extent possible, the type of explosive approved for use at the SMC has been limited to heavy ammonium nitrate fuel oil (HANFO), Fortran Eclipse 12, Fortran Eclipse 13 and Fortis Eclipse.

The exact explosive type used in each circumstance is determined by the risk assessment process outlined above.

5.6 MAINTENANCE OF BLAST MANAGEMENT ZONE POST BLASTING

The 500 m Blast Management Zone will be maintained following the completion of the blast until a thorough inspection of the blast site can be completed by the shotfirer. Once the shotfirer has completed a thorough inspection of the blast site and is satisfied that the site is safe (i.e. no misfires have occurred), the shotfirer will allow the re-establishment of access to the 500 m Blast Management Zone and normal operations to resume.

5.7 INTERACTION WITH SURROUNDING INFRASTRUCTURE

SCPL will establish a co-operation agreement with any surrounding infrastructure owners that may be impacted by blasting. The co-operation agreement will address any interaction issues between the two operations, along with relevant measures to minimise any incompatibility between the relevant project and the SMC.

5.8 SAFETY

Protection of Livestock

Livestock agisted on SCPL-owned land will be removed from areas which may be affected by flyrock. The owners of livestock grazing on land not owned by SCPL will be advised of any impending blast that has the potential to injure their livestock in order that they may relocate their livestock and/or animals beyond the prescribed 500 m Blast Management Zone.

Public Safety

Public safety will be ensured by removing all persons (other than blast management personnel permitted by the shotfirer to be within the 500 m Blast Management Zone for the purposes of blast management) from areas within the Blast Management Zone.
If persons have the potential to be within the Blast Management Zone they will be informed in advance of the scheduled blast using the notification procedures described in Section 5.2.1. Where forward notification to members of the public is not possible, persons within the Blast Management Zone will be detected when sentries are being established and requested to leave the area.

Vehicle and pedestrian traffic through the Blast Management Zone along either public or private roads will be prevented by the stationed blast sentries.

The 500 m Blast Management Zone can also be varied at the discretion of the shotfirer or Mine Manager when considered appropriate. The 500 m Blast Management Zone will be maintained by placing sentries at points of entry to the blast affected area.

Safety of Aircraft

A visual inspection of air space in the vicinity of blast area will be undertaken by the shotfirer prior to initiating the blast. If there is any perceived risk to aircraft in the area of the mine as a result of blasting, the blast will be delayed until the aircraft has left the blast area.

6 BLAST MONITORING PROGRAM

6.1 MONITORING METHODS AND PROGRAM

Monitoring will be conducted to confirm compliance with the blasting limits/criteria defined in Section 3 and will use a blasting seismograph which meets the standards specified in the Australian Standard Explosive Code (AS2187 – 2006). SCPL currently operates an existing blast monitoring network consisting of the following monitoring sites (Figure 4):

- Isaac;
- Ex Judge;
- Atkins;
- Woodford; and
- Clarke.

In addition, blast monitoring will be conducted at CTS-1 when blasting is scheduled to occur within 1 km of the site, to confirm that blasting does not damage the site, in accordance with Condition 14, Schedule 3 of Development Consent SSD-4966 (Figure 4).

An additional blast monitoring site will be established in between the SMC and Craven Village prior to the commencement of operations in the Stratford East Open Cut.

Note that all monitoring locations:

- Are subject to permission to monitor being given by the property owner.
- May be altered or supplemented on the basis of blasting results over time and/or community feedback. Any alteration to a monitoring location will first require a relevant EPL variation and revision of the BLMP.

Monitoring data is included within the Annual Review which is made available on the Stratford Coal website (www.stratfordcoal.com.au).

6.2 VIDEO MONITORING OF BLASTS

SCPL monitors each blast using video and audio recording so that blasts can be reviewed after the event. Blast video recording is conducted in accordance with the conditions of EPL 5161 (refer Table 3). A copy of each blast video will be retained for a period of at least 12 months.

6.3 MONITORING OF FUME

The level of blast fume generation will be monitored for each blast by the shotfirer as described in the Blast Fume Management Procedure. In situations where fume has been generated and where practicable, a visual assessment will be made of the extent to which the fume has travelled as well as its dispersion time.

6.4 MONITORING PROGRAM FOR FLYROCK DISTRIBUTION

Following each blast the shotfirer will inspect the blast site to determine whether all explosive has satisfactorily detonated and whether it is safe for work to resume in the area. During this inspection, a visual assessment will be made of flyrock distribution in the immediate area.

Similarly, where blasting occurs in a location where there is a potential for flyrock to reach a public road or private property, an inspection of the road or private property will be undertaken post-blast to ascertain whether flyrock has reached the road or private property. Should flyrock be present on the road or private property, it will be removed in order to make the trafficable surface safe for vehicle and pedestrian use.

Additionally, any damage to a public road or privately-owned property caused by flyrock will be repaired by SCPL.

7 RESPONSE PROTOCOLS & CONTINGENCY PLAN

An investigation (i.e. remedial action) will be undertaken when any one of the following arises as a result of a specific blast event:

- monitoring indicates an exceedance of the performance indicators described in Section 3.3;
- breach of any other Licence, Lease or Development Consent condition relating to blasting;
- receipt of a complaint from a member of the public or a public authority following blasting; and
- evidence of structural damage to nearby privately or publicly-owned structures attributable to blasting.

The outcomes of the investigation will inform remedial actions, and whether an incident or a non-compliance has occurred. The response to an incident or non-compliance will be as per the protocols in the Environmental Management Strategy (Section 9).

7.1 CONTINGENCY PLAN

In the event of any of an exceedance of blast criteria SCPL will implement the following Contingency Plan:

- The exceedance of the blasting criteria will be reported to the Operations Manager and Environment & Community Superintendent (or delegate) within 24 hours of assessment completion.
- SCPL will report the exceedance of the blasting criteria to the DP&E and EPA as soon as practicable.
- SCPL will identify an appropriate course of action with respect to the identified impact(s), in consultation with a suitably qualified and experienced independent specialist(s) and EPA, as necessary.
- SCPL will, on request, submit the proposed course of action to the DP&E for approval.
- SCPL will implement the approved course of action to the satisfaction of the DP&E.

7.1.1 Blast Fume

SCPL will notify the relevant regulatory authorities including the EPA and DP&E of any blast producing post blast fume that rates 3 at its highest extent and leaves the site, and any blast that rates 4 and 5. In the event that monitoring records a blast fume rating of 3 or above and the blast fume migrates off site towards nearby receivers without significant dispersion, SCPL will implement its Emergency Management System and Pollution Incident Response Management Plan (PIRMP), as appropriate. (The PIRMP is a requirement of the PoEO Act and is routinely tested and revised to ensure its effectiveness). Following such an event SCPL will instigate an investigation to identify the cause and any possible mitigation measures to be implemented to minimise the potential for ongoing blast fume generation.

The investigation process will be undertaken in accordance with Sections 5 and 6 of the Australian Explosives Industry and Safety Group Inc. Code of Practice, Prevention and Management of Blast Generated NOx Gases in Surface Blasting (Australian Explosives Industry and Safety Group Inc., 2011).

7.2 POTENTIAL CONTINGENCY MEASURES

Following the exceedance of the blast performance indicators described in Section 3 and where relevant completion of an independent review the following potential contingency measures will be implemented as appropriate:

- SCPL will investigate blast design parameters with a view to mitigate future exceedances. For example, reviewing blast protocols, blast site law, charge weight and/or explosive product selection.
- SCPL will notify affected landholder and tenants of the exceedance and provide them with blast monitoring results to confirm blasting at Stratford Mining Complex is compliant with criteria.
- SCPL will, on request, conduct a property investigation in accordance with Conditions 12 and 13, Schedule 3 of the Development Consent SSD-4966.

Potential contingency measures will be reviewed during revisions of this BLMP.

8 ANNUAL REVIEW AND IMPROVEMENT OF BLAST MANAGEMENT PLAN

8.1 ANNUAL REVIEW

In accordance with Condition 4, Schedule 5 of Development Consent SSD-4966, SCPL will conduct an Annual Review of the environmental performance of the SMC by the end of March each year, or other timing as may be agreed by the Secretary of the NSW DP&E.

The Annual Review will specifically address the following aspects of Condition 4, Schedule 5, which are directly relevant to blast management:

- include a comprehensive review of the monitoring results and complaints records for the SMC over the previous calendar year, including a comparison of these results against the:
  - relevant statutory requirements, limits or performance measures/criteria;
  - monitoring results of previous years; and
  - relevant predictions in the SEP EIS;
- identify any non-compliance over the past year, and describe what actions were (or are being) taken to ensure compliance;
- identify any trends in the monitoring data over the life of the SMC;
- identify any discrepancies between the predicted and actual impacts of the SMC, and analyse the potential cause of any significant discrepancies; and
- describe what measures will be implemented over the next year to improve the environmental performance of the SMC.

The Annual Review will be made publicly available on the Stratford Coal website, in accordance with Condition 11, Schedule 5 of Development Consent SSD-4966.

8.2 BLMP REVIEW AND UPDATE

In accordance with Condition 5, Schedule 5 of Development Consent SSD-4966, this BLMP will be reviewed to the satisfaction of the Secretary of the DP&E within three months of the submission of:

(a) an Annual Review under Condition 4, Schedule 5 of Development Consent SSD-4966;

(b) an incident report under Condition 7, Schedule 5 of Development Consent SSD-4966;

(c) an audit report under Condition 9, Schedule 5 of Development Consent SSD-4966; or

(d) any modification to the conditions of Development Consent SSD-4966.

Where this review leads to revisions of the BLMP, then within 4 weeks of the review, the revised BLMP will be submitted for the approval of the Secretary of the DP&E. The revision status of this BLMP is indicated on the title page of each copy.

This BLMP will be made publicly available on the Stratford Coal website in accordance with Condition 11, Schedule 5 of Development Consent SSD-4966. A hard copy of the BLMP will also be kept at the SMC.

9 REPORTING AND MANAGEMENT PROTOCOLS

In accordance with Condition 3, Schedule 5 of Development Consent SSD-4966, SCPL has developed protocols for managing and reporting the following:

- incidents;
- complaints;
- non-compliances with statutory requirements; and
- exceedances of the impact assessment criteria and/or performance indicators.

These protocols are described in detail in the Environmental Management Strategy. The management of exceedances of performance indicators is detailed in Sections 6 and 7 of this BLMP

In the event that upper limits of either blast overpressure or ground vibration limits are exceeded, the DP&E and EPA will be informed within 24 hours of the blast and the EPA notified in accordance with the EPL requirements.

10 REFERENCES

Australian and New Zealand Environment Council (1990) *Technical Basis for Guidelines to Minimise Annoyance Due to Blasting Overpressure and Ground Vibration*.

Australian Explosives Industry and Safety Group Inc (2011) *Code of Practice: Prevention and Management of Blast Generated NOx Gases in Surface Blasting*.

SLR Consulting (2012) *Stratford Extension Project Noise and Blasting Assessment.* Report prepared for Stratford Coal Pty Ltd.

Stratford Coal Pty Ltd (2012a) *Stratford Extension Project Environmental Impact Statement*.

Stratford Coal Pty Ltd (2012b) *Stratford Coal Annual Review 2012.*

Stratford Coal Pty Ltd (2013) *Stratford Coal Annual Review 2013*.

Stratford Coal Pty Ltd (2014) *Stratford Coal Annual Review 2014*.

Stratford Coal Pty Ltd (2017) *Stratford-Duralie Blast Fume Management Procedure*.

ATTACHMENT 1

BLAST FUME MANAGEMENT PROCEDURE

STRATFORD MINING COMPLEX
Blast Fume Management Procedure

Document Control

Description

Title	Blast Fume Management Procedure
General Description	To provide a documented process for managing post blast NOx fume in order to achieve an acceptable level of risk.
Key Support Documents	• Stratford-Duralie Coal Explosives Control Plan • NSW Work Health and Safety Act 2011 • NSW Work Health and Safety Regulation 2011 • NSW Work Health and Safety (Mines) Act 2013 • NSW Work Health and Safety (Mines) Regulation 2014 – Section 26 (6), 31 and Schedule 2 (4) • NSW Explosives Act 2003 • NSW Explosives Regulation 2013 • Australian Explosives Industry Safety Group (AEISG) - Prevention and Management of Blast Generated NOx Gases in Surface Blasting (August 2011) • Queensland Government - Queensland Guidance Note - Management of Oxides of Nitrogen (Nox) in Open Cut Blasting (QGN 19, 31 May 2011)

Approvals

ORIGINATOR	Kylie Hannigan	**POSITION**	Health and Safety Consultant
REVIEWED	Chris Cade	**POSITION**	Safety and Training Superintendent
APPROVED	Olivier Gratessolle	**POSITION**	Technical Services Superintendent

Revisions					Approved
Version #	**Date**	**Description**	**By**	**Checked**	**Name**
1	5.11.15	New document drafted from Explosives Risk Assessment outcomes and considering existing Blasting Contractor (i.e. Downer Blasting Services), Mining Contractor (i.e. Leighton's) explosives management systems and the requirements of the Work Health and Safety (Mines) Legislation.	STAC Consulting (Kylie Hannigan	CC	OG
2	12.9.17	Document revised to incorporate relevant components of the former Duralie Coal Mine Blast Fume Management Strategy and to address and incorporate DP&E review comments on the former Blast Fume Management Strategy.	Resource Strategies	MP	OG

The nominated Coordinator for this document is	Technical Services Superintendent

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1. PURPOSE

The purpose of this procedure is to provide a documented process for managing post blast NOx fume in order to achieve an acceptable level of risk.

2. AIM

This aim of this procedure is to minimise the likelihood of a fume event, or the impacts of a fume event if it were to occur.

3. SCOPE

This procedure applies to the Stratford-Duralie Coal Mine sites within the relevant Mining Leases for the sites and is relevant to all employees, contractors and subcontractors at the Stratford-Duralie Coal Mines.

4. BACKGROUND

Post-blast fume is a product of (incomplete) combustion from a blast. The products of combustion from a blast may include oxides of nitrogen, ammonia, nitric acid, carbon monoxide and carbon dioxide. These gases are often referred to as "fume". Nitrogen oxide is visible as a reddish brown colour, the other products are not visible.

Post-blast fume is composed of toxic gases (including NOx) which can be released into the atmosphere in significant quantities from blasting operations. Exposure to even quite low concentrations can pose a serious health risk. Fume can enter the body through inhalation or contact with eyes and skin. Exposure to nitrogen dioxide can result in delayed health effects that may be potentially life threatening, even though the exposed person may at first appear relatively unaffected. For this reason, anyone who has been exposed to NOx should undergo an immediate medical assessment and a continued period of observation at the advice of the treating doctor (refer Section 5.8)

The Australian Explosives Industry and Safety Group (AEISG) (2011) Code of Practice - *Prevention and Management of Blast Generated NOx Gases in Surface Blasting* has been considered in the development of the Blast Fume Management Procedure detailed in Section 5.

5. BLAST FUME MANAGEMENT PROCEDURE

5.1 FUME PREVENTION

The most effective way to manage fume is to eliminate the possibility of fume being generated. The elimination of fume requires the concerted action by all entities involved in the blasting activity. This requires an understanding of the factors known to affect the generation of post blast (NOx) fume within any blast process.

Stratford-Duralie Coal has identified the following, as the key factors involved in the generation of post blast fume within any blast process:

- Poor diesel absorption by ammonium nitrate (prill);
- Water ingress in products as the product exceeds sleep time limits;
- Presence of dynamic water within the blast holes;
- Poor loading practices;
- Emulsion formulation deficient in oil content or rich in ammonium nitrate content (oxygen rich / oxygen positive);
- Critical density;
- Critical diameter;
- Product de-sensitisation by pressure;
- Ground conditions such as presence of cavities, cracked ground, weak / soft rock areas;
- Lack of proper confinement (stemming of blast holes); or
- Direct contact of incompatible chemical compounds (e.g. DAMs 1 and DAMs 2).

Should NOx be produced in a surface blast the fault tree shown in Section 4.4 can be used to identify which of the fundamental causes was the significant contributor to the generation of NOx.

5.2 MANAGEMENT OF FUME

Management measures are required at each stage of the blasting process from product manufacture, to post blast, to minimise the likelihood of a fume event, or the impacts of an event if it were to occur. The stages of management throughout the blasting process include:

- Explosive formulation and quality assurance
- Geological conditions
- Blast design

- Explosive product selection
- On-bench practices
- Pre-Blast Considerations

These stages reflect the 6 key causes of NOx-generating conditions outlined in the AEISG (2011) *Code of Practice - Prevention and Management of Blast Generated NOx Gases in Surface Blasting*.

5.2.1 Explosive Formulation and Quality Assurance

The management measures for explosive formulation and quality assurance are:

Contributing Causes	▪ Explosive product incorrectly formulated ▪ Explosives product change ▪ Inadequate mixing of raw materials ▪ Delivery system metering incorrectly ▪ Explosive precursors not manufactured to specification ▪ Precursor degradation during transport and storage ▪ Raw material changes
Performance Objective(s)	To ensure that the explosive product and raw materials meet quality assurance requirements and therefore do not contribute to causing post blast NOx fume.
Management Strategies	▪ Quality assurance and quality control processes applied to the manufacture of explosive and precursor products. ▪ In the event of any changes to product specifications, a Change Management Procedure is applied and updated Technical Data Sheets. ▪ A visual check of materials whilst loading into holes to check for mixing is undertaken. ▪ Metering and measuring systems are calibrated within required calibration dates. ▪ Precursors are transported in accordance with Australian Standards. ▪ Precursor storage location and stock rotation management in accordance with AS4326-2008. ▪ Explosives are formulated to an appropriate oxygen balance to minimise the likelihood of post-blast gases. ▪ Explosives products are authorised. ▪ In the event of any changes to product specifications, tests are undertaken for adverse impacts. ▪ Density checks undertaken once per load or as specified in the Load Sheet. ▪ Precursors are inspected and/or tested prior to use. ▪ Raw material tests are carried out to assess the

	suitability of raw materials. ▪ Risk assessments are undertaken for all changes to product and raw materials. ▪ Density of emulsion and other final products is tested. ▪ Trigger Action Response Plan applied (Attachment B).
Performance Criteria	▪ Nil fume events due to a root cause of explosive product and raw material deficiencies. ▪ Blast performs to plan.
Monitoring Frequency	▪ QA/QC checks – quality, density, viscosity, mixing equipment calibration.
Corrective Actions	▪ All incidents shall be recorded in CMO. ▪ All corrective actions will be managed through CMO.

5.2.2 Geological Conditions

The management measures for geological conditions are:

Contributing Causes	▪ Lack of relief in weak/soft strata ▪ Inadequate confinement in soft ground ▪ Explosive product seeping into cracks ▪ Dynamic water in holes ▪ Mud and/or sediment in base of blast hole. ▪ Blast hole wall deterioration between drilling and loading e.g. cracks, voids, hole contraction ▪ Chemistry and moisture of rock type e.g. limestone ▪
Performance Objective(s)	To ensure that the geology of the blast area is understood and blast design, product selection and loading procedures take those conditions into consideration and therefore do not contribute to causing post blast NOx fume.
Management Strategies	▪ The geology of each shot is considered and blasts designed to ensure adequate relief in weak/soft strata. ▪ Explosives product selection takes into account the specific geological conditions. ▪ Blast design takes into account the specific geological conditions. ▪ Blast size is minimised where practicable. ▪ Blast hole liners utilised where appropriate. ▪ Blast holes that are slumped or require excessive explosive product to reach stemming height are recorded and monitored. ▪ Sleep time of shot is minimised or eliminated whenever possible. ▪ When dewatering holes, recharge rates are

	measured and appropriate explosives products selected. ▪ The hydrology of pit and plan blasting is assessed to avoid interaction between explosives and dynamic water (either natural or from other pit operations). ▪ The time between drilling and loading is minimised. ▪ Blast hole savers utilised where appropriate. ▪ Drilling foam used to stabilise hole (confirm chemical compatibility with explosives first). ▪ When blasting in the weathered zone pattern sizes should be reduced along with the sleep time. To minimize the potential for fume generation a water resistant or fume minimizing product should be selected. ▪ Trigger Action Response Plan applied (Attachment B). ▪ Prior to the firing of any blast, an assessment must be conducted to determine if there are likely to be adverse fume effects as a result of deviations from the blast plan and other issues encountered during the preparation and loading of the shot. ▪ The Shotfirer in charge of the loading needs to record any problems encountered in relation to those issues so that a reasonable deduction can be made on the likelihood of post blast fume occurring. These factors must be considered and recorded and mitigations planned where appropriate prior to a blast being undertaken. ▪ Maintain accurate drill records. ▪ Bag off holes above known cracking to avoid/minimise seepage of product. ▪ Daily inspections of sleeping shots by Shotfirers.
Performance Criteria	▪ Nil fume events due to a root cause of geological conditions. ▪ Blast performs to plan.
Monitoring Frequency	▪ QA/QC checks – quality, density, viscosity, mixing.
Corrective Actions	▪ All incidents shall be recorded in CMO. ▪ All corrective actions will be managed through CMO.

5.2.3 Blast Design

The management measures for blast design are:

Contributing Causes	▪ Explosive desensitisation due to the blast hole depth. ▪ Inappropriate priming and/or placement. ▪ Mismatch of explosives and rock type. ▪ Inter-hole explosive desensitisation. ▪ Intra-hole explosive desensitisation in decked blast holes. ▪ Initiation of significant explosive quantities in a single blast event.
Performance Objective(s)	To ensure that the blast design does not contribute to causing post blast NOx fume.
Management Strategies	▪ Bench height reduced where appropriate. ▪ Adequate relief provided in deep holes. ▪ Blasts will be designed with consideration for : – depth of holes – product initiation – product suitability – geology – timing – product selection – initiation selection – blast size ▪ The site approved blast design is reviewed to improve priming. ▪ Blast design / approval process including completion of Blasting Checklist (Attachment C). ▪ Authorisation of all blast events by the Operations Manager. ▪ Powder factor is reduced where appropriate. ▪ Trigger Action Response Plan applied (Attachment B).
Performance Criteria	▪ Nil fume events due to a root cause of blast design. Blast performs to plan.
Monitoring Frequency	▪ Video every blast using two cameras at 90 degrees.
Corrective Actions	▪ All incidents shall be recorded in CMO. ▪ All corrective actions will be managed through CMO.

5.2.4 Explosive Product Selection

The management measures for explosive product selection are:

Contributing Causes	▪ Non water-resistant explosive products loaded into wet or dewatered holes. ▪ Excessive energy in weak/soft strata desensitising adjacent explosive product columns. ▪ Primer of insufficient strength to initiate explosive column. ▪ Desensitisation of explosive column from in-hole cord initiation. ▪ Inappropriate explosive product for application.
Performance Objective(s)	To ensure that product selection does not contribute to causing post blast NOx fume.
Management Strategies	▪ Technical Data Sheet stating recommendations and procedure for variations to manufacturer's recommendations for explosive product selection and initiating systems are followed. ▪ Weather forecasts are considered prior to product selection. ▪ Bench is designed for effective surface water run-off. ▪ Detonating cord for down the hole initiation is minimised wherever possible. ▪ Blast design / approval process including completion of Blasting Checklist (Attachment C). ▪ Trigger Action Response Plan (Attachment B) ▪ Training of blast crew on product selection and designs.
Performance Criteria	▪ Nil fume events due to a root cause of product selection. Blast performs to plan
Monitoring Frequency	▪ Video every blast using two cameras at 90 degrees.
Corrective Actions	▪ All incidents shall be recorded in CMO. ▪ All corrective actions will be managed through CMO.

5.2.5 On-Bench Practices

The management measures for explosive formulation and quality assurance are:

Contributing Causes	▪ Hole condition incorrectly identified. ▪ Blast not drilled outside of acceptable variation from plan (more than 0.5 metre from design location.) ▪ Dewatering of holes diverts water into holes previously loaded with dry hole explosive products. Blast not loaded as per blast plan.
Performance Objective(s)	To ensure that bench practices do not contribute to causing post blast NOx fume.
Management Strategies	▪ All holes are dipped prior to loading. ▪ Bench is free draining as practicable. ▪ Wet, dewatered and dry holes are recorded on blast plans and this information is used as a basis for explosive product selection. ▪ Water from wet holes is to be diverted away from any dry product holes. ▪ Recharge rate of dewatered holes is used as a basis for explosive product selection. ▪ Actual load sheets recorded for each hole. ▪ Time between dipping and loading is minimised, especially in soft and clay strata. ▪ Sleep time of shot is minimised or eliminated whenever possible. ▪ If sleep time is exceeded a risk assessment must be completed by the MME and Explosives Inspectorate. ▪ Accurate drilling records are maintained and reviewed if required. ▪ Wet holes are loaded first and remaining holes are dipped prior to loading. The explosive product selection is adjusted accordingly. ▪ Gas bags are used in dewatered blast holes where required. ▪ Shotfirer records variations to blast design or changes to bench conditions during loading. ▪ Drill and Blast Engineer to be notified of any changes to load plan. ▪ Trigger Action Response Plan applied (Attachment B). ▪ Prior to the firing of any blast, an assessment must be conducted to determine if there are likely to be adverse fume effects as a result of deviations from the blast plan and other issues encountered during the preparation and loading of the shot. ▪ The Shotfirer in charge of the loading needs to record any problems encountered in relation to those issues so that a reasonable deduction can be made on the likelihood of post blast fume occurring. These factors

	must be considered and recorded and mitigations planned where appropriate prior to a blast been undertaken.
Performance Criteria	▪ Nil fume events due to a root cause of bench practices. ▪ Blast performs to plan.
Monitoring Frequency	▪ Video every blast using two cameras at 90 degrees. ▪ Explosives loading area bench acceptance inspection.
Corrective Actions	▪ All incidents shall be recorded in CMO. ▪ All corrective actions will be managed through CMO.

5.2.6 Pre-Blast Considerations

The management measures for explosive formulation and quality assurance are:

Contributing Causes	▪ Explosive product mixes with mud / sediment at bottom of hole. ▪ Interaction of explosive product with drilling muds. ▪ Penetration of stemming material into top of explosive column (fluid / pumpable explosive products only). ▪ Water entrainment in explosive product. ▪ Moisture in ground attacking explosive product. ▪ Contamination of explosives column by drill cuttings during loading. ▪ Rainfall on a sleeping shot.
Performance Objective(s)	To ensure that the risk of contamination of explosives in blast holes is minimised and does not contribute to causing post blast NOx fume.
Management Strategies	▪ Loading procedure followed during charging. ▪ Primer is positioned in undiluted explosive product. ▪ Gas bags used to separate mud / sediment from explosive product where required. ▪ Blast hole savers utilised where required. ▪ End of loading hose dispersers utilised where required to minimise contamination. ▪ Appropriate stemming material is sourced and used. ▪ Explosive product is gassed to required specifications before stemming. ▪ Gas bags used to seal the top of explosives columns prior to stemming where required. ▪ All primers are positioned in undiluted explosive product. ▪ Gas bags used in dewatered blast holes where required. ▪ Hole liners used where required. ▪ Hose lubrication minimised during charging.

	▪ Water recharge rate measured after dewatering and explosive product selection adjusted accordingly. ▪ Low blast holes loaded last where practical. ▪ Sleep time minimised or eliminated. ▪ Wet holes loaded first where practical and remaining holes dipped prior to loading and explosive product selection adjusted accordingly. ▪ Vehicle contact minimised near blast holes. ▪ Hole savers utilised where required. ▪ Early firing of scheduled blast considered if wet weather is predicted. ▪ Trigger Action Response Plan applied (Attachment B). ▪ Prior to firing any blast, an assessment must be conducted by the Operations Manager to determine if there are likely to be adverse fume effects as a result of deviations from the blast plan and other issues (including adverse weather conditions) encountered during the preparation and loading of the shot. ▪ The Operations Manager is to authorise adverse weather blast events. ▪ The Shotfirer in charge of the loading needs to record any problems encountered in relation to those issues so that a reasonable deduction can be made on the likelihood of post blast fume occurring. These factors must be considered and recorded and mitigations planned where appropriate prior to a blast being undertaken.
Performance Criteria	▪ Nil fume events due to a root cause of contaminated explosives in blast holes. Blast performs to plan.
Monitoring Frequency	▪ Video every blast using two cameras at 90 degrees.
Corrective Actions	▪ All incidents shall be recorded in CMO. ▪ All corrective actions will be managed through CMO.

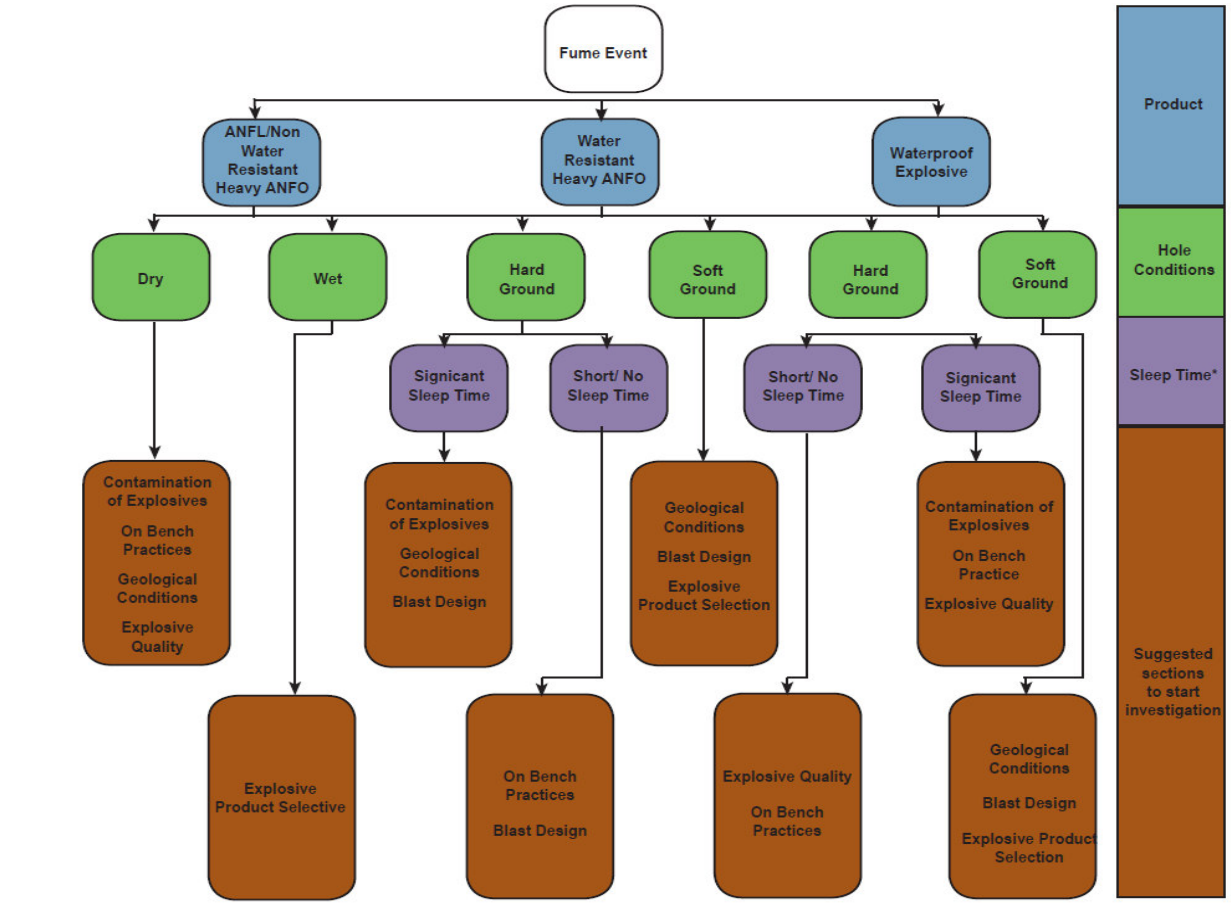
5.3PRE-BLAST ASSESSMENT

Prior to the firing of any blast, a review must be conducted to determine if there are likely to be adverse fume effects as a result of deviations from the blast plan and other issues encountered during the preparation and loading of the shot. This review is conducted just prior to the firing of the blast.

The Shotfirer in charge of the loading needs to record any problems encountered in relation to those issues, so that a reasonable deduction can be made on the likelihood of post blast fume occurring. These factors must be considered and recorded and mitigations planned where appropriate prior to a blast being undertaken.

5.4POST BLAST FUME MANAGEMENT

Should NOx be produced in a surface blast the following fault tree can be used to identify which of the fundamental causes was the significant contributor to the generation of NOx. Once the likely causes have been identified appropriate action plans can then be put in place to mitigate and reduce the generation of NOx from future surface blasts. These actions plans are to be internally reported and distributed to all relevant personnel. The fault tree can also be used to educate those responsible for surface blasts as to their responsibilities in ensuring appropriate steps are taken in the design, loading and firing of the blast to minimise the likelihood of generating NOx from the blast.



*Reference to short sleep or significant sleep in this Fault Tree does not refer to the explosives manufacturer's recommneded sleep time, but rather is a subjective term aimed at differentiating between a load and shoot blast and one which is designed to sleep for a period of time. It recognises that there is a correlation between increased sleep time and the generation of NOx gases from blasting. As a guide for this Fault Tree Analysis only, a time of less than 3 days is considered a short sleep time, however conditions vary from site to site and consideration should be given to the adverse impacts longer sleep times can have on loaded blast holes.

5.5VISUAL ESTIMATION OF FUME CATEGORY

Post blast fume categories are required to be estimated based on colour by the blast sentries and / or video records of the blast.

The width and depth of a fume cloud should be kept in mind when assessing fume; as the depth and width of a fume cloud increases so does the apparent colour of the fume.

To accurately assess a fume cloud's colour (and therefore category) it should be done from a vantage point that looks through the thinnest part of the shot (i.e. observe the shot front or back on, not from the side). Fume categories are typically identified visually using the following colour coding:

Level	Colour	Pantone Number
Level 0 No NOx gas		Warm Grey 1C (RGB 244, 222, 217)
Level 1 Slight NOx gas		Pantone 155C (RGB 244, 219, 170)
Level 2 Minor yellow/orange gas		Pantone 157C (RGB 237, 160, 79)
Level 3 Orange gas		Pantone 158C (RGB 232, 117, 17)
Level 4 Orange/red gas		Pantone 1525C (RGB 181, 84, 0)
Level 5 Red/purple gases		Pantone 161C (RGB 99, 58, 17)

Level		Typical Appearance
Level 0 No NOx gas		
Level 1 Slight NOx gas		
1A	Localised	
1B	Medium	
1C	Extensive	
Level 2 Minor yellow/orange gas		
2A	Localised	
2B	Medium	
2C	Extensive	
Level 3 Orange gas		
3A	Localised	
3B	Medium	
3C	Extensive	
Level 4 Orange/red gas		
4A	Localised	
4B	Medium	
4C	Extensive	
Level 5 Red/purple gas		
5A	Localised	
5B	Medium	
5C	Extensive	

Assessing the amount of NOx gases produced from a blast will depend on the distance the observer is from the blast and the prevailing weather conditions. The intensity of the NOx gases produced in a blast should be measured on a simple scale from 0 to 5 based on the table above. The extent of the NOx gases also needs to be assessed and this should be done on a simple scale from A to C where:

- A = Localised (i.e. NOx Gases localised across only a few blast holes)
- B = Medium (i.e. NOx Gases from up to 50% of blast holes in the shot)
- C = Extensive (i.e. Extensive generation of NOx Gases across the whole blast)

5.6 RECORDING AND REPORTING BLAST FUME

All blasts will be recorded, rated and reported as followed:

- Rate and record the fume characteristics of all shots using the rating system in Appendices 2 and 3 of the Australian Explosives Industry and Safety Group (AEISG) Code of Practice titled "Prevention and Management of NOx Gases in Surface Blasting". This includes all blasts even if there is no visible post blast fume.
- Records of fume ratings are to be kept on the mine site. NSW DP&E may take up the option of reviewing and discussing these results with the mine from time to time. Written records are to be kept for a minimum of 2 years.
- Video record of each blast using two cameras at 90 degrees.
- All video footage is to be stored for at least 1 year. All videos should be a minimum duration of 1 minute following the blast and should capture any post blast fume until the fume dissipates, leave the site or leaves the view of the camera.
- The rating and recording of post blast fume is to be kept from 1 April 2014.

In accordance with the site's Pollution Incident Response Management Plan (PIRMP) Stratford-Duralie Coal is required to notify, as soon as practicable, the relevant regulatory authorities including the NSW EPA and NSW DP&E of any blast producing post blast fume that rates 3 at its highest extent and leaves the site, and any blast that rates 4 and 5. A written report will be submitted within 7 days of the incident (refer Section 4.7 below).

Internal reporting actions following all blasts will include:

- completion of a Blasting Checklist to evaluate the potential impacts of the blast; and
- completion of an action plan that identifies which fundamental cause was the significant contributor to the generation of NOx from a blast fume event and the success of the mitigation measures used.

In addition, a summary of any blast fume event that rates 3 at its highest extent and leaves the site, and any blast that rates 4 and 5 will be provided within the Stratford-Duralie Annual Reviews.

5.7BLAST FUME INCIDENTS

Following a blast fume incident (Category Rating 3 - offsite, 4 or 5) at Stratford-Duralie Coal the following actions will occur:

- Notification to relevant authorities
- Debriefing with personnel directly involved in the incident within 24 hours of the cessation of the blast fume incident;
- Internal analysis of the blast fume incident;
- Submission of a report within 7 days of the incident to DP&E and EPA on the pollution incident outlining the following;
    - Date, time and nature of the pollution incident;
    - Identifying the cause (or likely cause) of the pollution incident;
    - Describing what action has been taken to date; and
    - Describing proposed measure to address the pollution incident
- Participate in any external investigation of the pollution incident.

Communications with the community will be based on a risk based approach identifying those that may be affected. For fume related incidents the stakeholders that are predicted to be impacted by each event will be notified prior to blasting. Contact registers for Stratford-Duralie Coal stakeholders are maintained on site. The method and content of communication will depend on the incident and the actions required to protect human health.

An investigation shall also be required in the event that a person is affected by the effects of NOx gasses.

5.8BLAST FUME EXPOSURE

If a person has been exposed to NOx gases medical attention must be sought as soon as possible.

The possibility of delayed and life threatening pulmonary oedema dictates that any person exposed to a visible plume of NOx, and/or any person experiencing sudden acute effects of coughing, shortness of breath or irritation of the mucous membranes of the eyes, nose or throat following post-blast NOx events must be examined by a medial practitioner without delay, even if no NOx smell was noticed or symptoms are mild.

The treating medical practitioner shall be informed of the potential NOx exposure (Refer to Attachment A – Letter to Doctor Re: Potential Exposure to NOx Gas Fumes).

6. TRAINING

The following personnel will be provided relevant training in the BCM blast management and procedures:

- general staff;
- Blast Crew;
- Shot firers;
- Drill and Blast Engineer;
- Explosives Inspectorate; and
- any other key DCM personnel associated with implementation of blast fume management procedure.

7. ACCOUNTABILITIES

Role	Accountability
Stratford-Duralie Coal Management	▪ Ensure a safe work environment is provided and maintained for all employees in accordance with the requirements outlined in this Procedure. ▪ Ensure they are fully familiar with and comply with the requirements of this Procedure. ▪ Ensure all work undertaken within their area of responsibility is conducted in accordance with the requirements of this Procedure. ▪ Ensure training and assessment of employees who may be affected by the requirements of this Procedure is provided. ▪ Ensure the requirements of this procedure are implemented and reviewed.
Mining Engineering Manager (MEM)	▪ Report any Notifiable Incidents (category 3 [offsite], 4 and 5 blasts) regarding blast fume to the relevant Statutory (Government) Department (refer Section 4.7).
Explosives Inspectorate	▪ External explosives and blasting regulation.
Drill and Blast Engineer	▪ Design blasts to minimise fume. ▪ Assess all post blast fume according to AEISG Rating

Role	Accountability
	Scale, and record results according to site procedures.
Environment and Community Superintendent	▪ Notify relevant authorities and potentially affected external stakeholders of notifiable blast fume incidents (category 3 [offsite], 4 and 5 blasts). ▪ Coordinate the response to blast fume incidents and initiation of site Pollution Incident Response protocol where required. ▪ Prepare reports relating to blast fume incidents.
Open Cut Examiner (OCE)	▪ Ensure a safe work environment is maintained for all employees in accordance with the requirements outlined in this Procedure. ▪ Ensure they are fully familiar with and comply with the requirements of this Procedure. ▪ Ensure all work undertaken within their area of responsibility is conducted in accordance with the requirements of this Procedure. ▪ Ensure training and assessment of coal mine workers who may be affected by the requirements of this Procedure and how it is to be applied is provided. ▪ Ensure any person who may have been exposed to NOx gasses seeks medical attention immediately and a Letter to the Doctor (Attachment A) is provided.
All Workers	▪ Act promptly to rectify or report hazards once identified. ▪ Comply with the requirements of this Procedure.

8. DEFINITIONS

Word	Definition
ANFO	A mixture of ammonium nitrate and fuel oil with or without a dye colouring agent.
BEZ	Blast Exclusion Zone
Dry Holes	Blast hole with no greater than 0.5 metres of water, which can be bagged off using a gas bag.
Dust	Airborne particulate matter ranging in diameter from 10 to 50 microns.
Dynamic Water	Water that is in motion (i.e. flowing water).
MME	Manager of Mining Engineering
NOx (Oxides of Nitrogen)	A multiple combinations of oxides of nitrogen (N2O2, NO, NO2, N2O3, N2O4, N2O5) with nitrogen dioxide (NO2) being the principle hazardous nitrous fume.
OCE	Open Cut Examiner
Post Blast Fume	Gases generated by the detonation of explosives during blasting.
Precursor	A material resulting from a chemical or physical change when two or more substances consisting of fuels and oxidisers are mixed is intended to be used exclusively in the production of an explosive.
Sleep Time	The time between explosives being loaded into a blast hole and their initiation.
Wet Holes	Blast holes containing dynamic or static water. Mud at base of blast hole is also indicative of a wet hole.

9. REFERENCES

Australian Explosives Industry Safety Group (AEISG) (2011) *Code of Practice Prevention and Management of Blast Generated NOx Gases in Surface Blasting* (Edition 2, August 2011).

DCPL (2016) *Duralie Coal Mine Blast Management Plan*.

DCPL (2016 *Duralie Coal Mine Explosives Principal Control Plan*.

DCPL (2015) *Duralie Coal Mine Pollution Incident Response Management Plan*.

Attachment A: Letter to Doctor Re: Potential exposure to NOx Gas Fumes

Advice to Medical Staff

This patient may have been exposed to NOx. This is a gas usually produced in mines after the use of explosives. NOx consists of multiple combinations of nitrogen and oxygen (N2O, NO, NO2, N2O4, N2O3, N2O5). Nitrogen dioxide (NO2) is the principle hazardous nitrous fume. NOx irritates the eyes and mucous membranes primarily by dissolving on contact with moisture and forming a mixture of nitric and nitrous acids. But this is not the only mechanism by which injury may occur. Inhalation results in both respiratory tract irritation and pulmonary oedema. High level exposure can cause methemoglobinemia. Some people, particularly asthmatics, can experience significant bronchospasm at very low concentrations.

The following effects are commonly encountered after NOx exposure:

ACUTE

- Cough
- Shortness of breath
- Irritations of the mucous membranes of the eyes, nose and throat

SHORT TERM

- Pulmonary oedema which may be delayed for up to 4 – 12 hours

MEDIUM TERM

- R.A.D.S. (Reactive Airways Dysfunction Syndrome)
- In rare cases bronchiolitis obliterans which may take from 2-6 weeks to appear

LONG TERM

- Chronic Respiratory insufficiency

High level exposure particularly associated with methemoglobinemia can cause chest pain, cyanosis, and shortness of breath, tachypnea, and tachycardia. Deaths have been reported after exposure and are usually delayed. Even non-irritant concentrations of NOx may cause pulmonary oedema. Symptoms of pulmonary oedema often don't become manifest until a few hours after exposure and are aggravated by physical effort. Prior to transport to you the patient should have been advised to rest and if any respiratory symptoms were present should have been administered oxygen.

The patient will need to be treated symptomatically but as a base line it is suggested that the following investigations are required:

- **Spirometry**
- **Chest X-ray**
- **Methheamoglobin estimation**

Because of the risk of delayed onset pulmonary oedema it is recommended that as a precaution the patient be **observed for up to 12 hours**. As no specific antidote for NOx exists, symptoms will have to be treated on their merits.

Attachment B: TARP – Fume Management

	Normal Operating Conditions	Abnormal Conditions	Cessation of Mining Conditions (Withdrawal Conditions Level 3 - 5)
Trigger Condition			
Condition	▪ **No abnormal/ unpredicted inclement weather conditions** ▪ **No Identified product discrepancies / deterioration** ▪ **Wind speed not faster than a breeze (i.e. approximately 3 m/s)** ▪ **Shot fired successfully – no post blast fume**	▪ **Unpredicted rainfall during loading operations** ▪ **Minor product discrepancies identified (Density Checks/Water affected/Deterioration)** ▪ **Reasonable wind speed (i.e. between approximately 5 m/s and 10 m/s)** ▪ **Shot fired successfully - Minor Fume Event (Level 1-3)** ▪ **Fume Event Occurs – Remains within the Blast Exclusion Zone (BEZ)**	▪ **Significant (or repeated) unpredicted rainfall/ weather event during loading operations** ▪ **Sleep time extended beyond product maximum specifications (with or without weather interference)** ▪ **Significant product degradation** ▪ **Strong to gale force winds (i.e. above approximately 10 m/s)** ▪ **Shot fired successfully – Major Fume Event (Level 4-5)** ▪ **Fume Event Breaches the Blast Exclusion Zone (BEZ)** ▪ **Single or multiple persons (on-site or off-site) exposed to fume**
Response Requirements			
Action & Reporting	**Shotfirer:** ▪ Proceed with normal post blast activities, declare the shot as clear for normal mining operations to resume ▪ Complete post blast documentation **Blast Guard:** ▪ No intervention required **Open Cut Examiner (OCE)** ▪ No intervention required **Worker/Visitor** ▪ No intervention required – remain out of the BEZ **Mining Engineering**	**Shotfirer:** ▪ Incident Notification, Investigating and Reporting – report any fume event to relevant stakeholders ▪ Monitor fume strength and record on fume rating sheet ▪ Monitor wind speed and direction of fume. Determine if blast guards will be required to push back to a safe position ▪ Notify mine personnel if fume is likely to breach the BEZ – provide a clear instruction if action is required	**Shotfirer:** ▪ Immediately determine action for the safety of personnel potentially affected outside of the BEZ based on the activity of the fume /strength/ direction/ speed ▪ Immediately communicate to mine personnel of current circumstances ▪ Identify the circumstances as an emergency (if required) and follow emergency response plan ▪ Provide immediate First Aid Treatment to exposed or potentially exposed mine personnel (requires medical attention – send Letter to Dr) ▪ Proceed to notify In accordance with Stratford-Duralie Coal Coal Incident Reporting Procedure – report any fume event to relevant stakeholders ▪ Complete post blast

	Normal Operating Conditions	Abnormal Conditions	Cessation of Mining Conditions (Withdrawal Conditions Level 3 - 5)
	Manager (MEM) ▪ No intervention required	▪ Complete post blast documentation **Blast Guard:** ▪ Notify Shotfirer if fume is approaching their allocated position ▪ Respond immediately to instructions received from the Shotfirer ▪ Ensure allocated blast guard position is not breached by any personnel or vehicle, notify Shotfirer if it occurs ▪ Notify Shotfirer of any visible fume/dust/ wind changes once the shot has been fired **Open Cut Examiner (OCE)** ▪ Ensure everyone remains out of the BEZ ▪ Follow any evacuation instructions received **Mining Engineering Manager (MEM)** ▪ No intervention required	documentation **Blast Guard:** ▪ Notify Shotfirer if fume is approaching their allocated position ▪ Report any identified changes to fume behaviour as visible from the blast guard location if safe (change of direction, increase in wind speed) ▪ Report any actual or potential exposure to fume ▪ Respond immediately to specific instructions received ▪ Close vehicles and put on reverse cycle air conditioning **Open Cut Examiner (OCE)** ▪ Report any actual or potential exposure to fume ▪ Gather exposed personnel and assist with providing immediate medical attention ▪ ▪ Gather incident data and commence **Worker/Visitor** ▪ Follow instructions received ▪ Remain inside a vehicle with airconditioning on recycle ▪ Do not return to areas unless cleared by the Shotfirer **Mining Engineering Manager (MEM)** ▪ Immediately notify the appropriate authorities of the fume event and its rating ▪ Communicate with inspectorate
Monitoring	**Shotfirer:** ▪ Continue to observe weather conditions for resumed loading ▪ Ensure video in position prior to firing	**Shotfirer:** ▪ Continue to observe weather conditions for resumed loading activities ▪ Ensure video in position prior to firing	**Shotfirer:** ▪ Continue to observe weather conditions for resumed loading ▪ Ensure video in position prior to firing and are not damaged **Blast Guard:** ▪ No intervention required

	Normal Operating Conditions	Abnormal Conditions	Cessation of Mining Conditions (Withdrawal Conditions Level 3 - 5)
	Blast Guard: ▪ No intervention required **Mining Superintendent** ▪ Review geological conditions as required with D&B Engineer **Worker/Visitor** ▪ No intervention **Mining Engineering Manager (MEM)** ▪ No intervention required	**Blast Guard:** ▪ No intervention required **Mining Superintendent** ▪ Review fume events in the specific geology to determine if product selection is appropriate for the strata **Worker/Visitor** ▪ No intervention required **Mining Engineering Manager (MEM)** ▪ Review fume events at the mine and determine if response measures remain accurate or corrective actions are required	**D&B Engineer** ▪ Implement corrective actions as highlighted in the investigation ▪ Communicate and advise investigation findings **Worker/Visitor** ▪ No intervention required **Mining Engineering Manager (MEM)** ▪ Review investigation outcomes and determine appropriate action to prevent a recurrence/ improve management

ATTACHMENT C – DCM BLASTING CHECKLIST

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PRE FIRING CHECKLIST FOR POST BLAST FUME MANAGEMENT

Date:	Location:	Blast ID:
D&B Engineer who designed the shot:	Shotfirer in Charge:	Date Blast Fired:

Prior to the firing of any blast, a review must be conducted to determine if there are likely to be adverse fume effects as a result of deviations from the blast plan and other issues encountered during the preparation and loading of the shot. A Shotfirer has to consider a number of blast hazards such as flyrock, overpressure, ground shock and post blast fumes. This review is conducted just prior to the firing of the blast.

The Shotfirer in charge of the loading will record any problems encountered, so that a reasonable deduction can be made on the likelihood of post blast fume occurring. These factors must be considered and recorded and mitigations planned where appropriate prior to a blast being undertaken.

ISSUES LIKELY TO CAUSE POST-BLAST FUME:	POTENTIAL POST-BLAST FUME TRIGGERS (TICK AS APPROPRIATE)	COMMENTS
FIRING TIME AND WEATHER CONDITIONS	☐ FIRING IMMEDIATELY AFTER 09:00AM ☐ FIRING AFTER 4:00PM AND BEFORE 5:00PM ☐ CURRENTLY RAINING ☐ RECENT RAIN FALL ☐ CLOUDY	
BLAST HOLE DIPPING AND LOGGING	**Were the blast holes dipped and logged prior to loading?** ☐ YES ☐ IF YES, < 1 DAY PRIOR TO LOADING ☐ IF YES, > 1 DAY PRIOR TO LOADING ☐ NO ☐ MUDDY BOTTOM RECOREDED / BAGGED ☐ MOIEST / WET SIDES RECORDED	
GROND WATER	**Was ground water identified in holes prior to loading?** ☐ NO ☐ YES- DYNAMIC WATER ☐ YES - STATIC WATER ☐ WERE THE BLASTHO9LES DEWATERED ☐ WAS THE RECHARGE RATE MEASURED	
SLEEP TIME	**Was sleep time excessive for the Product concerned (refer to the Product Technical Data Sheet)?** ☐ NO ☐ YES	

ISSUES LIKELY TO CAUSE POST-BLAST FUME:	POTENTIAL POST-BLAST FUME TRIGGERS (TICK AS APPROPRIATE)	COMMENTS
ROCK AND GROUND TYPE	☐ SOFT CLAYS ☐ WET CLAYS / SURFACE SOILS ☐ BROKEN / FRAGMENTED GROUND ☐ KNOWN CAVITIES ☐ BLASTHOLE INSTABLILITY DURING DRILLING ☐ POTENTIAL LOSS OF CRITICAL DIAMETER **Note: These will give the explosives poor confinement**	
PRODUCT DAMAGE BY WATER (POTENTIAL)	☐ INCORRECT PORDUCT LOADED (WET HOLES) ☐ LOADING TOOK PLACE IN WET CONDITIONS ☐ POOR DRAINAGE ON THE BENCH EXPOSING PRODUCT TO WATER ☐ SUBSTITUTED PORDUCT UNABLE TO MANAGE WATER CONDITIONS OR HOLE CONDITIONS	
BLAST DESIGN	☐ INADVERTENT DYNAMIC DESENSITIZATION OF SURROUNDING HOLES ☐ UNAUTHORISED PORDUCT CHANGES ☐ UNAUTHORISED PLAN CHANGES ☐ INADEQUATE TIMING FACTORS ☐ BLAST DESIGN NOT FOLLOWED ☐ INSUFFICIENT USE OF GAS BAGS ☐ INSUFFICIENT USE OF PRIMERS ☐ INADEQUATE STEMMING	
MPU GROSS INGREDIENT USEAGE	☐ PRODUCT QUALITY CHECKS COMPLETED (PODUCT EXCEEDS CRITICAL DENSITY) ☐ VEHICLES CALIBRATED WITHIN LAST 30 DAYS ☐ PRODUCT TOTALS REVERSE CALCULATED TO ENSURE ACCURATE DELIVERY ☐ PRODUCT OVER FUELLED ☐ PRODUCT UNDER FUELLED ☐ PRODUCT SPECIFICATION / FORMULATION INCORRECT (INCLUDES RAW MATERIALS) ☐ PRODUCT TOP LOADED FROM AUGER INTO WET HOLE	
PRE- FIRING	☐ BLAST CONTROLLER HAS CLEARED THE BLAST ZONE ☐ WINDSPEED AND DIRECTION HAS BEEN CHECKED TO ENSURE DUST OR FUME DON'T LEAVE SITE AND ONSITE PERSONNEL ARE NOT IN THE DIRECT PATH OF POTENTIAL DUST OR FUME ☐ AIRSPACE OF EXCUZION ZONE CHECKED AND CLEAR OF AIRCRAFT	

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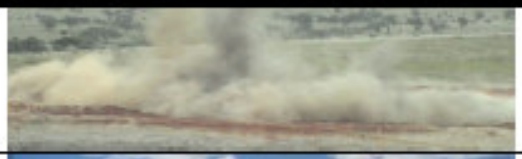
IDENTIFY POTENTIAL AND ACTUAL LEVEL OF FUME:

LEVEL	COLOUR	VISUAL GUIDE	SELECT POTENTIAL	SELECT ACTUAL
Level 0 No NOx Gas / No Fume Expected			☐	☐
Level 1 Slight NOx Gas / Fume Expected			☐	☐
Level 2 Minor Yellow/Orange Gas / Fume Expected			☐	☐
Level 3 Orange Gas / Fume Expected			☐	☐
Level 4 Orange/Red Gas / Fume Expected			☐	☐
Level 5 Red/Purple Gases / Fume Expected			☐	☐
OTHER FACTORS:				

SIGN OFF:		
POSITION	NAME	SIGNATURE