Environmental & Social Consultants

WOLLONGONG COAL

RUSSELL VALE COLLIERY REVISED UNDERGROUND EXPANSION PROJECT

Submissions Report – Part A

FINAL

November 2019

RUSSELL VALE COLLIERY REVISED UNDERGROUND EXPANSION PROJECT

Submissions Report – Part A

FINAL

Prepared by

Umwelt (Australia) Pty Limited

on behalf of

Wollongong Coal Limited

Project Director:	Barbara Crossley
Project Manager:	Gabrielle Allan
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Newcastle

75 York Street
Teralba NSW 2284

T| 1300 793 267
E| info@umwelt.com.au

www.umwelt.com.au

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1.0 Introduction

The Revised Preferred Project Report and Response to Second PAC Review (Revised Preferred Project Report) for the Russell Vale Revised Underground Expansion Project (Umwelt, 2019) was placed on public exhibition from 1 August 2019 to 29 August 2019. This Submissions Report has been prepared to address the key issues raised in the submissions received during the public exhibition period.

The Russell Vale Colliery (the Colliery) is an existing underground coal mine located in Russell Vale, north of Wollongong in NSW (refer to **Figure 1.1**) that is owned and operated by Wollongong Coal Limited (WCL). The Colliery has been on 'care and maintenance' since 2015 and the current Project Approval applying to mining operations at the Colliery requires that no mining occur after 31 December 2015. WCL is seeking Project Approval under the *Environmental Planning and Assessment Act 1979* (EP&A Act) to expand the mining operations at the Colliery. This ongoing application is referred to as the Underground Expansion Project (UEP).

During public exhibition, 213 submissions were made on the Revised Preferred Project. This included 11 government agency submissions and 202 community and interest group submissions. The 202 submissions received from the community and interest groups included 131 submissions objecting to the Revised Preferred Project, 70 submissions in support, and one submission providing a comment on the Revised Preferred Project. A full analysis of the submissions is provided in **Section 2.0**.

This Submissions Report – Part A has been prepared by Umwelt Environment and Social Consultants (Umwelt) on behalf of Wollongong Coal Limited (WCL) to address the key issues raised in the submissions.

1.1 Overview of the Revised Preferred Project

Mining has been undertaken at Russell Vale Colliery since the 1880s, including mining within the Bulli Seam, Balgownie Seam and the Wongawilli Seam. All three seams outcrop along the Illawarra Escarpment and the seams are accessed by adits[1] directly into the seams. There are two main mining areas within the Russell Vale Colliery lease area, which are referred to as Wonga East and Wonga West. The Cataract Reservoir broadly defines the boundary between the two areas (refer to **Figure 1.2**). In the Wonga East area, the Bulli Seam and Balgownie Seam have largely been fully extracted. The Colliery Pit Top is located at the base of the Illawarra Escarpment above the suburb of Russell Vale (refer to **Figure 1.3**). The Pit Top facilities occupy an area of approximately 100 hectares (ha) at the eastern extent of the Colliery holdings. The site is accessed via a private driveway from the Princes Highway at a signalised intersection with Bellambi Lane. Coal has historically been hauled from Russell Vale Colliery to Port Kembla Coal Terminal (PKCT) by truck, via Bellambi Lane and Memorial Drive.

In December 2004, after a period of care and maintenance, the mine was sold to NRE by the former owners Bellpac Pty Ltd and the assets transferred to a company called Gujarat NRE Coking Coal Ltd. Mining recommenced in 2005, however the mine produced very little coal when mining recommenced in the Wongawilli Seam. Jindal Steel and Power Limited acquired a majority stake in Gujarat NRE Coking Coal Ltd in October 2013. The name of the company, Gujarat NRE Coking Coal Ltd, was changed to WCL following the change in ownership.

[1] An entrance into a mine for access or drainage.

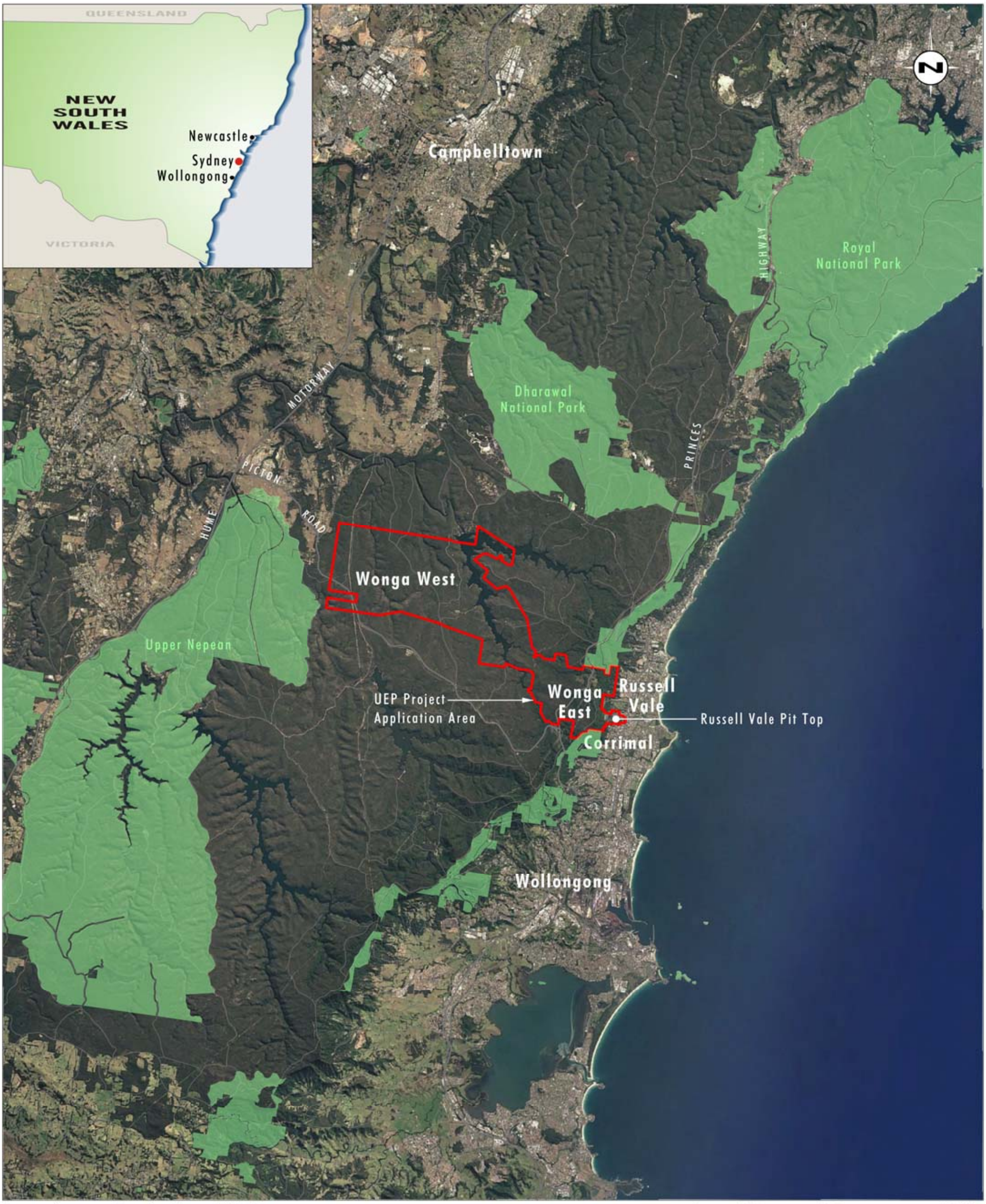


Image Source: Google Maps (2016)
Data Source: OEH (2016)

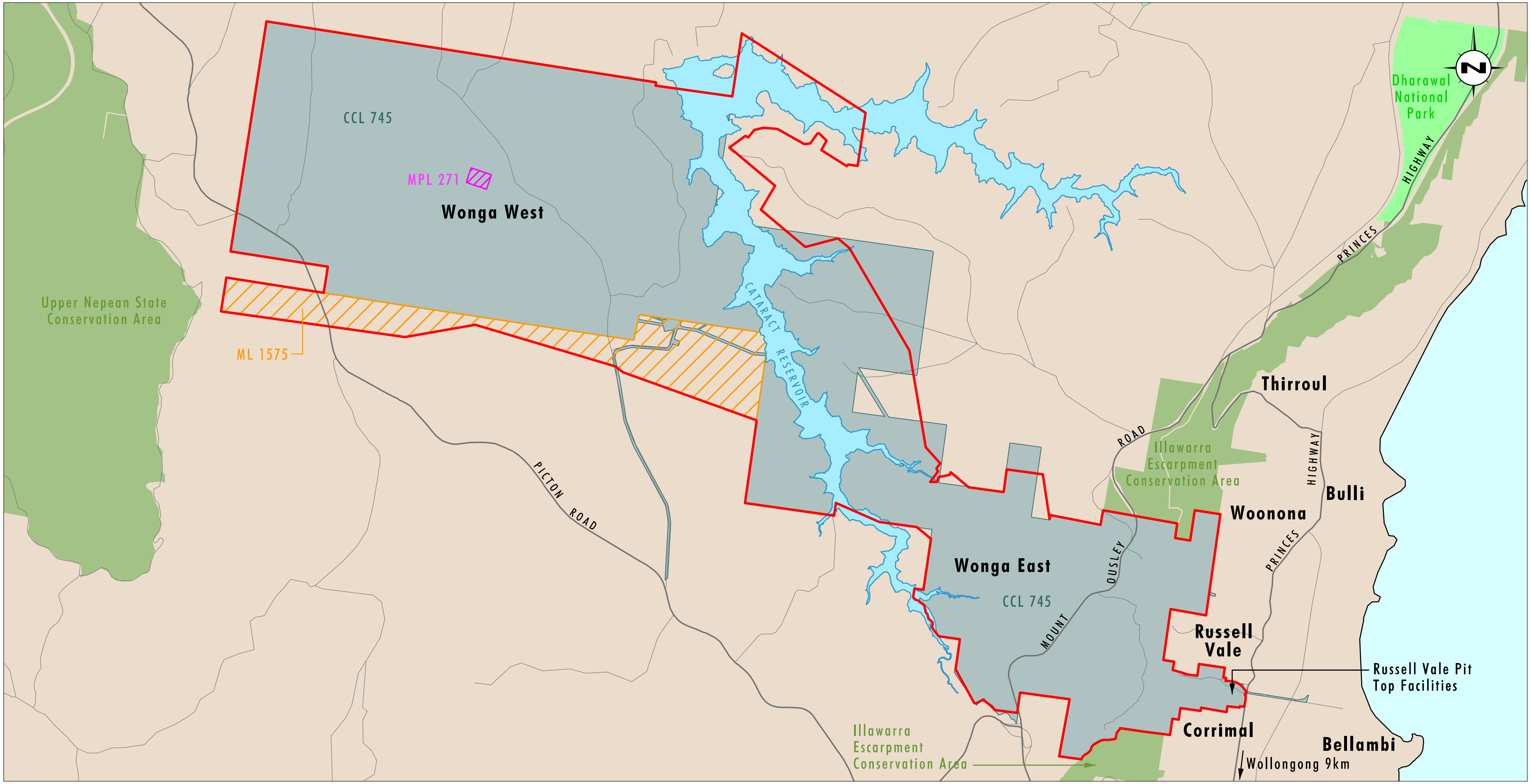
0 3.0 7.5 15.0km
1:300 000

Legend

UEP Project Application Area

FIGURE 1.1

Locality Plan



Data Source: Wollongong Coal (2016), OEH (2013)

0 1.0 2.0 4.0km
1:90 000

Legend

- UEP Project Application Area
- CCL 745
- ML 1575
- MPL 271

FIGURE 1.2

Russell Vale Colliery Mining Leases and UEP Application Area

File Name (A4): R13/3687_079.dgn
20190621 14.28

umwelt

Image Source: Nearmap (Oct 2016)
Data Source: Wollongong Coal (2016)

0 100 250 500m
1:10 000

Legend

UEP Project Application Area
Coal Transport Route

FIGURE 1.3

Existing Russell Vale Pit Top Facilities

The original UEP application submitted by Gujarat NRE Coking Coal Ltd in 2009 involved a substantial expansion of longwall mining in the Wongawilli Seam across the Wonga East area (a total of 11 longwall panels) and Wonga West area (a total of seven longwall panels) to extract 31 million tonnes (Mt) of run-of-mine (ROM) coal over a project life of 18 years (refer to **Figure 1.4**). In response to concerns from the public and government agencies, the original UEP application has been substantially revised over time to reduce the potential adverse impacts of the mine.

In order to address residual uncertainty regarding potential subsidence-related mining impacts on groundwater, surface water and biodiversity within the Cataract Reservoir water catchment, WCL has redesigned the UEP. Longwall mining is no longer proposed as part of the UEP and the revised mine design is based on a non-caving first workings mining system that will result in imperceptible subsidence.

Key elements of the Revised Preferred Project are:

- Mining using first working mining techniques only, with the workings designed to be long-term stable with minimal subsidence impacts. No longwall mining is proposed as part of the ongoing mine plan. Further, WCL have resolved that all future mine designs will be based on first working mine designs only to eliminate subsidence from mining activities affecting significant levels of strata stability and integrity towards the surface.

- Current longwall equipment will be retrieved from underground and sold. Recovery of the longwall mining equipment will require the mining of a 25 m section of LW6 to facilitate removal of the longwall mining equipment from the mine. This process reinforces WCL's commitment to no further longwall mining at Russell Vale Colliery.

- Extraction of approximately 3.7 Mt of ROM coal over a period of 5 years at a reduced production rate that will not exceed 1 Mt of product coal per year.

- Mining within the Wonga East area only, with no mining proposed within the Wonga West area or underneath the full supply level of Cataract Reservoir.

- Construction and use of a coal processing plant to improve the quality of product coal.

- Substantial redesign of the Pit Top layout to reduce amenity impacts.

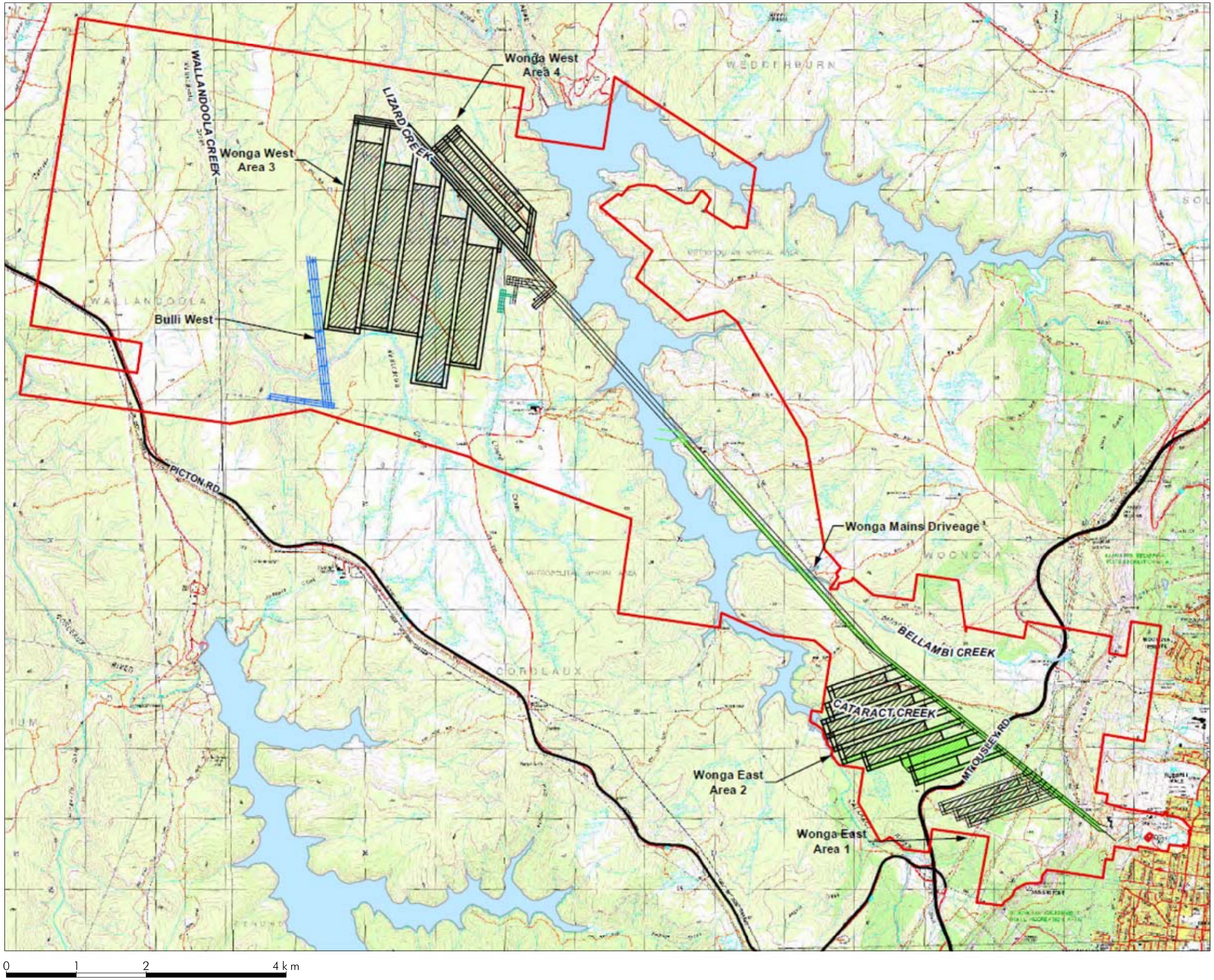
- Operation of surface facilities and product transport typically limited to daytime hours only (7.00 am to 6.00 pm Monday to Friday, 8.00 am to 6.00 pm Saturday, no Sundays and Public Holidays); with provision for occasional operation until 10.00 pm Monday to Friday to cater for unexpected Port closures or interruption.

- Reduced product trucking rates relative to previous proposals.

- Additional noise mitigation works surrounding the Pit Top including new noise barriers, extension to the height of existing bunds and acoustic treatment of coal processing infrastructure.

It is noted that following public exhibition of the Revised Preferred Project, WCL has refined the proposed noise barrier and bund arrangement in response to submissions made on the project. The revised barrier and bund arrangement is shown on **Figure 1.5** and described in further detail in **Section 3.1.1**.

The key features of the Revised Preferred Project are summarised in **Table 1.1** along with a comparison of the Revised Preferred Project with the Preferred Project.



Legend

- Project Application Area
- Previously Proposed Longwalls
- Approved Workings (MP10_0046)
- Proposed Balgownie Seam First Workings
- Proposed Bulli Seam First Workings
- Major Road

FIGURE 1.4

2009 Original Proposed UEP Mine Plan

Image Source: ERM (2013)

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20190703 14.23

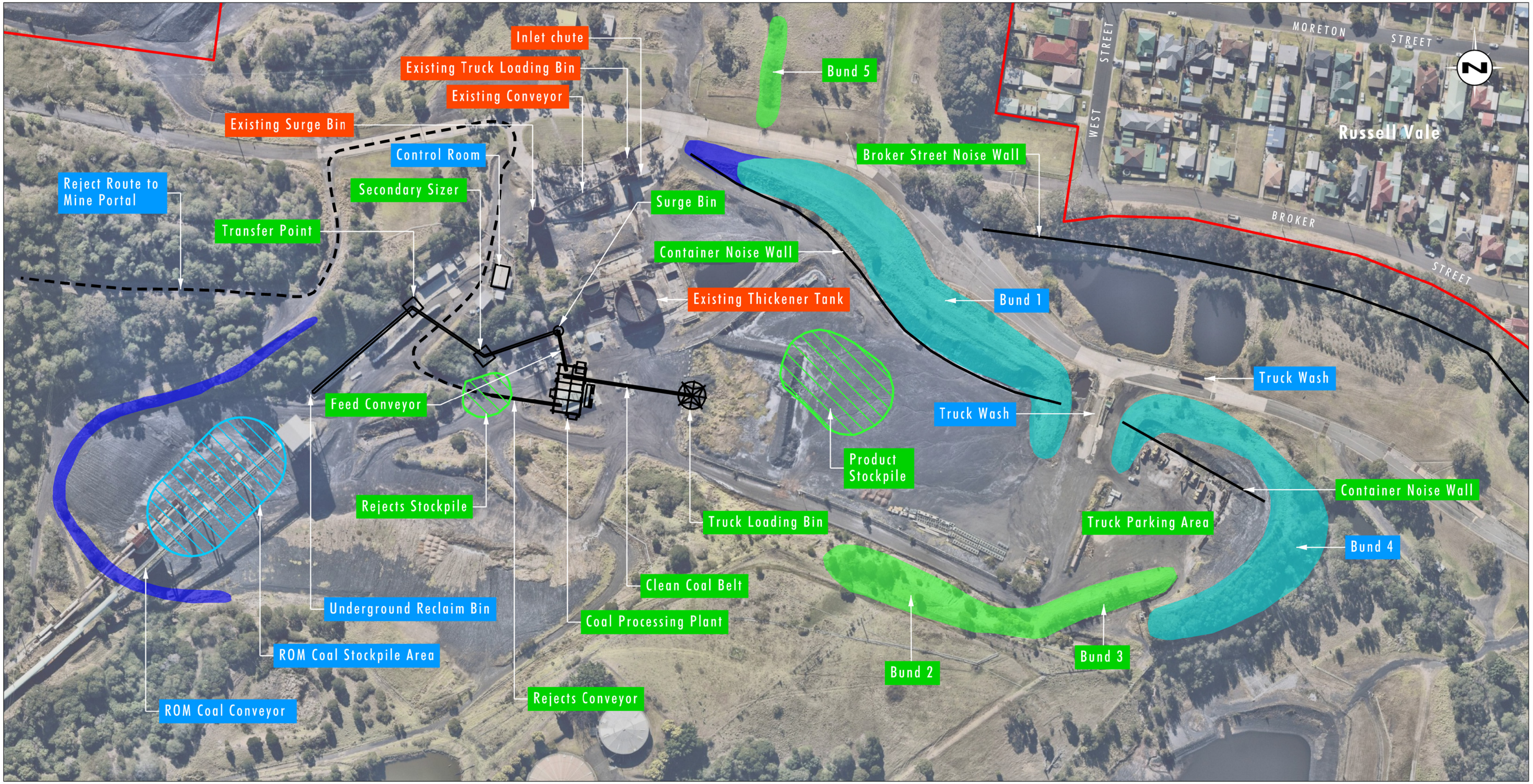


Image Source: Nearmap (Aug 2018)
Data Source: Wollongong Coal (2016)

0 50 100 150m
1:3 000

Legend

- UEP Project Application Area
- Existing Disused Infrastructure
- Existing Infrastructure to be used by UEP
- Infrastructure to be Constructed
- Proposed Flood Levee to be constructed under Mod 4
- Existing Bund
- Existing Bund to be raised/extended

FIGURE 1.5

Current and Proposed Plant and Infrastructure with Revised Noise Mitigation Structures

Table 1.1 Revised Preferred Project Key Features and Comparison with Preferred Project

Project Component	Preferred Project (2014)	Revised Preferred Project (2019)
Project Life	5 years	No change
Project Application Area	As per the historical Colliery Holdings/lease boundary, including Consolidated Coal Lease (CCL) 745, Mining Purposes Lease (MPL) 271 and Mining Lease (ML) 1575.	No change
Mine design and method	Extraction of 8 longwalls in three blocks within the Wonga East area.	Non-caving first workings within the Wonga East area, as shown in **Figure 1.5**. No longwall mining proposed as part of the ongoing mine plan. Longwall equipment will be recovered from underground and sold.
Target seam	Wongawilli seam	No change
Total Reserves Recovered	Approximately 4.7 Mt of ROM coal	Approximately 3.7 Mt of ROM coal
Extraction Rate	Up to 3 Mtpa	Up to 1.2 Mtpa ROM coal
Production Rate	Up to 3 Mtpa	Up to 1 Mtpa of product coal
Hours of Operation	**Underground Operations:** 24 hours, 7 days a week **Surface Facilities:** 24 hours, 7 days a week. **Product Transport:** 7.00am - 10.00pm, Mondays to Fridays; and 8.00am - 6.00pm Saturdays, Sundays and Public Holidays	**Underground Operations and delivery of ROM coal to the surface:** 24 hours, 7 days a week. **Surface Facilities and Product Transport:** 7.00am - 6.00pm, Mondays to Friday, 8.00am - 6.00pm Saturday. No Sundays or Public Holidays. Provision for occasional operation until 10.00pm Monday to Friday to cater for unexpected Port closures or interruptions. Operation until 10.00pm Monday to Friday has been considered in this assessment.

Project Component	Preferred Project (2014)	Revised Preferred Project (2019)
Pit Top Facilities	• Upgraded and continued operation of the Pit Top area, support facilities and utilities; • Construction and use of two new stockpiles of 140,000 t capacity each with associated reclaim facilities. • Construction and use of a new Sizing Plant • Construction and use of new truck loading facilities. • Upgrading of existing surface conveyers.	• Upgraded and continued operation of the Pit Top area, support facilities and utilities; • Establishment of new product stockpile (approx. 14,000 t capacity) and rejects stockpile (approx. 1,500 t capacity) within Pit Top disturbance area. • Construction and use of new enclosed Coal Processing Plant to improve coal quality. • Construction and use of a new Secondary Sizing Plant. • Construction and use of new Surge Bin in more shielded location. • Construction and use of enclosed conveyors for transfer of ROM coal to Secondary Sizer, Processing Plant and truck loading facility. • Construction of new truck loading facility. • Construction of noise barrier along access road and extension to height of existing bunds. • Establishment of a designated truck parking area.
Management of Mining Waste	Waste rock used onsite, or if the need arises, disposed of at an appropriately licensed facility.	Coarse rejects from the processing plant will be trucked off site as fill if it meets requirements for Virgin Excavated Natural Material (VENM), stockpiled for emplacement underground or used in the rehabilitation of the site.
Coal Transport	Transport by road to the PKCT for export.	No change.

Project Component	Preferred Project (2014)	Revised Preferred Project (2019)
Transport Hours and Rates	• An average rate of 17 coal truck loads per hour with a peak of 22 coal truck loads per hour, leaving the site between 7.00am - 10.00pm on Mondays to Fridays. • An average rate of 19 coal truck loads per hour with a peak of 26 coal truck loads per hour, leaving the site between 8.00am and 6.00pm Saturdays. • An average rate of 10.5 coal truck loads per hour with a peak of 14 coal truck loads per hour, leaving the site between 8.00 am and 6.00 pm Sundays and Public Holidays.	• An average rate of 16 laden outbound trucks per hour leaving the site between 7.00 am - 6.00 pm Monday to Friday and 8.00 am - 6.00 pm Saturday. • No coal transport Sundays or Public Holidays. • If coal transport is required during the evening to cater for unexpected Port closures or interruptions, these movements would be limited to an average of 12 trucks per hour leaving the site between 6.00 pm - 10.00 pm Mondays to Fridays only. • Trucks arriving at the site between 6:00 am - 7.00 am Monday to Friday or between 7.00 am - 8.00 am Saturday will be required to proceed to the truck parking area on site and turn off engine until loading commences at 7.00 am Monday to Friday or 8.00 am Saturday.
Employment	• Operational workforce of 300 employees and contractors. • Short-term construction workforce of up to 100 employees at various stages of the project	• Operational workforce of approximately 205 employees and contractors. • Short-term construction workforce of approximately 22 employees over a 6 - 12 month period.
Ongoing activities within mining tenements	• Exploration activities, environmental monitoring and maintenance of access to the existing underground workings and surface infrastructure within exploration and mining tenements in the Wonga West domain. • Ongoing maintenance and refurbishment of ventilation shafts, water and electrical facilities	No change
Rehabilitation	Progressive rehabilitation over project life, with rehabilitation of all surface facilities following the completion of mining.	No change
Capital Investment Value	$85 million	$35.3 million

1.2 Report Structure

The Submissions Report for the Revised Preferred Project will be submitted in two parts. This Submissions Report - Part A includes:

- a brief summary of the Project to provide context for the submissions (**Section 1.1**)
- analysis of the issues and themes raised in the submissions (**Section 2.0**)
- summary of the actions taken since the exhibition (**Section 3.0**)
- detailed response to the issues raised in the government submissions, excluding the Department of Planning, Industry and Environment – Water (DPIE Water) provided after the public exhibition period and dated 3 October 2019 (**Section 4.0**)
- detailed response to the issues raised in the interest group and community submissions (**Section 5.0**)
- an updated statement of commitments (**Section 6.0**).

A Submissions Report - Part B is being prepared in response to the DPIE Water submission and will include:

- a detailed response to the issues raised in the DPIE Water submission dated 3 October 2019
- updated evaluation of the Project merits, considering all detail included in Part A and Part B.

2.0 Submission Analysis

2.1 Breakdown of Submissions

The Revised Preferred Project Report was placed on public exhibition from 1 August 2019 to 29 August 2019. During the public exhibition period 213 submissions were made on the Project. This included 11 government agency submissions and 202 community and interest group submissions. **Table 2.1** provides a breakdown of the submissions received for the Project.

Table 2.1 Breakdown of Submissions

Category	Number of Submissions
Agency (State / Public Authorities)	9
Council	2
Community and Interest Groups	15
Members of the public	187
Total	**213**

Appendix 1 provides the Register of Submitters.

2.1.1 Agency Submissions

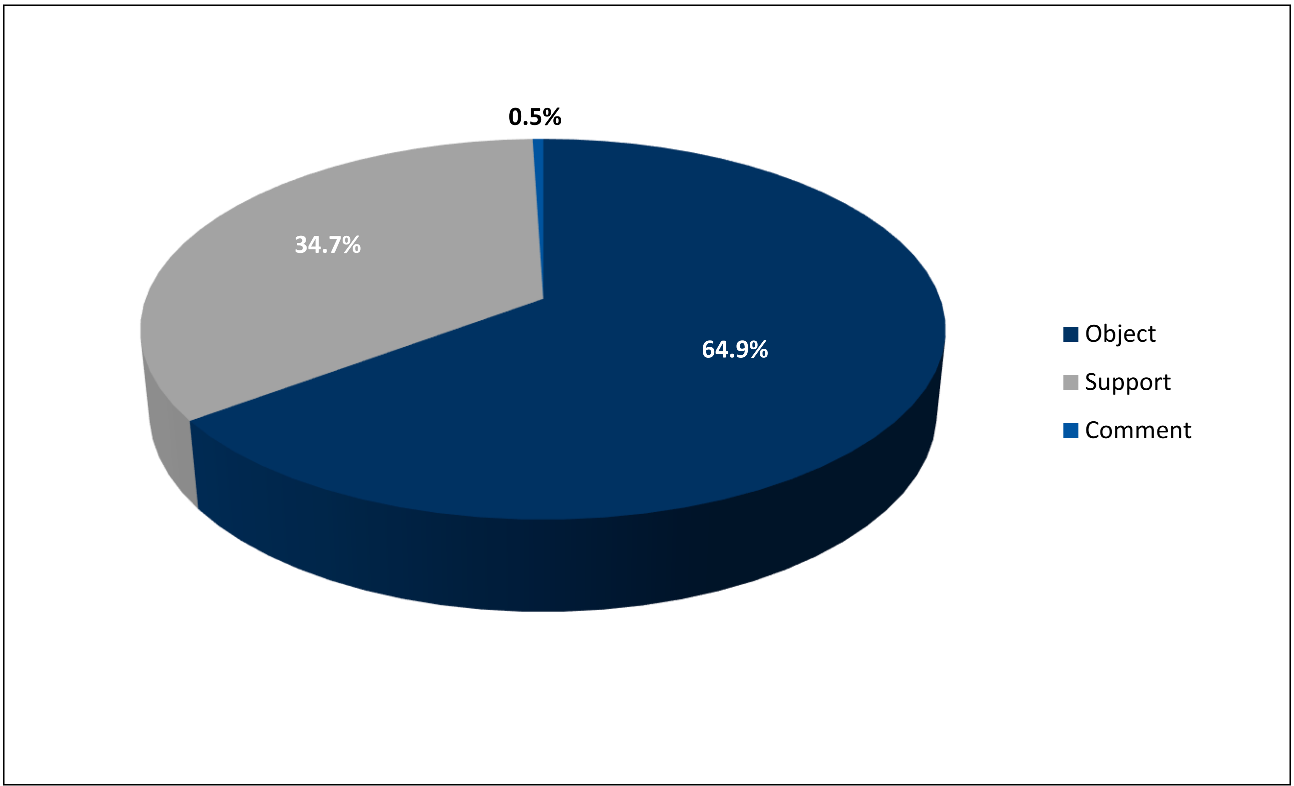
As outlined in **Table 2.1**, nine (9) agency submissions and two (2) council submissions were received, which included:

- Department of Planning, Industry and Environment - Division of Resources and Geoscience (DPIE DRG)
- Department of Planning, Industry and Environment - Resources Regulator
- Department of Planning, Industry and Environment – Water (DPIE Water)
- Environment Protection Authority (EPA)
- Water NSW
- Department of Planning, Industry and Environment - Biodiversity and Conservation Division – Environment, Energy and Science (DPIE BCD-EES)
- Roads and Maritime Service (RMS)
- Heritage Council of NSW (Heritage Council)
- NSW Rural Fire Service (NSW RFS)
- Wollongong City Council
- Wollondilly Shire Council.

None of the agencies identified that they oppose the Project, however, several agencies made submissions seeking further clarification regarding aspects of the assessment of the Project. These submissions are discussed further is **Section 4.0**.

2.1.2 Community and Interest Group

Of the 202 submissions from community members and interest groups, a total of 131 (64.9 per cent) were objections, 70 (34.7 per cent) were in support and one (0.5 per cent) provided comment (refer to **Graph 2.1**).



Graph 2.1 Percentage of Supporting and Objecting Community and Interest Group Submissions

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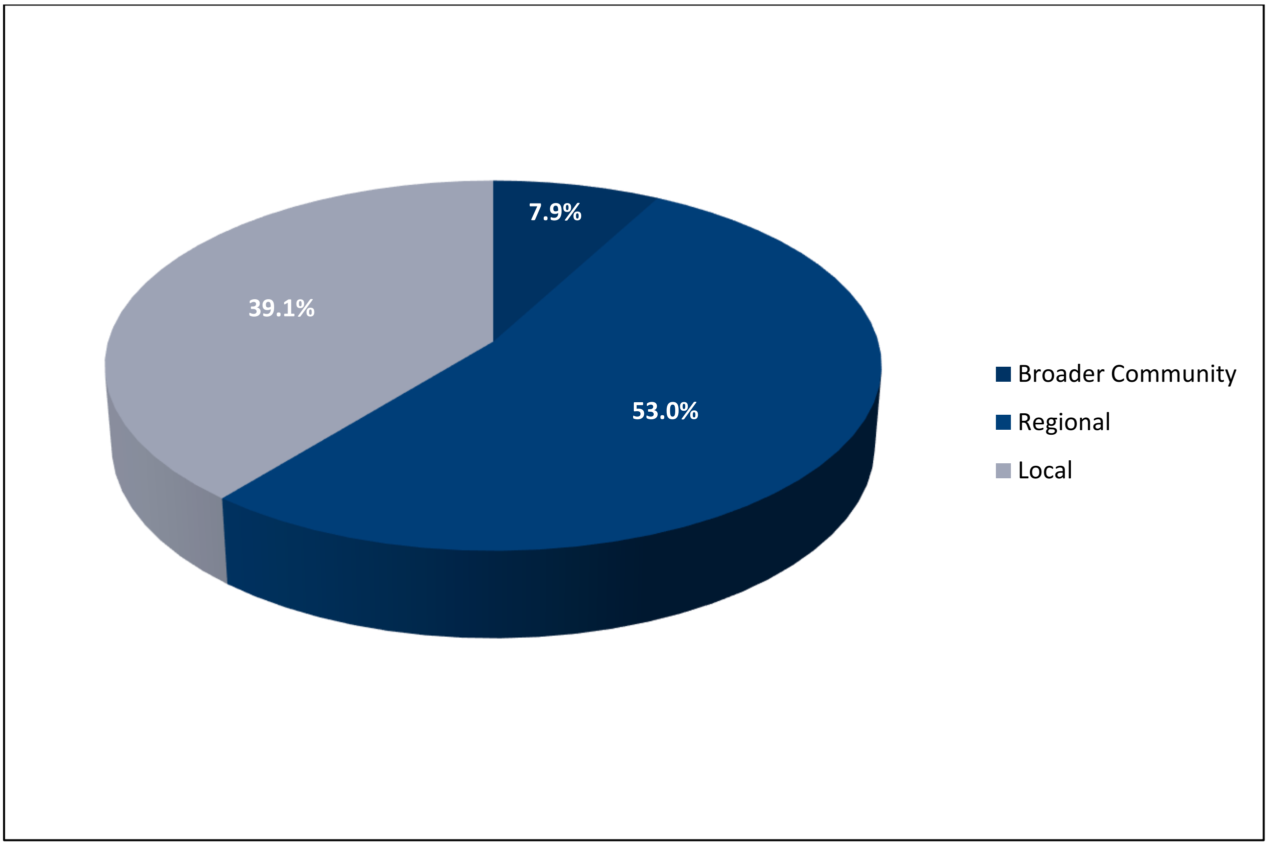
The 202 submissions received were comprised of:

- 117 (57.9 per cent) objections from community members
- 14 (6.9 per cent) objections from interest groups
- 56 (27.7 per cent) supporting submissions from community members
- 14 (6.9 per cent) supporting submissions from interest groups
- 1 (0.5 per cent) comment from an interest group.

The submissions were analysed based on proximity to the Project to determine the level of nearby (within approximately 8 km), local and sub-regional area (between approximately 8 and 100 km) and broader community (>100 km) interest in the Project. Of all the submissions received (including objections, supporting and comment), 79 (39.1 per cent) were received from the local area, 107 (53.0 per cent) from the surrounding region and 16 (7.9 per cent) from the broader community (refer to **Graph 2.2**).

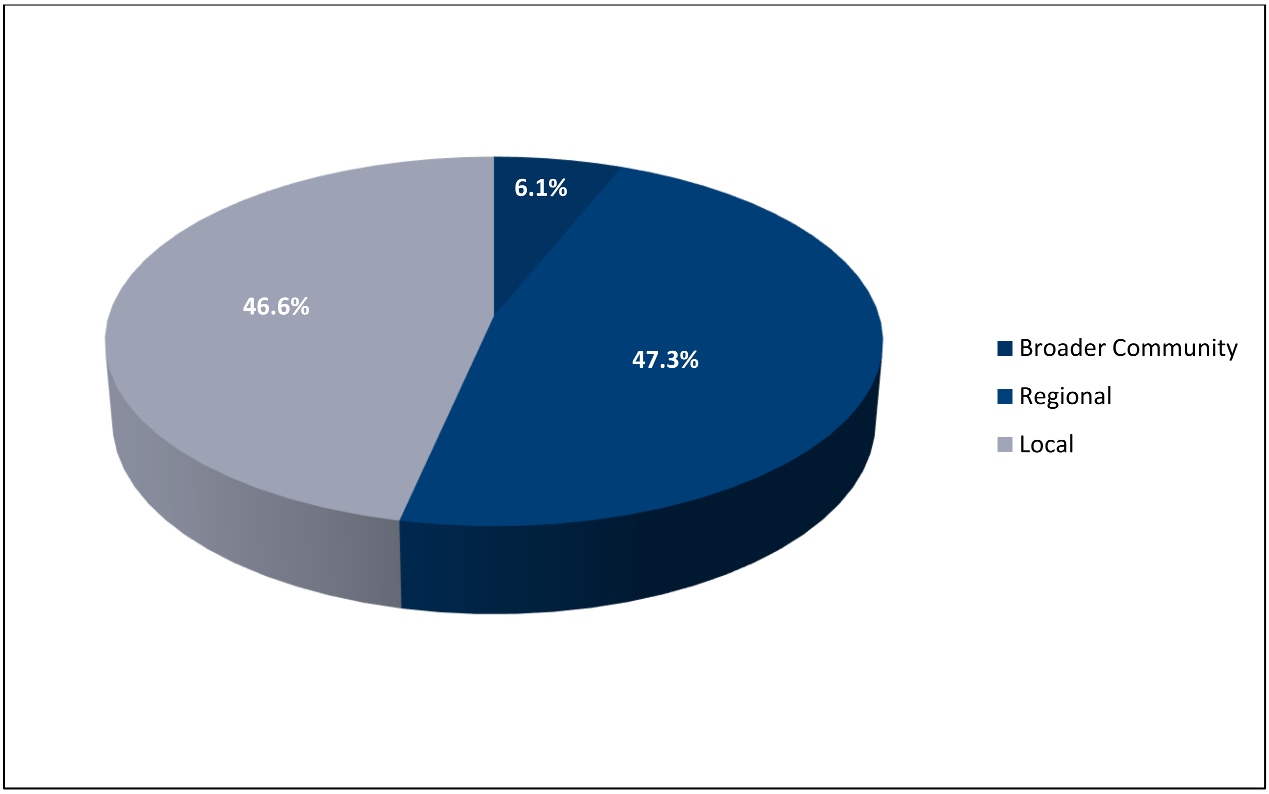


Graph 2.2 Percentage of Community and Interest Group Submissions by Area

Of the 131 objections, 27 submissions are considered form letters, being a standardised letter covering the same matters.

2.1.2.1 Objecting Submissions

As outlined above, a total of 131 submissions objected the Project, including 117 community members and 14 interest groups. Based on the analysis, 44 (33.6 per cent) objections were received from the nearby area (within approximately 8 km), 79 (60.3 per cent) from the local and sub-regional area (between approximately 8 and 100 km) and 8 (6.1 per cent) from the broader community (>100 km) (refer to **Graph 2.3**).



Graph 2.3 Percentage of Objecting Community and Interest Group Submissions by Area

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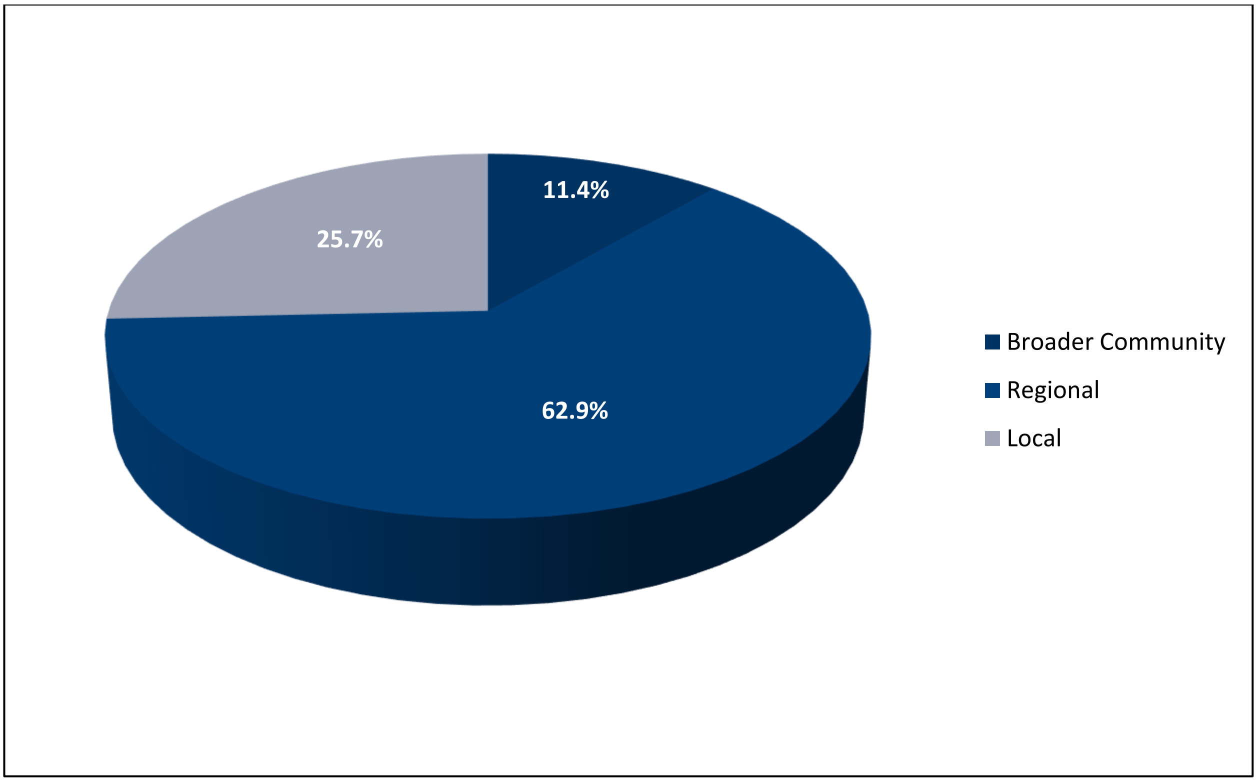
2.1.2.2 Supporting Submissions

A total of 70 submissions were received that support the Project, including 56 community members and 14 interest groups. Based on the analysis, 18 (25.7 per cent) supporting submissions were received from the nearby area (within approximately 8 km), 44 (62.9 per cent) from the local and sub-regional area (between approximately 8 and 100 km) and 8 (11.4 per cent) from the broader community (>100 km) (refer to **Graph 2.4**).



Graph 2.4 Percentage of Supporting Community and Interest Group Submissions by Area

2.2 Categorisation of Issues

A content analysis was undertaken on all community submissions to understand the key issues raised by the community in relation to the Project. Objections, supporting submissions or comment on the Project were analysed separately, as the themes within the submissions were distinct. The submission summary is provided in **Appendix 2** with a summary provided below.

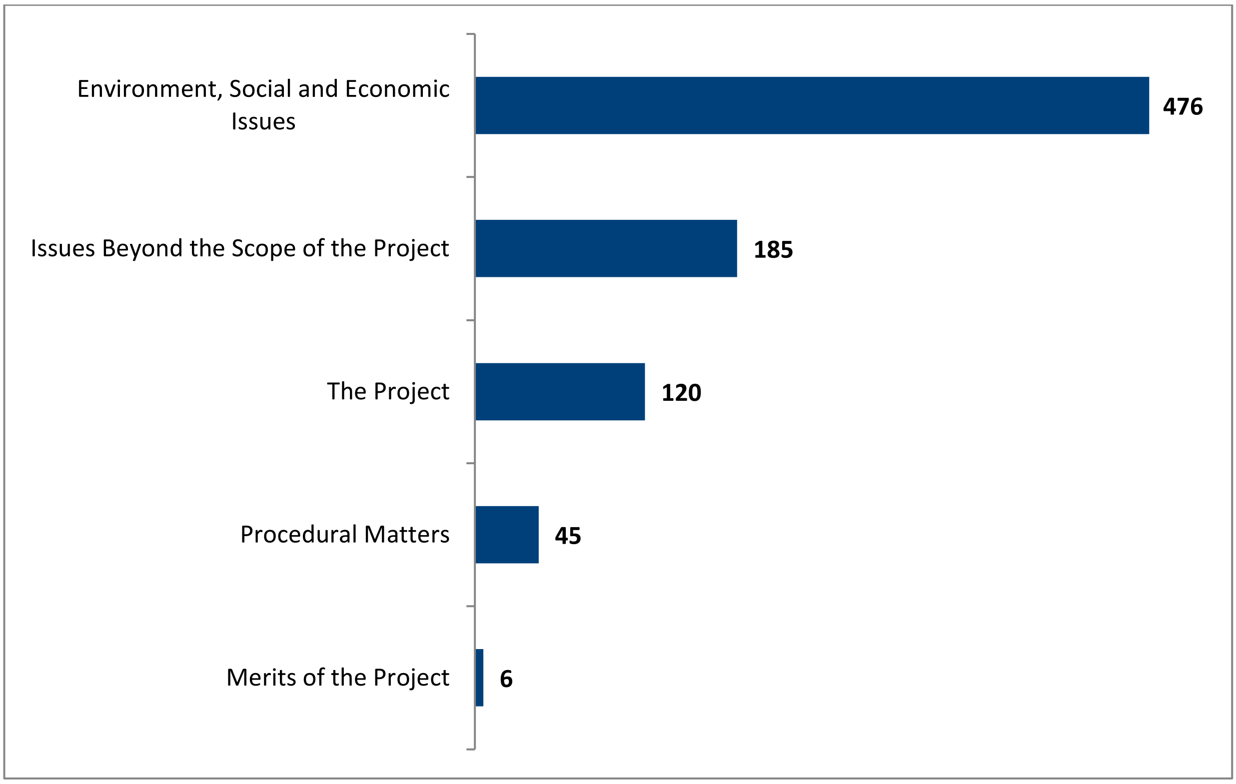
Issues have been categorised into the following broad groups:

- environmental, social and economic impacts of the Project
- the Project
- the merits of the Project
- procedural matters
- issues beyond the scope of the Project or not relevant to the Project (e.g. broader policy issues).

These broad issues categories were then divided into themes and sub-themes where relevant in order to provide greater definition of the issues raised. Further details of the categorisation of issues are provided in the following sections.

2.2.1 Objecting Submissions

Environmental, social and economic impacts of the Project were the most frequently raised category of issues in the 131 objecting submissions received (refer to **Graph 2.5**). Issues Beyond the Scope of the Project were the second most frequently raised category of issues, followed by issues related to the Project, Procedural Matters, and Merits of the Project. It should be noted that many submissions raised multiple issues categories and multiple themes and sub-themes within each issue category. The totals presented in the following tables and graphs have been tallied at the sub-theme level as identified in **Appendix 2**.



Graph 2.5 Categorisation of Objecting Submissions

As outlined in **Section 2.1.2**, 44 (33.6 per cent) objections were received from the nearby area (within approximately 8 km), 79 (60.3 per cent) from the local and sub-regional area (between approximately 8 and 100 km) and 8 (6.1 per cent) from the broader community (>100 km) (refer to **Graph 2.3**). When the objections were analysed in relation to location, there was a similar proportion of issues by category for each of the areas (refer to **Table 2.2**).

Table 2.2 Categorisation of Issues by Area

Locality	Category				
	The Project	Procedural Matters	Environmental, Social and Economic Impacts of the Project	Merits of the Project	Issues Beyond the Scope of the Project
Nearby Area (within 8 km)	13.9% (59)	4.7% (20)	57.8% (245)	0.2% (1)	23.3% (99)
Local and Sub-regional area (8km to 100 km	15.0% (54)	6.1% (22)	56.7% (204)	1.1% (4)	21.1% (76)
Broader Community (>100 km)	10.5% (4)	5.3% (2)	63.2% (24)	2.6% (1)	18.4% (7)

Environmental, Social and Economic Issues

There were seven key themes to the Environmental, Social and Economic Issues raised, including:

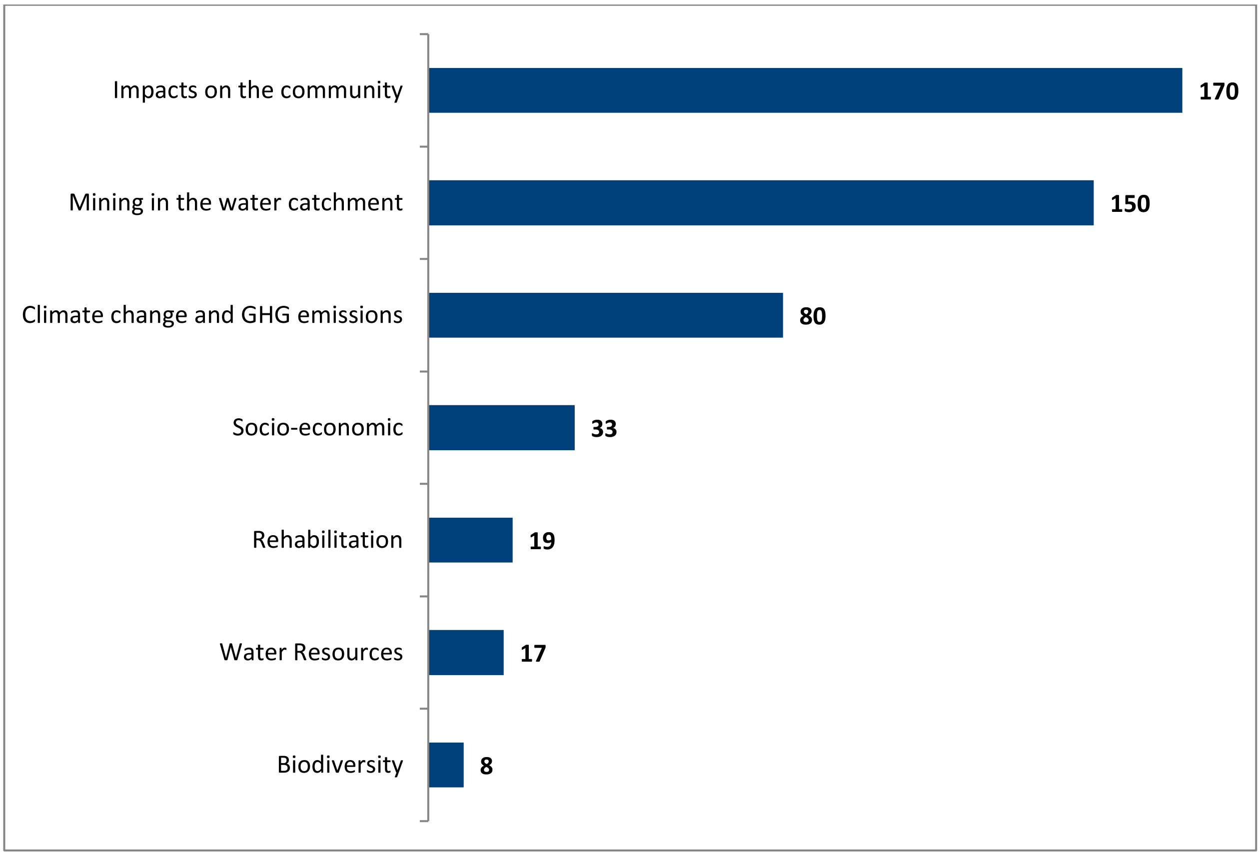
- impacts on the community
- mining in the water catchment
- climate change and greenhouse gas emissions
- water resources
- rehabilitation
- biodiversity
- socio-economics.

The most frequently raised theme was impacts on the community (refer to **Graph 2.6**). The key concerns raised in relation to impacts on the community included the following sub-themes:

- proximity to residential areas (55 submissions)
- proposed coal processing plant (43 submissions)
- trucks and road maintenance (30 submissions)
- air quality (18 submissions)
- impacts on human health (10 submissions)
- noise (9 submissions)
- coal stockpiles (2 submissions).

Mining in the water catchment was the second most frequently raised theme (refer to **Graph 2.6**), with concerns centred around the following sub-themes:

- water supply / risk to water supply (68 submissions)
- mining within the catchment should not be permitted (42 submissions)
- disturbance / damage to the catchment or surface features (40 submission).



Graph 2.6 Environmental, social and economic issues themes

Responses to objections raised in relation to Environment, Social and Economic Issues are addressed in **Section 5.1**.

Issues Beyond the Scope of the Project

This category includes broader policy issues or issues that are not directly related to the merits of the Project. The two key themes raised under this category were an opposition to coal mining (3 submissions) and whether WCL is considered a fit and proper proponent. In relation to whether WCL is fit and proper, three main issues were identified in the objecting submissions, being:

- history of non-compliances (73 submissions)

- ongoing investigations by the Resource Regulator (56 submissions)
- financial status (53 submissions).

Responses to objections raised in relation to Issues Beyond the Scope of the Project are addressed in **Section 5.5**.

The Project

The key themes raised in objecting submissions in relation to the Project were associated with consideration of Project alternatives (1 submission) and Project design. In relation to Project design, three main sub-themes were identified in the objecting submissions:

- the risks associated with triple seam mining (53 submissions)
- potential for destabilisation of overlying workings (50 submissions)
- concern regarding the mining method and mine plan (16 submissions)

Responses to objections raised in relation to the Project are addressed in **Section 5.2**.

Procedural Matters

The key issue raised in relation to procedural matters was the NSW Government planning process (43 submissions), in particular in relation to a lack of enforcement of conditions of consent and the need for the NSW Government to wait for the release of the IEPMC Report 2 prior to progressing assessment of the project. There was also one submission which raised unsatisfactory community consultation by WCL in relation to the Project.

Responses to objections raised in relation to Procedural Matters are addressed in **Section 5.2**.

Merits of the Project

Six submissions were received that stated a general objection to the Project however stated no specific issues or reasons for the objection. These submissions were classified as objections on the merits of the Project.

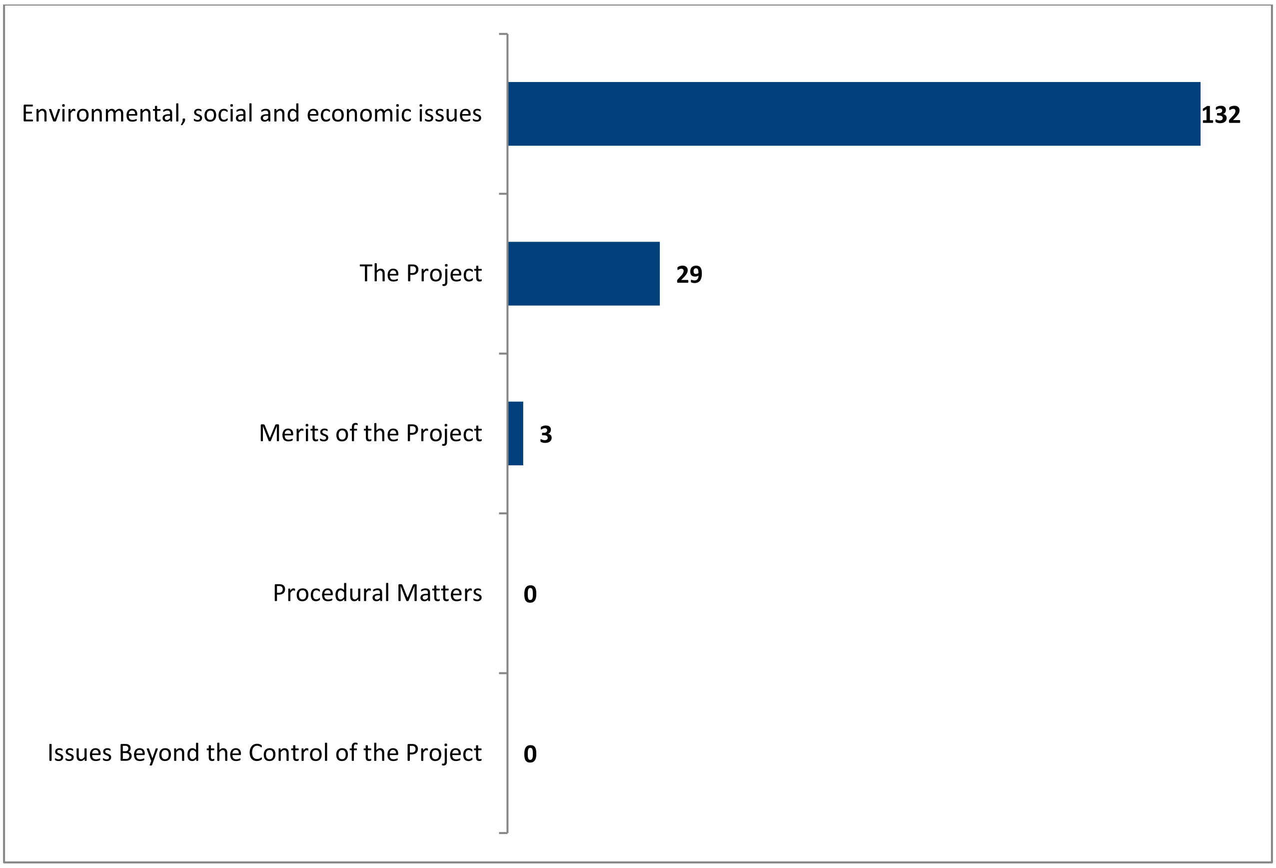
Responses to objections raised in relation to the Merits of the Project are addressed in **Section 5.5**.

2.2.2 Supporting Submissions

A total of 70 supporting submissions were received for the Project. The grounds for supporting the Project (refer to **Graph 2.7**) were broadly themed in relation to:

- Environmental, social and economic impacts of the Project (132 issues)
- the Project (29 issues)
- Merits of the Project (3 issues).

No supporting submission cited Procedural Matters or Issues Beyond the Scope of the Project.

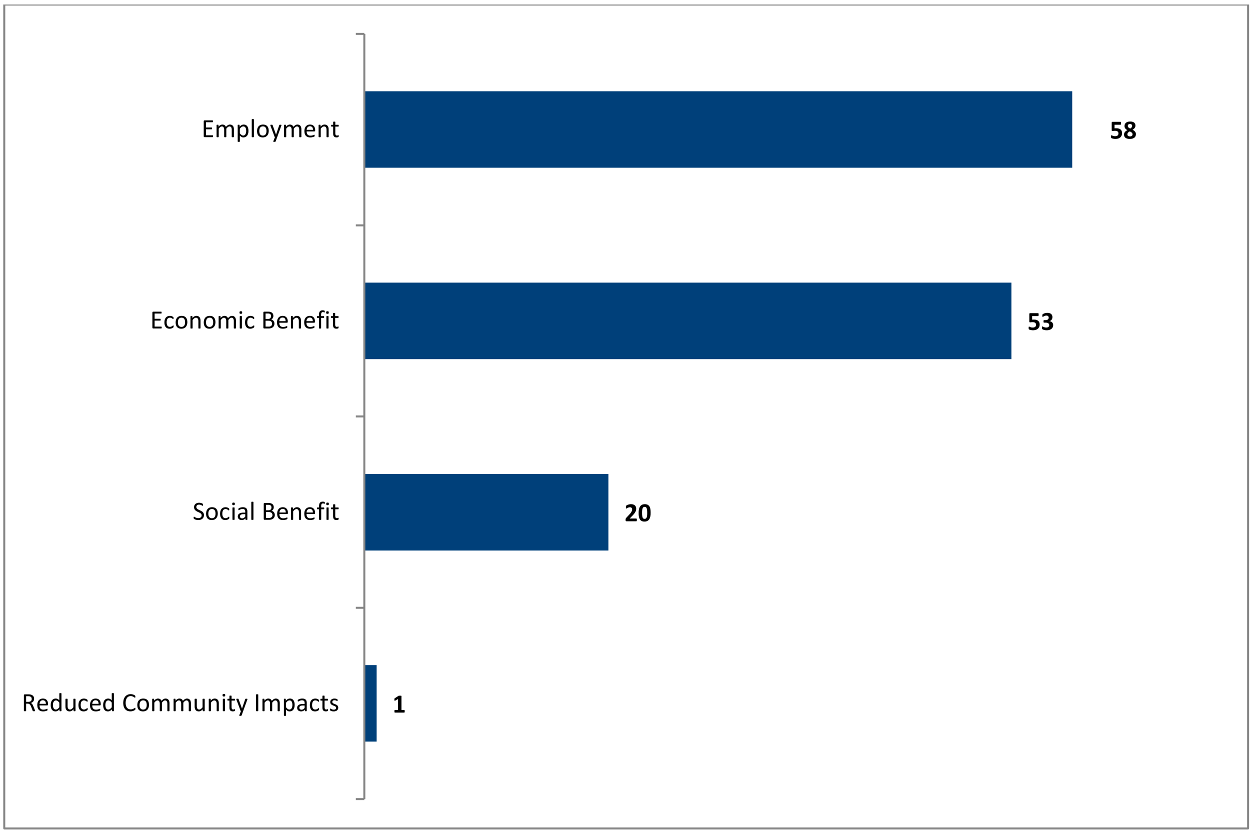


Graph 2.7 Categorisation of Supporting Submissions

Environmental, Social and Economic Issues

Of the 132 supporting issues raised in relation to Environmental, Social and Economic Issues, there were four key sub-themes identified (refer to **Graph 2.8**), being:

- continued employment and additional jobs
- economic benefits
- social benefits
- reduced community impacts.



Graph 2.8 Environmental, social and economic issues themes

The Project

There were a total of 29 supporting issues raised in relation to the Project. The key theme of the 29 issues was associated with the support of the bord and pillar mining method which was considered to minimise potential impacts from the Project.

Merits of the Project

Three supporting submissions were received on the Project which stated no specific issues or reasons for support. These submissions were classified as supporting the Merits of the Project.

3.0 Actions Taken Since Exhibition

Since the exhibition of the Revised Preferred Project, a number of actions have been taken based on the submissions received. These include:

- Project changes to address issues raised in submissions (refer to **Section 3.1**)
- further assessment of project changes and key aspects raised in submissions (refer to **Section 3.2**)
- peer reviews of the Subsidence Assessment and Groundwater Assessment (refer to **Section 3.3**)
- further agency consultation (refer to **Section 3.4**)
- consideration of the Independent Expert Panel for Mining in the Catchment's (IEPMC) second report on the impact of mining activities in the Greater Sydney Water Catchment Special Areas that was released following exhibition (refer to **Section 3.5**).

Details on the additional actions undertaken since the exhibition of the Revised Preferred Project are provided in this section.

3.1 Project Changes

3.1.1 Refinements to Noise Mitigation Measures

A key objective of the Revised Preferred Project design has been to develop comprehensive mitigation and management strategies to reduce environmental and social impacts associated with the UEP in order to meet relevant criteria where-ever practicable and feasible. This has included redesigning the Russell Vale Pit Top and identifying further noise mitigation measures to reduce the acoustic impact of surface operations on the surrounding community.

The Revised Preferred Project Report identified a number of reasonable and feasible noise mitigation measures to minimise noise impacts from surface operations. These included, among other measures:

- Extension and increase in the height of existing bunds in strategic locations surrounding the Pit Top to provide additional acoustic shielding for trucks and equipment.
- Construction of a 4 m high noise barrier along the northern side of the site access road between the site entrance and turn off to the truck parking area to mitigate impacts of trucks accessing the site.
- Establishing a temporary stockpile of ROM coal as early as possible in 'phase-in' operations to provide shielding to northern receivers from potential noise impacts from the dozer operating on the ROM stockpile.

The proposed noise barrier was to be constructed prior to operations commencing, while the extension to the height of existing bunds was to be undertaken progressively and as early as possible within the project's 'phase-in period' which was anticipated to last 12-24 months. In particular, the construction of Bund 1 was to be completed over as short a timeframe as possible, indicatively 6 - 8 weeks to achieve planned height. The bunds previously proposed in the Revised Preferred Project Report are shown on **Figure 3.1**.

Image Source: Nearmap (Aug 2018)
Data Source: Wollongong Coal (2016)

0 50 100 150m
1:3 000

Legend

- UEP Project Application Area
- Previously Proposed Noise Mitigation Structure
- Currently Proposed Noise Mitigation Structure
- Existing Bund
- Existing Bund to be raised/extended

FIGURE 3.1

Proposed Changes to Noise Mitigation Structures for Revised Preferred Project

File Name (A4): R13/3687_091.dgn
20191126 13.00

As outlined in the Noise Impact Assessment (Wilkinson Murray, 2019) presented in Appendix 5 of the Revised Preferred Project Report, the proposed noise mitigation measures and reconfiguration of the Pit Top significantly reduced the predicted operational noise levels in comparison with the pre-existing operation of the site and when compared to the previous Preferred Project site configuration. No exceedances of the Project Noise Trigger Levels were predicted during the day, evening and early morning shoulder period, with negligible 1-2dB exceedances predicted at a small number of representative receivers during the night time period under adverse weather conditions.

The construction noise assessment included in the Noise Impact Assessment (Wilkinson Murray, 2019) presented in Appendix 5 of the Revised Preferred Project Report noted that short term exceedances of the Interim Construction Noise Guideline noise management levels were likely for many receivers surrounding the site at some point during the construction process. These exceedances would however only occur for a short duration during the construction of closest bund (s) and under adverse weather conditions. For the remainder of time, construction noise is expected to comply with the 'noise affected' management level.

The EPA, in its submission on the Revised Preferred Project, noted that significant exceedances of the Interim Construction Noise Guideline noise management levels were predicted as a result of bund construction. The EPA indicated that due to the potential for significant construction noise impacts over an extended duration (up to 2 years), that WCL was required to provide further justification as to why all noise mitigation bunds/barriers should not be constructed prior to the commencement of operation and why requested WCL commit to a firm timeframe for completion of bund construction.

In order to address the EPA's submission in relation to the extended duration of construction noise impacts and to further improve the effectiveness of proposed noise mitigation structures at the Pit Top, WCL propose further refinements to the noise barrier and bund arrangement for the Revised Preferred Project. The key changes include:

- replacing the proposed extension to Bunds 1 and 4 with container noise walls
- relocating the access road noise barrier further north closer to the Broker Street site boundary and receivers.

The proposed container noise walls will significantly reduce the duration of construction and will enable construction to be completed prior to the commencement of operations, as WCL will not need to source suitable quantities of fill material that would otherwise have been required for an earthen bund. The relocated access road noise barrier will assist in providing more effective mitigation of noise to receivers to the north and east of the site by placing it closer to receivers.

Re-assessment of the acoustic and visual impacts of the proposed change to the noise barrier and bund arrangement has been completed and is discussed further in **Section 3.2**.

A comparison of the previously proposed noise mitigation measures and the currently proposed measures is provided in **Table 3.1** and shown on **Figure 3.1**.

Table 3.1 Refinements to Proposed Noise Mitigation Measures

Aspect	Previously Proposed Noise Mitigation Measures - Revised Preferred Project	Currently Proposed Noise Mitigation Measures – Revised Preferred Project
Extension of existing bunds	The existing bund network surrounding the Pit Top will be modified as follows: • Bund 1 will be raised by an additional 5 m throughout its length and extended to the west to the edge of the access road turn-off. • Bund 2 will be raised and extended to reach Reduced Level (RL) of 56 m throughout its length. • Bund 3 will be raised and extended to reach an RL of 47 m throughout its length. • Bund 4 will be raised by 4-5 m to reach an RL of 44 m throughout its length. • Bund 5 will be raised by additional 3 m throughout its length and extended to the south to the access road. The extension of Bund 1 will be prioritised and commenced prior to phase-in operations commencing. The construction of Bund 1 will be completed over as short a timeframe as possible, indicatively 6 - 8 weeks to achieve planned height.	The existing bund network surrounding the Pit Top will be modified as follows: • Bund 1 will not be altered (increased height to be achieved by installation of a container wall – see below). • Bund 2 will be raised and extended to reach approximately RL of 56 m throughout its length. • Bund 3 will be raised and extended to reach approximately RL of 47 m throughout its length. • Bund 4 will not be altered (increased height to be achieved by installation of a container wall – see below) • Bund 5 will be raised to reach approximately RL of 58 m throughout whole length and extended to the south to the access road and to the north such that total length equates 100 m. Bunds 2, 3 and 5 will be completed within three months of 'phase-in' operation commencing.

Aspect	Previously Proposed Noise Mitigation Measures - Revised Preferred Project	Currently Proposed Noise Mitigation Measures – Revised Preferred Project
Container walls	Not previously proposed	Construction of two container walls to the north of the Pit Top: • The container wall at the upper stockpile area would span a total length of approximately 240 m and consist of between two and three layers of containers stacked on top of each other. The top of the western section (approximately 80 m long and two containers-high) would reach approximately RL of 58.7 m at the western end and decrease to approximately RL of 55.2 m at the eastern end. The middle section (approximately 140 m long and three containers-high) would reach RL of approximately 52.8 m across the entire length. The eastern section (approximately 20 m long and two containers-high) would reach RL of approximately 45.2 m across the entire length. • The container wall at the lower stockpile area would span a total length of approximately 80 m and consist of two layers of containers stacked on top of each other. The top of the wall would reach RL of approximately 45.2 m. • The container wall will be sited on footings and supports subject to civil and structural engineering design prior to placement • The container wall will be painted in neutral colour scheme after installation. WCL has committed to constructing both container walls prior to ‘phase-in’ operations commencing.
Noise barrier	Construction of a 4 m high noise barrier along the northern side of the access road starting from the Princes Highway entrance to the turn off to the truck parking area. WCL has committed to building the noise barrier prior to the ‘phase-in’ operation commencing.	Construction of a 5 m high noise barrier along the northern boundary of the site starting from the Princes Highway entrance to the old Broker Street site gates. WCL has committed to building the noise barrier prior to the ‘phase-in’ operation commencing.

Aspect	Previously Proposed Noise Mitigation Measures - Revised Preferred Project	Currently Proposed Noise Mitigation Measures – Revised Preferred Project
Temporary stockpile of ROM coal (during phase-in operations)	A 9 m high temporary stockpile of ROM coal to be constructed directly to the east and north-east of the dozer location to provide shielding to the northern receivers from dozer noise. Once constructed, the temporary stockpile would remain untempered with until completion of the phase-in operation. WCL has committed to building the temporary stockpile of ROM coal as early as possible during the 'phase-in' operation.	No change.

With the revisions to the noise barrier and bund arrangement, WCL has optimised anticipated construction timeframes for the proposed Pit Top upgrades from 12-24 months to 6-12 months, resulting in a shortened "phase-in" period for the construction of site infrastructure and coal processing plant.

An updated Noise Impact Assessment has been prepared by Wilkinson Murray (refer to **Appendix 3**), to confirm the predicted acoustic performance of the Pit Top with the refined noise mitigation measures in place. The results of the assessment are discussed in the following section.

3.2 Further Assessment

As a result of submissions received on the Revised Preferred Project, additional assessment of impacts has been completed in relation to:

- further assessment of refined noise mitigation measures and their effectiveness (refer to **Section 3.2.1**)
- further assessment of low frequency noise impacts (refer to **Section 3.2.1.3**)
- re-assessment of the visual impacts of refined noise mitigation measures (refer to **Section 3.2.2**)
- assessment of the air quality impacts of a maximum daily production scenario (refer to **Section 3.2.3**)
- further reject material characterisation in order to assess potential impacts on groundwater quality associated with the emplacement of waste rock underground (refer to **Section 4.5.2**)
- further detailed classification of the target coal reserve in accordance with the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves ('the JORC Code') (refer to **Section 4.1**).

The revised assessments are discussed further in the following sections and in **Section 4.0**. In addition, the recommendation of the IEPMC Report 2 have been considered in **Section 3.5**.

3.2.1 Revised Noise Impact Assessment

A revised Noise Impact Assessment has been completed in order to assess:

- the impact of proposed refinements to the noise barrier and bund arrangement for the Revised Preferred Project on operational noise predictions

- the impact of changes to the construction methods associated with proposed refinements to the noise barrier and bund arrangement
- further detailed assessment of low-frequency noise to determine the need for the application of a modifying factor.

A copy of the revised Noise Impact Assessment is provided in **Appendix 3.** A summary of the key findings (where these findings vary from those reported in the Revised Preferred Project Report) is provided below.

3.2.1.1 Operational Noise Assessment Findings

The revised operational noise assessment found that the proposed refinements to the noise barrier and bund arrangement for the Revised Preferred Project will generally result in equivalent or reduced predicted noise levels at receivers to the north of the Pit Top (receivers R1 – R6 and R15). No changes to predicted noise levels are expected at receivers to the south of the Pit Top.

Consistent with the findings for the previous barrier and bund configuration, no exceedances of the day, evening or early morning shoulder period project noise trigger levels are predicted with the refined barrier and bund arrangements. However, as a result of the refined barrier and bund arrangement, the number of residences affected by residual 1-2dB night-time noise exceedances has reduced from 27 properties to 15 properties. The frequency of these 1-2dB night-time noise exceedances has also reduced from 2 to 5% of Winter nights to 2 to 3% of Winter nights.

Revised noise predictions based on the revised noise barrier and bund arrangement are presented below.

'Phase-in' Operation

The predicted $L_{Aeq,15min}$ operational noise levels representative of the 'phase-in' operation are presented in **Table 3.2**. The results in **Table 3.2** represent the maximum predicted $L_{Aeq,15min}$ noise levels when worst case noise-enhancing conditions applicable under the NPfI are applied.

Table 3.2 Predicted $L_{Aeq,15min}$ Noise Levels from Project – 'Phase-in' Operation

Rec ID	$L_{Aeq,15min}$ Noise Level (dBA)							
	Day (7am – 6pm)		Evening (6pm – 10pm)		Night (10pm – 5am)		Early Morning Shoulder (5am – 7am)	
	Prediction $L_{Aeq,15min}$	PNTL	Prediction $L_{Aeq,15min}$	PNTL	Prediction $L_{Aeq,15min}$	PNTL	Prediction $L_{Aeq,15min}$	PNTL
R1	41	44	37	43	**43**	42	43	44
R2	41	44	37	43	**43**	42	43	44
R3	40	44	36	43	42	42	43	44
R4	37	44	34	43	40	42	40	44
R5	36	48	33	45	35	42	36	44
R6	43	48	41	45	41	42	43	44
R7	40	48	38	45	41	42	42	44
R8	40	48	38	45	42	42	43	44
R9	37	44	36	43	**41**	39	41	41
R10	37	44	34	43	**41**	39	41	41
R11	36	44	33	43	38	39	38	41

Rec ID	$L_{Aeq,15min}$ Noise Level (dBA)							
	Day (7am – 6pm)		Evening (6pm – 10pm)		Night (10pm – 5am)		Early Morning Shoulder (5am – 7am)	
	Prediction $L_{Aeq,15min}$	PNTL	Prediction $L_{Aeq,15min}$	PNTL	Prediction $L_{Aeq,15min}$	PNTL	Prediction $L_{Aeq,15min}$	PNTL
R12	37	44	34	43	37	39	37	41
R13	38	44	36	43	38	39	38	41
R14	37	44	35	43	39	39	39	41
R15[1]	36	45	-	NA	-	NA	-	NA
R16[1]	35	45	-	NA	-	NA	-	NA
R17[1]	30	45	-	NA	-	NA	-	NA

Note 1: Receiver relates to school

As with the previously proposed barrier and bund arrangement, results indicate that no exceedances of the PNTL's are expected during the day, evening and early morning shoulder periods at any of the identified representative receivers.

A 1 decibel (dB) exceedance is anticipated at R1 and R2, and up to a 2 dB exceedance is expected at R9 and R10 during the night time period under adverse weather conditions. It is noted that the only noise generating activity occurring on the surface during the night time period is the running of ROM coal onto the ROM stockpile.

The NPfI and Voluntary Land Acquisition and Mitigation Policy (VLAMP) (2018) defines a 1-2 dB exceedance as a negligible residual noise impact indiscernible by the average listener.

Full Operation

The predicted $L_{Aeq,15min}$ operational noise levels representative of the full operation (once all infrastructure items and upgrades have been built) are presented in **Table 3.3**. The results in **Table 3.3** represent the maximum predicted $L_{Aeq,15min}$ noise levels when worst case noise-enhancing conditions applicable under the NPfI are applied.

Table 3.3 Predicted $L_{Aeq,15min}$ Noise Levels from Project – Full Operation

Rec ID	$L_{Aeq,15min}$ Noise Level (dBA)							
	Day (7am – 6pm)		Evening (6pm – 10pm)		Night (10pm – 5am)		Early Morning Shoulder (5am – 7am)	
	Prediction $L_{Aeq,15min}$	PNTL	Prediction $L_{Aeq,15min}$	PNTL	Prediction $L_{Aeq,15min}$	PNTL	Prediction $L_{Aeq,15min}$	PNTL
R1	41	44	38	43	42	42	43	44
R2	42	44	39	43	**43**	42	43	44
R3	42	44	39	43	42	42	43	44
R4	40	44	36	43	40	42	40	44
R5	38	48	35	45	35	42	36	44
R6	44	48	41	45	41	42	43	44
R7	40	48	39	45	41	42	42	44

Rec ID	$L_{Aeq,15min}$ Noise Level (dBA)							
	Day (7am – 6pm)		Evening (6pm – 10pm)		Night (10pm – 5am)		Early Morning Shoulder (5am – 7am)	
	Prediction $L_{Aeq,15min}$	PNTL	Prediction $L_{Aeq,15min}$	PNTL	Prediction $L_{Aeq,15min}$	PNTL	Prediction $L_{Aeq,15min}$	PNTL
R8	40	48	39	45	42	42	43	44
R9	38	44	36	43	**41**	39	41	41
R10	37	44	35	43	**41**	39	41	41
R11	36	44	34	43	38	39	38	41
R12	37	44	35	43	37	39	37	41
R13	39	44	37	43	38	39	38	41
R14	38	44	36	43	39	39	39	41
R15[1]	37	45	-	NA	-	NA	-	NA
R16[1]	37	45	-	NA	-	NA	-	NA
R17[1]	31	45	-	NA	-	NA	-	NA

Note 1: Receiver relates to school

As with the previously proposed barrier and bund arrangement, results indicate that no exceedances of the PNTL's are expected during the day, evening and early morning shoulder periods at any of the identified representative receivers.

A 1 decibel (dB) exceedance is anticipated at R2, and up to a 2 dB exceedance is expected at R9 and R10 during the night time period under adverse weather conditions. As with the 'Phase In' Operation scenario, the only noise generating activity occurring on the surface during the night time period is the running of ROM coal onto the ROM stockpile.

Again, the NPfI and Voluntary Land Acquisition and Mitigation Policy (VLAMP) (2018) defines a 1-2 dB exceedance as a negligible residual noise impact indiscernible by the average listener.

Frequency and Extent of Residual Noise Exceedances

Further analysis has been undertaken to define the frequency of occurrence of residual 1-2 dB night-time noise exceedances. These predicted night-time noise exceedances relate to noise levels during temperature inversions which occur primarily in Winter. Analysis of the cumulative frequency of occurrence of night-time noise levels identifies that residual noise exceedances are only expected to occur between 2 and 3% of the night-time period in Winter.

Further analysis was also completed to define the extent of predicted residual night-time noise impacts. Noise contours and additional point-source noise predictions have been completed for the full operation scenario to identify all receivers expected to be subject to residual noise exceedances and determine the level of exceedance for each of those receivers. A summary of all noise-sensitive receivers where exceedances are expected during full operation is presented in **Table 3.4** and the noise contours produced for the full operation scenario are presented in **Appendix 3**.

It is noted that as a result of the refinements to the bund and barrier arrangement presented in **Figure 3.1**, the number of residences affected by residual 1-2dB night-time noise exceedances has reduced from 27 properties to 15 properties.

Table 3.4 Predicted Night-time Noise Exceedances – Full Operation

Receiver Address	LAeq,15min Noise Level (dBA) Night	
	Prediction	PNTL - Night
26 West St, Russell Vale	43	42
28 West St, Russell Vale	43	42
30 West St, Russell Vale	43	42
4 Lyndon St, Corrimal	40	39
6 Lyndon St, Corrimal	41	39
8 Lyndon St, Corrimal	41	39
8 Wilford St, Corrimal	41	39
10 Wilford St, Corrimal	40	39
101 Midgley St, Corrimal	41	39
103 Midgley St, Corrimal	41	39
105 Midgley St, Corrimal	41	39
107 Midgley St, Corrimal	41	39
109 Midgley St, Corrimal	41	39
76 Midgley St, Corrimal	40	39
78 Midgley St, Corrimal	40	39

3.2.1.2 Construction Noise Assessment Findings

The construction phase of the Revised Preferred Project includes the installation of the container noise walls, construction of the Broker Street noise barrier and the extension and increase in height of Bunds 2, 3 and 5. The construction of the container noise walls and Broker Street noise barrier will be completed prior to the commencement of operation. The extension and increase in height of Bunds 2, 3 and 5 will be completed within 3 months of the commencement of 'phase-in' operations.

The EPA recognises that construction activities could potentially generate higher noise levels than those of an industrial operation. The *Interim Construction Noise Guideline* (ICNG) provides noise management criteria for construction activities and these have been applied for the assessment.

Construction noise levels were predicted for all proposed bunds/walls/barriers and the worst-case noise predictions were reported. The predictions therefore represent noise levels generated when constructing at the closest point to the individual sensitive receiver in question.

Table 3.5 $L_{Aeq,15min}$ Levels from Bund/Wall/Barrier Construction

ID	$L_{Aeq,15min}$ Noise Level (dBA)	'Noise Affected' Level (dBA)	'Highly Noise Affected' Level (dBA)
R1	**59**	49	75
R2	**65**	49	75
R3	**69**	49	75
R4	**68**	49	75
R5	**72**	53	75

ID	$L_{Aeq,15min}$ Noise Level (dBA)	'Noise Affected' Level (dBA)	'Highly Noise Affected' Level (dBA)
R6	**70**	53	75
R7	53	53	75
R8	**55**	53	75
R9	**58**	49	75
R10	**53**	49	75
R11	40	49	75
R12	35	49	75
R13	37	49	75
R14	39	49	75
R15[1]	**60**	55	-
R16[1]	**57**	55	-
R17[1]	45	55	-

Note 1: Receiver relates to school.

The predicted construction noise levels comply with the ICNG 'highly noise affected' management level at all identified receivers. However, at some point in time during construction works, the ICNG 'noise affected' management level is likely to be exceeded at 11 of the 17 representative receiver locations surrounding the site. These exceedances would however only occur for a short duration of up to 4 to 8 weeks while construction equipment is operating in close proximity to the receiver in question and under adverse weather conditions. For the remainder of time, construction noise is expected to comply with the 'noise affected' management level.

As a result of the predicted short duration exceedances of the 'noise affected' management levels, WCL will implement the following reasonable and feasible work practices in accordance with the ICNG:

- Schedule activities to minimise noise impacts:
  - All bund/wall/barrier construction works will be undertaken during recommended standard construction hours.
  - Bund construction will be scheduled as early as possible within the phase-in period so that they can be used as noise barriers, and completed within 3 months of commencement of operations.
  - Commitment to complete container noise walls and Broker Street noise barrier prior to the phase-in period commencing.
  - Minimise the duration of bund construction where feasible and reasonable.
  - Consult with affected neighbours about scheduling bund construction to seek to minimise noise impacts, where practicable.
- Equipment selection and methods:
  - Dump truck access to be provided to bunds on the side further away from the closest receivers to maximise distance to receivers and shielding from bunds.
  - Use mobile equipment with less annoying alternatives to the typical 'beeper' alarms where feasible and reasonable.

- Regularly inspect and maintain equipment in good working order.

- Notification before and during construction:
  - Provide information regarding construction activities to potentially affected neighbours, including the nature and expected duration of construction activities.
  - Provide signage at the front of the site providing contact information, construction hours and any updates on construction activities.
- Implement a complaint handling procedure, maintain a complaint register and implement all feasible and reasonable measures to address the source of complaints.
- Undertake attended noise monitoring at the nearest and potentially most impacted residence(s) when construction is occurring within 200 m of noise-sensitive receivers to confirm construction noise levels are consistent with predicted levels.

3.2.1.3 Low-Frequency Noise Assessment Findings

A revised low-frequency noise assessment was prepared for the Revised Preferred Project based on comments received from the EPA in their submission on the Revised Preferred Project Noise Impact Assessment (Wilkinson Murray July 2019). The revised assessment is provided in Section 7.5 of **Appendix 3**, with a summary of the findings provided below.

The NPfI sets out a method for assessing low frequency noise based on:

- Overall 'C' weighted and 'A' weighted predicted or measure noise levels, and
- One-third octave predicted or measure noise levels in the range 10-160 Hz.

'C' Weighted Minus 'A' Weighted Noise Levels

The revised assessment analysed the 'C' weighted minus 'A' weighted noise levels at all representative residential receiver locations. The difference between overall 'C' weighted and 'A' weighted predicted levels were found to be less than 15 dB at all receivers during the night-time and early morning shoulder periods. As such, it is unlikely that any of the receivers surrounding the Project would be subject to dominant low-frequency noise during these periods and no modifying factor correction for low-frequency noise is warranted.

The assessment identified nine representative receiver locations where the difference between overall 'C' weighted and 'A' weighted predicted levels are equal to or exceeding 15 dB during the day and/or evening periods. Therefore, day and evening low-frequency noise need to be further assessed against the low-frequency noise threshold levels provided in Table C2 of the NPfI.

Comparison with Low-Frequency Noise Threshold Levels

Predicted operational noise levels are based on octave band noise predictions ranging between 31.5 Hz to 16 kHz. As such, predictions do not provide one-third octave band levels and do not include frequency bands between 10 Hz and 160 Hz as required for comparison with the relevant low-frequency noise threshold levels provided in Table C2 of the NPfI.

In order to estimate one-third octave band levels at low frequencies (10 Hz - 160 Hz), the typical low-frequency spectrum measured at another mine site was normalised to the 63 Hz octave component of the predicted noise levels at each of the representative receivers. Levels were compared to the relevant low-frequency noise threshold levels provided in Table C2 of the NPfI.

This comparison indicated that one or more one-third octave band levels are likely to exceed the low-frequency noise threshold levels at receivers R1, R2, R3, R4 and R13 during the day. Exceedances are expected to range 1-4 dB (i.e. 5 dB or less) and therefore in accordance with the NPfI, no modifying factor corrections are required to be applied during the day.

During the evening all one-third octave band levels would comply with the low-frequency noise threshold levels. As such, no modifying factor corrections need to be applied during the evening period.

The revised low frequency noise assessment confirms that no modifying factor correction for low-frequency noise is warranted for the Revised Preferred Project.

3.2.2 Updated Visual Amenity Assessment

As discussed in **Section 3.1.1**, in order to reduce the extended duration of bund construction noise impacts, WCL intends to replace the proposed extension to the height of Bunds 1 and 4 with container noise walls. The container noise walls would sit within the active pit area on the inside edge of Bund 1 and Bund 4 (refer to **Figure 3.1** and **Figure 3.2**), and therefore would be partially shielded by these existing bunds when viewed from the north. The upper container noise wall will be 2 containers high at its northern and southern ends, and 3 containers high along the central section of Bund 1. The lower container noise wall will be 2 containers high.

The proposed container noise wall will be of a similar height as the previously proposed earth bunds and will be coloured in non-reflective grey/green tones to minimise contrast against the surrounding environment.

3.2.2.1 Existing Landscape Setting

As discussed in Section 5.10 of the Revised Preferred Project Report, the Russell Vale Pit Top area is predominately cleared and re-contoured undulating land with vegetation (mainly mature trees) bordering the north, east and southern site boundary. Residential properties border the north, east and southern site boundary. Direct views onto the site are possible from some residential locations however a combination of topography, vegetated bunds and mature screening vegetation generally obscures views of the active Pit Top areas for the majority of residences surrounding the site.

The visual assessment completed for the Revised Preferred Project assessed nine viewpoints (refer to **Figure 3.3**). In relation to potential views of Bund 1, the key viewpoints are 1, 2, 3, 4, 8 and 9. Views from viewpoints 1, 2, 3, 4, 8 and 9 are shown in **Plates 1** to **6**. These views demonstrate that some existing mining related infrastructure is visible, such as the disused surge bin and administration building (as illustrated on **Plate 4**), however much of the site remains obscured by topography or vegetation. The Pit Top area is generally not visible from publicly accessible areas or public roads.

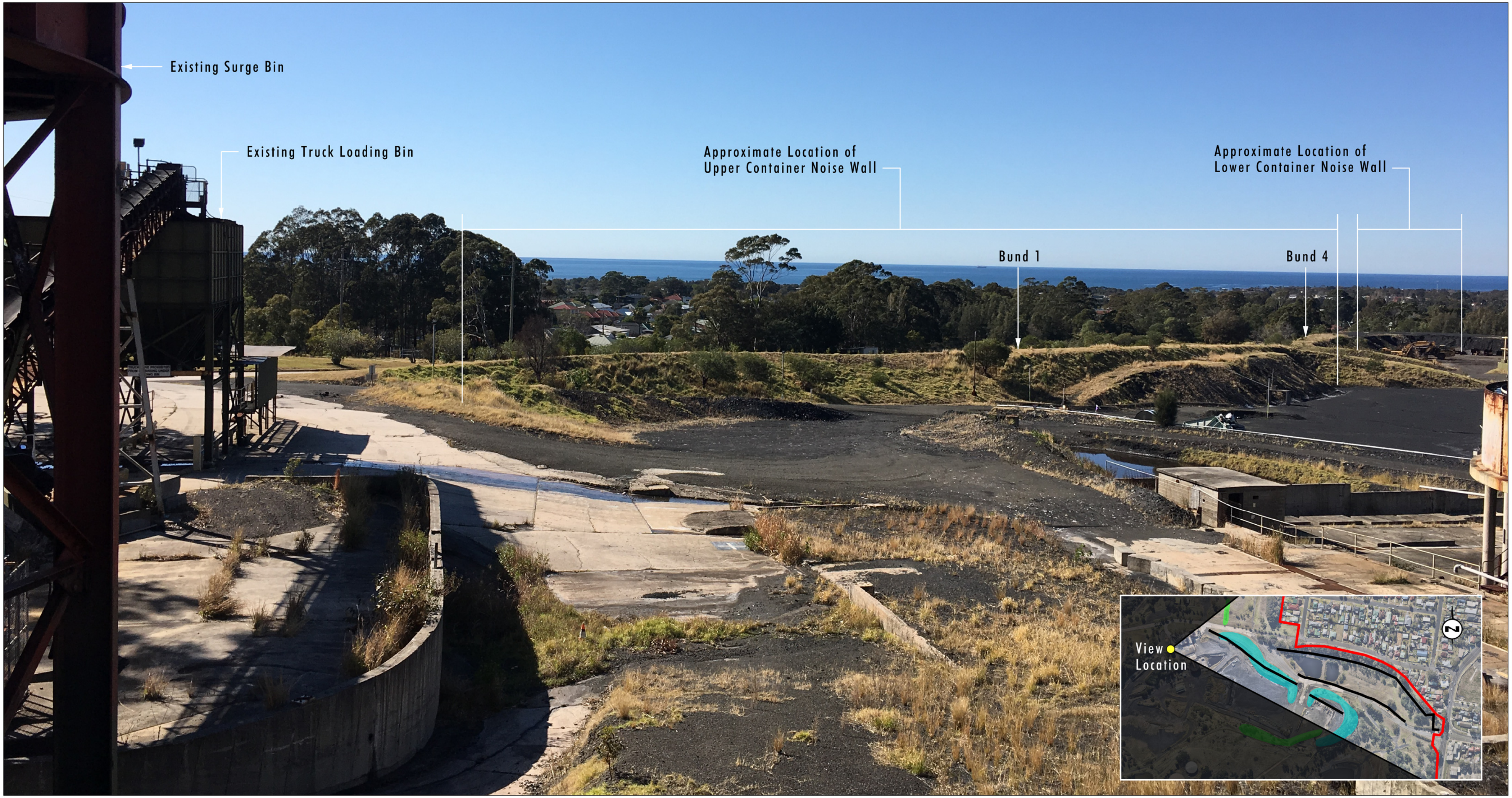


FIGURE 3.2

View Showing Approximate
Location of Container Noise Wall

Image Source: Umwelt (2018)

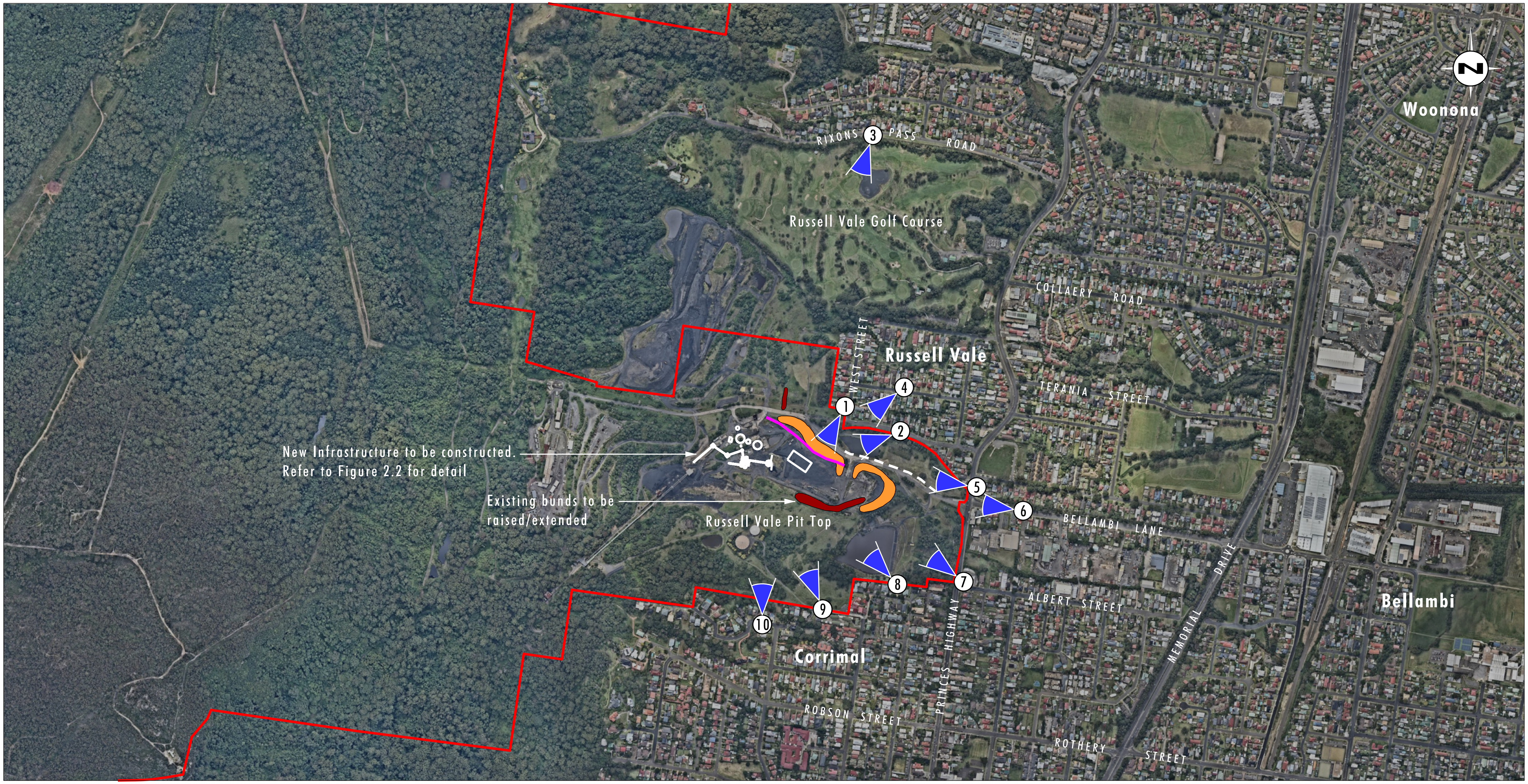


Image Source: Nearmap (Mar 2019)

0 250 500 750m
1:15 000

Legend

- UEP Project Application Area
- Representative Viewpoint Location
- Existing bund to be raised/extended
- Existing Bund
- Container Noise Wall

FIGURE 3.3

Representative Viewpoints surrounding the Russell Vale Pit Top

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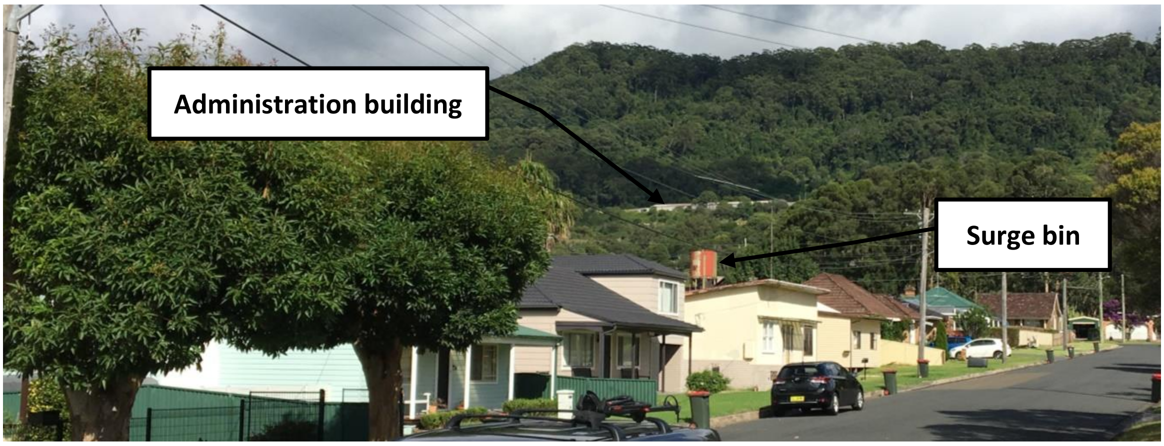
■ Plate 1 – View towards the Pit Top facilities area from West Street

■ Plate 2 – View towards the Pit Top facilities area from Broker Street.

■ Plate 3 – View towards to the Pit Top facilities from Rixons Pass Road.



■ Plate 4 – View from Moreton Street towards the Pit Top facilities, with the surge bin and administration building visible in the background.

■ Plate 5 – View from Wilford Street towards the Pit Top facilities, with the administration building slightly visible in the background.

■ Plate 6 – View from Lyndon Street, towards the Pit Top facilities.

3.2.2.2 Assessment of Impacts

To assess the potential visibility of the container noise wall replacing Bund 1, a viewshed analysis was prepared (refer to **Figure 3.4**). The viewshed analysis was developed using 3D topographic information and design heights for the container noise wall to identify the theoretical extent of potential views based on topography alone. Vegetation and surrounding buildings are not considered by the viewshed analysis. The viewshed analysis therefore provides an indication of areas around the site that may have visibility of the top of the container noise wall. Other factors such as vegetation and surrounding buildings that may alter potential views must then be considered when assessing potential visual impact. **Figure 3.4** is therefore considered highly conservative.

The visual analysis indicates that the top of the proposed container noise wall will be visible to surrounding residential receivers based on analysis of topography alone. However, as with views of existing site infrastructure, the views of the container noise wall will be filtered or obscured in most cases by existing established vegetation, topographical features or other noise mitigation structures, such as the earthen bund walls.

A series of cross sections have been prepared to demonstrate potential visibility from representative viewpoints surrounding the site (refer to **Figure 3.5**). The cross sections show that existing vegetation, which varies in height up to approximately 15 metres height, will assist in filtering potential views of the container wall, particularly for residents to the north and east (refer to **Figure 3.5**). The area south of the Pit Top facilities will have less obstructed views, however the proposed increase in the height of Bunds 2 and 3 will assist in shielding views of the container noise wall, as will existing established vegetation as demonstrated by cross section C-C1 (refer to **Figure 3.5**).

3.2.2.3 Visual Mitigation Measures

Additional visual mitigation controls to be implemented include:

- planting of appropriate vegetation or other screening to reduce views of mining infrastructure
- the container wall will be coloured in non-reflective natural grey/green tones to minimise contrast against the surrounding environment.

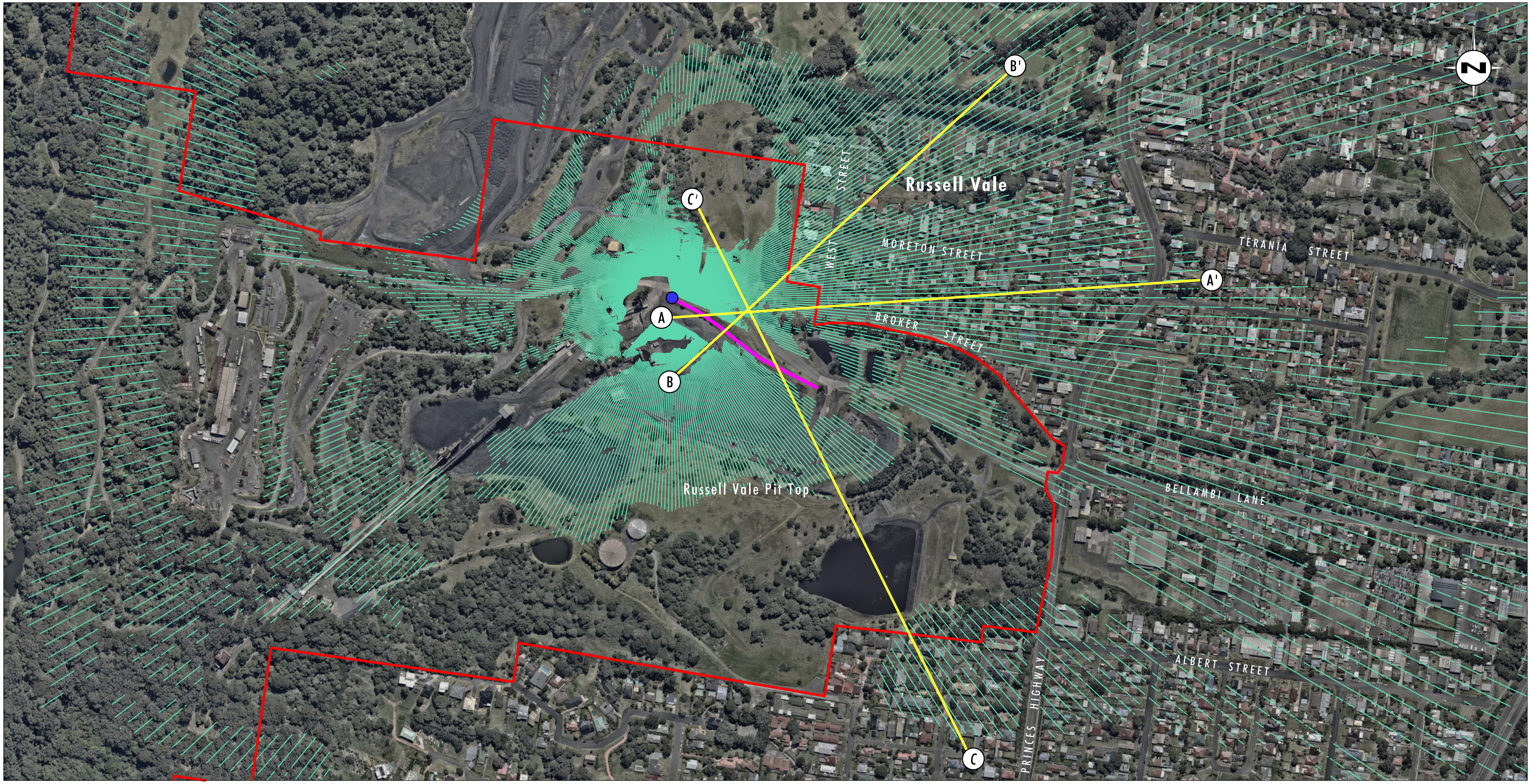


Image Source: Nearmap (Oct 2016)
Data Source: Wollongong Coal (2016), Wilkinson Murray (2018)

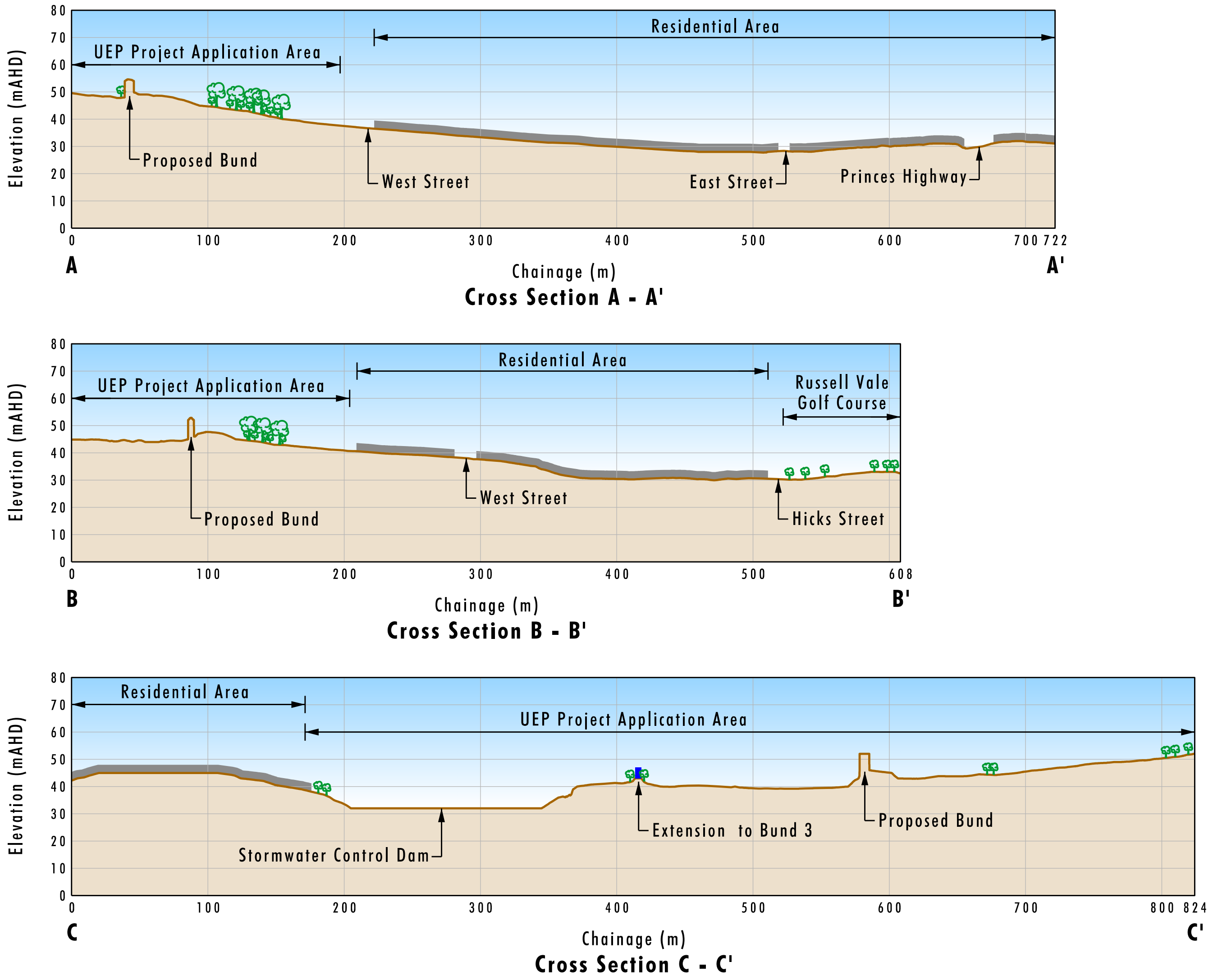
0 100 200 400m
1:7 500

Legend
- UEP Project Application Area
- Proposed Noise Bund
- Viewpoint Location
- Terrain Visible from Viewpoint Location
- Cross Section Location

FIGURE 3.4

Viewshed Analysis from Top of Container Noise Wall

File Name (A4): R13/3687_087.dgn
20191126 11.18



0 25 50 100m
Vertical Scale 1:2500

0 50 100 200m
Horizontal Scale 1:5000

File Name (A4): R13/3687_088.dgn
20191126 13.08

FIGURE 3.5

Visual Transects based on Viewshed Analysis

3.2.3 Additional Maximum Daily Production Air Modelling Scenario

An additional worst-case scenario was modelled to take account of maximum daily ROM throughput and product transfer. The modelling has assumed all site activities are operating at maximum levels on every day of the year. This is a highly conservative assumption that enables the assessment of maximum production levels coinciding with worst case dispersion conditions. In practice it is highly unlikely for such conditions to coincide, particularly in light of WCL commitment to implement a program of proactive and reactive dust control strategies as outlined in Section 5.7.7 of the Revised Preferred Project Report.

The following assumptions were made:

- maximum daily ROM throughput of 5,000 tonnes per day
- maximum product coal production of 6,000 tonnes per day
- a dozer operating for 2 hours per day, every day of the year
- stockpile areas remain unchanged
- truck sizes and haulage distances remain unchanged.

The results for maximum 24-hour average $PM_{2.5}$ and PM_{10} predicted concentrations are shown in **Figure 3.6** and **Figure 3.7**, respectively. The predictions are slightly higher than for the general operations, as expected. The $PM_{2.5}$ criterion is not predicted to be exceeded. However, there are predicted to be exceedances of the 24-hour average PM_{10} criterion, when combined with the 95th percentile measured background levels, a relatively conservative assumption.

A time series analysis of PM_{10} for the three most impacted representative receivers R1, R2 and R10, was undertaken combining these worst-case predictions with daily measured background levels corresponding to the same meteorological data used in the modelling. The results of this analysis is shown in **Figures 3.8** to **3.10**. The analysis shows that the highest measured levels do not occur on the same days as the highest predictions at those three residences, and that there are no exceedances of the 24-hour PM_{10} criterion due to the Revised Preferred Project in the modelled year.

Figure 3.6 Predicted maximum 24-hour average $PM_{2.5}$ concentrations when the maximum production coincides with worst case dispersion conditions

Figure 3.7 Predicted maximum 24-hour average PM_{10} concentrations when the maximum production coincides with worst case dispersion conditions

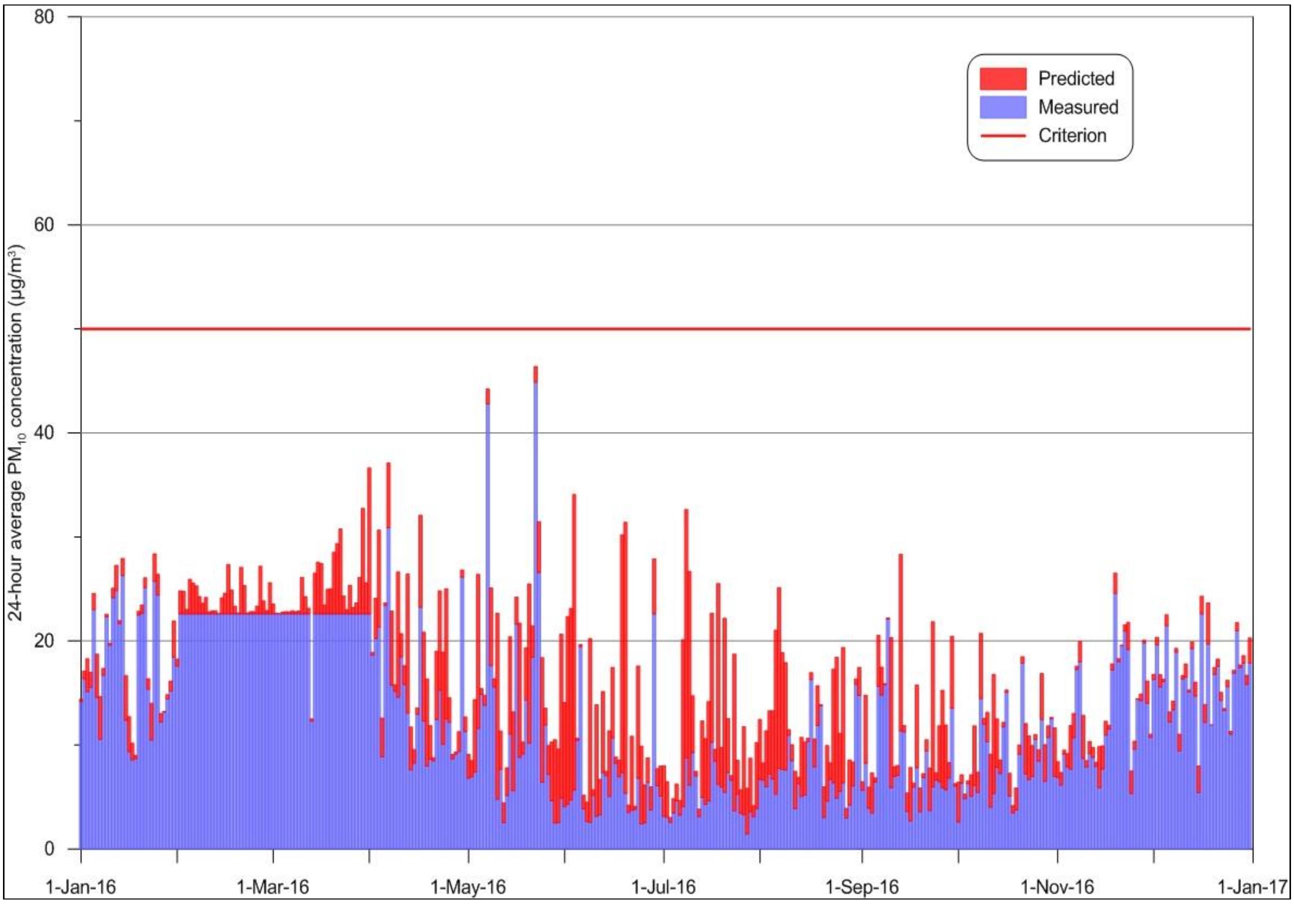


Figure 3.8 Predicted maximum 24hr average PM_{10} at Receptor 1

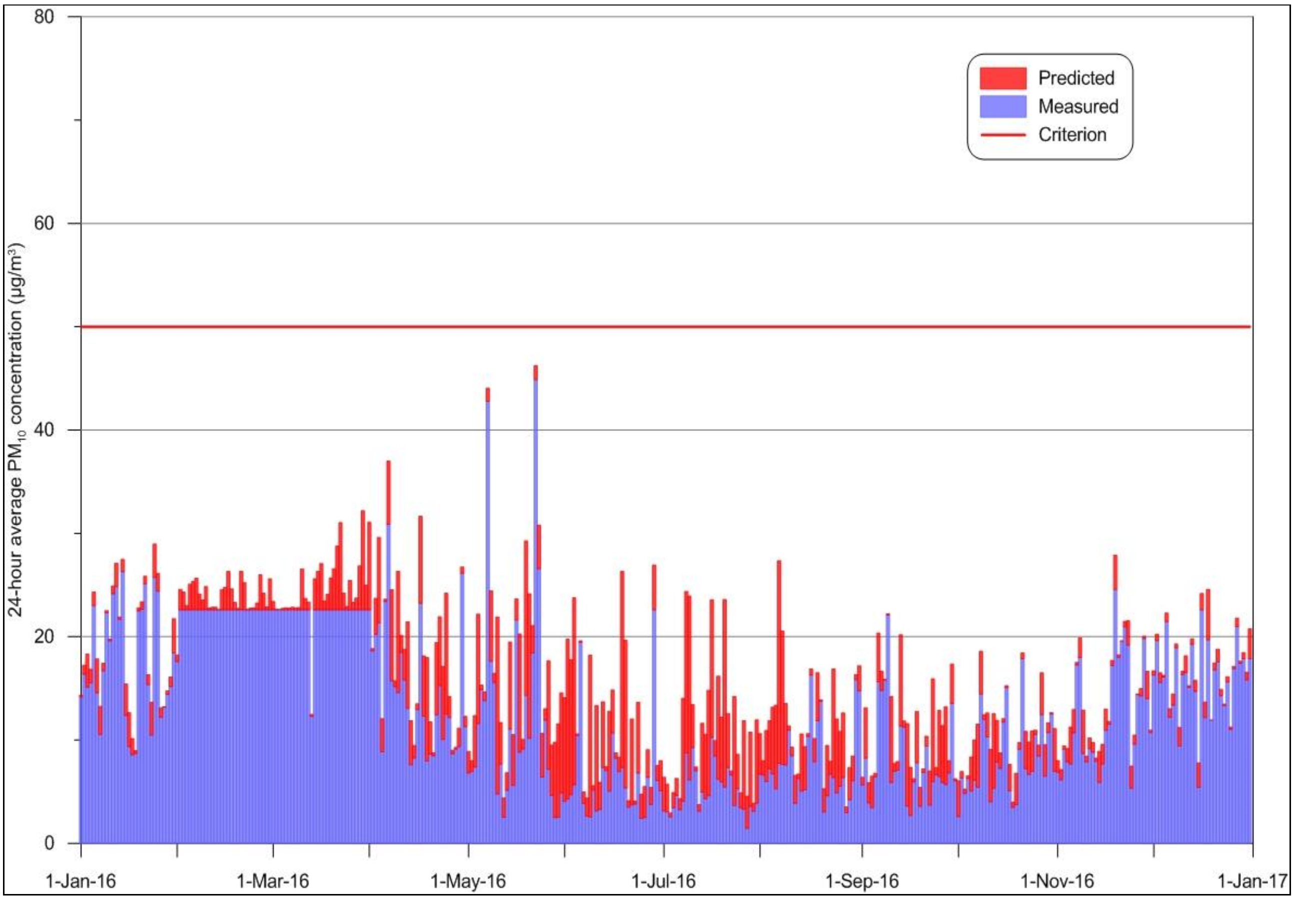


Figure 3.9 Predicted maximum 24hr average PM_{10} at Receptor 2

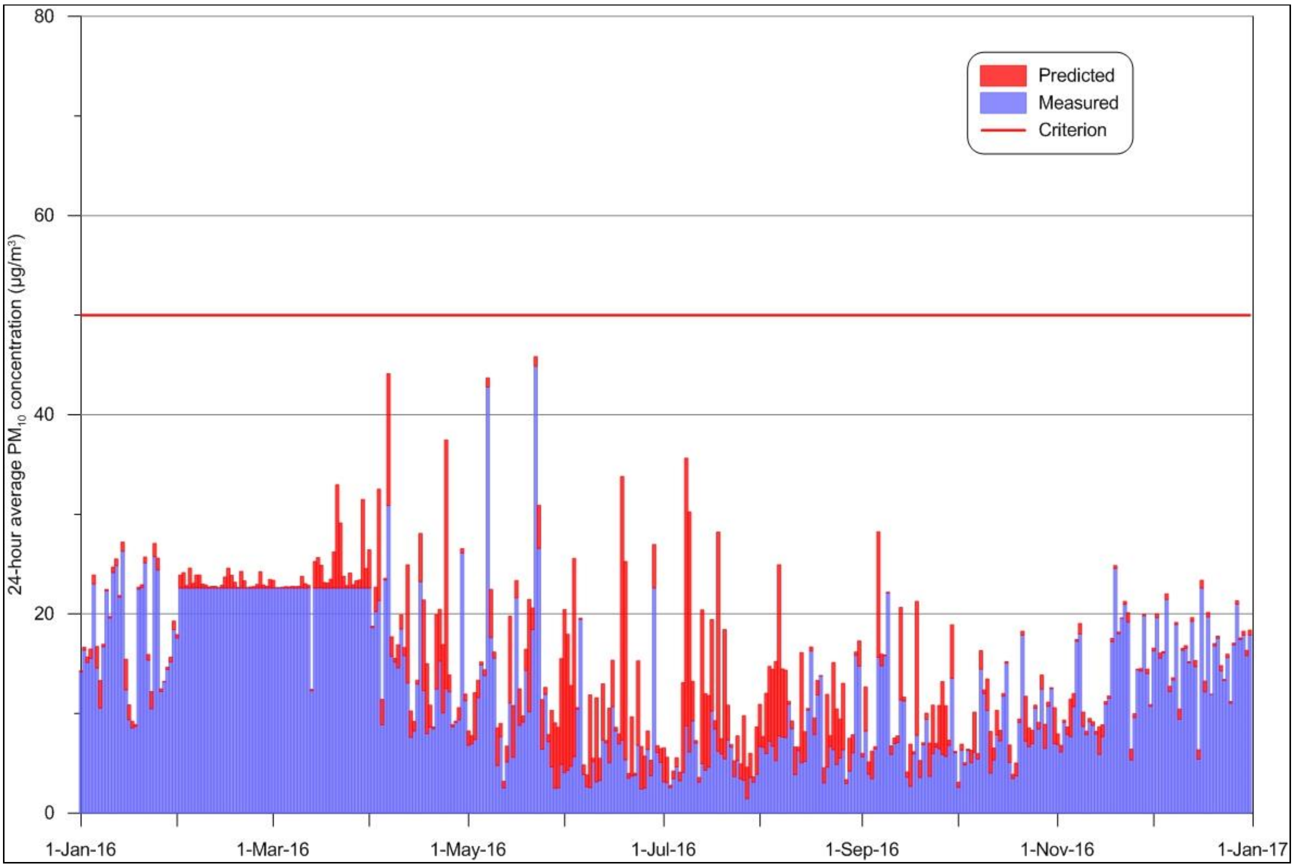


Figure 3.10 Predicted maximum 24hr average PM10 at Receptor 10

3.3 Peer Reviews

In consideration of submissions received for the Revised Preferred Project, peer reviews of the Subsidence Assessment and Groundwater Assessment have been completed.

3.3.1 Subsidence Assessment Peer Review

As outlined in **Section 2.0**, a number of submissions relate to subsidence related topics, in particular mining in the catchment and uncertainty associated with multi-seam mining. Given the number of submissions received relating to subsidence related issues, a peer review was commissioned by WCL to provide an independent assessment and review of the Subsidence Assessment for the Revised Preferred Project.

The peer review of the Subsidence Assessment prepared by SCT (2019) for the Revised Preferred Project has been undertaken by Bruce K. Hebblewhite. Mr Hebblewhite is considered an expert in the field of mine geotechnical engineering and was the Chair of the Independent Expert Panel of Review into *Impacts on Underground Coal Mining on Natural Features in the Southern Coalfield*.

The peer review process resulted in an initial peer review report being prepared that included a range of conclusions and recommendations for further analysis and discussion (refer to **Appendix 4**). The further analysis and discussion recommended by the peer reviewer was completed by SCT and a revised Subsidence Assessment prepared addressing the peer review comments (refer to **Appendix 5**). A final peer review report was then provided based on the revised Subsidence Assessment (refer to **Appendix 4**).

Further details of the peer review findings and updated assessment are provided in **Section 4.5.1**. In overview, the peer review process concluded:

- The subsidence movements expected from the proposed workings are not expected to cause any significant impact on any surface features within the UEP Application Area, specifically, the proposed workings are not considered to have any potential to perceptibly impact on surface features such as escarpments, swamps, cliffs, creeks and drainage lines, or the Cataract Reservoir.
- There is no credible risk of water flow along major structures from Cataract Reservoir as a result of the proposed first workings in the Wongawilli Seam.
- Large areas of the surface within the UEP Application Area are already in a state of limit equilibrium with potential for cracks to appear or movements to develop as a result of previous mining activity. It is agreed that this situation exists, but is independent of the proposed first workings in the Wongawilli Seam. It is also agreed that the proposed mining is not expected to have any significant impact on the stability of pillars in the overlying seams.
- The proposed mining is not considered likely to alter the status of mining/groundwater or surface interaction and impacts on groundwater are not expected to occur beyond the immediate vicinity of the Wongawilli Seam.

3.3.2 Groundwater Assessment Peer Review

In response to the DPIE Water submission, WCL engaged Dr Noel Merrick of HydroAlgorithmics Pty Ltd to undertake a peer review of the Groundwater Assessment. Dr Noel Merrick is a highly experienced Hydrogeologist and groundwater modeller with extensive experience both in the peer review of groundwater assessments and conducting groundwater assessments, including in the Southern Coalfields.

As a result of the DPIE Water submission and peer review process, an uncertainty analysis has also been commissioned and is being completed by HydroAlgorithmics Pty Ltd. The uncertainty analysis will be peer reviewed by Frans Kalf of Kalf and Associates Pty Ltd.

The peer review of the Groundwater Assessment and uncertainty analysis will be provided in Submissions Report – Part B, along with a detailed response to the DPIE Water submission.

3.4 Ongoing Stakeholder Consultation

During and post the public exhibition period for the Revised Preferred Project, WCL has undertaken ongoing consultation with government agencies in regard to their submissions to clarify issues and ensure that an appropriate response is provided in this report. A summary of the ongoing consultation undertaken for the Revised Preferred Project since the lodgement of the Revised Preferred Project Report for public exhibition is provided in **Table 3.6**.

Table 3.6 Consultation Undertaken Since Exhibition Phase

Stakeholder	Date	Description
Department of the Environment and Energy	28 August 2019	Briefing to DoEE on Revised Preferred Project and discussion regarding next steps for existing referral.
DPIE	28 August 2019	Update provided on assessment and public exhibition process
	21 October	Meeting to discuss DPIE Water submission, proposed peer review process and approach to addressing issues raised.
DPIE Resources Regulator	3 September 2019	Update provided on assessment
DPIE Water	21 October 2019	Meeting to discuss DPIE Water submission, proposed peer review process and approach to addressing issues raised.
Russell Vale CCC	19 August 2019	Update provided on assessment
Russell Vale CCC	18 November 2019	Update provided on assessment

3.5 Independent Expert Panel for Mining in the Catchment Part 2 Report

The Independent Expert Panel for Mining in the Catchment (IEPMC) was established in late February 2018 to provide expert advice to the (now) DPIE on the impact of mining activities in the Greater Sydney Water Catchment Special Areas, with a focus on risks to quantity of water.

The Initial Report submitted in November 2018 was concerned with Term of Reference 1. It had a particular focus on modelling and monitoring used in the assessment and management of subsidence-induced effects and impacts on groundwater and surface water at Dendrobium Mine and Metropolitan Mine.

The IEPMC released the Part 2 Report on 31 October 2019. The Part 2 Report addresses Term of Reference 2, which has a focus on the impacts of mining in the Greater Sydney Water Catchment Special Areas on water quantity and swamps, including cumulative impacts, and a requirement to review and update relevant findings of the 2008 Southern Coalfield Inquiry (SCI). The Part 2 Report is of relevance to the Revised Preferred Project.

The Part 2 Report provides an update of knowledge of:

- subsidence effects and impacts
- mining impacts on groundwater and surface water and consequences for water supply
- mining impacts and consequences on swamps.

The Part 2 Report also provides a number of conclusions and recommendations from the IEPMC. **Table 3.7** provides the recommendations from the IEPMC with a response in relation to the Revised Preferred Project.

As outlined in **Section 1.1**, the original UEP application submitted in 2009 involved a substantial expansion of longwall mining in the Wongawilli Seam across the Wonga East area (a total of 11 longwall panels) and Wonga West area (a total of seven longwall panels) to extract 31 Mt of ROM coal over a project life of 18 years. A Preferred Project was then exhibited in 2014 based on a reduced longwall mine plan of eight longwalls in the Wonga East area only.

A key issue for the then PAC in its consideration and review of the UEP Preferred Project was the uncertainty associated with subsidence and groundwater impacts as a result of the proposed longwall mining in the multi-seam mining environment present at Russell Vale, and in particular the Wonga East area. Therefore, a mine plan option for long term stable first workings was considered as a feasible alternative.

The previous UEP application and Preferred Project would have resulted in greater subsidence and groundwater impacts than is now proposed under the Revised Preferred Project. In terms of the IEPMC recommendations, the Revised Preferred Project significantly reduces the uncertainty associated with the proposed operations.

WCL have committed to a number of key management measures, including the development of TARPs, which align with the IEPMC recommendations. As discussed in **Section 3.3.2**, an uncertainty analysis and a peer review of the Groundwater Assessment have been undertaken, in accordance with recommendations 10 and 11 (refer to **Table 3.7**).

Table 3.7 Response to IEPMC Part 2 Report Recommendations

Recommendation		Response
Subsidence Effects, Impacts and Consequences on Water Supply		
1	The concept of subsidence effects, subsidence impacts and subsidence consequences should continue to be embedded in mining assessment processes.	The Revised Preferred Project using First Workings mining method has been specifically designed to address uncertainty regarding potential subsidence related effects, impacts and consequences on groundwater, surface water and biodiversity within the Cataract Reservoir water catchment. A detailed Subsidence Assessment was completed for the Revised Preferred Project using First Workings mining method that included consideration of subsidence effects, impacts and consequences. The findings of the Subsidence Assessment were considered in the assessment of other aspects, including water resources and biodiversity.
2	There is a need for a higher focus on the assessment of regional impacts and consequences associated with groundwater depressurisation, including if and how far these impacts and consequences might extend beyond the mining footprint.	A Groundwater Assessment was prepared for the Revised Preferred Project using First Workings mining method by Geoterra and GES in accordance with The Groundwater Modelling Guidelines. The groundwater model areal extent was chosen so the boundary conditions are of a sufficient distance from the proposed workings to consider the cumulative impact of the existing and proposed Russell Vale workings along with the surrounding mines. The cumulative assessment confirms that predicted cumulative losses do not expand into, or interact with, the current or proposed mining operations at South32 Appin Mine and Dendrobium Mine. The Groundwater Assessment was peer reviewed (refer to **Section 3.3.2**) which confirmed that the model extent and cumulative assessment was appropriate for the Revised Preferred Project.

Recommendation		Response
3	Research is required into: a. quantifying the height of complete drainage above mine workings b. the reliability of geomechanical modelling of rock fracturing and fluid flow for informing the calibration of groundwater models and, thus, also replacing the use of the Tammetta and/or Ditton equations c. establishing the potential for regional movement on bedding planes and the potential consequences that this may have, especially in the vicinity of water storages.	The Revised Preferred Project using First Workings mining method has been designed to be long term stable using first workings only so as to limit any strata deformation or cracking impacts above the coal seam that could affect surface flow and groundwater interactions (refer to **Section 4.5.1**). First Workings have a long history of operation and the geomechanics associated with First Workings are well understood without the need to develop new geomechanical concept models for groundwater drawdown and subsidence. As the Revised Preferred Project using First Workings mining method will have no perceptible subsidence impacts, stream and groundwater system connectivity impacts associated with the proposed mining are largely limited to induced drawdown impacts.
4	Management plans need to make provision for the early detection and control of the elevated risk that variance between predicted and measured subsidence effects, both conventional and non-conventional, when mining in areas sensitive to subsidence impacts, such as the Greater Sydney Water Catchment. This is especially the case when utilising longwall mining since the method is inflexible to immediate changes in mine layout to address of deviations from predictions.	It is noted that the Revised Preferred Project using First Workings mining method does not propose longwall mining. All existing environmental management plans will be reviewed and updated in consultation with relevant agencies. This will include a full review of existing TARPs and monitoring programs designed to detect any variance between predicted imperceptible and measured subsidence effects. Contingency measures will also be reviewed in the context of the revised mine design, noting that a first workings mine designs allows for significantly more flexibility in responding to any deviations from predictions than longwall mining.
5	Impact assessments for watercourses should consider not only rockbars and the pools behind them, but all features along the full lengths of watercourses.	As outlined in the Revised Preferred Project Report, the Revised Preferred Project using First Workings mining method will have no perceptible subsidence impacts on surface features or watercourses. As a result, the Revised Preferred Project using First Workings mining method is considered unlikely to result in changes to potential impacts to the geomorphological or hydrological values of local surface water systems. The Revised Preferred Project using First Workings mining method is not predicted to impact on watercourse features, including rockbars or pools.

Recommendation		Response
6	The Department should review the practicality of specifying water quality and iron staining as components of performance measure for only a proportion (or percentage) of the length of a watercourse.	This is recommendation is directed at DPIE. It is noted that iron staining has typically arisen as a result of fracturing of the Hawkesbury Sandstone strata either naturally or as a result of mining related subsidence. Due to the revised mine design, the Revised Preferred Project using First Workings mining method is not expected to perceptibly increase the iron staining impacts associated with previous mining.
Groundwater and Surface Water		
7	All future mine approvals should include performance measures that are objective and can more precisely determine the cumulative impacts and consequences of a mine project progression. Performance measures should include changes in pressure and/or pressure gradients where these have the potential to impact on surface water losses.	Proponents propose performance criteria as part of the environmental assessment process or preparation of relevant management plans. These performance criteria generally inform the performance measures included in any development consent. The final consideration of the performance measures is the responsibility of DPIE and/or the IPC. It is noted that Russell Vale Colliery has suite of existing subsidence impact performance measures that are outlined in the Preliminary Works Approval consent and existing environmental management plans. These existing subsidence impact performance measures are focussed on the impacts of previous longwall mining and will be reviewed as part of the management plan review process following determination to reflect the significantly lower levels of surface subsidence anticipated for the proposed first workings mining method compared to longwall mining.
8	When consent conditions make provision for meeting the requirements of performance measures by either by avoidance, mitigation or remediation, they need to be quite specific about the scope of attributes that have to be avoided, mitigated or remediated and the verification standards that avoidance, mitigation and remediation measures have to satisfy.	It is DPIE and/or the IPC's responsibility to provide conditions of approval which establish measurable performance standards against which environmental outcomes can be quantified. It is noted however that the Revised Preferred Project using First Workings mining method has, though design of a long term stable first workings mine plan, avoided the range of potential subsidence related impacts that would otherwise typically be associated with longwall mining (refer to **Section 4.5.1**).
9	TARP triggers for surface and groundwater should be based on meaningful indicators developed in consultation with relevant agencies and authorities with oversight and regulatory responsibilities for mining.	The surface water and groundwater TARPs will be reviewed as part of the Water Management Plan review process in consultation with relevant agencies. This review will occur within three months of the issue of any consent for the Revised Preferred Project.

Recommendation		Response
10	Uncertainty analysis of groundwater and surface water models should follow the uncertainty analysis workflow recommended by the IESC.	Noted. An uncertainty analysis has been completed for the Groundwater Assessment, in accordance with the IESC requirements (refer to **Submissions Report – Part B**).
11	Independent expert peer review should become a more regular part of the groundwater and surface water model assessment process.	An independent expert peer review has been undertaken for the Surface Water Assessment and Groundwater Assessment (refer to **Submissions Report – Part B**).
12	WaterNSW should continue its program of work towards determining the significance for the Greater Sydney water supply of different thresholds of surface water loss due to mining.	Noted. This recommendation is directed at WaterNSW.
13	An inter-agency working group should be set up with the task of identifying acceptable levels of surface water loss due to mining.	Noted. This recommendation is directed at Government.
14	A precautionary approach to mine design in the Special Areas should be taken that does not assume groundwater model outputs are accurate. Predictions of water losses should be conservatively high to allow for prediction uncertainty and where practicable the associated non-exceedance probability should be stated.	WCL have taken a precautionary approach to the re-design of the Revised Preferred Project using First Workings mining method in order to address residual uncertainty regarding potential subsidence-related mining impacts on groundwater, surface water and biodiversity within the Cataract Reservoir water catchment. Longwall mining is no longer proposed as part of the UEP and the revised mine design is based on a non-caving first workings mining system that will result in imperceptible subsidence. It is considered that a precautionary approach has been applied to the assessment of the Revised Preferred Project using First Workings mining method through: • careful project design aimed at reducing uncertainty in impact predictions • identification of the potential impacts and the likelihood and consequences of these impacts based on conservative assumptions • identification of management and mitigation measures that are designed to address the potential environmental impacts of the Revised Preferred Project • implementation of monitoring and reporting mechanisms for the project.

Recommendation		Response
15	Additional flow gauges and improvements to existing flow gauges should continue to be undertaken selectively by mining companies in consultation with WaterNSW, or by WaterNSW (with potential financing from the companies) including aiming for at least 4 years of baseline flow data at sites that are important for quantifying water supplies including future performance measure sites and control sites.	This recommendation is directed at WaterNSW. The water monitoring network for the Revised Preferred Project using First Workings mining method will be reviewed in consultation with WaterNSW as part of the management plan review process following determination of the project.
16	Monitoring of contaminant concentrations should be integrated with flow monitoring at operational mines to support calculation of contaminant loads at the main inputs to reservoirs and other key locations and to improve understanding of future contaminant loading risks. Relevant contaminants should be agreed between primary stakeholders.	As part of the update of the Water Management Plan, the existing surface water monitoring program will be reviewed and updated, and will include water quality and stream flow monitoring in Bellambi Gully Creek, Cataract Creek, Cataract River and Bellambi Creek. The Water Management Plan will be reviewed and updated in consultation with relevant agencies and authorities.

Recommendation		Response
17	Government should ensure that sufficient water entitlements are retained by mines operating in the Special Areas to cover surface water losses resulting from mining-induced effects.	This recommendation is directed at the Government. The legislative requirements put in place by the NSW Government, in particular the requirements of the NSW *Water Management Act 2000* and the *NSW Protection of the Environment Operations Act 1997*, have consideration of water take and impacts in their application. This includes the setting of sustainable water take levels through water licencing regimes and sustainable water quality limits through water discharge limits in an environment protection licence. The water licensing system considers available water within a system and allocates licences in consideration of all users of the water system and inherently covers cumulative impacts. The Groundwater Assessment prepared for the Revised Preferred Project using First Workings mining method quantifies predicted surface and groundwater take associated with existing and proposed mining at Russell Vale Colliery. WCL holds a current Water Access Licence (WAL) under the *Water Management Act 2000* for 515 ML (units)/year (Licence No. WAL36488), located within the Nepean Management Zone 2 of the Sydney Basin Nepean Groundwater Source, which provides sufficient entitlement for the predicted maximum groundwater inflow make into the WCL workings of 288ML/year. WCL is currently investigating trading options to acquire sufficient surface water entitlements to account for predicted levels of depressurisation from both historical mining operations and the Revised Preferred Project using First Workings mining method mine plan. In the event that sufficient entitlement cannot be acquired via trading options, WCL will consider a range of alternative mechanisms in consultation with the Natural Resources Access Regulator, including: • Offset via apportionment from current groundwater entitlements • Offset of surface water basic landholder right for harvestable rights from WCL Freehold land within the water sharing plan • Direct controlled allocation by the Department/ Minister of additional entitlement from the MZ under Section 65 of the *Water Management Act, 2000* • other mechanism to be determined in consultation with NRAR.

Recommendation		Response
Swamps		
18	Future swamp monitoring and modelling programs should be designed to: a. Provide a hydrological balance for representative swamps, sufficient to identify any mining-induced changes in soil moisture and in baseflow down the exit stream; and to provide vertical leakage rates as inputs to groundwater models, in order to quantify how much of the leakage is diverted back into the catchment or elsewhere. b. Link any changes in swamp vegetation to changes in water table position, soil moisture content and soil organic carbon content. c. Identify the presence of and any changes in obligate swamp fauna such as the giant dragonfly (*Petalura gigantea*).	WCL currently manages and monitors impacts to upland swamps and biodiversity values in accordance with their Biodiversity Management Plan (2019), Water Management Plan (2019) and Upland Swamp Management Plan (2015). Given the Revised Preferred Project using First Workings mining method is not predicted to result in perceptible subsidence impacts or have any potential to perceptibly impact natural surface features including upland swamps, monitoring of potential impacts will be focussed on subsidence impacts as well as primary impacts to groundwater systems associated with upland swamps, and surface water flow and quality in creeks. The subsidence and water monitoring programs will be reviewed as part of the management plan review process in consultation with relevant agencies following determination of the project.
19	Government should continue to support and/or carry out independent research (possibly on a cost recovery basis from the mining sector) to provide regional information on swamp hydrology and ecology. In particular, continuation of monitoring at sites where there is a substantial basis of data should be a priority.	This recommendation is directed at the Government. As outlined in the Revised Preferred Project Report, the proposed workings are not considered to have any potential to perceptibly impact on natural surface features including upland swamps.
20	Annual performance reports, end-of-panel reports and reports on studies required by development consent conditions, should: a. integrate hydrological and ecological impact and consequence assessments b. include discussion of the inter-related changes in hydrological and ecological consequences for swamps, rather than having only discrete chapters on each c. include results for the entire period of monitoring, rather than just the previous year, that should be assessed, not only for the current mining area but for previous mining domains.	WCL will undertake any reporting requirements in accordance with the relevant guidelines, policies and approval conditions. The assessments completed for the Revised Preferred Project using First Workings mining method provided an integrated approach for hydrological and ecological impacts, where relevant. As discussed in the Revised Preferred Project Report, the Revised Preferred Project using First Workings mining method does not predict any perceptible impacts to hydrological and/or ecological features.
Reverse Onus of Proof		
21	The concept of Reverse Onus of Proof should be discarded.	Noted.

Recommendation		Response
Cumulative Impacts		
22	Environmental data from mine companies should be housed in a centralised data portal, such as the SEED portal, prioritised according to its value in assessing cumulative impacts of concern.	Noted. WCL will provide relevant data, as required.
Remediation		
23	Remediation should not be relied upon for features, including watercourses and swamps, that are highly significant or of special significance (as per the guidance provided by the Planning Assessment Commission Panels for the Metropolitan Coal Project and the Bulli Seam Operations Project).	Noted. The Revised Preferred Project using First Workings mining method is not predicted to impact on any surface features, including watercourses and swamps, that are highly significant or of special significance. Remediation of such features is therefore not expected to be required.
Offsets		
24	There is a need to update provisions for offsetting water loss from the catchment resulting from all mining operations.	Noted. This is a policy decision for Government. As discussed above, WCL hold sufficient Water Access Licence entitlements for groundwater take associated with existing and proposed mining, and is progressing trading or other appropriate mechanism to account for surface water take. WCL has commenced preliminary discussions with the NSW Government regarding the potential for mine water quality treatment to replenish water loss. This is at the early stages of conceptualisation and may form part of a wider industry based response with discussions with the NSW Government and associated Authorities.

Recommendation		Response
25	Provisions for offsetting impacts on water quantity and water quality associated with mining operations in the catchment need to give careful consideration to long term impacts, post-mine closure.	Noted. This is a policy decision for Government. As noted in the Revised Preferred Project using First Workings mining method Report WCL has committed as part of the mine closure process to enter into a suitable funding arrangement with relevant stakeholders to fund the ongoing monitoring and treatment of future water outflows from the adit, if required. The funding arrangement will consider appropriate water quality targets based on an agreed potential end use at the time of closure and will be sufficient for 10 years of monitoring and treatment. It is envisaged that by the time adit outflows occur at Russell Vale Colliery (currently predicted to be around 2057), various options for beneficial reuse may exist. These options would be investigated as part of the detailed mine closure process in consultation with relevant agencies. It is also noted that at the request of the NSW EPA in their submission on the Revised Preferred Project, WCL will investigate the feasibility of sealing of the mine as an alternative to water treatment.

Recommendation		Response
Rehabilitation and Mine Closure Planning		
26	Mine planning today needs to take into account impacts that may arise in the long term, post-mine closure.	WCL propose to rehabilitate the Russell Vale Colliery at the cessation of mining to allow for relinquishment of the mining lease and disposal of the asset. Accordingly, consideration of post closure impacts has been considered as part of the mine design and assessment process. Impacts that may arise in the long term, post-mine closure have been considered in the mine planning for the Revised Preferred Project, in particular the substantial change to mine design that limits subsidence related impacts in both the short and long term, and through consideration of future water outflows from the mine adit (as discussed above). Mining operations are required to develop and implement a Mining Operations Plan (MOP) (soon to be Rehabilitation Management Plan), which includes: • objectives and criteria for rehabilitation that are required to be met for rehabilitation before the Resource Regulator will relinquish the mining lease and any associated rehabilitation security bond • proposed rehabilitation plans including a progressive rehabilitation schedule for the entire life cycle of a mine • defined key risks and opportunities that need to be addressed to achieve successful rehabilitation • the range of risk-based rehabilitation controls and methodologies • detailed monitoring programs designed to measure performance and compliance against the criteria as well as promote adaptive management processes.
27	A study be undertaken to better understand and quantify the potential impacts of historic and current mining for long-term cumulative impacts on water quantity and quality in the Greater Sydney Water Catchment, for the purpose of properly informing mine design, mine rehabilitation and closure planning, planning assessments, offsets and rehabilitation bonds.	Noted. It is noted that the relevant assessments undertaken for the Revised Preferred Project using First Workings mining method have considered the potential impacts of historical, current and proposed mining on water quantity and quality. It is also noted that WCL has redesigned the UEP in order to address potential risks and uncertainty regarding potential subsidence related impacts on groundwater and surface water quantity and quality associated with the previous longwall mine plans.

Recommendation		Response
28	SEARs and any conditions of consent should include a focus on the long term implications of mining proposals for rehabilitation and mine closure planning.	Noted. It is DPIE and/or the IPC's responsibility to provide conditions of approval, including any conditions relating to rehabilitation and mine closure. WCL have previously committed to a range of rehabilitation objectives, rehabilitation methods and conceptual completion criteria via the existing Russell Vale Colliery Rehabilitation Management Plan for the Revised Preferred Project using First Workings mining method in consultation with the relevant key stakeholders and government agencies. The conceptual rehabilitation strategy will be reviewed periodically as part of the management plan review process.
29	Impact assessments associated with proposals for mining in the Special Areas need to include detailed consideration of rehabilitation and mine closure planning that extends beyond management of the landscape.	NSW has a highly regulated system for rehabilitation and mine closure administered by the Resource Regulator. The Resource Regulator's regulatory approach to rehabilitation is outcomes focused whilst being flexible to allow for industry to develop and implement innovative and best practice methodologies specific to a site. The scope of rehabilitation activities covers a broad range of components that need to be addressed to establish a safe and stable environment following the closure of a mining operation. The scope of rehabilitation activities includes but is not necessarily limited to demolition of surface infrastructure; final landform establishment; geotechnical stabilisation; sealing of mine entries and boreholes; amelioration of soils for revegetation and revegetation works.
Government access to expertise		
30	Government needs to establish a sustainable mechanism for accessing objective and timely expert advice when assessing mining applications and performance outcomes and this mechanism needs to be supported by probity guidelines that have regard to experts having worked in the mining industry in order to gain their expertise.	Noted. WCL has engaged suitably qualified and experienced experts to undertake necessary assessments for the Revised Preferred Project. In addition, WCL has engaged two groundwater experts to peer review the Groundwater Assessment and a subsidence expert to peer review the Subsidence Assessment.

4.0 Response to Agency Submissions

4.1 Division of Resources and Geoscience

The Division considers the Project satisfies section 3A objects of the Mining Act 1992 and the requirements of clause 15 of the *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007*. The Project represents an efficient development and utilisation of coal resources which will foster significant social and economic benefits. The Division is generally satisfied that, should the operational outcomes be achievable, the proposed mine design and mining method submissions adequately recover coal resources and will provide an appropriate return to the state.

Noted.

The Division notes that Wollongong Coal has not yet completed coal reserve estimation for the Project in accordance with the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves (the JORC code). The Division recommends the Planning & Assessment Division request the Proponent to provide a reserves report for the Project, completed in accordance with the JORC code.

As requested, Wollongong Coal is currently completing a coal reserve estimation for the Project in accordance with the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves (the JORC code). The JORC assessment will be provided to DRG directly.

Based on current title information the Division advises that the Proponent holds the appropriate titles as required for planning applications for coal as relating to the Project and satisfies the requirements of section 380AA.

Furthermore, the holder of a mining lease is also liable to pay royalty for both publicly and privately owned minerals (refer to section 282-285 of the Act).

Noted.

The Division requests that the Proponent consider potential resource sterilisation should any future biodiversity offsets areas be considered. Further, that the Proponent consult with the Division and any holders of existing mining or exploration authorities that could be potentially affected by the proposed creation of any such biodiversity offsets, prior to creation occurring. This will ensure there is no consequent reduction in access to prospective land for mineral exploration or potential for the sterilisation of mineral and extractive resources.

An updated Ecological Impact Assessment was prepared for the Revised Preferred Project by Biosis (2019), included in Appendix 4 of the Revised Preferred Project Report. The first-workings mining method will not result in perceptible levels of subsidence; and will have negligible impacts to natural surface features including upland swamps, rocky environments and aquatic environments, as well as species occupying these environments. As a result, impacts to the biodiversity values of the UEP Application Area are predicted to be negligible.

The proposed upgrades to Pit Top will occur within existing disturbed areas, and no direct or indirect impact on biodiversity is anticipated as a result of these works.

As the risk to biodiversity is predicted to be negligible, there is no biodiversity offset proposed for the Revised Preferred Project. The Revised Preferred Project will therefore not result in the any resource sterilisation as a result of biodiversity offset.

The Division requests to review the draft conditions of approval before finalisation and any granting of development consent.

Noted, a matter for DPIE.

4.2 Resource Regulator

The Resources Regulator advises the Department of Planning, Industry & Environment - Resource Assessments that the information provided in the Revised Preferred Project Report (PRP) does not adequately address the issues raised in the submission from the Resources Regulator...

...The Revised PRP refers to existing Rehabilitation commitments and conditions for the Russell Vale Colliery Preliminary Works Project (PA 10_0046). A review of the current Development Consent for PA 10_0046 (MOD 3, approved 10 October 2014) shows Schedule 3, Conditions 42-44 are applicable to Rehabilitation.

The Resources Regulator has two issues of concern with the position stated in the Revised PRP:

1. It is understood that the Russell Vale Preliminary Works Project (PA 10_0046) is proposed to be replaced/superseded by the Russell Vale Colliery Underground Expansion Project (09_0013) if this is approved. If this were the case it would be inappropriate to refer to Rehabilitation Commitments in a separate Development Consent and a separate Environmental Assessment.

2. The initial Preferred Project report for the Underground Expansion Project…includes a detailed section on Rehabilitation (Section 2.1.2)…

There is no explanation as to why this Rehabilitation sections was included in the initial PRP but then removed from the revised PRP.

The Resources Regulator would expect an equivalent section in the revised PRP. This would ensure Rehabilitation aspects meet the Resources Regulator SEARs and that rehabilitation is covered to a contemporary standard, particularly noting Rehabilitation Aspects and Approval Conditions (Schedule 3, Conditions 42-44) for the Preliminary Works Project PA 10_0046 were last updated in October 2011.

While not specifically proposed as part of the UEP, WCL has no objection to surrendering the Preliminary Works Approval consent subject to satisfactory approval of the Revised Preferred Project and suitable transitional arrangements being provided for in the UEP consent (refer to proposed commitment in **Section 6.0**).

As noted by the Resource Regulator, the rehabilitation commitments for Russell Vale Colliery have previously been provided in the initial preferred project report. WCL also have an existing Rehabilitation Management Plan for Russell Vale Colliery. Notwithstanding refinements required for the Revised Preferred Project, the previous general rehabilitation objectives and measures remain current. The general rehabilitation objectives include:

- the sites shall remain in a safe, stable, non-polluting and sustainable state
- the socio-economic benefits of the rehabilitated sites will be maximised

- long term maintenance of the sites will not be greater than the surrounding environment
- the agreed post-mining land use will be compatible with the surrounding land fabric and land use requirements
- the rehabilitation landforms will have no greater management requirements than the surrounding landforms and land uses.

WCL has no objection to the rehabilitation commitments from the initial preferred project report (subject to refinements required for the Revised Preferred Project) and conditions 42-44 of PA 10_0046 being included in any new approval for the UEP. **Table 4.1** provides the rehabilitation objectives from PA 10_0046.

Table 4.1 Rehabilitation Objectives

Feature	Objective
Mine site (as a whole)	Safe, stable & non-polluting. Final land use compatible with surrounding land uses.
Project surface infrastructure	To be decommissioned, and subject to the Heritage Management Plan, removed (unless the Secretary agrees otherwise).
Portals and vent shafts	To be decommissioned and made safe and stable. Retain habitat for threatened species (e.g. bats), where practicable
Watercourses of 2nd order or higher subject to subsidence impacts	Hydraulically and geomorphologically stable.
Cliffs	No additional risk to public safety compared to prior to mining
Other land affected by the project	Restore ecosystem function, including maintaining or establishing self-sustaining ecosystems comprised of: • local native plant species (unless the Secretary agrees otherwise); and • landform consistent with the surrounding environment
Built features damaged by mining operations	Repair to pre-mining condition or equivalent unless: • the owner agrees otherwise; or • the damage is fully restored, repaired or compensated for under the *Coal Mine Subsidence Compensation Act 2017*.
Community	Ensure public safety. Minimise the adverse socio-economic effects associated with mine closure.

Notes: 1) These rehabilitation objectives apply to all subsidence impacts and environmental consequences caused by mining taking place after the date of this approval; and to all project surface infrastructure part of the project, whether constructed prior to or following the date of this approval.
2) Rehabilitation of subsidence impacts and environmental consequences caused by mining which took place prior to the date of this approval may be subject to the requirements of other approvals (e.g. under a mining lease or a Subsidence Management Plan approval) or the Proponent's commitments.

The post mining land use will be subject to detailed closure planning in consultation with relevant government authorities, Wollongong Council, and other relevant stakeholders. The indicative post mining uses previously identified include:

- residential

- amalgamation of E2 zoned land with the Illawarra Escarpment State Conservation Area (IESCA), following mutually acceptable agreement with the relevant Government authority
- amalgamation of E2 zoned land with the Metropolitan Special Area, following mutually acceptable agreement with the relevant Government authority.

WCL has committed to review and update the existing Russell Vale Colliery Rehabilitation Management Plan for the Revised Preferred Project in consultation with the relevant key stakeholders and government agencies. The conceptual rehabilitation strategy will be reviewed and refined periodically as part of the management plan review process.

WCL will commence consultation with the Resources Regulator and DPIE regarding detailed closure planning 2 years prior to planned closure.

The Resources Regulator makes note of the following information on page 149 of the Revised preferred Project Report:

"Under the base case scenario in the CBA, WCL will be obligated to rehabilitate the Russell Vale Colliery including the underground access points and the Pit Top facilities which is estimated at $215 million to be expected in 2020, with no future mining at Russell Vale."

The Resources Regulator is currently seeking an independent review of the existing rehabilitation security held in respect of the Russell Vale mine to determine if the amount held is sufficient.

WCL has advised that while the Economic Assessment of the Revised Preferred Project (Appendix 10 of the Revised Preferred Project Report) included costs termed as ‘rehabilitation’, these costs are broader than solely rehabilitation costs. The category of rehabilitation costs within the Economic Assessment includes business discontinuity, closure and rehabilitation costs. Confirmation of this advice is provided by Cadence Economics Pty Ltd in **Appendix 6**.

The Resources Regulator requested WCL to review and update of the previous rehabilitation cost estimates using the latest version of the NSW Resources Regulator Rehabilitation Cost Estimate Tool. The revised rehabilitation cost estimate for Russell Vale Colliery is $12,354,410 and has been assessed as acceptable by the Resources Regulator with a requirement that the security deposit be increased to reflect this revised amount.

4.3 Department of Planning, Industry and Environment – Water

We advise there are a number of concerns related to the proposal:

- **The groundwater model requires further refinement to meet the requirements of the Australian Groundwater Modelling Guidelines (2012). It currently does not adequately consider cumulative effects of historic, current and planned operations by this proposal and other mines in the area.**
- **The proponent needs to demonstrate that they have or are able to obtain sufficient shares of water from relevant water sources.**
- **The groundwater monitoring information lacks the detail required to confirm the predictions derived from the modelling, as well as management measures to address unpredicted events or anomalous results.**

A response to the DPIE Water submission will be provided in the Submissions Report - Part B.

As discussed in **Section 3.3.2**, a peer review of the Groundwater Assessment is currently being completed by Dr Noel Merrick. A revised Groundwater Assessment, addressing DPIE Water's comments and the peer review comments, will be provided in Submissions Report – Part B.

4.4 Environment Protection Authority

4.4.1 Noise

A response to the EPA in relation to the noise impact assessment has been prepared by Wilkinson Murray and is included as **Appendix 7**. Summary responses are provided below.

The proponent must provide additional justification for the new RBLs; noting that they are higher than RBLs presented in previous assessments, are appropriate giving consideration to the length of period of monitoring, and the location of the monitoring relative to the most affected receivers and any other aspect pertinent to noise monitoring is in accordance with Fact Sheets A and B of the Noise Policy for Industry (NPfl) (EPA, 2017).

The Rating Background Levels (RBLs) determined in the previous 2013 and 2014 UEP noise assessments were based on approximately one week of noise monitoring data. While the *Noise Policy for Industry* (NPfI) nominates one full week of monitoring as a suitable period for determining an RBL, RBLs established over such durations may be influenced by small fluctuations in the local natural environment (e.g. insect noise quieter in winter than summer) and human activities (e.g. road network surrounding the site may be busier some periods than others) at various times of the year. As such, it is generally considered that the longer the monitoring period, the more accurate and representative the RBL.

The noise assessment prepared for the Revised Preferred Project has utilised one full year of noise monitoring data collected from two long-term noise monitors located on the Russell Vale Colliery site to establish RBLS for the residential areas in proximity to these monitors. The monitoring data was from a period when the site was not in operation and is therefore not influenced by site operational noise. It is considered that use of RBLs based on background noise levels measured over an entire year are more accurate and representative than RBLs based on one week's worth of data as long-term RBLs would account for fluctuations occurring at various times of the year.

The location of long-term noise monitors is shown on Figure 4.1 of **Appendix 3**. It is considered that the noise monitor location NMT1 RBLs are representative of the long-term RBLs at the northern receivers set back from the Princes Highway and shielded from high traffic noise levels. Similarly, the noise monitor location NMT2 RBLs are considered representative of the long-term RBLs at the southern receivers shielded from the Princes Highway.

The RBLs established for properties to the east of the site where the acoustic environment is dominated by traffic noise from the Princess Highway is based on noise monitoring undertaken by Wilkinson Murray over a 12-day period in June 2014. The RBLs adopted for these properties in the current assessment are the same as those adopted in the 2014 UEP noise assessment prepared by Wilkinson Murray.

The three noise catchment areas described above (i.e. northern receivers, southern receivers and eastern receivers) are shown in Figure 4.1 of **Appendix 3**.

There are provisions in the NPfI that provide for consideration of the duration of previous operations to take account of operational noise emissions when establishing background noise levels. Taking into account that the mine has been on care and maintenance in the recent years, and to ensure a conservative approach, these provisions have not been adopted for this assessment.

2) Assessed scenarios

a) It is not clear from the report why all the noise mitigation bunds/barriers are not constructed prior to the commencement of operations. It is expected that noise mitigation bunds/barriers are constructed prior to the commencement of operations, unless sufficient justification can be provided.

b) Noise mitigation measures should be constructed as early as possible, unless community engagement identifies an alternative preference.

c) The proponent should commit to a firm timeframe for completion of the bund construction so that any period of potentially significant impacts is limited and to inform the expectations of the community and regulators.

As discussed in **Section 3.1.1**, WCL has amended the noise barrier and bund arrangement for the Revised Preferred Project Report in order to reduce bund construction timeframes. WCL has committed to constructing the container noise walls and the Broker Street noise barrier prior to the phase-in operations commencing, and Bunds 2, 3 and 5 within the first three months of the phase-in period.

As outlined in the Statement of Commitments in Section 6.0 of the Revised Preferred Project Report, WCL has also committed to implementing a range of feasible and reasonable construction noise management measures during construction of bunds around the Pit Top, in accordance with the ICNG.

Further, the noise assessment presented in **Appendix 3** indicates that for the initial 3 months of the phase-in period when Bunds 2, 3 and 5 are not yet in place, operational noise levels are predicted to comply with project noise trigger levels during the day, evening and early morning shoulder periods at all identified representative receivers. Negligible 1-2dB exceedances are predicted at a small number of representative receiver locations during the night-time period under adverse weather conditions. Therefore, it is unlikely that surrounding receivers will experience unacceptable noise impacts as a result of the minor delay in the construction of these bunds.

3) Proposed Noise Mitigation Measures

a) There is a significant reduction in predicted levels between the 2014/2015 noise reports and the 2019 noise report. The proponent should provide details of the predicted noise reductions associated with significant mitigation including engineering controls (including berms/ barriers) and operational changes to demonstrate their individual and combined effectiveness.

The reduction in predicted noise levels between the 2014 and 2019 UEP noise assessment reports can be attributed to a range of factors relating to:

- source inventory, including changes to noise sources associated with proposed Pit Top upgrades and a change in the times of use for some sources
- sound power levels (SWLs), including substantial sound power level reductions achieved through at-source noise mitigation measures and replacing noisier equipment with quieter equipment
- meteorological conditions, including a change in prediction methodology associated with the introduction of the Noise Policy for Industry
- changes to site layout and shielding provided by proposed bunds/walls/barriers in the 2019 report.

Each of these aspects are discussed in further detail in **Appendix 7**.

b) The phase-in scenario includes a 9m ROM coal stockpile as a noise control measure for the ROM stockpile dozer. However, this measure is only in place during the phase-in scenario and not the operational scenario. It is currently not clear what mitigation measure replaces the 9m stockpile in the operational scenario to retain similar predicted noise levels at receivers. The proponent should provide clarification on how the dozer is mitigated in both the phase-in and operational scenarios.

Post phase-in period, the acoustic mitigation provided by the 9m ROM stockpile will be replaced by the noise mitigation works proposed to be implemented during the phase-in period in order to achieve compliance during the day.

c) The proponent should clarify if the D8 dozer will have at source mitigation (Hushpack) applied prior to the phase-in scenario commencing.

Hushpack engine and grouser attenuation is proposed to be applied to the D8 dozer prior to commencement of operations.

d) Noise barriers and berms in a variety of configurations have been assessed in multiple previous noise assessments for the premises to be of limited acoustic benefit. The proponent must provide justification that the barriers and berms proposed in the 2019 noise report will have an appropriate level of acoustic benefit.

The Revised Preferred Project presents a new Pit Top layout designed to maximise acoustic shielding and minimise noise impacts on surrounding sensitive receivers. This has been an iterative design process that has considered both the optimal location for plant and equipment and the optimal location for noise barriers and bunds. As part of this design process, new locations for potential noise barriers closer to noise sources (i.e. container noise walls) and receivers (i.e. noise barrier along northern boundary of the site) have been considered in order to provide more efficient acoustic shielding. Increased barrier heights and changes in site layout have been proposed to maximize shielding effects from noise barriers and local topography.

A summary of typical noise reductions experienced at the identified receivers due to changes in site layout, shielding effects and other factors such as sound power levels and meteorological conditions is presented in further detail in **Appendix 7**.

e) Table 7-3 presents the 27 receivers identified to exceed the Project Noise Trigger Levels (PNTLs), with a maximum exceedance of 2 dB. It would aid the assessment of the proposal and the assessment of reasonable and feasible mitigation if the proponent provided more detail on which were the major sources that contribute to the exceedances at these receivers.

Section 7.3 of the report presented in **Appendix 3** has been amended to address this point.

f) Previous noise assessments for the site have identified a range of different outcomes including no mitigation, mitigation with significant residual impacts and mitigation with no significant residual impacts. It would assist the assessment of the application if the proponent provided an indication of the scale and potential for different outcomes that could eventuate if there were under or overestimations of the effectiveness of the mitigation measures. The noise report should present additional contingency and safeguard mitigation measures that could be deployed should operational noise levels exceed predicted values.

Noise predictions include some level of conservatism associated primarily with:

- noise sources (i.e. assuming that all sources would be operating continuously and simultaneously, operations would be operating to cater for unexpected Port closures or interruptions, etc.)
- meteorological conditions (i.e. assuming noise-enhancing conditions are present during worst-case operations although such conditions are expected to occur for a small percentage of the time).

Although the effectiveness of noise mitigation measures may vary due to a number of factors, the level of conservatism built into the modelling process would ensure that noise levels are generally overpredicted.

Contingency and other mitigation measures that will be implemented if operational noise levels exceed predicted values include:

- **Operational Management Measures**
  - review of site real time noise monitoring data
  - attended noise monitoring
  - review of plant scheduling
  - review of mobile plant operations to determine if relocation of mobile plant would provide beneficial noise outcomes
  - review temporary shutting down of plant for short durations during periods of adverse weather conditions.
- **Additional Noise Mitigation Measures**
  - review of further extension of noise bunding or walls along the rear of West Street property boundaries (following consultation with property owners) to determine if this would provide beneficial noise outcomes.

4) Operational Noise Assessment

a) The EPA does not recommend or endorse any particular noise prediction method or software. The proponent is responsible for demonstrating the method they have used is suitable.

Section 6.1 of the report presented in **Appendix 3** has been amended to address this point.

b) The proponent must provide more information regarding the difference in predicted levels between the 2019 noise report and the 2015 noise report. Predicted noise levels have reduced by between 2 and 15 dB during the day and evening. During the night period, some receivers have reduced noise levels, and some have increased noise levels compared to the 2015 noise report. The proponent should provide more detail on the difference between the two sets of predictions and the reasons for the differences.

Further information regarding differences in noise predictions between the 2015 and 2019 UEP noise reports has been provided in **Appendix 7**.

c) The low frequency noise assessment in Chapter 7.5 of the 2019 noise report has not followed the NPfI procedure. Section 2.2 of the NPfI states that noise levels should be rounded to the nearest integer. This means that the numbers in Table 7-4 of the 2019 report should be reported as integers. This would mean that R2 and R11 have a C-A weighted noise level difference of 15 dB. One part of the trigger for the low frequency correction in NPfI Table C-1 is where the C- A weighted level difference is 15 dB or more. Since the difference at R2 and R11 is 15 dB (rounded to the nearest integer), the proponent should further investigate the potential for low frequency noise impacts and the applicability of a low frequency penalty.

A revised low frequency noise assessment has been prepared and is presented in Section 7.5 of **Appendix 3**. The revised assessment confirms that no modifying factor correction for low-frequency noise is warranted for the Revised Preferred Project. A summary of the key findings is provided in **Section 3.2.1.3**.

d) Table 6-4 of the 2019 noise report states the sound power level (SWL) used in the modelling but also in some cases also states the mitigated noise level. The proponent should clarify which SWL has been used to generate the predicted noise levels.

Table 6-4 of the report presented in **Appendix 3** has been amended to address this point.

e) The assumptions regarding the front end loader (FEL) in Table 6-4 state that it would only be used for 2 minutes per 15 minutes due to operational limitations on the number of trucks. The proponent should provide further justification that this is a reasonable assumption.

The revised noise assessment presented in **Appendix 3** assumes the front-end loader would operate continuously throughout the entire 15-minute period. This is considered conservative as the front-end loader would generally not be expected to operate continuously.

f) The proponent should confirm which type of truck will be used to haul rejects. For example, will an articulated dump truck (for example, CAT 740 style truck) or another type of truck be used. There is potential for different trucks types to generate higher noise levels.

The assessment has assumed a sound power level of 102 dBA for rejects haulage which is consistent with road trucks travelling at 40 km/hr. This assumes trucks are road worthy and properly maintained.

5) Sleep Disturbance assessment

a) The predictions from the tripper in Table 8-1 are about 1 dB higher than the Leq,1smin noise levels. Further explanation is requested as this currently implies that the dominant noise sources would not have a maximum noise level substantially above their Leq,15min noise level.

The overall sound power level of the site was calculated to be 111.3 dBA for the night time period and 111.4 dBA for the early morning shoulder period. Those are noted to be greater than the L_{AFmax} sound power levels used in the maximum noise level event assessment (i.e. 108 dBA for the mitigated tripper arrangement and 102 dBA for trucks in the early morning shoulder period) and as such the predicted L_{AFmax} noise levels at the surrounding receivers are expected to be comparable to the predicted $L_{Aeq,15min}$ levels.

As a conservative measure, it was assumed in the updated noise assessment report presented in **Appendix 3** that maximum noise level events would occur at the same time as worst case $L_{Aeq,15min}$ level and the L_{AFmax} levels were added to the predicted $L_{Aeq,15min}$ levels before assessment against the Project's L_{AFmax} trigger levels for the maximum noise level event screening assessment.

b) The proponent should provide more information on the SWL, type and locations of Lmax sources assumed for truck movements

Section 8 of the noise assessment was amended to provide characterisation of the early morning shoulder truck movement sound power levels (refer to **Appendix 3**). Other assumptions related to the maximum noise level event assessment for the early morning shoulder period were also included.

6) Project Noise Trigger Levels

The proponent has assumed that there are no existing and no future industrial noise sources in the area other than the subject premises in their determination of the amenity level. The proponent should provide further information on the potential for the existing, planned or zoned commercial and industrial premises on Bellambi Lane and the area surrounding the mine to influence industrial noise levels at relevant receivers

Land to the North and South of the Russell Vale Colliery Pit Top is zoned primarily for a mixture of low density residential and public recreational land uses. No existing or future significant noise generating land uses are present or permitted to be present within these areas. Review of the current Wollongong Local Environmental Plan zoning map shows that the only area where potentially noise generating land uses could be permitted within the vicinity of the site is the block directly south of Bellambi Lane which is zoned as light industrial.

The results of a search from Wollongong Council's Development Application (DA) tracking site and observations made during various site visits indicate that all current and approved DAs for lots along Bellambi Lane do not consist of developments with the potential to generate relatively high industrial noise potentially impacting on receivers surrounding the site. It is noted also that any future industrial development within this block would be similarly constrained by the presence of residential dwellings in the immediate vicinity.

As such, it can be concluded that there are no existing or currently proposed industrial premises in the vicinity of the site with the potential of generating ambient industrial noise at receivers potentially impacted by the Revised Project.

4.4.2 Air Quality

A response to the EPA in relation to the air quality assessment has been prepared by ERM and is included as **Appendix 8**. Summary responses are provided below.

The proponent should incorporate a meteorological analysis that includes at least five years of meteorological data at or near the site and re-asses if 2016 meteorological data is representative

The EPA has noted the minimal number of calm winds represented in the 2016 meteorological dataset. Their concern is that this may not capture the worst-case impacts as these can often occur under calm wind conditions. While it is true that these conditions will generally represent a worst case for dispersion, calm conditions also lead to lower estimates of emissions for those sources that are wind speed dependent. These sources include wind erosion and material transfer and these make up nearly 25% of the total PM_{10} emissions, and nearly 30% of $PM_{2.5}$ emissions. These are not insignificant proportions and would be reduced considerably if there was a higher percentage of lower wind speeds.

As required by the Approved Methods, the assessment should use meteorological data that is representative of the site. As these data are taken from the on-site weather station they are considered site representative, even if not necessarily 'worst-case' with regard to dispersion.

Regardless, further analysis has been carried out on the data available for the five years from 2014 – 2018 (inclusive), noting that wind direction data was not available for 2018. A comparison of wind rose plots for years 2014 – 2017 show a very low percentage of calms in all years. In addition, the annual trends are similar from year to year, indicating that 2016 is a typical and representative year for the site. Rainfall, temperature and wind speed data from 2014 – 2018 also support the use of 2016 as a representative year.

The assessment should be revised to include all available ambient air quality data at or near the site to robustly characterise background air quality surrounding the project site and characterise local air quality impacts in the vicinity of the proposal in the context of historic operations

The background levels assumed are reasonable as they were measured while the site was not operating. This provides a more accurate representation of background levels to which the modelled project contributions can be added, as has been done in the assessment. There are no other data sets available that are as representative of the local area.

These data were also contemporaneous with the meteorological data used and so enables a better 24-hour cumulative assessment. That is, measurements are relevant to concentrations experienced on a specific day, so when combined with predicted levels made using the meteorological information for that same day, it is a more realistic estimate of total cumulative concentrations.

Detailed information for the calculation of the emissions inventory should be provided to enable the EPA to replicate emissions. In particular, this information is to be provided for those activities (hauling, wind erosion for exposed areas, FEL loading) with the largest contribution to the total emissions.

The dust emission inventories have been prepared for each modelling scenario using the operational description of the project and the US EPA's AP42 emission factors. Estimated emissions are presented for all significant dust generating activities associated with the operations.

Further details of the emissions calculations are provided in **Appendix 8**.

The proponent should present the location of the modelled sources for both scenarios

The source locations used in the modelling of both scenarios are provided in **Appendix 8**.

The proponent should revise the AQIA to include a worst-case scenario. This scenario should include emissions at daily maximum processing quantity

An additional worst-case scenario was modelled to take account of maximum daily ROM throughput and product transfer. The results of the works case maximum daily production scenario are reported in **Appendix 8** and summarised in **Section 3.2.3**.

4.4.3 Water Resources

The EPA notes that the Statement of Commitments for the UEP contains agreed programs to install and maintain works proposed under Mod 4 and the EPA has no further comments to make

Noted.

The PAC however stated that "If sealing of an adit constitutes a control for managing water inflow, then this control should be risk assessed to determine its likely· practicality and effectiveness and hence residual risk." The PAC's recommendation has not been addressed in the PPR. The EPA believes that the PAC's recommendation should be addressed not necessarily to reduce inflow but because recent experience at other mines in the Southern Highlands demonstrates the difficulty in finding a long term solution to legacy groundwater discharges. The discharges are often saline and contain dissolved metals that combine to permanently affect the downstream aquatic health of rivers. The EPA considers that this issue does not need to be resolved prior to approval (if granted) because it is pre-existing and is not significantly altered by the revised proposal. However, the EPA requests that a program to investigate sealing of the mine as an alternative to water treatment be included as a Statement of Commitment or an Approval Condition

WCL will undertake a program to investigate sealing of the mine as an alternative to water treatment at the mine closure stage as part of the detailed closure planning process. Any investigation will be undertaken with consideration of the advice of the Independent Expert Panel for Mining in the Catchment and in consultation with relevant agencies, including the EPA, WaterNSW and DPIE.

4.5 Water NSW

4.5.1 Subsidence

The revised project report addresses the issues raised in the Second PAC review, and considered both WaterNSW's Mining Principles and the recommendations of the 2018 IEPMC Initial Report. WaterNSW considers that:

- **the first workings mining method is much safer than the previous proposal for longwall mining and is unlikely to cause significant surface subsidence or significant interaction with the overlying seams**
- **the mining method is likely to minimise the potential groundwater impacts by limiting depressurisation within and immediately above the mined coal seam, and**
- **the proposed first workings are likely to have negligible impacts on natural surface features including upland swamps, cliffs, steep slopes, drainage lines, creeks, Cataract Creek, Cataract River, and Cataract Reservoir.**

Noted.

WaterNSW notes that this is a unique mining proposal where a third coal seam is proposed to be undermined under already mined Bulli and Balgownie seams. One of the key uncertainties with the proposed mining area relates to the stability of the Bulli seam pillars, the potential for pillar run, and associated subsidence and environmental consequences including induced leakage.

...the subsidence assessment report does not simulate geological structures due to the limitations and constraints inherent with the model set up and code, as well as uncertainty in the location, stratigraphic persistence and hydraulic properties.

While WaterNSW acknowledges that the revised mine plan is designed to minimise these concerns, a number of uncertainties remain. Consequently, WaterNSW recommends that:

- **the subsidence assessment report is peer reviewed by a multi-seam mining expert within the NSW Government or an independent consultant acceptable to the Department, and**
- **subject to the findings of this expert peer review, the management of uncertainties is addressed through the approval conditions i.e. an extraction plan process (or equivalent) to allow the expert stakeholders to provide advice on an ongoing basis.**

A peer review of the Subsidence Assessment prepared by SCT (2019) for the Revised Preferred Project (Appendix 1 of the Revised Preferred Project Report) has been undertaken by Bruce K. Hebblewhite. Mr Hebblewhite is considered an expert in the field of mine geotechnical engineering and was the Chair of the Independent Expert Panel of Review into *Impacts on Underground Coal Mining on Natural Features in the Southern Coalfield*.

The peer review process resulted in an initial peer review report being prepared that included a range of conclusions and recommendations for further analysis and discussion. The further analysis and discussion recommended by the peer reviewer was reviewed by SCT and a revised Subsidence Assessment prepared addressing the peer review comments. A final peer review report was then provided based on the revised Subsidence Assessment.

Copies of the initial and final peer review reports have been included as **Appendix 4**, with the updated Subsidence Assessment provided as **Appendix 5**. A summary of the peer review findings and updated assessment are provided in the following sections.

Peer Review Initial Findings

The peer reviewer's initial findings are set out in **Appendix 4**. The peer reviewer confirmed his agreement with the conclusions of the Subsidence Assessment prepared by SCT. The initial peer review confirmed that:

- The subsidence movements expected from the proposed workings are not expected to cause any significant impact on any surface features within the UEP Application Area, specifically, the proposed workings are not considered to have any potential to perceptibly impact on surface features such as escarpments, swamps, cliffs, creeks and drainage lines, or the Cataract Reservoir

- There is no credible risk of water flow along major structures from Cataract Reservoir as a result of the proposed first workings in the Wongawilli Seam

- Large areas of the surface within the UEP Application Area are already in a state of limit equilibrium with potential for cracks to appear or movements to develop as a result of previous mining activity. It is agreed that this situation exists, but is independent of the proposed first workings in the Wongawilli Seam. It is also agreed that the proposed mining is not expected to have any significant impact on the stability of pillars in the overlying seams

- The proposed mining is not considered likely to alter the status of mining/groundwater or surface interaction and impacts on groundwater are not expected to occur beyond the immediate vicinity of the Wongawilli Seam.

The peer reviewer made recommendations in relation to the following additional analysis or clarifications required in the report:

- further analysis and discussion of pillar stability under the varying loading conditions present

- further clarification of the location of areas of marginally stable pillars in the Bulli Seam.

The recommendations have been addressed in the updated Subsidence Assessment prepared by SCT and are discussed below.

Updated Subsidence Assessment Findings

SCT (2019b) prepared an updated Subsidence Assessment (refer to **Appendix 5**) addressing the initial findings and recommendations of the initial peer review report. Updates to the report included:

- Revisions to pillar stability terminology to be consistent with the peer reviewer's recommendation, with a more in-depth discussion on pillar strength calculations and estimates of loading scenarios, under protected overlying panel regions, under panel edges, and under virgin conditions. Further, the assessment of the pillar stability has been considerably expanded. The conclusions in relation to pillar stability remain unchanged.

- Further detailed analysis and discussion of the overlying Bulli Seam pillars has been provided. A new figure (Figure 13 of **Appendix 5**) has been added to show one area of Bulli Seam pillars, adjacent to dykes, that were considered to be marginally stable when inspected in 2013. Furthermore, a discussion has been added in relation to managing the risk of potential instability of these pillars and the possible impact on surface power line structures. The conclusions in relation to Bulli seam pillar instability remain unchanged.

- Elastic compression of the pillars as well as the surrounding strata has been observed in the report.

- A revised program of subsidence monitoring in areas that are not sensitive to surface movements has been recommended. This program would be targeted to confirm the magnitude of subsidence from the proposed first working mining method and provide the opportunity to modify the impact management strategy before proceeding to mine below subsidence sensitive infrastructure, such as transmission lines.

Peer Review Final Conclusions

Following review of the updated Subsidence Assessment (refer to **Appendix 5**), the peer reviewer provided a supplementary report (provided in full in **Appendix 4** of this report). This report concluded that the updates to the subsidence assessment report had adequately addressed the initial peer review findings and recommendations. The following four key points were highlighted and supported by the peer reviewer:

- proposed mining is not expected to result in any significant subsidence impacts on either the surface or sub-surface groundwater regimes
- movement due to previous mining (primarily horizontal) may be ongoing and could cause low-level surface impacts, and will continue, regardless of any proposed future Wongawilli Seam workings
- future differential ground movements may occur if any marginally stable Bulli Seam pillars are destabilised in the vicinity of transmission line pylons
- there is a need for a revised/updated subsidence management plan to be developed and implemented.

The peer reviewer confirmed that the updates to the subsidence report had addressed the following:

- The terminology used for pillar stability has improved. Apart from potentially very localised higher loading concentrations, the overall pillar systems demonstrate an acceptable level of stability using current, conventional strength and stability calculations. It is then accepted that the larger pillars may potentially continue to accept higher levels of load as they deform, resulting in an effectively higher level of overall stability, albeit with further deformation.
- It is accepted that the particularly narrow (12m) pillars only occur as single rows of pillars between regions of wider pillars. As such, they are not required to contribute to regional stability and the surrounding pillars have a demonstrated capacity to carry the full cover load, even if the 12m wide pillars carry no load.
- A copy of the previous Figure 15 from the Appendices has now been brought forward into the main report as Figure 13, to indicate one such location of marginally stable Bulli Seam pillars. Furthermore, a discussion is provided in relation to managing the risk of potential instability of these pillars and the possible impact on surface power line structures.
- The recommended revised subsidence monitoring plan is supported. It is also considered prudent to include some underground pillar system stability monitoring as part of an overall ground control management plan. This could include both assessment of pillar performance as well as some attempt to monitor loading conditions as some of the initial panels are formed under overlying goaf areas, and near goaf edges.

To conclude, the peer reviewer confirmed that the conclusions reached in the updated subsidence report are considered appropriate and valid.

Subsidence Management and Monitoring Commitments

WCL has committed to reviewing and updating the subsidence monitoring program based on the significantly lower levels of surface subsidence anticipated for the proposed first workings mining method compared to longwall mining. The monitoring program will be targeted to confirm the magnitude of subsidence from the proposed first working mining method and provide the opportunity to modify the impact management strategy before proceeding to mining below subsidence sensitive infrastructure.

In addition, in accordance with the recommendations of the peer reviewer, a new Subsidence Monitoring and Management Plan (or equivalent) will be prepared for the Revised Preferred Project within 3 months of approval. This plan will include a program of underground pillar stability monitoring as recommended by the peer reviewer.

4.5.2 Water Resources

Further information is required with regards to how the predicted annual (cumulative) take of approximately 10ML/year of stream baseflow and leakage from Cataract Creek and the upper Cataract River catchments will be achieved.

WCL has entered into discussions with the Natural Resources Access Regulator (NRAR) regarding surface water licencing. NRAR has advised that all trading options should be thoroughly investigated and exhausted before any other mechanisms are considered.

WCL is currently investigating trading options to acquire sufficient surface water entitlements to account for predicted levels of depressurisation from both historical mining operations and the Revised Preferred Project. In the event that sufficient entitlement cannot be acquired via trading options, WCL will consider a range of alternative mechanisms in consultation with the Natural Resources Access Regulator, including:

- offset via apportionment from current groundwater entitlements
- offset of surface water basic landholder right for harvestable rights from WCL Freehold land within the water sharing plan
- direct controlled allocation by the Department/ Minister of additional entitlement from the MZ under Section 65 of the *Water Management Act 2000*
- other mechanism to be determined in consultation with NRAR.

Further details should be provided about the quantity of reject materials to be emplaced underground and the potential associated impacts on groundwater water quality

The Revised Preferred Project is proposed to produce up to approximately 200,000 tonnes of reject material per annum. The reject is proposed to be either emplaced underground in disused workings or marketed for beneficial use.

A sampling and geochemical testing program was completed across a range of representative lithologies within the existing reject emplacement area. The program sought to determine the acid generating potential of the range of rejects typically produced by Russell Vale Colliery. The findings of the sampling program have been reported by WCL in a Reject Geochemical Review provided as **Appendix 9**.

The results of the Acid Base Account (ABA) tests indicate that all reject emplacement area samples tested are likely to be non-acid forming (NAF) and have a high factor of safety with respect to potential acid generation. All reject emplacement area samples have negligible total sulphur content and a moderate acid neutralising capacity (ANC).

In general, the reject emplacement area samples can be regarded as NAF and containing excess ANC that will provide a buffer against acidification.

The metal concentrations in the reject material are unlikely to present any environmental issues from heavy metals or the generation of saline runoff. The reject material impact on the quality of surface water and groundwater is expected to be low.

The reject material is capable of meeting the EPA standards for beneficial use.

Once the mine moves into production, subject to approval, the reject material will be further tested for Acid Base Account parameters on a 6 monthly basis. Rejects generated will also be tested in accordance with the EPA's Coal Washery Reject Order 2014 in order to be able to market the reject material for beneficial reuse applications.

It is also noted in **Appendix 9**, that previous testing indicates that coal from the Wongawilli Seam at Russell Vale Colliery has a low inherent spontaneous combustion potential.

WaterNSW considers that the project would not have any significant impacts on water quantity and has the potential to achieve a neutral or beneficial effect (NorBE) on water quality, subject to:

- **the provision of sufficient additional information**
- **the imposition of performance measures for Cataract Creek, Cataract River, Bellambi Creek, Cataract Reservoir and upland swamps overlying the mining area (see WaterNSW's suggested measures in Attachment 1)**
- **a requirement that the mining company does not cause any exceedances of the performance measures, and**
- **requirements for a range of monitoring and management plans for subsidence, surface water, groundwater and upland swamps**

WCL has committed to the review and update of all existing operations environmental management plans and monitoring networks (where necessary) to reflect the Revised Preferred Project approval requirements, should the project be approved. This process will be undertaken in consultation with relevant agencies, including WaterNSW, NRAR, and DPIE.

Each environmental management plan will include (where relevant):

- detailed baseline data
- a description of:
    - 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 project or any management measures

- a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria
- a program to monitor and report on the:
  - impacts and environmental performance of the project
  - effectiveness of any management measures
- a contingency plan to manage any unpredicted impacts and their consequences
- a program to investigate and implement ways to improve the environmental performance of the project over time
- a protocol for managing and reporting any:
  - incidents
  - complaints
  - non-compliances with statutory requirements
  - exceedances of the impact assessment criteria and/or performance criteria
- a protocol for periodic review of the plan.

WCL will consult with WaterNSW as part of the review and update of the Russell Vale East Water Management Plan to ensure the performance measures, monitoring program and contingency plan adequately address WaterNSW requirements.

4.5.3 Master Agreement

Update on the status of the agreement given the change in mine ownership. WaterNSW requires that such an agreement is established, which should provide firm guarantees and requirements of a security deposit

The conditions of WCL's various mining leases require the following (or similar) in relation to mining within the Catchment Areas, being the Upper Nepean and Metropolitan Special Area:

> *(c) The lease holder must enter into and hold a current agreement or agreements with the Sydney Catchment Authority whilst undertaking mining operations within the Upper Nepean River Catchment Area and Metropolitan Special Area that addresses but is not limited to the following:*
>
> *(i) Compensation*
>
> *(ii) Landholder consent*
>
> *(iii) Protection of SCA assets and infrastructure*
>
> *(iv) Indemnity for loss and damage*
>
> *(v) Protection of the surface of catchment area*
>
> *(vi) Giving and maintaining of security.*

A Master Agreement dated 22 July 2005 is in place that was executed by Gujarat NRE and the SCA.

WaterNSW has requested that the 2005 Master Agreement be updated and WCL has commenced discussions and negotiations with WaterNSW to put in place a mutually agreeable Master Agreement to cover the conditions of the Mining Leases related to mining within the water catchment.

4.5.4 Stakeholder Engagement

WaterNSW requests to remain a stakeholder for the proposal and any updates to the relevant plans

WCL commits to reviewing and updating the existing Russell Vale East Water Management Plan in consultation with WaterNSW and DPIE for the Revised Preferred Project. WCL will continue to consult with WaterNSW on all relevant matters as required.

4.6 Biodiversity and Conservation Division – Environment, Energy and Science

4.6.1 Biodiversity

On the basis of the proposed first workings only mining technique, our concerns regarding subsidence impacts upon Coastal Upland Swamp threatened ecological community and significant streams to be undermined by longwall mining have been addressed based on negligible predicted impacts

Noted.

We support ongoing subsidence monitoring, as suggested in the revised PPR and supporting biodiversity assessment (Biosis, 2019), to confirm that predicted imperceptible subsidence impacts to undermined swamps will occur throughout the life of the project. We remain available to discuss conditions of project approval for this or any other relevant mitigation measure as required

WCL currently manages and monitors impacts to biodiversity values in accordance with their Biodiversity Management Plan (2018) and Upland Swamp Management Plan (2015). The existing Biodiversity Management Plan and Upland Swamp Management Plan will be reviewed and updated to reflect the Revised Preferred Project and any associated management and monitoring measures.

Given that no perceptible subsidence impacts are predicted to occur as a result of the Revised Preferred Project, monitoring of potential biodiversity impacts will be focussed on subsidence impacts as well as primary impacts to groundwater systems associated with upland swamps, and surface water flow and quality in creeks. This will include:

- continued subsidence monitoring along existing subsidence monitoring lines, and extension of the program to include relevant monitoring for areas within the Revised Preferred Project first workings mine plan
- visual inspection of the rock formation that forms the base of upland swamps CCUS4, CCUS5, CCUS10, BCUS4 and BCUS6 during routine monitoring
- monitoring of groundwater levels and water quality in upland swamps using the existing network of shallow groundwater piezometers

- continued monitoring of surface outflow monitoring in upland swamp CCUS4 using the existing box weir (site CT3a)

- monitoring of surface water levels and water quality in Cataract Creek and tributaries using the network of existing sites.

- If subsidence impacts and/or primary impacts in excess of those predicted are detected, the monitoring program will be reassessed.

WCL will consult with the Biodiversity and Conservation Division as part of the process to review and update the Biodiversity Management Plan and Upland Swamp Management Plan to reflect the Revised Preferred Project and associated management and monitoring measures.

4.6.2 Aboriginal Cultural Heritage

The applicant should provide an Aboriginal cultural heritage impact assessment that addresses our comments...

...The applicant should clarify how the previous Aboriginal cultural heritage survey effort and heritage assessment relates to the current UEP. Additional survey may be required if some areas of the UEP have not previously been included in an Aboriginal cultural heritage assessment.

To clarify the adequacy of the Aboriginal heritage assessment, we recommend that applicant provide:

- **An overlay of the recorded Aboriginal cultural heritage sites and UEP mine plan.**
- **An overlay of Aboriginal cultural heritage survey transects in relation to the UEP min plan.**
- **An updated AHIMS site search given the time since the previous assessments.**
- **An updated impact assessment based on this information.**

The assessment could also be improved by the applicant providing examples of similar cultural heritage sites above mines that have used the proposed extraction technique.

Several Aboriginal heritage sites have been previously identified within the UEP Application Area. These sites are mainly associated with rock shelters in sandstone cliff formations and grinding groove sites on upland sandstone outcrops (Biosis 2013a). An updated Aboriginal Heritage Information Management System (AHIMS) search was completed on 22 November 2019. The results of this search are shown on **Figure 4.1** and summarised in **Table 4.2**.

umwelt

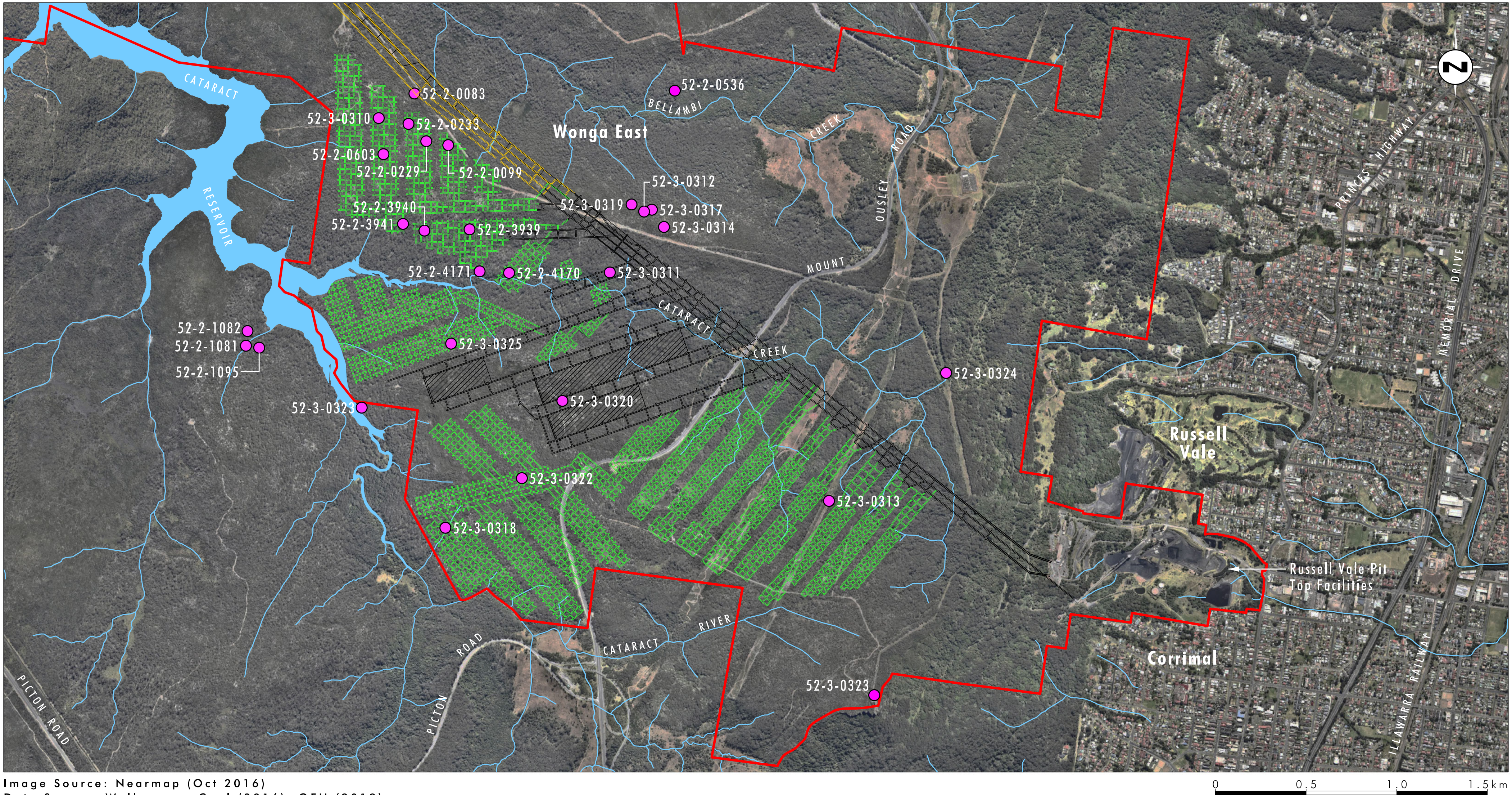


Image Source: Nearmap (Oct 2016)
Data Source: Wollongong Coal (2016), OEH (2019)

Legend
- UEP Project Application Area
- Approved Wonga Central Development Mains
- Proposed Wongawilli Seam Workings
- Existing Wongawilli Seam Workings
- AHIMS Registered Cultural Heritage Site

FIGURE 4.1

Aboriginal Cultural Heritage Items

File Name (A4): R13/3687_090.dgn
20191129 11.45

Table 4.2 AHIMS Sites within Wonga East

Site	Name	Context	Site Type
52-2-0083	Bulli Mine Shaft Site 7	Enclosed Shelter	Shelter with Deposit
52-2-0099	Bulli Mine Shaft Site 8	Open Site	Axe grinding grooves
52-2-0229	Bulli Mine Shaft Site 12	Open Site	Axe grinding grooves
52-2-0233	Bulli Mine Shaft Site 13	Open Site	Axe grinding grooves
52-2-0603	Bulli Mine Shaft Site 19	Enclosed Shelter	Shelter with Art and Artefact
52-2-3939	Wonga East 1	Open Site	Shelter with Deposit
52-2-3940	Wonga East 2	Open Site	Shelter with Deposit
52-2-3941	Wonga East 3	Open Site	Shelter with Deposit
52-2-4170	Wonga East 4	Open Site	Shelter with Deposit
52-2-4171	Wonga East 5	Open Site	Shelter with Stone Arrangement
52-2-0536	Bulli Mine Shaft Site 17	Enclosed Shelter	Shelter with Deposit
52-3-0310	Bulli Mine Shaft Site 18	Enclosed Shelter	Shelter with Art, Deposit and axe grinding grooves
52-3-0311	Bulli Mine Shaft Site 20	Enclosed Shelter	Shelter with Deposit
52-3-0312	Bulli Mine Shaft Site 23	Enclosed Shelter	Shelter with Deposit
52-3-0313	Bulli Mine Shaft Site 29	Open Site	Open Camp Site
52-3-0314	Bulli Mine Shaft Site 21	Enclosed Shelter	Shelter with Art
52-3-0317	Bulli Mine Shaft Site 22	Enclosed Shelter	Shelter with Deposit
52-3-0318	Bulli Mine Shaft Site 30	Enclosed Shelter	Shelter with Art
52-3-0319	Bulli Mine Shaft Site 24	Enclosed Shelter	Shelter with Deposit
52-3-0320	Bulli Mine Shaft Site 25	Open Site	Axe grinding grooves
52-3-0322	Bulli Mine Shaft Site 31	Open Site	Axe grinding grooves
52-3-0323	Bulli Mine Shaft Site 26	Enclosed Shelter	Shelter with Deposit
52-2-1147	Bulli Mine Shaft Site 32	Open Site	Open Camp Site
52-3-0325	Bulli Mine Shaft Site 27	Enclosed Shelter	Shelter with Art and Deposit
52-3-0324	Bulli Mine Shaft Site 28	Open Site	Open Camp Site

As outlined in the Revised Preferred Project Report, the proposed first workings are not predicted to result in any perceptible subsidence at the surface or cause perceptible impacts to any natural surface features, including Aboriginal heritage sites.

Further, no additional disturbance at the Pit Top is proposed, beyond that currently disturbed and approved for development. The Revised Preferred Project is therefore not predicted to result in any impacts to Aboriginal cultural heritage.

On the basis that the Revised Preferred Project will not result in any perceptible impacts to any natural surface features, including Aboriginal heritage sites and is therefore not predicted to result in any impacts to Aboriginal cultural heritage, an Aboriginal cultural heritage assessment of the Revised Preferred Project is not considered warranted.

It is noted that an Aboriginal cultural heritage assessment was undertaken for the original and previously proposed Preferred Project by ERM (2012) and Biosis (2013a). These assessments were undertaken on the basis that subsidence associated with the previously proposed longwall mine plans had the potential to impact on Aboriginal cultural heritage. This is not the case for the Revised Preferred Project first workings mine plan, which, as noted above, is not expected to result in perceptible subsidence or cause perceptible impacts to any natural surface features, including Aboriginal heritage sites.

These subsidence assessment findings have been confirmed by way of a peer review process (refer to **Appendix 4**).

The subsidence assessment report …refers to previous impacts from extraction of the Bulli Seam on one rock shelter site. The applicant should clarify which site is being referred to in this statement

SCT advise that the shelter site referred to as having been impacted by instability to the associated sandstone overhang, either as a result of previous mining in the Bulli Seam or as a result of tree root invasion and natural erosion processes, is site 52-2-3941. The location of site 52-2-3941 is shown on **Figure 4.1**.

The impacts to this site were described in SCT (2014) prepared to assess the impacts of longwall mining proposed by the previous Preferred Project. SCT (2014) states:

> *Site 52-2-3941 is part of a 3-4m high cliff formation that been previously involved in a rock fall. The overhang that constitutes the site is located below a detached boulder and has an overhang of approximately 4m. Figure 33 shows a photograph of the site including the fractured rock strata where the boulder has detached from the general cliff formation.*
>
> *There are several characteristics of the rock fall that indicate it is likely to have been associated with mining in the Bulli Seam more than 50 years ago. The site is estimated to have previously experienced approximately 0.2m of subsidence with horizontal compression of about 0.1m.*
>
> …

Figure 33: Photograph of Archaeological Site 52-2-3941.

Plate 4.1 Photograph of Archaeological Site 52-2-3941 (SCT 2014)

As outlined above, the proposed first workings are predicted to result in imperceptible subsidence and are not expected to cause perceptible impacts to any natural surface features, including Aboriginal heritage sites.

Baseline archaeological recording should occur for rock art, rock shelter and grinding grooves sites. Without this information it will be impossible to effectively monitor the impact of the mining on the Aboriginal cultural heritage sites. AHIMS site cards should be updated with the updated baseline recordings.

Baseline archaeological recording and ongoing monitoring of known Aboriginal cultural heritage sites will be considered as part of the updates to the existing Heritage Management Plan (or if required as a condition of approval, a specific Aboriginal Cultural Heritage Management Plan).

Aboriginal community consultation specific to the current UEP is required.

...Updated Aboriginal community consultation records and outcomes should be provided. If consultation has not been continuous, the applicant may need to restart the formal consultation. The Aboriginal community must be provided an opportunity to contribute to the proposed Aboriginal heritage management. We recommend the consultation follow the Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010 guideline.

On the basis that the Revised Preferred Project will not result in any perceptible impacts to any natural surface features, including Aboriginal heritage sites and is therefore not predicted to result in any impacts to Aboriginal cultural heritage, an Aboriginal cultural heritage assessment of the Revised Preferred Project, including associated Aboriginal community consultation, is not considered warranted.

WCL has committed to the review and update of all existing environmental management plans and monitoring networks (where necessary) to reflect the Revised Preferred Project approval requirements, should the Project be approved. As part of this process, updates to the existing Heritage Management Plan (or if required as a condition of approval, a specific Aboriginal Cultural Heritage Management Plan) will be prepared in consultation with the Aboriginal community. Any ongoing consultation with the Aboriginal community will be undertaken in accordance with the Aboriginal cultural heritage consultation requirements for proponents 2010 (DECCW 2010).

Should the project be approved, we recommend that the project approval:

- **Specify that harm to Aboriginal objects is not permitted (reflecting the predicted negligible Aboriginal heritage impacts).**
- **Require that an Aboriginal Heritage Management Plan (AHMP) is prepared before the underground mining commences.**
- **Require Aboriginal community consultation to follow the Aboriginal cultural heritage consultation requirements for proponents 2010 (DECCW 2010), which is available on our website.**

As outlined above, there is no predicted impact to Aboriginal heritage sites or objects as a result of the Revised Preferred Project.

Russell Vale Colliery has an existing Heritage Management Plan but does not currently have a requirement for a specific Aboriginal Cultural Heritage Management Plan (ACMP). WCL will update to the existing Heritage Management Plan (or if required as a condition of approval, prepare a specific Aboriginal Cultural Heritage Management Plan) in consultation with the Aboriginal community, should the Revised Preferred Project be approved.

Any ongoing consultation with the Aboriginal community will be undertaken in accordance with the Aboriginal cultural heritage consultation requirements for proponents 2010 (DECCW 2010).

4.6.3 Water Resources

The revised PPR (Umwelt 2019) provides reference to the Bellambi Gully Flood Assessment (Engeny, 2018), which outlines an approach to manage surface water at the site. This approach was previously reviewed by OEH (now DPIE's Environment Energy & Science group) as part of the MP10_0046 MOD 4 application, and understood to have been determined adequate in minimising adverse impacts to water quality and flooding to Bellambi Creek and downstream residents.

Noted.

Although the Engeny (2018) approach was an alternative to the approved Cardno (2015) approach, none of the major elements from any approaches have yet been implemented. As such the development continues to present a risk to the downstream community and environment as experienced in the August 1998 flood event, which resulted in significant downstream flooding and water quality impacts.
Should the Underground Expansion Project (UEP) be approved, it is recommended that it be conditioned in such a way that ensures adequate measures are put in place to reduce the impacts the development has on downstream flooding and water quality. The development conditions should embrace requirements of Wollongong City Council on flood risk management and the EPA on water quality for suitable stormwater and flood risk management measures that reduces off site impacts.

WCL is currently seeking approval modify the existing Preliminary Works Project (PA 10_0046 Modification 4) to retain the existing Bellambi Gully Diversion Pipeline to divert upslope runoff from the Bellambi Gully catchment through the site to the downstream creek as originally identified in the Bellambi Gully Flood Study (Cardno, 2015) and further refined by recent more detailed investigations by Engeny (2018).

Improvements proposed to the WMS under Modification 4 will involve upgrades and formalisation of drains as well as improvements to maintenance practices. In summary, these improvements will include:

- Construction of a levee upstream of the stockpile area to minimise clean water runoff entering the stockpile and laydown areas from upslope drainage systems.
- Extending the existing noise bund on the northern side of the Pit Top approximately 35 m to the west to reduce the volume of upslope runoff entering the stockpile area.
- Minor regrading of the laydown area to convey flows to the east and limit spilling to Bellambi Lane.
- The laydown area east of the current truck wash will be utilised as a dry detention basin with a low flow channel conveying overflows to the SWCD.
- Construction of a low flow channel from the Dry Detention Basin to allow ponded water to spill to the SWCD and minimise flows to Bellambi Lane when the capacity of the pipes to Dam 1 and Dam 2 are exceeded.
- Construct easy-to-maintain debris control structures at the Bellambi Gully Creek diversion pipe inlets.
- Measures to control and manage turbid water ingress to the Bellambi Gully Diversion Pipeline and manage pipeline loading/capacity.
- The existing and proposed flow control structures will be included in regular maintenance schedules.

The proposed improvements to the WMS reduce the quantity of clean catchment runoff entering the Pit Top WMS and reduce the volume of stormwater draining into the dirty water management system. The outcome of the proposed improvements includes an improvement in the quality of water leaving the site during high rainfall events and reduced flood impacts to downstream properties.

Further, the pre-treatment of inflows to Dam 1 and changes to the management of water seeping through the SWCD wall will improve the operation and outflows for the dirty water system. In addition, regular and programmed inspection as well as clearing of debris control structures is proposed to optimise performance.

As committed to in the Revised Preferred Project Report, WCL will implement the upgrades to the existing Water Management System as proposed in the Bellambi Gully Flood Assessment (Engeny, 2018), Response to Submissions for Modification 4 (Umwelt, 2018), Further Response to Submissions for Modification 4 (Umwelt, 2019) and additional information provided to DPIE on 14 November 2019, in accordance with the timing requirements established under MOD4.

4.7 Wollongong City Council

4.7.1 Water Resources

Council is concerned about the loss of water to reservoirs due to mining activities. Council does not want to see any further water losses to reservoirs, creeks and upland swamps as a result of mining activities. **Council requests that the revised preferred project for Russell Vale Colliery be considered by the Independent Expert Panel for Mining in the Catchment, as a precautionary peer review measure, before any approval recommendation is made by the Department to the Independent Planning Commission.** **The Independent Expert Panel for Mining in the Catchment should review the proposal's potential impact upon the quantity and quality of water available in the catchment for drinking water supplies and for upland swamps. Further, the Panel is requested to consider the cumulative impact that the proposed Russell Vale coal mine and other coal mines have on drinking water supplies and the health of upland swamps in the Greater Sydney Water Catchment Special Areas**

As discussed in **Section 3.5**, the IEPMC released the *Report of the Independent Expert Panel for Mining in the Catchment: Part 2* Report (Part 2 Report) on 31 October 2019. The Part 2 Report addresses Term of Reference 2, which has a focus on the impacts of mining in the Greater Sydney Water Catchment Special Areas on water quantity and swamps, including cumulative impacts, and a requirement to review and update relevant findings of the 2008 SCI.

The Part 2 Report also provides a number of conclusions and recommendations from the IEPMC. **Table 3.2** in **Section 3.5** provides the recommendations from the IEPMC with a response in relation to the Revised Preferred Project. In summary, the commitment to a first workings only mine plan for the Revised Preferred Project, and the conduct of detailed subsidence and groundwater peer review processes, together with WCL's commitment to future management and monitoring actions, fully address the recommendations from the IEPMC.

4.7.2 Noise

The Umwelt report indicates that only negligible (1-2d8) exceedances predicted at surrounding residences will occur for a small percentage (less than 10%) of winter nights. This scenario is considered acceptable from Council's perspective provided that these pit top noise control measures are included as conditions of the project approval (if the project is ultimately recommended for approval by the Department and the Independent Planning Commission).

Noted. Implementation of the proposed Pit Top noise mitigation measures form part of Statement of Commitments for the Revised Preferred Project (refer to Section 6.0 of the Revised Preferred Project Report) and will therefore form part of any future approval.

4.7.3 Reject Material

An appropriate condition be provided on any approval stating that under no circumstances is coal reject material to be deposited upon the former Russell Vale Colliery Emplacement Area (should the project ultimately be approved).

WCL confirms that emplacement of reject or waste rock material on the Russell Vale Emplacement Area is not proposed as part of the Revised Preferred Project. WCL accepts Wollongong Council's proposed condition, should the Revised Preferred Project be approved.

4.7.4 Traffic and Transport

A condition of approval be imposed which requires Wollongong Coal to obtain special one-off written clearances from the Department to undertake any coal transporting between the hours of 6.00 pm to 10.00 pm Mondays to Fridays. Any such request by Wollongong Coal would need to demonstrate as to why the variation to the normal hours of coal transport is necessary and appropriate, in the circumstances

Coal transportation between the hours of 6.00pm and 10.00pm Mondays to Fridays would only be required in response to unforeseen circumstances. Such unforeseen circumstances are likely to arise at short notice and require prompt response from WCL, which makes obtaining a written clearance from the Department impracticable.

The assessment of impacts shows relevant criteria can be achieved for operations between 6.00pm and 10.00pm Monday to Friday and that these operations are unlikely to result in a significant adverse impact, therefore approval is sought to undertake these activities without further specific one-off approval.

WCL commits to advising DPIE and Wollongong City Council via email prior to any instances of coal transportation being required between the hours of 6.00pm and 10.00pm Mondays to Fridays. Additionally, WCL commits to notifying the community of any instances as early as practicable prior to such operations commencing. Community notifications will be via both the WCL website and by email to the CCC. In addition, WCL will provide opportunity for the local community to register an interest in being notified directly by email.

It is noted Wollongong Coal will seek to reach agreement with Council within 12 months of the project approval for a road maintenance contribution for the maintenance of Bellambi Lane. This arrangement is considered acceptable and hence, Council requests that a condition be imposed dealing with this statement of commitment that Wollongong Coal seek to reach agreement with Council within this 12 month timeframe (should the project ultimately be approved).

WCL accepts a condition that requires WCL to seek to reach agreement with Council for a road maintenance contribution for the maintenance of Bellambi Lane within 12 months of any project approval, should the Revised Preferred Project be approved.

WCL has commenced discussions directly with Wollongong City Council regarding road contributions.

4.8 Wollondilly Shire Council

It is noted that while the UEP Application Area incorporates land within both Wollondilly Shire Council and Wollongong City Council local government areas, all of the Revised Preferred Project mining area and the Pit Top facilities are located within the Wollongong City Council local government area.

4.8.1 Economics

The proposed expansion of the Russell Vale Colliery Project is considered unlikely to result in direct economic benefits to Wollondilly or social implications given the isolation of the Project Area and its proximity to Wollongong. However, the Application is likely to result in indirect benefits that can be identified from modelling within the document "Community Demographic Resources for Wollondilly Shire Council" which calculates economic benefits for the Wollondilly LGA based on the direct employment of a particular Project

An Economic Impact Assessment (EIA) was completed for the Revised Preferred Project (Appendix 10 of the Revised Preferred Project Report) in accordance with:

- *Guidelines for the economic assessment of mining and coal seam gas proposals* (NSW Government 2015) (the Guidelines)

- *Technical Notes supporting the guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals* (the Technical Notes).

The assessment is based on a Cost Benefit Analysis (CBA) and a Local Effects Analysis (LEA), estimating the net benefits of the Revised Preferred Project to the State and the local benefits to the Wollongong region.

The overall finding of the CBA is that the Revised Preferred Project is estimated to contribute a total net economic benefit for the NSW community of approximately $174.3 million in net present value (NPV) (i.e. how much a future sum of money is worth today). This is comprised of $116.9 million and $57.5 million in direct and indirect benefits respectively.

The benefits for NSW in present value terms are estimated to exceed the costs of the Project borne by NSW. Each estimate is measured in NPV terms, calculated using a 7 % real discount rate, in 2019 price terms, calculated over the period 2020 to 2025.

Consistent with the Guidelines, the indirect benefits of the UEP accrue to workers, suppliers and landowners.

The analysis shows that the total indirect benefits are estimated at $57.4 million and consists of:

- worker benefits are predicted to amount to $43.6 million in NPV terms, over the life of the Revised Preferred Project

- supplier benefits are predicted to amount to $13.8 million in NPV terms

- no expected benefits to landowners.

4.8.2 Water Resources

The Wollondilly LGA receives its water supply directly from Avon and Cataract Dams located within a section of the Drinking Catchment Area. The potential adverse implications to this water supply from water loss as a consequence of mine induced fracturing is consequently viewed as being a potential impact of the Project. The PPR however would not appear to have investigated potential long-term associated social and economic implications of any such reduction in supply to consumers. This issue has implications for the adequate servicing of current and future Development applications received by Council as well as servicing Growth Areas that includes Wilton and Appin within the Wollondilly LGA that are projected to involve approximately 50,000 residents. The DPIE is requested to note in relation to this matter that Council resolved, (in part), at its meeting on 18th August that "Council write to the NSW Minister for Planning highlighting the challenges of water conservation in our area and request this be considered in relation to growth in our region".

Unlike longwall mining, first workings mining methods proposed for the Revised Preferred Project are designed to support the roof strata above the coal seam using pillars of coal that provide stability to the seam void in the long term. The roof strata do not sag or collapse as in longwall mining. Consequently, the fracture zone that forms in the strata above a coal seam following longwall mining, and that can result in hydraulic connection to aquifers or surface water above the seam, is not present for first workings.

The Subsidence Assessment prepared for the Revised Preferred Project (Appendix 1 of the Revised Preferred Project Report) concludes that the proposed mining is not expected to increase interactions between the mine and surface water or groundwater at levels above those currently experienced. There is no significant potential for additional interaction between surface water, groundwater and the underground mining horizons as a result of the Revised Preferred Project.

The subsidence assessment concluded that the subsidence movements forecast for the Revised Preferred Project are not expected to cause any significant impacts to natural surface features within the UEP Application Area, including the Cataract Reservoir.

Previous subsidence assessments were undertaken on the risks to the stored waters of Cataract Reservoir in relation to the Corrimal Fault and Dyke D8. The assessments found that there is no credible risk of inflow between the stored waters of Cataract Reservoir and the mining horizons through either the Corrimal Fault or Dyke D8 as a result of the proposed UEP-PPR mining layout for longwall extraction. Longwall mining is no longer proposed as part of the Revised Preferred Project. Any effects from mining first workings roadways in the Wongawilli Seam are expected to be generally limited to a few metres around the proposed roadways. No significant subsidence impacts or environmental consequences are expected from mining through or in the vicinity of the Corrimal Fault and Dyke D8 by the proposed first workings layout. The likelihood of impacts to the Corrimal Fault is considered to be very low. The consequences of any impacts to the Corrimal fault are expected to be negligible. Any impacts on groundwater are expected to be limited to the immediate vicinity of the Wongawilli Seam and only in the area of the proposed mining.

Furthermore, the peer review of the subsidence assessment (refer to **Appendix 4**) indicates that there is no credible risk of water flow along major structures from Cataract Reservoir as a result of the proposed first workings in the Wongawilli Seam.

There is a range of generic descriptions in Specialist reports including "As the revised Project will not result in any change to the contributing receiving water catchment area, and will result in an improvement to the discharge water quality from the Surface Facilities, no negative cumulative impacts are considered likely as a result of the revised Project".

The quote used by Wollondilly Shire Council is part of a conclusion of the surface water assessment in relation to cumulative impacts of the Revised Preferred Project. The full paragraph states:

The receiving waters downstream of the Pit Top have historically been impacted by the presence of the Russell Vale Colliery as well as urban development. As the Revised Preferred Project will not result in any change to the contributing receiving water catchment area, and will result in an improvement to the discharge water quality from the Pit Top, no negative cumulative impacts are considered likely as a result of the Revised Preferred Project when compared to the existing care and maintenance scenario.

It is important to note that this conclusion relies on the full assessment presented in the surface water assessment including consideration of:

- catchment areas and annual flow volumes
- flooding
- downstream water quality
- geomorphological and hydrological values
- riparian and ecological values and watercourses
- water users.

The conclusion is considered specific to the Revised Preferred Project in relation to the outcomes of the surface water assessment. It is also noted that the outcomes of the surface water assessment account for the proposed management and mitigation measures committed to by WCL.

There is insufficient detail of potential impacts to water sources which are listed in the Surface Water specialist report.

A detailed surface water assessment was completed for the Revised Preferred Project (refer to Appendix 3 of the Revised Preferred Project Report). The surface water assessment for the Preferred Revised Project identified the following key aspects of the Revised Preferred Project that have the potential to impact on surface water resources:

- impacts to catchment areas and downstream watercourses
- impacts to flooding, including flow rates, velocities and depths
- impacts to water quality in downstream watercourses.

Furthermore, the key aspects listed above have the potential to impact on the following surface water characteristics:

- flow volumes in downstream watercourses
- flooding, including flow rates, velocities and depths

- water quality in downstream watercourses
- geomorphological and hydrological values of watercourses, including environmental flows
- riparian and ecological values of watercourses, and
- water users, both in the vicinity and downstream of the Surface Facilities.

An assessment of these potential impacts was undertaken for the Revised Preferred Project and are reported in the surface water assessment.

There is insufficient assessment of potential impacts that may occur in the sections of the Project Area where there is identified potential for the collapse of installed pillars. The PPR is noted to state in relation to this matter that this could result in subsidence of 1 to 2 metres (with resulting fracturing extending towards the surface).

As discussed in the Subsidence Assessment (Appendix 1 of the Revised Preferred Project Report), the proposed mining in the Wongawilli Seam is not expected to cause any significant instability of pillars in the overlying seams, including areas of identified marginally stable pillars in the Bulli Seam.

This conclusion has been confirmed by the subsidence peer review process, whereby the peer reviewer agrees the proposed mining is not expected to have any significant impact on the stability of pillars in the overlying seams. The peer reviewer has recommended that a program of pillar stability monitoring be included as part of the revised subsidence monitoring program to be prepared for the Revised Preferred Project. WCL has agreed to this recommendation and included this as an additional commitment in **Section 6.0**.

The statement that the Project is "not expected to result in perceptible surface subsidence or significant interaction with existing groundwater systems" is questioned based on the above identified concerns. It is therefore considered warranted that the Precautionary Principle be applied to assume that the First Workings approach has the potential to impact surface and groundwater sources over both a short and long timeframe.

Environmental assessment involves the prediction of potential environmental outcomes of a development. The precautionary principle reinforces the need to take risk and uncertainty into account, especially in relation to threats of irreversible environmental damage.

The Revised Preferred Project has been designed to address the residual risk and uncertainty regarding subsidence predictions, geotechnical constraints and potential impacts on groundwater, surface water and biodiversity that was associated with longwall mining.

The Precautionary Principle has been applied to the assessment of the Revised Preferred Project through:

- careful project design aimed at reducing uncertainty in impact predictions
- identification of the potential impacts and the likelihood and consequences of these impacts
- identification of management and mitigation measures that are designed to address the potential environmental impacts of the Revised Preferred Project
- implementation of monitoring and reporting mechanisms for the project.

Detailed subsidence, groundwater and surface water assessments have been completed for the Revised Preferred Project. Subsidence and groundwater assessment findings have or are being peer reviewed to confirm that the proposed mining is not expected to cause significant surface subsidence, significant interaction with the overlying seams or significant interaction with existing groundwater systems. Importantly, the proposed mine plan is not considered to have any potential to perceptibly impact natural surface features including upland swamps, cliffs including the Illawarra Escarpment, steep slopes, drainage lines, creeks, Cataract Creek and Cataract Reservoir. This is primarily due to the proposed first workings mining method that has been designed to be long-term stable. Additionally, due to the small magnitude of subsidence effects expected from the proposed mining layout, there is a high level of confidence in the reliability of the subsidence impacts forecast.

Existing monitoring programs will be reviewed and updated based on the significantly lower levels of surface subsidence anticipated for the proposed first workings mining method compared to longwall mining. The ongoing collection and interpretation of the data will be used to update TARP trigger levels as required. Adaptive management procedures will be reviewed and updated as part of the management plan review process in order to ensure a systematic process for continually detecting impacts that deviate from predictions, validating predictions and improving mining operations so that subsidence impacts creating a risk of negative environmental consequences do not occur.

It is further considered warranted that these potential impacts be subject to a detailed environmental assessment in the form of a revised PPR that is publicly exhibited. Staff would expect that this environmental assessment be consistent with the following position of Council expressed in a range of previous submissions (including recently to the Dendrobium Colliery Project) prior to any consideration of Determination:

- **Applications should contain a description of the properties and behaviour of the groundwater environment that is informed by extensive groundwater monitoring and consistent with scientific research.**
- **All potentially affected watercourses should be subject to detailed assessment of likely subsidence induced impacts to surface and groundwaters (including their connectivity), within a catchment context.**
- **Trigger Response Plans and any equivalent Plans should be based on strong scientific knowledge and extensive baseline data.**
- **There should be full rehabilitation of any watercourses impacted by mining operations to their former ecological condition.**

The detailed environmental assessments completed for the Revised Preferred Project have been exhibited as part of the Revised Preferred Project Report which has been publicly exhibited, including detailed groundwater and surface water assessments.

Trigger Response Plans form part of the requirement of contemporary environment management plans. Trigger Response Plans will be updated in consultation with relevant agencies as part of the review and update of management plans for the Revised Preferred Project following any future approval.

The Revised Preferred Project is not considered to have any potential to perceptibly impact natural surface features including upland swamps, drainage lines, creeks, Cataract Creek and Cataract Reservoir, therefore no subsidence remediation/rehabilitation is expected to be required.

WCL notes that the Revised Preferred Project is not associated with the Dendrobium Colliery Project. Both projects should be assessed on their own merits, acknowledging appropriate cumulative groundwater assessment for which further details will be provided in the Part B Response.

4.8.3 Mining Method

Council staff would expect that the PPR consider the Hume Coal Project and that the specialist advice on this Project be considered during the development of any Determination by the DPIE. The apparent absence of reference to the Hume Coal Project and specialist advice within the PPR is therefore noted with strong concern. The DPIE is requested to obtain scientific advice over the relevance of the Hume Coal Project to the proposed First Workings only approach of the Russell Vale Colliery Project Application.

The Revised Preferred Project is not associated with the Hume Coal Project. Both projects should be assessed on their own merits.

The environmental assessments undertaken for each project are specific to the sites including geological context and specific mine design. Assessments are not transferrable to another site, geological setting or mine design. Similarly, while both the Revised Preferred Project and Hume Coal Project propose first working mining methods, the mining systems is different, with the Hume Coal Project proposing the Pine Feather Mining System and the Revised Preferred Project proposing a traditional bord and pillar first workings roadways layout.

Specialist assessments have been prepared for the Revised Preferred Project, taking into consideration the input provided through previous Planning Assessment Commission processes. Peer reviews of key technical studies have also been completed.

4.8.4 Subsidence

There is insufficient assessment of potential impacts that may occur in the sections of the Project Area where there is identified potential for the collapse of installed pillars. The PPR is noted to state in relation to this matter that this could result in subsidence of 1 to 2 metres (with resulting fracturing extending towards the surface).

As discussed in the Subsidence Assessment (Appendix 1 of the Revised Preferred Project Report), the proposed mining in the Wongawilli Seam is not expected to cause any significant instability of pillars in the overlying seams, including areas of identified marginally stable pillars in the Bulli Seam.

This conclusion has been confirmed by the subsidence peer review process, whereby the peer reviewer agrees the proposed mining is not expected to have any significant impact on the stability of pillars in the overlying seams. The peer reviewer has recommended that a program of pillar stability monitoring be included as part of the revised subsidence monitoring program to be prepared for the Revised Preferred Project. WCL has agreed to this recommendation and included this as an additional commitment in **Section 6.0**.

4.8.5 Planning Process

It is considered warranted and requested that the DPIE require the review of the PPR to identify the adequacy of the PPR based on the findings and recommendations of the Hume Coal IPAC Report as well as specialist advice provided on this Project. The DPIE is further requested to note the preferred position of Council Staff that the PPR should be the subject of an investigation by an IPAC and that a Public Hearing be held as part of this process.

The Independent Planning Commission (IPC) will assess and determine the Revised Preferred Project.

4.8.6 Biodiversity

The protection of local koala populations and habitat is of major concern to Council and the local community. It is considered appropriate that this habitat be protected and the PPR identify any potential habitat linkage that exists between the Project Area and known populations to the west near Wilton.

A biodiversity assessment has been prepared for the Preferred Revised Project (Appendix 4 of the Revised Preferred Project Report) which concluded that the Revised Preferred Project is not considered to have any potential to perceptibly impact on natural surface features, including habitat for threatened species. The Revised Preferred Project is considered to have negligible risk of impacting any potential Koala habitat.

The DPIE is requested to provide a commitment/condition in any Determination that requires the preparation of a Biodiversity Management Plan in the event of the proponent identifying that vegetation clearance is necessary. The DPIE is further requested to ensure that this Plan be required to consider any impacts of such clearance on koala habitat in a broad context.

As noted in Section 5.5.3 of the Revised Preferred Project Report, WCL currently manages and monitors impacts to biodiversity values in accordance with their Biodiversity Management Plan (2018) and Upland Swamp Management Plan (2015). The existing Biodiversity Management Plan will be reviewed and updated to reflect the Revised Preferred Project and associated management and monitoring measures.

As outlined in **Section 1.1**, no additional disturbance at the Pit Top is proposed, beyond that currently disturbed and approved for development. Further, as outlined above, the Revised Preferred Project is considered to have negligible risk of impacting any potential Koala habitat.

4.9 Roads and Maritime Service

The key state roads are the Princes Highway and Memorial Drive. **The applicant proposes to continue monitoring and managing the impacts of mine subsidence through the Built Features Management Plan for Mount Ousley Road (and Picton Road Interchange).** **Having regard for the above, RMS will not object to the DA subject to the conditions outlined in Attachment 1 being included in the conditions of development consent.** **RMS highlights that in determining the DA the *Environmental Planning and Assessment Act, 1979*, it is the consent authority's responsibility to consider the environmental impacts of any road works which are ancillary to the development. This includes any works which form part of the proposal and/or any works which are deemed necessary to include as requirements in the conditions of development consent. Depending on the level of environmental assessment undertaken to date and nature of the works, the consent authority may require the developer to undertake further environmental assessment for any ancillary road works.**

Wollongong Coal notes the condition outlined in Attachment 1 of the RMS in relation to reviewing and updating their Subsidence Management Plan for any works which have the potential to cause mine subsidence or compromise RMS infrastructure. It is anticipated that this will be a requirement of any future development consent.

In relation to any road works which are ancillary to the development, Wollongong Coal is not proposing any road works as part of the Project. No further environmental assessment in relation to road works is required.

4.10 Heritage Council of NSW

It is not clear from the submitted documentation if the project would affect the State Heritage Register (SHR) listed item Cataract Dam (SHR 01359). It is noted that the HHA dates to 2013, before the proposal was revised in 2014. Therefore, the HHA report should be revised and the heritage impact assessment updated.

The HHA does not include a site plan showing the proposed mining location in relation to the Cataract Dam SHR curtilage. It is recommended that this is incorporated into the HHA.

It is further recommended that all project works should be located outside the Cataract Dam SHR curtilage with no extraction beneath or within 1km of the SHR curtilage.

The SHR item must be monitored for vibration and subsidence during mining operations. If vibration and subsidence is detected, the area must be rehabilitated, and a report submitted to Heritage outlining the actions taken.

It is noted that 'NRE No 1 Colliery' was previously known as the South Bulli Colliery, which is an 'archaeological site' currently listed on the Wollongong Local Environmental Plan 2009. This site and its management have previously been the subject of a Conservation Management Plan prepared by GML Heritage in 2004. The Umwelt 2019 document has not identified how the amended proposal will or will not affect this locally listed item. It is recommended the HHA be revised to address the changes now proposed that is not clearly addressed in the Umwelt submission. This is relevant given the previous advice from the Heritage Council of NSW which sought to ensure the statement of commitments were adopted to manage this locally significant site (former South Bulli Colliery).

Relevant local councils and state agencies should be invited to comment where heritage items on the LEP and the s.170 Register are being affected. Early collaboration with local councils and relevant state agencies on mitigation impacts to heritage items and heritage landscapes associated with the project is recommended.

A Historic Heritage Assessment was completed in November 2012 for the Underground Expansion Project. The assessment identified a number of items as being present within the UEP Application Area as outlined in **Table 4.3**.

Table 4.3 Previously Identified Heritage Items

Item	Listing
South Bulli Colliery	Wollongong Local Environmental Plan 2009
South Bulli Colliery – 1918 Portal for ventilation	Illawarra Regional Environmental Plan No.1
South Bulli Colliery – Bellambi Creek Dam (Charlesworth's Dam)	Illawarra Regional Environmental Plan No.1
South Bulli Colliery – Concrete base for ball miss at pit top	Illawarra Regional Environmental Plan No.1
South Bulli Colliery – Main portal (S.W. Tunnel 1887)	Illawarra Regional Environmental Plan No.1
South Bulli Colliery – Mines office (former)	Illawarra Regional Environmental Plan No.1
South Bulli Colliery – Old washery (1960)	Illawarra Regional Environmental Plan No.1
South Bulli Colliery – Signal Box	Illawarra Regional Environmental Plan No.1
Cataract Dam	State Heritage Register Wollondilly Local Environmental Plan 2011
Illawarra Escarpment	Register of National Estate NSW National Trust Register

A search undertaken on 11 October 2019 identified no additional listed items or places within the UEP Application Area.

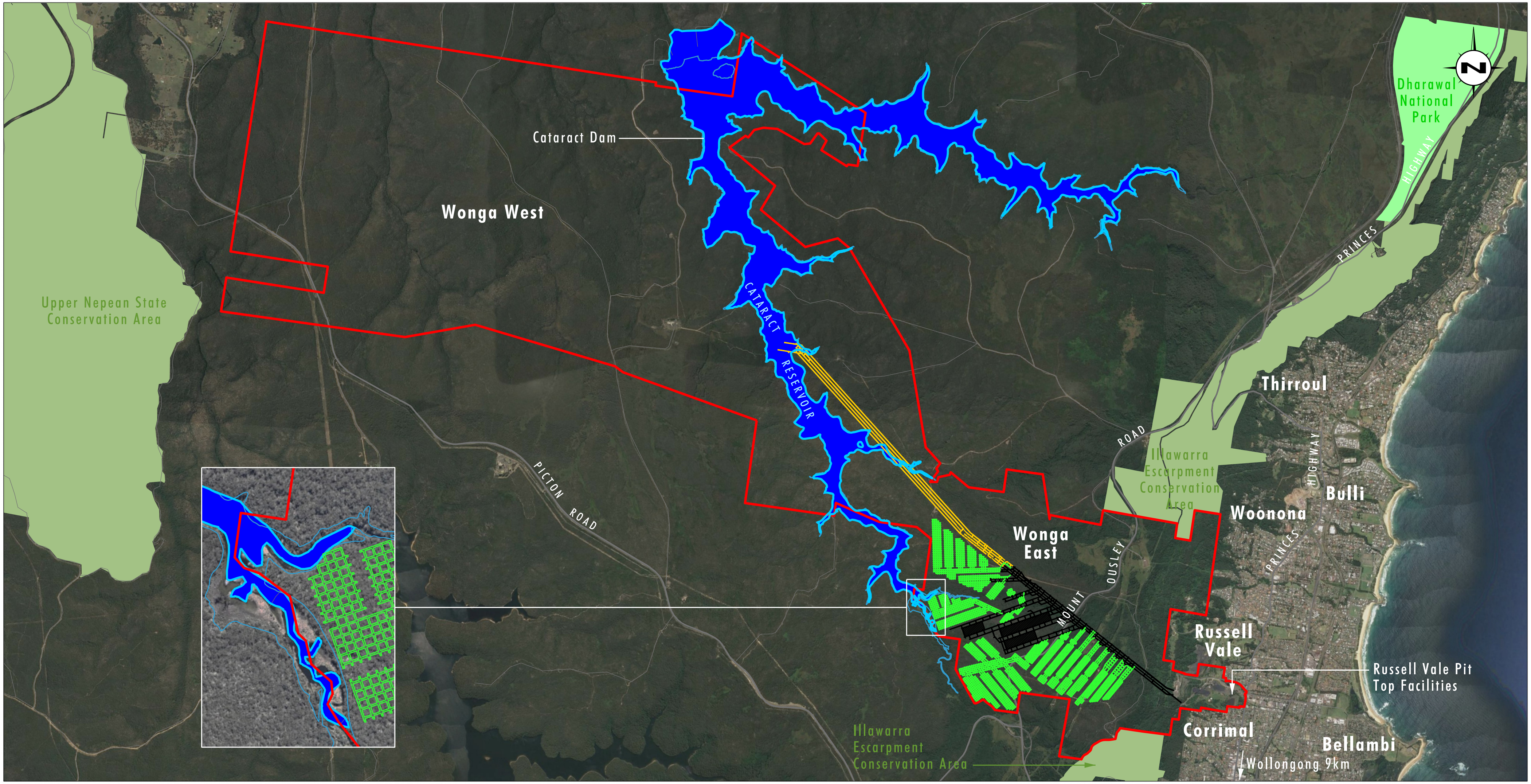
The previous Historic Heritage Assessment (2012) concluded that that Preferred Project would not impact on listed heritage items, or items of potential heritage significance. The Revised Preferred Project has substantially reduced the risk of any subsidence related impacts to surface features, including Cataract Dam, Illawarra Escarpment, the Colliery and any other items of potential heritage significance. Potential impacts to heritage items at the Colliery Pit Top as a result of Pit Top upgrades are considered consistent with those previously assessed in 2012. Based on the previous heritage assessment and the relevant updated assessments completed for the Revised Preferred Project, no change to the predicted impact on heritage listed items, or items of potential heritage significance is anticipated.

Cataract Dam is listed on the State Heritage Register. The UEP Application Area is located within the headwaters of the Cataract River and the Cataract Reservoir and predominantly within the catchment of Cataract Creek. The Cataract Dam State Heritage Register curtilage in relation to the Revised Preferred Project is shown on **Figure 4.2**. No mining is proposed beneath the full supply level of Cataract Reservoir, except the approved Wonga Mains development.

As outlined in the Subsidence Assessment and confirmed as part of the subsidence Peer Review process, the proposed first workings are not considered to have any potential to perceptibly impact on the Cataract Reservoir based on the current proposed mine plan. Therefore, any recommendation for no extraction within 1km of the SRH curtilage of Cataract Dam is not considered appropriate or warranted.

A Conservation Management Plan for the South Bulli Colliery was prepared by Biosis in 2013. The plan addresses those items identified in **Table 4.3** associated with the South Bulli Colliery. WCL will update the Conservation Management Plan as part of any development consent for the Revised Preferred Project, should it be approved.

Wollongong City Council has been given the opportunity to comment on the Revised Preferred Project Report. Wollongong City Council has not raised any concerns in relation to heritage matters.



Data Source: Wollongong Coal (2016), OEH (2013)
Image Source: Google Earth (Dec 2018)

Legend

- UEP Project Application Area
- Cataract Dam State Heritage Register Curtilage
- Approved Wonga Central Development Mains
- Proposed Wongawilli Seam Workings
- Existing Wongawilli Seam Workings

FIGURE 4.2

Cataract Dam State Heritage Register Curtilage

File Name (A4): R13/3687_084.dgn
20191128 9.19

4.11 NSW Rural Fire Service

A Fire Management Plan to be prepared for the site by a suitably qualified consultant in consultation with the local NSW RFS District Office.

Wollongong Coal will develop and implement a site specific Fire Management Plan for the Revised Preferred Project in consultation with the RFS to manage bushfire threat and to document emergency response procedures.

5.0 Response to Community and Other Stakeholder Submissions

As outlined in **Section 2.0**, 117 individual community submissions and 14 interest group submission were received objecting to the Project. A response to the issues raised in these submissions is included in the following sections grouped by categories outlined in **Section 2.2**.

A number of the community and interest group submissions received were similar or had consistent themes. Where this is the case, the theme of the concern has been provided in **bold** in the text boxes below with some examples of specific quotes from the submissions provided in normal type to assist the reader. Specific issues, that is, where an issue was raised only once have also been addressed.

5.1 Environmental, Social and Economic Issues

5.1.1 Climate Change and Greenhouse Gas Emissions

Issues relating to the climate change and greenhouse gas emissions were raised in 75 community submissions and in 5 interest group submission(s).

Contribution to climate change:

'In addition to the extensive direct effects of the proposed expansion, this project would also contribute to the global threat of climate change.'

'Coal mining, whether for energy or steelmaking, produces the GHG Emissions that are causing dangerous climate change. This project is estimated to result in 11,624,000 tonnes of GHG emissions through the mining and the burning of the coal.'

The Revised Preferred Project's forecast energy use intensity is considered to fall within the normal operating range for an Australian underground coal mine and expected to generate approximately 1,523,000 t CO2-e of Scope 1 and 2 emissions.

The Revised Preferred Project is also forecast to be associated with approximately 9,624,000 t CO2-e of Scope 3 emissions. The Revised Preferred Project's Scope 3 emissions are beyond the operational control of WCL, and the majority of Scope 3 emissions will be generated downstream of the Revised Preferred Project, when coal products are combusted as part of the steel making process.

WCL notes that the main market for the coking coal produced will be India, which is a signatory to the Paris Agreement.

The Intergovernmental Panel on Climate Change (IPCC) define climate change as a change in the state of the climate that can be identified by changes in the mean and/or variability of its properties, and persists for an extended period, typically decades or longer (IPCC 2007).

Climate change is caused by changes in the energy balance of the climate system. The energy balance of the climate system is driven by atmospheric concentrations of GHG and aerosols, land cover and solar radiation (IPCC 2007).

Climate change models forecast many different climate change impacts, which are influenced by future GHG emission scenarios. Climate change forecasts also vary significantly from region to region.

A qualitative assessment of climate change requires a regional reference and future emission trajectory assumptions. The Revised Preferred Project, in isolation, is unlikely to influence global emission trajectories. Future emission trajectories will largely be influenced by global scale issues such as; technology, population growth and greenhouse gas mitigation policy.

NSW climate change projections have been modelled by the NSW and ACT Regional Climate Modelling (NARCliM) project. NARCliM has modelled climate change projections for 2030 and 2070, using the IPCC high emissions A2 emission trajectory scenario. The proposed Revised Preferred Project is consistent with the A2 emissions trajectory scenario, therefore the climate change projections developed by NARCliM seem a reasonable basis for a qualitative climate change impact assessment.

The extent to which global emissions and atmospheric concentrations of greenhouse gases have a demonstrable impact on climate change will be largely driven by the global response to reducing total global emissions that includes all major emission sources and sinks.

Scope 3 emissions discounted:

'Scope 3 emissions accounts for about 86% of the total emissions and Wollongong Coal has totally discounted it or given it any consideration.'

'…No attempt is made to include Scope 3 as being important…'

A Greenhouse Gas and Energy Assessment (GHGEA) was completed for the Revised Preferred Project (Appendix 8 of the Revised Preferred Project Report). The GHGEA was prepared in accordance with relevant guidelines. The GHGEA assessed and reported on the estimated Scope 3 emissions that will be associated with the Revised Preferred Project.

The Revised Preferred Project is forecast to be associated with approximately 9,624,000 t CO2-e of Scope 3 emissions during its operation phase. The Revised Preferred Project's Scope 3 emissions are beyond the operational control of WCL. Annual average Scope 3 emissions are forecast at approximately 1,925,000 t CO2-e per annum.

Scope 3 emissions are indirect emissions that are a consequence of the activities of the reporting entity but occur at sources owned or controlled by another reporting entity. Scope 3 emissions are only estimates and may have a relatively high level of uncertainty, unreliability and variability.

The Revised Preferred Project's Scope 3 emissions are beyond the operational control of WCL, and the majority of Scope 3 emissions will be generated downstream of the Revised Preferred Project, when coal products are combusted to produce coke. WCL notes that the main market for the coking coal produced will be India, which is a signatory to the Paris Agreement.

Project cannot be considered in isolation, cumulative impact must be considered:

'Wollongong Coal's document states that "*the Revised Preferred Project, in isolation, is unlikely to influence global emission trajectories*". When it comes to climate change nothing can be taken in isolation.'

The GHGEA (Appendix 8 of the Revised Preferred Project Report) assesses the greenhouse gases generated by the Project in the context of global volumes.

To put the Revised Preferred Project's emissions into perspective, under current policy settings, global GHG emissions are forecast to reach 56,200,000,000 t CO_2-e per annum by 2025 (UNEP 2016). During operation, the Revised Preferred Project will contribute approximately 0.0005% to global emissions per annum (based on its projected Scope 1 emissions). The relative environmental impact of the Revised Project is likely to be relative to its proportion of global GHG emissions.

Rocky Hill Coal Project precedent:

'The NSW Land and Environment Court has recently refused development consent for the Rocky Hill Coal Project in the Gloucester Valley, citing the mine's likely contribution to climate change as a key reason. The decision will have wide-reaching consequences and will likely affect the viability of coal and other fossil fuel-dependent industries in Australia.

The growth in international jurisprudence directly linking fossil fuel developments with climate change may also lead banks and others who would traditionally invest in these industries to consider alternatives. Chief Justice Preston said that the Rocky Hill mine would be in the wrong place at the wrong time. The mine was open cut, not underground, but like Russell Vale, was for coking coal.'

On 8 February 2019, Chief Judge Preston of the NSW Land and Environment Court delivered judgment in the case of *Gloucester Resources Limited v Minister for Planning* [2019] NSWLEC 7 (Rocky Hill case).

In that case, the Court found that the development application for the Rocky Hill Coal Project should be refused on numerous grounds. In particular, the Court found that the "significant and unacceptable planning, visual and social impacts" of that project warranted refusal on those grounds alone. Whilst it was unnecessary for the Court to do so, and did not affect the outcome which the Court had already arrived at, the greenhouse gas emissions of the Rocky Hill Project and their contribution to climate change was said by the Court to be "a further reason for refusal". The judgement did not cite climate change as a key reason for refusal.

The Rocky Hill case was concerned with the specific facts and circumstances of that proposed mining project. The IPC, in determining the Revised Preferred Project, is not obliged to adopt, consider or follow any particular aspect of the Court's decision in the Rocky Hill case. The IPC is obliged to consider and determine the development application for the Revised Preferred Project on its own, individual merits, having regard to the environmental assessment material and information that is before it.

Russell Vale Colliery will be classed a gassy mine:

'We note that the mine will be classified as a gassy mine (Page 5 of Appendix 8).

- The ventilation system will extract a flat rate of 270,000 t CO_2-e of fugitive emissions per annum (historical average).
- The mine will be classified as a 'Gassy Mine' and generate post mining emissions from stockpiled ROM coal.'

As outlined in the Greenhouse Gas and Energy Assessment, the mine will be classified a 'Gassy Mine'. The *National Greenhouse and Energy Reporting Act 2007* (NGER Act) and the National Greenhouse Account (NGA) Factors define gassy mines as underground mines with a methane content greater than 0.1% methane in ventilation emissions.

The classification as a gassy mine is an assessment and reporting implication. NGER and the NGA factors require gassy mines to report post mining emissions, that is methane released from ROM stockpiles. Gassy mines are likely to report higher GHG emissions than non-gassy mines, as ventilation air methane emissions are likely to be higher than non-gassy mines, and gassy mines must also report post mining emissions.

All potential greenhouse gas emissions from the Revised Preferred Project have been assessed and reported in the Greenhouse Gas and Energy Assessment (Umwelt 2019).

Alternative fuels/technologies available for steel making:

'The ongoing approval of these minor insignificant mines is hindering the transitioning away from coal and antiquated manufacturing methods of steel production. It inhibits those mechanisms that would drive the rapid up-take of alternative technologies for steel production - technologies which currently exist at commercial scales even though they haven't been widely implemented.'

It is unclear what alternative technologies for steel production are being referred to in the submission. Over 71% of steel produced uses coal (World Coal Association 2019). Basic oxygen furnace or electric arc furnaces are the most common steel making methods. Other forms of steel making technologies, such as hydrogen-based metallurgical processes are being researched and tested. There are no alternatives that are commercially proven and available at present.

The Australian Government's Department of Industry, Innovation and Science indicates that Australia's export volumes of metallurgical coal are forecast to grow from 179 million tonnes in 2017–18 to reach 203 million tonnes in 2022–23, before receding back to 198 million tonnes in 2023–24 (DIIS 2019). This reflects an expected recovery from supply disruptions and modest production growth, before the impact of several mine depletions take effect.

The Australian Government's Department of Industry, Innovation and Science indicates that Australia's export volumes of metallurgical coal are forecast to grow from 179 million tonnes in 2017–18 to reach 203 million tonnes in 2022–23, before receding back to 198 million tonnes in 2023–24 (DIIS 2019). This reflects an expected recovery from supply disruptions and modest production growth, before the impact of several mine depletions take effect.

The Revised Preferred Project responds to a need for metallurgical coal globally. The up-take of other alternative technologies is not the responsibility of the proponent.

No proposal to capture methane:

'The original Underground Expansion Project Statement of Commitments states "*NRE will investigate opportunities to capture and/or use methane, 2015 onwards*", this commitment has not brought forward or continued on to the Revised PPR.'

'There is no plan to capture emissions.'

WCL advise that there is very low methane content in the Wonga East area making method capture unviable.

Future approval areas for Wonga West will require methane drainage, capture and opportunities for power generation to be reviewed.

Thermal coal production:

‘The proposed mine has a mix of thermal and metallurgical coal. Renewable electricity generation as it is now cheaper to build than thermal coal.’

‘The proponent extols the virtues of metallurgical coal but does not mention that 25% of the ROM coal extracted at Russell Vale is thermal coal. With the Revised PPR now proposing to process coal on site, this means that 33% of the product coal will be thermal coal.’

‘Approximately 50% only of the coal to be mined is for steel making’

The Revised Preferred Project does not propose a mix of thermal and metallurgical coal.

The output of mine production will be marketed as a ROM coking coal product, that when washed will produce a high quality low ash coking coal and a secondary high ash coking coal product.

Future generations:

‘I'm sad that we are selling out our kids' future and our local environment by investing in outdated and environmentally destructive technology.’

‘I object this development in the name of the future generations that will be negatively impacted by the long term effects in the damage of the land, water and air.’

‘Please act in the long term interests of our children and grandchildren.’

‘I have two young children and am extremely worried about the effects of the coal mining expansion plans on their future.’

The Revised Preferred Project Report provided an assessment against the principles of ecologically sustainable development, including intergenerational equity (Section 16.3 of the Revised Preferred Project Report).

Intergenerational equity is based on the principle that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations. The principles of intergenerational equity are addressed by the Revised Preferred Project most fundamentally via the revised mine design that significantly limits subsidence related impacts and secondly through the development and implementation of management and mitigation measures that are designed to address any residual potential environmental impacts.

A cost benefit analysis was undertaken for the Revised Preferred Project (Appendix 10 of the Revised Preferred Project Report) which assessed the net benefit of the Revised Preferred Project when all external and internal costs were considered, including environmental and social externality costs. The cost benefit analysis determined that the Revised Preferred Project would result in a net economic benefit of approximately $174.3 million in NPV terms for the NSW community, approximately $17.0 million in NPV terms to the Wollongong local area through employment and expenditure in the local area, and indirect costs of $19,158.

This environmental assessment demonstrates that with the implementation of existing and proposed management and mitigation measures, the Revised Preferred Project can proceed within acceptable environmental standards and would result in a net benefit to the NSW community.

Climate change policy:

'The NSW Government has released the NSW Climate Change Policy Framework, which commits NSW to the aspirational objectives of achieving net-zero emissions by 2050 but does not offer any policy regarding transitioning from GHG emitting industries. While all over NSW Councils are declaring Climate Change Emergencies our State and Federal Governments appear to be sitting on their hands. We need a policy that addresses kerbing GHG emissions rather than reacting to its aftermath.'

Noted.

The Greenhouse Gas and Energy Assessment (Appendix 8 of the Revised Preferred Project Report) was completed in accordance with relevant guidelines and policy. An assessment against current relevant climate change policy objectives has been completed.

WCL has no control over government policy.

Need for coal:

'The coal industry would have us think we need this dirty product to meet growing demand for steel and energy. This is simply untrue. We can no longer listen to or believe these incumbent industries. We can't wait any longer to break free from this coal addiction. We know that to prevent catastrophic climate change we need to move away from coal now and that climate policy requires that much of the world's reserves of coal remain unmined.'

It is important to recognise that there is, and will remain for the foreseeable future, a demand for coal (both coking and thermal coal) as a reliable, affordable and efficient source of energy to meet the basic needs of human populations throughout the world.

Global coal demand in anticipated to be stable for the next five years (International Energy Agency 2018). In terms of the total energy mix, coal's contribution is expected to decline from 27% to 25%, mainly due to growth of renewables and natural gas, however coal is expected to be a key component for the foreseeable future (International Energy Agency 2018).

As outlined above, the Australian Government's Department of Industry, Innovation and Science indicates that Australia's export volumes of metallurgical coal are forecast to grow from 179 million tonnes in 2017–18 to reach 203 million tonnes in 2022–23, before receding back to 198 million tonnes in 2023–24 (DIIS 2019).

It is considered that there is an ongoing current need for coal for steel making. The Revised Preferred Project will assist in meeting the predicted demand in the short term.

Greenhouse gas generation:

'Carbon dioxide and other greenhouse gases are produced in NSW by the following top three activities or sources: stationary energy sources, such as coal-fired power stations (47 per cent); transport (18 per cent); and coal mines (12 per cent). All three can be attributed in some degree to the Russell Vale mine. Not to mention the emissions from the steel making industry.'

All emissions associated with the Revised Preferred Project have been calculated and assessed in the Greenhouse Gas and Energy Assessment (Umwelt 2019) (Appendix 8 of the Revised Preferred Project Report).

The NSW Government has developed its NSW Climate Change Policy Framework, which aims to deliver net-zero emissions by 2050, and a State that is more resilient and responsive to climate change (OEH 2016).

The policy framework is being delivered through:

- the Climate Change Fund
- developing an economic appraisal methodology to value GHG emissions mitigation
- embedding climate change mitigation and adaptation across government operations
- building on NSW's expansion of renewable energy
- developing action plans and strategies.

As outlined in the Greenhouse Gas and Energy Assessment (Umwelt 2019), the Revised Preferred Project is unlikely to affect the objectives of the NSW Climate Change Policy Framework in a material way.

Green energy use:

'There is no mention in the Revised PPR of the purchase of green energy. This type of acquisition brings about change to more sustainable energy production and to some degree may achieve carbon neutrality of the project.'

WCL access electricity from the grid for their operations. All electricity retailers buy electricity through the national electricity market (NEM), a central pool which aggregates and distributes power produced from a range of sources, including coal- and gas-fired power stations, wind farms and hydroelectric plants.

WCL will reduce electricity usage by significant amount (approximately 40%) by using continuous miners compared to longwalls.

WCL has committed to continuing to seek operational energy use efficiencies where commercially feasible and will review renewable energy opportunities as new technology is developed and becomes viable.

Greenhouse gas emissions:

'The employment of 200 people at Russell Vale potentially produces 11,624,000 t CO2-e, can you imagine what would happen if every employee generated 58,120 t CO2-e of GHG emissions over a 5 year period.'

Particular industries will generate a higher quantity of greenhouse gas emissions per employee, such as mining and energy production. It is not appropriate to consider greenhouse gas emissions generated per employee as a standard measurement for the merit of a project.

5.1.2 Mining in the water catchment

Issues relating to the mining in the water catchment were raised in 97 community submissions and all 7 interest group submission(s).

Water loss / risk to water supply / current water shortages:

'The Russell Vale Underground Expansion Project poses a threat to our community and water security. It is inevitable that this expansion will damage Sydney's water catchment which supplies water to Wollongong, areas which are currently under drought conditions.'

'Geoterra is of the opinion that the Revised Project may not add to this water loss but does state that the old mine workings mean that there is some risk of additional water loss.'

'Wollongong Coal told the community that their proposed non-caving first workings mining system would produce no water loss from the catchment. Now the Revised PPR is saying that large volumes of water will be drained from adjoining mines.'

'There is no doubt in my mind that the extent of the proposal & that it will add a 3rd level of mining under old mined out coal seams, will escalate the loss & contamination of water from the Special Areas of Sydney's Drinking Water catchment.'

'The extraction for the Wonga Central Development Mains extends under the Cataract Reservoir itself. Cataract is severely affected by drought and is currently at only 29% of capacity. Mining should not be permitted anywhere near Great Sydney water supply reservoirs.'

'How much of this current situation can be attributed to coal mining with billions of litres of water a year being draining into mines under the Sydney Water Catchment and their resultant damage and impact being felt way into the future.'

'In this Revised PPR the area shown to be mined has increased dramatically in size from the previous layout. The layout extends closer to the Cataract reservoir than previously. This extension now encroaches far into the Dam Notification Area and goes right up to the full supply level of the Cataract reservoir. This is a very risky proposal as it is a three seam mining method, making subsidence predictions and behaviour complicated. The mining layout should be redesigned to stop short of the Cataract reservoir and at least allow for the 35 degree angle of draw.'

'Government planning needs to provide for a fast-growing population in a changing climate. It is time for the government to prioritise water supply for future generations. We need to have clean, reliable water in the future. For this reason NPA Illawarra branch members strongly believe that expansion of mining in the water catchment should not be approved.'

'Wollongong Coal is investigating an alternative mining method under the Sydney Water Catchment area that has no subsidence and no loss of water. If this is the case then clearly it is an acknowledgment that coal mining damages the water catchment.'

The Revised Preferred Project mine plan has been specifically designed as a non-caving first workings mining system to limit potential for interaction with existing overlying workings or subsidence-related impacts to natural or built surface features or groundwater, including the Cataract Reservoir. The pillars remaining are designed to be long-term stable with a large width to height ratio.

Due to the long term stable mine plan, the proposed workings are not considered to have any potential to perceptibly impact on natural surface features including upland swamps, cliffs (including the Illawarra Escarpment), steep slopes, drainage lines, creeks, Cataract Creek and Cataract Reservoir.

While the Revised Preferred Project mine plan represents an increased mining footprint compared to the previous layout, the predicted impacts are significantly reduced based on the non-caving first workings mining system. As outlined in **Section 1.1**, mining is not proposed underneath the full supply level of the Cataract Reservoir, nor is it predicted to have any perceptible subsidence related impacts on Cataract Reservoir.

Impacts on groundwater are not expected to occur beyond the immediate vicinity of the Wongawilli Seam and there is no significant potential for additional interaction between surface water, groundwater and the underground mining horizon as a result of the long term stable mine plan.

No adverse impacts on stored water quantity or quality are predicted to occur as a result of the proposed first working extraction on, or in, Cataract Reservoir.

A peer review of the subsidence assessment has also been completed, as discussed in **Section 3.3.1**. The peer review supported the findings of the subsidence assessment for the Revised Preferred Project. The peer review stated the following in relation to the risk of potential surface and groundwater interactions:

- the proposed mining is not expected to result in any significant subsidence impacts on either the surface or sub-surface groundwater regimes
- there is no credible risk of water flow along major structures from Cataract Reservoir as a result of the proposed first workings in the Wongawilli Seam
- the proposed mining is not considered likely to alter the status of mining/groundwater or surface interaction
- impacts on groundwater are not expected to occur beyond the immediate vicinity of the Wongawilli Seam

The Groundwater Assessment prepared for the Revised Preferred Project (Appendix 2 of the Revised Preferred Project Report) quantifies predicted surface water and groundwater losses associated with both the proposed mining and historical mining within the Russell Vale Colliery. Modelling predicts less than 0.5 ML/year in reduced inflows to Cataract Reservoir as a result of the Revised Preferred Project. This level of impact is considered to be negligible. Cumulative losses taking account of all previously mined areas, are predicted to be approximately 9.91 ML/year.

The groundwater assessment found that the Revised Preferred Project will not result in an observable reduction in the quantity of surface or groundwater inflows to, or loss of water from, Cataract Reservoir, and that the Revised Preferred Project is predicted to have no (or neutral) impact on water quality in the Cataract Reservoir and its tributaries.

The Revised Preferred Project was assessed against relevant policy considerations set out in the NSW Aquifer Interference Policy, WaterNSW Principles for Managing Mining and Coal Seam Gas Impacts in Declared Catchment Areas and *State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011*, and was found to satisfy the requirements of these policies.

Mining infrastructure and subsidence damaging the catchment:

'Further the mining infrastructure, such as access roads and vent shafts, will disturb and damage the catchment at a time when there is greater need than ever to protect habitats and ecosystems to help wildlife withstand climate change and habitat losses elsewhere…'

Proposed changes and/or upgrades to mining infrastructure as part of the Revised Preferred Project relate to improvements to the stormwater management system and noise mitigation works (raising and extending noise bunds) at the Pit Top. The proposed surface facilities works will be restricted to the existing disturbance area at the Pit Top facilities. The construction activities associated with these works have been assessed as part of the Revised Preferred Project and were presented in Section 5.0 of the Revised Preferred Project Report.

No additional or upgrades to access roads or vent shafts are proposed as part of the Revised Preferred Project.

5.1.3 Water Resources

Issues relating to the water resources were raised in three interest group submissions and 12 community submissions.

5.1.3.1 Water Licensing

Water licensing:

'The Revised PPR suggests the water flowing into the mine is from the adjoining mines only and that subsequently the flow of water into the Russell Vale workings should not be required to be licensed by Wollongong Coal. But then they go on to says in Table 5.3 that the Total Licensable Inflow into the mine at the end of Longwall 6 was 157 ML/year and that after the proposed First Workings under the Revised PPR it would be 288 ML/year, which is a gain of 131 ML/year. If that licensable water is not coming from the adjoining mines then it must be drain from the water catchment. '

Predicted water take associated with both historical and proposed mining at Russell Vale Colliery has been quantified as part of the Groundwater Assessment prepared for the Revised Preferred Project by Geoterra.

WCL will require WALs for all groundwater taken in the course of mining. The total licensing entitlement required will be the maximum mine water make, which will include the water taken from each formation. Based on the predicted maximum groundwater inflow make into the WCL workings of 288ML/year, WCL currently hold a sufficient quantity of units in their WAL. WCL will also require a WAL (or alternate mechanism agreed with NRAR), for the annual (cumulative) take of up to 10.04 ML/yr of stream baseflow resulting from depressurisation of deeper aquifers. This relates to depressurisation from both historical mining operations and the Revised Preferred Project mine plan.

Further detail and confirmation of the cumulative groundwater impacts of mining will be provided in Part B of this Submissions Report.

Water licensing doesn't account for permanent damage:
'Wollongong Coal currently holds a Water Access Licence (WAL) under the Water Management Act 2000 for 515 ML/year, Licence No. WAL36488. WaterNSW is responsible for managing access to water and ensuring water is shared equitably between the environment, people of NSW and industry. But a water licences doesn't give the holder the right to permanently damage the catchment. That water will be lost from the catchment for ever. We are not talking short term, like the life of the mine. The mining companys' water allocation isn't being drawn out of the reservoir or pumped up from a bore. They are physically damaging the vessel that the water is captured in and they don't take responsibility for that damage because they think they are blameless because they have a licence. No one has ever held them to account and when this foolishness is realised the mining companies will be long gone.' 'I think it is time for a review of the whole water licence process and not tolerate permanent damage. We are only the custodians of this water catchment; it is not up to this generation to decide what amount of damage, if any, is tolerable.'

The legislative requirements put in place by the NSW Government, in particular the requirements of the NSW *Water Management Act 2000* and the NSW *Protection of the Environment Operations Act 1997*, have consideration of water take and impacts in their application. This includes the setting of sustainable water take levels through water licencing regimes and sustainable water quality limits through water discharge limits in an environment protection licence.

All groundwater take associated with the Revised Preferred Project will be licensed in accordance with the *Water Management Act 2000*. The water licensing system considers available water within a system and allocates licences in consideration of all users of the water system and inherently covers cumulative impacts.

Water licensing:
'It appears that when the mining companies exceed their water allocations they simply apply for an extended licence. There is no compunction on their part to operate within their allocation as it will be so easily extended. This process is not to the advantage of the people of NSW. Water entitlements from licensed water extractions in the catchment in the Hawkesbury-Nepean and Woronora in 2010 were 11,351ML/yr but grew to 31,147ML/yr in 2016.'

As stated above, the legislative requirements put in place by the NSW Government have consideration of water take in their application. Sustainable water take levels are set through water licencing regimes. The water licensing system considers available water within a system and allocates licences in consideration of all users of the water system and inherently covers cumulative impacts.

Water Access Licences (WALs) entitle licence holders:

- to specified shares in the available water within a particular water management area or water source (the share component)
- to take water at specified times, rates or circumstances from specified areas or locations (the extraction component).

Water sharing plans establish rules for sharing water between the environmental needs of the river or aquifer and water users, and between different types of water use such as domestic supply, stock watering, industry and irrigation.

The *Water Management Act 2000* recognises that a WAL is a valuable asset. WALs provide:

- a clearly defined right to a share of the available water in a particular water source
- increased opportunities to trade water through the separation of land and water rights.

Mining companies are required to operate within their licence allocation. It is not possible to extend a licence, rather mining companies can attempt to purchase additional licence allocation, if available.

A holder of a WAL who takes water from a water source other than as authorised by the licence is guilty of an offence under the *Water Management Act 2000*. Penalties for taking water may include penalty units and/or imprisonment.

The Revised Preferred Project is covered by:

- the *Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011* (Groundwater WSP)
- the *Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources 2011* (Unregulated River WSP)
- the *Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources* (Surface Water WSP).

The Groundwater WSP applies to thirteen groundwater sources and the Unregulated River WSP includes six water sources, with the Revised Preferred Project situated entirely within the 'Upper Nepean and Upstream Warragamba Water Source'. The Surface Water WSP encompasses the overall UEP Application Area and is contained within the Sydney Basin Nepean Groundwater Source Area.

WCL holds a current WAL under the *Water Management Act, 2000* for 515 ML (units)/year (Licence No. WAL36488), located within Nepean Management Zone 2 of the Sydney Basin Nepean Groundwater Source.

Since the Groundwater WSP applies to all aquifers, WCL will require WALs for all groundwater taken in the course of mining. The total licensing entitlement required will be the maximum mine water make, which will include the water taken from each formation. Based on the predicted maximum groundwater inflow make into the WCL workings of 288ML/year, WCL currently hold a sufficient quantity of units in their WAL.

WCL will require a WAL for the annual (cumulative) take of up to 10.04 ML/yr of stream baseflow resulting from depressurisation of deeper aquifers. This relates to depressurisation from both historical mining operations and the Revised Preferred Project mine plan.

5.1.3.2 Groundwater modelling and monitoring

> **Limitations and Uncertainty in Groundwater Modelling:**
>
> 'Even though companies and the government have been attempting for decades to assess and predict the risks posed by undermining in the catchment, any proposed predictive modelling has been deemed inadequate.'
>
> 'The most fundamental change and ensuing uncertainty regarding the hydrogeological regime in the Special Areas is how much it is modified by subsidence-induced fracturing following undermining. As discussed in Section 2.2, the distribution and orientation of subsidence-induced fracturing is not currently well understood and can't be accurately predicted." (WaterNSW submission to the IEP- Task 1 Matters May 2018 - p.26-28)

The Groundwater Assessment (Appendix 2 of the Revised Preferred Project Report), including the groundwater modelling, has been undertaken in accordance with relevant guidelines and policies, and based on the best available information. As outlined in **Section 3.3.2**, a peer review of the Groundwater Assessment is currently being completed and the findings of the peer review process will be reported in Part B of this Submissions Report.

> **Surface water management on site:**
>
> 'There is a 63ML settlement pond located on the Russell Vale mine site just west of Princes Hwy on the Bellambi Creek system. This settlement pond collects dirty polluted water from the site… This pond is proposed to be used as retard or retention basin under the Wollongong City Council flood study. Its proposed capacity is to be the top 30ML and is solely reliant on Wollongong Coals pumps to keep the capacity of the settlement pond down.'
>
> 'The Russell Vale retention basin is actually the top half of a polluted stormwater settlement pond. When this retention basin/settlement pond is full during a flood event, it will flow over the spillway and down Bellambi Creek. However the settlement ponds at the Russell Vale mine historically were seldom dredged or cleaned out and caused problems in a heavy rain event. So when this polluted stormwater settlement pond has a sudden influx of water, such as a flood event, it will stir up the sediment in the bottom of the pond and flush it down the creek. The retention basin and the settlement pond should be totally separate components to protect the creek.'
>
> 'This polluted stormwater settlement pond has a leaky dam wall. The mining company insists it is a filter devise for some of the water but EPA is perplexed about this feature. The question needs to be asked, is the dam wall just poorly constructed and allowing the water to seep through? If this is the case this dam is unsafe and requires remediation before there is a 63ML deluge of polluted water down Bellambi Creek.'
>
> 'Wollongong Coal believe that because they have a licences to discharge up to 2.5ML/day down the creek that they are not responsible for the environmental damage to the creek. If this is their attitude then the water discharge allocation should be re-examined and the licence taken off them, they present as caring environmental corporate citizens.'

The Stormwater Control Dam (SWCD), located just west of the Princes Highway, was constructed in 1993 to reduce the frequency of discharge of 'dirty' water from the site.

The site's dirty water management system is designed to capture surface runoff generated from the surface facilities at the site. Accordingly, runoff from the stockpile and coal handling area, with a high sediment loading, initially flows to Dam 1 (the primary sediment basin) and Dam 2, before spilling to the SWCD. Dam 1 and Dam 2 act as flow-through basins to settle out the coarse solids. Further details regarding the site's dirty water management system is provided in the SWIA undertaken as part of the assessment of the Revised Preferred Project (refer to Appendix 10 of the Revised Preferred Project Report).

Managing water levels in the SWCD

The SWCD has a target operating volume of 30 ML (with maximum capacity of 62 ML) to provide a suitable freeboard to accommodate large storm events. Recent flood modelling (Engeny, 2018) has shown that the SWCD does not spill during any of the modelled flood events, therefore spills and re-entrainment of sediment could only occur in events greater than the 100 year ARI.

During dry periods, the dam level is kept at a minimum to maximise the storage available to capture stormwater runoff in the event of a storm. Pumps located immediately downstream of the SWCD can be either operated manually or automatically when the water level reaches a pre-determined level (Douglas Partners, 2019).

The dam embankment, spillway, pumps and associated drainage structures are inspected regularly by WCL. Observations made during the inspections, together with documentation of the dam level and water depth, are recorded. Furthermore, dam levels are remotely monitored by electronic surveillance equipment installed at the dam. Where inspections indicate substantial accumulation of sediment in a sediment dam, clean out will be undertaken as to comply with the minimum levels.

During wet conditions (greater than 10 mm per 24 hours), water can be discharged under the site's Environmental Protection Licence (EPL 12040) conditions in excess of 2.5 ML/day from the licence discharge point (LDP 2) for the following 72 hours to ensure a safe water level is maintained in the SWCD.

Water treatment and transfer from the SWCD

Water from the SWCD is pumped to the onsite water treatment plant (thickener tank) where suspended solids are removed. The total capacity of the pumps is 6 kl/min which have been designed to keep the dam level low to optimise the storage volume. From the thickener tank, water is either:

- pumped to the fire and pit top dams for use as fire and process water (when the colliery is operational)
- discharged to the Bellambi Gully Creek Diversion Pipeline via LDP 2 (refer to Figure 3.1 of the Revised Preferred Project Report). EPL 12040 allows discharge of 2.5 ML/d to via LDP 2 under dry conditions.

In addition, water is discharged from the SWCD to Bellambi Gully Creek via:

- The dam wall (at LDP 3) - The wall of the SWCD is designed to be permeable and slowly filter and discharge water (BECA, 2010) which provides some treatment (filtering and some pH adjustment) as the water flows through. Seepage through the dam wall is collected in an internal slotted PVC pipe and directed to a collection sump that was previously equipped with a v-notch weir to monitor seepage flow rate and discharge quality (as per the EPL 12040 conditions). Refer to the Surface Water Impact Assessment of the Revised Preferred Project (summarised in Section 5.4 of the Revised Preferred Project Report) for further detail.

- The spillway (at LDP 9) – During large rainfall events, the SWCD discharges through a heavily armoured and engineered spillway located on the northern abutment. The 24 m wide open channel spillway (rock filled gabion baskets) has been designed to pass the Probable Maximum Flood (PMF).

A more detailed overview of the SWCD is provided in the SWIA (see Appendix 10 of the Revised Preferred Project Report).

Inspection

The SWCD is registered with the NSW Dams Safety Committee and is a “Prescribed” dam under the *NSW Dams Safety Act 2015*. The *NSW Dams Safety Act 2015* requires that a Type 2 Surveillance Report for the dam is prepared and submitted to the Dams Safety Committee every five years.

The most recent Type 2 Surveillance Report[2] was prepared by Douglas Partners in January 2017 and found that the dam is well maintained and in good working order.

Dam Safety Emergency Plan

WCL has an existing *Dam Safety Emergency Plan - Storm Water Control Dam WCL No. 1 Colliery Russell Vale Site* (2019) (DSEP) in place, for emergency conditions such as an extreme rainfall event (flooding), seismic event (earthquake) events, or any condition where there is potential for the embankment to fail. This plan has been prepared in accordance with the NSW Dam Safety Committee’s requirements as outlined in *DSC 2G Emergency Management for Dams (2010)* and the *Australian National Committee on Large Dams (ANCOLD) - Guidelines for Dam Safety Management (2003*). The DSEP details:

- methodology for identification, evaluation and classification of potential emergency conditions;
- access and communication procedures;
- potential consequences; and
- preventative actions.

> ‘The Revised PPR proposes a stormwater detention basin within the polluted stockpile and working area. Under this proposal this area is also shown to be used for the storage or parking of vehicles and equipment. Wollongong Coals MOD4 proposal has not included method of treating the stored dirty polluted water before it is discharged into Bellambi Creek.’

Improvements to the SWMS proposed by Mod 4 include a flow channel being constructed from the dry detention basin to the SWCD to act as an outlet from the basin.

The proposed dry detention basin will allow for further settlement of sediments before overflowing to the SWCD. In addition, a suite of additional monitoring, management and contingency measures are proposed as part of Mod 4 (refer to Section 4.0 of the Further RTS, dated June 2019).

No vehicles or equipment will be parked or stored within the dry detention basin during heavy rain events. Alternative truck parking is available west of the upper container noise wall in the event of wet weather.

[2] Type 2 Reports are required for High C consequence category dam, and Significant consequence category dams over 15 m in height.

‘It should also be noted that there is no plan showing the proposed pit top layout and all the proposed stormwater features including the underground piped Bellambi Creek line. This is an essential document.’

A figure showing the proposed water management system overlayed on an aerial photo is provided as Figure 3.3 of the SWIA attached as Appendix 3 of the Revised Preferred Project Report. A figure showing the proposed water management system overlayed by the proposed Pit Top layout is provided as **Figure 5.1**.

‘The carpark for staff and visitors still is not sealed in this Revised PPR. This carparks stormwater discharges into the clean water system on the site. In any other development this vast carpark would need to be sealed.’

The car parking area is constructed of compacted roadbase and partly sprayed sealed. No changes to the existing car park are proposed as part of the Revised Preferred Project.

Heavy metal monitoring:

‘Currently there is no monitoring for heavy metals discharging from the Russell Vale mine. The EPA has determined that it is not required because it discharges into an estuarine creek. At present they are only required to monitor electrical conductivity, pH, total suspended solids and turbidity. There is no requirement to monitor or test for heavy metals and yet a large number of people live on or near the creek. The proposed ongoing treatment of this water when the mine closes down should allow for the removal of these heavy metals.’

WCL undertakes surface water quality monitoring at the Pit Top facilities in accordance with the requirements of EPL 12040. This includes a requirement for monitoring and reporting of a number of water quality parameters including EC, pH, oil and grease, Turbidity and TSS.

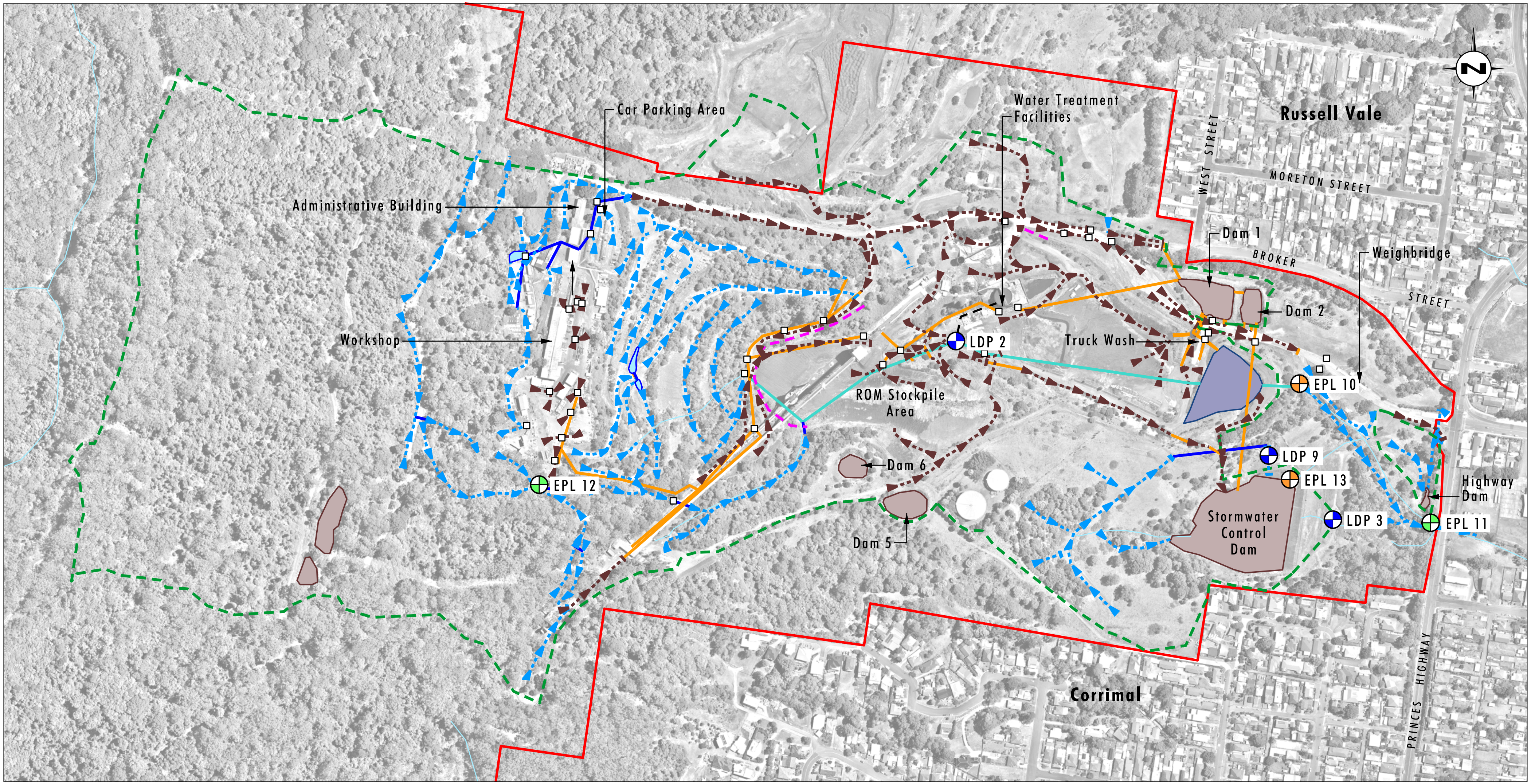


Image Source: Nearmap (Dec 2018)

Legend

- UEP Project Application Area
- WMS Boundary
- Pit/Sump
- Clean Water Dam
- Dirty Water Dam
- Clean Water Diversion Drain
- Dirty Water Diversion Drain
- Clean Water Pipe/Culvert
- Dirty Water Pipe/Culvert
- Dry Sediment Basin
- Bund/Levee
- Existing Drainage Line
- Bellambi Creek Pipeline
- Thickener Discharge Pipe
- EPL Point is Ambient Monitoring Location
- EPL Point is Licensed Discharge Point
- Former Monitoring Location

FIGURE 5.1

Proposed Water Management System

File Name (A4): R13/3687_085.dgn
20191126 10.54

5.1.4 Biodiversity

Issues relating to biodiversity were raised in 8 community submissions. None of the interest group submission(s) raised biodiversity as an issue.

Impacts on upland swamps:

'I am well aware of the ecological impacts of such mining on flora and fauna in the area, I am also concerned about the mining under swamps in the area. Swamps play an integral role in the storing and slow release of water during drought, when longwall mining is completed below the surface swamps have completely lost this retention ability and have not been seen to recover.'

'Why should the community and the approving authorities risk the damage to the swamp CCUS4 just because the proponent made another poor decision'

An updated Ecological Impact Assessment was prepared for the Revised Preferred Project by Biosis (Appendix 4 of the Revised Preferred Project Report) based on updated Subsidence and Groundwater Assessment findings. The assessment found that as the Revised Preferred Project mine plan will not result in any perceptible surface subsidence and is not considered to have any potential to perceptibly impact on natural surface features including upland swamps, impacts to upland swamps from the Revised Preferred Project mine plan are predicted to be negligible.

Given that no perceptible subsidence impacts are predicted to occur as a result of the Revised Preferred Project, monitoring of potential biodiversity impacts will be focussed on subsidence impacts as well as primary impacts to groundwater systems associated with upland swamps, and surface water flow and quality in creeks. This has been further detailed in the Revised Preferred Project Report in Section 5.5.3.

WCL currently manages and monitors impacts to biodiversity values in accordance with their Biodiversity Management Plan (2018) and Upland Swamp Management Plan (2015). The existing Biodiversity Management Plan will be reviewed and updated to reflect the Revised Preferred Project and associated management and monitoring measures.

Impact on biodiversity:

'…the destruction of biodiversity…'

'…it endangers our ecological resources…'

'This proposal should be rejected on the basis of the … ecological impacts'

The updated Ecological Impact Assessment prepared for the Revised Preferred Project (Appendix 4 of the Revised Preferred Project Report) identified that as the first-workings mining plan will not result in perceptible levels of subsidence, negligible impacts to natural surface features including upland swamps, rocky environments and aquatic environments, as well as species occupying these environments are anticipated. As a result, impacts to the ecological values of the UEP Application Area are predicted to be negligible.

In addition, the proposed upgrades to the Pit Top surfaces area will occur within existing disturbed areas, and no direct or indirect impact on biodiversity is anticipated as a result of these works.

5.1.5 Rehabilitation

Issues relating to the rehabilitation were raised in 14 community submissions and in 4 interest group submissions.

Adit outflows and treatment:

'The Revised PPR states "The modelled adit drainage rate of up to 0.3ML/day is capable of being managed by water treatment systems. Appropriately treated, this water would be capable of reuse for residential or industrial purposes or discharge into local creek systems". Bellambi Creek could not cope with the additional 0.3ML/day and it would change the ecosystem of the creek as well as add to potential flooding problems.

As with existing (approved) mine workings, following the completion of mining, groundwater inflows associated with past and proposed workings will recover to the level of the Wongawilli Seam adit (GeoTerra, 2019). The predicted rate of outflows from the adit is approximately 0.3ML/day.

As indicated in the submission, relevant assessments indicate that the predicted rate of outflows from the adit (approximately 0.3ML/day) are capable of being treated to an appropriate quality prior to any discharge to Bellambi Gully if reuse for industrial or other uses is not required.

In addition, in response to a request from the EPA in their submission on the Revised Preferred Project (refer to **Section 4.4.3**), WCL will undertake a program to investigate sealing of the mine as an alternative to water treatment at the mine closure planning stage. Any investigation will be undertaken with consideration of the Independent Expert Panel on Mining in Sydney Catchment Report and in consultation with relevant agencies, including the EPA, WaterNSW and DPIE.

Ongoing treatment costs:

'And *"As part of the mine closure process, a suitable funding arrangement will be negotiated with the relevant stakeholders to fund the ongoing monitoring and treatment of future water outflows from the adit, if required. The funding arrangement will consider appropriate water quality targets based on an agreed potential end use at the time of closure and will be sufficient for 10 years of monitoring and treatment".* This is not mentioned in the existing Mine Closure and Rehabilitation Management Plan and the cost probably hasn't been allowed for in the revised rehabilitation cost. 10 years is an insufficient time frame for ongoing treatment costs and should be more like 100 years. It may take 10 years for the mine to fill with water and reach the adit. The timing should start from this point forward not from when the mine is closed.'

As noted in the submission, WCL has committed as part of the mine closure planning process to negotiate a suitable funding arrangement with relevant stakeholders to fund the ongoing monitoring and treatment of future water outflows from the adit, if required. WCL consider it likely that by the time groundwater recovery reaches the level of the adit (currently estimated at 2057 with the Revised Preferred Project and not allowing for any future mining at the site), there would be a demand for the beneficial re-use of this outflow water for industrial or other purposes. WCL therefore envisages that any such funding arrangement would seek to provide the establishment of any required water treatment and ongoing monitoring of this treatment process for a reasonable period to prove the performance of the system for beneficial re-use. The details of any such arrangement would need to be negotiated with the relevant stakeholders at the time of mine closure planning.

It is noted however that the EPA has requested in their submission on the Revised Preferred Project (refer to **Section 4.4.3**), that WCL undertake a program to investigate sealing of the mine adit as an alternative to water treatment. WCL has committed to undertake this program of investigation.

The preferred approach to managing adit outflows will therefore need to be determined in consultation with relevant stakeholders as part of the detailed mine closure planning process.

Rehabilitation costing and rehabilitation bond insufficient:

'The Economic Impact Assessment in Appendix 10 indicates that the rehabilitation cost for Russell Vale is $215,000,000. This is staggering considering Wollongong Coal has only provided a security of $5,657,000 by way of a bank guarantee and the balance of $1,859,000 as a cash deposit (i.e. $7,516,000 in total) for the rehabilitation bond for its Russell Vale mine. This disparity needs to be rectified immediately and a greater bond paid.'

'The Revised PPR also states that *"to rehabilitate the Russell Vale Colliery including the underground access points and the Pit Top facilities which is estimated at $215million"*. To my knowledge the Resources Regulator does not hold sufficient bond to cover this estimated amount of rehabilitation. There is a necessity to be resolved immediately as Wollongong Coal is known to be experiencing financial difficulties.'

As discussed in **Section 4.2**, WCL has confirmed that the Economic Assessment of the Revised Preferred Project included costs termed as 'rehabilitation' however, these costs are broader than solely rehabilitation costs. The category of rehabilitation costs within the Economic Assessment includes business discontinuity, closure and rehabilitation costs.

The Resources regulator required WCL to review and update of the previous rehabilitation cost estimates using the latest version of the NSW Resource Regulator Rehabilitation Cost Estimate Tool. The revised rehabilitation cost estimate for Russell Vale Colliery is $12,354,410. The revised rehabilitation cost estimate has been provided and assessment by the Resources Regulator and WCL is required to provide an updated security for this amount.

Water treatment as part of mine closure:

'The Revised PPR has no further detailed assessment of rehabilitation and closure and relies on the existing management plan. This is curious because the CEO for Wollongong Coal promised that there would be water treatment provided on site when the mine closed down. However, there is no detail of this in the management plan.'

As noted in the Revised Preferred Project Report, WLC will review and update the existing Russell Vale Colliery Rehabilitation Management Plan to reflect approval requirements and commitments associated with the Revised Preferred Project and refinements to the site water management system proposed as part of Mod 4. Further, the commitment to consider water treatment post closure has been retained, as noted above, as part of the considerations for the detailed mine closure planning process in consultation with relevant stakeholders.

5.1.6 Impacts on the Community

Issues relating to impacts on the community were raised in 68 community submissions and 5 interest group submissions.

Proximity to Residential Areas:

'The Revised PPR states *"The site has a long established history of mining activity, with mining having been undertaken at the Russell Vale Colliery since 1887. Over time, urban development has encroached on the Russell Vale Pit Top and these facilities are now bordered by residential land uses. Russell Vale Colliery has therefore coexisted with these neighbouring land uses over an extended period with a degree of impact on the amenity of these residential land uses".* Wollongong Coal makes this coexistence sound harmonious, whereas residents hate it and would prefer the mine gone. The mine has been limping along for almost two decades with very little continuous extraction of coal.'

'The mine has been in care and maintenance for 5 years and this Revised PPR should not be seen as a continuation of mining at Russell Vale, it should be approached as a whole new mine and the authorities should reconsider the impacts on the surrounding residential areas. What may have been acceptable 20 years ago is not acceptable today. This mine can no longer be tolerated to operate in a residential area.'

The detailed Social Impact Assessment, included in the Revised Preferred Project Report, outlines the relevant issues raised by the local community, in relation to co-existence with the mine.

As outlined in the Revised Preferred Project Report, substantial improvements to the Pit Top layout and adoption of a range of additional feasible and reasonable noise control measures, including restricting hours of operation, have been proposed to reduce the noise impact of the Pit Top facilities and trucks accessing the site. The noise impact assessment demonstrates that the proposed changes are effective at reducing noise levels from the site to within acceptable levels, with only negligible (1-2dB) exceedances predicted at a limited number of surrounding residences during a small percentage (less than 10%) of Winter nights.

Air dispersion modelling indicates that with the implementation of feasible and reasonable mitigation measures, particulate concentration and deposition levels will remain below the NSW EPA (2016) impact assessment air quality criteria at all representative sensitive receiver locations off site with the operation of the Revised Preferred Project.

All relevant assessments have been undertaken in accordance with contemporary standards and demonstrate that with the implementation of feasible and reasonable mitigation measures, the proposal can proceed within acceptable environmental standards.

Not a suitable site for a processing plant:

'The colliery site at Russell Vale is closer to dense residential areas than any mine in Australia. It is bound by Russell Vale to the north and east and Corrimal to the south. These residential areas have suffered the impacts from this mine over many years… What may have been acceptable 20 years ago is not acceptable today. This mine can no longer be tolerated to operate in a residential area.'

'Relevant land zonings under each of the LEPs are shown in Figure 3.1. Zoning map Page 33 shows zoning of land around the mine site. It fails to show any residential west of Princes Hwy. It doesn't show the WCC LEP environmental zonings along the escarpment. The map is very misleading.'

'The Revised PPR states there will be a deshaling plant on site. Wollongong Coal has stated in their End of Year Report that the coal will be further processed at a washery plant off site. The Revised PPR should include all coal processing and transport routes but does not mention this off site washery plant.'

Proximity to residential areas

As noted above, the Russell Vale Colliery has a long-established history of mining activity, with mining having been undertaken at the colliery since the 1880's. Over time, urban development has encroached on the Russell Vale Pit Top and these facilities are now bordered by residential land uses. Russell Vale Colliery has therefore coexisted with these neighbouring land uses over an extended period with a degree of impact on the amenity of these residential land uses.

Key elements of the Revised Preferred Project have been designed to minimise impacts on these surrounding land uses, including substantial noise mitigation works around the Pit Top to reduce noise impacts on surrounding residents and controls on the speed and timing of trucks entering and leaving the site.

The potential impacts of the Pit Top Facilities on the surrounding community have been assessed against current relevant NSW Government guidelines. These assessments demonstrate that with the implementation of feasible and reasonable mitigation measures, the proposal can proceed within acceptable environmental standards.

It is noted also that the project is permissible with consent under the *Environmental Planning and Assessment Act 1979*.

Zoning map

As identified in a community submission, there was an error in Figure 3.1 of the Revised Preferred Project Report resulting in the zoning being displayed incorrectly surrounding the Russell Vale Colliery Pit Top Facility. An updated zoning map is provided as **Figure 5.2**.

Despite the issue with Figure 3.1 of the Revised Preferred Project Report, all relevant assessments considered the correct zoning and land uses surrounding the Pit Top, this being primarily residential. There is no change to assessment outcomes from the Revised Preferred Project Report.

Processing Plant

The Coal Processing Plant will comprise a coal sizing plant that will remove rock material. No washing of coal is proposed. Processed coal is transported directly from the site to Port Kembla for export.

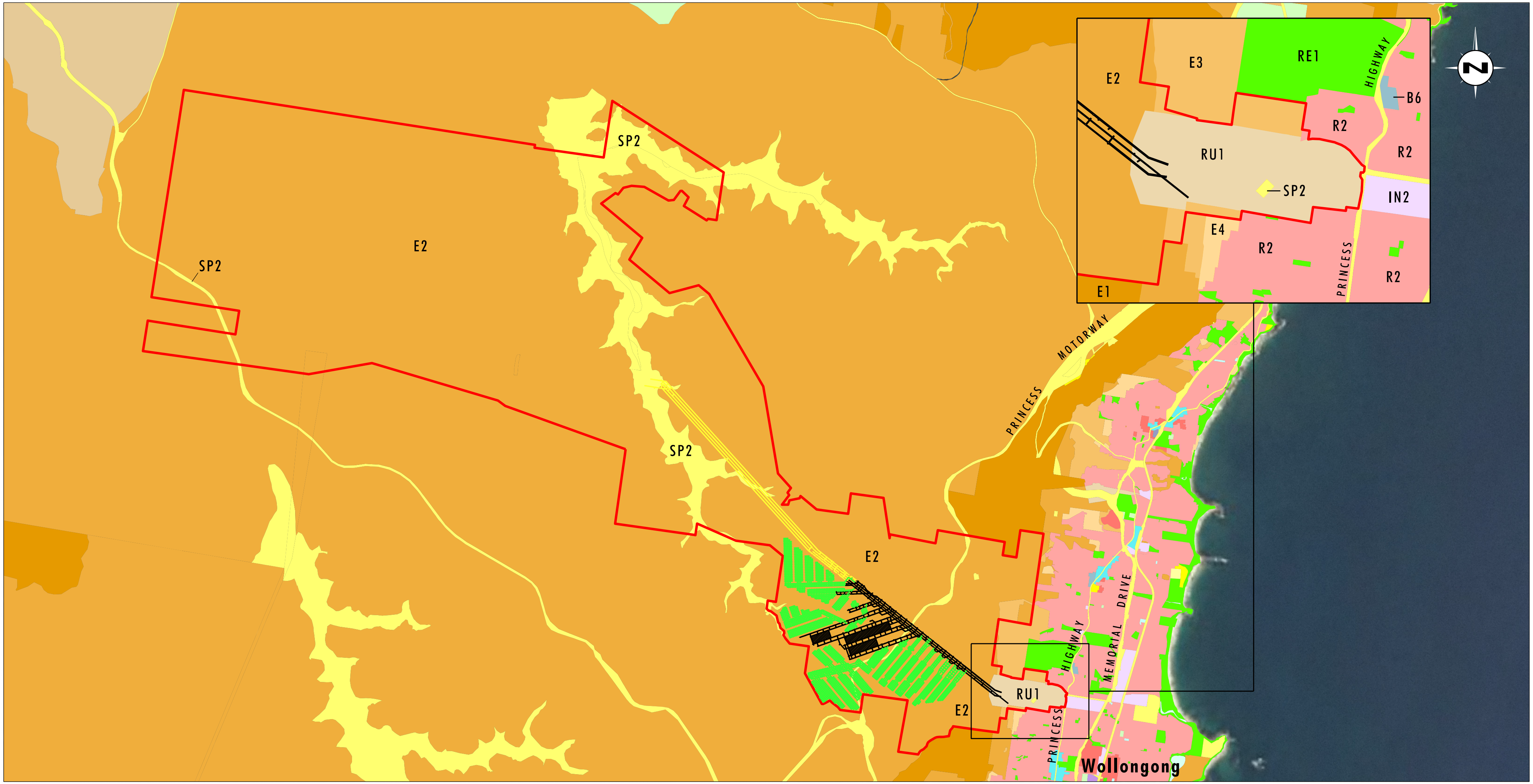


Image Source: Google maps (2016)
Data Source: Wollongong Coal (2016), NSW Environment Planning Industry (2018), Wollongong LEP (2009), Wollondilly LEP (2011), Wingecarribee LEP (2010)

Legend

- UEP Project Application Area
- Approved Wonga Central Development Mains
- Proposed Wongawilli Seam Workings
- Existing Wongawilli Seam Workings
- B1 Neighbourhood Centre
- B2 Local Centre
- B4 Mixed Use
- B6 Enterprise Corridor
- E1 National Parks / Nature Reserves
- E2 Environmental Conservation
- E3 Environmental Management
- E4 Environmental Living
- IN2 Light Industrial
- IN3 Heavy Industrial
- R2 Low Density Residential
- R3 Medium Density Residential
- RE1 Public Recreation
- RE2 Private Recreation
- RU1 Primary Production
- RU2 Rural Landscape
- RU4 Primary Production Small Lots
- SP1 Special Activities
- SP2 Infrastructure
- SP3 Tourist
- W1 Natural Waterways

FIGURE 5.2

Zoning Map

File Name (A4): R13/3687_086.dgn
20191126 13.05

Site layout and operation:

'The Revised PPR only shows the pit top plan and infrastructure in its final configuration. The coal processing plant and truck load facility won't be in place for 2 years. They state that they will be trucking ROM coal from the mine in the interim but how and where is it going to be loaded? Where are the roads going to be located? Is heavy machinery going to cross over the Bellambi Creek pipeline? How will the pipeline be protected? Wollongong Coal needs to provide an interim pit top plan showing function and proposed infrastructure.'

'A 3D model of the pit top site should also be provided. All development applications these days have 3D modelling to aid and help the community understand exactly what is going on.'

New coal handling facilities and surface infrastructure upgrades are proposed as part of the Revised Preferred Project to improve the quality of ROM coal in order to meet market demands and to minimise impacts on the environment and local community. The proposed coal handling facilities and surface infrastructure upgrades are illustrated in Figure 2.2 and described further in Section 2.2 of the Revised Preferred Project Report.

The construction of the new coal handling facilities will be completed and phased in over a 12 - 24-month period. During this period, ROM coal will be transported from the underground workings via the existing underground conveyor system to the primary sizer building where it will be crushed. Coal will then be transferred to the existing ROM stockpile from where a front-end loader will load ROM coal onto trucks to be transported to PKCT.

Once the new Coal Processing Plant and associated infrastructure is fully operational, ROM coal processing will commence. From the ROM stockpile, coal will be fed into an existing underground coal reclaim using a dozer, then conveyed to a new screening and sizing station where oversize material is removed. From the screening and sizing station, coal will be transferred to the new surge bin by conveyor and on to the new Coal Processing Plant.

As outlined in the Statement of Commitments presented in Section 6.0 of the Revised Preferred Project Report, WCL will implement a range of measures to manage heavy vehicle crossings over the Bellambi Gully Diversion Pipeline.

Trucks - Noise, Congestion, pollution and damage to roads:

'The Revised PPR states that waste material will be produced and trucked from the site. There is no mention of transport routes for this coal and number of trucks is not included in the transport study.'

'There are still about 30 additional trucks per hour (loaded and unloaded) travelling along a residential street, the expressway and the motorway. There has been a new traffic count, in May 2017, but it was done before a large Bunnings store opened in October 2017 at the intersection of Bellambi Lane and Grand Pacific Drive which substantially increased traffic volumes and potential for accidents.'

'Serious problems continue for the community: noise, diesel fumes and air pollution. They have all been cited before and are not minor. Only recently residents on Bellambi Lane have complained about noisy trucks, as the company removed material from the emplacement near the pit top.'

'One point not mentioned in the traffic analysis is the stretch of freeway between the Expressway and the Port Kembla exit. This link is now very crowded with trucks and there are frequent accidents. The RMS traffic volume viewer at the bottom of Mount Ousley Rd measures 5,105 trucks per average weekday in 2019, increased from 3,319 in 2010.'

Transport of reject material

Following commissioning of the Coal Processing Plant, approximately 0.2 Mtpa of reject material will be produced at full production. Reject will consist of rock material that will either be sold for use as fill material, used in site rehabilitation or hauled back to the mine portal via the internal haul road for emplacement underground.

Reject material sold and transported offsite will be subject to the same transport restrictions as ROM and product coal and will be managed within the proposed coal transport truck numbers set out in Section 2.1.5 of the Revised Preferred Project Report. The transport route for reject transferred offsite will depend on the destination of the material but will generally be transported via Bellambi Lane and Memorial Drive.

Traffic Counts

The updated Traffic Impact Assessment (TIA) undertaken for the Revised Preferred Project states that the traffic generated by the Bunnings Warehouse store, as detailed in the Bunnings Development traffic and parking assessment report, has been included in the weekday (morning and evening) peak hour traffic volumes for the Revised Preferred Project at the following two intersections:

- Princes Highway, Bellambi Lane & Colliery Access Road
- Memorial Drive & Bellambi Lane

Transport Route

The proposed transport route for the Revised Preferred Project is via the Russell Vale Colliery Access Road, Bellambi Lane, Memorial Drive, M1 Princes Motorway, Masters Road, Springhill Road and Port Kembla Road. The public roads that form the transport route between the Colliery and Port Kembla are all approved 25/26 metre B Double routes. Figure 3 in the TIA (Appendix 7 of the Revised Preferred Project Report) shows the transport route.

The TIA concluded that the Revised Preferred Project is not expected to have any adverse impacts on road safety on the road network, or on other road users. While there will be an increase in traffic using the road network due to the Revised Preferred Project, the traffic volumes generated by the Revised Preferred Project will be of a similar level as previously generated by the colliery. The transport route via Bellambi Lane/Memorial Drive to Port Kembla uses Bellambi Lane to Memorial Drive and then state arterial roads and motorways. All these roads are approved 25/26 metre B-Double routes.

WCL propose to maintain a voluntary 50km/h speed restriction in Bellambi Lane on all trucks generated by the colliery and will continue to maintain the truck speeds aiming to achieve 95% compliance with the voluntary speed restriction and 100% compliance with the signposted 60km/h speed limit. Compliance will be assessed using GPS monitoring.

An assessment of road traffic noise impacts associated with the Revised Preferred Project indicates an acceptable relative traffic noise increase to residents along Bellambi Lane and surrounds under the NSW Road Noise Policy (EPA 2011).

Dust generated from unsealed roads:

‘The Revised PPR and WC are no considering sealing all roads for trucks. The roads thru the stockpile and working area will not be sealed and WC has no intention of even considering the option. This is curious as previous proposals have always stated that all roads would be sealed to reduce dust (and no doubt drip waste from trucks).’

Air dispersion modelling indicates that with the implementation of feasible and reasonable mitigation measures, particulate concentration and deposition levels will remain below the NSW EPA (2016) impact assessment air quality criteria at all representative sensitive receiver locations off site with the operation of the Revised Preferred Project.

A range of air quality mitigation measures and controls have been included in the Revised Preferred Project design and will be implemented by WCL in the ongoing operation of the Revised Preferred Project. These include the use of water carts on unsealed haul roads and consideration of the use of stability polymer veneer coating on unsealed haul routes. The Air Quality Impact Assessment does not indicate a need to permanently seal internal haul roads.

Air quality:

‘The new estimates for air quality and particulate pollution lie within EPA guidelines but for some of the receptors, especially R1 and R2, they are very close to residents and very high values of PM10 of 45 micrograms per 24 hour period are modelled. We know that particulate pollution is dangerous to human health, so why take this risk? We don’t see it factored in to the Cadence economic analysis of the last Appendix.

The greatest amount of air pollution at the pit top is caused by front end loaders dumping ROM or product coal into trucks. The new plans do not alter this impact.’

Air dispersion modelling indicates that with the implementation of feasible and reasonable mitigation measures, particulate concentration and deposition levels will remain below the NSW EPA (2016) impact assessment air quality criteria at all representative sensitive receiver locations off site with the operation of the Revised Preferred Project. The air quality guidelines adopted in NSW are those recommended by the EPA and are specified in the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (EPA 2016). These guidelines have been developed in consideration of the protection of human health and well-being.

WCL will review and update the existing Russell Vale Colliery Air Quality and Greenhouse Gas Management Plan for the UEP. WCL have committed to a number of dust control measures and the plan will incorporate a range of proactive and reactive dust control strategies.

In relation to the Economics Assessment (Appendix 10 of the Revised Preferred Project Report), the costs of undertaking air quality mitigation and management measures are included in the operational costs of the UEP. The Economic Assessment did not report any indirect costs associated with air quality as the results didn't indicate any exceedances of relevant criteria. The Economics Assessment was completed in accordance with the relevant guidelines.

Dust and noise generation from onsite coal processing:

'The original Under Ground Expansion project and the Preferred Project Report were only going to extract and export ROM coal from the Russell Vale mine. But now Wollongong Coal intends processing coal on site...There have been numerous noise and dust issues at this site with just ROM coal, what is going to happen if Wollongong Coal is permitted to process coal on site.'

New coal handling facilities and surface infrastructure upgrades are proposed as part of the Revised Preferred Project. The construction of the new coal handling facilities will be completed and phased in over a 12 - 24-month period. Once the new Coal Processing Plant and associated infrastructure is fully operational, ROM coal processing will commence.

The construction and operation of the proposed new coal handling facilities and surface infrastructure upgrades were considered in relevant assessments for the Revised Preferred Project. Specific management and mitigation measures in relation to operating the coal processing plant were incorporated into the project design, including enclosing the Coal Processing Plant, restricting operation to daytime use only and a series of noise barriers and bunds established around the Pit Top to improve noise mitigation.

Air dispersion modelling indicates that with the implementation of feasible and reasonable mitigation measure, particulate concentration and deposition levels will remain below the NSW EPA (2016) impact assessment criteria at all representative sensitive receiver locations off site with the operation of the Revised Preferred Project.

Noise modelling results indicated that no exceedances of the Project Noise Trigger Levels (PNTLs) are expected during the day, evening and early morning shoulder periods at any of the identified representative receivers. Exceedances of 1 – 2 decibels (dB) are anticipated at a small number of receivers during the night time period under adverse weather conditions. The Coal Processing Plant will not be operation during the night time period, with the only noise generating activity occurring on the surface during the night time period being the running of ROM coal onto the ROM stockpile. The Noise Policy for Industry (NPfI) and Voluntary Land Acquisition and Mitigation Policy (VLAMP) (2018) defines a 1-2 dB exceedance as a negligible residual noise impact indiscernible by the average listener.

Dust monitoring:

'The dust monitoring at Russell Vale will only be 10 microns not 2 microns. The realtime monitors on site can register down to 2 microns but they will only have to record 10 microns… This is the closest mine to any residential area in Australia but they only have to monitor 10 microns, what are the authorities thinking?'

This statement is incorrect.

WCL maintains two tapered element oscillating microbalance (TEOM) monitors at their northern and southern boundaries that continuously monitor PM_{10} and $PM_{2.5}$ concentrations. WCL will continue to monitor PM_{10} and $PM_{2.5}$ concentrations at the two TEOM monitors for the duration of their operations.

> **Environmental monitoring:**
>
> 'Looking at the currently available monitoring available on the company website for air and noise monitoring, the latest quarterly report available is for April to June 2018 and it is obvious that the equipment has not been maintained:
>
> Air
>
> A statistical summary of the monitoring data collected during the second quarter of 2018 is provided in Table 4.1. The data recovery rate (for 24-hour average) was 22% for TEOM1 and 30% for TEOM2. There were no days over the criteria from April to June 2018. The 24-hour PM10 concentrations are presented in Figure 4.1 for TEOM1 and Figure 4.2 for TEOM2.
>
> Noise
>
> Two permanent ambient noise monitors continuously monitor noise levels from all sources at two locations near the site boundary. The unattended noise monitoring during the second quarter of 2018 recovered 3% of data at NMT1 and 0% of data at NMT2. For NMT1, there was 3.3% data capture for April, 3% for May, and 3.3% data capture for June.

WCL acknowledge that there have been previous reliability issues with some continuous monitoring equipment that has resulted in low data recovery rates. WCL has responded to these issues as part of its continuous improvement processes. WCL is currently implementing monitoring equipment upgrades due for completion by December 2019 that are intended to deliver improved data recovery rates.

> **Stockpiles:**
>
> 'Previous Russell Vale mine had, under the Preliminary Works Project, an approval for one ROM stockpile and small incidental stockpile for reject coal that would be removed at regular intervals. What was found to be stockpiled on site by Wollongong Coal was an 80,000 tonne ROM stockpile, a 176.000 tonnes of high ash coal and 200,000 tonnes of oversize coal. That is a total of 456,000 tonnes for an approved stockpile of 80,000 tonnes. Some of the coal is still on site today, awaiting overdue removal.'
>
> 'So when Wollongong Coal says they will now have 3 coal stockpiles on site, 30,000 tonnes of ROM coal, 14,000 tonnes of product coal and 1,500 tonnes of reject material, what are we to believe will be stored on site?'
>
> 'It should also be noted that the reject material stockpile is a single stockpile and there is no Virgin Excavated Natural Material stockpile. There is also no processing of the reject material noted on site.'
>
> 'Currently when you survey the site there still appears to be stockpiles of material that look like coal. Wollongong Coal is not permitted to store or stockpile coal on site, as their Preliminary Works Project approval has lapsed. These piles of coal could not be considered to be sound walls or the like, as they have not been topped and seeded.'

As noted in the Revised Preferred Project Report, over size reject material that is separated by the Processing Plant will be transferred to a rejects stockpile by the rejects conveyor (refer to **Figure 1.2**) from where it will be either loaded onto road trucks to be sold as fill material, transferred to the mine portal and emplaced underground or used in site rehabilitation. No further processing of reject material is proposed.

There are no coal stockpiles currently present on site. The coal stockpiles required to be removed from site under a Development Control Order was completed in July 2019.

It is noted that the Preliminary Works Project Approval (PA 10_0046) has not lapsed and remains valid.

> **Noise:**
>
> 'The proponent is again offering to cover all conveyors to minimise dust and noise… The most prominent section of conveyors has never been covered. This section of conveyors has now been called a "tripper" and so does not need to be covered. This tripper is one of the most problematic areas in to sound generation at night. Under the new Revised UEP the tripper will be locked in place and only discharge at one point but Wollongong Coal still refuse to cover it to reduce noise and sound. We have been told that the tripper will be locked in place and does not move. If this is the case then it is no longer a tripper and surely it is just part of the conveyor and should be covered?'

To reduce noise impacts associated with the Revised Preferred Project, WCL has undertaken a significant redesign of the Pit Top and identified additional noise mitigation measures to reduce the potential noise impacts associated with surface operations to an acceptable level. This design work builds on a range of noise mitigation measures that have already been implemented at the Pit Top over recent years, including acoustic treatment of the existing tripper system.

The acoustic treatment of the existing tripper system has included internal lining and vibration isolation of tripper impact plates and hangers, as well as internal lining and top covering of trouser leg chutes.

Coal and rocks impacting the tripper leg chutes as it is discharged onto the ROM stockpile was identified as a noise source that could potentially trigger sleep arousal during the night or early morning shoulder period. As outlined in the Revised Preferred Project Report, the Noise Impact Assessment indicates that L_{AFmax} noise levels associated with the Revised Preferred Project's infrastructure are predicted to be below the L_{AFmax} trigger levels at all the representative receivers.

The existing acoustic treatment of the tripper system is considered adequate as acceptable noise levels are predicted to be achieved at all sensitive receivers.

> **Health effects:**
>
> 'This project carries significant detrimental health impacts to the community, through both air pollution from coal dust, water insecurity as detailed above, and contribution to climate change from the 11 million tonnes of CO2-equivalent greenhouse gas emissions that the coal from the Russell Vale colliery will produce in its lifecycle. These health impacts will hit the most vulnerable in our communities the hardest - children, pregnant women, the elderly, and those with chronic health conditions. This is an unacceptable burden to place on the communities of the Illawarra, for the private profit of Wollongong Coal.'
>
> 'Instead of allowing a dodgy company to make more money, the government should be investing in a transition plan for mine workers and be considering the health and well-being of local residents who have to drink the water and breath the air being affected by Russell Vale mine.'
>
> 'The area is highly urbanised and represents an immense health risk to residents and locals.'

The detailed assessment of environmental aspects including air quality, water resources and greenhouse gases has been undertaken in accordance with relevant legislation and guidelines, and by appropriately qualified specialists. Relevant legislation and guidelines for environmental aspects that have potential risks to public safety or human health are based on accepted safety or health based assessment criteria established by the NSW government.

As outlined in the Revised Preferred Project Report and above, the predicted 24 hour and annual average particulate matter concentration and deposition levels arising from the Revised Preferred Project was assessed at 10 representative residential receivers surrounding the site. The predictions include both the incremental contribution of the Revised Preferred Project to annual average PM_{10}, $PM_{2.5}$ and dust deposition, as well as cumulative emissions when considering background emissions. The assessment results were compared to relevant air quality criteria for PM_{10}, $PM_{2.5}$ and deposited dust and no exceedances of relevant criteria were predicted at any sensitive receptor locations off site.

Water quality impacts associated with the Revised Preferred Project are expected to be reduced in comparison to the existing operation with the implementation of various improvements to the site SWMS proposed under Mod 4. Improvements to flood management will reduce the frequency and volume of uncontrolled discharges of dirty/mine water from the site during high rainfall events and the proposed water treatment measures will result in lower concentrations of sediment in licensed off-site discharges.

It is considered that the Revised Preferred Project represents a low risk of potential health impacts to the local community. Regardless, WCL proposes a number of management and mitigation measures to manage potential impacts from the Revised Proposed Project.

Infrastructure:

'The community were told at the information session that all pit top infrastructure would be in place before any coal was extracted but now the Revised PPR states it will take 12-24 months for the entire infrastructure to be built.

This proponent cannot be trusted to deliver on any condition, commitment or order. Therefore all infrastructures should be in place prior to any coal extraction to safeguard the neighbouring residents.'

The Revised Preferred Project states that construction of the proposed Pit Top upgrades will commence at the same time as operations and the use of new and upgraded facilities will be phased in over approximately 12 - 24 months as construction is completed. As discussed in the Revised Preferred Project Report, the supporting Noise Impact Assessment and at the Community Information Session, WCL has committed to constructing a number of proposed noise mitigation structures prior to the commencement of operations in order to minimise noise impacts from construction and operational activities.

Following consideration of submissions on the Revised Preferred Project, WCL has further revised anticipated construction timeframes for the Pit Top upgrades from 12-24 months to 6-12 months. The proposed Broker Street Noise Wall and Container Noise Walls will be installed prior to the commencement of operations, with further bund extension works to be completed within 3-months of the commencement of operations.

5.1.7 Socio-Economic Impact

Issues relating to socio-economic impacts were raised both in objection and support of the Revised Preferred Project. Perceived negative socio-economic impacts related to a lack of economic benefit and impacts on property values, while perceived positive socio-economic impacts related to employment opportunities, contribution to the economy and flow on impacts to the local community.

The perceived negative socio-economic impacts are addressed below.

Limited economic benefit / impact on jobs minimal as currently in care and maintenance:

'The mine itself is currently in 'care and management' mode with 60 staff employed. In rejecting this application, the impact on the employment outlook for the Illawarra would be minimal.'

'The company currently employs 14 workers at Wongawilli, where the mine is in care and maintenance, and about 70 at Russell Vale, so the closing of operations would not have a big impact on jobs.'

'The Revised PPR states they will require approximately 205 staff. Surely these numbers will only be required for the maximum 1 million tonne extract period… the 205 staff is an exaggeration and brinkmanship on part of Wollongong Coal, as they have done in all previous applications and modifications.'

'There is no mention as to whether this staff is full time permanent or contractors? Wollongong Coal have always used contractors in the past and these contractors usually do not have receive the normal benefits of full-time employment and should be considered part time or substandard positions.'

As outlined in the Revised Preferred Project Report, the operation of the Revised Preferred Project will require approximately 205 staff. A short-term construction workforce of approximately 22 employees over a 6-12 month period will also be required. The estimated employment generation is based on peak production requirements and WCL considers them an accurate and appropriate assumption.

WCL will maintain a workforce that will include a mix of employees and contractors.

The employment generated by the Revised Preferred Project will have a positive economic result for the Wollongong area. A Local Effects Analysis was undertaken as part of the Economic Impact Assessment for the Revised Preferred Project to assess the net economic impacts to the local community in the Wollongong region of NSW. The analysis shows a total estimated net benefit of $14.3 million in net present value (NPV) terms to local suppliers and employees in the Wollongong local area. This is driven largely by:

- benefits to local workers of $8.7 million in NPV terms based on the assumption that 20% of the mine's direct employees is located in the local area
- benefits to local suppliers of $5.5 million in NPV terms based on the assumption that 20% of the inputs to production are suppled from the region.

It is noted that the Revised Preferred Project also received 56 supporting submissions from community members and 14 from interest groups. Of those 70 submissions, one of the key benefits of the Revised Preferred Project raised was continued employment and additional jobs, refer to **Section 2.2.2**.

No benefit to local steel industry:

'I understand that the coal the proponents intend to produce, will not be used for local steel.'

'It should also be noted here that this coal will never benefit Australia or maintain any steel manufacturer in or region… None of the steel produced from this mine will ever be used in Australia. It is not beneficial in any way to regional steel manufacture and will in fact produce steel that is detrimental to the current manufactures.'

The Revised Preferred Project will have considerable economic benefits for the local and State economies.

A detailed Economic Impact Assessment was completed for the Revised Preferred Project (Appendix 10 of the Revised Preferred Project Report). The overall finding of the Cost Benefit Analysis (CBA) is that the Revised Preferred Project is estimated to contribute a total net economic benefit for the NSW community of approximately $174.3 million in NPV (i.e. how much a future sum of money is worth today). This is comprised of $116.9 million and $57.5 million in direct and indirect benefits respectively.

The Revised Preferred Project is predicted to generate the following direct benefits:

- Total net producer surplus of $112.2 million in NPV terms, of which $39.7 million is attributable to NSW based on a 35.4 % NSW ownership share of WCL.

- Total corporate taxes of $120.3 million in NPV terms for Australia, of which $38.5 million is attributed to NSW.

- $38.7 million in other government revenue for NSW in NPV terms, the largest component of this being royalties of $33.2 million with council rates and land taxes of $2.1 million and payroll taxes contributing $3.4 million.

The indirect benefits of the UEP accrue to workers, suppliers and landowners. The analysis shows that the total indirect benefits are estimated at $57.4 million and consists of:

- Worker benefits are predicted to amount to $43.6 million in NPV terms, over the life of the Revised Preferred Project.

- Supplier benefits are predicted to amount to $13.8 million in NPV terms.

- No expected benefits to landowners.

Consideration of the local steel making industry is not a requirement for consideration under the *Guidelines for the economic assessment of mining and coal seam gas proposals* (NSW Government 2015).

Project will devalue properties:

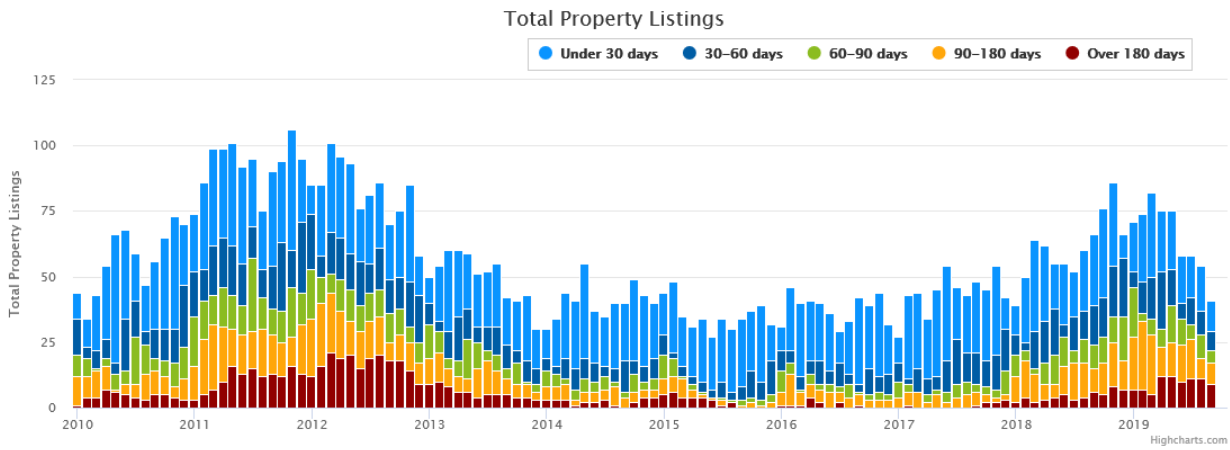
'Industry always devalues property and it is understandable why.'

'We are particularly concerned by the instability of the land surrounding the area and as potential home buyers in the area we feel this is very concerning for potential and existing residents' home values and safety.'

The site has a long established history of mining activity, with mining having been undertaken at the Russell Vale Colliery since the 1880's. Over time, urban development has encroached on the Russell Vale Pit Top and these facilities are now bordered by residential land uses. Russell Vale Colliery has therefore coexisted with these neighbouring land uses over an extended period with a degree of impact on the amenity of these residential land uses. Key elements of the Revised Preferred Project have been designed to minimise impacts on these surrounding land uses, including substantial noise mitigation works around the Pit Top to reduce noise impacts on surrounding residents and controls on the speed and timing of trucks entering and leaving the site.

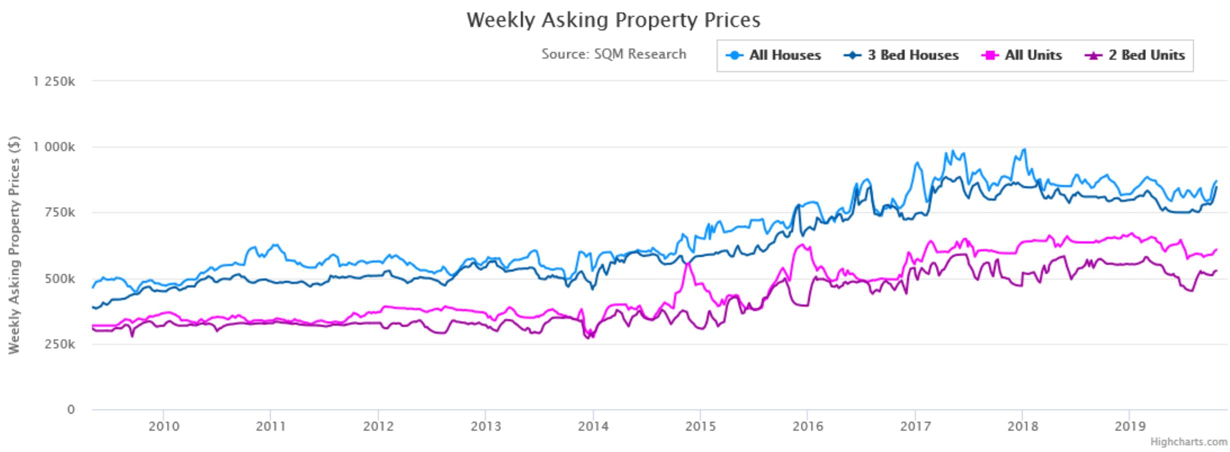
As outlined in the Social Impact Assessment for the Revised Preferred Project, housing prices in Russell Vale and Corrimal have demonstrated an increase since 2009. Unit prices have also increased in Corrimal (data is not available for the unit prices in Russell Vale). In Russell Vale house prices have nearly doubled since 2009, from $399,000 - $765,000 (2017). Although between 2016 and 2017 prices have decreased slightly (from $770,000 to $765,000). In Corrimal house prices have more than doubled since 2009, from $380,000 to $799,000 (2017). Similarly, unit prices have also increased over this time from $295,000 (2009) to $518,000 (2017).

Stock on market for postcode 2517 of which Russell Vale is part is provided in **Graph 5.1** and analysis of asking prices is provided in **Graph 5.2** and **Table 5.1**. There is insufficient data to provide a reliable median sale price for Russell Vale beyond that presented in the Social Impact Assessment for the Revised Preferred Project.



Graph 5.1 Total Property Listings, postcode 2517

SQM Research, https://sqmresearch.com.au/total-property-listings.php?sfx=&postcode=2517&t=1



Graph 5.2 Weekly Asking Property Prices, postcode 2517

SQM Research, https://sqmresearch.com.au/asking-property-prices.php?postcode=2517&t=1

Table 5.1 Weekly Asking Prices Index

SQM Research Weekly Asking Prices Index							
Week ending 29 Oct 2019			Change on prev week	Rolling month % change	Rolling quarter % change	12 month % change	3 year % change
Postcode 2517	All Houses	869.8	10.2 ▲	9.2% ▲	4.5% ▲	-0.8% ▼	9.9% ▲
	3 br Houses	847.5	32.5 ▲	8.0% ▲	13.0% ▲	7.0% ▲	10.1% ▲
	All Units	608.6	6.4 ▲	3.6% ▲	4.2% ▲	-6.8% ▼	22.9% ▲
	2 br Units	527.7	2.3 ▲	2.9% ▲	16.6% ▲	-4.8% ▼	16.2% ▲

As shown in **Graph 5.2**, housing prices in the 2517 postcode experienced growth from 2014 to 2018 and have generally plateaued over the past 18 months which is consistent with broader property markets. Asking prices for 'All Houses' for the 2517 postcode have experienced an increase of 10.1 per cent over the last three years (refer to **Table 5.1**).

There are a wide range of factors which affect property values including broader regional market trends. In regard to impacts associated with the Revised Preferred Project, the assessments have found that in most surrounding areas there will be minimal changes to impacts from those previously experienced when the site was not in care and maintenance. As discussed in **Section 4.5.1**, the Revised Preferred Project is not predicted to result in any significant subsidence impacts. The Revised Preferred Project will not contribute to instability of the land surrounding the area.

Given the long history of mining in the area and acceptable predicted impacts, adverse effects on property values are considered unlikely.

5.2 The Project

Concerns relating to the Project were raised in 60 community submissions and in 5 interest group submissions.

5.2.1 Mining Method and Proposed Mine Plan

Bord and pillar mining can cause subsidence:

'I have no confidence in their assurances that the "non-caving first workings mining system ... will result in imperceptible subsidence"'

'The proponent has stated that the Bord and Pillar proposed mining system produces NO subsidence. But now terminologies like small, imperceptible, negligible and low levels of subsidence are now mentioned. This needs to be clarified as to what this terminology means. They are not included in the Revised PPR definitions. To state NO subsidence is deceptive; all mining methods have the capacity to produce or induce subsidence, even without failure.'

'So, clearly it is possible for bord-and-pillar to cause subsidence.'

The subsidence assessment (SCT 2019a) undertaken as part of the updated environmental assessment for the Revised Preferred Project states that the Project is expected to result in some very low-level subsidence movements (less than 100 mm and generally less than 30 mm) with corresponding very low levels of tilt and strain. These low-level movements are associated with elastic compression of the pillars and strata above and below the pillars. Any such subsidence is likely to occur gradually and expected to be generally imperceptible (SCT 2019a).

The Revised Preferred Project Report does not state that the project will produce no subsidence.

A peer review of the subsidence assessment was undertaken by Bruce K Hebblewhite subsequent to the exhibition of the Revised Preferred Project. The peer reviewer agrees with the predicted very low levels of subsidence expected as a result of the Revised Preferred Project mine plan.

Uncertainty in Bulli seam:

'Some areas of mining in the Bulli seam are unknown in regard to layout and stability. Mining under these areas should be avoided at all cost or a thorough investigation and analysis should be undertaken. The risk of mining under these areas unstable areas is to great considering Wollongong Coal are talking up this development as no or negligible impact. The pylons for the four power transmission lines are located in this area and all precautions should be taken.

The Revised PPR says that in a few small areas where the Bulli Seam pillars are narrow and the voids between them wide enough that stability appears marginal irrespective of any further mining there is some potential for pillar instability to lead to additional subsidence, potentially of the order of 1m to 2m should the pillars collapse over a large enough area. These areas should be investigated and analysed or steered away from in the mine layout.'

‘The Revised PPR does state that there is *“however a low risk of the proposed mining destabilising remnant pillars in historical Bulli Seam workings above the proposed workings”*. And *“If these areas of marginally stable pillars are destabilised for any reason there is some potential for additional subsidence movements, however this potential generally exists irrespective of the proposed mining”*. If there was a pillar failure in this area it could easily induce a catastrophic pillar run.

It goes on to say *“The potential for additional subsidence from destabilised pillars in the upper seams is considered low, however cannot be eliminated. Therefore, a suitable engineered solution or alternative method of reducing uncertainty regarding the Bulli seam layout will be outlined in a Built Features Management Plan for the powerlines to be prepared in consultation with the asset owners prior to undermining of the lines”*. Surely it is not only the built environment that requires protecting and if there is going to be additional subsidence it should be dealt with in this approval process and not left to a later date.’

The target seam for the UEP is the Wongawilli Seam which underlies historical workings in the Balgownie and Bulli seams. The presence of previous mining activity and the potential for multi-seam interactions as a result of proposed further mining in the Wongawilli Seam have been investigated and assessed as part of the subsidence and groundwater assessments prepared for the Revised Preferred Project. This past mining has allowed a better understanding of the nature of the potential interactions between seams and the potential for pillar instability, particularly in the Bulli seam, to cause unexpected additional subsidence.

The mine design has been developed with regard to the past mining in the seams located above the Revised Preferred Project mine plan. The proposed mine plan is not expected to contribute to significantly increased loading in the overlying seams, therefore in general there is very limited potential for the proposed mining to lead to additional pillar instability in the overlying seams.

In relation to the areas of marginally stable pillars in the Bulli Seam overlying the proposed workings, if these areas of marginally stable pillars are destabilised for any reason there is some potential for additional subsidence movements. It is noted that this potential generally exists irrespective of the proposed mining, and as noted above, there is very limited potential for the proposed mining to lead to additional pillar instability in the overlying seams.

The 330kV and 132kV powerlines located east of Mount Ousley Road are both supported on steel truss pylons which are very sensitive to differential ground movements from subsidence. The ground movements associated with the proposed mining are so low as to be well within the tolerance of these steel truss pylon structures.

As identified in a submission, the assessment identified that the only potential for impacts on the steel truss pylons would be from subsidence movements resulting from destabilisation of remnant pillars in the historically mined Bulli seam above the proposed workings. As discussed, the potential for additional subsidence from destabilised pillars in the upper seams is considered low, however cannot be eliminated. WCL has therefore committed to identifying a suitable engineered solution or alternative method of reducing uncertainty regarding the Bulli seam layout which will be included in a Built Features Management Plan for the powerlines to be prepared in consultation with the asset owners prior to undermining of the lines.

The two 33kV powerlines located further to the east are not expected to be impacted by the low levels of subsidence movements forecast for proposed first workings mining. These powerlines are supported on single and double pole structures that are generally tolerant of subsidence movements.

As outlined in the Subsidence Assessment (refer to **Appendix 5**), the issue of a “pillar run” in the Bulli Seam was raised on the previous UEP mine plans. The geometries in the Bulli Seam and the evidence from previous mining in the Balgownie Seam make it unlikely that a “pillar run” event would be extensive. The subsidence from such an event would be limited to low levels of less than a few hundred millimetres maximum due to the narrow panel width of standing pillars small enough to be destabilised and would be limited to only those areas where there are small standing pillars that have not previously been mined under in the Balgownie Seam.

The terms “pillar run” is potentially being used to describe the phenomenon that is perhaps better described as “stress redistribution” because of the relatively smaller ground movements involved, typically less than 100mm. The proposed workings in the Wongawilli seam are not expected to cause any significant instability of pillars in the overlying seams.

As discussed in **Section 3.3.1**, a peer review of the Subsidence Assessment prepared by SCT (2019a) for the Revised Preferred Project (Appendix 1 of the Revised Preferred Project Report) has been undertaken by Bruce K. Hebblewhite. The revised Subsidence Assessment (refer to **Appendix 5**) includes a more detailed discussion and analysis for the issue of overlying Bulli Seam pillars. The peer review accepts that the particularly narrow (12 m) pillars only occur as single rows of pillars between regions of wider pillars. As such, they are not required to contribute to regional stability and the surrounding pillars have a demonstrated capacity to carry the full cover load, even if the 12 m wide pillars carry no load.

Triple Seam Mining:

‘The mining is particularly risky because a third seam of coal is being mined beneath two previously mined seams. Triple seam mining has little precedent and impacts are difficult to predict. The proponent admits that instability in the overlaying old Bulli seam workings may cause pillar collapse and subsequent subsidence of 1 to 2 metres.’

‘This method of mining is not simple and has cumulative impacts. The seams above have previously been mined by using Bold and Pillar, Pillar Reduction, Pillar extraction and Longwall mining. They all add a complication to the subsidence predictions and all overly stress the ground.’

‘This project will mine the Wongawilli seam, underneath old mine workings. SCT in Appendix 1 does not entirely rule out risks due to this (p.32):

The formation of isolated roadways in the Wongawilli Seam is not expected to have potential to cause instability in these Bulli Seam pillars. There is no known evidence of this effect at the Russell Vale site. However, the possibility cannot be ruled out completely.’

‘Longwall mining has already resulted in shocking subsidence-induced fracturing and consequent loss of valuable water in our water catchments. The cumulative effects of previous mining in this area cannot be quantified as it will continue indefinitely into the future and even escalate after the mine closes down.’

‘Mining should not be permitted anywhere near Great Sydney water supply reservoirs. The mining is particularly risky because a third seam of coal is being mined beneath two previously mined seams. Triple seam mining has little precedent and impacts are difficult to predict.’

‘The possibility that the tunnelling may be made more risky in the context of the proposed extension and its `third seam' method must be evaluated. Certainty that no risk is posed to the water storage must be established.’

A detailed Subsidence Assessment (Appendix 1 of the Revised Preferred Project Report) was completed for the Revised Preferred Project which considered a number of factors including the geological setting, previous mining and pillar stability.

The presence of previous mining activity and the potential for multi-seam interactions as a result of proposed further mining in the Wongawilli Seam have been investigated and assessed as part of the subsidence and groundwater assessments prepared for the Revised Preferred Project.

Previous mining in the Bulli, Balgownie and Wongawilli Seams provided a baseline of impact experience and recovery for the assessment of subsidence in the vicinity of the proposed first workings, allowing an opportunity to examine the impacts over timeframes of 50 to 100 years for the Bulli Seam and 30 to 40 years for the Balgownie Seam mining. This past mining also provides greater certainty in understanding the location and nature of geological structures in the areas and their behaviour in response to local mining impacts.

The ongoing nature of the mining operation at Russell Vale Colliery provided specialists the opportunity to inspect the mine workings in the Bulli Seam and the Balgownie Seam to better understand the nature of the potential interactions between seams and the potential for pillar instability, particularly in the Bulli Seam, to cause unexpected additional subsidence.

Subsidence monitoring data available from mining in the Balgownie Seam and more recently from three longwall panels in the Wongawilli Seam is available and this provides a basis for confirming overburden behaviour and estimating the potential for further subsidence. This data indicates that while there are some differences in behaviour compared to single seam mining, the multi-seam behaviour is reasonably predictable and occurs predominantly within the bounds of the individual panels that were mined. This data and observations of previous ground movements indicate that the ground movements expected to result from the proposed mining are likely to be insignificant for all practical purposes.

The Revised Preferred Project mine design has considered this accumulated data regarding past mining in overlying seams when establishing the design parameters for the mine plan. The proposed mine plan is not expected to contribute to significantly increased loading in the overlying seams, therefore in general there is very limited potential for the proposed mining to lead to additional pillar instability in the overlying seams.

The cumulative risks of mining within the UEP Application Area have been assessed and considered. Overall, the subsidence movements forecast for the proposed mine plan are not expected to result in any perceptible subsidence at the surface or cause any significant impacts to natural surface features within the UEP Application Area.

As outlined in the Subsidence Assessment, ongoing subsidence movement associated with previous mining may continue within the lease area irrespective of any further mining in the Wongawilli Seam. This ongoing subsidence movement is a legacy of previous mining and is not expected to be influenced by the proposed mining.

As outlined in **Section 3.3.1**, a peer review of the Subsidence Assessment prepared by SCT (2019) for the Revised Preferred Project has been undertaken by Dr Bruce K. Hebblewhite. Copies of the initial and final peer review reports have been included as **Appendix 4**, with the updated Subsidence Assessment provided as **Appendix 5**. A summary of the peer review findings and updated assessment are provided in **Section 3.3.1**.

The peer review agreed that the conclusions of the SCT Subsidence Assessment were appropriate and valid, and specifically in relation to ongoing subsidence movements and risks associated with destabilising overlying workings, the peer reviewer agrees that:

- ongoing subsidence may continue to occur as a result of previous mining activities however this is independent of the proposed first workings, and
- the proposed first workings are not expected to have significant impact on the stability of pillars in the overlying seams, even marginally stable pillars in the Bulli Seam.

WCL accepts the recommendation of the peer reviewer that a program of underground pillar stability monitoring be included in the revised subsidence monitoring program for the Revised Preferred Project.

Risk of destabilisation of overlying workings:

'The proponent admits that instability in the overlaying old Bulli seam workings may cause pillar collapse and subsequent subsidence of 1 to 2 metres. It is unacceptable of the NSW government to allow such risky mining in the water catchment for 5 million people of Greater Sydney in a time of drought.'

'We find this paragraph interesting, in terms of the possible legal impacts of a small risk:

In the unlikely event of further subsidence due to pillar instability in the Bulli Seam without any further nearby mining activity in the Wongawilli Seam, any consequential impacts would be due to historic mining and any remediation costs would be covered by Subsidence Advisory NSW (formerly the Mine Subsidence Board). If, on the other hand, subsidence due to pillar instability in the Bulli Seam were to occur after mining in the Wongawilli Seam, even if only in the general vicinity, WCL would be in the position of needing to demonstrate the subsidence was not due to their recent mining activity to avoid being held responsible under the Work Health and Safety Act 2011 and specifically the Work Health and Safety (Mines and Petroleum Sites) Regulation 2014 for any impacts that may occur. This burden of proof may be difficult to support.'

The Revised Preferred Project Report indicated that there are some areas of marginally stable pillars in the Bulli Seam overlying the proposed workings. If these areas of marginally stable pillars are destabilised for any reason there is some potential for additional subsidence movements, however this potential exists irrespective of the Revised Preferred Project.

The potential for the Revised Preferred Project to contribute to destabilisation of these pillars has been assessed. The proposed mine plan is not expected to contribute to significantly increased loading in the overlying seams, therefore in general there is very limited potential for the proposed mining to lead to additional pillar instability in the overlying seams.

The subsidence peer review agreed with these conclusions of the Subsidence Assessment (refer to **Appendix 4**).

Any mining induced subsidence from previous mining is managed in accordance with the relevant planning instruments and processes, and in accordance with the existing subsidence management framework established by the NSW Government.

Potential subsidence from previous mining:

'The Revised PPR also states*, "A number of areas within the UEP Application Area are currently in limiting equilibrium (on the verge of moving) because of previous mining, including Longwalls 4-6 in the Wongawilli Seam. Some ongoing low-level ground movement, mainly horizontal movement associated with previous mining including the Wongawilli Seam longwalls, may not yet have ceased completely. This low-level movement related to previous longwall mining operations has potential to continue to cause low-level impacts to Mount Ousley Road and valley closure across Cataract Creek that may be perceptible. This movement is a legacy of previous mining and is not expected to be influenced by the proposed mining. Movement may continue irrespective of any further mining in the Wongawilli Seam"*. This appears to insinuate that Wollongong Coal are no longer responsible for the subsidence caused by their previous mining operations and that somehow the approving authority has to estimate how much subsidence will occur from past mining and how much subsidence will be caused by the proposed mining. This should not be the case as all subsidence will be caused by Wollongong Coal and should be their responsibility and taken into account in this planning application.'

This application is seeking approval for the Revised Preferred Project. The Subsidence Assessment considers the potential subsidence movements associated with the Revised Preferred Project in the context of its regional setting including cumulative impacts from previous mining irrespective of who completed that mining.

Ongoing subsidence movements associated with previous mining are monitored in accordance with the requirements of the LW6 Extraction Plan and LW5 Subsidence Management Plan.

Any mining induced subsidence from previous mining is managed in accordance with the relevant planning and mining approvals.

Secondary extraction:

'There is mention in the Revised PPR that second workings will not be used under some of the built infrastructure. Is the proponent saying that there will be second workings in other locations when they have previously stated that it is only proposing a non-caving first workings mining system?

The Revised PPR states *"the proposed first workings mine plan has been specifically re-designed to avoid any secondary extraction beneath Cataract and Bellambi Creeks or Cataract River and their associated swamps, as well as Cataract reservoir".* Is the proponent saying that there will be second workings in other locations when they have previously stated that it is only proposing a non-caving first workings mining system?'

The Revised Preferred Project does not propose secondary extraction as part of the ongoing mine plan. As noted below, recovery of the longwall mining equipment will require the mining of a 25 m section of LW6 to facilitate removal of the longwall mining equipment from the mine. This process reinforces the commitment to no further longwall mining at Russell Vale Colliery.

The submission quotes specific comments in the Revised Preferred Project Report in relation to built infrastructure and the Cataract Reservoir. These statements were specific to the issues being discussed within the Revised Preferred Project Report and were not purposefully, or otherwise, intended to be contradictory to commitments made in relation to secondary extraction.

Retrieval of longwall equipment:

'Wollongong Coal has stated that they will be only using a non-caving first workings mining system but for the removal of longwall equipment they want to drive it forward 25m to the next gate-road. This should not be allowed even if it was approved under their expired modification MOD2. Wollongong Coal has stated that this Revised PPR is for first workings only and if they want to retrieve their longwall equipment they should find another method using first workings. It should be remembered that Wollongong Coal made the decision to not finish LW6 and retrieve their mining equipment in 2014. This is just one of the many poor decisions they have made in their short chequered history. Why should the community and the approving authorities risk the damage to the swamp CCUS4 just because the proponent made another poor decision? Their right to use the longwall miner has lapsed, the approval is finished.'

As outlined in the Revised Preferred Project Report, WCL will not be seeking future approval for longwall mining within the Russell Vale Colliery lease holding. It is proposed however to retrieve the existing longwall mining equipment that is currently located within LW6. It is considered that the retrieval of the longwall equipment is a reasonable expectation and demonstrates WCL's commitment to no further longwall mining within the lease area.

The longwall face equipment is currently located approximately 25 m short of the next gate road access point that would allow for its safe removal. Recovery will therefore require the mining of this 25 m section of LW6 to facilitate removal. This mining has been previously assessed and approved under the existing *Russell Vale East - LW6 (365m) Extraction Plan* (Hanson Bailey, 2015c) and represents the panel retreat between 340 - 365 m of LW6.

The Russell Vale Colliery operates under Project Approval (PA) 10_0046 and has been on 'care and maintenance' since 2015. PA 10_0046 (as modified) remains valid and authorises the ongoing use of surface infrastructure and 5 shafts at Russell Vale Colliery as well as a range of mining activities, including development mains in the Wongawilli Seam and extraction of longwall panels 4, 5 and the first 365 metres of LW 6. Schedule 2, Condition 5(a) of PA 10_0046 however requires that no mining occur after 31 December 2015, thereby preventing the completion of LW6 extraction and retrieval of the longwall equipment.

The Revised Preferred Project seeks approval to recommence mining within the Russell Vale Colliery based on a revised mine plan, and allowing for the completion of mining previously assessed and approved under PA 10_046 and the *Russell Vale East - LW6 (365m) Extraction Plan* only to the extent of the 25m required to enable retrieval of the longwall equipment.

Definition of 'long term stable':

'The retention of the pillars is described as being *long-term stable* within the proposal. But what does *long-term* mean in this context?'

'…the claims of long-term stability and absence of subsidence of the proposed first-workings bord-and-pillar mining are unclear in terms of timeframe.'

The judgement of pillar stability is considered from a risk management perspective. The proposed first workings pillars in the Wongawilli Seam at Russell Vale East could be considered to be 'subsidence protection pillars'. Subsidence protection pillars are defined in ACARP C9018 (2005) as:

- may be a single pillar, or a region of large pillars used to protect major surface, or sub-surface features or infrastructure

- must satisfy a pillar stability criterion such that they are both strong enough not to fail under the prevailing regional loading conditions over the lifetime of the features being protected, and that they are stiff enough that the amount of elastic compression of the pillars (or pillar foundations) is within an acceptable subsidence limit
- the lifecycle of these pillars is determined by the time required for protection of the features concerned. This would typically be decades, extending to “permanent protection” – i.e. the pillars must continue to function well after the mine life has finished and the workings abandoned and probably flooded.

The proposed first workings pillars in the Wongawilli Seam at Russell Vale East are expected to limit subsidence and provide protection to surface and sub-surface features from subsidence impacts and environmental consequences for the life of the surface and sub-surface features. Therefore the proposed first workings are considered to provide permanent protection.

Description of maximum excavated panel distances:

‘…I did not find described the maximum excavated panel distances between these pillars.’

The Subsidence Assessment (Appendix 1 of the Revised Preferred Project Report) summarises the geometry of the proposed mine plan.

The proposed first workings form square pillars in generally rectangular panels. Each panel typically has five headings and is separated from adjacent panels by solid coal barriers of generally greater than 40m in width. A cutting height of approximately 2.4 m is proposed, with standard 5.5 m wide roadways. Pillars located beneath longwall panels in the overlying Balgownie seam have been designed to be approximately 25 m wide centre to centre, therefore will typically comprise 19.5 m by 19.5 m solid square pillars with 5.5 m wide roadways. This represents a width to height ratio for these pillars of approximately 8. Pillars outside the Balgownie seam longwalls are designed to be square at approximate 30 m centres (approximate 24.5 m by 24.5 m solids pillars with 5.5 metre wide roadways), representing a width to height ratio of approximately 10.

Longwall mining:

‘Longwall mining causes subsidence and major loss or contamination of water, and no effective methods exist of stopping this damage.’

‘Allowing further long-wall mining to occur under the Sydney Water Catchment Special Area is both irresponsible and dangerous.’

The Revised Preferred Project proposes a mine plan using first working mining method, with the workings designed to be long-term stable with minimal subsidence impacts. No longwall mining is proposed, except for a 25 m section of LW6, necessary to extract the longwall wall mining equipment from the mine for sale or disposal as it is no longer required.

Further, WCL have resolved that all future mine designs will be based on first working mine designs only to eliminate subsidence from mining activities affecting significant levels of strata stability and integrity towards the surface.

Dewatering of overlying seams:

'What is the justification for assuming that the overlying workings are not required to be drained? What is the evidence for making this assumption? Why outline a best-case scenario rather than a worst-case scenario? What would be the consequences for groundwater if draining was required?'

'The revised PPR says that if the *"Balgownie and Bulli Seams are required to be drained as an inrush control measure then this may alter the current groundwater flow paths underground. Any changes to flow paths are not expected to increase the overall quantity of groundwater entering the mine".* The decision to drain the two seams above the Wongawilli seam should be made now and the consequences determined before this project is approved. Any changes or dewatering in the mine should be taken into consideration upfront.'

The Revised Preferred Project mine plan has been designed to be long term stable and dewatering of overlying seams is not anticipated to be required. However, in the event that unexpected conditions are identified during mining activities that warrant dewatering of flooded overlying seams for safety reasons (e.g. to prevent inrush), dewatering would be undertaken. WCL have been drilling overlying seams and installation of pressure tested pipes for this eventuality as a precaution. No water has been found and the Resources Regulator has reviewed these installations. The potential impacts of dewatering flooded overlying workings has been considered in the Subsidence Assessment (SCT 2019), and determined that if required, would not result in destabilisation of pillars in the Bulli or Balgownie seams and while dewatering may alter the current groundwater flow paths underground it would not be expected to change the overall quantity of groundwater entering the mine.

5.2.2 Project Alternatives

Withdrawal of UEP application and closure of Russell Vale Colliery should be considered:

'I call on the NSW State Government to reject this application from Wollongong Coal, and to commence a process to close the Russell Vale mine permanently'

'The Revised PPR consideration of project alternatives stated*, "Withdraw the UEP application and close Russell Vale Colliery. The option was not considered a feasible alternative due to the significant investment in the UEP from WCL to date and the extent of valuable coal resources remaining in the colliery holding".* The option however should be considered by the approving authority.'

The option of withdrawing the UEP application and closing the Russell Vale Colliery was not considered a feasible option due to the significant investment WCL has made to date in the development and redesign of the UEP as well as the extent of valuable coal resources remaining in the colliery holding.

WCL notes that there is a strong global demand for high quality coking coal.

The Revised Preferred Project represents the culmination of an exhaustive process of reviewing project alternatives to address issues raised in agency and public submissions and by the PAC's first and second review reports. The key objectives that have guided the refinement of the Revised Preferred Project include:

- developing a mine design that eliminates residual uncertainty regarding subsidence predictions, geotechnical constraints and potential impacts on groundwater, surface water and biodiversity associated with longwall mining

- gaining access to sufficient resources to enable mining to recommence and occur over a sufficient time frame to undertake the necessary assessments to confirm a suitable mine plan in the Wonga West area that would extend the life of Russell Vale Colliery for a period similar to that sought in the initial UEP application
- developing comprehensive mitigation and management strategies to reduce environmental and social impacts in order to meet relevant criteria where-ever practicable and feasible
- conducting mining in an environmentally responsible manner to minimise project specific and cumulative environmental and social impacts
- creating additional employment opportunities within the local and regional community
- co-existing with the local community.

Therefore, the Revised Preferred Project is considered to strike an appropriate balance between maximising resource recovery within the environmental and community constraints of the site.

5.3 Procedural Matters

Issues relating to the planning process were raised in 34 community submissions and in 5 interest group submission(s).

Need to wait for Independent Expert Panel on Mining in Sydney Catchment Report:

'I cannot see how the department can take the panel's advice on a preferred project report for the Russell Vale expansion if the panel has not yet completed the update of the 2008 southern coalfields inquiry which is to inform the review of Russell Vale mining operations and associated projects.'

'Lock the Gate recommends that the Department seek advice from the Independent Expert Panel on Mining in the Catchment as per their terms of reference: 3.d.'

'This Project should not be considered in isolation. There are also operating mines at Dendrobium (to the south of Russell Vale), and at Helensburgh and Appin to the north. The cumulative impacts of these are currently under consideration by the Independent Expert Panel for Mining in the Catchment. The Final Report from this body is now delayed until October. The community should be able to assess the information from the Panel before any decision is made regarding Russell Vale.'

The IEPMC has been established to provide informed expert advice to DPIE on the impact of mining activities in the Greater Sydney Water Catchment Special Areas, with a particular focus on risks to the quantity of water in the Catchment. As identified in the submission, 3.d of the terms of reference requires the provision of advice on the Revised Preferred Project.

The IEPMC released its second report on the impacts of coal mining in the Special Areas on 14 October 2019. WCL has considered and responded to the key recommendations of the report in **Section 3.5**.

Wonga Central Developments Mains not approved:

'The proponent states that it is not proposing to mine under the Cataract Reservoir, yet the Wonga Central Development Mains clearly passes under the reservoir. Wollongong Coal complacently states that this driveage is covered under their previous, now expired approval.'

'The proponent states that it is not proposing to mine under the Cataract reservoir, yet the Wonga Central Development Main passes under the reservoir. This driveage was in the expired Preliminary Works Project but as the PWP has expired, this driveage requires a new application. '

The Russell Vale Colliery operates under Project Approval (PA) 10_0046 and has been on 'care and maintenance' since 2015. PA 10_0046 (as modified) authorises the ongoing use of surface infrastructure and 5 shafts at Russell Vale Colliery as well as a range of mining activities, including development mains in the Wongawilli Seam and extraction of longwall panels 4, 5 and the first 365 metres of LW 6.

The Wonga Mains development were approved as a component of PA 10_0046. This project approval remains valid. However, Schedule 2, Condition 5(a) of PA 10_0046 requires that no mining occur after 31 December 2015, thereby preventing the continued development of the approved mains within the Wongawilli Seam.

The project approval remains valid. However, Schedule 2, Condition 5(a) of PA 10_0046 requires that no mining occur after 31 December 2015, thereby preventing the continued development of the approved mains within the Wongawilli Seam.

The Revised Preferred Project seeks approval to recommence mining within the Russell Vale Colliery based on a revised mine plan, and allowing for the continued development of the mains previously assessed and approved under PA 10_046 (refer to **Figure 1.5**).

Incremental/piecemeal approvals:

'They have been criticised by the community and Government Agencies for obtaining approvals in a piecemeal manner…This is another incremental shift in their approval process and should not be allowed.'

'There is no guarantee that Wollongong Coal will not apply for additional modifications to allow secondary workings or amendments to conditions or statement of commitments.'

The development of an economically feasible mine plan for a coal mine is a complex iterative process that considers a wide range of inputs including geological conditions, economics, environmental and social impacts, and planning and legislative controls. While all best endeavours are made in the initial design of a project, the need for modifications or additional approvals is often required in a coal mining context.

The Revised Preferred Project has been developed after a number of years of investigations and consideration of a number of different mine plan options. The Revised Preferred Project has also evolved in response to agency and community input. WCL has attempted to be transparent and clear throughout the approval process for the Revised Preferred Project as to its intentions for future approvals.

As outlined in Section 1.6 of the Revised Preferred Project Report, large volumes of economically viable coal remain un-extracted within the central and western portions of the Russell Vale lease holding. WCL has clearly stated that it remains committed to undertaking further detailed environmental and social impact studies to enable the recovery of this resource in an environmentally and socially acceptable manner and has commissioned studies that are ongoing for this purpose. Subject to completion of further detailed environmental studies and development of a suitable non-caving first workings mine plan for Wonga West, WCL intends to seek development consent for the continued operation of the Russell Vale Colliery to recover the portions of this resource that can be extracted in an environmentally acceptable manner.

It is noted that the incremental approval process has been support by the Independent Expert Panel for Mining in the Catchment in their second report dated 14 October 2019 for longwall mines operating in the Southern Coalfields as it better provides for an adaptive management approach. The report states:

> *…longwall mines operating in the Southern Coalfield, and especially in the Special Areas, are operating in a complex and relatively unique combination of geotechnical, hydrogeological and environmental conditions, with an incomplete design knowledge base that is still evolving and which may never be complete, and with high potential consequences attached to some aspects of deficient mine design .*
>
> *Therefore, given the complexity and highly technical nature of issues associated with mining in the Special Areas, uncertainties in knowledge bases, performance outcomes to date and the potential consequences of unplanned outcomes, due diligence in risk management necessitates incremental approvals and external expert review at this point in time.*

All approvals and modifications sought by WCL are undertaken in accordance with relevant planning legislation. The NSW planning process provides the community opportunity to comment on development and modification applications.

Deemed refusal has passed:

'Why is it, that given the time limit for deemed refusal has passed for Wollongong Coal Ltd's underground expansion proposal according to the *Environmental Planning and Assessment Act* (1979), that the proposal continued to remain as an active project and has now on public exhibition again in a revised form?'

The Revised Preferred Project has not appealed to the Court under the deemed refusal provisions of the *Environmental Planning and Assessment Regulation 2000*.

PAC Review process:

'The second PAC review was held in 2016: why did the company take until now to respond to that review? The company seem to ignore proper processes.'

A key issue for the PAC in its consideration of the Preferred Project was the uncertainty associated with subsidence and groundwater impacts as a result of proposed longwall mining in the multi-seam mining environment present at Russell Vale. In response to these concerns, WCL revised the previous longwall mine plan and revised the project to significantly reduce the potential adverse impacts of the project. WCL has developed a revised mine design based on a non-caving first workings mining system that will result in imperceptible subsidence to address the residual uncertainty regarding impacts of longwall mining. Changes to the Russell Vale Pit Top are also proposed to address concerns regarding potential amenity impacts to surrounding residential areas.

Due to the significant changes to the mine plan, revised environmental assessments were required to adequately assess the impacts of the Revised Preferred Project. The process of redesigning the mine plan and Pit Top to achieve appropriate environmental and social outcomes takes time. As does completing the detailed technical assessments and consultation required to support the revised application.

WCL has not ignored proper process, rather they have attempted to design a project that addressed the PAC's concerns by providing a revised mine plan that is addresses uncertainty associated with potential subsidence-related mining impacts on groundwater, surface water and biodiversity within the Cataract Reservoir catchment.

Lack of enforcement of conditions:

'…the NSW government has proven to be unable or unwilling to enforce compliance.'

This is a matter for government.

Community consultation process lacking:

As a member of the Illawarra Knitting Nannas Against Greed I attended one of their sessions. To my knowledge there were only two group consultations. One with us and the other with Protect Our Water Alliance. They held a meeting and an open day but not in the suburbs that would be most affected or with the people who would be most affected.

'They said they letter boxed the local area but no one in my street received a flyer or any kind of information. Friends in Russell Vale have not received any recent notification either.'

'I was not confident with their community consultation process…They held a meeting and an open day but not in the suburbs that would be most affected or with the people who would be most affected. In fact they said they letter boxed the local area but no one in my street received a flyer or any kind of information. Friends in Russell Vale have not received any recent notification either.'

As discussed in the Revised Preferred Project Report, a range of mechanisms were used to engage with local landholders, key stakeholders and the wider community during the updated assessment process for the Revised Preferred Project. The stakeholder engagement program was aimed to:

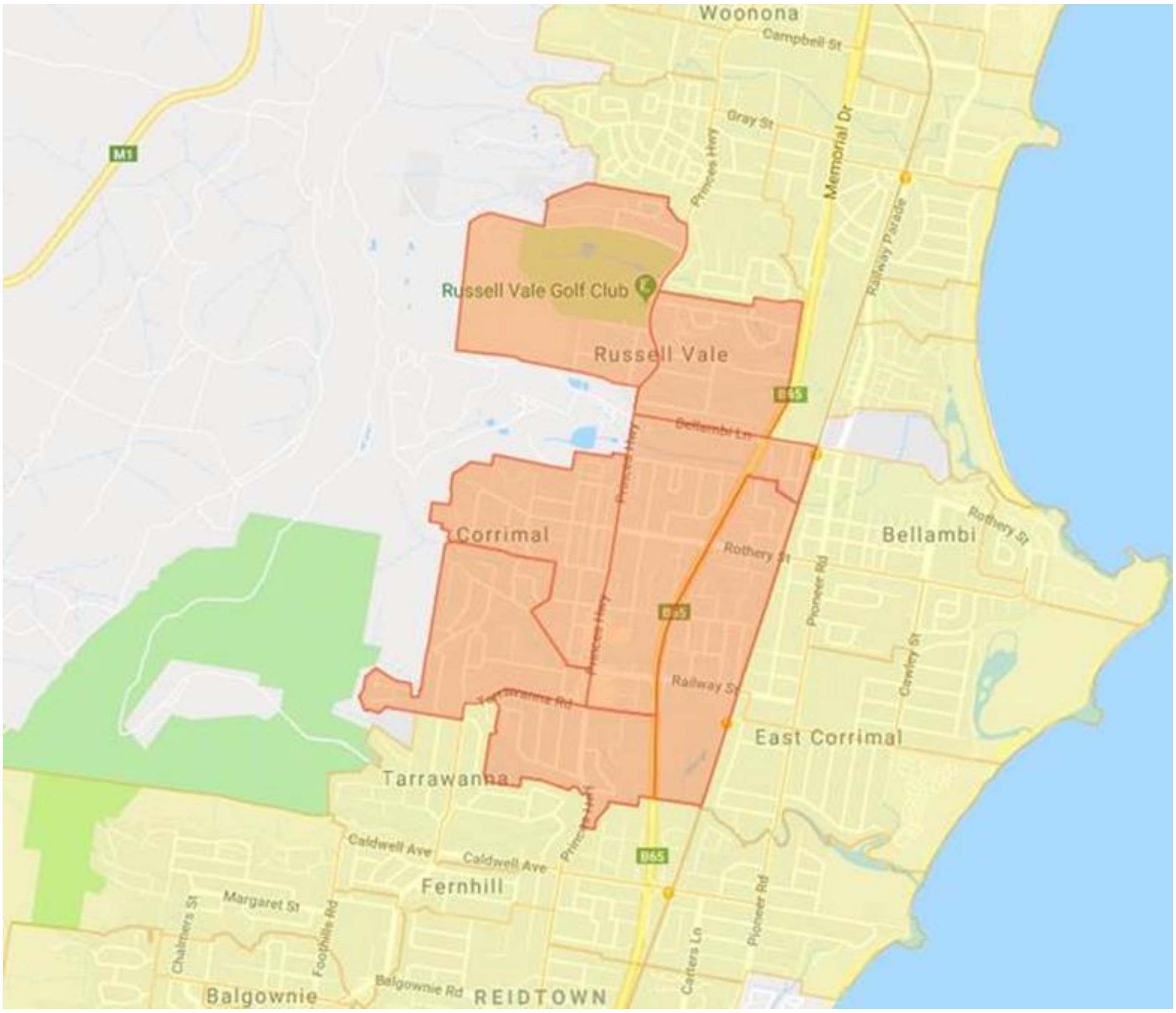
- inform and seek feedback from stakeholders during the design and development of the proposed revised mine plan
- identify key issues to inform the environmental assessment of the Revised Preferred Project
- seek feedback from stakeholders to identify and refine proposed mitigation measures to seek to minimise environment and community impacts.

During the second phase of stakeholder engagement that occurred in May 2019, face to face meetings were held with key community-based organisations including the Illawarra Residents for Responsible Mining (IRRM) and the Knitting Nannas Against Greed (KNAG) on 22 May 2019. Additional organisations within the immediate surrounds were contacted via telephone to provide opportunity for a meeting or further information, including Russell Vale Pre-School, Aspect School South Coast and Russell Vale Golf Course.

A Community Information Session was held at Thirroul Community Centre on 25 May 2019. The Thirroul Community Centre is located approximately 6 km north of the Russell Vale Colliery and was selected as an appropriate venue due to a lack of availability of more local venues which were large enough to facilitate the session (including Russell Vale Community Hall, Corrimal Community Centre and Russell Vale Golf Club).

Approximately 1,500 invitations were sent to residents of Russell Vale and Corrimal, including homes along Rixons Pass Road via letter box drop one week prior to the event. A notice was also placed in the Illawarra Mercury on 16 May 2019 to inform the broader community of the session, and details of the information were placed on the WCL website. The session was attended by approximately 67 people. It is considered WCL took appropriate measures to notify the community of the information session.

Project Information Sheet No.2 was letterbox dropped to approximately 1,500 residences in Russell Vale (including Rixons Pass Road) and Corrimal on 27 and 28 May 2019 following the Community Information Session. The distribution area for the letterbox drop of the Community Information Session invitation and Project Information Sheet No. 2 is shown in **Figure 5.3**. It is noted the invitation and information sheet were not able to be delivered to mail boxes displaying a No Junk Mail (or similar) notice.



Source: Aegean Zhang (Flyers Direct) in email dated 9 May 2019

Figure 5.3 Community Information Session Invitation and Project Information Sheet 2 Distribution Area

5.4 Merits of the Project

As outlined in **Section 2.2.1**, six objections were received on the Project which stated no specific issues. These objections were classified as objections on the merits of the Project.

An updated evaluation of Project merits will be provided in Part B of this Submissions Report.

5.5 Issues beyond the scope of the Project

Issues relating to the proponent were raised in 73 community submissions and in 6 of the interest group submissions.

Resources Regulator investigation into Fit and Proper:

'Lock the Gate first wrote to the NSW Minister for Planning in October 2015 outlining why Wollongong Coal was not a 'fit and proper' entity. Subsequently, an official investigation commenced by the Resources Regulator, which – according to a recent report in the Illawarra Mercury - is "ongoing"'

'Wollongong Coal and their parent company Jindal Steel and Power, are currently involved in an ongoing investigation by the Resources Regulator into whether or not this company is 'fit and proper.' We are of the view that this is relevant to any decision made under the *Environment Planning and Assessment Act 1979* regarding Wollongong Coal's development application for the Russell Vale Underground Expansion Project and it Revised PPR.'

WCL has provided the following statement in response to these issues:

Mining activities can be hazardous activities and, poorly conducted, they can have unacceptable impacts on the community and the environment. The right to access and develop the mineral resources that belong to the people of NSW is a special privilege. The rights to develop mineral resources within NSW are provided under the *Mining Act 1992*.

The *Mining Act 1992* has provisions for the decision maker determination of whether the relevant person is fit and proper in relation to mining rights. Section 380A of the *Mining Act 1992* states:

Section 380A Fit and proper person consideration in making certain decisions about mining rights

(1) Despite anything to the contrary in this Act, any of the following decisions under this Act may be made on the ground that, in the opinion of the decision-maker, a relevant person is not a fit and proper person (without limiting any other ground on which such a decision may be made)—

(a) a decision to refuse to grant or renew a mining right (a relevant person in such a case being an applicant for the grant or renewal of the mining right),

(b) a decision to refuse to transfer a mining right (a relevant person in such a case being the proposed transferee),

(c) a decision to cancel a mining right or to suspend operations under a mining right (in whole or in part), a relevant person in such a case being a holder of the mining right,

(d) a decision to restrict operations under a mining right by the imposition or variation of conditions of a mining right (a relevant person in such a case being a holder of the mining right)

It is noted that the planning application for the Russell Vale UEP Project does not involve a mining right grant, being a decision under the EP&A Act, and therefore section 380A is not a matter for the IPC.

It should be noted that Wollongong Coal Limited does not have any notices from the Resources Regulator under Section 380A of any intent to cancel, suspend or restrict operations for the mining rights held in relation to the Russell Vale UEP Project.

The Resources Regulator compliance and enforcement actions are driven by a risk-based approach that apply a flexible and robust intervention framework that can apply a variety of escalating enforcement actions. In this context risk is measured by identifying the likelihood of a particular event occurring and the consequence (actual or potential) to the industry, workers, the community and the state should that event occur. This compliance model aims to put risk at the heart of all compliance actions and decisions. The Resources Regulator seeks to address low risk non-compliances through a collaborative process with industry involving education through advisory services and publication. Moderate and higher risk non-compliances are dealt with in an escalating manner with increasingly severe enforcement action taken based on the level of risk and potential for harm.

Where a breach of the *Mining Act 1992* has occurred, the Resources Regulator needs to take into consideration as to whether cancellation or suspension is the most appropriate regulatory action having regard to the other powers that include:

- Imposing conditions on an authorisation;
- Lodging of security deposits to ensure conditions of authorisations are complied with;
- Penalty infringement notices;
- Enforceable undertakings; and
- Prosecution.

If cancellation or suspension is determined to be the appropriate response, consideration should then be given to the legal basis for that response. However, the decision maker must provide the authorisation holder or applicant with procedural fairness.

Wollongong Coal Limited has been the subject of past investigations by the Resources Regulator for various compliance matters that have results in various Advisory Letters, Official Cautions and/or Notices and Directions that are typical of low to medium level regulatory compliance response from the Resources Regulator in response to matters of safety and environmental compliance. A recent investigation by the Resources Regulator into matters of safety due diligence was concluded in October 2019, with the Resources Regulator advising that it had concluded its investigation in the matter.

Wollongong Coal Limited was the subject of regulatory action during 2018 relating to later payment of fees for mining authorisations, however, this matter has been concluded with the implementation of an Enforceable Undertaking that was put in place in June 2018. The Enforceable Undertaking requires certain actions to be completed by Wollongong Coal Limited and Wollongong Coal Limited is compliant with those requirements.

During 2016, Wollongong Coal Limited received notice from the NSW Government that it had initiated an investigation as to whether Wollongong Coal was a “fit and proper person” as defined under Section 380A of the *Mining Act 1992*. Wollongong Coal has assisted the Resources Regulator with its inquiries, such as providing financial records requested, and the investigation is ongoing.

Wollongong Coal Limited considers that notwithstanding the ongoing investigation by the Resources Regulator, the directors of the Company are and continue to be fit and proper persons. Wollongong Coal believes that there is no proper legal basis for such an investigation to be made and no reasonable prospect that there would be a finding by the Department that the directors of the Company are not 'fit and proper'.

History of non-compliance:

'Wollongong Coal cannot comply with basic and simple conditions or orders placed upon them. On 19 July 2018 Wollongong Coal were served a Development Control Order to remove 200,000 tonnes of oversize coal that was illegally stockpiled on the adjoining slag heap. They were given a year to remove the stockpile but it still hasn't been completed.'

'Land required to be dedicated to Council in a 1989 approval from Wollongong City Council still hasn't been transferred. That is 30 years overdue.'

'The proponent at Russell Vale was required to realign Bellambi Creek to protect it from pollution and flooding by Oct 2012, under their Preliminary Works Project. The work was never started and now in 2019 Wollongong Coal is attempting to modify the Statement of Commitments to remove the item and replace it with a controversial watered down version, saving the company millions of dollars. All the coal has been extracted under the Preliminary Works Project approval and sold but the company is not prepared to meet its obligations under the approval.'

'The Revised PPR Part A concludes with an updated Statement of Commitments. The community can never trust Wollongong Coal to deliver on any of these commitments or for NSW Planning Compliance to administer these obligations. We have lost faith in this proponent and in the planning and regulating process.'

'The company has a history of failing to comply with conditions of approval…In terms of compliance issues, previous applications and approvals promised numerous facilities to protect the community and the environment but the company has failed to implement their promises. These include but are not limited to: truck loading facilities, creating sound barriers, new covered conveyors, and the realignment of Bellambi Creek.'

'The Preliminary Works Project included approval and commitment to load trucks out of the old loading bins but this never been met. The proponent kept saying that work was being done to operate the bins but it never actually happened, it was just talk. They have only ever loaded the trucks off the stockpiles with tractors. This is archaic and a considerable dust and noise generator. Now WC is offering this again for the first 2 years. How can we now believe that they will commit to constructing the infrastructure that they have promised? The only sure ways is to have all the infrastructure is place at this mine prior to the extraction of any coal. If this isn't done it will be another 10 years before they up to date facilities at this mine.'

'The Project report states "Construction of the proposed Pit Top upgrades will commence at the same time as operations and the use of new and upgraded facilities will be phased in over approximately 12 – 24 months as construction is completed." In the past the company has failed to meet commitments such as this. What action will the Department take if the upgrades are not made?'

WCL has provided the following statement in response to these issues:

> Wollongong Coal Limited has been from time to time subject to Directions, Notices and Control Orders under the various provisions of the *Mining Act 1992* and *Environmental Planning and Assessment Act 1979* to undertake actions or make improvements in relation to general compliance.

The management at Wollongong Coal Limited takes matters of both safety and environmental compliance very seriously and endeavour to ensure that any matters raised by the relevant Government agencies are dealt with in a professional and timely manner. WCL has implemented a 6 weekly HSE Notifications and Compliance review. This is attended by CEO, COO, site managers, senior engineers and Environment managers to look at issues, work orders close outs and verification actions. The summary report is also reported to the Board and attended by a Director.

Financial status (debts exceed assets, unpaid tax, unpaid Council fees, suspended from ASX, underpaying workers):

'This firm have owed Wollongong Council (rate payers) $400,000 for many years…They have paid no company income tax for many, many years…Fair trading ruled against them for underpaying workers…ASIC has asked them prove economic viability. They are currently still under three major non-compliances and suspended on the ASX (WLC).'

'Wollongong Coals end of year report has some very revealing facts. This year they sustained a loss of $380,000,000 for the year, the assets of their mines decreased by $274,000,000 (due to inflated assessment in previous years) and their Auditor stated "*as of that date the Group's current liabilities exceeded its current assets by $925,496,000*".'

'Why is a company that is so financially compromised even being considered by the NSW Government to operate a coal mine under our water catchment area and in a sensitive residential area?'

'…Wollongong Coal has failed to make a profit for each of the last five years it has been in business, losing – on average – approximately $167 million per annum since 2015. Ongoing financial difficulties indicate that Wollongong Coal may not be able to carry out its obligations under the Mining Act.'

'In November 2017, Wollongong Coal was convicted in court and fined $40,000 over its failure to pay $288,000 in debts to the NSW Government.'

'Even its auditors have questioned its capacity to continue as a going concern; its current liabilities exceed its current assets by nearly A$1 billion.'

'The Wongawilli mine recently ceased mining due to concerns with safety in operating with ancient equipment. This means that Wollongong Coal has no current income.'

'The company cannot make enough money to cover costs, even if it gains approval and mines until 2023.'

WCL has provided the following statement in response to these issues:

Financial Status

Wollongong Coal Limited was voluntarily suspended from trading on the ASX quotation on 13 December 2018 pending an investigation by ASIC related to the fair value estimate of its mining assets. Wollongong Coal Limited has worked with ASIC in relation to the matters central to their concerns and ASIC advised Wollongong Coal Limited on 22 August 2019 that it has discontinued its enquiries. However, the ASX suspension remains while the Company considers the case as to why the Company should remain listed on the ASX.

Wollongong Coal Limited continues to have the full support of its ultimate controlling shareholder, the Indian listed company, Jindal Steel and Power Limited (JSPL).

Jindal Steel and Power Limited

JSPL is a member of the formidable OP Jindal Group, which is an Indian conglomerate company founded by O.P. Jindal. Over the last three decades the OP Jindal Group has grown into a US $ 22 billion global business conglomerate with interests spanning the steel, mining, power, industrial gases and ports verticals. The group was founded by Shri O.P. Jindal, a first-generation entrepreneur and steel visionary who started an indigenous single-unit steel plant in Hissar (Haryana) in 1952. OP Jindal Group is now one of India's most dynamic business organisations.

From mining iron ore and coal, OP Jindal Group produces sponge iron, ferro alloys and a wide range of hot-rolled and cold-rolled steel products ranging from HR coils / sheets / plates, hot-rolled structural sections and rails to CR coils / sheets, high-grade pipes and value-added items such as stainless steel, galvanised steel and coated pipes. It has not only diversified into power generation but also into petroleum, infrastructure, diamond and high value metals and mineral exploration. The technology-driven OP Jindal Group employs over 50,000 people across the globe. Shri O.P. Jindal over the years built a reputation of integrity and dynamism and his four sons are today continuing with his rich legacy. OP Jindal Group is now headed by Smt Savitri Devi Jindal and the group is still expanding, integrating, amalgamating and growing across sectors around the world.

JSPL is an industrial powerhouse with a dominant presence in steel, power, mining and infrastructure sectors. JSPL produces economical and efficient steel and power through backward and forward integration. JSPL's business operations span across the states of Chhattisgarh, Odisha and Jharkhand in India, where it operates some of India's most advanced steel manufacturing and power generation capacities of global scale. JSPL has created cutting-edge capacities to produce up to 9.95 Million tonne per annum (Mtpa) Iron through a mix of Direct Reduced Iron (DRI), Blast Furnace and Hot Briquetted Iron (HBI) routes across three locations in India. JSPL has a well-spread out installed finished steel capacity of 6.55 Mtpa prudently spread over Bar Mills, Plate Mills, Rail and Universal Beam Mill (RUBM), Medium & Light Structural Mill (MLSM), and Wire Rod Mill.

JSPL's has its own iron ore mines at Tensa, Odisha with production capacity of 3.11 Mtpa. JSPL also owns and operates combined power generation capacities of 5,034 MW including the 3,400 MW O.P. Jindal Super Thermal Power complex at Tamnar, Chhattisgarh. JSPL's global operations include a 2 Mtpa integrated steel complex at Sohar, Oman and coal-mining operations spread across South Africa, Mozambique and Australia.

JSPL has a very strong demand for high quality coking coal that the mining assets held by Wollongong Coal Limited, once fully operational, can provide. JSPL has capacity to annually produce 9.95 Mtpa of iron annually, which requires up to 8 Mtpa of coking coal per annum for use in steel manufacture.

No coal mining: 'Coal is dead, stop mining this antiquated fuel which can only created CO2..' It is past time for governments at all levels to stand up and be counted in their opposition to any more coal mining/gas fracking initiatives. The public do not want more coal mines. And we do not want them in our backyard.

As outlined in **Section 5.3.1**, it is important to recognise that there is, and will remain for the foreseeable future, a demand for coal (both coking and thermal coal) as a reliable, affordable and efficient source of energy to meet the basic needs of human populations throughout the world.

Global coal demand in anticipated to be stable for the next five years (International Energy Agency 2018).

It is considered that there is an ongoing current need for coal for steel making. The Revised Preferred Project will assist in meeting the predicted demand for metallurgical coal in the short term.

6.0 Updated Statement of Commitments

Section 6.0 of the Revised Preferred Project Report included a Statement of Commitments for the Revised Preferred Project. As a result of submissions received, WCL has committed to additional environmental management and monitoring measures in this Submission Report – Part A. **Table 6.1** presents an updated consolidated Statement of Commitments for the Revised Preferred Project. Any new or revised commitments are in *italics* to differentiate.

Table 6.1 Updated Statement of Commitments

Commitment	Timing
Future Mine Planning	
WCL will not be seeking future approval for longwall mining within the Russell Vale Colliery lease holding.	Ongoing
Surrender of Preliminary Works Approval	
Subject to suitable transitional arrangements being provided for, WCL will within 12 months of the date of approval of the UEP, unless otherwise agreed by the Secretary, surrender all existing development consents for the Russell Vale Colliery Preliminary Works Project Approval 10_0046 in accordance with clause 97 of the EP&A Regulation.	*Within 12 months of approval*
Hours of Operation	
Mining operations and the transfer of ROM coal to the surface will be undertaken 24 hours a day, 7 days a week.	Ongoing
Coal beneficiation, truck loading and coal transport will typically be limited to daytime hours only between: • 7.00am - 6.00pm Monday to Friday • 8.00am - 6.00pm Saturday. • No coal beneficiation, truck loading and coal transport will occur on Sundays or Public Holidays. Coal beneficiation, truck loading and coal transport may occasionally be required until 10.00pm Monday to Friday in exceptional circumstances such as Port closure or supply interruption, however such circumstances would be rare and as a result of unexpected events.	Ongoing
Haulage of reject material from the reject stockpile to the mine portal will be limited to 7.00 am - 6.00 pm Monday to Friday.	Ongoing
All construction works will be undertaken during standard working hours as defined in the Interim Construction Noise Guidelines (ICNG) (DECCW, 2009), being: • 7.00am - 6.00pm Monday to Friday • 8.00am - 1.00pm Saturday • No construction works on Sundays or Public Holidays.	During construction
Environmental Management Plans	
WCL will prepare a Construction Environmental Management Plan, prior to the commencement of construction, that identifies the environmental and social management controls to be implemented during the construction phase.	Prior to the commencement of construction

Commitment	Timing

All existing operational environmental management plans and monitoring networks will be reviewed and revised (where necessary) to reflect the Revised Preferred Project approval requirements, should the project be approved.
Each environmental management plan will include (where relevant):
• detailed baseline data
• a description of:
  - 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 project or any management measures
• a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria
• a program to monitor and report on the:
  - impacts and environmental performance of the project
  - effectiveness of any management measures
• a contingency plan to manage any unpredicted impacts and their consequences
• a program to investigate and implement ways to improve the environmental performance of the project over time
• a protocol for managing and reporting any:
  - incidents
  - complaints
  - non-compliances with statutory requirements
  - exceedances of the impact assessment criteria and/or performance criteria
• a protocol for periodic review of the plan.
	Within 3 months of approval

Social and Economic	
WCL will conduct regular community liaison meetings and provide regular updates to the community both during construction and operation of the project, including quarterly website updates and annual community information sessions.	Ongoing
WCL will continue to operate the Russell Vale Community Consultative Committee following relevant DPIE guidelines.	Ongoing
WCL will continue to implement the existing community complaints response and management program.	Ongoing
Subsidence	
WCL will review and update existing Built Features Management Plans for all surface infrastructure within the vicinity of the proposed first workings to manage any potential subsidence-related impacts on surface infrastructure. The Built Features Management Plans will be reviewed in consultation with the asset owner prior to proposed first workings near the surface infrastructure.	Prior to proposed first workings near the surface infrastructure

Commitment	Timing
WCL will prepare a new Subsidence Monitoring and Management Plan (or equivalent) for the Revised Preferred Project within 3 months of approval. This plan will include a program of underground pillar stability monitoring as recommended by the subsidence peer reviewer.	*Within 3 months of approval*
Groundwater	
The existing Russell Vale East Water Management Plan will be reviewed and updated in consultation with DPIE Water, WaterNSW and DPIE and the updated plan will be implemented for the Revised Preferred Project.	*Within 3 months of approval and ongoing*
The existing groundwater monitoring network will continue to be utilised to monitor impacts associated with the Revised Preferred Project. The existing groundwater monitoring program will be reviewed and updated to reflect the Revised Preferred Project as part of an update to the existing Russell Vale East Water Management Plan. The groundwater monitoring program will include monitoring of groundwater levels, water quality, mine water inflows, pumping volumes and stream flows. The ongoing collection and interpretation of the data will be used to update the TARP trigger levels and the groundwater model as required.	Within 3 months of approval and ongoing
Existing monitoring and management measures associated with the mining of longwalls 4 to 6, as set out in the existing Russell Vale East Water Management Plan and LW5 Water Management Plan will remain in place.	Ongoing, with regular review of the results, effectiveness and ongoing need for monitoring as set out in the Water Management Plan
WCL will obtain WALs, or alternative mechanisms agreed in consultation with the Natural Resources Access Regulator, for all groundwater or surface water take in the course of mining.	*Ongoing*
Soil and Water	
WCL will implement pre-treatment of dirty water using flocculant block at the inlet to Dam 1 to aid settling of solids prior to overflowing into Dam 2.	Ongoing as required
Ongoing real time turbidity monitoring of LDP 2 discharge, Bellambi Gully Creek upstream and Bellambi Gully Creek downstream to allow rapid response to deviations above water quality trigger values.	Ongoing
WCL will implement the upgrades to the existing Water Management System as proposed in the Bellambi Gully Flood Assessment (Engeny, 2018), Response to Submissions for Modification 4 (Umwelt, 2018), Further Response to Submissions for Modification 4 (Umwelt, 2019) and additional information provided to DPIE on 14 November 2019, in accordance with the timing requirements established under MOD4.	In accordance with timing requirements established under MOD 4
Detailed plans of the revised Water Management System will be prepared by a suitably qualified civil engineer in consultation with Wollongong City Council and provided to the consent authority for approval prior to commencement of works.	Prior to the commencement of construction
WCL will maintain the existing Bellambi Gully Diversion Pipeline as the method to divert upslope runoff from the Bellambi Gully catchment through the site to the downstream creek.	Ongoing
WCL will undertake a Pipeline Condition Assessment and develop a Pipeline Integrity Management Strategy, as detailed in Appendix 5 of the Further Response to Submissions for Modification 4 (Umwelt, 2019).	Within 6 months of approval of the Mod 4
WCL will manage the proposed ROM stockpile height to not exceed 7m above the Bellambi Gully Diversion Pipeline.	Ongoing

Commitment	Timing
WCL will implement dedicated crossings for heavy vehicles driving over the Bellambi Gully Diversion Pipeline with offset areas of 5 m from the centreline of the pipe either side.	Prior to the commencement of construction
A maintenance schedule will be prepared and implemented for the new on-site stormwater system.	Within 3 months of approval and ongoing
New and existing flood structures and controls will be included on regular maintenance schedules.	Ongoing
WCL will implement the management, monitoring and contingency measures described in Section 7.0 of the Response to Submissions for Modification 4 (Umwelt, 2018) and Section 4.2 of the Further Response to Submissions for Modification 4 (Umwelt, 2019).	Following the approval of MOD 4 and ongoing
WCL will update the Surface Facilities Water Management Plan, including and / or taking account of: • Conditions and commitments set out in the Modification 4 approval • Water Balance • Erosion and Sedimentation Control Plan • Baseline data on water quality • Monitoring program details • Trigger levels for the investigation of any potentially adverse impacts.	Within 3 months of approval
The Water Management Plan will include a Monitoring, Management and Maintenance Plan for the proposed flood levee and existing SWCD. This will include an effective monitoring, management and maintenance program designed to ensure the ongoing and safe operation of the flood levee and SWCD in the event of a significant flood.	Within 3 months of approval
WCL will continue to consult with WaterNSW to put in place a mutually agreeable Master Agreement to cover the conditions of the Mining Leases related to mining within the water catchment.	*Within 2 years of approval*
Hazardous materials, including diesel fuel, water treatment chemicals and hydraulic fluid emulsions will be stored in appropriately sized bunds. All hydrocarbon storage and handling will be undertaken in accordance with *AS1940-2017: The storage and handling of flammable and combustible liquids*.	Ongoing
Once the mine moves into production, subject to approval, the reject material will be further tested for Acid Base Account parameters on a 6-monthly basis.	*Ongoing on a 6 monthly basis*
Biodiversity	
WCL will consult with the NSW Biodiversity and Conservation Division as part of the process to review and update the Biodiversity Management Plan and Upland Swamp Management Plan to reflect the Revised Preferred Project and associated management and monitoring measures.	*Within 3 months of approval and ongoing*
Given that no perceptible subsidence impacts are predicted to occur as a result of the Revised Preferred Project, monitoring of potential biodiversity impacts will be focussed on subsidence monitoring and monitoring required to detect primary impacts to groundwater systems associated with upland swamps, and surface water flow and quality in creeks. If subsidence impacts and/or primary impacts in excess of those predicted are detected, the monitoring program will be reassessed.	Ongoing in accordance with the Biodiversity Management Plan

Commitment	Timing
Noise	
WCL will review and update the existing Noise Management Plan for the Russell Vale Colliery and implement the updated plan for the Revised Preferred Project.	Within 3 months of approval and ongoing
Construction of the access road noise barrier will be completed prior to phase-in operations commencing.	Prior to phase-in operations commencing
WCL will construct both container walls (Bund 1 and Bund 4) prior to 'phase-in' operations commencing.	*Prior to phase-in operations commencing*
Bunds 2, 3 and 5 will be completed within three months of 'phase-in' operation commencing.	*Within three months of 'phase-in' operation commencing*
WCL will implement the following feasible and reasonable construction noise management measures during construction of bunds around the Pit Top, in accordance with the ICNG. These measures will be identified in the Construction Environmental Management Plan: • Schedule activities to minimise noise impacts o All bund/wall/barrier construction works will be undertaken during recommended standard construction hours o Bund construction will be scheduled as early as possible within the phase-in period so that they can be used as noise barriers o Minimise the duration of bund construction where feasible and reasonable o Consult with affected neighbours about scheduling bund construction to seek to minimise noise impacts, where practicable. • Use quieter equipment and methods o Dump truck access to be provided to bunds on the side further away from the closest receivers to maximise distance to receivers and shielding from bunds o Use mobile equipment with less annoying alternatives to the typical 'beeper' alarms where feasible and reasonable o Regularly inspect and maintain equipment in good working order. • Notification before and during bund construction o Provide information regarding construction activities to potentially affected neighbours, including the nature and expected duration of construction activities o Provide signage at the front of the site providing contact information, construction hours and any updates on construction activities. • Implement a complaints handling procedure, maintain a complaints register and implement all feasible and reasonable measures to address the source of complaints. • Undertake attended noise monitoring at the nearest and potentially most impacted residence(s) when construction of noise bunds is occurring within 200 m of noise-sensitive receivers to confirm construction noise levels are consistent with predicted levels.	Ongoing during construction
WCL will implement the following operational noise mitigation measures for the Revised Preferred Project: • Acoustic treatment of new plant and equipment, including enclosing the Coal Processing Plant and Secondary Sizer in an acoustically treated building, acoustic treatments to the Surge bin and conveyors and attenuation pack and grouser treatment of the dozer	 During construction

Commitment	Timing
• establishing a temporary stockpile of ROM coal as early as possible in 'phase-in' operations to provide shielding to northern receivers from potential noise impacts from the dozer operating on the ROM stockpile	Established as early as possible in 'phase-in' operations and maintained throughout 'phase-in' operations
• Dozer movements will be restricted to near ground level during 'phase-in' operation to maximise shielding provided by temporary ROM coal stockpile	During 'phase-in' operations
• operation of the dozer, rejects front-end loader, rejects truck, and underground loader will be restricted to daytime only use	Ongoing
• the operation of the reclaim conveyor system, Secondary Sizer, Surge Bin, Processing Plant and truck loading bins will generally be to daytime use only	Ongoing
• voluntary speed limit of coal trucks of 50 km/hr applied to Bellambi lane	Ongoing
• 40 km/hr speed limit on site	Ongoing
WCL will continue to operate two continuous noise monitoring stations within the Russell Vale Colliery site.	Ongoing
Air Quality	
WCL will review and update the existing Russell Vale Colliery Air Quality and Greenhouse Gas Management Plan and implement the updated plan for the Revised Preferred Project. The Air Quality and Greenhouse Gas Management Plan will detail the monitoring and management controls to be implemented to manage air quality impacts associated with the Revised Preferred Project including implementation of proactive and reactive management protocols in response to air quality trigger levels defined in the plan. Specifically, the proactive air quality management approach will include: • implementation of a system to provide the operation with a daily forecast of expected dust conditions in the vicinity of the operation • discussion of the weather conditions and dust considerations at daily pre-shift meetings • modifying or suspend the planned activities, as appropriate, to minimise dust impacts. Reactive air quality management will include the modification or suspension of activities in response to the following triggers: • visual conditions, such as visible dust from trucks above wheel height. • meteorological conditions, such as dry, windy conditions, with winds blowing towards sensitive receptors, and/or • ambient air quality conditions (that is, elevated short-term PM_{10} concentrations).	Within 3 months of approval and ongoing

Commitment	Timing
WCL will implement a range of air quality mitigation measures and controls during operation of the Revised Preferred Project: • Enclosure of conveyors and material transfer points • Enclosure of Coal Processing Plant • Water sprays on ROM stockpile • Water carts on unsealed haul routes • Water sprays on stockpiles and exposed areas triggered during periods of high winds • Water sprays on the bunds during construction • Trucks will be covered before leaving the site • Trucks will be washed before leaving the site • Consideration of the use of stability polymer veneer coating on long-term unworked stockpiles (>30 days) and unsealed haul routes • Revegetation/rehabilitation of exposed disturbed areas.	Ongoing
WCL will continue to monitor PM_{10} and $PM_{2.5}$ concentrations at the two TEOM monitors for the duration of their operations.	*Ongoing*
Traffic	
WCL will review and update the existing Russell Vale Colliery Traffic Management Plan and Drivers Code of Conduct and implement the updated plan for the Revised Preferred Project.	Within 3 months of approval and ongoing
Coal transport will be restricted to an average rate of 16 laden trucks per hour leaving the site between 7.00 am to 6.00 pm Monday to Friday and between 8.00 am to 6.00 pm Saturday, with no haulage on Sunday or Public Holiday; Coal transport may occasionally be required until 10.00pm Monday to Friday as a result of unexpected Port closures or interruptions. If this is the case, outbound laden truck movements will be further limited to an average of 12 trucks per hour between 6.00pm and 10.00pm, Monday to Friday only.	Ongoing
WCL will advise DPIE and Wollongong City Council via email prior to coal transportation being required between the hours of 6.00pm and 10.00pm Mondays to Fridays.	*Ongoing*
WCL will notify the local community via the Russell Vale CCC of coal transportation outside regular hours, via their website and email. Additionally, or by a direct notification via email process subject to registration of interest, as early as practicable prior to such operations commencing.	*Ongoing*
Trucks arriving between 6.00am and 7.00am (Mondays to Fridays) or 7.00am and 8.00am (Saturdays) will park in the dedicated truck parking provided on site and switch off engines.	Ongoing
WCL will maintain, monitor and enforce the voluntary speed limit along Bellambi Lane of 50km/hr for all trucks accessing the Colliery, with the continued aim of achieving 95% compliance with the voluntary speed restriction.	Ongoing
WCL will seek to reach agreement with Wollongong City Council for a road maintenance contribution for the maintenance of Bellambi Lane.	Within 12 months of project approval

Commitment	Timing
Visual Amenity	
WCL will implement the following measures to improve the visual amenity of the site and minimise the visual impact of the Revised Preferred Project: • *The container noise wall will be coloured in non-reflective grey/green tones to minimise contrast against the surrounding environment* • Bunds surrounding the Pit Top will be progressively rehabilitated, spread with topsoil and planted with a selection of native species as soon as practical once final bund height is achieved • Existing vegetation outside the Pit Top disturbance area will be regularly maintained and supplemented or replaced if necessary to maintain visual screening • Areas of disturbance will be kept to the minimum practicable and rehabilitated as soon as practical • Proposed coal handling infrastructure will be coloured in non-reflective natural tones to minimise contrast against the surrounding environment • All outdoor lighting will be installed and operated in accordance with Australian Standard AS4282 (INT) 1995 – Control of the Obtrusive Effects of Outdoor Lighting, including measures such as directing lighting downwards towards work areas and not toward private residences and roads, and where appropriate, using shields to limit the emission of light off site.	Ongoing
Greenhouse Gas and Energy	
WCL will review and update the Greenhouse Gas Management Plan to consider both the construction and operational phase of the Revised Preferred Project.	Within 3 months of approval and ongoing
WCL will continue to seek operational energy use efficiencies where commercially feasible and will review renewable energy opportunities as new technology is developed and becomes viable.	Ongoing
Heritage	
Baseline archaeological recording and ongoing monitoring of known Aboriginal cultural heritage sites will be considered as part of the updates to the existing Heritage Management Plan (or if required as a condition of approval, a specific Aboriginal Cultural Heritage Management Plan).	*Within 12 months of approval and ongoing*
WCL will update to the existing Heritage Management Plan (or if required as a condition of approval, prepare a specific Aboriginal Cultural Heritage Management Plan) in consultation with the Aboriginal community, should the Revised Preferred Project be approved.	*Within 12 months of approval and ongoing*
WCL will update the existing Conservation Management Plan (Biosis 2013) within 12 months of development consent for the Revised Preferred Project, should it be approved.	*Within 12 months of approval and ongoing*
Bushfire	
WCL will develop and implement a site-specific Fire Management Plan for the Revised Preferred Project in consultation with the RFS to manage bushfire threat and to document emergency response procedures.	*Within 3 months of approval and ongoing*
Rehabilitation and Mine Closure	
WCL will review and update the existing Russell Vale Colliery Rehabilitation Management Plan for the Revised Preferred Project in consultation with the relevant key stakeholders and government agencies.	Within 3 months of approval and ongoing

Commitment	Timing
WCL will progressively rehabilitate the site as soon as reasonably practicable following disturbance to the satisfaction of the Executive Director Mineral Resources.	Ongoing and upon mine closure
As part of the mine closure process, WCL will undertake a program to investigate sealing of the mine adit at the mine closure stage. Any investigation will be undertaken with consideration of the advice of the Independent Expert Panel for Mining in the Catchment and in consultation with relevant agencies, including the EPA, WaterNSW and DPIE. If sealing of the adit is found to be unsuitable or not the preferred option (based on advice and/or consultation), a suitable funding arrangement will be negotiated with the relevant stakeholders to fund the ongoing monitoring and treatment of future water outflows from the adit, if required. The funding arrangement will consider appropriate water quality targets based on an agreed potential end use at the time of closure and will be sufficient for 10 years of monitoring and treatment.	*Prior to mine closure*
WCL will commence consultation with the Resources Regulator and DPIE regarding detailed closure planning within 2 years prior to planned closure.	*Within 2 years prior to planned closure*

7.0 Updated Evaluation of Project Merits

An updated evaluation of merits will be provided in Part B of this Submissions Report.

8.0 References

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SCT 2019b. Russell Vale Colliery: Subsidence Assessment for Proposed Workings in Wongawilli Seam at Russell Vale East (Updated)

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Wollongong Coal, 2018. Russell Vale Colliery Biodiversity Management Plan

Wollongong Coal, 2019. Dam Safety Emergency Plan - Storm Water Control Dam WCL No. 1 Colliery Russell Vale Site

World Coal Association, 2019. https://www.worldcoal.org/

APPENDIX 1

Register of Submitters

Appendix 1 - Register of Submitters

Group	Reference number	Name	View	Section where issues have been addressed
Public Authorities	-	Division of Resources and Geoscience (DRG)	Comment	Section 4.1
	-	Resource Regulator	Comment	Section 4.2
	-	DPIE - Water	Comment	Section 4.3
	-	Environment Protection Authority (EPA)	Comment	Section 4.4
	-	WaterNSW	Comment	Section 4.5
	-	Biodiversity and Conservation Division - Environment, Energy and Science	Comment	Section 4.6
	-	Roads and Maritime Services (RMS)	Comment	Section 4.9
	-	Heritage Council	Comment	Section 4.10
	-	NSW Rural Fire Service (RFS)	Comment	Section 4.11
Local Councils	-	Wollongong City Council	Comment	Section 4.7
	-	Wollondilly Shire Council	Comment	Section 4.8
Stakeholder Groups	334123	IRRM	Object	Section 5.0
	334196	Georges River Environmental Alliance	Object	Section 5.0
	334012	Illawarra Branch National Parks Association of NSW	Object	Section 5.0
	334799	National Parks Association of NSW	Comment	Section 5.0
	334117	Sutherland Shire Environment Centre	Object	Section 5.0
	334143	Lock the gate alliance	Object	Section 5.0
	334081	Australian Youth Climate Coalition Wollongong	Object	Section 5.0
	333763	Protect Our Water Alliance (POWA)	Object	Section 5.0
	333844	Ausloo Pty Ltd	Support	
	333783	AMP Control Limited	Support	
	334032	Mine & Tunnel Constructions Pty Ltd	Support	
	334021	Bitz Excavations Pty Ltd	Support	
	333944	CJL Haulage Pty Ltd	Support	
	334017	Australian Winch & Haulage Co. Pty. Ltd	Support	
	333715	NCH Australia Pty Ltd	Support	
	333723	HDSecurity	Support	
Individuals	333771	Alan Beal	Support	
	333719	Andrew Brook	Support	
	333899	Anil Kumar Jain	Support	
	333610	Ben Herrald	Support	
	333842	Brendan Jolliffe	Support	
	333903	Brian Almeida	Support	
	334014	Brian Hemsworth	Support	
	333761	Chris Wilson	Support	
	333744	Craig Clarke	Support	
	333905	Devendra Vyas	Support	
	333740	Diane Gibson	Support	
	334027	Glenn Bartho	Support	
	333631	Jamie Harris	Support	
	333883	Joanne Sheil	Support	
	334039	Kevin Gorick	Support	

Group	Reference number	Name	View	Section where issues have been addressed
	333725	Kylie Booth	Support	
	333970	Les Kennedy	Support	
	333606	Luke Ryan	Support	
	333608	Luke Ryan	Support	
	333637	Lyn Karakolevski	Support	
	333907	Mandeep Saini	Support	
	333759	Michael Galea	Support	
	334025	Mick Payne	Support	
	333645	Name withheld	Support	
	333643	Name withheld	Support	
	333633	Name withheld	Support	
	333626	Name withheld	Support	
	333624	Name withheld	Support	
	333733	Name withheld	Support	
	333711	Name withheld	Support	
	333688	Name withheld	Support	
	333746	Name withheld	Support	
	333833	Name withheld	Support	
	333816	Name withheld	Support	
	333785	Name withheld	Support	
	333799	Name withheld	Support	
	333881	Name withheld	Support	
	333913	Name withheld	Support	
	333911	Name withheld	Support	
	333949	Name withheld	Support	
	333946	Name withheld	Support	
	333940	Name withheld	Support	
	333920	Name withheld	Support	
	334077	Name withheld	Support	
	334075	Name withheld	Support	
	334145	Name withheld	Support	
	334202	Name withheld	Support	
	333909	Narendra Soni	Support	
	333915	Nishant Kotecha	Support	
	334133	Peter Roser	Support	
	333620	Phillip Grant	Support	
	333717	Ravinder Saini	Support	
	333901	Rudhresh Menon	Support	
	333588	Sanjay Sharma	Support	
	334037	Sarah Jones	Support	
	333983	Sasa Cugalj	Support	
	333622	Steven Ockers	Support	
	333586	Sudha Sharma	Support	
	333825	Tim Gaudry	Support	
	333635	Tony Karakolevski	Support	
	333929	Warwick Lidbury	Support	

Group	Reference number	Name	View	Section where issues have been addressed
	334200	Wayne Sly	Support	
	334085	Alex Pan	Object	Section 5.0
	334176	Alice Zhang	Object	Section 5.0
	333870	Alison Smith	Object	Section 5.0
	334159	Andre Bosch	Object	Section 5.0
	333959	Andrew Briggs	Object	Section 5.0
	333616	Anne Marrett	Object	Section 5.0
	334233	Annie Marlow	Object	Section 5.0
	333641	Benjamin Gill	Object	Section 5.0
	333695	Brian Mason	Object	Section 5.0
	333936	Bronwen Evans	Object	Section 5.0
	334029	Carole Carter	Object	Section 5.0
	333887	Cate Doosey	Object	Section 5.0
	334100	Cath Blakey	Object	Section 5.0
	334125	Catherine Reynolds	Object	Section 5.0
	334069	Cathy Merchant	Object	Section 5.0
	333957	Claire Rogers	Object	Section 5.0
	333430	Daniel O'Reilly	Object	Section 5.0
	333602	Daryl Tiyce	Object	Section 5.0
	334089	David Bourke	Object	Section 5.0
	334129	David Schwartz	Object	Section 5.0
	333520	Declan Moylan	Object	Section 5.0
	333748	Deidre Stuart	Object	Section 5.0
	333614	Desmond Jacob	Object	Section 5.0
	333516	Dylan Green	Object	Section 5.0
	333604	Freya Gordon	Object	Section 5.0
	333850	George Broadfoot	Object	Section 5.0
	334137	Ginette Villasmil	Object	Section 5.0
	334155	Glen Richards	Object	Section 5.0
	333691	Hayley Schultz	Object	Section 5.0
	333449	Ikey Doosey-Shaw	Object	Section 5.0
	334568	Irene Tognetti	Object	Section 5.0
	333864	Isabella Gould	Object	Section 5.0
	334121	James Dagher	Object	Section 5.0
	334139	Jennifer Tuckwell	Object	Section 5.0
	333647	Jeremy Park	Object	Section 5.0
	333879	John Spira	Object	Section 5.0
	334223	Julie Marlow	Object	Section 5.0
	334208	Kate Broadfoot	Object	Section 5.0
	334161	Kaye Osborn	Object	Section 5.0
	333455	Laura Charlton	Object	Section 5.0
	333846	Lindsay Smith	Object	Section 5.0
	334019	Magi Carmody	Object	Section 5.0
	333862	Mala Elith	Object	Section 5.0
	333422	Maneesha Todd	Object	Section 5.0
	333530	Maria Schettino	Object	Section 5.0
	334004	Mark Gawnee	Object	Section 5.0
	333852	Mark Melek	Object	Section 5.0
	333618	Matthew Ribas	Object	Section 5.0
	334023	Matthew Skellett	Object	Section 5.0
	333428	Micaela O'Reilly	Object	Section 5.0
	334105	Michael Gould	Object	Section 5.0
	333579	Michael Rhydderch	Object	Section 5.0
	334217	Michael Whatman	Object	Section 5.0
	333735	Mike Donaldson	Object	Section 5.0

Group	Reference number	Name	View	Section where issues have been addressed
	334098	Miles Carter	Object	Section 5.0
	334141	Miles Park	Object	Section 5.0
	334225	Mithra Cox	Object	Section 5.0
	333639	Name withheld	Object	Section 5.0
	333686	Name withheld	Object	Section 5.0
	333755	Name withheld	Object	Section 5.0
	333773	Name withheld	Object	Section 5.0
	333837	Name withheld	Object	Section 5.0
	333822	Name withheld	Object	Section 5.0
	333820	Name withheld	Object	Section 5.0
	333818	Name withheld	Object	Section 5.0
	333868	Name withheld	Object	Section 5.0
	333938	Name withheld	Object	Section 5.0
	334041	Name withheld	Object	Section 5.0
	334063	Name withheld	Object	Section 5.0
	334119	Name withheld	Object	Section 5.0
	334115	Name withheld	Object	Section 5.0
	334102	Name withheld	Object	Section 5.0
	334109	Name withheld	Object	Section 5.0
	334107	Name withheld	Object	Section 5.0
	334091	Name withheld	Object	Section 5.0
	334095	Name withheld	Object	Section 5.0
	334093	Name withheld	Object	Section 5.0
	334083	Name withheld	Object	Section 5.0
	334073	Name withheld	Object	Section 5.0
	334135	Name withheld	Object	Section 5.0
	334204	Name withheld	Object	Section 5.0
	334191	Name withheld	Object	Section 5.0
	334186	Name withheld	Object	Section 5.0
	334211	Name withheld	Object	Section 5.0
	334227	Name withheld	Object	Section 5.0
	334231	Name withheld	Object	Section 5.0
	334229	Name withheld	Object	Section 5.0
	334235	Name withheld	Object	Section 5.0
	333998	Name withheld	Object	Section 5.0
	333803	Name withheld Kath Gadd	Object	Section 5.0
	334008	Natalie Murray	Object	Section 5.0
	333856	Ola Daszkowska	Object	Section 5.0
	334067	Ouita Spalding	Object	Section 5.0
	333866	Patricia Kahler	Object	Section 5.0
	333572	Peter Buffington	Object	Section 5.0
	333895	Peter Lamb	Object	Section 5.0
	333590	Peter Mills	Object	Section 5.0
	333592	Peter Mills	Object	Section 5.0
	333955	Phil Horstman	Object	Section 5.0
	334061	Phillip Laird	Object	Section 5.0
	333709	Rada Germanos	Object	Section 5.0
	333891	Raylee Golding	Object	Section 5.0
	333893	Raylee Golding	Object	Section 5.0
	334167	Reece Turner	Object	Section 5.0
	334169	Reece Turner	Object	Section 5.0
	334127	Richard Redman	Object	Section 5.0
	334071	Robert McLaughlin	Object	Section 5.0
	333649	Saoirse Aherne	Object	Section 5.0
	333655	Sarah Park	Object	Section 5.0

Group	Reference number	Name	View	Section where issues have been addressed
	334221	Sean Sullivan	Object	Section 5.0
	333953	Sharon Pusell	Object	Section 5.0
	334213	Sharon Settecasse	Object	Section 5.0
	334171	Shirley Gladding	Object	Section 5.0
	333426	Simon Green	Object	Section 5.0
	333663	Stephen Spencer	Object	Section 5.0
	333789	Stephen Watts	Object	Section 5.0
	333812	Stephen Young	Object	Section 5.0
	334165	Steven Hyem	Object	Section 5.0
	334182	Susan Hewett	Object	Section 5.0
	334157	Suzanne Grainger	Object	Section 5.0
	333413	Toby Thompson	Object	Section 5.0
	333860	Tracey Hales	Object	Section 5.0
	333854	Vimala Colless	Object	Section 5.0
	334113	Winnie Fu	Object	Section 5.0

APPENDIX 2

Submission Summary

Appendix 2 - Submissions summary

					Issue Category	Environmental, Social and Economic Issues																												The Project					Merits	Procedural Matters		Beyond the project scope			
					Theme	Mining in the Water Catchment			Climate Change	Impacts on Community								Rehabilitation			Water Resources				Biodiversity		Heritage		Bushfire	Socio-Economic				Project Design				Alternatives	Merits	Planning Process	Consultation	Fit & Proper Person			Objection to coal mining
					Sub-Theme	Water loss / risk to water supply	No mining in the catchment	Disturbance / damage to catchment or surface features	GHG emission & impact on climate change	Processing Plant	Proximity to residential area	Stockpiles	Trucks & road maintenance	Air Quality	Noise	Human Health	Reduced community impact	Adit outflows and treatment	Reject management	Rehabilitation & Rehabilitation Bond	Groundwater quality	Water Licensing	Groundwater assessment and modeling	Flooding, surface water management and monitoring	Upland Swamps	Biodiveristy impact, monitoring and management	Aboriginal Cultural Heritage Assessment	Listed heritage items	Bushfire Management Plan	Economic impact	Social benefit	Employment	Property values	Mining method and mine plan	Triple seam mining	Destabilisation of overlying workings	Mining method minimises impact	Project Alternatives	Support / Object (non-specific)	Planning Process	Ongoing stakeholder consultation	History of non-compliance / trust	RR investigation into Fit and Proper	Financial status	No coal mining
Submitter	Ref. Number	Location	Group	View	Form Letter																																								
DRG	na		Government																											1										1	1				
Resource Regulator (RR)	na		Government																	1																									
DPIE - Water	na		Government																			1	1																						
EPA	na		Government											1	1			1						1																					
WaterNSW	na		Government																		1	1													1	1	1				1				
Biodiversity and Conservation Division - EES	na		Government																					1	1	1	1																		
RMS	na		Government					1																																					
Heritage Council of NSW	na		Government																									1																	
NSW Rural Fire Service (RFS)	na		Government																										1																
Wollongong City Council (WCC)	na		Local Council										1		1				1																					1					
Wollondilly Shire Council (WSC)	na		Local Council			1														1				1		1				1				1		1				1					
Ausloo Pty Ltd	333844	Barnsley NSW	Group	Support																										1		1													
Australian Winch & Haulage Co. Pty. Ltd	334017	Smithfield NSW	Group	Support																										1		1					1								
Bitz Excavations Pty Ltd, Woonona NSW	334021	Woonona NSW	Group	Support																										1	1														
CJL Haulage Pty Ltd	333944	Ingleburn NSW	Group	Support																												1													
HDSecurity, NSW	333723	Wollongong NSW	Group	Support																										1															
Mine & Tunnel Constructions Pty Ltd	334032	Wyong NSW	Group	Support																										1		1													
AMP Control Limited	333783	Raymond Terrace NSW	Group	Support													1													1		1					1								
NCH Australia Pty Ltd	333715	NSW	Group	Support																										1	1														
Australian Youth Climate Coalition Wollongong	334081	Wollongong NSW	Group	Object		1		1	1			1		1										1																					
Sutherland Shire Environment Centre	334117	Sutherland NSW	Group	Object		1							1	1	1						1									1				1								1	1	1	
IRRM	334123	Russell Vale	Group	Object		1			1	1	1	1	1	1	1	1		1		1	1			1						1				1	1	1		1		1		1	1	1	
Illawarra Branch National Parks Association of NSW	334012	Illawarra	Group	Object		1	1		1				1	1	1	1		1												1										1		1	1	1	
Lock the gate alliance	334143	Sydney NSW	Group	Object		1			1	1	1		1					1												1					1	1				1		1	1	1	
Protect Our Water Alliance	333763		Group	Object		1			1									1																1	1	1				1		1	1	1	
Georges River Environmental Alliance	334196	George River NSW	Group	Object		1																								1					1	1						1	1		
National Parks and Wildlife Association NSW	334198	Pyrmont NSW	Group	Comment																																				1					
Alan Beal	333771	Argenton NSW	Individual	Support																										1		1					1								
Andrew Brook	333719	Tomago NSW	Individual	Support																												1													
Anil Kumar Jain	333899	Wollongong NSW	Individual	Support																										1		1													
Ben Herrald	333610	Lake Heights NSW	Individual	Support																										1		1					1								

					Issue Category	Environmental, Social and Economic Issues																												The Project					Merits	Procedural Matters		Beyond the project scope			
					Theme	Mining in the Water Catchment			Climate Change	Impacts on Community								Rehabilitation			Water Resources				Biodiversity		Heritage		Bushfire	Socio-Economic				Project Design				Alternatives	Merits	Planning Process	Consultation	Fit & Proper Person			Objection to coal mining
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Submitter	Ref. Number	Location	Group	View	Form Letter																																								
Brendan Jolliffe	333842	Corrimal NSW	Individual	Support																																			1						
Brian Almeida	333903	Bondi Beach, NSW	Individual	Support																										1		1													
Brian Hemsworth	334014	Gordon NSW	Individual	Support																										1	1	1													
Chris Wilson	333761	Albion Park Rail NSW	Individual	Support																												1													
Craig Clarke	333744	Wollongong NSW	Individual	Support																										1		1					1								
Devendra Vyas	333905	Leppington NSW	Individual	Support																										1		1					1								
Diane Gibson	333740	Berkeley NSW	Individual	Support																												1													
Glenn Bartho	334027	Jewells NSW	Individual	Support																										1		1					1								
Jamie Harris	333631	Tarrawanna NSW	Individual	Support																										1	1	1					1								
Joanne Sheil	333883	Warilla, NSW	Individual	Support																										1	1	1													
Kevin Gorick	334039	Dapto NSW	Individual	Support																										1		1					1								
Kylie Booth	333725	Cringilla NSW	Individual	Support																										1	1														
Les Kennedy	333970	Coledale NSW	Individual	Support																										1	1	1					1								
Luke Ryan	333606	Kiama Downs	Individual	Support																												1													
Luke Ryan	333608	Kiama Downs	Individual	Support																												1													
Lyn Karakolevski	333637	Corrimal NSW	Individual	Support																										1		1					1								
Mandeep Saini	333907	Corrimal, NSW	Individual	Support																											1	1													
Michael Galea	333759	Balgownie NSW	Individual	Support																										1															
Mick Payne	334025	Berrima NSW	Individual	Support																										1		1					1								
Name withheld	333645	Bellambi NSW	Individual	Support																										1	1														
Name withheld	333643	Katoomba NSW	Individual	Support																																			1						
Name withheld	333633	Corrimal NSW	Individual	Support																										1		1					1								
Name withheld	333626	Coniston NSW	Individual	Support																										1		1													
Name withheld	333624	Woonona NSW	Individual	Support																												1													
Name withheld	333733	Figtree NSW	Individual	Support																										1		1													
Name withheld	333711	Unanderra NSW	Individual	Support																										1		1													
Name withheld	333688	Grasmere NSW	Individual	Support																										1		1					1								
Name withheld	333746	Douglas Park NSW	Individual	Support																												1					1								
Name withheld	333833	Flinders NSW	Individual	Support																												1													
Name withheld	333816	Corrimal NSW,	Individual	Support																										1		1					1								
Name withheld	333785	Wollongong NSW	Individual	Support																																			1						

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					Theme	Mining in the Water Catchment			Climate Change	Impacts on Community								Rehabilitation			Water Resources				Biodiversity		Heritage		Bushfire	Socio-Economic				Project Design				Alternatives	Merits	Planning Process	Consultation	Fit & Proper Person			Objection to coal mining
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Submitter	Ref. Number	Location	Group	View	Form Letter																																								
Name withheld	333799	North Wollongong NSW	Individual	Support																												1													
Name withheld	333881	Barrack Point, NSW	Individual	Support																										1	1	1													
Name withheld	333913	Woonona NSW	Individual	Support																										1		1													
Name withheld	333911	Wollongong, NSW	Individual	Support																										1	1	1					1								
Name withheld	333949	Bondi NSW	Individual	Support																										1	1	1													
Name withheld	333946	Bondi NSW	Individual	Support																										1															
Name withheld	333940	Balgownie NSW	Individual	Support																										1		1					1								
Name withheld	333920	Woonona NSW	Individual	Support																										1							1								
Name withheld	334077	Picnic Point NSW	Individual	Support																										1		1					1								
Name withheld	334075	Picnic Point NSW	Individual	Support																										1		1					1								
Name withheld	334145	Wollongong NSW	Individual	Support																										1	1	1													
Name withheld	334202	Moorebank NSW	Individual	Support																												1													
Narendra Soni	333909	Bellambi, NSW	Individual	Support																										1		1													
Nishant Kotecha	333915	Sutherland, NSW	Individual	Support																												1													
Peter Roser	334133	Tahmoor NSW	Individual	Support																										1	1	1					1								
Phillip Grant	333620	Mt Kemlba NSW	Individual	Support																											1	1					1								
Ravinder Saini	333717	Corrimal NSW	Individual	Support																										1	1	1													
Rudhresh Menon	333901	Bellambi, NSW	Individual	Support																										1	1	1					1								
Sanjay Sharma	333588	Flinders NSW	Individual	Support																										1															
Sarah Jones	334037	Dapto NSW	Individual	Support																										1		1													
Sasa Cugalj	333983	Lake Illawarra NSW	Individual	Support																										1	1	1					1								
Steven Ockers	333622	Thirlmere NSW	Individual	Support																										1		1													
Sudha Sharma	333586	Flinders NSW	Individual	Support																										1		1					1								
Tim Gaudry	333825	Picton NSW	Individual	Support																										1	1	1													
Tony Karakolevski	333635	Corrimal NSW	Individual	Support																										1		1					1								
Warwick Lidbury	333929	Wollongong NSW	Individual	Support																										1		1					1								
Wayne Sly	334200	Kiama NSW	Individual	Support																										1	1	1					1								
Alex Pan	334085	Baulkham Hills NSW	Individual	Object		1			1																																				
Alice Zhang	334176	Bondi Junction NSW	Individual	Object																																			1						
Alison Smith	333870	Wollongong NSW	Individual	Object			1		1																																	1	1	1	
Andre Bosch	334159	Casula NSW	Individual	Object												1																													

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Submitter	Ref. Number	Location	Group	View	Form Letter																																								
Andrew Briggs	333959	Menai NSW	Individual	Object		1																																							
Anne Marrett	333616	Corimal NSW	Individual	Object	FL		1	1	1	1	1																										1	1				1		1	1	1	
Annie Marlow	334233	BERKELEY NSW	Individual	Object		1			1	1	1		1	1	1									1						1														1	1	1	
Benjamin Gill	333641	Many Vale NSW	Individual	Object		1		1	1																																	1	1		
Brian Mason	333695	Coledale NSW	Individual	Object			1	1	1	1	1		1	1	1																				1	1				1		1	1	1	
Bronwen Evans	333936	Darlinghurst NSW	Individual	Object		1																												1	1									
Carole Carter	334029	Austinmer, NSW	Individual	Object	FL		1	1	1	1	1																										1	1				1		1	1	1	
Cate Doosey	333887	Wollongong, NSW	Individual	Object		1																																							
Cath Blakey	334100	Wollongong NSW	Individual	Object		1			1			1	1	1											1	1					1				1	1						1		1			
Catherine Reynolds	334125	Bundeena NSW	Individual	Object		1													1																		1	1						1	1		
Cathy Merchant	334069	Hunters Hill NSW	Individual	Object			1		1																									1						1					
Claire Rogers	333957	East Corrimal NSW	Individual	Object			1		1		1																									1	1									
Daniel O'Reilly	333430	Russell Vale NSW	Individual	Object	FL		1	1	1	1	1																										1	1				1		1	1	1	
Daryl Tiyce	333602	As above NSW	Individual	Object																																				1						
David Bourke	334089	Russell Vale NSW	Individual	Object	FL2	1		1	1	1	1		1					1												1					1	1				1		1	1	1	
David Schwartz	334129	Parramatta NSW	Individual	Object		1			1																																				
Declan Moylan	333520	Keiraville NSW	Individual	Object		1			1																1										1										
Deidre Stuart	333748	Keiraville NSW	Individual	Object		1		1																										1	1	1				1		1			
Desmond Jacob	333614	Bellambi NSW	Individual	Object	FL		1	1	1	1	1																										1	1				1		1	1	1	
Dylan Green	333516	Keiraville NSW	Individual	Object		1		1	1					1											1																		1			
Freya Gordon	333604	Thirroul NSW	Individual	Object	FL		1	1	1	1	1																										1	1				1		1	1	1	
George Broadfoot	333850	Bulli NSW	Individual	Object					1																1																					
Ginette Villasmil	334137	Gladesville NSW	Individual	Object		1																													1								1		
Glen Richards	334155	Dolans Bay NSW	Individual	Object																																										1
Hayley Schultz	333691	Bellambi NSW	Individual	Object	FL2	1		1	1	1	1		1					1												1					1	1				1		1	1	1	
Ikey Doosey-Shaw	333449	Bulli, NSW	Individual	Object		1	1		1																															1		1			
Irene Tognetti	334568	Keiraville NSW	Individual	Object		1		1	1	1	1		1													1					1													1			
Isabella Gould	333864	Bulli, NSW	Individual	Object	FL		1	1	1	1	1																										1	1				1		1	1	1	
James Dagher	334121	Erina NSW	Individual	Object		1			1																																				
Jennifer Tuckwell	334139	Randwick NSW	Individual	Object																																										1
Jeremy Park	333647	Thirroul NSW	Individual	Object		1							1					1						1	1											1	1								1	1	

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John Spira	333879	Austinmer, NSW	Individual	Object		1			1				1					1			1									1												1		1	
Julie Marlow	334223	BERKELEY NSW	Individual	Object		1			1																									1	1	1				1					
Kate Broadfoot	334208	Bulli, NSW	Individual	Object		1							1																																
Kaye Osborn	334161	Corrimal NSW	Individual	Object		1			1	1	1							1																		1				1		1	1	1	
Laura Charlton	333455	Wollongong NSW	Individual	Object																																			1						
Lindsay Smith	333846	Bulli NSW	Individual	Object						1	1																						1												
Magi Carmody	334019	Gymea Bay NSW	Individual	Object			1																							1															
Mala Elith	333862	Corrimal NSW	Individual	Object																	1					1																			
Maneesha Todd	333422	Cordeaux Heights, NSW	Individual	Object		1	1		1																															1		1			
Maria Schettino	333530	Warrawong NSW	Individual	Object		1								1	1																					1						1			
Mark Gawnee	334004	Gwynneville NSW	Individual	Object	FL		1	1	1	1	1																								1	1				1		1	1	1	
Mark Melek	333852	Woonona East NSW	Individual	Object						1	1																																		
Matthew Ribas	333618	Bankstown NSW	Individual	Object	FL		1	1	1	1	1																								1	1				1		1	1	1	
Matthew Skellett	334023	Terrigal NSW	Individual	Object		1																																							
Micaela O'Reilly	333428	Russell Vale NSW	Individual	Object	FL		1	1	1	1	1																								1	1				1		1	1	1	
Michael Gould	334105	Wollongong NSW	Individual	Object		1			1																									1											
Michael Rhydderch	333579	Balgownie NSW	Individual	Object				1	1																										1	1						1	1	1	
Michael Whatman	334217	Mangerton NSW	Individual	Object																																				1					
Mike Donaldson	333735	NSW	Individual	Object	FL		1	1	1	1	1																								1	1				1		1	1	1	
Miles Carter	334098	Kogarah Bay NSW	Individual	Object																					1																	1			
Miles Park	334141	Thirroul NSW	Individual	Object		1					1	1	1	1	1	1																										1			
Mithra Cox	334225	Corrimal NSW	Individual	Object		1					1																			1												1			
Name withheld	333639	Coalcliff NSW	Individual	Object					1																					1															
Name withheld	333686	Bulli NSW	Individual	Object		1		1																																					
Name withheld	333755	Keiraville NSW	Individual	Object		1			1																									1								1			
Name withheld	333773	Bulli NSW	Individual	Object			1				1																																		
Name withheld	333837	Coledale NSW	Individual	Object		1			1																																				
Name withheld	333822	Fern Hill NSW	Individual	Object									1																																
Name withheld	333820	Woonona NSW	Individual	Object				1	1	1																																1	1		
Name withheld	333818	BERKELEY NSW	Individual	Object	FL		1	1	1	1	1																								1	1				1		1	1	1	
Name withheld	333868	Woonona, NSW	Individual	Object	FL		1	1	1	1	1																								1	1				1		1	1	1	

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Name withheld	333938	Russell Vale NSW	Individual	Object						1			1		1															1												1	1	1	
Name withheld	334041	Waterfall NSW	Individual	Object		1																																							
Name withheld	334063	Balgownie NSW	Individual	Object		1					1		1			1															1			1									1			
Name withheld	334119	Thirroul NSW	Individual	Object	FL2	1		1	1	1	1		1					1											1					1	1				1		1	1	1	
Name withheld	334115	Russell Vale NSW	Individual	Object		1				1			1																1					1	1						1			
Name withheld	334102	Drummoyne NSW	Individual	Object		1			1																																				
Name withheld	334109	Bellambi NSW	Individual	Object		1	1	1	1		1		1	1	1															1			1		1						1	1			
Name withheld	334107	Thirroul NSW	Individual	Object				1																																				
Name withheld	334091	Bass Hill NSW	Individual	Object				1																																				
Name withheld	334095	Mount Pleasant NSW	Individual	Object		1			1		1																														1			
Name withheld	334093	Corrimal NSW	Individual	Object	FL		1	1	1	1	1																								1	1				1		1	1	1	
Name withheld	334083	Gymea NSW	Individual	Object			1	1		1	1			1	1																				1	1				1		1	1	1	
Name withheld	334073	Bulli, NSW	Individual	Object		1			1				1					1			1																				1		1	
Name withheld	334135	Corrimal NSW	Individual	Object																																					1	1	1	
Name withheld	334204	Heathcote NSW	Individual	Object		1																																							
Name withheld	334191	Petersham NSW	Individual	Object																																		1						
Name withheld	334186	Annerley QLD	Individual	Object																																		1						
Name withheld	334211	Mangerton NSW	Individual	Object		1			1	1	1		1																	1					1	1						1	1		
Name withheld	334227	Wyoming NSW	Individual	Object				1																																				
Name withheld	334231	Thirroul NSW	Individual	Object		1			1							1														1															
Name withheld	334229	Bellambi NSW	Individual	Object			1																	1																					1
Name withheld	334235	Corrimal NSW	Individual	Object	FL		1	1	1	1	1																								1	1				1		1	1	1	
Name withheld	333998	Gwynneville NSW	Individual	Object			1	1			1																								1							1		1	
Name withheld Kath Gabb	333803	East Corrimal NSW	Individual	Object	FL		1	1	1	1	1																								1	1				1		1	1	1	
Natalie Murray	334008	Maroubra NSW	Individual	Object	FL		1	1	1	1	1																								1	1				1		1	1	1	
Ola Daszkowska	333856	North Nowra NSW	Individual	Object	FL		1	1	1	1	1																								1	1				1		1	1	1	
Ouita Spalding	334067	Bulli, NSW	Individual	Object				1																																				
Patricia Kahler	333866	Basin View, NSW	Individual	Object			1																																					
Peter Buffington	333572	Bellambi NSW	Individual	Object				1		1																																		
Peter Lamb	333895	Fairy Meadow, NSW	Individual	Object		1			1	1	1			1																				1	1						1	1	1	
Peter Mills	333590	Wombarra NSW	Individual	Object		1	1		1																																				

					Issue Category	Environmental, Social and Economic Issues																												The Project					Merits	Procedural Matters		Beyond the project scope			
					Theme	Mining in the Water Catchment			Climate Change	Impacts on Community								Rehabilitation			Water Resources				Biodiversity		Heritage		Bushfire	Socio-Economic				Project Design				Alternatives	Merits	Planning Process	Consultation	Fit & Proper Person			Objection to coal mining
Submitter	Ref. Number	Location	Group	View	Form Letter	Water loss / risk to water supply	No mining in the catchment	Disturbance / damage to catchment or surface features	GHG emission & impact on climate change	Processing Plant	Proximity to residential area	Stockpiles	Trucks & road maintenance	Air Quality	Noise	Human Health	Reduced community impact	Adit outflows and treatment	Reject management	Rehabilitation & Rehabilitation Bond	Groundwater quality	Water Licensing	Groundwater assessment and modeling	Flooding, surface water management and monitoring	Upland Swamps	Biodiveristy impact, monitoring and management	Aboriginal Cultural Heritage Assessment	Listed heritage items	Bushfire Management Plan	Economic impact	Social benefit	Employment	Property values	Mining method and mine plan	Triple seam mining	Destabilisation of overlying workings	Mining method minimises impact	Project Alternatives	Support / Object (non-specific)	Planning Process	Ongoing stakeholder consultation	History of non-compliance / trust	RR investigation into Fit and Proper	Financial status	No coal mining
Peter Mills	333592	Wombarra NSW	Individual	Object		1	1		1																																				
Phil Horstman	333955	Corrimal NSW	Individual	Object							1		1	1							1																								
Phillip Laird	334061	Keiraville NSW	Individual	Object			1	1	1	1	1		1																						1	1				1		1	1	1	
Rada Germanos	333709	Woonona NSW	Individual	Object		1			1					1		1																				1									
Raylee Golding	333891	Coledale, NSW	Individual	Object	FL		1	1	1	1	1																								1	1				1		1	1	1	
Raylee Golding	333893	Coledale, NSW	Individual	Object	FL		1	1	1	1	1																								1	1				1		1	1	1	
Reece Turner	334167	Thirroul NSW	Individual	Object		1			1																					1				1									1	1	
Reece Turner	334169	Thirroul NSW	Individual	Object		1			1																					1				1									1	1	
Richard Redman	334127	Caringbah South NSW	Individual	Object	FL2	1		1	1	1	1		1					1												1					1	1				1		1	1	1	
Robert McLaughlin	334071	Bulga NSW	Individual	Object		1			1	1	1		1					1												1					1	1				1		1	1	1	
Saoirse Aherne	333649	North Wollongong NSW	Individual	Object		1	1																		1									1											
Sarah Park	333655	Darlinghurst NSW	Individual	Object		1							1					1			1			1						1				1								1			
Sean Sullivan	334221	BERKELEY NSW	Individual	Object	FL		1	1	1	1	1																								1	1				1		1	1	1	
Sharon Pusell	333953	Fairy Meadow, NSW	Individual	Object	FL		1	1	1	1	1																								1	1				1		1	1	1	
Sharon Settecasse	334213	Thirroul NSW	Individual	Object		1					1			1										1						1												1	1	1	
Shirley Gladding	334171	Fairy Meadow, NSW	Individual	Object		1			1		1		1					1																1	1	1						1	1	1	
Simon Green	333426	Keiraville NSW	Individual	Object		1	1		1																																		1		
Stephen Spencer	333663	Wollongong NSW	Individual	Object	FL2	1		1	1	1	1		1					1												1					1	1				1		1	1	1	
Stephen Watts	333789	Woonona NSW	Individual	Object						1	1			1		1																													
Stephen Young	333812	Thirroul NSW	Individual	Object		1																												1								1			
Steven Hyem	334165	Engadine NSW	Individual	Object		1																																							
Susan Hewett	334182	Wollongong NSW	Individual	Object	FL		1	1	1	1	1																								1	1				1		1	1	1	
Suzanne Grainger	334157	Larnook NSW	Individual	Object		1					1		1			1								1						1												1			
Toby Thompson	333413	Thirroul NSW	Individual	Object																																			1						
Tracey Hales	333860	East Corrimal NSW	Individual	Object			1		1																																	1	1	1	
Vimala Colless	333854	Woonona NSW	Individual	Object					1				1					1												1					1	1						1			
Winnie Fu	334113	Kensington NSW	Individual	Object		1																													1	1								1	

Issue Category						Environmental, Social and Economic Issues																												The Project					Merits	Procedural Matters		Beyond the project scope			
Theme						Mining in the Water Catchment			Climate Change	Impacts on Community								Rehabilitation			Water Resources				Biodiversity		Heritage		Bushfire	Socio-Economic				Project Design				Alternatives	Merits	Planning Process	Consultation	Fit & Proper Person			Objection to coal mining
Sub-Theme						Water loss / risk to water supply	No mining in the catchment	Disturbance / damage to catchment or surface features	GHG emission & impact on climate change	Processing Plant	Proximity to residential area	Stockpiles	Trucks & road maintenance	Air Quality	Noise	Human Health	Reduced community Impact	Adit outflows and treatment	Reject management	Rehabilitation & Rehabilitation Bond	Groundwater quality	Water Licensing	Groundwater assessment and modeling	Flooding, surface water management and monitoring	Upland Swamps	Biodiveristy impact, monitoring and management	Aboriginal Cultural Heritage Assessment	Listed heritage items	Bushfire Management Plan	Economic impact	Social benefit	Employment	Property values	Mining method and mine plan	Triple seam mining	Destabilisation of overlying workings	Mining method minimises impact	Project Alternatives	Support / Object (non-specific)	Planning Process	Ongoing stakeholder consultation	History of non-compliance / trust	RR investigation into Fit and Proper	Financial status	No coal mining
Submitter	Ref. Number	Location	Group	View	Form Letter																																								
Total by Issues Category						632																												154					9	48		185			
Total by Theme						152			80	174								23			24				11		2		1	165				153				1	9	46	2	182			3
Total by Sub-Theme						69	42	41	80	43	55	4	31	19	11	10	1	19	1	3	8	2	1	13	8	3	1	1	1	84	20	58	3	17	54	52	30	1	9	46	2	73	56	53	3
Total Government agency						0	0	1	0	0	0	0	0	1	1	0	0	1	0	1	1	2	1	2	1	1	1	1	1	1	0	0	0	0	1	1	1	0	0	1	2	0	0	0	0
Total Local council						1	0	0	0	0	0	0	1	0	1	0	0	0	1	1	0	0	0	1	0	1	0	0	0	1	0	0	0	1	0	1	0	0	0	2	0	0	0	0	0
Total Interest Group						7	1	1	5	2	2	2	4	4	3	2	1	4	0	1	2	0	0	2	0	0	0	0	0	12	2	5	0	3	4	4	2	1	0	5	0	6	6	5	0
Total Individual						61	41	39	75	41	53	2	26	14	6	8	0	14	0	0	5	0	0	8	7	1	0	0	0	71	18	53	3	13	49	46	27	0	9	39	1	67	50	48	3

APPENDIX 3

Updated Noise Impact Assessment

RUSSELL VALE COLLIERY

UNDERGROUND EXPANSION PROJECT
REVISED PROJECT NOISE ASSESSMENT

A C O U S T I C S A N D A I R

REPORT NO. 14141-E
VERSION A

NOVEMBER 2019

PREPARED FOR

WOLLONGONG COAL LIMITED
PO BOX 281
FAIRY MEADOW NSW 2519

WILKINSON MURRAY

DOCUMENT CONTROL

Version	Status	Date	Prepared By	Reviewed By
A	Final	28 November 2019	Roman Haverkamp	John Wassermann

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50 YEARS 1962–2012

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GLOSSARY OF ACOUSTIC TERMS

Most environments are affected by environmental noise which continuously varies, largely as a result of road traffic. To describe the overall noise environment, a number of noise descriptors have been developed and these involve statistical and other analysis of the varying noise over sampling periods, typically taken as 15 minutes. These descriptors, which are demonstrated in the graph below, are here defined.

Maximum Noise Level (L_{Amax}) – The maximum noise level over a sample period is the maximum level, measured on fast response, during the sample period.

L_{A1} – The L_{A1} level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the L_{A1} level for 99% of the time.

L_{A10} – The L_{A10} level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L_{A10} level for 90% of the time. The L_{A10} is a common noise descriptor for environmental noise and road traffic noise.

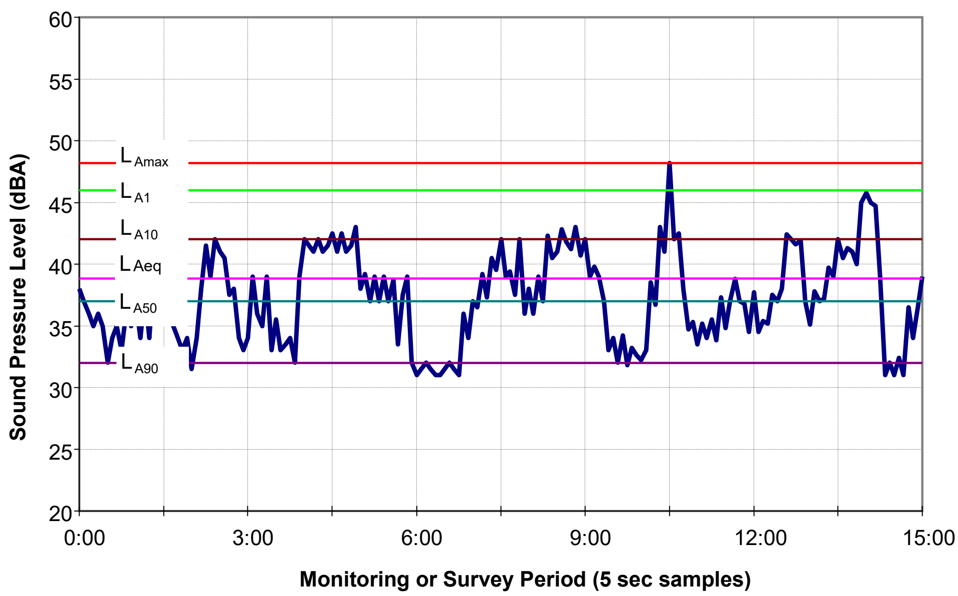
L_{A90} – The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level.

L_{Aeq} – The equivalent continuous sound level (L_{Aeq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.

ABL – The Assessment Background Level is the single figure background level representing each assessment period (daytime, evening and night time) for each day. It is determined by calculating the 10^{th} percentile (lowest 10^{th} percent) background level (L_{A90}) for each period.

RBL – The Rating Background Level for each period is the median value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period – daytime, evening and night time.

Typical Graph of Sound Pressure Level vs Time



1 INTRODUCTION

Russell Vale Colliery is located within the Southern Coalfields Region of New South Wales, approximately 8 kilometres north of Wollongong and 70 kilometres south of Sydney. The Colliery is owned and operated by Wollongong Coal Limited (WCL) and is currently in care and maintenance, since the cessation of mining operations in 2015.

On behalf of WCL, Umwelt Australia Pty Limited (Umwelt) is coordinating the environmental assessment of a revised plan for the Russell Vale Colliery Underground Extension Project (UEP) – hereafter referred to as the Revised Project. The Revised Project will continue to be assessed under the current UEP application process under Part 3A of the EP&A Act.

The Revised Project proposes an updated mine plan design which addresses the concerns raised by the Planning Assessment Commission (PAC) in its First and Second Assessment Reports on the Russell Vale UEP. The Revised Project constitutes the principal response to the latest PAC report (PAC Second Review Report, dated March 2016).

This Noise Impact Assessment has been prepared by Wilkinson Murray Pty Ltd (WM) on behalf of Umwelt as part of the environmental assessment for the Revised Project. It provides a re-evaluation of operational and traffic noise impacts with respect to the Revised Project, with reference to the newly published *Noise Policy for Industry (NPfI)*.

This report has been prepared with consideration to the following New South Wales Government policies:

- *Noise Policy for Industry (NPfI)* (EPA, 2017);
- *Road Noise Policy (RNP)* (Environment Protection Agency [EPA], 2011)*;*
- *Interim Construction Noise Guideline (ICNG)* (Department of Environment and Climate Change [DECC], 2009);
- *Noise Guide for Local Government (NGLG)* (Environment Protection Agency [EPA], 2013);
- *Voluntary Land Acquisition and Mitigation Policy* (*VLAMP*) (NSW State Government, 2018); and
- *Construction Noise & Vibration Strategy (CN&VS)* (Transport for NSW Infrastructure and Services Division, 2018).

This report has been prepared to support the environmental assessment and assess the noise impacts associated with the Revised Project.

The remaining sections of this report address the following:

Section 2	Provides a description of the Revised Project focusing on matters relating to noise.
Section 3	Identifies the sensitive receivers located around the site and the rationale behind their consideration.
Section 4	Discusses the existing noise environment with consideration to the results from previous surveys conducted in the areas surrounding the site and additionally on long-term noise monitoring data collected by two on-site monitoring stations operated by WCL.
Section 5	Establishes the project-specific noise criteria considered relevant to the Revised Project, with consideration to the evaluation of the existing noise environment, as discussed in Section 4.
Section 6	Sets out the noise assessment methodology and assumptions, inclusive of considerations relating to the modelling process, meteorological conditions, noise source sound power levels and mitigation measures adopted by the Revised Project.
Section 7	Presents the Revised Project operational noise predictions and provides discussion on the predicted residual exceedances of criteria. A low-frequency noise assessment is also included in this section.
Section 8	Addresses the potential for night time noise impacts and sleep disturbance effects.
Section 9	Addresses the potential for construction noise impacts.
Section 10	Addresses the potential for road traffic noise impacts.
Section 11	Discusses implications with regards to the *VLAMP*.
Section 12	Presents conclusions with respect to the potential Revised Project noise effects.

2 PROJECT DESCRIPTION

In response to concern raised by government agencies, the PAC and the community, WCL proposes to revise operations on the Russell Vale Underground Expansion Project (UEP). The site changes are proposed principally to address potential subsidence, biodiversity and water impacts within the Cataract Reservoir catchment and noise and traffic impacts associated with surface operations (Revised Project).

The key elements of the Revised Project are:

- Mining using first working mining techniques only with the workings designed to be long term stable with minimal subsidence impacts.
- Extraction of approximately 3.7 million tonnes of ROM coal over 5 years at a production rate that would not exceed 1 million tonnes of product coal per year.
- Construction and use of a coal processing plant to improve the quality of product coal.
- Redesign of the Pit Top layout to strategically relocate infrastructure to more shielded locations;
- Reduced product trucking rates relative to the Preferred Project mine plan.
- Additional noise mitigation works at the Russell Vale Pit Top including relocation of infrastructure, a new noise barrier, two new container walls, a new berm and extension to the height of existing bunds and acoustic treatment of coal processing infrastructure.

A summary of the key components of the Revised Project is provided in Table 2-1.

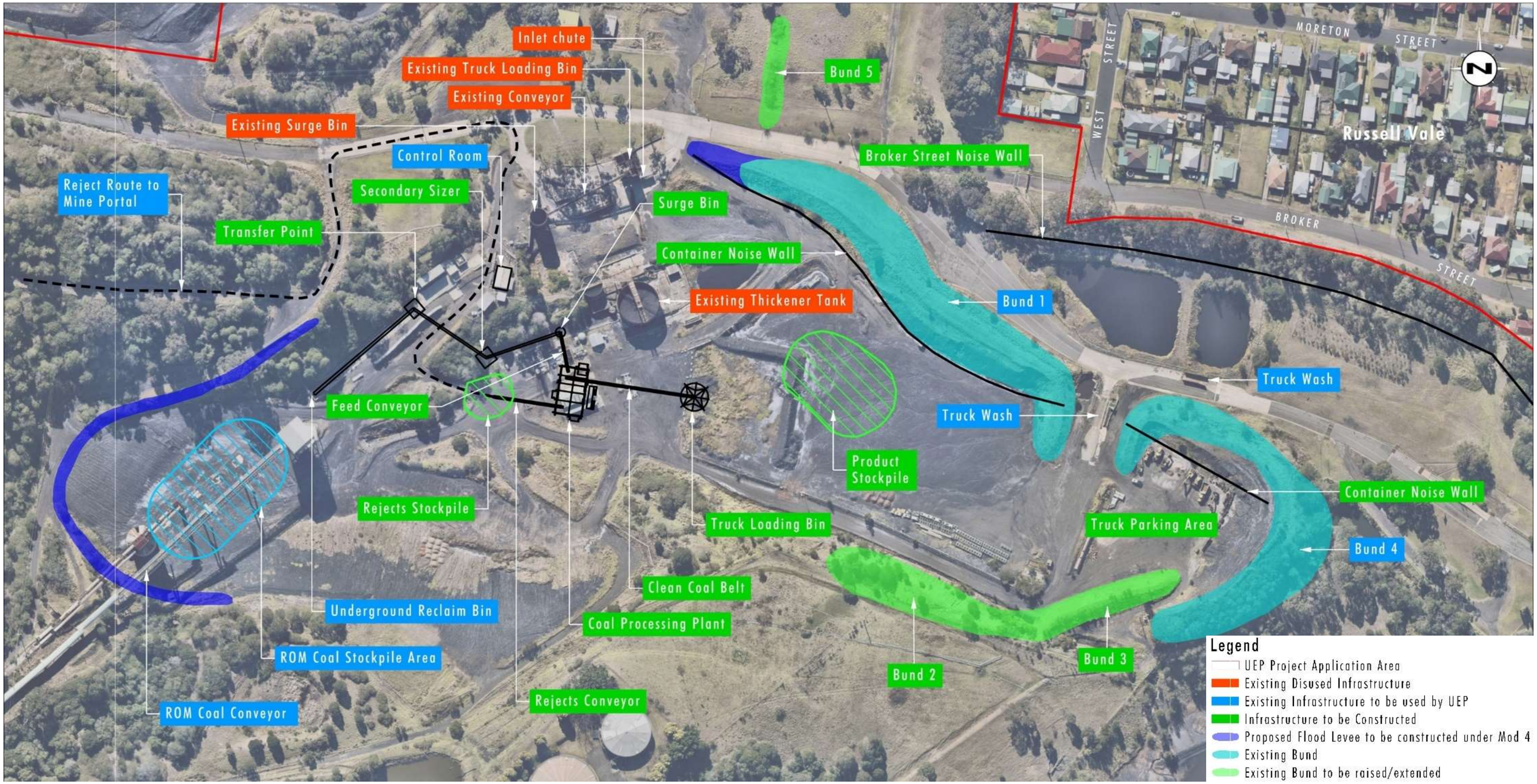
Figure 2-1 shows a locality map of the Russell Vale Colliery and identifies the proposed reconfigured site layout, including the principal noise sources and noise barriers/walls/berms considered by this assessment. The noise sources are detailed further in Section 6.

Details of the Revised Project operations are provided in Sections 2.1 to 2.5.

Table 2-1 Revised Project Components

Project Component	Summary of the Revised Project
Mining Method	Non-caving first workings board and pillar panels using continuous miners.
Resource	Wongawilli Seam
Annual ROM Production	Up to 1.2 Mtpa
Product Coal	Up to 1 Mtpa
Mine Life	5 years
Total Resource Recovered	Approximately 3.7Mt ROM
Coal Processing	Construction and use of coal processing plant to improve product coal.
Hours of Operation	Underground Mining – 24 hours per day, 7 days per week Surface Facilities and Product Transport: 7.00am to 6.00pm, Monday to Friday, 8.00am to 6.00pm Saturday. No Sundays and Public Holidays. Provision for occasional operation until 10.00pm Monday to Friday to cater for unexpected Port closures or interruptions. This operation during the evening has been considered in this assessment.
Management of Mining Waste	Reject from the coal processing plant will be stockpiled for emplacement underground or trucked off-site as inert fill.
General Infrastructure	• Construction and use of new coal processing plant, secondary sizer, surge bin and truck loading facility. • Construction and use of enclosed conveyors for transfer of ROM coal to new secondary sizer, coal processing plant and truck loading facility. • Ongoing use of ROM stockpile and establish new product and temporary reject stockpiles within Pit Top disturbance area. • Minor changes to water management infrastructure. • Construction of noise bunds/walls/barriers and extension to height of existing bunds around Pit Top. • Ongoing maintenance and refurbishment of existing ventilation shafts, water and electrical facilities.
Product Transport	Product coal will be transported by truck to Port Kembla via Bellambi Lane and Memorial Drive.
Transport Hours and Rates	An average rate of 16 laden trucks per hour leaving the site between 7.00am and 6.00pm. Monday to Friday and 8.00am and 6.00pm Saturday. No coal transport Sundays and Public Holidays. If coal transport is required during the evening to cater for unexpected Port closures or interruptions, these movements would be limited to an average of 12 trucks per hour leaving the site between 6.00pm and 10.00pm Mondays to Fridays only. Trucks arriving at the site prior to 7.00am Monday to Friday or 8.00am Saturday will be required to proceed to the truck parking area on site and turn off engine until loading commences at 7.00am Monday to Friday or 8.00am Saturday.
Operational Workforce	Approximately 205
Construction Workforce	Approximately 22

Figure 2-1 Russell Vale Colliery Revised Pit Top Layout



2.1 Coal Handling & Processing

ROM coal will be transported from the underground workings via the existing underground conveyor system. Coal is transported from the underground workings to the surface via a decline conveyor which transports coal from the portal to the stockpile area. There are two declines, one servicing mining in the Bulli seam and one servicing mining in the Wongawilli Seam. The Bulli Seam decline has been decommissioned and will not be used as part of the Revised Project.

The coal is transferred to a screening and sizing station at the top of the decline. From the screening and sizing station, coal is transferred to the ROM stockpile via a conveyor and tripper arrangement. From the ROM stockpile, the ROM coal is pushed into an underground reclaim bin by dozer where it will be transferred via a new conveyor through a secondary sizer and then to a new surge bin.

Coal will then be transferred to the new coal processing plant via a new conveyor. The processing plant is a coal sizing plant which removes rock material via a heavy media cyclone.

Product coal is then transferred to a new truck loading bin via a new clean coal conveyor. Coal will then be either loaded onto road trucks for transportation to Port or transferred to an Emergency Clean Coal Stockpile. Coal will be loaded onto road trucks from the Emergency Clean Coal Stockpile via front-end loader.

Rocky reject material that is separated by the coal processing plant will be transferred to a rejects stockpile by conveyor and will then be either loaded onto road trucks to be sold as inert fill material or will be transferred from a rejects stockpile by front-end loader and haul truck to the mine portal, and emplaced underground.

ROM coal may also be transferred from the site as a ROM coal product. This would occur during the first 6-12months of operation while the site infrastructure is being constructed. Where this occurs, road trucks will be loaded using a front-end loader from the ROM stockpile area.

ROM coal will be delivered to the ROM stockpile 24 hours a day. The coal beneficiation operations would typically be limited to daytime hours only, 7.00am to 6.00pm Monday to Friday and 8.00am to 6.00pm Saturday. Provision is required for occasional operation until 10.00pm Monday to Friday to cater for unexpected Port closures or interruptions. This operation during the evening has been considered in this assessment.

Production rates will not exceed one million tonnes per annum (Mtpa) product coal.

2.2 Coal Transport

Product coal will be transported to Port Kembla by road registered semi-trailer trucks and B-double trucks. Consistent with previously approved operations, the transport route would be via Bellambi Lane and Memorial Drive which is the route that has historically been used for the transport of coal from the Russell Vale site.

Truck loading operations will be limited to 7.00am and 6.00pm, Monday to Friday, and 8.00am to 6.00pm on Saturdays. No loading or coal transport will occur on Sundays and Public Holidays. Provision is required for occasional operation until 10.00pm Monday to Friday to cater for unexpected Port closures or interruptions. This operation during the evening has been considered in this assessment.

The proponent recognises the risk of noise generated by early morning trucks parking and waiting outside the site until they are allowed to drive onto the site to load at 7.00am (Monday to Friday) or 8.00am (Saturday). In order to avoid trucks parking in residential streets prior to the commencement of loading operations, a designated truck parking area will be established on site (refer to Figure 2-1). A noise barrier will be constructed along the northern boundary of the site to mitigate the noise impacts of trucks accessing the truck parking area. Trucks entering the site prior to the commencement of loading operations will be required to turn off their engines while parked. Adequate parking areas will be available on site to avoid trucks queuing on the road outside of the Colliery.

Outbound laden (coal or reject) truck movements will be limited to an average of 16 per hour between the hours of 7.00am and 6.00pm Monday to Friday and 8.00am and 6.00pm Saturday. If trucking is required during the evening period to cater for unexpected Port closures or interruptions, outbound trucks will be further limited to an average of 12 trucks per hour between 6.00pm and 10.00pm Monday to Friday.

The sign posted speed limit for vehicles using Bellambi Lane is 60 kilometres per hour (km/hr). Under the Preliminary Works Approval, coal truck movements along Bellambi Lane were subject to a voluntary speed limit of 50 km/hr. This voluntary speed limit for trucks has been monitored through the use of Geographical Positioning Systems (GPS). While there has been an extremely high compliance with this limit (99.86% from 2,162 truck movements), three minor exceedances have occurred with all exceedances being below the signposted 60 km/hr limit. The voluntary speed limit for coal/reject trucks of 50 km/hr along Bellambi Lane will be maintained for the Revised Project with WCL aiming to achieve 95% compliance with the voluntary speed limit and 100% compliance with the sign posted 60 km/hr speed limit. All coal/reject trucks will be subject to GPS monitoring to monitor compliance with this speed limit.

2.3 Reject Material Handling

Reject material from the Coal Processing Plant and sizing and screening plant will be transferred to the reject stockpile. Reject material will consist of rock material.

Reject material will either be transferred off-site for use as inert fill material or hauled to the mine portal via an internal road where it will be temporarily stockpiled pending disposal in the underground Russell Vale workings. Reject material will be transferred to road truck via a front-end loader.

Haulage of reject material from the reject stockpile to the pit top will be limited to 7.00am to 6.00pm Monday to Friday. Reject material transferred off-site will be managed within the overall coal transport limits for the Revised Project. The transport route and truck size for reject transferred off-site will depend on the destination of the material, but it will generally be transported via Bellambi Lane and Memorial Drive.

2.4 Construction Activities

Construction of the coal processing plant and associated infrastructure will be staged to meet production requirements and is planned to be undertaken within a 6-12-month timeframe (subject to delays such as weather and logistical issues), with an average construction workforce of 22 people.

The site will be operational during construction of the site infrastructure and coal processing plant with ROM coal being transported off site without processing. This is referred to as the 'phase-in' operation period.

In order to improve noise mitigation from site operations, berms and barriers surrounding the Pit Top and the site will be erected, raised and/or extended. The new noise barrier along the northern boundary of the site and the two container walls to the north of the Pit Top will be constructed prior to 'phase-in' operations commencing. The remaining berms (Bunds #2, #3 and #5) will be completed over as short a timeframe as possible, indicatively three months to achieve planned height.

Construction works will be undertaken during standard construction hours 7.00am to 6.00pm Monday to Friday and 8.00am to 1.00pm Saturday. No construction activities will be undertaken on Sunday and public holidays.

2.5 Mine Workforce

The operation of the mine will require a total of approximately 205 staff. Underground mining operations would work on a three shifts per day, seven days per week basis.

3 NOISE-SENSITIVE RECEIVERS

The site is located on the lower slopes of the Illawarra Escarpment approximately two kilometres from the coast with residential areas generally to the north-northeast (Russell Vale) and south-southeast (Corrimal).

The potentially most exposed residential receivers are located in Russell Vale along Broker Street and West Street; and in Corrimal along Midgley Street, Wilford Street, Lyndon Street and Taylor Place.

Consistent with WM's 2014 assessment, the sensitive receivers considered by this assessment, which are deemed representative of the potentially most impacted receivers surrounding the site, are shown in Figure 3-1. Table 3-1 shows the addresses of these residential receivers.

The receivers identified in Table 3-1 are intended to broadly represent noise catchments around the site and intervening residential properties adjoining the site are subject to the same considerations as their closest neighbouring 'representative' receiver.

Review of the neighbourhood also identifies three schools in proximity of the site. These are also included in Table 3-1 and shown in Figure 3-1.

Table 3-1 Noise-Sensitive Receivers Considered

Receiver Type	Receiver ID	Address
Residence	R1	16 West St, Russell Vale
	R2	30 West St, Russell Vale
	R3	13 West St, Russell Vale
	R4	13 Broker St, Russell Vale
	R5	4 Broker St, Russell Vale
	R6	659 Princes Hwy, Russell Vale
	R7	34 Princes Hwy, Corrimal
	R8	95 Midgley St, Corrimal
	R9	109 Midgley St, Corrimal
	R10	6 Lyndon St, Corrimal
	R11	22 Lyndon St, Corrimal
	R12	46 Lyndon St, Corrimal
	R13	6 Taylor Pl, Corrimal
	R14	15 Taylor Pl, Corrimal
School	R15	Russell Vale Pre-school (652 Princes Highway, Russell Vale)
	R16	Autism Association NSW Aspect South Coast School (4 Wilford Street, Corrimal)
	R17	Early Learning Corrimal (67 Midgley Street, Corrimal)

Figure 3-1 Noise-Sensitive Receivers Considered

4 EXISTING NOISE ENVIRONMENT

For the evaluation of noise impacts with respect to the Revised Project, this assessment considers long-term noise monitoring data collected by two on-site monitoring stations operated by WCL, and the result from a previous survey conducted by WM.

4.1 WCL 2016 Real-Time Background Noise Monitoring Results

For the purposes of this assessment long-term noise monitoring data collected by two on-site monitoring stations (NMT1 and NMT2) operated by WCL have been analysed. Figure 4-1 identifies the locations of the long-term monitoring sites (NMT1 and NMT2).

RBLs determined from the long-term monitoring are shown in Table 4-1.

Table 4-1 Summary of Long-Term RBLs – Based on 2016 Full Year Measurements

Monitoring Location		Measured RBLs (dBA)		
ID	Address	Day	Evening	Night
NMT1	M2	39	38	37
NMT2	M3	39	38	34

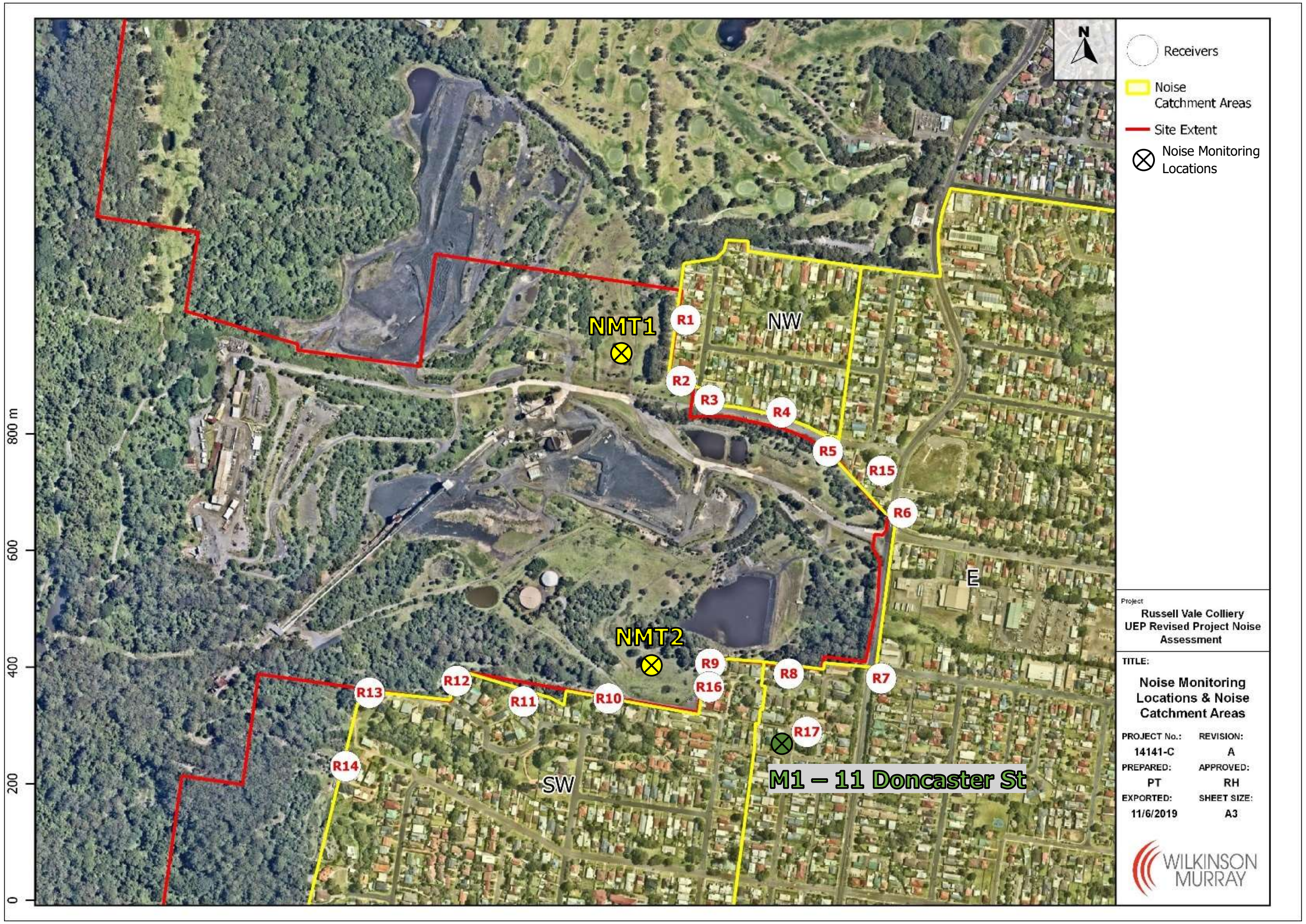
Notes:
Day: the period from 7.00am to 6.00pm.
Evening: the period from 6.00pm to 10.00pm.
Night: the period from 10.00pm to 7.00am.

It is considered that the NMT1 RBLs are representative of the long-term RBLs at the northern receivers set back from the Princes Highway and shielded from high traffic noise levels. Similarly, the NMT2 RBLs are representative of the long-term RBLs at the southern receivers shielded from the Princes Highway.

Continuous 15-minute interval data collected by each monitoring station over the entire 2016-year period has been processed in accordance with the *NPfI* methodology in conjunction with the coinciding 15-minute interval meteorological data collected by the WCL-operated on-site weather station. No changes in land use occurred in the area since 2016 and therefore the local acoustic environment is not believed to have changed since 2016.

The site went into care and maintenance in late 2015 and was not operational throughout 2016. As such, it is considered that use of this long-term data provides a good representation of the site's existing background noise environment. Short-term RBLs (e.g. RBLs based on one week) may vary slightly depending on the time of year and therefore, long-term RBLs (e.g. RBLs based on one year) are considered more accurate and should be used if available.

Figure 4-1 Noise Monitoring Locations and Noise Catchment Areas



4.2 WM 2014 Background Noise Survey

In order to identify an RBL for receiver areas with an acoustic environment dominated by traffic noise from the Princes Highway, reference is made to noise measurements undertaken by WM between 6-18 June 2014 as part of the noise assessment undertaken for the previously proposed site arrangement (WM report dated 9 October 2014). RBLs were established for the daytime, evening and night time assessment periods at three representative locations. See Glossary of Terms provided at the beginning of this report for definitions.

The survey was conducted in the absence of noise generated by mining operations during a period when the site did not operate.

Meteorological data for the relevant periods were obtained from the on-site weather station at the Russell Vale Colliery. Periods in which it was likely to be raining, or when wind speeds exceeded 5 m/s at microphone height, were excluded from analysis, in accordance with the *NPfI*.

The RBLs were established following the process recommended by the *NPfI*. Full details concerning the monitoring and analysis procedure are set out in Section 5 of the WM 2014 report.

The survey carried out by WM in 2014 included a monitoring location at 11 Doncaster Street, Corrimal (M1) (refer to Figure 4-1). The RBLs measured at M1 are considered to be representative of an acoustic environment dominated by Princes Highway traffic noise. As such, the RBLs measured at M1 have been selected as the relevant RBLs for R5, R6, R7 and R8.

RBLs measured at M1 are shown in Table 4-2.

Table 4-1 Summary of M1 RBLs

Monitoring Location		Measured RBLs (dBA)		
ID	**Address**	**Day**	**Evening**	**Night**
M1	11 Doncaster Street	43	40	37

Notes:
Day: the period from 7.00am to 6.00pm.
Evening: the period from 6.00pm to 10.00pm.
Night: the period from 10.00pm to 7.00am.

4.3 RBLs Relevant to Assessment

RBLs have been established for the early morning shoulder period (5.00am-7.00am) in order to allow for accurate assessment of night time operations with early morning truck arrivals. Table 4-2 summarises the RBLs adopted by this assessment. The morning shoulder period RBLs were found to be 2 dB higher than the night time RBLs at all three locations. Note that RBLs for the revised night time period (10.00pm-5.00am) have been calculated and were found to be the same as for the previously defined night time period (10.00pm-7.00am).

Table 4-2 RBLs Relevant to Assessment

Monitoring Location	Representative Receiver ID	Measured RBLs (dBA)			
		Day	Evening	Night	Early Morning Shoulder
NMT1 (2016 Long-Term Survey)	R1, R2, R3, R4	39	38	37	39
M1 (2014 WM Survey)	R5, R6, R7, R8	43	40	37	39
NMT2 (2016 Long-Term Survey)	R9, R10, R11, R12, R13, R14	39	38	34	36

Notes:
Day: the period from 7.00am to 6.00pm.
Evening: the period from 6.00pm to 10.00pm.
Night: the period from 10.00pm to 5.00am.
Early Morning Shoulder: the period from 5.00am to 7.00am.

The three noise catchment areas (i.e. northern receivers, southern receivers, and eastern receivers) where the RBLs summarised in Table 4-3 are deemed representative are shown in Figure 4-1.

It should be noted that when a development has been operating for more than 10 years, the *NPfI* states that its noise emissions may be included in the background noise assessment. As such, excluding noise generated by the Colliery from the background noise environment may be considered conservative as it would result in more stringent noise criteria.

5 OPERATIONAL NOISE ASSESSMENT CRITERIA

This section discusses the various noise criteria and guidelines relevant to the Revised Project, with consideration to the RBLs discussed in Section 4.

5.1 Project Noise Trigger Levels – Residential Receivers

The *NPfI* sets out two forms of project noise trigger levels. In assessing noise levels at residences, the trigger levels should be assessed at the most-affected point on or within the residential property boundary or, if this is more than 30 meters (m) from the residence, at the most-affected point within 30 m of the residence. Project noise trigger levels apply to noise levels measured under certain specific wind and temperature inversion conditions, as outlined in the *NPfI*.

Project noise trigger levels are described below.

5.1.1 Project Intrusiveness Noise Levels

The *NPfI* specifies an intrusiveness noise level which requires that the $L_{Aeq,15min}$ from a specific industrial source should not exceed the background noise level by more than 5 dB.

Table 5-1 provides a summary of the Project intrusiveness noise levels at the identified receivers.

Table 5-1 Project Intrusiveness Noise Levels

Representative Receiver		Project Intrusiveness Noise Levels, $L_{Aeq,15min}$ (dBA)			
ID	**Address**	**Day**	**Evening**	**Night**	**Early Morning Shoulder**
R1	16 West St, Russell Vale	44	43	42	44
R2	30 West St, Russell Vale				
R3	13 West St, Russell Vale				
R4	13 Broker St, Russell Vale				
R5	4 Broker St, Russell Vale	48	45	42	44
R6	659 Princes Hwy, Russell Vale				
R7	34 Princes Hwy, Corrimal				
R8	95 Midgley St, Corrimal				
R9	109 Midgley St, Corrimal	44	43	39	41
R10	6 Lyndon St, Corrimal				
R11	22 Lyndon St, Corrimal				
R12	46 Lyndon St, Corrimal				
R13	6 Taylor Pl, Corrimal				
R14	15 Taylor Pl, Corrimal				

Notes:
Day: the period from 7.00am to 6.00pm.
Evening: the period from 6.00pm to 10.00pm.
Night: the period from 10.00pm to 5.00am.
Early Morning Shoulder: the period from 5.00am to 7.00am.

5.1.2 Project Amenity Noise Levels

The *NPfI* specifies an amenity noise level which aims to maintain noise amenity over the whole daytime, evening and night periods where it is subjected to cumulative noise from a number of industrial sources.

The amenity noise level is relevant in the context of controlling cumulative noise impacts resulting from the concurrent operation of the Project and the other potential sources of industrial noise. The amenity noise level sets upper limits to control the total $L_{Aeq,Period}$ noise levels at a given receiver from all industrial sources over day, evening and night periods.

The identified receivers are considered to be suburban residences in accordance with the *NPfI* because they are located in an area that has local traffic with characteristically intermittent traffic flows. For suburban residences, the recommended amenity noise levels are:

- Daytime (7.00am-6.00pm) $L_{Aeq,Period}$ 55 dBA
- Evening (6.00pm-10.00pm) $L_{Aeq,Period}$ 45 dBA
- Night Time (10.00pm-7.00am) $L_{Aeq,Period}$ 40 dBA

Note that the amenity noise level refers to the $L_{Aeq,Period}$ noise level, which represents noise over an entire day, evening or night time period, whereas the intrusiveness noise level refers to a noise level over 15 minutes.

Because no other industries are present in the area, or likely to be introduced in the area in the future, the values above represent the Project amenity noise levels. The policy also stipulates that Project trigger noise levels should be expressed as $L_{Aeq,15min}$ values and provides the following method to convert $L_{Aeq,Period}$ levels into $L_{Aeq,15min}$ levels:

- $L_{Aeq,15min} = L_{Aeq,Period} + 3$ dB

Therefore, the resultant Project amenity noise levels are:

- Daytime (7.00am-6.00pm) $L_{Aeq,15min}$ 58 dBA
- Evening (6.00pm-10.00pm) $L_{Aeq,15min}$ 48 dBA
- Night Time (10.00pm-7.00am) $L_{Aeq,15min}$ 43 dBA

5.1.3 Project Noise Trigger Levels

The *NPfI* describes the 'Project noise trigger levels' as being the lower (i.e. more stringent) of the Project intrusiveness noise level and Project amenity noise levels.

Table 5-2 summarises the Project noise trigger levels used for all identified receivers in this assessment. The Project intrusiveness noise levels are lower (i.e. more stringent) compared to the Project amenity noise levels and therefore become the Project trigger noise levels.

Table 5-2 Project Noise Trigger Levels – Residential Receivers

Representative Receiver		Project Noise Trigger Levels, $L_{Aeq,15min}$ (dBA)			
ID	Address	Day	Evening	Night	Early Morning Shoulder
R1	16 West St, Russell Vale	44	43	42	44
R2	30 West St, Russell Vale				
R3	13 West St, Russell Vale				
R4	13 Broker St, Russell Vale				
R5	4 Broker St, Russell Vale	48	45	42	44
R6	659 Princes Hwy, Russell Vale				
R7	34 Princes Hwy, Corrimal				
R8	95 Midgley St, Corrimal				
R9	109 Midgley St, Corrimal	44	43	39	41
R10	6 Lyndon St, Corrimal				
R11	22 Lyndon St, Corrimal				
R12	46 Lyndon St, Corrimal				
R13	6 Taylor Pl, Corrimal				
R14	15 Taylor Pl, Corrimal				

Notes:
Day: the period from 7.00am to 6.00pm.
Evening: the period from 6.00pm to 10.00pm.
Night: the period from 10.00pm to 5.00am.
Early Morning Shoulder: the period from 5.00am to 7.00am.

5.2 Project Noise Trigger Levels – Schools

The *NPfI* sets out an internal amenity noise level of 35 dBA for school classrooms. The level is expressed as an $L_{Aeq,1hr}$ and is applicable to the Revised Project's noisiest 1-hour period when the school is in use (day and evening only).

It is accepted in the industry that an internal noise level inside a space is generally equivalent to the outdoor noise level just outside the space minus 10 dB with windows open. Assuming natural ventilation is required in the identified schools, an internal amenity noise level of 35 dBA would correspond to an external amenity noise level of 45 dBA.

As explained in Section 5.1.3, the *NPfI* stipulates that Project trigger noise levels should be expressed as $L_{Aeq,15min}$ values. For the purpose of this assessment, the $L_{Aeq,1hr}$ levels are conservatively assumed to be the same as $L_{Aeq,15min}$ levels. Therefore, a Project trigger level of 45 dBA ($L_{Aeq,15min}$) was used for all three identified schools during the day and evening periods.

5.3 Modifying Factor Adjustments

Where a noise source contains certain annoying characteristics, such as low frequency noise, the *NPfI* states that a penalty should be applied to measured or predicted noise levels before comparing to the relevant Project noise trigger levels.

The *NPfI* provides a method of low frequency noise assessment based on:

- overall 'C' weighted and 'A' weighted predicted or measured levels; and
- one-third octave predicted or measured levels in the range 10–160 Hertz (Hz).

Two penalties are nominated in the *NPfI*:

2 dB (evening and night)	if the C- minus A-weighted noise level over the same period is 15 dB or more, and where any of the third octave noise levels in Table C2 of the *NPfI* are exceeded by up to and including 5 dB and cannot be mitigated.
2 dB (day) and 5 dB (evening and night)	if the C- minus A-weighted noise level over the same period is 15 dB or more, and where any of the third octave noise levels in Table C2 of the *NPfI* are exceeded by more than 5 dB and cannot be mitigated.

Table C2 of the *NPfI* is reproduced below:

Table C2: One-third octave low-frequency noise thresholds.

Hz/dB(Z)	***One-third octave $L_{Zeq,15min}$ threshold level***												
Frequency (Hz)	*10*	*12.5*	*16*	*20*	*25*	*31.5*	*40*	*50*	*63*	*80*	*100*	*125*	*160*
dB(Z)	*92*	*89*	*86*	*77*	*69*	*61*	*54*	*50*	*50*	*48*	*48*	*46*	*44*

5.4 Residual Noise Impacts

The *NPfI* recognises that where all source and pathway feasible and reasonable noise mitigation measures have been applied a proposed development might give rise to residual noise impacts.

Table 4.1 of the *NPfI*, which interprets the significance of any potential noise exceedances, is reproduced below in Table 5-3. These significance categories (i.e. negligible, marginal, moderate and significant) are generally consistent with Table 1 of the *Voluntary Land Acquisition and Mitigation Policy* (*VLAMP*) (NSW State Government, 2018) which addresses noise and air quality impacts from State significant mining, petroleum and extractive industry developments.

Table 5-3 Significance of Residual Noise Impacts

If the predicted noise level minus the project noise trigger level is:	**And the total cumulative industrial noise level is:**	**Then the significance of residual noise level is:**
<=2 dBA	Not applicable	Negligible
>= 3 but <=5 dBA	< recommended amenity noise level or > recommended amenity noise level, but the increase in total cumulative industrial noise level resulting from the development is less than or equal to 1dB	Marginal
>= 3 but <=5 dBA	> recommended amenity noise level and the increase in total cumulative industrial noise level resulting from the development is more than 1dB	Moderate
>5 dBA	=< recommended amenity noise level	Moderate

If the predicted noise level minus the project noise trigger level is:	And the total cumulative industrial noise level is:	Then the significance of residual noise level is:
>5 dBA	> recommended amenity noise level	Significant

The *NPfI* also gives examples of noise mitigation measures addressing residual noise impacts in Table 4.2 of the policy. Table 4.2 of the *NPfI* is reproduced in Table 5-4.

Table 5-4 Examples of Receiver-Based Treatment to Mitigate Residual Noise Impacts

Significance of residual noise level	Example of potential treatment
Negligible	The exceedance would not be discernible by the average listener and therefore would not warrant receiver-based treatment or controls.
Marginal	Provide mechanical ventilation/comfort condition systems to enable windows to be closed without compromising internal air quality/amenity.
Moderate	As for 'marginal', but also upgraded façade elements, such as windows, doors or roof insulation, to further increase the ability of the building façade to reduce noise levels.
Significant	May include suitable commercial agreement where considered feasible and reasonable.

5.5 Assessment Methodology

Table 5-5 presents the methodology for assessing noise levels which may exceed the *NPfI* Project noise trigger levels at all receivers surrounding the Colliery.

Table 5-5 Project Noise Impact Assessment Methodology

Noise Management Zone		Noise Affectation Zone
1-2 dB above Project noise trigger levels (refer Table 5-2)	3-5 dB above Project noise trigger levels (refer Table 5-2)	> 5 dB Project noise trigger levels (refer Table 5-2)
No treatment/controls required	• Voluntary mitigation rights applicable. • Architectural treatment required if requested (incl. ventilation & upgraded façade elements).	• Voluntary mitigation rights applicable. • Architectural treatment required if requested (incl. ventilation & upgraded façade elements). • Voluntary land acquisition rights applicable.

5.6 Maximum Noise Level Event Assessment

To help protect residents from sleep disturbance (awakening or disturbance to sleep stages), the *NPfI* states the following:

> *Where the subject development/premises night time noise levels at a residential location exceed:*
>
> - *$L_{Aeq,15min}$ 40 dB(A) or the prevailing RBL plus 5 dB, whichever is the greater, and/or*
> - *L_{AFmax} 52 dB(A) or the prevailing RBL plus 15 dB, whichever is the greater,*
>
> *a detailed maximum noise level event assessment should be undertaken.*

Based on the measured night time RBLs, the Project's trigger levels for the maximum noise level event screening assessment have been established and are summarised in Table 5-6. Schools are not included in Table 5-6 as they are only deemed to be used during the day and evening periods.

The trigger levels for the maximum noise level event assessment are only applicable to night time and early morning shoulder operations.

Table 5-6 Maximum Noise Level Event Screening Assessment Trigger Levels

Representative Receiver		Maximum Noise Level Event Screening Assessment Trigger Levels (dBA)			
		L_{AFmax}		$L_{Aeq,15min}$	
ID	Address	Night	Early Morning Shoulder	Night	Early Morning Shoulder
R1	16 West St, Russell Vale	52	54	42	44
R2	30 West St, Russell Vale				
R3	13 West St, Russell Vale				
R4	13 Broker St, Russell Vale				
R5	4 Broker St, Russell Vale	52	54	42	44
R6	659 Princes Hwy, Russell Vale				
R7	34 Princes Hwy, Corrimal				
R8	95 Midgley St, Corrimal				
R9	109 Midgley St, Corrimal	52	52	40	41
R10	6 Lyndon St, Corrimal				
R11	22 Lyndon St, Corrimal				
R12	46 Lyndon St, Corrimal				
R13	6 Taylor Pl, Corrimal				
R14	15 Taylor Pl, Corrimal				

Notes:
Night: the period from 10.00pm to 5.00am.
Early Morning Shoulder: the period from 5.00am to 7.00am.

6 NOISE ASSESSMENT METHODOLOGY & ASSUMPTIONS

6.1 Noise Modelling Methodology

With consideration to the Revised Project, operational noise levels for the day, evening, night and early morning shoulder operating scenarios have been calculated at the nearby receivers using the Environmental Noise Model (ENM) a proprietary computer program from RTA Technology Pty Ltd. This modelling software is recognized as industry standard and has been previously accepted by the EPA for use in environmental noise assessments. The assessment models the total noise at each receiver from the operation of the Project. Total predicted operational noise levels are then compared with the Project trigger noise levels presented in Table 5-2.

Construction of site infrastructure and coal processing plant is expected to take between 12 and 24 months. The site would be operational during the construction period with ROM coal being transported off-site without processing. Site operation during the first 6-12 month-period is referred to as the 'phase-in' operation and is included in the assessment for completeness. It is important to note that daytime predictions for the 'phase-in' operation also include construction activities and are assessed against the Project trigger noise levels since the site would be operational at the same time and construction noise would be indiscernible from operational noise by the community.

Two operational scenarios have therefore been modelled:

- Phase-in Operation, representing the initial 6-12 months of operation where ROM coal is transported off site without processing and construction of site infrastructure is ongoing.
- Full Operation, representative of when the coal processing plant is operational, and the site is operating at full production capacity.

6.2 Revised Project Operations – Phase-in Operation

During construction of site infrastructure and coal processing plant, the Revised Project would involve the following operational processes:

- Coal from the underground workings would be taken through the primary sizer building near the conveyor portal, transported downhill via the decline conveyor, and distributed throughout the ROM stockpile area using the tripper system. The site is expected to operate at a reduced production capacity during the phase-in operation period.
- A dozer (CAT D8) would manage the stockpile.
- A front-end loader would load ROM coal into road trucks for transportation off-site.

The ROM stockpile dozer would be restricted to daytime only use (between 7.00am and 6.00pm Monday to Friday and 8.00am to 6.00pm Saturday). The front-end loader and road trucks would also typically only operate during daytime hours, however provision is required to operate into the evening period (between 6.00pm and 10.00pm Monday to Friday) in the event of unexpected Port closures or interruptions, therefore for the purpose of this assessment have been assumed to operate during the day and evening periods. The existing infrastructure (primary sizer building, decline conveyor and tripper system) would operate on a 24-hour basis.

Construction activities undertaken during this period include construction of the coal processing plant, conveyors and associated infrastructure and ongoing extension to noise berms surrounding the pit top facilities (Bunds #2, #3 and #5).

6.3 Revised Project Operations – Full Operation

Once all proposed upgrades are completed, the Revised Project would involve the following operational processes:

- Coal from the underground workings would be taken through the primary sizer building near the conveyor portal, transported downhill via the decline conveyor, and distributed throughout the ROM stockpile area using the tripper system.
- A dozer (CAT D8) would manage the stockpile and push coal into an underground conveyor system which would transport coal through the proposed secondary sizer building and into the surge bin.
- From the surge bin, the sized coal would then be transported via conveyor to the proposed coal processing plant for processing.
- From the coal processing plant the clean coal would be transported via conveyor to truck loading bin for transportation off-site via road trucks. Rejects would be transported from the coal processing plant via a further conveyor to form a rejects stockpile.
- A front-end loader would load the rejects from the stockpile to a truck for transportation off-site or to the mine portal area for underground emplacement via Eimco underground loader.

The ROM stockpile dozer, rejects front-end loader, rejects truck and underground loader would be restricted to daytime only use (between 7.00am and 6.00pm). Road trucks and the reclaim circuit (including the secondary sizer, surge bin, coal processing plant and truck loading bin) would also typically only operate during daytime hours, however provision is required to operate into the evening period (between 6.00pm and 10.00pm Monday to Friday) in the event of unexpected Port closures or interruptions, therefore for the purpose of this assessment have been assumed to operate during the day and evening periods. The rest of the infrastructure would operate on a 24-hour basis.

As mentioned in Section 2.3, reject material may either be transferred off-site and sold for use as fill material (if meeting VENM specifications) or transferred back into the underground Russell Vale workings. Both scenarios have been addressed in the assessment and the worst-case daytime noise emissions have been reported.

6.4 Meteorological Environment for Noise Assessment Purposes

Fact Sheet D of the *NPfI* defines standard meteorological conditions and noise-enhancing meteorological conditions to be considered for the assessment. The definition of those conditions is provided in Table D1 of Fact Sheet D which is reproduced below.

Table D1: Standard and noise-enhancing meteorological conditions.

Meteorological conditions	***Meteorological parameters***
Standard meteorological conditions	*Day/evening/night: stability categories A-D with wind speed up to 0.5m/s at 10m AGL*
Noise-enhancing meteorological conditions	*Day/evening: stability categories A-D with light winds (up to 3m/s at 10m AGL)* *Night: stability categories A-D with light winds (up to 3m/s at 10m AGL) and/or stability category F with winds up to 2m/s at 10m AGL*

Notes: *m/s = metres per second; m = metres; AGL = above ground level; where a range of conditions is nominated, the meteorological condition delivering the highest predicted noise level should be adopted for assessment purposes. However, feasible and reasonable noise limits in consents and licences derived from this process would apply under the full range of meteorological conditions nominated under standard or noise-enhancing conditions as relevant. All wind speeds are referenced to 10m AGL. Stability categories are based on the Pasquill-Gifford stability classification scheme.*

Fact Sheet D provides two options when considering meteorological effects:

- Conservatively adopt noise-enhancing meteorological conditions without processing meteorological data local to the site; or
- Determine the significance of noise-enhancing meteorological conditions based on meteorological data local to the site and adopt significant noise-enhancing conditions for the assessment. Where noise-enhancing meteorological conditions are deemed non-significant, standard meteorological conditions may be adopted.

The second option was adopted for the noise assessment as it would provide a more realistic estimate of noise impacts.

The significance of noise-enhancing meteorological conditions is based on the 2016 meteorological data collected by the WCL-operated on-site weather station. It includes wind speed, wind direction and observations of sigma-theta used to determine Pasquill stability categories (in accordance with Fact Sheet D).

Percentages of occurrence of moderate-to-strong temperature inversions were found to be above the threshold of occurrence of 30% in Winter (i.e. 33.1 %). As such, moderate-to-strong temperature inversions are considered significant to the Project. Those are applicable to the night and early morning shoulder periods.

Fact Sheet D of the *NPfI* does not provide guidance regarding the use of drainage flow winds during temperature inversions. A pragmatic risk management approach may be adopted, whereby temperature inversions with drainage flow winds are only considered in the assessment when the frequency of occurrence is greater than 10 % in any season. Based on recent discussions with a senior NSW EPA officer, this approach is considered reasonable and acceptable.

Analysis of the on-site meteorological data establishes a frequency of occurrence of night time (including the early morning shoulder period) meteorological conditions involving temperature inversions with drainage flow winds at more than 10 % in the following directions: SSE, S, SSW, SW, WSW, W, WNW, NW and NNW. Drainage flow winds in those directions are consistent with the topography of the site which is located on the slope of the Illawarra escarpment. Drainage flow winds from the SSE, S, SSW and NNW directions are believed to result from the effect of gradients within the site. The above drainage flow winds have been considered as part of the noise assessment. Drainage flow winds are considered too infrequent for all other directions and may be managed by WCL.

Drainage flow winds were found to be significant at up to 1.5 m/s in the nominated directions except for the SSE, WNW and NW directions where winds were only found to be significant at up to 1 m/s and the NNW direction where significant winds were only established at up to 0.5 m/s.

With regards to meteorological conditions involving winds but no inversions, analysis of the on-site meteorological data according to Fact Sheet D of the *NPfI* established no wind-related noise-enhancing meteorological conditions during the day, evening or night time periods.

All meteorological conditions presented in Table 6-1 have been considered for the assessment. Those include both standard and noise-enhancing conditions since noise-enhancing meteorological conditions do not necessarily result in higher noise levels when compared with standard meteorological conditions at a particular receiver location.

Table 6-1 Relevant *NPfI* (Fact Sheet D) Meteorological Conditions

Assessment Period	*NPfI* Meteorological Condition	Description of Meteorological Parameters
Day	Standard meteorological conditions	0.5m/s wind in source-to-receiver direction; stability categories A-D
Evening	Standard meteorological conditions	0.5m/s wind in source-to-receiver direction; stability categories A-D
Night	Noise-enhancing meteorological conditions	Stability category F; no drainage flow wind
		Stability category F with 1.5 m/s drainage flow wind in S, SSW, SW, WSW & W directions
		Stability category F with 1 m/s drainage flow wind in SSE, WNW & NW directions
		Stability category F with 0.5 m/s drainage flow wind in NNW direction
	Standard meteorological conditions	0.5m/s wind in source-to-receiver direction; stability categories A-D
Early Morning Shoulder	Noise-enhancing meteorological conditions	Stability category F; no drainage flow wind
		Stability category F with 1.5 m/s drainage flow wind in S, SSW, SW, WSW & W directions
		Stability category F with 1 m/s drainage flow wind in SSE, WNW & NW directions
		Stability category F with 0.5 m/s drainage flow wind in NNW direction
	Standard meteorological conditions	0.5m/s wind in source-to-receiver direction; stability categories A-D

Notes:
- m/s = metre per second
- SSE = South South East
- S = South
- SSW = South South West
- SW = South West
- WSW = West South West
- W = West
- WNW = West North West
- NW = North West
- NNW = North North West
- Wind in source-to-receiver direction was considered using the closest direction in a 16-direction compass to the source-to-receiver direction.

For each assessment period, only the highest noise predictions under the relevant *NPfI* meteorological conditions presented in Table 6-1 (including both standard and noise-enhancing meteorological conditions as described in Fact Sheet D) are reported.

Appendix A provides wind roses for the 2016 meteorological data collected by the WCL-operated on-site weather station.

6.5 Reasonable & Feasible Noise Mitigation Measures

Reasonable and feasible noise mitigation measures have been implemented on site or included as commitments going forward and as such have been included in modelling assumptions for this Revised Project noise impact assessment. These include recommendations provided to WCL by independent noise and vibration consultants Hatch, in a number of reports [1,2,3], and additional recommendations arising from this assessment.

Reasonable and feasible noise mitigation measures include constructing a noise barrier along the northern boundary of the site, two container walls to the north of the Pit Top and a new berm as well as raising/extending several of the existing berms with the intent to reduce potential noise impacts on the community. Some of these mitigation measures would be implemented prior to commencement of the phase-in operation to ensure noise generated by the phase-in operation is mitigated appropriately.

Table 6-2 and 6-3 provide a summary of the mitigation measures which have been included in the Revised Project noise modelling.

Table 6-2 Summary of Physical Mitigation Measures Incorporated in Modelling

Physical Noise Mitigation Measures	
Existing noise bunds *	• Four existing noise bunds (Bunds #1, #2, #3, #4 & #5 as shown in Figure 2-1) have been installed to minimise site noise at the nearby receivers located directly to the north, north-east, south-east and east of the colliery. • Additionally, an existing 2.5 m high bund has been built near the Rubber Tyred Vehicle (RTV) and track portal area.
New bund and extension/raise of existing bunds *	• Bund #2 to be constructed to reach RL of 56 m throughout whole length. • Bund #3 to be raised and extended to reach RL of 47 m throughout whole length. • Bund #5 to be extended to the south until access road and to the north such that total length equates 100 m, and raised to reach RL of 58 m throughout whole length. Bunds #2, 3 and 5 will be completed over as short a timeframe as possible, indicatively within three months of 'phase-in' operation commencing.

[1] *Russell Vale Tripper Conveyor and Surface Noise Source Management*, Hatch, July 2014
[2] *Russell Vale Coal Reclaim, Screening, Sizing and Separation Plant*, Hatch, February 2015
[3] *Russell Vale Coal Deshaling Plant*, Hatch, November 2015

Physical Noise Mitigation Measures	
Container walls *	Construction of two container walls to the north of the Pit Top: • The container wall at the upper stockpile area would span a total length of approximately 240 m and consist of between two and three layers of containers stacked on top of each other. The top of the western section (approximately 80 m long and two containers-high) would reach RL of 58.7 m at the western end and decrease to RL of 55.2 m at the eastern end. The middle section (approximately 140 m long and three containers-high) would reach RL of 52.8 m across the entire length. The eastern section (approximately 20 m long and two containers-high) would reach RL of 45.2 m across the entire length. • The container wall at the lower stockpile area would span a total length of approximately 80 m and consist of two layers of containers stacked on top of each other. The top of the wall would reach RL of 45.2 m. WCL has committed to constructing both container walls prior to 'phase-in' operations commencing.
Noise barrier *	Construction of a 5 m high noise barrier along the northern boundary of the site starting from the Princes Highway entrance to the old Broker Street site gates. WCL has committed to building the noise barrier prior to the 'phase-in' operation commencing.
Temporary stockpile of ROM coal (during phase-in operations)	A 9 m high temporary stockpile of ROM coal to be constructed directly to the east and north-east of the dozer location to provide shielding to the northern receivers from dozer noise. Once constructed, the temporary stockpile would remain untempered with until completion of the phase-in operation. WCL has committed to building the temporary stockpile of ROM coal as early as possible during the 'phase-in' operation.
New infrastructure layout maximising shielding from site topography	Positioning of secondary sizer near bottom of nearby batter and surge bin at toe of nearby batter to maximise shielding to northern receivers.
Acoustic treatment of Primary Sizer Building	Side sheeting lined with absorption material installed around all facades of the building (except for the northern façade where an opening had to be left for ventilation purposes).
Acoustic treatment of Existing Tripper System	Internal lining and vibration isolation of tripper impact plates and hangers as well as internal lining and top covering of trouser leg chutes completed.
Decline conveyor semi-enclosed.	
Poly rollers provided to all conveyors.	
Vulcanised Joints applied to all conveyors.	
Coal processing plant to be enclosed in acoustically treated building according to recommendations made by Hatch.	
Secondary sizer plant to be enclosed in acoustically treated building according to recommendations made by Hatch.	
Surge bin to be acoustically treated building according to recommendations made by Hatch.	
D8 dozer provided with attenuation pack and grouser treatment.	
Internal access road maintained such as to avoid potholes and other road defects.	

*Note: Bunds, noise walls and barrier are shown in Figure 2-1.

Table 6-3 Summary of Operational Mitigation Measures Incorporated in Modelling

Operational Noise Mitigation Measures
Coal loading and laden truck movements typically restricted to daytime period only, with provision for occasional operation in the evening period to cater for unexpected Port closures or interruptions. 40 km/hr on-site speed limit and 50 km/hr speed limit along Bellambi Lane with driver code of conduct enforced.
The D8 dozer, rejects front-end loader, rejects truck and underground loader would be restricted to daytime only use.
Reclaim conveyor system, secondary sizer, surge bin, coal processing plant and truck loading bins typically restricted to daytime period only, with provision for occasional operation in the and evening period to cater for unexpected Port closures or interruptions.
Dozer movements restricted to near ground level (directly above underground reclaim system) during phase-in operation to maximise shielding provided by temporary ROM coal stockpile.
Early morning truck movements to designated truck parking area prior to 7.00am would be restricted to a maximum of six arrivals per 15-minute period.

6.6 Revised Project Equipment Inventory, Sound Power Levels & Periods of Operation

Table 6-4 sets out the principal noise sources and associated sound power levels (SWLs) considered in the Revised Project noise model. The table also specifies where plant items have already been mitigated and provides a source reference for each SWL used.

Figure 6-1 shows the location of all the identified noise sources.

Table 6-4 Russell Vale Revised Project – Equipment Inventory, Including Sound Power Levels & Period of Operation

Area	Fleet/ Infrastructure Item	Source ID (Fig. 6-1)	Period	Number of Items	Sound Power Level (dBA)	Mitigation Applied?	Reference	Function
Coal Transport Infrastructure	RV2 decline conveyor	S1	Day, Evening, Night, Shoulder	1	70/m	Yes – Semi-Enclosure Constructed	NRE No.1 Colliery – Noise Assessment Major Works Project, ERM, Nov 2012	Transport coal from portal area to primary sizer building
	Primary sizer building	S2	Day, Evening, Night, Shoulder	1	104	Yes – Enclosure Constructed	Russell Vale Tripper Conveyor and Surface Noise Source Management, Hatch, July 2014 (SWL of 104 dBA after partial mitigation).	Crush coal to smaller size
	RV1 conveyor (enclosed)	S3	Day, Evening, Night, Shoulder	1	70/m	Yes – Semi-Enclosure Constructed	NRE No.1 Colliery – Noise Assessment Major Works Project, ERM, Nov 2012	Transport coal from portal area to ROM stockpile area
	RV1 stackout conveyor	S4	Day, Evening, Night, Shoulder	1	70/m	Yes – Poly Rollers Installed	NRE No.1 Colliery – Noise Assessment Major Works Project, ERM, Nov 2012	Transport coal from decline conveyor to ROM stockpile area
	RV1 tripper system	S5	Day, Evening, Night, Shoulder	1	100 (tripper); 103 (Stockpile)	Yes – Tripper treated according to Hatch advice	Wilkinson Murray site measurements (11 June 2015)	Distribute coal within ROM stockpile area
	Drive tower	S6	Day, Evening, Night, Shoulder	1	94	Yes – Enclosure Constructed	Russell Vale Tripper Conveyor and Surface Noise Source Management, Hatch, July 2014	Drive conveyor and tripper system

Area	Fleet/ Infrastructure Item	Source ID (Fig. 6-1)	Period	Number of Items	Sound Power Level (dBA)	Mitigation Applied?	Reference	Function
ROM Coal Reclaim	D8 dozer	S7	Day (up to 2hr per day)	1	112	Yes – Hushpack engine and grouser attenuation proposed to be applied prior to commencement of phase-in scenario	Wilkinson Murray site measurements (8 July 2014), Hushpack Engineering advice, Umwelt Mt Owen Assessment	Manage ROM stockpile
	Reclaim tunnel fans	S8	Day, Evening	1	108 (combined)	No Change	NRE No.1 Colliery – Noise Assessment Major Works Project, ERM, Nov 2012	Provide ventilation for reclaim tunnels
	Reclaim tunnel to transfer station conveyor	S9	Day, Evening	1	70/m	Yes – Poly Rollers to be installed	NRE No.1 Colliery – Noise Assessment Major Works Project, ERM, Nov 2012	Transport coal from reclaim tunnel to transfer station
	New transfer station	S10	Day, Evening	1	100	Yes – Enclosure Constructed	Wilkinson Murray database	Transfer coal from one conveyor to the next
	Transfer station to secondary sizer conveyor	S11	Day, Evening	1	70/m	Yes – Poly Rollers to be installed	NRE No.1 Colliery – Noise Assessment Major Works Project, ERM, Nov 2012	Transport coal from transfer station to secondary sizer
	New secondary sizer building	S12	Day, Evening	1	72	Yes – Equipment to be enclosed in building according to design advice from Hatch (i.e. treatment with 'speed panel' acoustic building claddings)	Russell Vale – Coal reclaim, screening sizing and separation plant, Hatch, February 2015	Crush coal to smaller size
	Secondary sizer to surge bin conveyor	S13	Day, Evening	1	70/m	Yes – Poly Rollers to be installed	NRE No.1 Colliery – Noise Assessment Major Works Project, ERM, Nov 2012	Transport sized coal to surge bin
	600t surge bin	S14	Day, Evening	1	100	Yes – Surge bin to be clad according to design advice	Wilkinson Murray database	Regulate coal being transferred to existing truck loading bins

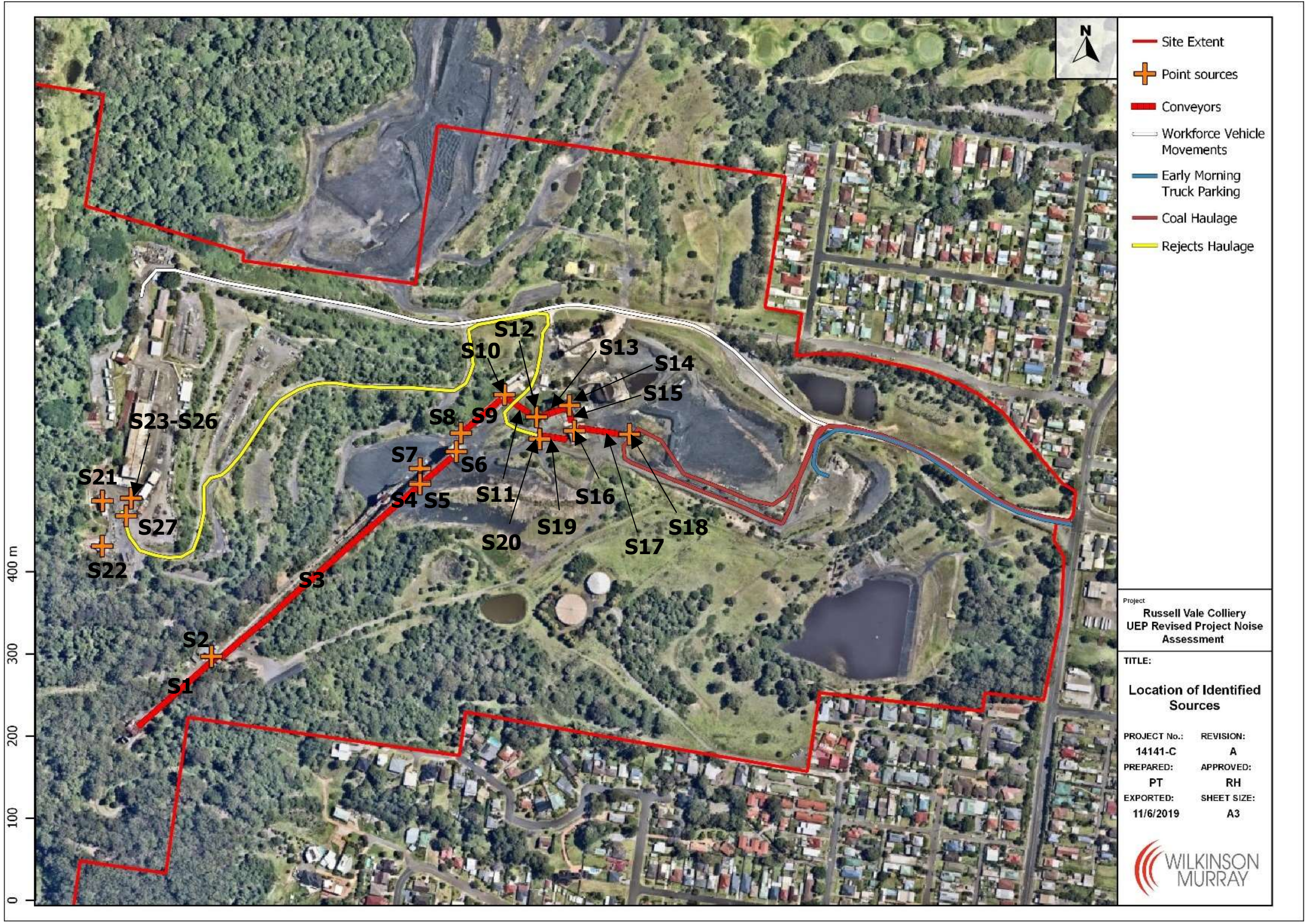
Area	Fleet/ Infrastructure Item	Source ID (Fig. 6-1)	Period	Number of Items	Sound Power Level (dBA)	Mitigation Applied?	Reference	Function
						from Hatch (i.e. treatment with acoustic building claddings).		
	Surge bin to coal processing plant conveyor	S15	Day, Evening	1	70/m	Yes – Poly Rollers to be installed	NRE No.1 Colliery – Noise Assessment Major Works Project, ERM, Nov 2012	Transport sized coal to coal processing plant
	Coal processing plant	S16	Day, Evening	1	49 (Ground Flr); 86 (Screen Flr)	Yes – Equipment to be enclosed in building according to design advice from Hatch (i.e. treatment with 'Concrete/R32' acoustic building claddings).	Russell Vale Coal Deshaling Plant, Hatch, November 2015	Coal processing plant
	Coal processing plant to truck loading bin conveyor	S17	Day, Evening	1	70/m	Yes – Poly Rollers to be installed	NRE No.1 Colliery – Noise Assessment Major Works Project, ERM, Nov 2012	Transport clean coal to truck loading bin
	Truck loading bin	S18	Day, Evening	1	105	-	Wilkinson Murray database	Load coal into road trucks to transport off-site
	Rejects conveyor	S19	Day, Evening	1	70/m	Yes – Poly Rollers to be installed	NRE No.1 Colliery - Noise Assessment Major Works Project, ERM, Nov 2012	Transport reject material to rejects stockpile
	Front-End Loader	S20	Day	1	113	-	Wilkinson Murray site measurements of CAT988B front-end loader (8 July 2014)	Load reject into trucks
Coal Haulage	Truck and dog	-	Day, Evening	Up to 32/Hr (Day)	102 (40 km/hr)	On site speed limit of 40 km/hr enforced and driver code of conduct applied.	Wilkinson Murray database	Transport off-site

Area	Fleet/ Infrastructure Item	Source ID (Fig. 6-1)	Period	Number of Items	Sound Power Level (dBA)	Mitigation Applied?	Reference	Function
				Up to 24/Hr (Eve)		Coal Haulage restricted to day and evening only. No night movements.		
Rejects Haulage	Truck	-	Day	Up to 2/Hr (Day)	102 (40 km/hr)	On site speed limit of 40 km/hr enforced and driver code of conduct applied. Rejects Haulage restricted to day only. No evening or night movements.	Wilkinson Murray database	Transport rejects to underground emplacement area
RTV Portal Area	Compressor House	S21	Day, Evening, Night, Shoulder	1	105	Yes – Enclosure Constructed	Russell Vale Tripper Conveyor and Surface Noise Source Management, Hatch, July 2014	Generate power for underground facilities
	Main Ventilation Fans	S22	Day, Evening, Night, Shoulder	2	104 (combined)	No Change	Russell Vale Tripper Conveyor and Surface Noise Source Management, Hatch, July 2014	Provide underground ventilation
	Hyster116 forklift	S23	Day, Evening, Night, Shoulder	1	84	No Change	Wilkinson Murray site measurements (8 July 2014)	General maintenance work
	Hyster117 forklift	S24	Day, Evening, Night, Shoulder	1	95	No Change	Wilkinson Murray site measurements (8 July 2014)	General maintenance work

Area	Fleet/ Infrastructure Item	Source ID (Fig. 6-1)	Period	Number of Items	Sound Power Level (dBA)	Mitigation Applied?	Reference	Function
	Juggonaut	S25	Day, Night, Shoulder	1	104	No Change	Noise Levels of Mobile Equipment, BGMA, July 2010	Transport men and material down portal. Assumed to be operating for 5mins at shift change during the day and at night (i.e. not evening period)
	Men transporter	S26	Day, Night, Shoulder	3	104	No Change	Derived from Juggonaut SWL (Noise Levels of Mobile Equipment, BGMA, July 2010)	Transport men down portal. Assumed 3 to be operating for 3mins at shift change during the day and at night (i.e. not evening period)
	Eimco underground loader	S27	Day	1	110	Loader use limited to day use only	Wilkinson Murray site measurements of CAT970 front-end loader (8 July 2014)	Transport rejects to underground emplacement
Early morning truck parking	Truck	-	Shoulder	Up to 14/30mins	102 (40 km/hr)	On site speed limit of 40 km/hr enforced and driver code of conduct applied. Once at the truck parking area, trucks would turn off their engine immediately until 7.00am.	Wilkinson Murray database	Remove potential noise generated by early morning trucks parking and waiting outside the site

Area	Fleet/ Infrastructure Item	Source ID (Fig. 6-1)	Period	Number of Items	Sound Power Level (dBA)	Mitigation Applied?	Reference	Function
Workforce	Light vehicles	-	Day, Evening, Night, Shoulder	Up to 56/30mins (Day) Up to 26/30mins (Eve, Night, Shoulder)	67 (40 km/hr)	-	Wilkinson Murray database	Staff movements at shift change

Figure 6-1 Russell Vale Revised Project – Location of Identified Sources



6.7 Construction Fleet Inventory & Sound Power Levels (Phase-in Operation)

Table 6-5 sets out the principal noise sources and associated sound power levels (SWLs) assumed for construction of the site infrastructure and coal processing plant. Two scenarios were addressed, and the worst-case scenario was included in the daytime noise model for the phase-in operation.

Table 6-5 Construction Fleet Inventory & Sound Power Levels (Phase-in Operation)

Construction Scenario	Plant Item	Number of Items	SWL/Item	Total SWL
Site establishment & Earthworks	Scraper	1	113	116
	Water Cart	1	107	
	Compactor	1	106	
	Franna Crane	1	105	
	3-tonne Excavator	1	90	
	23-tonne Excavator	1	105	
	Bobcat	1	104	
	40-tonne Dump Truck	1	102	
Service Installation	Franna Crane	1	105	116.8
	20-tonne Crane	1	113	
	Water Cart	1	107	
	Front-End Loader	1	113	

As shown in Table 6-5, service installation represents the construction scenario with the higher total SWL. As such, it was assumed when predicting daytime noise levels from the phase-in operation.

It should be noted that a correction of -5 dB was applied to the total SWL for each construction scenario to account for time correction, as the entire construction fleet would not always operate concurrently (i.e. not all plant items are expected to be operating all the time).

7 INDUSTRIAL NOISE PREDICTIONS & DISCUSSION

7.1 Revised Project Predicted Noise Levels – Full Operation

The predicted $L_{Aeq,15min}$ operational noise levels representative of the full operation (once all infrastructure items and upgrades have been built) under the Revised Project are presented in this section.

Results are presented as $L_{Aeq,15min}$ noise levels under Fact Sheet D meteorological conditions (Section 6.4). The maximum result of applicable Fact Sheet D meteorological conditions (i.e. standard conditions and noise-enhancing conditions) is presented.

Project noise trigger levels, as discussed in Section 5.0, are shown in yellow shading. Predicted levels exceeding criteria are shown in bold.

Table 7-1 Predicted $L_{Aeq,15min}$ Noise Levels from Project – Full Operation

Representative Receiver ID	$L_{Aeq,15min}$ Noise Level (dBA)							
	Day		Evening		Night		Early Morning Shoulder	
	Prediction	PNTL	Prediction	PNTL	Prediction	PNTL	Prediction	PNTL
R1	41	44	38	43	42	42	43	44
R2	42	44	39	43	**43**	42	43	44
R3	42	44	39	43	42	42	43	44
R4	40	44	36	43	40	42	40	44
R5	38	48	35	45	35	42	36	44
R6	44	48	41	45	41	42	43	44
R7	40	48	39	45	41	42	42	44
R8	40	48	39	45	42	42	43	44
R9	38	44	36	43	**41**	39	41	41
R10	37	44	35	43	**41**	39	41	41
R11	36	44	34	43	38	39	38	41
R12	37	44	35	43	37	39	37	41
R13	39	44	37	43	38	39	38	41
R14	38	44	36	43	39	39	39	41
R15[1]	37	45	-	n/a	-	n/a	-	n/a
R16[1]	37	45	-	n/a	-	n/a	-	n/a
R17[1]	31	45	-	n/a	-	n/a	-	n/a

Notes:
Day: the period from 7.00am to 6.00pm.
Evening: the period from 6.00pm to 10.00pm.
Night: the period from 10.00pm to 5.00am.
Early Morning Shoulder: the period from 5.00am to 7.00am.
Note 1: Receiver relates to school therefore only daytime prediction presented.

As shown in Table 7-1, night time noise levels are predicted to exceed the Project noise trigger levels by 1 dB at R2, and by up to 2 dB at R9 and R10. At all other locations, compliant night time noise levels are predicted. Table 7-1 shows that no exceedances are to be expected during the day, evening and early morning shoulder periods at any of the identified representative receivers. As discussed in Section 7.4, these night time noise exceedances are only predicted to occur between 2 and 3% of the night time period in Winter.

It is important to note that a 1 to 2 dB exceedance represents a negligible residual noise impact indiscernible by the average listener according to the *NPfI* and the *VLAMP*.

Predicted $L_{Aeq,15min}$ operational noise levels for the full operation under the Revised Project comply with the Project amenity noise levels of 58 dBA, 48 dBA and 43 dBA for the day, evening and night time periods, respectively.

7.2 Revised Project Predicted Noise Levels – Phase-in Operation

The predicted $L_{Aeq,15min}$ operational noise levels representative of the phase-in operation under the Revised Project are presented in this section.

Results are reported as $L_{Aeq,15min}$ noise levels under Fact Sheet D meteorological conditions (Section 6.4) with the maximum result of applicable Fact Sheet D meteorological conditions (i.e. standard conditions and noise-enhancing conditions) being presented.

Project noise trigger levels, as discussed in Section 5.0, are shown in yellow shading. Predicted levels exceeding criteria are shown in bold.

Daytime predictions conservatively include construction activities associated with the site infrastructure and coal processing plant (Section 6.7).

Table 7-2 Predicted $L_{Aeq,15min}$ Noise Levels from Project – Phase-in Operation

Representative Receiver ID	$L_{Aeq,15min}$ Noise Level (dBA)							
	Day		Evening		Night		Early Morning Shoulder	
	Prediction	PNTL	Prediction	PNTL	Prediction	PNTL	Prediction	PNTL
R1	41	44	37	43	**43**	42	43	44
R2	41	44	37	43	**43**	42	43	44
R3	40	44	36	43	42	42	43	44
R4	37	44	34	43	40	42	40	44
R5	36	48	33	45	35	42	36	44
R6	43	48	41	45	41	42	43	44
R7	40	48	38	45	41	42	42	44
R8	40	48	38	45	42	42	43	44
R9	37	44	36	43	**41**	39	41	41
R10	37	44	34	43	**41**	39	41	41
R11	36	44	33	43	38	39	38	41
R12	37	44	34	43	37	39	37	41
R13	38	44	36	43	38	39	38	41
R14	37	44	35	43	39	39	39	41

Representative Receiver ID	$L_{Aeq,15min}$ Noise Level (dBA)							
	Day		Evening		Night		Early Morning Shoulder	
	Prediction	PNTL	Prediction	PNTL	Prediction	PNTL	Prediction	PNTL
R15[1]	36	45	-	n/a	-	n/a	-	n/a
R16[1]	35	45	-	n/a	-	n/a	-	n/a
R17[1]	30	45	-	n/a	-	n/a	-	n/a

Notes:
Day: the period from 7.00am to 6.00pm.
Evening: the period from 6.00pm to 10.00pm.
Night: the period from 10.00pm to 5.00am.
Early Morning Shoulder: the period from 5.00am to 7.00am.
Note 1: Receiver relates to school therefore only daytime prediction presented.

Table 7-2 shows that night time noise levels during the phase-in operation are predicted to exceed the Project noise trigger levels by 1 dB at R1 and R2, and by up to 2 dB at R9 and R10. Compliance of night time noise levels is anticipated at all other representative locations. Table 7-2 indicates that no exceedances are to be expected during the day, evening and early morning shoulder periods at any of the identified representative receivers.

Again, 1 to 2 dB exceedances represent a negligible residual noise impact indiscernible by the average listener according to the *NPfI* and the *VLAMP*.

Predicted $L_{Aeq,15min}$ operational noise levels for the phase-in operation would comply with the Project amenity noise levels of 58 dBA, 48 dBA and 43 dBA for the day, evening and night time periods, respectively.

7.3 Discussion on Extent of Noise Exceedances

Assessment of noise at the 17 identified receivers, which represent the potentially most impacted noise-sensitive receivers, has enabled the appropriate design of revised site operations and extensive noise mitigation measures, as detailed in Table 6-2 of this report.

Because of the presence of residual noise exceedances anticipated at some of the identified receivers, it is necessary to determine the extent of the residual noise impacts surrounding the site. Noise contours of Project noise trigger levels in combination with additional point-source noise predictions have been generated for the full operation to identify all receivers expected to be subject to residual noise exceedances and determine the level of exceedance for each of those receivers.

Figures showing indicative day, evening, night and early morning shoulder period noise contours of the Project noise trigger levels under Fact Sheet D meteorological conditions for the full operation scenario are presented in Appendix B. It is important to note that receivers partly or totally 'inside' noise contours can be subject to rounded noise levels in compliance with criteria. Project noise trigger level applicability areas shown in the noise contour figures do not apply to the schools (R15-R17).

Table 7-3 presents a summary of all noise-sensitive receivers where exceedances are expected during full operation. Exceedance are only expected at night and no exceedances are expected during the other assessment periods. As discussed in Section 7.4, these night time noise exceedances are only predicted to occur between 2 and 3% of the night time period in Winter.

Table 7-3 Predicted Noise Exceedances from Project – Full Operation

Receiver Address	$L_{Aeq,15min}$ Noise Level (dBA) – Night	
	Prediction	PNTL
26 West St, Russell Vale	**43**	42
28 West St, Russell Vale	**43**	42
30 West St, Russell Vale	**43**	42
4 Lyndon St, Corrimal	**40**	39
6 Lyndon St, Corrimal	**41**	39
8 Lyndon St, Corrimal	**41**	39
8 Wilford St, Corrimal	**41**	39
10 Wilford St, Corrimal	**40**	39
101 Midgley St, Corrimal	**41**	39
103 Midgley St, Corrimal	**41**	39
105 Midgley St, Corrimal	**41**	39
107 Midgley St, Corrimal	**41**	39
109 Midgley St, Corrimal	**41**	39
76 Midgley St, Corrimal	**40**	39
78 Midgley St, Corrimal	**40**	39

Note:
Night: the period from 10.00pm to 5.00am.

Table 7-3 indicates that exceedances are anticipated at residences located at the above 15 addresses during the proposed full operation. All exceedances would range between 1 and 2 dB, representing a negligible residual noise impact indiscernible by the average listener according to the *NPfI* and the *VLAMP*.

The three main noise contributors impacting the receivers listed in Table 7-3 can be summarised as follows, from most (1) to least (3) significant:

- Receivers along West Street, Russell Vale:
  1. Primary sizer building
  2. RV1 tripper system
  3. Compressor house (RTV portal area)

- Receivers along Lyndon Street, Corrimal:
  1. Primary sizer building
  2. Main ventilation fans (RTV portal area)
  3. RV1 tripper system

- Receivers along Wilford Street and Midgley Street, Corrimal:
    1. Primary sizer building
    2. Main ventilation fans (RTV portal area)
    3. Compressor house (RTV portal area)

7.4 Frequency of Occurrence of Residual Noise Exceedances

Appendix C provides a selection of cumulative frequency of occurrence noise graphs showing the percentage of time for which the identified night time residual exceedances are expected to occur in winter. Because the noise exceedances relate to noise levels during temperature inversions, the percentage of time for which Project noise trigger levels are expected to be exceeded would be the greatest in winter.

The three graphs included in Appendix C show the cumulative frequency of occurrence of night time noise levels in winter for the three receivers expected to exceed the Project noise trigger levels during full operation, namely receivers R2, R9 and R10.

Review of the graphs indicates that the identified residual noise exceedances are only expected to occur between 2 and 3% of the night time period in Winter.

7.5 Low-Frequency Noise Assessment Results

A low-frequency noise assessment was conducted to ascertain whether any of the identified representative receivers should be subject to a modifying factor correction due to dominant low-frequency content. Such correction would be applied to the predicted noise levels before comparing to the relevant Project noise trigger levels.

As stated in Section 5.2, the *NPfI* provides a method for assessing low frequency noise based on:

- overall 'C' weighted and 'A' weighted predicted or measured levels; and
- one-third octave predicted or measured levels in the range 10–160 Hz.

7.5.1 Identification of Unbalanced Spectra Containing Low-Frequency Noise

The C-weighted noise level minus A-weighted noise level assessment focuses on the full operation scenario. It was conducted on all the identified representative residential receivers for all four assessment periods. The assessment was based on the relevant *NPfI* meteorological conditions (Table 6-1) resulting in the highest noise levels.

Table 7-4 summarises the C-weighted noise level minus A-weighted noise level assessment results for the Full Operation scenario. Differences between the two weightings equal to or exceeding 15 dB are shown in bold.

Table 7-4 C- Minus A-Weighted Noise Levels – Full Operation

Representative Receiver ID	$L_{Ceq,15min}$ Noise Level - $L_{Aeq,15min}$ Noise Level (dB)			
	Day	Evening	Night	Early Morning Shoulder
R1	**15**	**16**	9	9
R2	**15**	**16**	10	10
R3	**15**	**16**	9	9
R4	**15**	**16**	9	10
R5	**15**	**16**	12	14
R6	11	11	8	11
R7	11	11	9	10
R8	11	12	9	10
R9	14	14	10	10
R10	**15**	**16**	9	9
R11	14	**15**	12	12
R12	14	**15**	14	14
R13	**15**	**15**	14	14
R14	13	14	12	12

Results presented in Table 7-4 show that the difference between overall 'C' weighted and 'A' weighted predicted levels are equal to or exceeding 15 dB at receivers R1 to R5 and receivers R10 to R13 during the day and/or evening periods. Therefore, day and evening low-frequency noise spectra predicted at those receivers are considered unbalanced and need to be assessed against the low-frequency noise threshold levels provided in Table C2 of the *NPfI*. It should be noted that the identification of unbalanced spectra is likely to be related to limitations in the predictive software at lower frequencies and the relatively close proximity of the site to the receivers would in reality be unlikely to generate unbalanced spectra.

Differences between the two weightings are found to be less than 15 dB at all receivers during the night time and early morning shoulder periods. As such, the low-frequency noise assessment indicates that it is unlikely that any of the receivers surrounding the Project would be subject to dominant low-frequency noise during those assessment periods.

7.5.2 Comparison with Low-Frequency Noise Threshold Levels

All predicted operational noise levels are based on octave band noise predictions ranging between 31.5 Hz to 16 kHz. As such, predictions do not provide one-third octave band levels and do not include frequency bands between 10 Hz and 160 Hz as required for comparison with the relevant low-frequency noise threshold levels provided in Table C2 of the *NPfI*.

Reliable data of low-frequency mining noise and coal handling over short distances is currently unavailable. The most reliable dataset available to establish a typical low-frequency spectrum shape was captured as part of a noise audit conducted for the Wambo Open Cut Coal Mine (*Wambo Coal – Independent Noise Review*, Wilkinson Murray, 2019). The measurements were conducted in one-third octave bands between 10 Hz to 160 Hz at an approximate distance of 2 km from the mine.

The spectrum shape shown in Table 7-5 corresponds to an average of 94 low-frequency measurements normalised to a broadband level of 35 dBA (i.e. the spectra were shifted up or down until their equivalent broadband level equates to 35 dBA).

Table 7-5 Typical Measured Low-Frequency Spectrum – Wambo Open Cut Coal Mine Noise Audit

	One-Third Octave Band Centre Frequency, Hz												
	10	**12.5**	**16**	**20**	**25**	**31.5**	**40**	**50**	**63**	**80**	**100**	**125**	**160**
Average measurement level (dBZ)	46	50	55	50	50	49	49	50	48	49	49	45	41

In order to estimate one-third octave band levels at low frequencies (10 Hz - 160 Hz), the typical low-frequency spectrum measured as part of the Wambo Open Cut Coal Mine noise audit was normalised to the 63 Hz octave component of the predicted noise levels at each of the representative receivers.

Tables 7-6 and 7-7 summarise the resultant low-frequency one-third octave band levels at the receivers subject to unbalanced spectra for the day and evening periods, respectively. The low-frequency noise threshold levels provided in Table C2 of the *NPfI* are also included. Predicted levels exceeding low-frequency noise threshold levels are shown in bold.

Table 7-6 Resultant Low-Frequency Spectra – Day

	Third Octave Band Centre Frequency, Hz												
	10	**12.5**	**16**	**20**	**25**	**31.5**	**40**	**50**	**63**	**80**	**100**	**125**	**160**
R1 (dBZ)	48	53	57	52	53	51	51	**52**	50	**51**	**51**	**48**	43
R2 (dBZ)	49	54	58	53	54	52	52	**53**	**51**	**52**	**52**	**49**	44
R3 (dBZ)	48	53	57	52	53	51	51	**52**	50	**51**	**51**	**48**	43
R4 (dBZ)	46	50	55	50	50	49	49	49	48	48	**49**	45	41
R5 (dBZ)	43	48	52	47	48	47	46	47	46	46	46	43	39
R10 (dBZ)	45	49	54	49	49	48	48	49	47	48	48	44	40
R11 (dBZ)	43	48	52	47	48	46	46	47	45	46	46	43	38
R12 (dBZ)	43	47	52	47	47	46	46	47	45	46	46	42	38
R13 (dBZ)	48	52	57	52	52	51	51	**52**	50	**51**	**51**	**47**	43
Low-Frequency Noise Thresholds (dBZ)	92	89	86	77	69	61	54	50	50	48	48	46	44

Table 7-6 indicates that one or more one-third octave band levels are likely to exceed the low-frequency noise threshold levels at receivers R1, R2, R3, R4 and R13 during the day. Exceedances are expected to range 1-4 dB (i.e. 5 dB or less) and therefore no modifying factor corrections need to be applied.

Table 7-7 Resultant Low-Frequency Spectra – Evening

	Third Octave Band Centre Frequency, Hz												
	10	**12.5**	**16**	**20**	**25**	**31.5**	**40**	**50**	**63**	**80**	**100**	**125**	**160**
R1 (dBZ)	38	43	47	42	43	41	41	42	40	41	41	38	33
R2 (dBZ)	40	45	49	44	45	43	43	44	42	43	43	40	35
R3 (dBZ)	39	44	49	43	44	43	43	43	42	42	42	39	35
R4 (dBZ)	38	42	47	41	42	41	41	41	40	40	40	37	33
R5 (dBZ)	38	42	47	42	43	41	41	42	40	41	41	38	33
R10 (dBZ)	37	41	46	41	41	40	40	41	39	40	40	36	32
R11 (dBZ)	35	40	44	39	40	38	38	39	37	38	38	35	30
R12 (dBZ)	38	42	47	41	42	41	41	41	40	40	40	37	33
R13 (dBZ)	41	46	50	45	46	45	44	45	44	44	44	41	37
Low-Frequency Noise Thresholds (dBZ)	92	89	86	77	69	61	54	50	50	48	48	46	44

Review of Table 7-7 indicates that all one-third octave band levels would comply with the low-frequency noise threshold levels during the evening. As such, no modifying factor corrections need to be applied during the evening period.

Therefore, no modifying factor correction for low-frequency noise is warranted for the Revised Project.

7.6 Contextualisation of Revised Project Noise Assessment

Appendix D provides a comparison of the predicted Revised Project noise levels for the full operation with those predicted by the previous UEP assessment, as detailed in the WM report dated 9 October 2014 (Report No 14141 Ver C). Under the same meteorological conditions, noise levels associated with the Revised Project are found to have reduced by 0-11 dB, 2-15 dB, and 1-11 dB for the day, evening and night periods, respectively, when compared with the levels predicted in the UEP assessment. These reductions are noted to be considerable.

Appendix E provides a discussion of historical noise levels at Russell Vale Colliery since 1980.

Appendix F summarises the responses to noise issues identified in PAC Second Review Report. Section 4.5 of the PAC Second Review Report discusses noise issues and the Commission's findings are summarised in Section 4.5.5, with concluding comments provided in Section 5 of the PAC Second Review Report. Specific responses to the matters raised by the PAC are provided in Appendix F of this report.

8 MAXIMUM NOISE LEVEL EVENT ASSESSMENT

Two noise sources have been identified as potentially triggering sleep arousal during the night time or early morning shoulder periods:

- Intermittent noise from coal pieces and rocks impacting the tripper trouser leg chutes, and
- Early morning truck arrivals.

A maximum noise level event screening assessment has been conducted for each of these sources. As described in Section 5.6, the screening assessment is based on two criteria:

- $L_{Aeq,15min}$ 40 dB(A) or the prevailing RBL plus 5 dB, whichever is the greater, and/or
- L_{AFmax} 52 dB(A) or the prevailing RBL plus 15 dB, whichever is the greater.

8.1 L_{AFmax} Levels from Site Infrastructure

Intermittent noise from coal pieces and rocks impacting the tripper trouser leg chutes has the potential to trigger sleep arousal at night. Intermittent noise associated with this source has been considered in the assessment of sleep disturbance.

The mitigated tripper arrangement sound power level of $L_{A1,1min}$ 108 dBA as used in WM's 2014 assessment, has been applied in the Revised Project night time impact noise assessment (as an L_{AFmax} sound power level).

L_{AFmax} noise predictions are based on the relevant meteorological conditions determined in accordance with Fact Sheet D of the *NPfI* (Table 6-1).

The Project's L_{AFmax} trigger levels for the maximum noise level event screening assessment are shown in yellow shading.

Table 8-1 L_{AFmax} Levels from Site Infrastructure

Representative Receiver		Predicted L_{AFmax} Noise Level (dBA)	Maximum Noise Level Event Screening Assessment L_{AFmax} Trigger Levels (dBA)	
ID	Address		Night	Early Morning Shoulder
R1	16 West St, Russell Vale	47	52	54
R2	30 West St, Russell Vale	46		
R3	13 West St, Russell Vale	48		
R4	13 Broker St, Russell Vale	43		
R5	4 Broker St, Russell Vale	39	52	54
R6	659 Princes Hwy, Russell Vale	44		
R7	34 Princes Hwy, Corrimal	45		
R8	95 Midgley St, Corrimal	46		
R9	109 Midgley St, Corrimal	43	52	52
R10	6 Lyndon St, Corrimal	43		

Representative Receiver		Predicted L_{AFmax} Noise Level (dBA)	Maximum Noise Level Event Screening Assessment L_{AFmax} Trigger Levels (dBA)	
ID	Address		Night	Early Morning Shoulder
R11	22 Lyndon St, Corrimal	41		
R12	46 Lyndon St, Corrimal	42		
R13	6 Taylor Pl, Corrimal	42		
R14	15 Taylor Pl, Corrimal	43		

Notes:
Night: the period from 10.00pm to 5.00am.
Early Morning Shoulder: the period from 5.00am to 7.00am.

Table 8-1 indicates that L_{AFmax} noise levels associated with the Revised Project's infrastructure are predicted to be below the L_{AFmax} trigger levels at all the representative receivers.

8.2 L_{AFmax} Levels from Early Morning Trucks Accessing Parking Area

Trucks allowed to access the truck parking area prior to 7.00am may potentially trigger sleep arousal during the early morning shoulder period.

A L_{AFmax} sound power level of 102 dBA was assumed for trucks driving along the access road between the Princes Highway entrance and the parking area. This is conservative for engine noise associated with typical road trucks travelling at 40 km/hr. It is important to note that the internal access road should be maintained in order to avoid impact noise associated with potholes and other road defects.

Based on the relevant meteorological conditions determined in accordance with Fact Sheet D of the *NPfI*, predicted L_{AFmax} noise levels generated by trucks at the closest possible location along the access road (between the Princes Highway entrance and the parking area) to each representative receiver are set out in Table 8-2. The noise predictions assume the noise barrier along the northern boundary of the site is in place.

Table 8-2 L_{AFmax} Levels from Early Morning Trucks Accessing Parking Area

Representative Receiver		Predicted L_{AFmax} Noise Level (dBA)	Maximum Noise Level Event Screening Assessment L_{AFmax} Trigger Levels (dBA)
ID	Address		Early Morning Shoulder
R1	16 West St, Russell Vale	43	54
R2	30 West St, Russell Vale	44	
R3	13 West St, Russell Vale	44	
R4	13 Broker St, Russell Vale	41	
R5	4 Broker St, Russell Vale	40	54
R6	659 Princes Hwy, Russell Vale	52	
R7	34 Princes Hwy, Corrimal	47	
R8	95 Midgley St, Corrimal	46	
R9	109 Midgley St, Corrimal	45	52

Representative Receiver		Predicted L_{AFmax} Noise Level (dBA)	Maximum Noise Level Event Screening Assessment L_{AFmax} Trigger Levels (dBA)
ID	**Address**		**Early Morning Shoulder**
R10	6 Lyndon St, Corrimal	43	
R11	22 Lyndon St, Corrimal	39	
R12	46 Lyndon St, Corrimal	38	
R13	6 Taylor Pl, Corrimal	39	
R14	15 Taylor Pl, Corrimal	40	

Note:
Early Morning Shoulder: the period from 5.00am to 7.00am.

Review of Table 8-2 indicates that L_{AFmax} noise levels due to trucks allowed to access the truck parking area prior to 7.00am are within the L_{AFmax} trigger levels at all the representative receivers.

8.3 $L_{Aeq,15min}$ Levels during Night & Early Morning Shoulder (Full Operation)

Table 8-3 assesses night time and early morning shoulder $L_{Aeq,15min}$ noise levels associated with the full operation against the Project's $L_{Aeq,15min}$ trigger levels for the maximum noise level event screening assessment shown in yellow shading.

Table 8-3 $L_{Aeq,15min}$ Levels - Night & Early Morning Shoulder (Full Operation)

Representative Receiver		$L_{Aeq,15min}$ Noise Level (dBA)		Maximum Noise Level Event Screening Assessment $L_{Aeq,15min}$ Trigger Levels (dBA)	
ID	**Address**	**Night**	**Early Morning Shoulder**	**Night**	**Early Morning Shoulder**
R1	16 West St, Russell Vale	42	43	42	44
R2	30 West St, Russell Vale	**43**	43		
R3	13 West St, Russell Vale	42	43		
R4	13 Broker St, Russell Vale	40	40		
R5	4 Broker St, Russell Vale	35	36	42	44
R6	659 Princes Hwy, Russell Vale	41	43		
R7	34 Princes Hwy, Corrimal	41	42		
R8	95 Midgley St, Corrimal	42	43		
R9	109 Midgley St, Corrimal	**41**	41	40	41
R10	6 Lyndon St, Corrimal	**41**	41		
R11	22 Lyndon St, Corrimal	38	38		
R12	46 Lyndon St, Corrimal	37	37		
R13	6 Taylor Pl, Corrimal	38	38		
R14	15 Taylor Pl, Corrimal	39	39		

Notes:
Night: the period from 10.00pm to 5.00am.
Early Morning Shoulder: the period from 5.00am to 7.00am.

Table 8-3 shows that night time noise levels during the full operation are predicted to exceed the Project's $L_{Aeq,15min}$ trigger levels for the maximum noise level event screening assessment by 1 dB at R2, R9 and R10. Compliance of night time noise levels is anticipated at all other representative residential receivers. Table 8-3 indicates that no exceedances are to be expected during the early morning shoulder periods at any of the identified representative receivers.

It should be noted that the phase-in operation would generate 1 dB negligible exceedances at R1, R2, R9 and R10.

A 1 dB exceedance represents a negligible residual noise impact indiscernible by the average listener according to the *NPfI* and the *VLAMP*. However, it warrants a detailed assessment for the night time period in accordance with the *NPfI*.

The detailed assessment considers aspects like the extent to which maximum noise levels exceed the RBL and the number of times maximum noise level events occur across the night time period. Since maximum noise levels are below the relevant RBLs plus 15 dB, it is considered that no noise impact due to maximum noise level events from the Revised Project is expected at any of the noise-sensitive receivers surrounding the site.

9 CONSTRUCTION NOISE

As mentioned in Section 6.5, reasonable and feasible noise mitigation measures for the operation of the Revised Project would include constructing a noise barrier along the northern boundary of the site, two container walls to the north of the Pit Top and a new berm as well as raising/extending several of the existing berms with the intent to reduce potential noise impacts on the community.

Based on past experience for similar projects, it is understood regulators consider construction of noise berms an activity to be assessed against the *Interim Construction Noise Guideline (ICNG)* even if occurring within the context of an operational site. This is generally justified for the following two reasons:

- Potential noise impacts associated with the construction of noise berms is expected to be relatively high by nature (i.e. mobile fleet associated with the construction of noise berms would be in relatively close proximity and exposed [i.e. working on top of the berms] to surrounding receivers) but unavoidable in order to mitigate long-term noise generated by the site in general; and
- Construction of noise berms is relatively short in duration.

9.1 Construction Noise Criteria

The recommended noise management levels described in the *ICNG* for residences are provided in Table 9-1.

Table 9-1 Construction Noise Guideline Noise Management Levels - Residences

Time of Day	Management Level $L_{Aeq,15min}$	How to Apply
Recommended standard hours: Monday to Friday 7.00 am to 6.00 pm Saturday 8.00 am to 1.00 pm No work on Sundays or public holidays	Noise affected RBL + 10 dBA	The noise affected level represents the point above which there may be some community reaction to noise: • Where the predicted or measured $L_{Aeq,15\ min}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. • The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dBA	The highly noise affected level represents the point above which there may be strong community reaction to noise: • Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: 1. Times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences). 2. If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours:	Noise affected RBL + 5 dBA	• A strong justification would typically be required for works outside the recommended standard hours. • The proponent should apply all feasible and reasonable work practices to meet the noise affected level.

Time of Day	Management Level $L_{Aeq,15min}$	How to Apply
		• Where all feasible and reasonable practices have been applied and noise is more than 5 dBA above the noise affected level, the proponent should negotiate with the community.

The recommended noise management level described in the *ICNG* for schools when in use is an external $L_{Aeq,15min}$ noise level of 55 dBA.

9.2 Description of Construction Activities

Bunds shown on Figure 2-1 would be constructed/modified as follows:

- Bund #2 would be extended and raised to reach Reduced Level (RL) of 58 m throughout whole length.
- Bund #3 would be constructed to reach RL of 56 m throughout whole length.
- Bund #5 would be extended and raised to reach RL of 47 m throughout whole length.
- The container wall at the upper stockpile area would span a total length of approximately 240 m and consist of between two and three layers of containers stacked on top of each other. The top of the western section (approximately 80 m long and two containers-high) would reach RL of 58.7 m at the western end and decrease to RL of 55.2 m at the eastern end. The middle section (approximately 140 m long and three containers-high) would reach RL of 52.8 m across the entire length. The eastern section (approximately 20 m long and two containers-high) would reach RL of 45.2 m across the entire length.
- The container wall at the lower stockpile area would span a total length of approximately 80 m and consist of two layers of containers stacked on top of each other. The top of the wall would reach RL of 45.2 m.
- A 5 m high noise barrier would be constructed along the northern boundary of the site starting from the Princes Highway entrance to the old Broker Street site gates.

Table 9-2 sets out the principal noise sources and associated sound power levels (SWLs) assumed for construction of the above bunds/walls/barriers.

Table 9-2 Construction Fleet Inventory & Sound Power Levels (Construction of Noise Berms)

Description	Plant Item	Number of Items	SWL/Item
Noise Bund	Excavator (20 to 30 tonne)	1	105
	10 tonne tipper truck	1	104
	Front-end Loader	1	113
Container wall	Excavator (20 to 30 tonne)	1	105
	Container truck	1	104
	Mobile 15-tonne crane	1	106

Description	Plant Item	Number of Items	SWL/Item
Noise barrier	Bobcat	1	104
	Excavator (20 to 30 tonne) with auger piling rig attachment	1	110
	Manitoo jib crane	1	105
	Flat top truck	1	102

As mentioned in Section 2.4, construction works would be undertaken during standard construction hours 7.00am to 6.00pm Monday to Friday and 8.00am to 1.00pm Saturday. No construction activities will be undertaken on Sunday and public holidays.

9.3 Construction Noise Predictions

The predicted $L_{Aeq,15min}$ construction noise levels are presented in this section. Construction noise levels were predicted for all identified bunds/walls/barriers (as shown in Figure 2-1) and the worst-case noise predictions were reported in Table 9-3. Therefore, the predictions represent noise levels generated when constructing the structure closest to a receiver in question.

Although not required by the *ICNG*, construction noise predictions are conservatively provided under relevant meteorological conditions determined in accordance with Fact Sheet D of the *NPfI* (Table 6-1).

Recommended noise management levels described in the *ICNG* are shown in yellow shading and predicted levels exceeding relevant noise affected levels are shown in bold.

Table 9-3 $L_{Aeq,15min}$ Levels from Bund/Wall/Barrier Construction

ID	$L_{Aeq,15min}$ Noise Level (dBA)	'Noise Affected' Level (dBA)	'Highly Noise Affected' Level (dBA)
R1	**59**	49	75
R2	**65**	49	75
R3	**69**	49	75
R4	**68**	49	75
R5	**72**	53	75
R6	**70**	53	75
R7	53	53	75
R8	**55**	53	75
R9	**58**	49	75
R10	**53**	49	75
R11	40	49	75
R12	35	49	75
R13	37	49	75
R14	39	49	75
R15 [1]	**60**	55	-
R16 [1]	**57**	55	-
R17 [1]	45	55	-

Note 1: Receiver relates to school.

The results of Table 9-3 indicate that construction noise levels would comply with the *ICNG* 'highly noise affected' management level at all representative residential receivers.

At some point in time, the *ICNG* 'noise affected' management level is likely to be exceeded at 11 of the representative receivers. These exceedances would only occur for a very short duration (i.e. during the construction of the closest bund/wall/barrier and under adverse weather conditions) and it is expected that noise levels associated with the construction of noise berms would generally comply with the 'noise affected' management level.

These exceedances trigger the need to implement all feasible and reasonable work practices to meet the 'noise affected' levels and are expected given the nature of the works (i.e. involving relatively close and exposed mobile plant). The following section describes all feasible and reasonable work practices that should be implemented to address construction noise impacts.

9.4 Work Practices Implemented to Address Construction Noise Impacts

Because of the expected brief exceedances of the 'noise affected' management levels, the proponent should implement the following feasible and reasonable work practices in accordance with the *ICNG*.

9.4.1 Schedule activities to minimise noise impacts

- Commitment to undertake all bund/wall/barrier construction works during the recommended standard hours;
- Schedule construction of bunds/walls/barriers as early as possible within the phase-in period so that they can be used as early as possible as noise barriers;
- Commitment to complete all identified container walls and noise barrier at northern boundary of the site prior to the phase-in period commencing;
- Commitment to complete all identified noise bunds within three months of the phase-in period commencing;
- Where feasible and reasonable, reduce duration of berm construction works; and
- Consult with affected neighbours about scheduling berm construction works to minimise noise impacts.

9.4.2 Use Quieter Equipment and Methods

- Provide dump truck access to the bunds/walls/barriers on the side further away from the closest receivers to maximise distance to receivers and shielding from bund/wall/barrier;
- Where feasible and reasonable, use bobcat, excavator, front-end loader, cranes and trucks with less annoying alternatives to the typical 'beeper' alarms (e.g. smart alarms and broadband alarms); and
- Regularly inspect and maintain equipment to ensure it is in good working order.

9.4.3 Notification Before and During Construction of Berms

- Provide, reasonably ahead of time, information such as nature of works to be carried out, the intention behind the works (i.e. to reduce long-term operational noise levels emanated from the site), total bund/wall/barrier construction duration, what bund/wall/barrier section(s) are expected to be noisy, their duration, and when respite periods would occur;
- Provide information to neighbours before and during construction through letterbox drops, postal or email mailing lists, meetings or individual contact; and
- Use a site information board at the front of the site with the name of the organisation responsible for the site and their contact details, construction hours and regular information updates - this signage should be clearly visible from the outside and include a contact phone number for enquiries during the works.

9.4.4 Complaint Handling

- Give complaints a fair hearing;
- Have a documented complaints process, including an escalation procedure so that if a complainant is not satisfied there is a clear path to follow;
- Call back as soon as possible to keep people informed of action to be taken to address noise problems;
- Implement all feasible and reasonable measures to address the source of complaint; and
- Keep a register of any complaints, including details of the complaint such as date, time, person receiving complaint, complainant's contact number, person referred to, description of the complaint, time of verbal response and timeframe for written response where appropriate.

9.4.5 Application of *CN&VS* Additional Management Measures

The *Construction Noise & Vibration Strategy (CN&VS)* (Transport for NSW Infrastructure and Services Division) sets out 'additional mitigation measure matrices' used to determine the additional measures to be implemented once all feasible and reasonable work practices have been put in place.

The matrices recommend that during standard construction hours, periodic notification and attended noise monitoring should be implemented when construction noise levels are expected to exceed RBLs plus 20 dB and be less than the *ICNG* 'highly noise affected' management level of 75 dBA. Noise associated with the construction of noise bunds/walls/barriers would generally be likely to exceed RBLs plus 20 dB when construction occurs within 200 m of a receiver.

Therefore, in line with the CN&VS, we recommend that notifications providing an overview of upcoming works be distributed to all noise-sensitive receivers located within 200 m of upcoming bund/wall/barrier construction works. Refer to Section 9.4.3 for content and means of notifications.

Also in line with the *CN&VS*, we recommend that attended noise monitoring be conducted at the nearest and potentially most impact residence(s) when construction of noise bunds/walls/barriers is occurring within 200 m of noise-sensitive receivers. The purpose of monitoring would be to confirm construction noise levels are consistent with the predictions presented in Table 9-3.

10 ROAD TRAFFIC NOISE

Product coal will be transported by truck to Port Kembla using road registered semi-trailer trucks and B-double trucks. Consistent with previously approved operations, the transport route would be via Bellambi Lane and Memorial Drive which is the route that has historically been used for the transport of coal from the Russell Vale site. Bellambi Lane and Memorial Drive is an approved 25/26 metre B-double route, as is the remainder of the transport route to Port Kembla.

Truck loading operations will typically be limited to 7.00am and 6.00pm, Monday to Friday, and 8.00am to 6.00pm on Saturdays. Provision is required for occasional operation until 10.00pm Monday to Friday to cater for unexpected Port closures or interruptions. This operation during the evening has been considered in this assessment. These loading hours remain the same as previously approved under the Preliminary Works Approval.

Outbound laden (coal or reject) trucks will be limited to an average of 16 return trips (32 movements) per hour between the hours of 7.00am and 6.00pm. If coal transport is required during the evening to cater for unexpected Port closures or interruptions, these movements would be further limited to an average of 12 return trips (24 movements) per hour between 6.00pm and 10.00pm Mondays to Fridays only.

The sign posted speed limit for vehicles using Bellambi Lane is 60 km/hr. Under the Preliminary Works Approval, coal truck movements along Bellambi Lane were subject to a voluntary speed limit of 50 km/hr. This voluntary speed limit will be maintained for the Revised Project with WCL aiming to achieve 95% compliance with the voluntary speed limit and 100% compliance with the sign posted 60 km/hr speed limit. All coal/reject trucks will be subject to GPS monitoring to monitor compliance with this speed limit.

The noise impact to residences associated with traffic along Bellambi Lane would likely be most sensitive to movements associated with coal trucks from the Colliery.

10.1 Identification of Receivers

Residential receivers are located on both sides of Bellambi Lane. Those to the north have their rear yards facing Bellambi Lane. These receivers are accessed via Keerong Avenue. Under the Wollongong Local Environmental Plan (LEP) 2009, this area is zoned R2 Low Density Residential. On the southern side of Bellambi Lane, residences as well as light industrial sites face the road. With reference to the LEP this area is zoned IN2 Light Industrial Zone.

10.2 Suitable Noise Criteria

Bellambi Lane has been identified as a 'principal haulage route' as per the *Road Noise Policy*. The following is extracted from Section 2.2.2 of the *RNP* in support of this classification.

> *"Some industries such as mines and extractive industries are, by necessity, in locations that are often not served by arterial roads. Heavy vehicles must be able to access these often more remote sites, and this may mean travelling on local public roads. Good planning practice acknowledges this type of road use and develop ways of managing any associated adverse noise impacts. Where local authorities identify a 'principal haulage route', the noise criteria for the route should match those for arterial/sub arterial roads, recognising that they carry a different level and mix of traffic to local roads."*

This assessment considers the increase in noise levels from the existing traffic volumes. As per the *RNP*, an increase of 2 dB represents a minor impact that is considered barely perceptible to the average person.

10.3 Methodology & Assessment

Table 10-1 sets out the existing Bellambi Lane vehicle volumes considered by this assessment, based on the vehicle volumes, as set out in Tables 3.1 and 3.3 of the traffic and transport impact assessment report for the Revised Project (Transport and Urban Planning Pty Ltd Report No. 17066r, dated December 2018) and applying an average 1.5% per year background traffic growth (linear) for Bellambi Lane as estimated in the traffic and transport impact assessment. The existing traffic volumes are based on traffic counts undertaken between 2-8 May 2017, during a period when Russell Vale Colliery was in care and maintenance, and as such do not include vehicle movements associated with the site.

Table 10-1 2019 Existing Bellambi Lane Traffic (excl. Project Traffic)

Timeframe	Vehicle Type	5 Day Average			7 Day Average		
		WB*	EB*	Total	WB*	EB*	Total
Daytime 15-hr (7am-10pm)	LV [1]	2288	2664	4952	2109	2491	4600
	HV [2]	128	149	277	118	139	257
	Total	2415	2813	5228	2228	2630	4858
Night Time 9-hr (7am-10pm)	LV [1]	177	263	440	167	233	400
	HV [2]	10	14	24	9	13	22
	Total	187	277	464	176	246	422

Notes: Based on Traffic Counts undertaken between 2-8 May 2017 and applying an average 1.5% per year background traffic growth (linear)
1 - Light Vehicles – Austroads 1 and 2 vehicle classifications
2 - Heavy Vehicles – Austroads 3-12 vehicle classifications
* EB = Eastbound; WB = Westbound

With consideration to the project's traffic generation, Table 10-2 shows the anticipated total vehicle volumes on Bellambi Lane i.e. existing plus project traffic.

Table 10-2 Project plus Existing 2019 Bellambi Lane Traffic

Timeframe	Vehicle Type	5 Day Average		
		*WB	*EB	Total
Daytime 15-hr (7am-10pm)	LV [1]	2314	2740	5054
	HV [2]	352	373	725
	Total	2665	3114	5779
Night Time 9-hr (7am-10pm)	LV [1]	254	289	543
	HV [2]	10	14	24
	Total	264	303	567

Notes: 1 - Light Vehicles – Austroads 1 and 2 vehicle classifications
2 - Heavy Vehicles – Austroads 3-12 vehicle classifications
* EB = Eastbound; WB = Westbound

In order to assess the impact along Bellambi Lane, the existing and projected traffic volumes have been evaluated using the *CoRTN (Calculation of Road Traffic Noise)* algorithm. The analysis indicates that with the Revised Project traffic may be expected to result in relative traffic noise level increases of:

- 2.0 dB during the day; and
- 0.6 dB at night.

These increases are noted to be within the 2 dB increase margin recognised by the *RNP* as acceptable and considered to be barely perceptible to the average person. These relative traffic noise level increases are expected to reduce during the project life as background traffic volumes are expected to grow at a rate of 1.5% per year while project traffic volumes will remain the same.

It is important to note that irrespective of the modelling, traffic noise impacts are also being managed as follows:

- Haulage is restricted (as per Condition 6 of Major Project Approval 08_0009 for PKCT) such that no movements are to occur during the night time period.
- The above truck numbers are based on the use of 19 metre articulated vehicles (i.e. semi-trailers, truck and dog trailers). WCL may, in the future, use B-double vehicles which will reduce the average number of outbound trucks per hour.

11 VOLUNTARY LAND ACQUISITION & MITIGATION POLICY

The NSW State Government has issued the *Voluntary Land Acquisition and Mitigation Policy (VLAMP)* which addresses noise and air quality impacts from State significant mining, petroleum and extractive industry developments.

Table 1 of the *VLAMP*, which interprets the significance of any potential noise exceedances and identifies potential treatment for these exceedances, is reproduced below in Table 11-1. As mentioned in Section 5.3, the characterisation of impacts according to the *VLAMP* is generally consistent with Table 4.1 of the *NPfI* addressing the significance of residual noise impacts.

Table 11-1 Characterisation of Noise Impacts & Potential Treatments

If the predicted noise level minus the project noise trigger level is:	And the total cumulative industrial noise level is:	Characterisation of impacts:	Potential treatment:
All time periods 0-2dB(A)	Not applicable	Impacts are considered to be **negligible**	The exceedances would not be discernible by the average listener and therefore would not warrant receiver-based treatments or controls.
All time periods 3-5dB(A)	• <=recommended amenity noise level in Table 2.2 of the *NPfI*; or • >recommended amenity noise level in Table 2.2 of the *NPfI*, but the increase in total cumulative industrial noise level resulting from the development <=1dB	Impacts are considered to be **marginal**	Provide mechanical ventilation / comfort condition systems to enable windows to be closed without compromising internal air quality / amenity.
All time periods 3-5dB(A)	>recommended amenity noise level in Table 2.2 of the *NPfI*, but the increase in total cumulative industrial noise level resulting from the development >1dB	Impacts are considered to be **moderate**	As for marginal impacts but also upgraded façade elements like windows, doors or roof insulation, to further increase the ability of the building façade to reduce noise levels.
Day and evening >5dB(A)	<=recommended amenity noise level in Table 2.2 of the *NPfI*	Impacts are considered to be **moderate**	As for marginal impacts but also upgraded façade elements like windows, doors or roof insulation, to further increase the ability of the building façade to reduce noise levels.
Day and evening >5dB(A)	>recommended amenity noise level in Table 2.2 of the *NPfI*	Impacts are considered to be **significant**	Provide mitigation as for moderate impacts and see voluntary land acquisition provisions above.
Night >5dB(A)	Not applicable	Impacts are considered to be **significant**	Provide mitigation as for moderate impacts and see voluntary land acquisition provisions above.

The provisions for voluntary mitigation and land acquisition rights under the *VLAMP* have been reproduced below.

Voluntary Mitigation Rights

A consent authority should only apply voluntary mitigation rights where, even with the implementation of best practice management at the mine site:

- *the noise generated by the development would meet the requirements in Table 1 (see following page), such that the impacts would be characterised as marginal, moderate or significant, at any residence on privately owned land; or*
- *the development would increase the total industrial noise level at any residence on privately owned land by more than 1dB(A) and noise levels at the residence are already above the recommended amenity noise levels in Table 2.2 of the Noise Policy for Industry; or*
- *the development includes a private rail line and the use of that private rail line would cause exceedances of the recommended acceptable levels in Table 6 of Appendix 3 of the RING by greater than or equal to 3dB(A) at any residence on privately owned land.*

All noise levels must be calculated in accordance with the NPfI or RING (as applicable).

The selection of mitigation measures should be guided by the potential treatments identified in Table 1 (see following page).

Voluntary Land Acquisition Rights

A consent authority should only apply voluntary land acquisition rights where, even with the implementation of best practice management:

- *the noise generated by the development would be characterised as significant, according to Table 1 (see following page), at any residence on privately owned land; or*
- *the noise generated by the development would contribute to exceedances of the acceptable noise levels plus 5dB in Table 2.2 of the NPfI on more than 25% of any privately-owned land where there is an existing dwelling or where a dwelling could be built under existing planning controls; or*
- *the development includes a private rail line and the use of that private rail line would cause exceedances of the recommended maximum criteria in Table 6 of Appendix 3 of the RING at any residence on privately owned land.*

All noise levels must be calculated in accordance with the NPfI or RING (as applicable).

Predicted noise levels indicate that no residence or privately-owned land would be subject to voluntary mitigation or land acquisition rights in accordance with the *VLAMP*.

12 CONCLUSION

This report provides a re-evaluation of operational and traffic noise impacts with respect to the Revised Project, with reference to the newly published *Noise Policy for Industry*.

The principal findings of the Revised Project noise assessment are as follows:

- The proposed Revised Project, which has been developed by WCL to address those issues raised in the PAC Second Review Report, involves the implementation of revised site operations and extensive noise mitigation measures, as detailed in Table 6-2 of this report, including relocation of secondary sizer and surge bin, raising and extension of noise berms, construction of noise bunds/walls/barriers, restrictions on coal haulage, acoustic treatment of the D8 dozer, and acoustic treatment of new processing plantrooms.

- A full year of noise monitoring data, captured by on-site monitoring stations during 2016 whilst the site was not operational, and additional data obtained over a 12-day period in June 2014 has been reviewed. Project noise trigger levels have been re-evaluated based on the long-term background noise level data.

- Despite the implementation of feasible and reasonable mitigation, some infrequently residual exceedances of the operational criteria are predicted to remain: night time noise levels during phase-in and full operations are predicted to exceed the Project noise trigger levels by up to 1 dB at representative receivers R1 and R2, and by up to 2 dB at representative receivers R9 and R10. A 1 to 2 dB exceedance represents a negligible residual noise impact indiscernible by the average listener according to the *NPfI* and the *VLAMP*.

- Noise contours of Project noise trigger levels and additional point-source noise predictions have identified exceedances at a total of 15 addresses during the proposed full operation. A summary of all receivers subject to residual exceedances is provided in Table 7-3 of the report. All exceedances would range between 1 and 2 dB, representing a negligible residual noise impact indiscernible by the average listener according to the *NPfI* and the *VLAMP*.

- A low-frequency noise assessment was conducted in accordance with the *NPfI* and established that no modifying factor correction for low-frequency noise is warranted for the Revised Project.

- L_{AFmax} noise levels due to night and early morning shoulder operations from the Revised Project are predicted to be within the L_{AFmax} trigger levels for the maximum noise level event screening assessment at all the identified receivers. However, night time $L_{Aeq,15min}$ noise levels during the full and phase-in operations are predicted to exceed the Project's $L_{Aeq,15min}$ trigger levels by 1 dB at R2, R9 and R10. These represent a negligible residual noise impact indiscernible by the average listener according to the *NPfI* and the *VLAMP*. Furthermore, since maximum noise levels are below the relevant RBLs plus 15 dB, it is considered that no noise impact due to maximum noise level events from the Revised Project is expected at any of the noise-sensitive receivers surrounding the site.

- Operational noise predictions associated with the Revised Project comply with the Project amenity noise levels. Therefore, no consideration of cumulative industrial noise was required.

- Construction of the noise bunds/walls/barriers would trigger exceedances of the *ICNG* 'noise affected' management level at 11 of the identified representative receivers. These exceedances would only occur for a very short duration and it is expected that noise levels would generally comply with the 'noise affected' management level. Construction noise levels would comply with the *ICNG* 'highly noise affected' management level at all identified receivers. It is recommended that the proponent should inform all noise-sensitive receivers located within 200 m of upcoming bund/wall/barrier construction works of the nature of works to be carried out, the expected noise levels and duration, as well as contact details. It is also recommended that attended noise monitoring be conducted at the nearest and potentially most impact residence(s) when construction of noise berms is occurring within 200 m of noise-sensitive receivers.

- The traffic generation of the Revised Project will be similar to the previous traffic generation of the Russell Vale Colliery, when it was operational. With respect to the background traffic volumes on Bellambi Lane, traffic generation from the Revised Project is expected to result in acceptable relative traffic noise increases of no more than 2 dB.

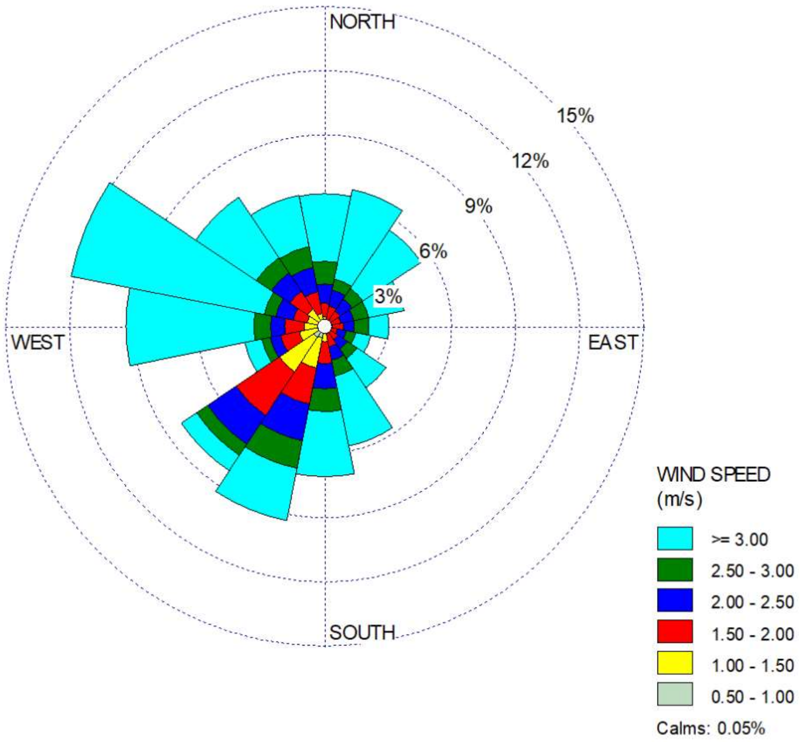
- As demonstrated in Appendices D and E, significantly reduced operational noise levels are predicted with the proposed mitigation measures and site reconfiguration, in comparison with the pre-existing operation of the site and when compared with the recently proposed site arrangement (as detailed in WM report dated 9 October 2014 – Report No 14141 Ver C).

- Appendix F documents the response to the noise issues raised in PAC Second Review report to the Underground Expansion Project at Russell Vale Colliery.

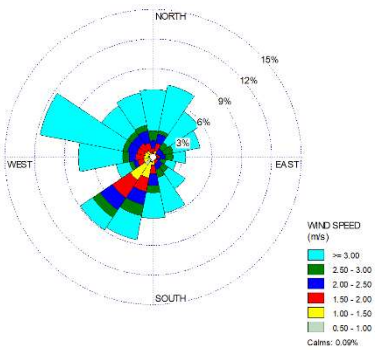
APPENDIX A

WIND ROSES

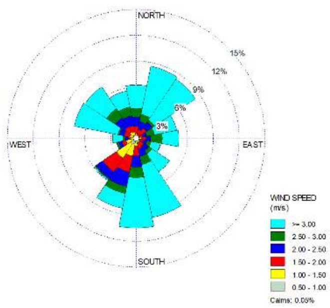
ANNUAL



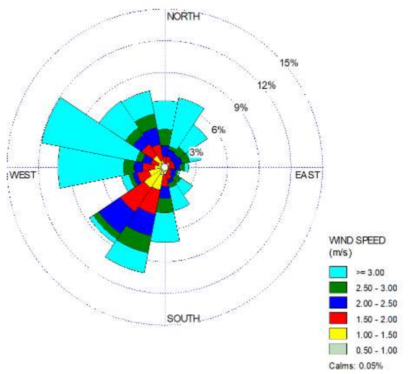
SPRING



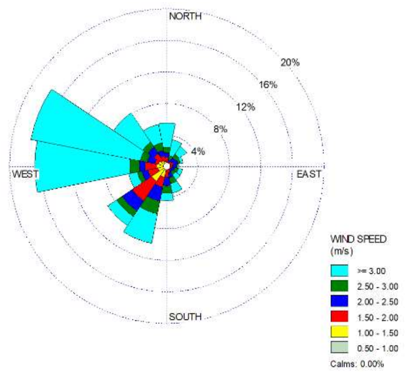
SUMMER



AUTUMN



WINTER



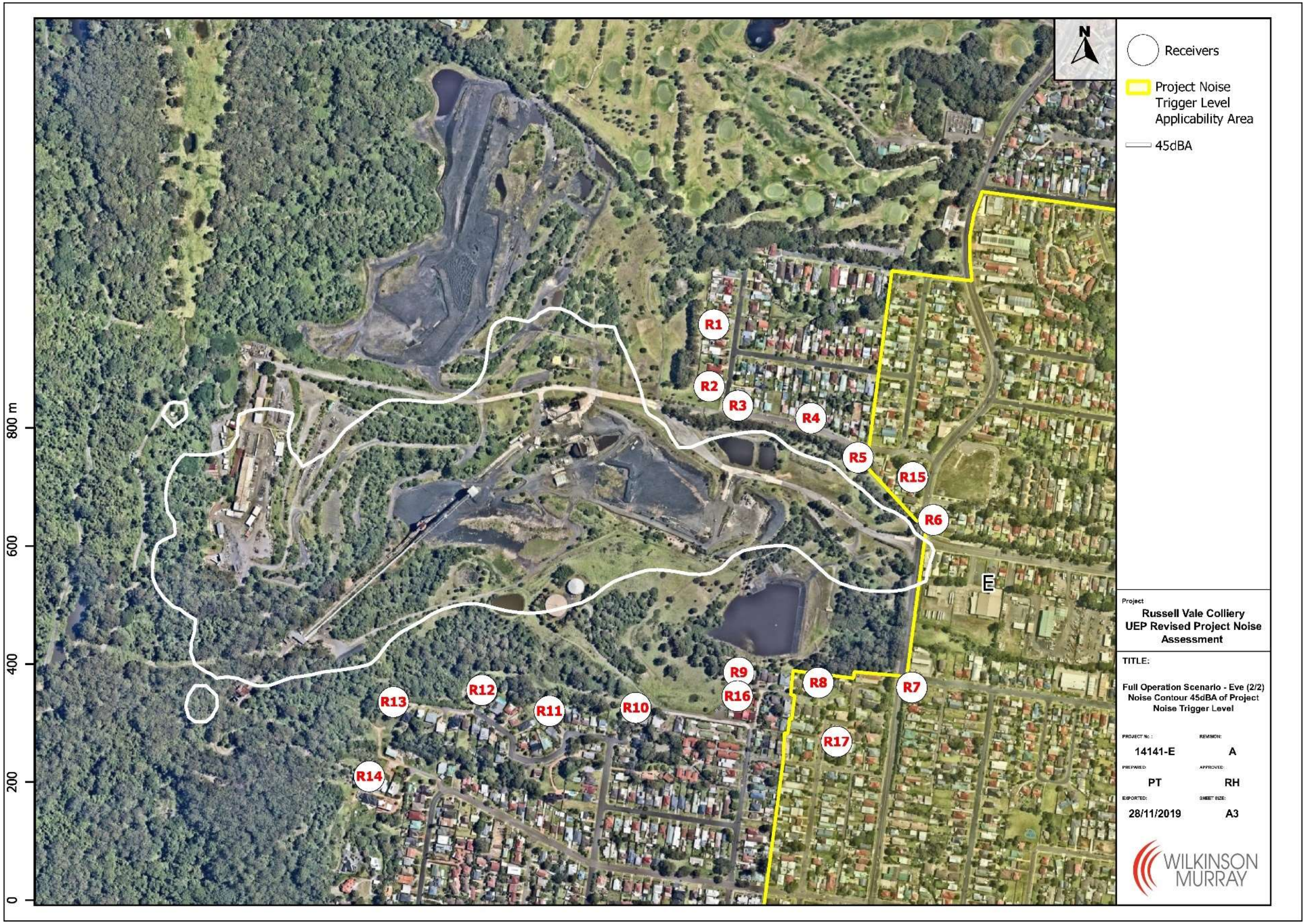
APPENDIX B

NOISE CONTOURS


N
Receivers
Project Noise Trigger Level Applicability Area
44dBA
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
R17
NW
SW
800 m
600
400
200
0
Project
Russell Vale Colliery UEP Revised Project Noise Assessment
TITLE:
Full Operation Scenario - Day (1/2) Noise Contour 44dBA of Project Noise Trigger Level
PROJECT No.: 14141-E
REVISION: A
PREPARED: PT
APPROVED: RH
EXPORTED: 28/11/2019
SHEET SIZE: A3
WILKINSON MURRAY


N
Receivers
Project Noise Trigger Level Applicability Area
48dBA
0
200
400
600
800 m
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
R17
E
Project
Russell Vale Colliery UEP Revised Project Noise Assessment
TITLE:
Full Operation Scenario - Day (2/2) Noise Contour 48dBA of Project Noise Trigger Level
14141-E
A
PT
RH
28/11/2019
A3
WILKINSON MURRAY


N
Receivers
Project Noise Trigger Level Applicability Area
43dBA
NW
SW
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
R17
800 m
600
400
200
0
Project
Russell Vale Colliery
UEP Revised Project Noise Assessment
TITLE:
Full Operation Scenario - Eve (1/2)
Noise Contour 43dBA of Project Noise Trigger Level
14141-E
A
PT
RH
28/11/2019
A3
WILKINSON MURRAY


N
Receivers
Project Noise Trigger Level Applicability Area
45dBA
800 m
600
400
200
0
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
R17
E
Project
Russell Vale Colliery
UEP Revised Project Noise Assessment
TITLE:
Full Operation Scenario - Eve (2/2)
Noise Contour 45dBA of Project Noise Trigger Level
14141-E
A
PT
RH
28/11/2019
A3
WILKINSON MURRAY


N
Receivers
Project Noise Trigger Level Applicability Area
39dBA
R1
R2
R3
R4
R5
R15
R6
R9
R8
R7
R16
R17
R13
R12
R11
R10
R14
SW
800 m
600
400
200
0
Project
Russell Vale Colliery
UEP Revised Project Noise Assessment
TITLE:
Full Operation Scenario - Night (1/2)
Noise Contour 39dBA of Project Noise Trigger Level
14141-E
A
PT
RH
28/11/2019
A3
WILKINSON MURRAY


N
Receivers
Project Noise Trigger Level Applicability Area
42dBA
NW
E
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
R17
0
200
400
600
800 m
Project
Russell Vale Colliery UEP Revised Project Noise Assessment
TITLE:
Full Operation Scenario - Night (2/2) Noise Contour 42dBA of Project Noise Trigger Level
PROJECT No.: 14141-E
REVISION: A
PREPARED: PT
APPROVED: RH
EXPORTED: 28/11/2019
SHEET SIZE: A3
WILKINSON MURRAY

Project
Russell Vale Colliery
UEP Revised Project Noise Assessment

TITLE:
Full Operation Scenario
AM Shoulder (1/2)
Noise Contour 41dBA of Project Noise Trigger Level

PROJECT No:	REVISION:
14141-E	A
PREPARED:	APPROVED:
PT	RH
EXPORTED:	SHEET SIZE:
28/11/2019	A3

WILKINSON MURRAY

Project
Russell Vale Colliery
UEP Revised Project Noise Assessment

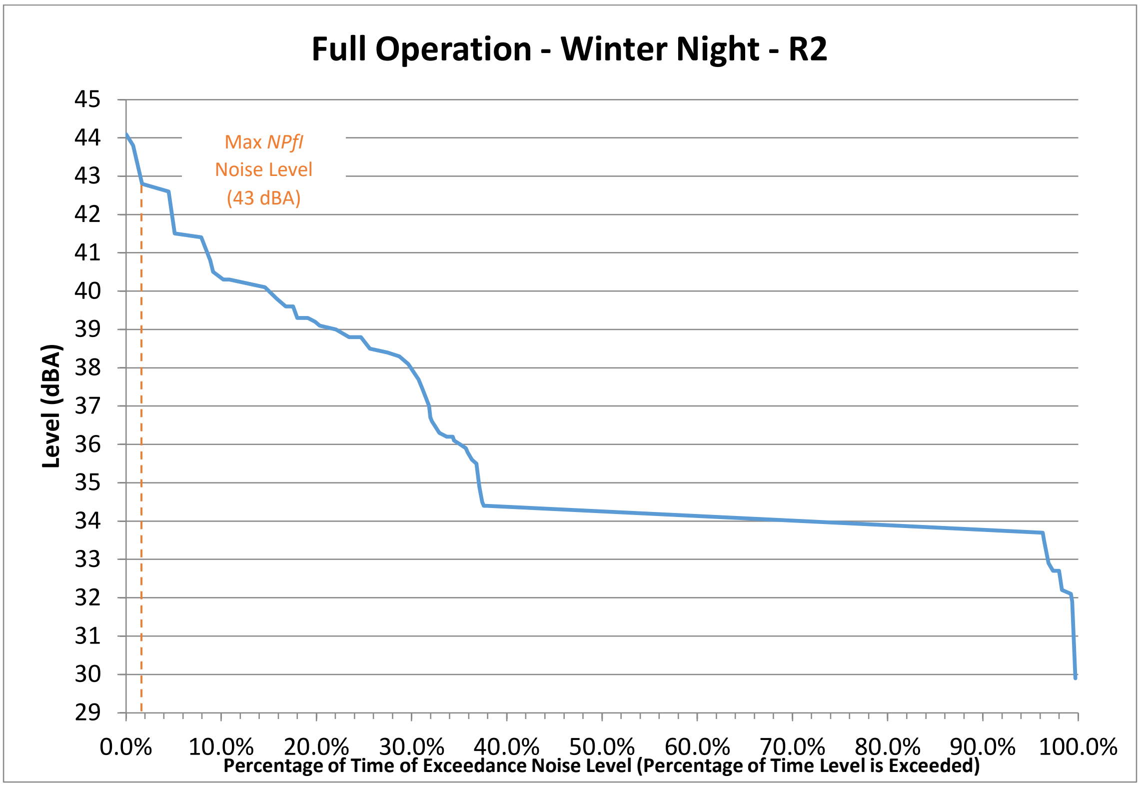
TITLE:
Full Operation Scenario
AM Shoulder (2/2)
Noise Contour 44dBA of Project Noise Trigger Level

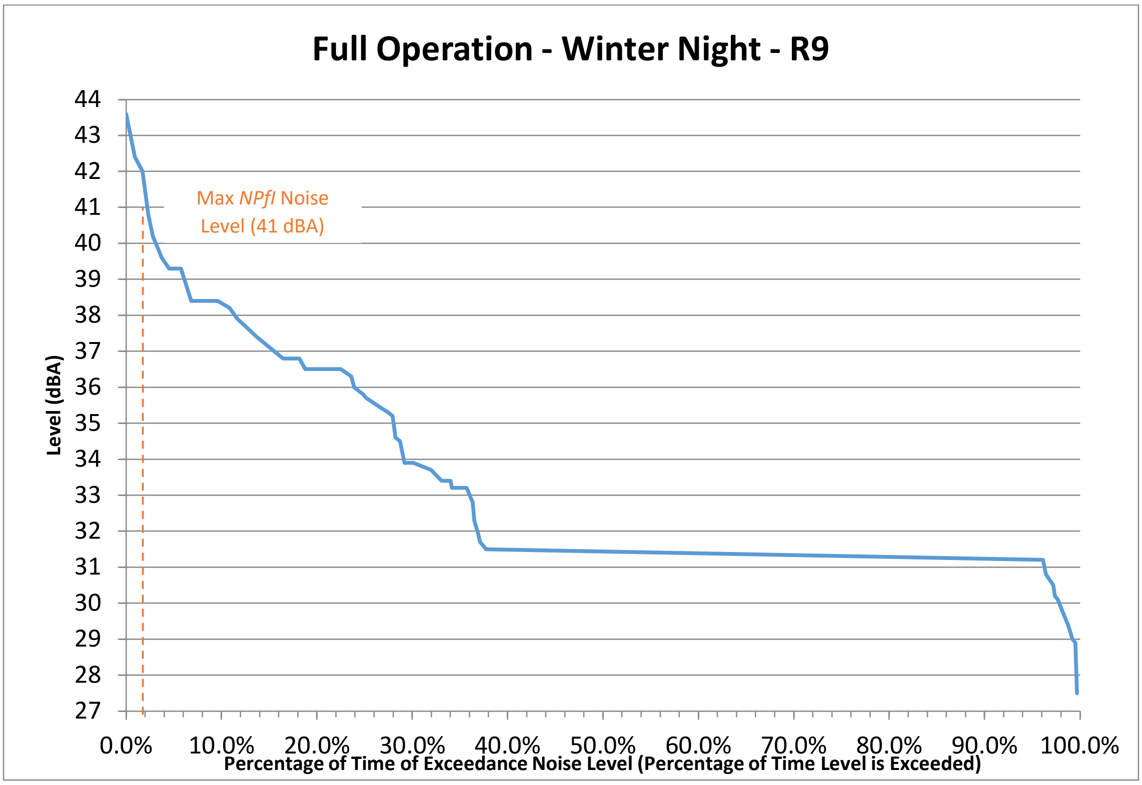
PROJECT No.:	REVISION:
14141-E	A
PREPARED:	APPROVED:
PT	RH
EXPORTED:	SHEET SIZE:
28/11/2019	A3

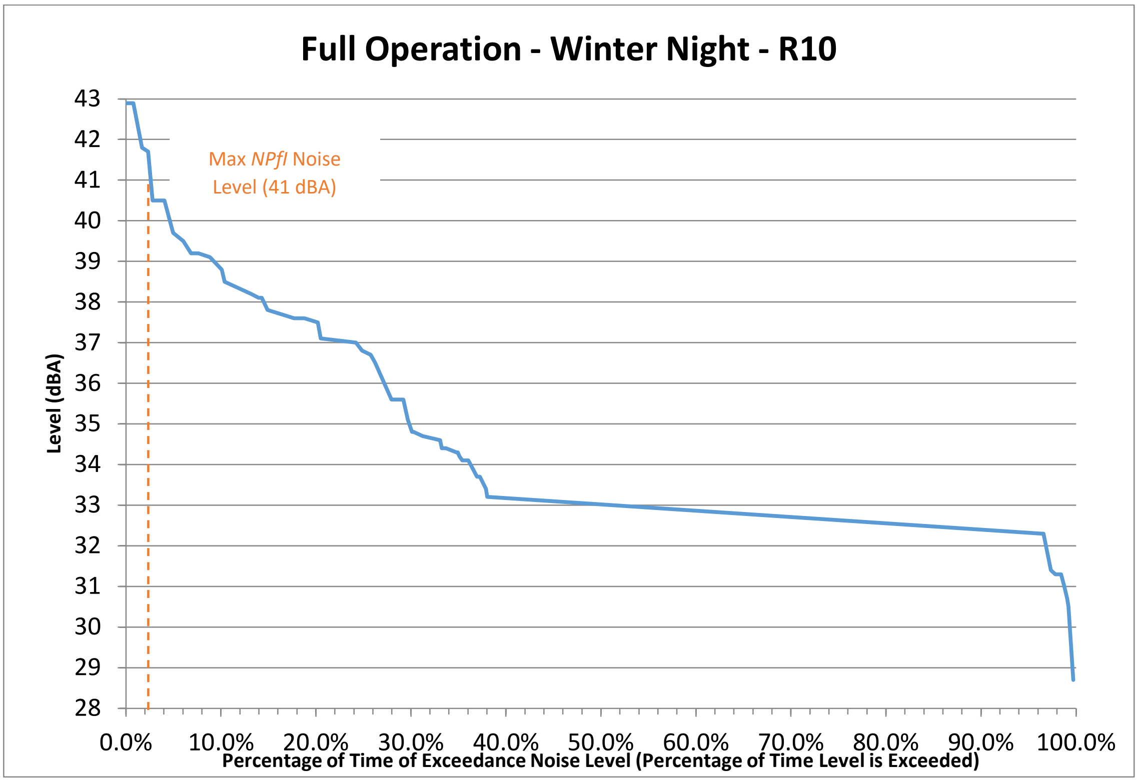
WILKINSON MURRAY

APPENDIX C

CUMULATIVE FREQUENCY OF OCCURRENCE NOISE GRAPHS


Full Operation - Winter Night - R2
Max *NPfI* Noise Level (43 dBA)
Level (dBA)
45
44
43
42
41
40
39
38
37
36
35
34
33
32
31
30
29
0.0%
10.0%
20.0%
30.0%
40.0%
50.0%
60.0%
70.0%
80.0%
90.0%
100.0%
Percentage of Time of Exceedance Noise Level (Percentage of Time Level is Exceeded)


Full Operation - Winter Night - R9
Max *NPfI* Noise Level (41 dBA)
Level (dBA)
44
43
42
41
40
39
38
37
36
35
34
33
32
31
30
29
28
27
0.0%
10.0%
20.0%
30.0%
40.0%
50.0%
60.0%
70.0%
80.0%
90.0%
100.0%
Percentage of Time of Exceedance Noise Level (Percentage of Time Level is Exceeded)


Full Operation - Winter Night - R10
Level (dBA)
43
42
41
40
39
38
37
36
35
34
33
32
31
30
29
28
Max NPfI Noise Level (41 dBA)
0.0%
10.0%
20.0%
30.0%
40.0%
50.0%
60.0%
70.0%
80.0%
90.0%
100.0%
Percentage of Time of Exceedance Noise Level (Percentage of Time Level is Exceeded)

APPENDIX D

COMPARISON WITH NOISE PREDICTIONS FROM PREVIOUS ASSESSMENTS

D.1 Comparison of Revised Project Noise Levels against Previous UEP Predicted Noise Levels

Tables D-1 and D-2 compare the predicted Revised Project noise levels for the full operation with those predicted by the previous UEP assessment (UEP Project Year 4 with all upgrades in place), as detailed in the WM report dated 9 October 2014 (Report No. 14141 Ver C), for neutral and adverse conditions respectively.

The previous UEP assessment was prepared in accordance with the now superseded *Industrial Noise Policy* and presented predictions expressed as 10th percentile exceedance noise levels or P10 noise levels (i.e. the level that is exceeded 10% of the time), and levels under calm isothermal conditions. As such, noise predictions associated with the Revised Project in Tables D-1 and D-2 are expressed in terms of levels under 'Calm' and 'P10' meteorological conditions to allow for accurate comparison of noise emissions between the Revised Project and the previous UEP assessment.

Predictions during the early morning shoulder period were not included in the comparison since the previous UEP assessment did not consider early morning shoulder period activities. Similarly, schools were not included in Tables D-1 and D-2 as they were not addressed in the UEP assessment.

Whilst some residual exceedances are noted with the previous UEP assessment, the main observations to be made from Tables D-1 and D-2 are the appreciable reductions in predicted noise levels under the Revised Project, compared with the UEP assessment. Under calm meteorological conditions, reductions are found to range 1-10 dB, 2-13 dB, and 1-11 dB for the day, evening and night periods, respectively. Under P10 conditions, reductions range 0-11 dB, 4-15 dB, and 1-11 dB for the day, evening and night periods, respectively. These reductions are noted to be considerable.

Table D-1 Russell Vale – Predicted $L_{Aeq,15min}$ Noise Levels – Revised Project Compared with Previous UEP Modification Predictions – Considering Calm Isothermal Conditions

Rec ID	$L_{Aeq,15min}$ Noise Level (dBA)								
	Day			Evening			Night		
	UEP Mod (WM 2014)	Revised Project	PNTL	UEP Mod (WM 2014)	Revised Project	PNTL	UEP Mod (WM 2014)	Revised Project	PNTL
	Calm	Calm		Calm	Calm		Calm	Calm	
R1	**48**	40	44	**48**	38	43	40-**44**	34	42
R2	**51**	41	44	**51**	39	43	42-**46**	35	42
R3	**50**	42	44	**50**	38	43	41-**45**	34	42
R4	**46-47**	39	44	**46-47**	36	43	38-42	32	42
R5	**47**	37	48	**47**	34	45	35-38	29	42
R6	46-47	43	48	**46-47**	41	45	36-39	31	42
R7	41-42	40	48	41-42	39	45	35-38	31	42
R8	42-44	40	48	42-44	39	45	37-41	33	42
R9	41-44	37	44	41-43	36	43	38-**42**	32	39

Rec ID	$L_{Aeq,15min}$ Noise Level (dBA)								
	Day			Evening			Night		
	UEP Mod (WM 2014)	Revised Project	PNTL	UEP Mod (WM 2014)	Revised Project	PNTL	UEP Mod (WM 2014)	Revised Project	PNTL
	Calm	Calm		Calm	Calm		Calm	Calm	
R10	38-40	37	44	38-40	35	43	36-39	33	39
R11	37-38	36	44	37-38	34	43	34-36	33	39
R12	39-41	37	44	39-41	35	43	36-39	34	39
R13	41-42	39	44	41	37	43	37-39	36	39
R14	40-42	37	44	39-41	35	43	37-**40**	35	39

Notes:

Day: the period from 7.00am to 6.00pm.

Evening: the period from 6.00pm to 10.00pm.

Night: the period from 10.00pm to 7.00am for the UEP Modification noise predictions, and the period from 10.00pm to 5.00am for the Revised Project.

Table D-2 Russell Vale – Predicted $L_{Aeq,15min}$ Noise Levels – Revised Project Compared with Previous UEP Modification Predictions – Considering Adverse Meteorological Conditions

Rec ID	$L_{Aeq,15min}$ Noise Level (dBA)								
	Day			Evening			Night		
	UEP Mod (WM 2014)	Revised Project	PNTL	UEP Mod (WM 2014)	Revised Project	PNTL	UEP Mod (WM 2014)	Revised Project	PNTL
	P10	P10		P10	P10		P10	P10	
R1	**50-51**	44	44	**52**	**44**	43	**43-46**	42	42
R2	**52-53**	44	44	**54**	**44**	43	**44-48**	41	42
R3	**52**	44	44	**53-54**	43	43	**44-47**	41	42
R4	**49**	42	44	**53**	40	43	**43-46**	38	42
R5	**49-50**	39	48	**52**	37	45	41-**44**	33	42
R6	48-**49**	45	48	**54**	44	45	41-**44**	39	42
R7	43-44	43	48	**49**	45	45	42-**44**	39	42
R8	44-46	42	48	**48-49**	44	45	**43-46**	40	42
R9	43-**45**	39	44	**46-48**	40	43	**43-47**	38	39
R10	40-42	39	44	**44-47**	40	43	**43-46**	39	39
R11	38-39	37	44	41-42	37	43	39-**40**	36	39
R12	40-42	38	44	42-**44**	37	43	39-**42**	36	39
R13	42	40	44	43-**44**	39	43	39-**40**	38	39
R14	42-44	39	44	**44-46**	39	43	**40-43**	38	39

Notes:

Day: the period from 7.00am to 6.00pm.

Evening: the period from 6.00pm to 10.00pm.

Night: the period from 10.00pm to 7.00am for the UEP Modification noise predictions, and the period from 10.00pm to 5.00am for the Revised Project.

APPENDIX E

HISTORICAL NOISE LEVELS AT RUSSELL VALE COLLIERY

A review of previously measured noise levels provides an understanding of how noise emissions associated with the Russell Vale Colliery have evolved throughout the years.

Section 7.4 of WM's 2014 assessment (Report No 14141 Ver C) provides a detailed discussion of historical noise levels at Russell Vale Colliery and provides a review of past monitoring reports prepared between 1980 and 1991. This offers some understanding of the Site's noise impact on the surrounding community during the time of the operation of the old washery, which was in use until 2002. In summary, night time noise levels during the time of the washery were measured at:

- 56 dBA at R1;
- 52-59 dBA at R2;
- 48 dBA at R4; and
- low 40's-47 dBA at R12.

Pacific Environment (PE) has undertaken a number of attended noise monitoring surveys between 2012 and the time the site switched to care and maintenance in 2015. Measurements conducted along West Street and Broker Street on the northern side of the site and along Midgley Street and Lyndon Street on the southern side correspond best with the representative receivers addressed in the assessment.

Comparison between the PE measurement results (2012-2015) and the noise predictions presented in this assessment (full operation) is summarised in Table E-1. The comparison focuses on night time noise levels and is based on monitoring locations corresponding to receivers R2, R3, R5, R9, R12 and R13. Project noise trigger levels, as discussed in Section 5.0, are shown in yellow shading.

Table E-1 Comparison of Historical Measured Levels (2012-2015) & Revised Project Noise Predictions

Rec ID	$L_{Aeq,15min}$ Noise Level (dBA)							
	PE Measurement Results						Revised Project Night Prediction	Night Time PNTL
	Nov 12	Jun 13	Mar 14	Jul 14	Dec 14	May 15		
R2	44	43-45	<39	36-37	41	43-44	43	42
R3	44	39-40	<38	37-38	40	42	42	42
R5	38	34-37	36	33	<30	<37	35	42
R9	35	33-35	<37	35-38	33	39	41	39
R12	38	37-38	<38	39-40	39	40-41	37	39
R13	38	40-41	<37	39-40	38	37-38	38	39

Measured noise levels captured during the operation of the old washery and between 2012 and 2015 show how the various site designs and mitigation measures have reduced noise emissions throughout the years. Measured noise levels on the northern side (R2) were reportedly once up to 16 dB higher than the predictions associated with the Revised Project. Similarly, measured levels on the southern side (R12) were up to 10 dB higher.

The upper end of the range of levels measured during the 2012-2015 period should be used for comparison with predictions associated with the Revised Project, as the latter represent noise emissions for full operation under noise-enhancing conditions. Levels were found to have decreased by 2 to 4 dB at receivers R2, R3, R5, R12 and R13. Measurement results for R9 show lower levels than the Revised Project's noise predictions. Due to access restrictions, measurements at the R5 and R9 locations seem to have been carried out on the road behind the house (i.e. Broker Street for R5 and Midgley Street for R9), thus benefiting from some level of shielding provided by the row of houses directly adjacent to the Site.

APPENDIX F

RESPONSES TO PAC SECOND REVIEW REPORT COMMENTS

The Commission summarises its findings, as they do relate to the previous Russell Vale Colliery noise assessments, in Section 4.5.5 of its Second Review Report, as follows:

> **4.5.5 Commission's Findings**
>
> The Commission finds:
>
> 1. The Department's adoption of the modelled noise levels as existing noise levels is not reasonable or sufficiently justified.
> 2. The setting of benchmarks should have regard to the 2011 approved noise limits, the 2012 noise audit results and the *Industrial Noise Policy*.
> 3. If the PSNLs are accepted as the benchmark for assessment of impact, the proposed project would have significant residual noise impact on certain nearby residences, notwithstanding the already implemented and proposed on site mitigation measures.
> 4. The draft recommended noise criteria for the identified receivers are not reasonable, particularly the criteria for "all other privately-owned land" especially to those who are neighbours to the identified receivers.
>
> The Commission notes the advice from the EPA that the Industrial Noise Policy that where acceptable noise levels cannot be achieved with reasonable and feasible measures then the determining authority should consider the impacts against the social and economic benefits of the project. The Commission addresses this balance in its conclusions for this Review.

In its concluding comments relating to noise in Section 5 of its report, the Commission notes the following:

> The operational noise from the pit top site would have significant impact on nearby residences if the noise criteria derived from the *Industrial Noise Policy* is used for assessment instead of the modelled existing noise levels. Similarly, the traffic noise impact on residences along Bellambi Lane is likely to be higher than assessed if actual existing truck movements were used as a base for the assessment. As a result of under-assessment of the level of impacts, it is likely that extra mitigation measures including mitigation on private residences are required to reduce the noise impact to acceptable level.

The following sections aim to address the above PAC comments.

F.1 Response to PAC Comment 4.5.5.1

This assessment has considered background noise levels measured in 2014 and 2016 as the basis of assessment.

F.2 Response to PAC Comment 4.5.5.2

In relation to PAC comment 4.5.5.2, WM maintains its position that the 2011 approved noise limits are inappropriate as they are the outcome of a flawed assessment approach, that was not undertaken in full accordance with the *NSW Industrial Noise Policy*.

As previously reported to the PAC, WM has found a general inconsistency with the approved limits, the Project-Specific Noise Levels (PSNLs) (determined by the ERM 2010 assessment) and the predicted noise levels (determined by the ERM 2010 assessment). It has been noted that the limits developed from the predicted levels are based on "under-predictions" that seemingly did not incorporate the appropriate meteorological conditions and sound power levels. Additionally, based on these under-predicted levels some of the approved limits are lower than the determined PSNLs.

Due to these inconsistencies, it is considered appropriate that the approved limits are reconsidered based on the findings of the Revised Project noise assessment.

As previously noted, the 2012 audit results indicated that the Site complied with its limits during the brief period of the audit. Whilst this may provide a benchmark in terms of the site's compliance status for the period of the audit, WM considers that due to the temporal variations in site noise emissions, the most appropriate assessment would consider the site emissions at full capacity and under relevant meteorological conditions.

WM considers the provisions of the *NPfI* are appropriate in the setting of noise criteria. The Revised Project noise assessment has drawn on long-term background noise monitoring data collected on-site over the full 2016 year and over a 12-day period in June 2014, whilst the site was not operational. It is considered that this long-term site-specific data provides the best estimation of the background noise environment around the site and new Project noise trigger levels have been re-evaluated on this basis.

F.3 Response to PAC Comment 4.5.5.3

The Revised Project noise assessment has re-evaluated impacts, with consideration of a significant site reconfiguration, substantial changes to operational processes and the adoption of extensive noise mitigation measures as detailed in Table 6-4 of this report. Additionally, Project noise trigger levels have been re-evaluated based on long-term site-specific background noise data, collected on-site over the full 2016 year and over a 12-day period in June 2014, whilst the site was not operational. It is considered that this long-term data provides the best estimation of the background noise environment around the site and new Project noise trigger levels are justified on this basis.

With these proposed changes, significantly reduced operational noise levels are predicted, in comparison with the pre-existing operation of the site and when compared with the recently proposed site arrangement (as detailed in WM report dated 9 October 2014 – Report No. 14141 Ver C).

Despite the implementation of feasible and reasonable mitigation, some residual exceedances of the operational criteria are predicted to remain:

- Night time noise levels during phase-in and full operations are predicted to exceed the Project noise trigger levels by up to 1 dB at representative receivers R1 and R2, and by up to 2 dB at representative receivers R9 and R10.

It should be noted that the extent of these exceedances is significantly less than previously assessed by WM, indicating a marked environmental noise reduction (i.e. according to the UEP assessment, residual noise impact with upgrades in place would have ranged up to 11 dB, 13 dB and 9 dB during the day, evening and night periods, respectively). Additionally, whilst some residual exceedances are predicted, they are considered negligible and indiscernible by the average listener. No noise impact due to maximum noise level events from the Revised Project is expected at any of the noise-sensitive receivers surrounding the site.

F.4 Response to PAC Comment 4.5.5.4

As noted in Section 3.0 of this report and consistent with WM's 2014 assessment, the sensitive receivers considered by this assessment (as identified in Table 3-1) are deemed representative of the potentially most impacted receivers surrounding the Site.

Noise catchment areas have been identified (Figure 4-1) to represent areas of similar background noise levels. As illustrated in the noise contour figures (Appendix B), those noise catchment areas are in turn used to define Project noise trigger level applicability areas. All receivers located within the same Project noise trigger level applicability area are subject to the same Project noise trigger levels.

F.5 Response to PACs Concluding Comments

With respect to the above PAC comments, WM notes that the proposed Revised Project has been developed by WCL to address the noise issues raised.

The extent of the exceedances identified by this assessment is significantly less than previously assessed by WM (2014), indicating a marked improvement (i.e. according to the UEP assessment, residual noise impact with upgrades in place would have ranged up to 11 dB, 13 dB and 9 dB during the day, evening and night periods, respectively). Additionally, whilst some residual exceedances are predicted, they are considered negligible and indiscernible by the average listener. No noise impact due to maximum noise level events from the Revised Project is expected at any of the noise-sensitive receivers surrounding the site.

WCL's commitment to continue to undertake real-time noise monitoring would allow for evaluation of its compliance with the proposed Project noise trigger levels and consideration of remedial action in the case of any material exceedances.

The traffic generation from the Revised Project will be similar to the previous traffic generation of the Russell Vale Colliery, when it was operational. With respect to the existing traffic volumes on Bellambi Lane, traffic generation from the Revised Project is expected to result in acceptable relative traffic noise increases, of no more than 2 dB.

APPENDIX 4

Subsidence Peer Review Reports

REPORT TO:	**Wollongong Coal Ltd** **7 Princes Highway** **CORRIMAL NSW 2519**
ATTN:	**Mr Mitch Jakeman** **CEO, Wollongong Coal**

Peer Review – Russell Vale Colliery Subsidence Assessment

(SCT Report UMW4609, 10 July 2019)

REPORT NO:	**1907/01.1**
PREPARED BY:	**BRUCE K HEBBLEWHITE**
DATE:	**6th September 2019**

B.K. HEBBLEWHITE BE(Min.) PhD
Consultant Mining Engineer

B K Hebblewhite Consulting
ABN 85 036 121 217

5 Plant St
Balgowlah NSW 2093
AUSTRALIA
Mobile: +61 (0) 417 267 876
Email: hebble@bigpond.com

1. SCOPE OF WORK

A peer review report has been requested by Wollongong Coal Limited, to provide an independent assessment and review of the Subsidence Assessment for the proposed Russell Vale Colliery workings, conducted by SCT Operations Pty Ltd (Report UMW4609, final version dated 10 July 2019).

This current report provides the independent peer review in response to this request.

1.1 Documentation Provided

The following documents were provided by Wollongong Coal Ltd for the purposes of conducting this peer review:

- SCT Report UMW4609, dated 10 July 2019: *"Russell Vale Colliery: Subsidence Assessment for Proposed Workings in Wongawilli Seam at Russell Vale East"*, prepared by Stephen Wilson and Ken Mills.
- Russell Vale Colliery Yearly Production Plan, Drawing Number RV-02-0067, Rev. 0, dated 05/08/2019.
- Russell Vale Colliery Yearly Production Plan, WLC4111_09.

1.2 This Report

I offer the following comments on the above SCT subsidence assessment report, on the basis of my relevant professional qualifications, experience and background (see Summary CV in Appendix A). My background relevant to this project includes association with a number of different coal mining projects across NSW and internationally – from various perspectives, including mine design and audit on behalf of coal companies; and consulting/review studies on behalf of government and agencies (e.g. NSW Dept of Planning, Dept of Primary Industry and Dams Safety Committee); an earlier such study being as Chair of the Independent Expert Panel of Review into *"Impacts of Underground Coal Mining on Natural Features in the Southern Coalfield"* (jointly for the NSW Dept of Planning & Dept of Primary Industry, 2006-2008).

I confirm that this review has been undertaken and presented in line with the NSW Department of Planning and Environment's Peer Review Guideline (draft) (2017).

I also confirm that the documentation provided, as listed above, is considered sufficient and appropriate for the purposes of carrying out this review, as reported, which has been conducted in accordance with all relevant professional standards and practices.

This report is structured in the form of some relevant background information; followed by specific comments on the SCT Assessment Report provided.

In relation to this report commentary, specific comments are provided in the order they appear in the report text, and not in any order of priority or importance (with the exception of comments on the Conclusions and Recommendations section, which are provided at the end of this review report). Some summary factual data is reproduced for ease of reference and understanding of the points under discussion. Some review comments are quite minor in significance and are provided more in the form of an observational comment rather than a major criticism.

It should be noted that this review is focused on mine subsidence and related impacts which may include influence on groundwater parameters. However, detailed assessment of groundwater or related hydrogeological factors is outside of the scope for this report and is not included.

In line with the DPE Peer Review Guidelines, for the purposes of transparency, I declare that I have had previous associations with SCT as an organisation, and some members of their staff, as individuals, in the following manner:

- Participation in various joint/collaborative research and consulting projects, and subsequent jointly authored publications;
- Conduct of previous independent peer reviews of SCT reports for government authorities and other third parties.

2 BACKGROUND

The following project background information has been taken from the SCT Report. (This, and all other project-related factual information is assumed to be correct for the purposes of this review and has not been independently verified).

1 Introduction (p1 (SCT)) & 3.2 Project Background (p6 (SCT))

Wollongong Coal Limited (WCL) is proposing to mine the Wongawilli Seam at the Russell Vale Colliery in an area known as Russell Vale East located approximately 9km north-northwest of Wollongong. After consideration of the findings of two Planning Assessment Commission (PAC) reviews, WCL revised the proposed mining plan by removing secondary extraction by the longwall method and to instead form first workings only with large width to height ratio pillars that are designed to be long-term stable. Umwelt Australia Pty Ltd (Umwelt), the lead consultant responsible for managing the Underground Expansion Project (UEP) approval process, commissioned SCT Operations Pty Ltd (SCT) to undertake a subsidence assessment for the revised mine plan layout. This report presents the results of our assessment.

Russell Vale Colliery is located near Russell Vale in the Illawarra region of New South Wales. The mine has had several names since it commenced in the late nineteenth century. The mine was known as South Bulli Colliery for most of its life, more recently as NRE No1 Colliery after being purchased by Gujarat NRE and for the last four years, the mine has been known as Russell Vale Colliery.

The colliery holding covers a total area of approximately 6,973 hectares (ha). The holding includes multiple sub leases held between WCL and surrounding mine operators, including Consolidated Coal Lease (CCL) 745, Mining Purposes Lease (MPL) 271 and Mining Lease (ML) 157.

Underground mining within the colliery holdings is extensive, particularly in the Bulli Seam where bord and pillar mining, pillar extraction and numerous longwall panels have largely exhausted the Bulli Seam resource in the eastern part of the mine. Eleven longwall panels have been mined in the Balgownie Seam and three short panels have been mined in the Wongawilli Seam. Nevertheless, substantial high quality coking and thermal coal resources remain.

Originally, Gujarat NRE intended to expand its Wongawilli Seam operations in two stages. Stage 1 plans were detailed in the Preliminary Works Project Part 3A application that was approved in October 2011, allowing main headings first workings with gateroad panel development roadways for Longwalls 4 and 5, and upgrades to surface facilities. In December 2012, the Preliminary Works Project Part 3A was modified to allow the secondary extraction of Longwalls 4 and 5 and the development of Maingate 6.

The original Stage 2 application known as the Underground Expansion Project Part3A (UEP) was lodged with the Department of Planning and Infrastructure (DPI now Department of Planning and Environment DP&E) in August 2009 detailing an application to extract eleven longwalls in the Wonga East area (as it was known at the time) and seven longwalls in the Wonga West area together with surface facilities upgrades to allow production of up to 3Mtpa for up to 20 years.

> After consideration of the submissions received for the application, NRE made the decision to substantially revise the UEP Application to facilitate the approval process and allow continuity of operations. Due to the scope of the changes, the then DPI requested NRE to prepare a Preferred Project Report (PPR) for the revised UEP Application based on only eight longwalls in the Wonga East area and upgrading of surface facilities to manage an extraction rate of up to 3Mtpa ROM coal per annum.
>
> In February 2014, Gujarat NRE formally changed its name to Wollongong Coal Ltd (WCL) following a change in shareholder ownership. WCL subsequently changed the name of the mine to Russell Vale Colliery and the eastern mining area from Wonga East to Russell Vale East.
>
> A further modification to the Preliminary Works Project Part 3A approval was granted in November 2014 allowing the first 365m of Longwall 6 panel in the Wongawilli Seam to be mined.
>
> The PPR application was assessed by the Planning Assessment Commission (PAC) and after holding public submissions, a report was released in April 2015. The PAC concluded that further information was required. After responses to submissions were provided by WCL in 2015, a second PAC review was commissioned. After further public hearings, a report released in March 2016 declined to recommend approval for the project based on a range of issues relating to subsidence impacts on water and upland swamps and noise.
>
> In December 2016, WCL engaged Palaris Mining Pty Ltd to design a mining plan layout for the Russell Vale East area suitable to address the concerns of the PAC. An initial layout design with limited secondary extraction at the edges was reviewed by SCT in March 2017 and the plan was subsequently modified by Palaris to exclude secondary extraction. This final plan forms the basis of the assessment presented in this report.

Figure 1 is a copy of the proposed mine plan as depicted in the updated Yearly Production drawing provided. This plan also shows the previously mined longwall panels in the Wongawilli Seam – LW4, LW5 and LW6.

Figure 2 is a copy of the plan provided in the SCT Report as their Figure 2, showing the boundary of the Application Area, including both the proposed first workings mine plan and the previously proposed longwall layout for the Wongawilli Seam, of which only LWs 4, 5 and 6 were mined. Figure 2 also shows the surface topography and major surface infrastructure overlying the proposed workings.

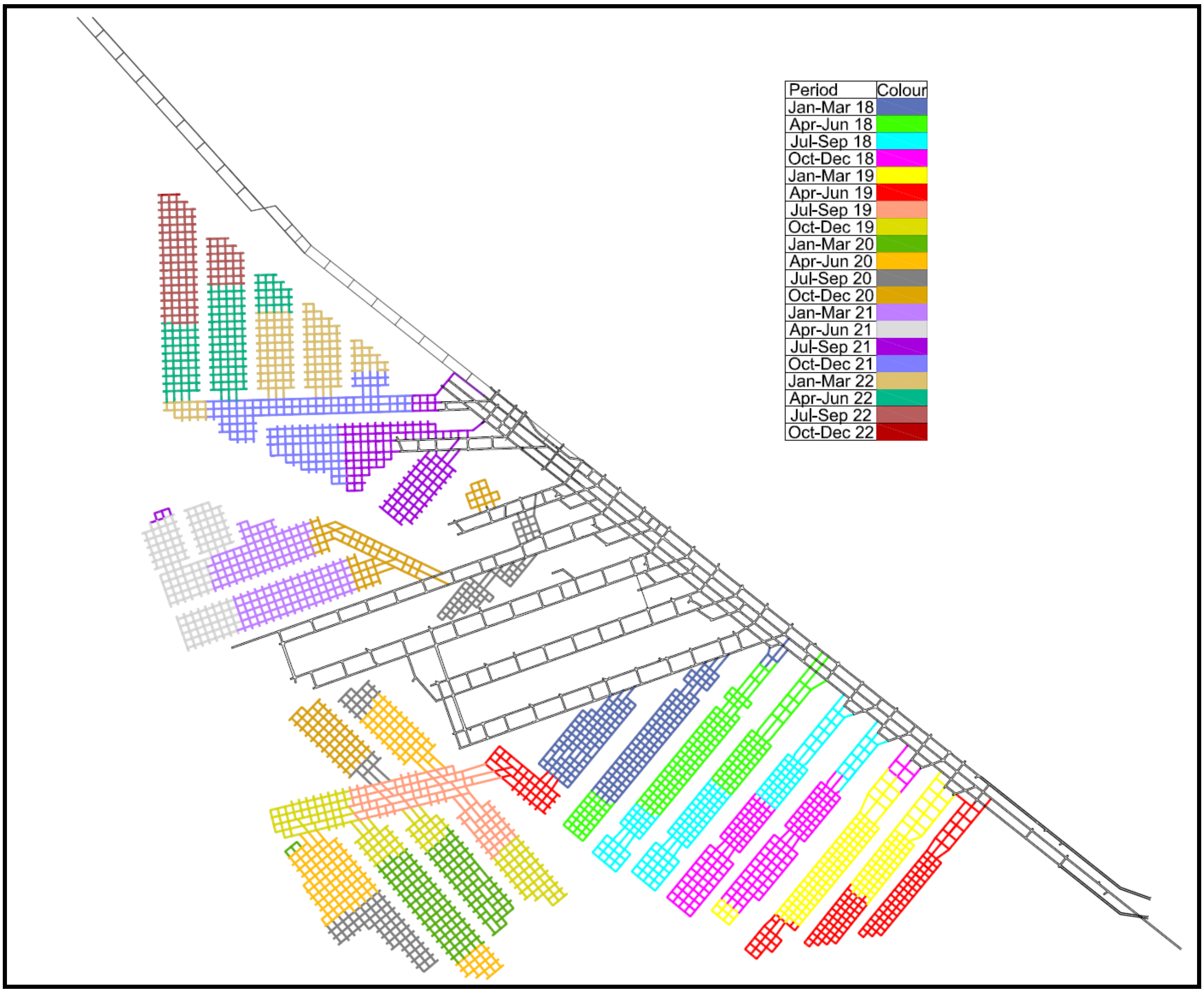


Figure 1. Russell Vale – Proposed Mine Plan and Production Schedule
(source: Wollongong Coal, WLC4111_09)

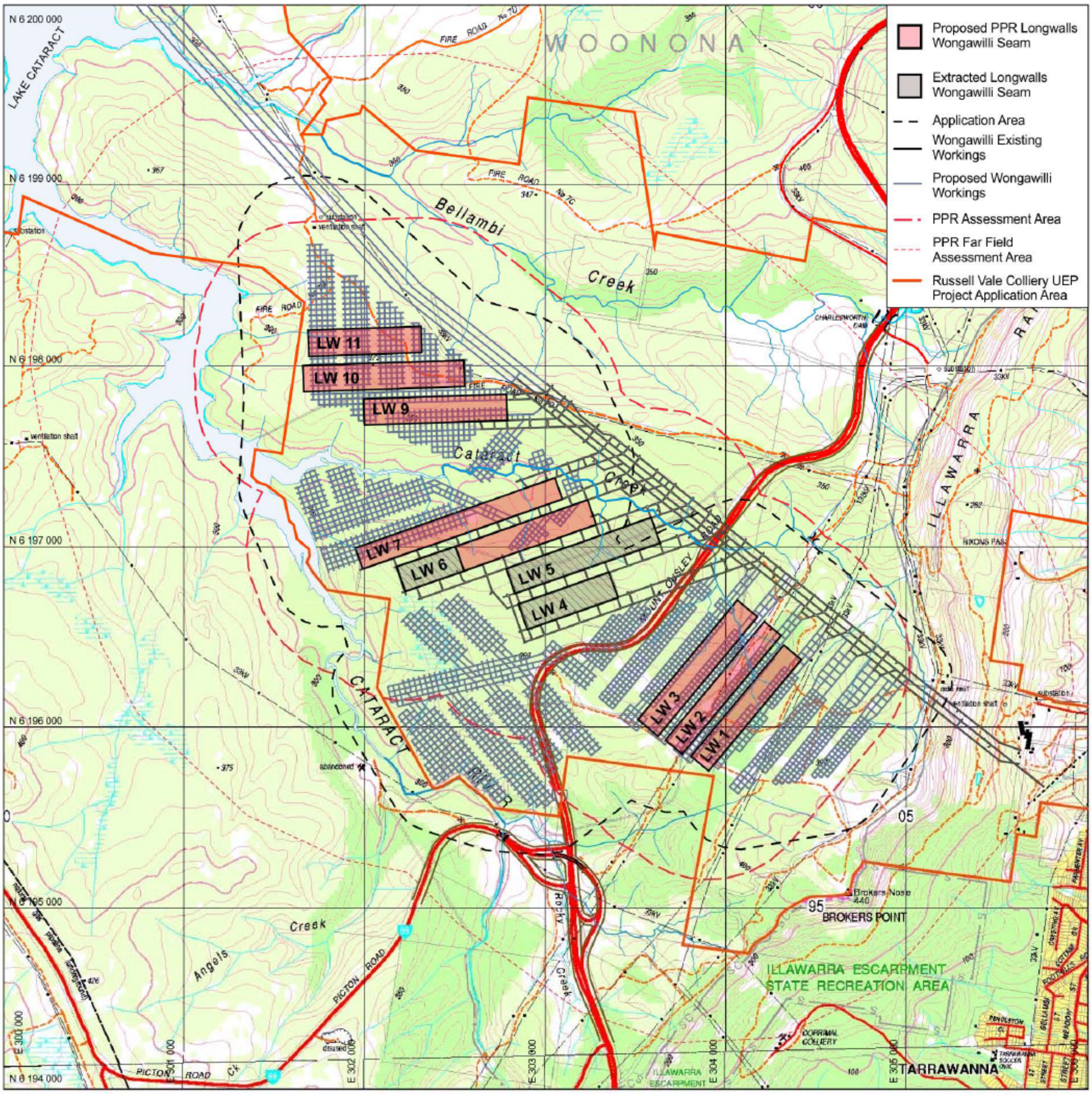


Figure 2. Russell Vale – Application Area with Proposed and Previous Wongawilli Seam Workings
(source: SCT Report UMW4609, 2019)

Figure 3 shows a vertical geological section through the mining area, indicating the major geological units present in the overburden above the Illawarra Coal Measures, which comprise the three mined seams – Bulli, Balgownie and Wongawilli.

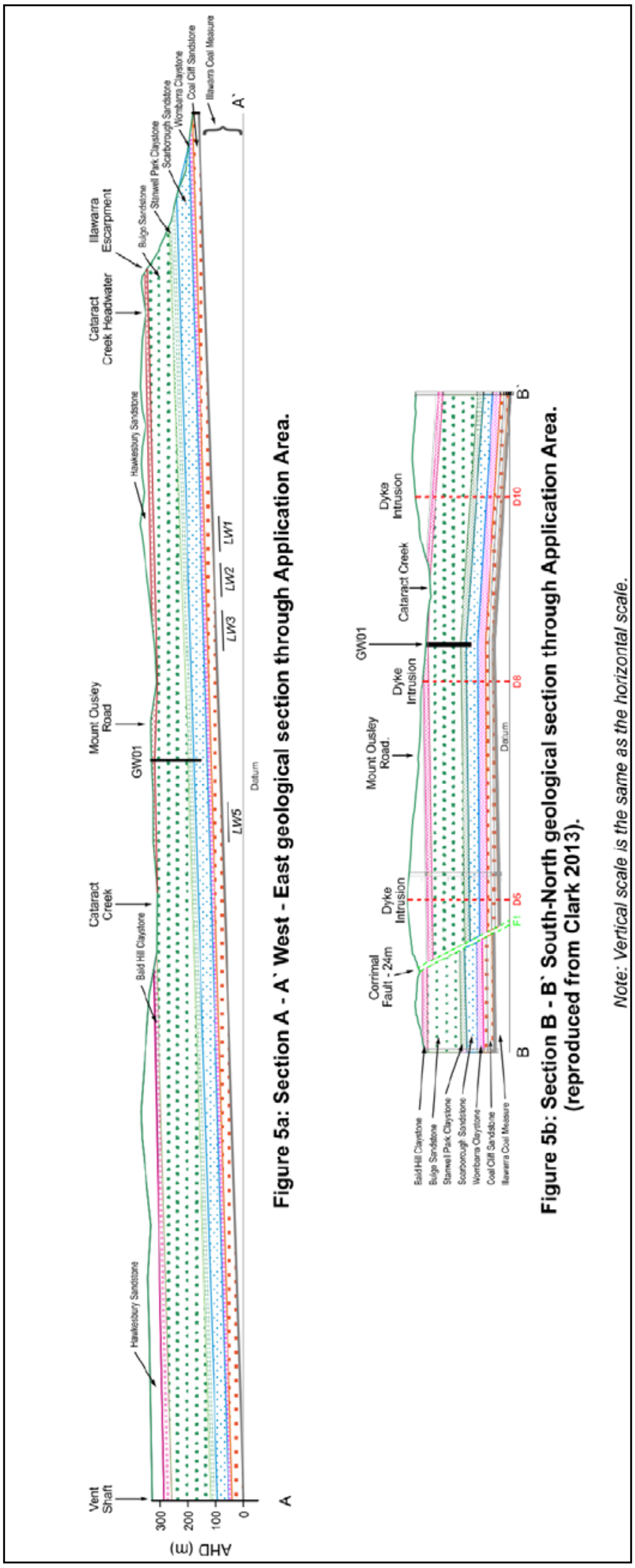


Figure 3. Overburden stratigraphy
(source: SCT Report UMW4609, 2019)

Table 1 lists geometric parameters relating to the three mined seams across the Application Area, as defined by SCT. The proposed mining thickness in the Wongawilli Seam is the bottom 2.4m.

Table 1. Seam thicknesses and separations *(source: SCT Report UMW4609, July 2019)*

Strata Unit	Average Thickness (m)	Thickness Range (m)
Bulli Seam	2.2	
Bulli-Balgownie interburden	10	5 - 14
Balgownie Seam	1.2	
Balgownie-Wongawilli interburden	20	
Wongawilli Seam		8-12

Figure 4 is a graphic representation and contouring of the depth of cover to the floor of the Wongawilli Seam in the Application Area, ranging from 250m to 380m.

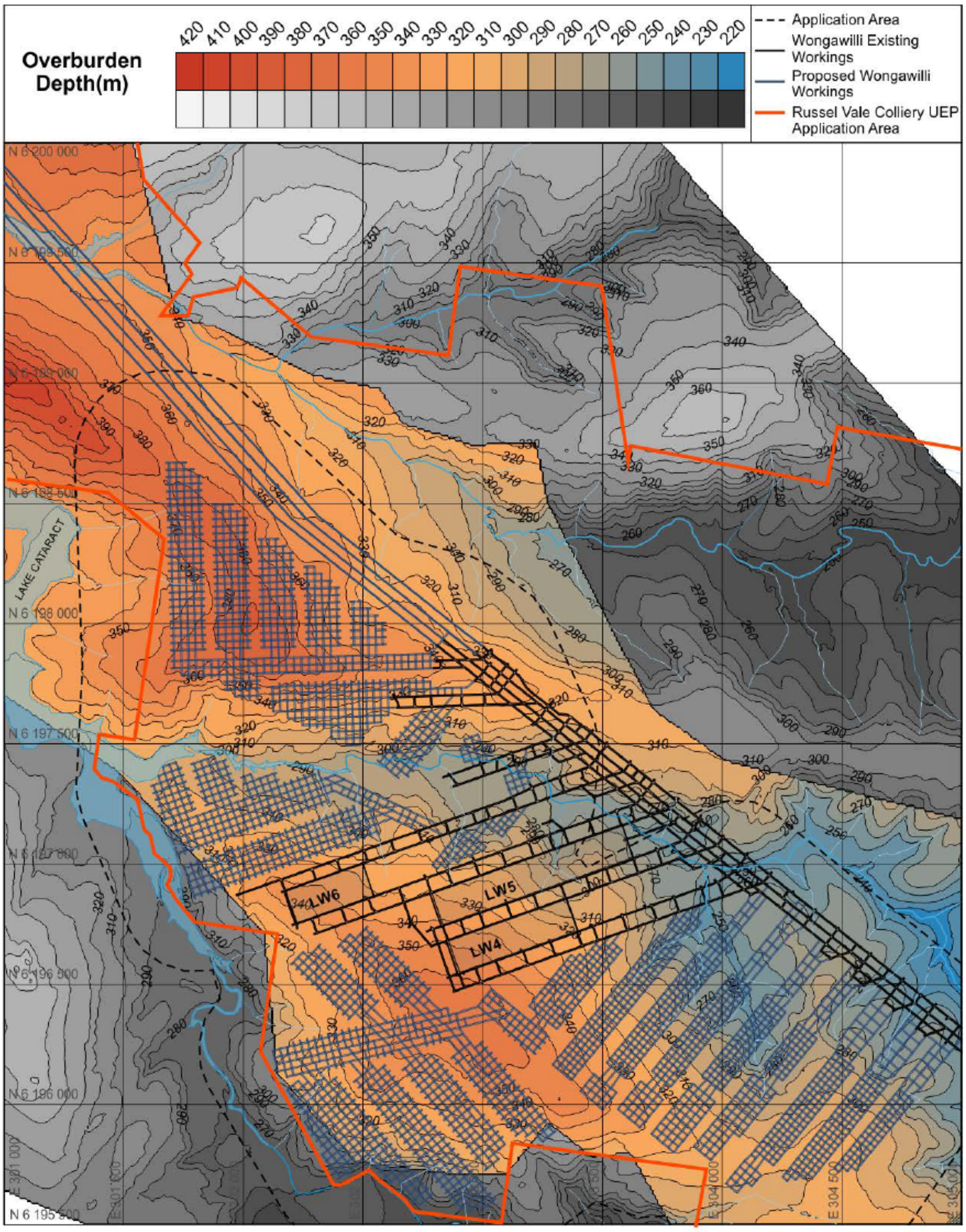


Figure 4. Depth to floor of Wongawilli Seam
(source: SCT Report UMW4609, 2019)

Figure 5 is a composite plan of all existing mine workings in the three seams, together with the proposed Wongawilli Seam workings.

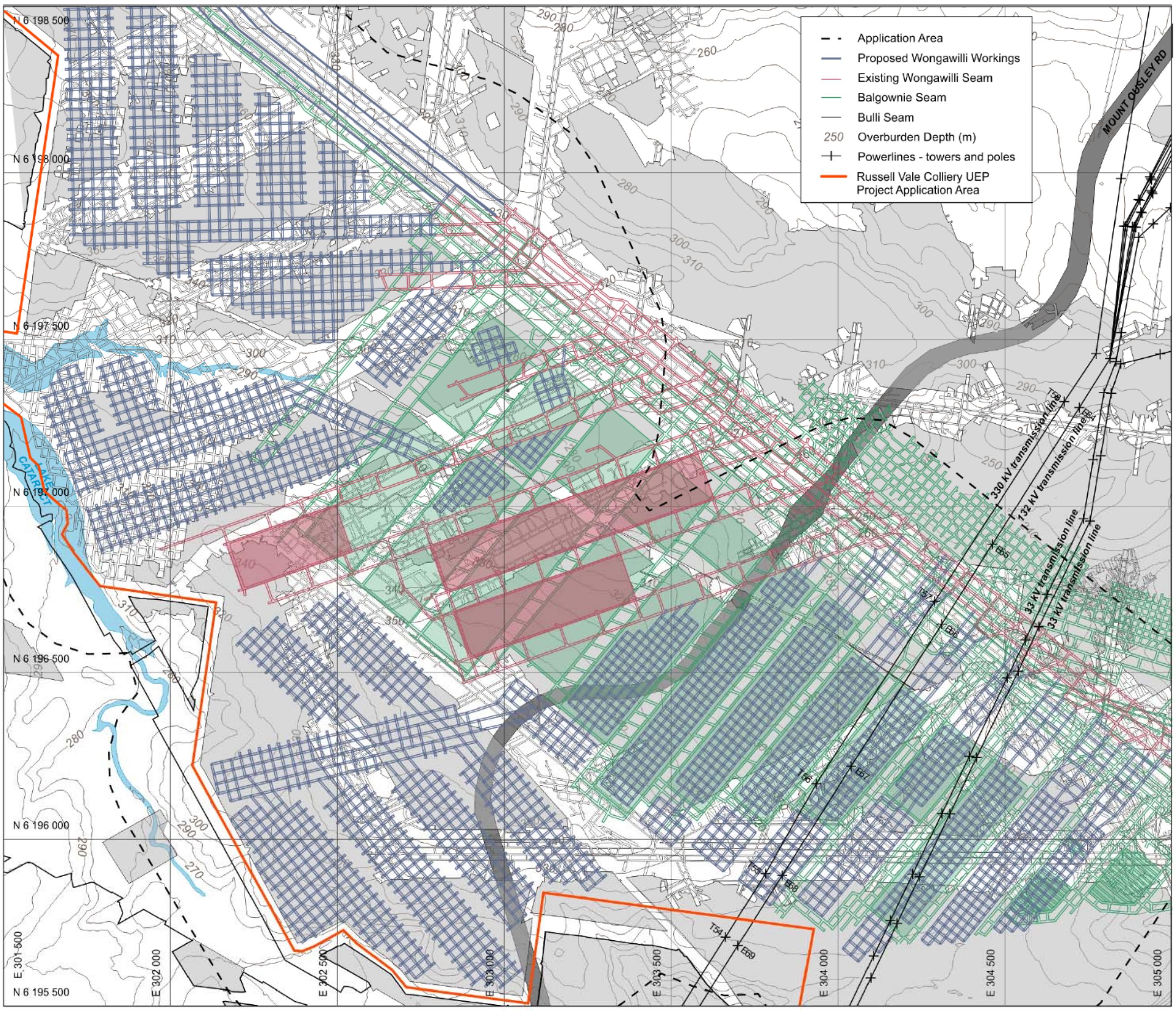


Figure 5. Existing mine workings in all three seams, plus proposed Wongawilli Seam workings
(source: SCT Report UMW4609, 2019)

3 REVIEW COMMENTS ON SCT REPORT

The following independent review comments are provided on the SCT Report UMW4609, July 2019 (hereafter referred to as "*the Report*").

3.1 Summary

The following is the summary of the SCT assessment findings, as contained in the Report:

> The proposed mining layout based on pillars with a width to height ratio of 8 and 10 is long-term stable. The mining of these pillars is not expected to cause significant surface subsidence, significant interaction with the overlying seams or significant interaction with existing groundwater systems.
>
> The proposed layout is not considered to have any potential to perceptibly impact natural surface features including upland swamps, cliffs including the Illawarra Escarpment, steep slopes, drainage lines, creeks, Cataract Creek and Cataract Reservoir. Assuming the overlying workings are not required to be drained for mining in the Wongawilli Seam, any impacts on groundwater are expected to be limited only to the immediate vicinity of the Wongawilli Seam and only in the area of the proposed mining.
>
> Some ongoing low-level ground movement, mainly horizontal movement associated with previous mining including the Wongawilli Seam longwalls, may not yet have ceased completely. This low-level movement has potential to continue to cause low-level impacts to Mount Ousley Road and valley closure across Cataract Creek that may be perceptible. This movement is a legacy of previous mining and is not expected to be influenced by the proposed mining. Movement may continue irrespective of any further mining in the Wongawilli Seam.
>
> Two power transmission lines, a 330kV line and a 132kV line both supported on steel truss pylons, traverse the surface to the east of Mount Ousley Road. The pylons are very sensitive to differential ground movements that may occur if any marginally stable Bulli Seam pillars are destabilised. Uncertainty remains as to the extent of marginally stable pillars in the vicinity of these pylons. An engineered solution is expected to be required by regulatory authorities to manage the very low-likelihood, very high consequence risk to the power transmission pylons within the Work Health and Safety (Mines and Petroleum Sites) Regulation 2014 given the uncertain nature of the Bulli Seam layout and the limited options to reduce this uncertainty.
>
> Existing management plans for management of subsidence impacts and the monitoring included in them are focussed on longwall mining. A review of these is recommended based on the significantly lower levels of surface subsidence anticipated for the proposed system of mining compared to longwall mining. There may be potential to modify the frequency and nature of monitoring to achieve more effective outcomes.

Further detail will be presented from the review of the body of the report below. However, four key points from this summary are worthy of note at this point, and are considered valid and important points:

- The proposed mining is not expected to result in any significant subsidence impacts on either the surface or sub-surface groundwater regimes;

- Movement due to previous mining (primarily horizontal) may be ongoing and could cause low-level surface impacts, and will continue, regardless of any proposed future Wongawilli Seam workings;
- Future differential ground movements may occur if any marginally stable Bulli Seam pillars are destabilised in the vicinity of transmission line pylons;
- There is a need for a revised/updated subsidence management plan to be developed and implemented.

3.2 Chapter 1: Introduction

1. P1 – The change of the previously proposed mine plan to remove any secondary extraction and only use first workings mining using large width:height (w/h) ratio pillars for long-term stability is a sound principle and is supported.

2. P1 – Reference is made to the contents of the Appendices to the Report, also noting previous SCT reports for previous mining proposals. This review does not extend to a review of that previous work and accepts the summary findings as being factually correct. The specific description of the work is summarised in this section of the Report, as follows:

   > A review of previous mining activity in the Russell Vale East area and the associated subsidence effects and subsidence impacts is presented in Appendix 1 as context. The estimations and measured results in Appendix 1 are largely reproduced from SCT Report WCRV4263 "Update of Subsidence Assessment for Wollongong Coal Preferred Project Report Russell Vale No 1 Colliery" (SCT 2014). This report was prepared in support of the previous Underground Expansion Project – Preferred Project Report (UEP – PPR) longwall mining application.

3.3 Chapter 2: Conclusions and Recommendations

(See later – Section 3.8)

3.4 Chapter 3: Overview and Background

1. Various extracts have already been taken from this section to provide background and context to the proposed mine workings. No further review comment is required on these factual context sections.

2. P5 – The following definition is provided for the pillar sizes in the proposed workings:

   > Palaris Mining Pty Ltd (Palaris), in consultation with the WCL, identified an optimum cutting height of 2.4m in the lower section of the Wongawilli Seam. Pillars in the Wongawilli Seam located below longwall panels in the overlying Balgownie Seam are designed to be 25m wide measured centre to centre. The width to height ratio for the pillars is therefore approximately 8 for nominal 5.5m wide roadways. Pillars outside the Balgownie Seam longwall panels are designed to be square at 30m centres. These pillars have a width to height ratio of approximately 10 for nominal 5.5m wide roadways.

   These can be summarised, as follows:
   Pillars beneath Balgownie longwall goaf – 2.4m high; 19.5m x 19.5m solids; 5.5m bords.

Pillars elsewhere – 2.4m high; 24.5m x 24.5m solids; 5.5m bords.

There is no reference here to depths, although this is provided by reference to contours, as shown in Figure 4 above.

There is also no reference to the width of the barrier pillars between the panels, although inspection of the mine plan provided indicates reasonably-sized barriers. It would be useful to have barrier widths summarised and documented, relative to depths, and quoting solid barrier widths.

3. P16 (Geological Structures) – A detailed description of the range of geological structures across the lease area is provided in this section. It is agreed that the proposed mine workings in the Wongawilli Seam are not likely to unclamp or in any way mobilise any of these structures. Where any of the pillar panels intersect any geological structures there may be localised poor ground conditions but this is not expected to have any regional ramifications.

   However, the later discussion of regions of a small area of marginally stable pillars in the Bulli Seam (see section 3.5) needs to be considered in terms of their proximity to any major structures, in the event that any such Bulli Seam instability may cause some structural mobilisation (see later discussion).

4. P18 (Previous Mining) – The plan showing all previous mining in the three seams has been reproduced as Figure 5 above. SCT has noted the design feature of aligning proposed Wongawilli Seam panels directly beneath the goaf areas of previous Balgownie Seam longwall panels. This is considered good practice for two reasons – firstly, as stated in the Report, it avoids any under-mining of the Balgownie chain pillars that might threaten their load-carrying capacity for the overlying overburden. Secondly, it provides a degree of protection for the loading applied to the pillars in the proposed new Wongawilli Seam panels. This is good practice, although there is a possibility that some of the pillars on the edges of the new panels may see some excess load due to the expanding footprint of load beneath the overlying chain pillars. This is likely to only result in localised issues, if any, rather than any serious regional instability.

3.5 Chapter 4: Pillar Stability

1. P21, section 4.1 – The wording used in the introductory paragraph is considered to be slightly misleading. The statement made is:

   > *"the pillars of the size of those proposed to be formed at Russell Vale East continue to gain strength as they deform so there is no potential for sudden collapse or load shedding at failure".*

   Whilst the intent of this statement is clear, the terminology is not right. Strength is a fixed parameter, being the maximum load-bearing capacity of a material (or pillar). Strength does not continue to increase with deformation, but the pillars may exhibit an ability to carry increasing stress, up to a point (yet to reach the point of peak strength of the pillar). (This is a technical point of terminology detail and not an issue in terms of overall conclusions).

   Of more importance is the issue of the stability of the proposed Wongawilli Seam pillar panels, based on expected loading and pillar strengths. It is not considered valid to assume that the proposed pillars are all too large to achieve a peak strength value, or to fail or exhibit no load-shedding after failure. Reliance on stress-strain behaviour for large w/h values, such as illustrated for high values of w/h in Figure 11 (see discussion below) cannot be assumed. There is a need for a proper analysis of the stability of the proposed pillar systems, the dimensions of which were summarised previously. Such an analysis should be central to this part of the Report and is lacking. It should include not only strength calculations for the two different sets of pillar sizes, but also a range of assumptions and justification for different loading regimes for such pillars at different depths, and different locations – both under Balgownie Seam goaf areas and elsewhere. This point is revisited later in this review report (section 3.6).

2. P22 – The discussion about behaviour of pillars of different w/h ratios is valid and appropriate. This includes the comment about the appropriateness of probability-based strength calculation methods; and the point is also made that larger pillar strengths are less dependant on material properties (such as cohesion) and more a function of surrounding geology and geometry which impacts on confinement of the pillar core. The same comments as above apply to this discussion regarding the use of the term strength. Generally, the term is used to describe the peak strength or maximum stress the pillar can carry; and then a post-failure or reduced strength after the point of peak strength has been reached.

3. P22 (Figure 11) – This figure displays typical stress-strain characteristics for pillars of different w/h ratios. The absolute values of the axes and the w/h ratios may vary and should not be assumed to be absolute and correct for all conditions – it is the changing shape of the curves which is important. This figure is referenced from a 1995 AMIRA Report. Unfortunately, AMIRA Reports are confidential to the funding clients and the contractor (presumably SCT), so any content drawn from this report cannot be independently verified.

4. P22 (final paragraph of section 4.1) – A conclusion is drawn that Wongawilli Seam pillars under a weak roof display similar strength and deformational characteristics to Bulli Seam pillars with strong roof and floor, due to confinement effects. Reference is made to stress change pillar monitoring data from previous Wongawilli pillar workings. Whilst the conclusion is an encouraging one in terms of proposed pillar performance, the monitoring data is not provided or referenced to any available publication to enable any verification of this behaviour in support of this important conclusion. It would have been useful to have included some evidence of such monitoring in the Report to support this conclusion.

5. P22 (section 4.2, Pillar Loading) – This correctly notes that there can be significant variations in loading as a result of previous overlying mining – ranging from possible reduced loading in protected areas under panel goafs, through to localised load concentrations under regions of load-bearing pillars such as chain and barrier pillars.

6. P23, 24 (Section 4.3, Flooded Workings) – SCT discusses the presence of some areas of flooded Bulli and Balgownie Seam workings overlying the proposed Wongawilli panels, with water heads ranging up to 13m to 17m. The concept of a buoyancy effect reducing the pillar loading on these pillars is discussed, but SCT has rightly ignored any buoyancy effects in calculation of pillar loading and related stability assessment. The presence of such water is more an issue for consideration in the context of inrush risk rather than pillar loading considerations. Inrush risk falls outside the scope of this review report.

7. P25 (section 4.3.1 Pillar Stability (overlying workings)) – The first statement in this section claims:

   "Proposed workings in the underlying Wongawilli Seam are not expected to have any significant effect on pillar loading in the overlying seams".

   Although there is no quantitative analysis provided to support this assertion, it is considered a reasonable conclusion based on the proposed first workings layouts and dimensions. It is agreed that mining of 5.5m wide roadways in the Wongawilli Seam using the proposed pillar layout would not be expected to impact the loading on the overlying pillar systems.

8. P25 – The Bulli Seam pillar systems are described as follows:

> The bord and pillar layout mined in the Bulli Seam in the subject area generally consisted of two heading panels and sub-panels. The two parallel headings are separated by long, narrow pillars ranging in width from 12m to 15m. The pillars are typically rectangular in shape with the length being more than 1.5-2.0 times greater than width. Flanking the narrow two heading panels are wider pillars, generally 20m to 30m wide. Some irregular shaped pillars, including triangular pillars, were formed where the sub-panels intersect the two parallel headings.
>
> The Bulli Seam pillars range in size from 12m by 24m up to 24m by 48m with many formed at 20m by 20m in size.

The pillars are reported to be at depths not exceeding 270m in the area overlying the proposed workings. The mining height is 2.2m. These pillars are stated to have w/h ratios between 5 and 11, typically 9. SCT claims that such pillars under strong roof and floor conditions *"tend to build strength as they become loaded"* and are *"therefore not subject to becoming overloaded and losing strength".*

Apart from some ongoing concerns with terminology (relating to building strength – see previous review comments above), any possible concern with these pillars relates to the pillars with a w/h value of 5. Certainly, there is unlikely to be any problem with the pillars at the higher end of the w/h range. But for pillars of dimensions 12m x 24m, w/h of 5.5 at a depth of 270m, there could be some concern over the long-term stability – depending on the extent of such pillars through the mine workings. Pillars of this w/h ratio can fail, rather than being "not subject to overloading" as claimed. It is stated that such pillars exist in a single row, surrounded by much larger pillars (20m x 20m, or 24m x 48m). If this is the case, and there is no larger region of the smaller pillars, then there is no real concern. However, if a larger region of multiple rows of such pillars existed, there could be some cause for concern. It would have been useful to provide a section of the mine plan specifically focused on the location and extent of such pillars, within the body of the report in this section, in order to provide a more informed assessment.

9. P26 – Reference is made to experience drawn from monitoring of the Bulli Seam pillars, as reported by Mills and Gale (1994). This experience is stated to be the basis for adopting the use of the Bieniawski pillar strength formula, quoted on p26.

   A number of comments are needed here:
   a) The Report does not contain any reference to Mills and Gale (1994). Presumably this a typographical error and is intended to be AMIRA (1995) which was authored by Gale and Mills.
   b) As commented earlier, if such monitoring is of value in drawing any conclusions for the current work, it would be useful to have included some extracted information from such monitoring, to support the conclusions reached (recognising that the AMIRA report is unpublished, and confidential to sponsors, so not available for independent scrutiny).
   c) SCT has determined to use the Bieniawski strength equation for their stability assessment, which is quite reasonable. However, it may have been more appropriate in 2019 to use more recent formulae, such as the UNSW pillar strength formulae, which offer a number of advantages, being: (1) a probabilistic means of assessment of stability; (2) calibrated to Australian conditions; (3) incorporating

rectangular pillar dimensions in the calculation. None of these advantages are available with the Bieniawski formula.

The UNSW formulae actually provide a marginally higher value of pillar strength at the range of pillar sizes and w/h values of interest, as they are based on a power law calculation rather than the simple linear relationship used by Bieniawski. Figure 6 shows the difference in strength calculation between the two strength formulae for a set of square pillars, 2.2m high. The outcome of using the Bieniawski formulae represents a slight degree of conservatism in the stability assessment, compared to using the more widely-used UNSW formulae.

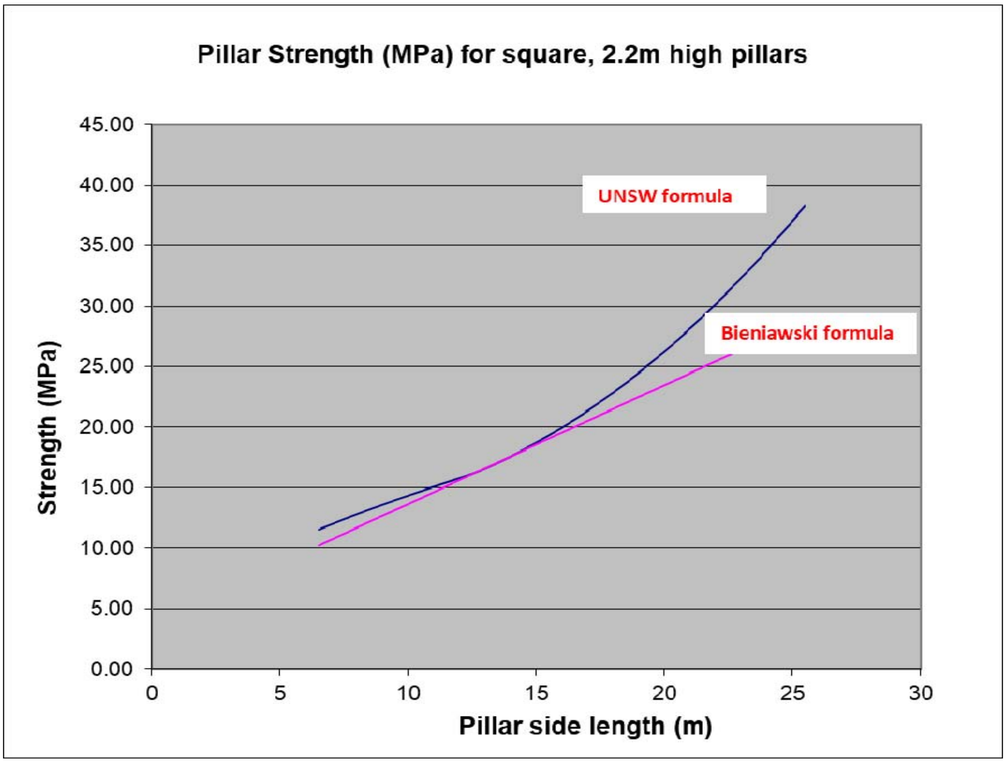


Figure 6. Comparison of UNSW and Bieniawski pillar strength calculations

10. P26 – The Report then reiterates comment on the expected stability of the Bulli Seam pillars, with strength exceeding applied load (stress) by between 1 and 2.6 and more typically 2.1 for the 20m x 20m pillars. As discussed above, there is no concern for the 20m x 20m (or larger) pillars, but the smaller pillars (with a Factor of Safety closer to 1) deserve closer scrutiny, depending on the extent and position of them in the workings.

11. P26 – The remaining pillars in the Balgownie Seam are also considered here, being typically 40m wide, 40m to 70m in length and a mining height of 1.5m. SCT states that these have a w/h ratio of 30 and as such are long-term stable. The w/h ratio is slightly below 30, at 27. However, with such dimensions, and likely longwall panel abutment loading regimes, they would certainly be considered to be long-term stable.

3.6 Chapter 5: Forecast Ground Movements for the Proposed Workings

1. P27 – This section of the Report is the only section directly discussing the design and anticipated stability of the proposed workings in the Wongawilli Seam and the related ground movements through to the surface. Chapter 6 then discusses the impact of any such movements. However, the section appears to be missing any discussion of the actual design of the panels and pillars, in terms of likely stability. As noted previously, there has been no pillar stability analysis provided, or related discussion on the actual pillar dimensions in the proposed Wongawilli Seam panels, or the expected loading regimes, hence the likely levels of stability. Whilst it is anticipated that the dimensions proposed are adequate to ensure stability, it is not sufficient to assume that they will simply continue to accept load and not fail in any form, without a more complete analysis being conducted.

2. P27 – It is noted that some level of deformation (less than 100mm) is expected as a result of elastic compression of the strata above and below the coal seam. This should also include the compression of the coal seam itself in the pillars. This expectation (and approximate magnitude) is considered reasonable. It is also reasonable to expect any such minor or negligible subsidence to occur quite gradually, without any significant tilts or strains on the surface.

3. P27 – Ongoing horizontal movements may continue to occur as a result of previous mining activity. It is agreed that this is independent of the proposed Wongawilli Seam mining.

4. P27 – It is also agreed that the proposed mining is not expected to have any significant impact on the stability of pillars in the overlying seams.

5. P27 – The issue of some marginally stable pillars in the Bulli Seam is again discussed. This marginal stability is considered to be independent of future proposed Wongawilli Seam mining. The Report notes that there is potential instability in some remnant Bulli Seam pillars where voids are wide enough *"that stability appears marginal irrespective of any further mining".* Should such pillars fail, it is expected that surface subsidence of between 1m and 2m may occur, depending on the extent of any failure. It would have been helpful to show the locations of these marginally stable pillars in the body of the Report at this point.

3.7 Chapter 6: Impact Assessment of Forecast Ground Movements

1. P28 – It is agreed that the subsidence movements expected from the proposed workings are not expected to cause any significant impact on any surface features within the Application Area.

2. P28 – It is also agreed that there is no credible risk of water flow along major structures from Cataract Reservoir as a result of the proposed first workings in the Wongawilli Seam.

3. The issue of any major geological structures located in the vicinity of the areas of potentially unstable remnant Bulli Seam pillars (as discussed earlier) should be further investigated and clarified, as to whether there are any significant structures in the vicinity of these remnant pillars. This issue, and consideration of it, is independent of the proposed Wongawilli Seam workings.

4. P28 – It is noted that large areas of the surface within the Application Area are already in a state of limit equilibrium with potential for cracks to appear or movements to develop as a result of previous mining activity. It is agreed that this situation exists, but again, is independent of any future proposed first workings in the Wongawilli Seam.

5. P29 – It is also agreed that the proposed mining is not considered likely to alter the status of mining/groundwater or surface interaction.

6. P29 – The concern for the stability of powerline support pylons above areas of potentially unstable Bulli Seam pillars is valid, and the recommendation for some form of remedial action or alternative support or ground stabilisation is supported.

3.8 Conclusions and Recommendations (Pp1-3)

1. Very low levels of subsidence expected with only minor impacts additional to that due to previous mining activity – *Agreed*.

2. Proposed pillars, at width/height ratios of 8 – 10 are large enough to be long-term stable – *Agreed*, *but further analysis and discussion should be provided to support this view, including definition and justification of the likely range of loading conditions expected for each panel of pillars.*

3. Some low-level deformation of the first workings is expected due to elastic compression of strata which may result in low levels of surface subsidence with correspondingly low levels of tilt and strain. Such movement likely to be very gradual and largely imperceptible – *Agreed*.

4. Known areas of marginally stable pillars in the Bulli Seam have the potential for increased subsidence, independent of proposed Wongawilli Seam first workings mining – *Agreed. Such areas need to be identified.*

5. Proposed workings not considered to have any potential to perceptibly impact on any other surface features such as escarpments, swamps, cliffs, creeks and drainage lines, or the Cataract Reservoir - *Agreed.*

6. Impacts on groundwater are not expected to occur beyond the immediate vicinity of the Wongawilli Seam – *Agreed.*

7. Ongoing low-level horizontal movement expected to continue, as a result of previous mining activity, with potential to continue cracking of features such as Mt Ousley Road *(noted)* and is independent of the proposed future mining – *Agreed.*

8. Differential ground movements may occur as a result of possible destabilisation of remnant Bulli Seam pillars – *Noted.*

9. It is recorded that these pillars exist in a location to the east of Mt Ousley Road – *Noted.*

10. Engineering controls should be developed and implemented to ensure the future stability of transmission line towers above these remnant Bulli Seam pillars – *Agreed.*

11. Ongoing use of existing management plans is recommended (including subsidence monitoring and management) – *Noted, but it is recommended that a new management plan may be required, rather than relying on existing plans only.*

3.9 Appendices

It is not intended to provide a review of the Appendices which cover previous work done in reviewing mining and subsidence impacts associated with previous mining activity. It is noted, however, that Figure 15 in the Appendices shows an area of potentially unstable small pillars in the Bulli Seam. It is unclear, though likely, that this is the area of pillars referred to on multiple occasions by SCT in the Report. A copy of Figure 15 is reproduced below, for information, as Figure 7.

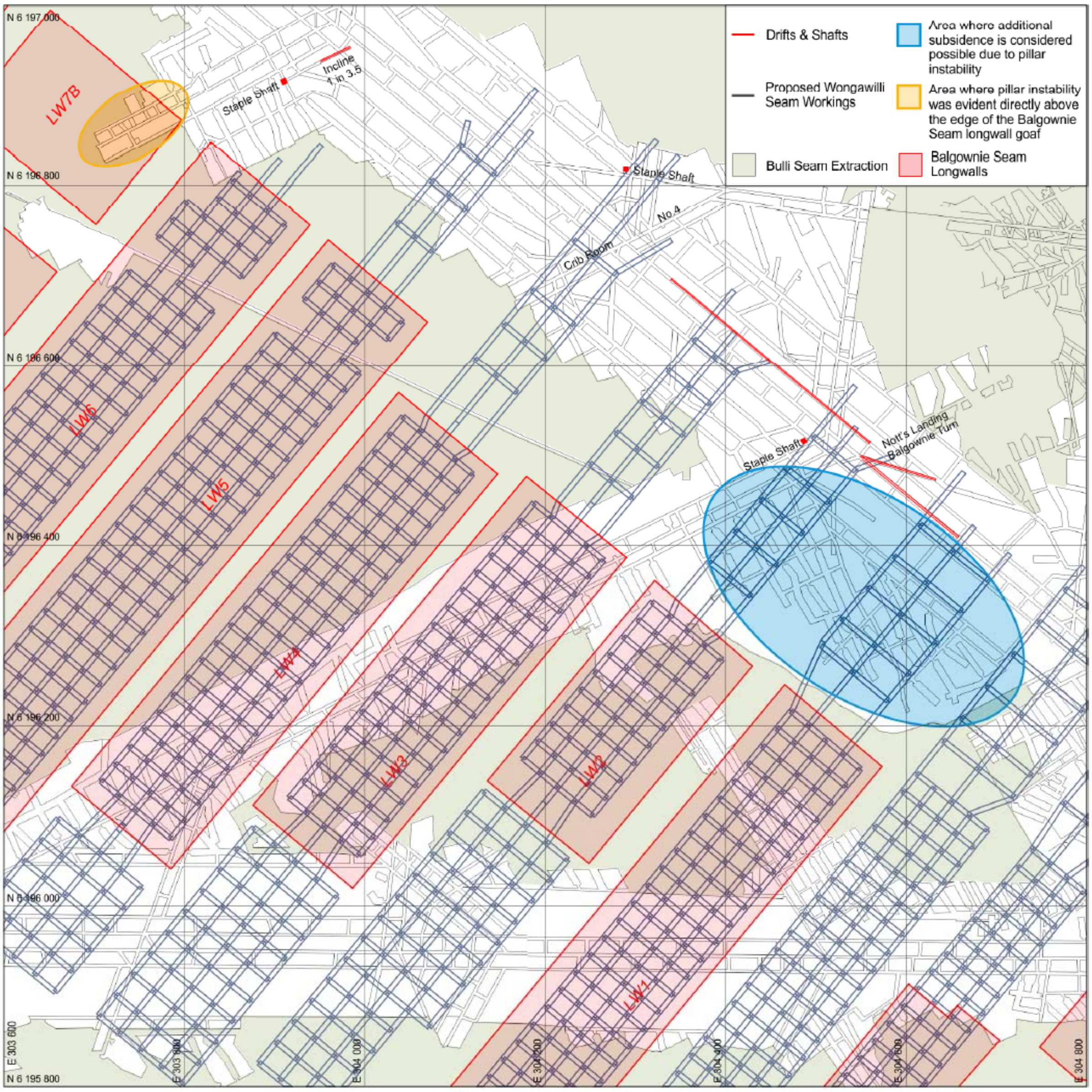


Figure 15: Plan showing areas of existing and potential pillar instability in overlaying Bulli Seam.

Figure 7. Copy of SCT Figure 15 showing area of potentially unstable Bulli Seam pillars
(source: SCT Report UMW4609, 2019)

Bruce Hebblewhite
6th September 2019

APPENDIX A

Attached is a summary Curriculum Vitae for the author of this report, Bruce Hebblewhite. Bruce Hebblewhite has worked within the Australian mining industry from 1977 to the present time, through several different employment positions. Throughout this period, he has been actively involved in all facets of mining industry operations. In addition, he has visited and undertaken consulting and contract research commissions internationally in such countries as the UK, South Africa, China, New Zealand and Canada. For the majority of his 17-year employment period with ACIRL Ltd he had management responsibility for ACIRL's Mining Division which included specialist groups working within both the underground and surface coal mining sectors, and the coal preparation industry– actively involved in both consulting and research in each of these areas.

In his current employment position with The University of New South Wales, Bruce Hebblewhite is involved in undergraduate and postgraduate teaching and research, and contract industry consulting and provision of industry training and ongoing professional development programs – for all sectors of the mining industry – coal and metalliferous.

Both past and present employment positions require regular visits, inspections and site investigations throughout the Australian mining industry, together with almost daily contact with mining industry management, operations and production personnel.

<u>Disclaimer</u>
Bruce Hebblewhite is employed as a Professor within the School of Minerals & Energy Resources Engineering, at The University of New South Wales (UNSW). In accordance with policy regulations of UNSW regarding external private consulting, it is recorded that this report has been prepared by the author in his private capacity as an independent consultant, and not as an employee of UNSW. The report does not necessarily reflect the views of UNSW and has not relied upon any resources of UNSW.

SUMMARY CURRICULUM VITAE

Bruce Kenneth Hebblewhite

(Professor, Chair of Mining Engineering),
School of Minerals & Energy Resources Engineering, The University of New South Wales, &

Consultant Mining Engineer

DATE OF BIRTH	1951
NATIONALITY	Australian

QUALIFICATIONS
1973: Bachelor of Engineering (Mining) (Hons 1) School of Mining Engineering, Univ. of New South Wales
1977: Doctor of Philosophy, Department of Mining Engineering, University of Newcastle upon Tyne, UK
1991: Diploma AICD, University of New England

PROFESSIONAL MEMBERSHIPS; APPOINTMENTS; AWARDS & SPECIAL RESPONSIBILITIES
Member - Australasian Institute of Mining and Metallurgy
Member - Australian Geomechanics Society
Member – Society of Mining and Exploration Engineering (SME), USA
Member - International Society of Rock Mechanics (President – Mining Interest Group (2004 – 2011))
Emeritus Member - Society of Mining Professors (SOMP) (President (2008/09); Council Member (2006 - 2018); Secretary-General (2011-2018))
Executive Director – Mining Education Australia (July 2006 – December 2009)
Chair, Governing Board – Mining Education Australia (2015)
Member, Branch Committee – AusIMM Sydney Branch (2017-2019)

Expert Witness assisting Coroner: Coronial Inquest (2002-2003): 1999 Northparkes Mine Accident
Chair: 2007-2008 Independent Expert Panel of Review into Impact of Mining in the Southern Coalfield of NSW (Dept of Planning & Dept of Primary Industries)
Expert Witness assisting NSW Mines Safety Investigation Unit – Austar Mine double fatality, April, 2014.
Member (2012 – present): Scientific Advisory Board, Advanced Mining Technology Centre, Uni. of Chile.
Trustee (2013 – present): AusIMM Education Endowment Fund
2012 Syd S Peng Ground Control in Mining Award – by SME (USA).
2017 Ludwig Wilke Award for contribution to international mining research and education (Society of Mining Professors).
2017 SME Award for Rock Mechanics (presented at 2018 SME Annual Meeting in Minneapolis, USA in Feb 2018).

PROFESSIONAL EXPERIENCE

2014 – present	University of New South Wales, School of Minerals & Energy Resources Engineering (formerly School of Mining Engineering) Professor of Mining Engineering (p/t)
1995 - present	Principal Consultant - B K Hebblewhite Consulting
2003-2014	University of New South Wales, School of Mining Engineering

	Head of School and Research Director, (Professor, Kenneth Finlay Chair of Rock Mechanics (to 2006); Professor of Mining Engineering (from 2006))
2006 – 2009	Mining Education Australia (a national joint venture between UNSW, Curtin University of Technology, The University of Queensland & The University of Adelaide) Executive Director (a concurrent appointment with UNSW above).
1995-2002	University of New South Wales, School of Mining Engineering Professor, Kenneth Finlay Chair of Rock Mechanics and Research Director, UNSW Mining Research Centre (UMRC)
1983-1995	ACIRL Ltd, Divisional Manager, Mining - Overall management of ACIRL's mining activities. Responsible for technical and administrative management of ACIRL's Mining Division covering both research and consulting activities in all aspects of mining and coal preparation. Director of METS Pty. Limited (1990-1992) and MineRisk Management Services Pty. Limited (1991 - 1995).
1981-1983	ACIRL Ltd, Manager, Mining - Responsibility for ACIRL mining research and commissioned contract programs.
1979-1981	ACIRL Ltd, Senior Mining Engineer - Assistant to Manager, Mining Research for administrative and technical responsibilities. Particularly, development of geotechnical activities in relation to mine design by underground, laboratory and numerical methods.
1977-1979	ACIRL Ltd, Mining Engineer Project Engineer for research into mining methods for Greta Seam, Ellalong Colliery, NSW. Project Engineer for roof control and numerical modelling stability investigations.
1974-1977	Cleveland Potash Ltd, Mining Engineer and Department of Mining Engineering, University of Newcastle-upon-Tyne, UK - Research Associate. Employed by Cleveland Potash Limited to conduct rock mechanics investigations into mine design for deep (1100m) potash mining, Boulby Mine, N Yorkshire (subject of Ph.D. thesis).

SPECIALIST SKILLS & INTERESTS

- Mining geomechanics
- Mine design and planning
- Mining methods and practice
- Mine safety and training
- Mine system audits and risk assessments
- Mining education and training

B.K. HEBBLEWHITE B.E.(Min.) PhD
Consultant Mining Engineer

B K Hebblewhite Consulting
ABN 85 036 121 217

5 Plant St
BALGOWLAH NSW 2093
AUSTRALIA
Mobile: +61 (0) 417 267 876
Email: hebble@bigpond.com

12 October 2019

Report No. 1907/01.2
Peer Review – Russell Vale Colliery Subsidence Assessment
Supplementary Summary Report

Attn: Mr Mitch Jakeman, CEO Wollongong Coal
cc Mr Ron Bush, Group Environment and Approvals Manager

Introduction

Wollongong Coal was provided with my original peer review report, No. 1907/01.1, dated 6 September 2019. This review considered the Subsidence Assessment Report No. UMW4609, dated 10 July 2019, prepared by SCT Operations Pty Ltd.

It is understood that my review report was forwarded to SCT for their consideration. Subsequently, SCT has produced an updated version of their report, UMW4609, V2, dated 3 October 2019. This report has been updated in the light of comments contained in my original peer review.

The purpose of this Supplementary Report (No. 1907/01.2) is to provide a summary of the SCT responses to my original review, which should be read in conjunction with this supplementary, summary report.

Summary Comments

These comments refer to the comment numbering system used by me in the original peer review report (see section 3 of Report No. 1907/01.1).

- There are no substantive changes in the background section of the SCT Report.

- Four key points from the SCT Summary are again worthy of note at this point. These are considered valid and important points which I agree with, and are repeated below:

    - The proposed mining is not expected to result in any significant subsidence impacts on either the surface or sub-surface groundwater regimes;
    - Movement due to previous mining (primarily horizontal) may be ongoing and could cause low-level surface impacts, and will continue, regardless of any proposed future Wongawilli Seam workings;
    - Future differential ground movements may occur if any marginally stable Bulli Seam pillars are destabilised in the vicinity of transmission line pylons;
    - There is a need for a revised/updated subsidence management plan to be developed and implemented.

- Section 3.4, comment 2 – barrier widths are now noted to be generally 40m or greater, which is reasonable considering the proposed panel geometries and depths. Range of depths is also quoted.

- Section 3.5, Pillar Stability, comment 1 – Terminology has been improved, as per recommendation. More importantly, the report now contains an expanded section on pillar strength calculations and estimates of loading scenarios – under protected overlying panel regions, under panel edges, and under virgin conditions. Apart from potentially very localised higher loading concentrations, the overall pillar systems demonstrate an acceptable level of stability using current, conventional strength and stability calculations. It is then accepted that the larger pillars may potentially continue to accept higher levels of load as they deform, resulting in an effectively higher level of overall stability – albeit with further deformation.

- Section 3.5, comment 3 – A copy of the 1995 AMIRA Report has been provided to me for reference, to support the evidence sourced from it.

- Section 3.5, comment 8 – A more detailed discussion and analysis is provided for the issue of overlying Bulli Seam pillars. It is accepted that the particularly narrow (12m) pillars only occur as single rows of pillars between regions of wider pillars. As such, they are not required to contribute to regional stability and the surrounding pillars have a demonstrated capacity to carry the full cover load, even if the 12m wide pillars carry no load.

- Section 3.5, comments 9, 10 – Whilst no further monitoring data has been provided, SCT has used both Bieniawski and UNSW pillar strength calculations to assess the Bulli Seam pillar systems.

- Section 3.6, comment 1 – Pillar stability assessment has now been substantially expanded, as discussed above.

- Section 3.6, comment 2 – Elastic compression of the pillars as well as the surrounding strata is now noted.

- Section 3.6, comment 5 – A copy of the previous Figure 15 from the Appendices has now been brought forward into the main report as Figure 13, to indicate one such location of marginally stable Bulli Seam pillars. Some discussion is provided in relation to managing the risk of potential instability of these pillars and the possible impact on surface power line structures.

- Section 3.8, Conclusions – No change to my previous review commentary, which was essentially in agreement with the conclusions provided. It is noted that a revised subsidence monitoring plan is recommended, which is supported. It is also considered prudent to include some underground pillar system stability monitoring as part of an overall ground control management plan. This could include both assessment of pillar performance as well as some attempt to monitor loading conditions as some of the initial panels are formed under overlying goaf areas, and near goaf edges.

Overall Conclusion

I am satisfied that the updated V2 SCT Report has adequately responded to my substantive comments from the original peer review and that the conclusions reached are therefore considered appropriate and valid, based on the information available.

Bruce Hebblewhite

APPENDIX 5

Updated Subsidence Assessment

Strata Control Technology

UMWELT (AUSTRALIA) PTY LTD

Russell Vale Colliery: Subsidence Assessment for Proposed Workings in Wongawilli Seam at Russell Vale East

UMW4609

SCT Operations Pty Ltd PO Box 824 Wollongong NSW 2520 Australia
Phone: +61 2 4222 2777 Email: sctnsw@sct.gs Website: www.sct.gs
ABN 23 078 328 953

REPORT TO David Holmes
Principal Environmental Consultant
Umwelt (Australia) Pty Ltd
75 York St
TERALBA NSW 2284

TITLE Russell Vale Colliery:
Subsidence Assessment for
Proposed Workings in Wongawilli Seam at
Russell Vale East

REPORT NO UMW4609

PREPARED BY Stephen Wilson
Ken Mills

Date 3 October 2019

Stephen Wilson
Mine Planner

Ken Mills
Principal Geotechnical Engineer

Report No	Version	Date
UMW4609	Draft	16 June 2017
UMW4609	Final	10 July 2019
UMW4609	Version 2	3 October 2019

SUMMARY

Wollongong Coal Limited (WCL) is proposing to mine the Wongawilli Seam in the Russell Vale East area of Russell Vale Colliery located approximately 9km north-northwest of Wollongong. After consideration of the findings of two Planning Assessment Commission (PAC) reviews, WCL revised the proposed mining plan by removing secondary extraction by longwall method and to instead form first workings only with large width to height ratio pillars that are designed to be long-term stable. Umwelt Australia Pty Ltd (Umwelt), the lead consultant responsible for managing the Underground Expansion Project (UEP) approval process, commissioned SCT Operations Pty Ltd (SCT) to undertake a subsidence assessment for the revised mine plan layout. This report presents the results of our assessment.

Our assessment indicates the proposed mining layout is likely to be long-term stable with low potential to cause significant surface subsidence, significant interaction with the overlying seams or significant interaction with existing groundwater systems. The proposed layout is not considered to have any potential to perceptibly impact natural surface features including upland swamps, cliffs including the Illawarra Escarpment, steep slopes, drainage lines, creeks, Cataract Creek and Cataract Reservoir. Assuming the overlying workings are not required to be drained for mining in the Wongawilli Seam, any impacts on groundwater are expected to be limited only to the immediate vicinity of the Wongawilli Seam and only in the area of the proposed mining.

Some ongoing low-level ground movement, mainly horizontal movement associated with previous mining including the Wongawilli Seam longwalls, may not yet have ceased completely. This low-level movement has potential to continue to cause low-level impacts to Mount Ousley Road and valley closure across Cataract Creek that may be perceptible. This movement is a legacy of previous mining and is not expected to be influenced by the proposed mining. Movement may continue irrespective of any further mining in the Wongawilli Seam.

Two power transmission lines, a 330kV line and a 132kV line both supported on steel truss pylons, traverse the surface to the east of Mount Ousley Road. The pylons are very sensitive to differential ground movements that may occur if any marginally stable Bulli Seam pillars are destabilised. Uncertainty remains as to the extent of marginally stable pillars in the vicinity of these pylons. An engineered solution is expected to be required by regulatory authorities to manage the very low-likelihood, very high consequence risk to the power transmission pylons within the Work Health and Safety (Mines and Petroleum Sites) Regulation 2014 given the uncertain nature of the Bulli Seam layout and the limited options to reduce this uncertainty.

Existing management plans for management of subsidence impacts and the monitoring included in them are focussed on longwall mining. A review of these is recommended based on the significantly lower levels of surface subsidence anticipated for the proposed system of mining compared to longwall mining. There may be potential to modify the frequency and nature of monitoring to achieve more effective outcomes.

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1. INTRODUCTION

Wollongong Coal Limited (WCL) is proposing to mine the Wongawilli Seam in the Russell Vale East area of Russell Vale Colliery located approximately 9km north-northwest of Wollongong. After consideration of the findings of two Planning Assessment Commission (PAC) reviews, WCL revised the proposed mining plan by removing secondary extraction by the longwall method and to instead form first workings only with large width to height ratio pillars that are designed to be long-term stable. Umwelt Australia Pty Ltd (Umwelt), the lead consultant responsible for managing the Underground Expansion Project (UEP) approval process, commissioned SCT Operations Pty Ltd (SCT) to undertake a subsidence assessment for the revised mine plan layout. This report presents the results of our assessment.

The report is structured to provide:

- conclusions and recommendations
- overview and background, including a description of the site and the proposed first workings mining geometry
- a summary of the deformation characteristics of coal pillars and expectation of the stability of the proposed pillars under the range of loading conditions likely below extracted workings in the overlying seams
- an assessment of the ground movements expected from the proposed first workings geometry with consideration of the potential for greater than expected ground movements including from seam interaction effects
- an impact assessment for surface features and surface infrastructure based on the magnitude of ground movements expected.

A review of previous mining activity in the Russell Vale East area and the associated subsidence effects and subsidence impacts is presented in Appendix 1 as context. The estimations and measured results in Appendix 1 are largely reproduced from SCT Report WCRV4263 "Update of Subsidence Assessment for Wollongong Coal Preferred Project Report Russell Vale No 1 Colliery" (SCT 2014). This report was prepared in support of the previous Underground Expansion Project – Preferred Project Report (UEP – PPR) longwall mining application.

2. CONCLUSIONS AND RECOMMENDATIONS

Our assessment indicates the proposed mining layout is likely to be long-term stable with low potential to cause significant surface subsidence, significant interaction with the overlying seams or significant interaction with existing groundwater systems.

The mining geometry proposed comprises pillars that are large enough, at a width to height ratio of 8 and 10, to be long-term stable.

Some low-level deformation of the first workings pillars is expected with elastic compression of the pillars and strata above and below these pillars. This strata compression has potential to result in some low magnitude subsidence movements with imperceptibly low levels of tilt and strain. Any subsidence movements are expected to occur gradually.

Interaction with the overlying seams is expected to be negligible, but there are areas of Bulli and Balgownie Seam pillars that may be marginally stable including one area of Bulli Seam pillars that is considered to be marginally stable. If these areas of pillars are destabilised for any reason, there may be perceptible subsidence, but this potential exists irrespective of any proposed mining.

The proposed workings are not considered to have any potential to perceptibly impact on natural surface features including upland swamps, cliffs including the Illawarra Escarpment, steep slopes, drainage lines, creeks, Cataract Creek and Cataract Reservoir. Assuming the overlying workings are not required to be drained for mining in the Wongawilli Seam, any impacts of the proposed workings on groundwater are expected to be limited only to the immediate vicinity of the Wongawilli Seam and only in the area of the proposed mining. If the overlying workings in the Balgownie and Bulli Seams are required to be drained as an inrush control measure, dewatering may alter the current groundwater flow paths underground but would not be expected to change the overall quantity of groundwater entering the mine.

The proposed mining plan involves first workings within the DSC Notification Area for Cataract Storage Reservoir. Mining within the DSC Notification Area requires the consent of the Dams Safety Committee.

It should be recognised that some ongoing low-level horizontal ground movement associated with previous mining including the recent Wongawilli Seam longwalls, may still be ongoing. This low-level movement has potential to continue to cause perceptible cracking on Mount Ousley Road at the top of the ridge to the south of Cataract Creek and some compression on the road at the crossing of Cataract Creek. This movement is expected to continue irrespective of any further first workings that are developed in the Wongawilli Seam. The movement is a legacy of previous mining and is not expected to be influenced by the proposed mining.

The Bulli Seam in the general area of the proposed mining was mined at a time when there was no legal requirement to keep 'accurate' mine records. A small area of marginally stable standing pillars in the Bulli Seam is known to exist to the east of Mount Ousley Road. Although this area is shown on the mine plans, there is uncertainty about whether there may be other areas of marginally stable pillars elsewhere across the area given that most of these workings are now inaccessible.

Two power transmission lines, a 330kV line and a 132kV line traverse the surface to the east of Mount Ousley Road. Both lines are supported on steel truss pylons. The pylons are sensitive to differential ground movements. Such movements may occur if marginally stable Bulli Seam pillars in the vicinity are destabilised. The proposed mining is not expected to result in destabilisation of the pylons, however due to the very high consequence of the risk, an engineered solution is likely to be required by regulatory authorities to manage the very low-likelihood risk to the power transmission pylons within the Work Health and Safety (Mines and Petroleum Sites) Regulation 2014 because of the uncertain nature of the Bulli Seam layout and the limited options to reduce this uncertainty.

Engineered controls include construction of cruciforms at the base of the existing pylons, replacing the towers with single pole structures, filling the Bulli Seam voids with cement stabilised material and leaving coal barriers with only a minimum three entries within a radius of 0.7 times depth (35° angle of draw) of the pylons.

Exploration drilling that demonstrates full subsidence has occurred in areas below the pylons may confirm that the risk of further subsidence has been eliminated.

The existing Built Features Management Plans for Mount Ousley Road (and Picton Road interchange) and the adjacent electricity transmission lines are recommended to use but these were developed for longwall mining and should be reviewed based on the significantly lower levels of surface subsidence anticipated.

A revised program of subsidence monitoring in areas not sensitive to surface movements is also recommended. This program would be targeted to confirm the magnitude of subsidence from the proposed first working mining method and provide the opportunity to modify the impact management strategy before proceeding to mine below subsidence sensitive infrastructure.

3. OVERVIEW AND BACKGROUND

This section provides a general context for the assessment. The section is structured to provide an overview of the site, the background to the mining application, a summary of surface ownership, surface features, the geological setting, previous mining and a description of the major surface features. More detail on specific aspects of the project is presented in other specialist reports associated with the project.

3.1 Site Overview

Figure 1 shows the location of existing and proposed workings in the Russell Vale East Area superimposed onto a 1:25,000 topographic series map of the area. The main headings access and services roadways are also shown.

Figure 1: Plan showing location of Application Area with existing and proposed Wongawilli Seam proposed workings superimposed onto a 1:25,000 topographic series map with creek alignments update based on LiDAR imaging of the ground surface.

The Application Area for the project provides an area within which the influence of proposed mining is considered. The Application Area is defined by a distance around the proposed first workings equal to the overburden depth to the Wongawilli Seam. Features within the Application Area and major features just outside are considered in this assessment.

3.1.1 Surface Features

The Application Area is located entirely within the headwaters of Cataract River and the Cataract Reservoir and predominantly within the catchment of Cataract Creek. The surface is mainly undeveloped bushland. Surface features include sections of rainforest in the valleys, a variety of upland swamps located mainly on the valley sides and numerous sandstone rock formations associated with the Hawkesbury Sandstone outcrop on the upper slopes. The surface is traversed by the Mount Ousley Road and four high-voltage power transmission lines, two of which are supported on steel truss pylons and the other two on single pole structures.

The location of surface watercourses, particularly Cataract Creek, has been refined using surface contours available from LIDAR (Laser Interferometric Detection and Ranging) imagery flown since the 1:25,000 series topographic series map was produced. The watercourses are ranked on the basis of their stream order using the approach described in the Strategic Review into Impacts of Underground Coal Mining on Natural Features in the Southern Coalfields (NSW Department of Planning 2008). First and second order streams are located across the Application Area. Two short sections of third order streams on Cataract Creek to the east of Mount Ousley Road join to form a fourth order stream downstream of Mount Ousley Road.

Surface features outside the Application Area that may nevertheless be sensitive to subsidence impacts include the Hawkesbury Sandstone outcrop on the Illawarra Escarpment forming Brokers Nose, a telecommunications facility on Brokers Nose and a bridge on the Picton Road interchange.

3.1.2 Proposed Mining Geometry

After recovery of the existing longwall equipment, WCL propose to continue development of the Wongawilli Seam. Outside of the main headings roadways, the proposed mining system has replaced longwall mining with first workings only. These first workings form square pillars in generally rectangular panels.

Each panel typically has five headings and is separated from adjacent panels by solid coal barriers of generally greater than 40m in width. The proposed layout is designed to dovetail with previous mining in the Wongawilli Seam and to fit within the footprint of previous mining in the overlying seams so that there are more than five headings in some areas and irregular shapes in others. This design is intended to improve roadway conditions and reduce the potential for surface subsidence.

Palaris Mining Pty Ltd (Palaris), in consultation with the WCL, identified an optimum cutting height of 2.4m in the lower section of the Wongawilli Seam. Palaris developed a proposed mining plan for areas where the overburden depth ranges from a minimum of about 250m to a maximum of approximately 380m. This mining plan includes 25m wide square pillars, measured centre to centre, located below longwall panels in the overlying Balgownie Seam. The width to height ratio for these pillars is approximately 8 for nominal 5.5m wide roadways. Pillars outside the footprint of the Balgownie Seam longwall panels are generally designed to be square at 30m centres. These pillars have a width to height ratio of approximately 10 for nominal 5.5m wide roadways.

3.2 Project Background

Russell Vale Colliery is located near Russell Vale in the Illawarra region of New South Wales. The mine has had several names since it commenced in the late nineteenth century. The mine was known as South Bulli Colliery for most of its life, more recently as NRE No1 Colliery after being purchased by Gujarat NRE and for the last four years, the mine has been known as Russell Vale Colliery.

The colliery holding covers a total area of approximately 6,973 hectares (ha). The holding includes multiple sub leases held between WCL and surrounding mine operators, including Consolidated Coal Lease (CCL) 745, Mining Purposes Lease (MPL) 271 and Mining Lease (ML) 157.

Underground mining within the colliery holdings is extensive, particularly in the Bulli Seam where bord and pillar mining, pillar extraction and numerous longwall panels have largely exhausted the Bulli Seam resource in the eastern part of the mine. Eleven longwall panels have been mined in the Balgownie Seam and three short panels have been mined in the Wongawilli Seam. Nevertheless, substantial high quality coking and thermal coal resources remain.

Originally, Gujarat NRE intended to expand its Wongawilli Seam operations in two stages. Stage 1 plans were detailed in the Preliminary Works Project Part 3A application that was approved in October 2011, allowing main headings first workings with gateroad panel development roadways for Longwalls 4 and 5, and upgrades to surface facilities. In December 2012, the Preliminary Works Project Part 3A was modified to allow the secondary extraction of Longwalls 4 and 5 and the development of Maingate 6.

The original Stage 2 application known as the Underground Expansion Project Part3A (UEP) was lodged with the Department of Planning and Infrastructure (DPI now Department of Planning and Environment DP&E) in August 2009 detailing an application to extract eleven longwalls in the Wonga East area (as it was known at the time) and seven longwalls in the Wonga West area together with surface facilities upgrades to allow production of up to 3Mtpa for up to 20 years.

After consideration of the submissions received for the application, NRE made the decision to substantially revise the UEP Application to facilitate the approval process and allow continuity of operations. Due to the scope of the changes, the then DPI requested NRE to prepare a Preferred Project Report (PPR) for the revised UEP Application based on only eight longwalls in the Wonga East area and upgrading of surface facilities to manage an extraction rate of up to 3Mtpa ROM coal per annum.

In February 2014, Gujarat NRE formally changed its name to Wollongong Coal Ltd (WCL) following a change in shareholder ownership. WCL subsequently changed the name of the mine to Russell Vale Colliery and the eastern mining area from Wonga East to Russell Vale East.

A further modification to the Preliminary Works Project Part 3A approval was granted in November 2014 allowing the first 365m of Longwall 6 panel in the Wongawilli Seam to be mined.

The PPR application was assessed by the Planning Assessment Commission (PAC) and after holding public submissions, a report was released in April 2015. The PAC concluded that further information was required. After responses to submissions were provided by WCL in 2015, a second PAC review was commissioned. After further public hearings, a report released in March 2016 declined to recommend approval for the project based on a range of issues relating to subsidence impacts on water and upland swamps and noise.

In December 2016, WCL engaged Palaris Mining Pty Ltd to design a mining plan layout for the Russell Vale East area suitable to address the concerns of the PAC. An initial layout design with limited secondary extraction at the edges was reviewed by SCT in March 2017 and the plan was subsequently modified by Palaris to exclude secondary extraction. This final plan forms the basis of the assessment presented in this report.

Figure 2 shows a comparison between the proposed UEP-PPR longwall mining plan and the proposed first workings only mine plan for the Wongawilli Seam at Russell Vale East.

3.3 Surface Ownership

Figure 3 shows the surface ownership within the Application Area. Most of the area is within the Metropolitan Special Area for Cataract Water Supply Reservoir. The surface area in the catchment is administered by WaterNSW. The stored waters of Cataract Reservoir are also administered by the Dams Safety Committee (DSC).

A large part of the area to the east of Mount Ousley Road and small areas to the west are owned by WCL. The easement for the Mount Ousley Road and an area northeast of the Picton Interchange within the Application Area is owned and administered by the Roads and Maritime Services (RMS).

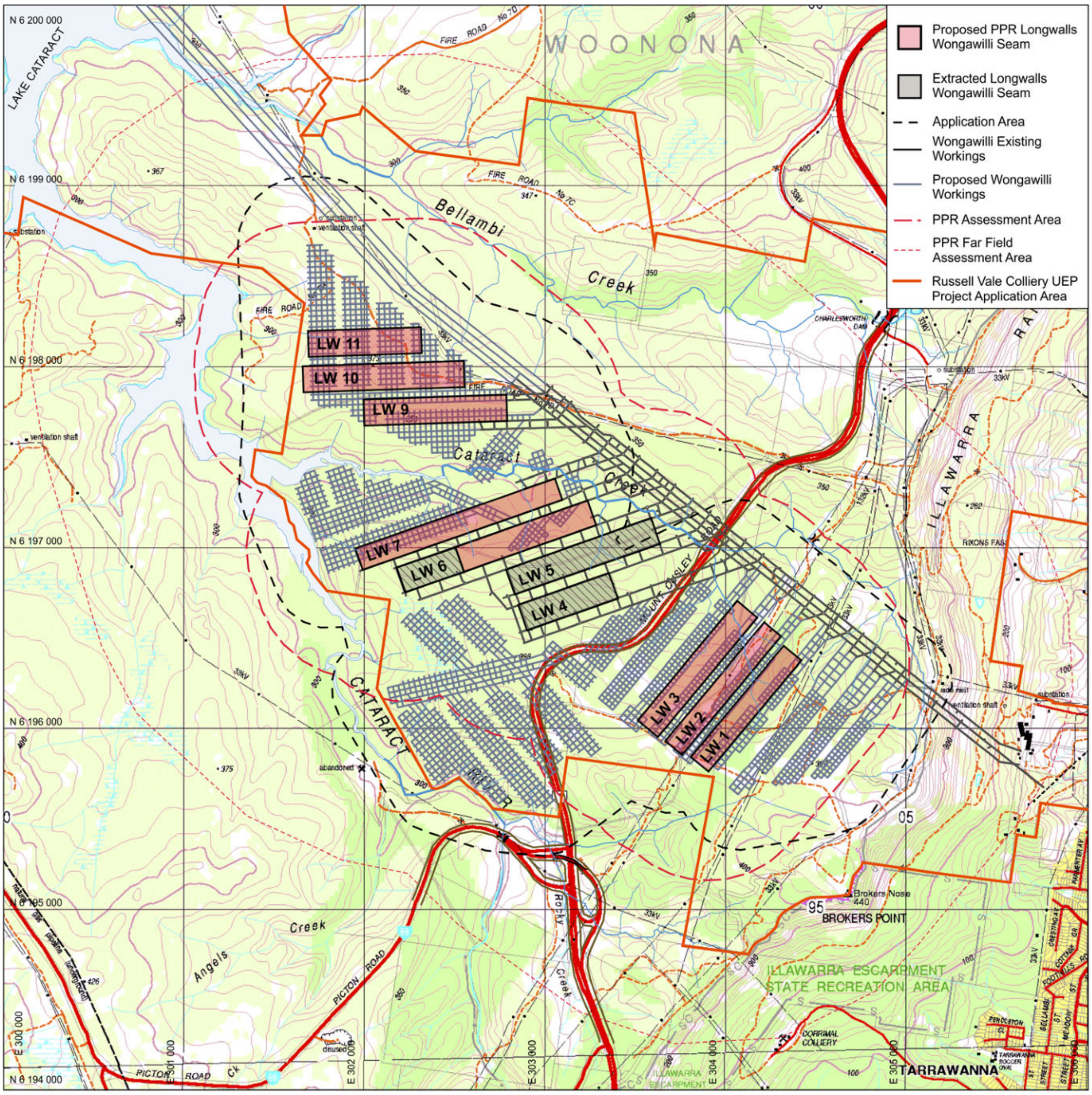

Figure 2: Plan showing comparison between the proposed longwall panels in the PPR and the proposed workings in this current application

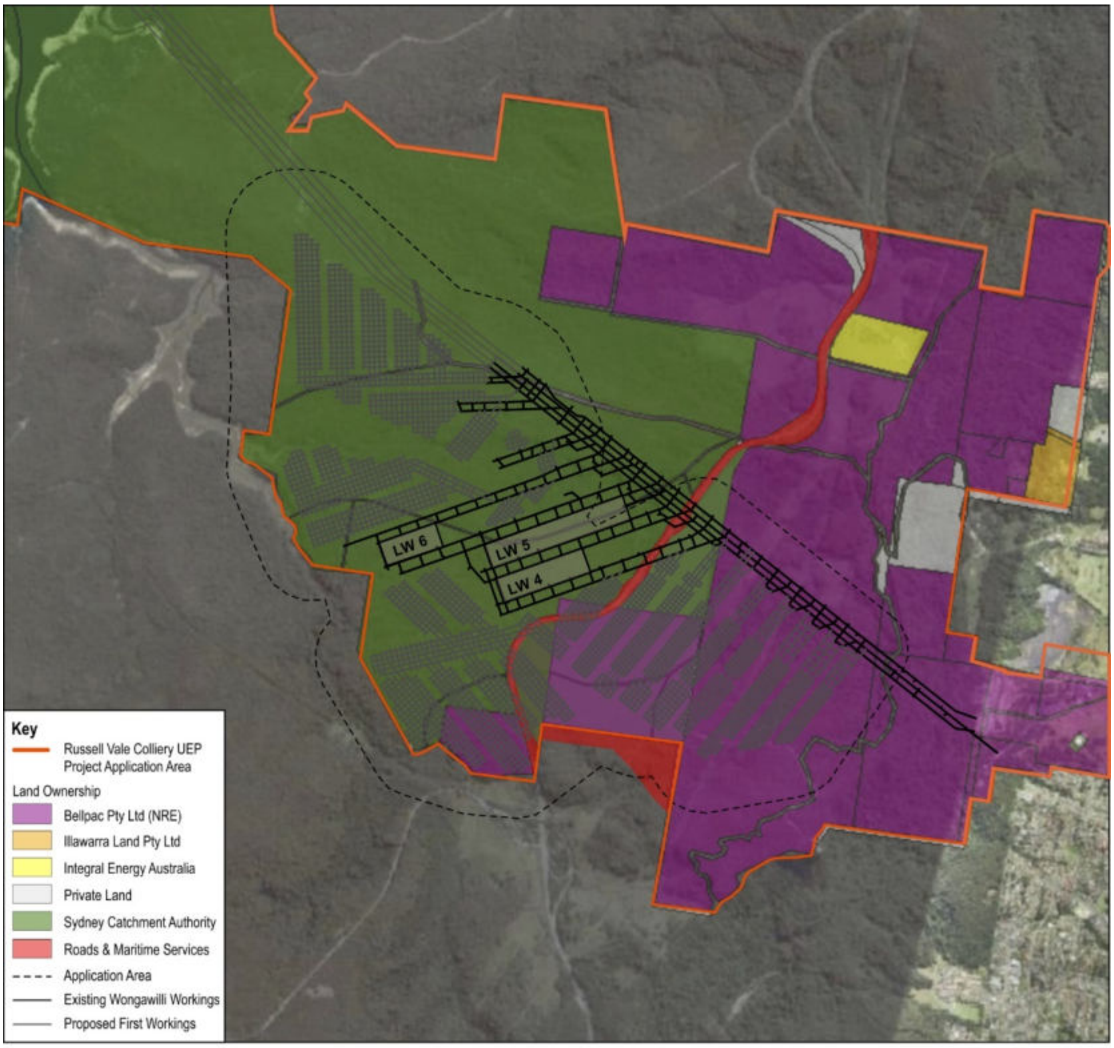

Figure 3: Plan showing land ownership within Application Area. (Diagram modified from Environmental Resources Management Drawing Number 0079383s_EA_GIS013_RO.mxd dated 22/9/10).

3.4 Surface Infrastructure

Major infrastructure within the Application Area includes the Mount Ousley Road and four high voltage power lines to the east that cross the area. The location of this infrastructure is shown on the topographic map in Figure 1.

Mount Ousley Road (recently renamed the M1 Princes Motorway) is a major four lane highway connecting New South Wales largest and third largest cities. This road is administered by Roads and Maritime Services (RMS). The interchange with the Picton Road is located to the south at the boundary of the Application Area. This interchange includes a concrete bridge and several drainage culverts.

Mount Ousley Road was constructed as a defence route during 1942 with duplication of the highway commencing in 1965 reaching Picton Road from the south in 1979 (OzRoads 2012). A major deviation at Cataract Creek was opened in 1980. The northbound carriageway on Mount Ousley Road at Cataract Creek was last resurfaced in 2009 with the surface expected to last 10-12 years (Vecovski 2012). The southbound carriageway was last resurfaced in 2003 and resurfacing of this section is expected within 5-6 years

A major upgrade and realignment of the Mount Ousley Road is planned over the next few years. This realignment is expected to involve widening the road to three lanes in each direction across the Application Area and softening of bends at the top of the ridge to the south of Cataract Creek.

There are four power transmission lines located within the Application Area, a 330kV transmission line owned and maintained by Transgrid, a 132kV transmission line located alongside that is owned and maintained by Endeavour Energy and two 33kV transmission lines and associated infrastructure owned and maintained by Endeavour Energy. There are also two more 33kV lines located at the north east corner of the Application Area. One of these line services mine owned infrastructure.

There is a telecommunications installation located adjacent to the Illawarra Escarpment at Brokers Nose. This facility is approximately 600m from the nearest panel of first workings.

3.5 Natural Features

Major natural features and natural resources in the area include the Illawarra Escarpment and the upper parts of Lake Cataract that forms part of Sydney's water supply catchment. The Illawarra Escarpment is located 400m east of the nearest panel of proposed workings. Approximately half of the Application Area is located within the DSC Cataract Notification Area (revised in 2013).

There are numerous natural swamps identified within the Application Area. The nature and distribution of these swamps are described in detail in associated specialist reports.

There are numerous sandstone cliff formations located within the Hawkesbury Sandstone outcrop in the Application Area. Most of these are less than 5m high. Multiple rock falls are evident across the site. Some were caused by previous mining and others have occurred naturally.

There are several locations where drainage lines and first order creeks flow over sandstone outcrops to form waterfalls following periods of heavy rain. Two of these features are approximately 7m high.

However, only the feature at the downstream edge of swamp CCUS4 is regarded as a semi-permanent waterfall on a first order watercourse. The others are either located on drainage lines that have no permanent flow or have been impacted by previous mining so that water emerges from the base of the rock formation during periods of low flow rather than flowing over the rock as a waterfall.

3.6 Heritage Features

Several Aboriginal heritage sites have been identified within the Application Area. These sites are mainly associated with rock shelters in sandstone cliff formations and grinding groove sites on upland sandstone outcrops.

One of the shelter sites appears to have been impacted by instability to the associated sandstone overhang, either as a result of previous mining in the Bulli Seam or as a result of tree root invasion and natural erosion processes.

3.7 Geological Setting

An understanding of the geological setting described in this section is helpful as context for the subsidence assessment and the surface geomorphology. The geological setting is described in detail in Clark (2013).

Figure 4 shows a plan of the geological formations that outcrop at the surface and the geological structure that exists at the Wongawilli Seam level and at the surface. The existing and proposed workings in the Wongawilli Seam are also shown.

Within the Application Area, the strata dips at between 1 in 25 and 1 in 30 to the west-north-west from its outcrop on the Illawarra Escarpment.

Hawkesbury Sandstone is present on the surface over most of the Application Area. The Bald Hill Claystone that underlies the Hawkesbury Sandstone outcrops in Cataract Creek and its tributaries. The Bulgo Sandstone that underlies the Bald Hill Claystone outcrops along the main channel of Cataract Creek on both sides of Mount Ousley Road.

Figure 5 shows cross-sections drawn at natural scale through the Application Area extending from west to east and from south to north. These sections are located in the vicinity of Mount Ousley Road and Cataract Creek. The sections show how Cataract Creek has cut down through the stratigraphy near the top of the anticlinal structure that exists in this area. This anticlinal structure is an arch shaped fold in the geological strata.

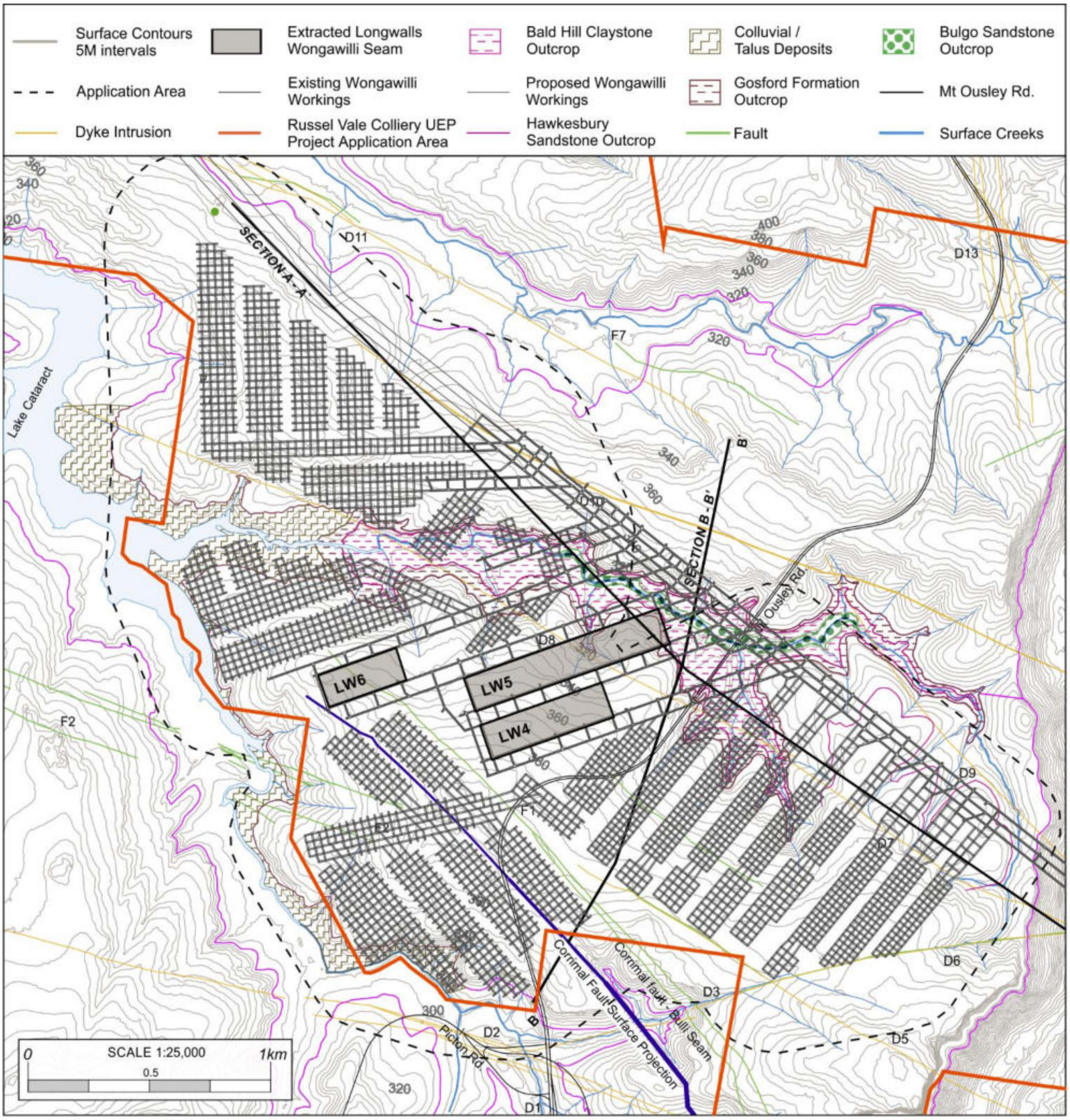

Figure 4: Plan showing geological outcrop at the surface and the location of major geological structures. (reproduced from Clark 2013).

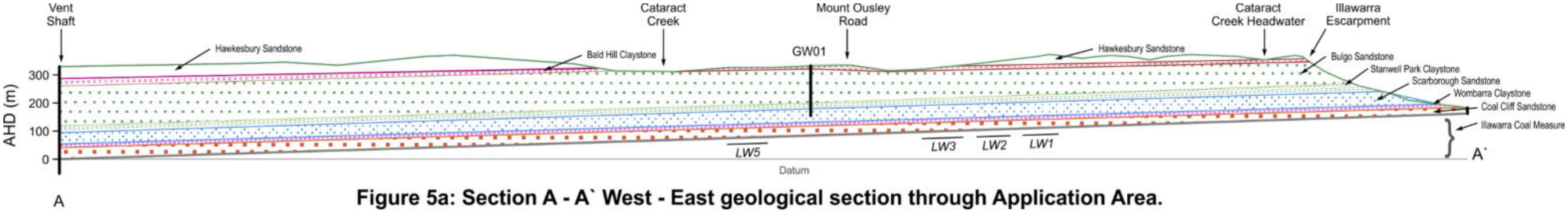

Figure 5a: Section A - A` West - East geological section through Application Area.

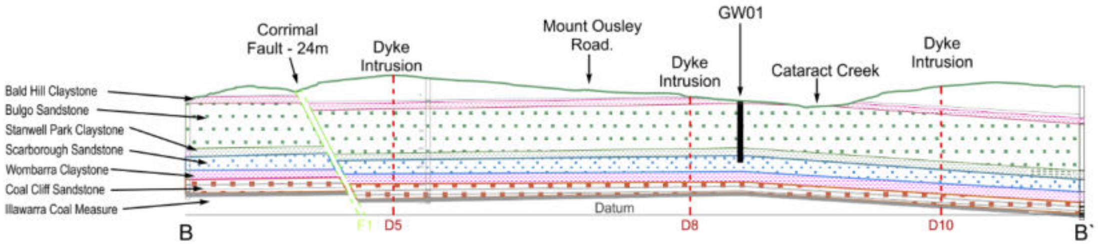

Figure 5b: Section B - B` South-North geological section through Application Area. (reproduced from Clark 2013).

Note: Vertical scale is the same as the horizontal scale.
Refer to Figure 4 for section locations.

3.7.1 Coal Seams

The three coal seams mined at the colliery are all located within the Illawarra Coal Measures.

The Bulli Seam is the uppermost of the three seams and averages about 2.2m in thickness across the Application Area. Figure 6 shows the layout of the Bulli Seam workings and the geological structure in the Bulli Seam (reproduced from Clark 2013).

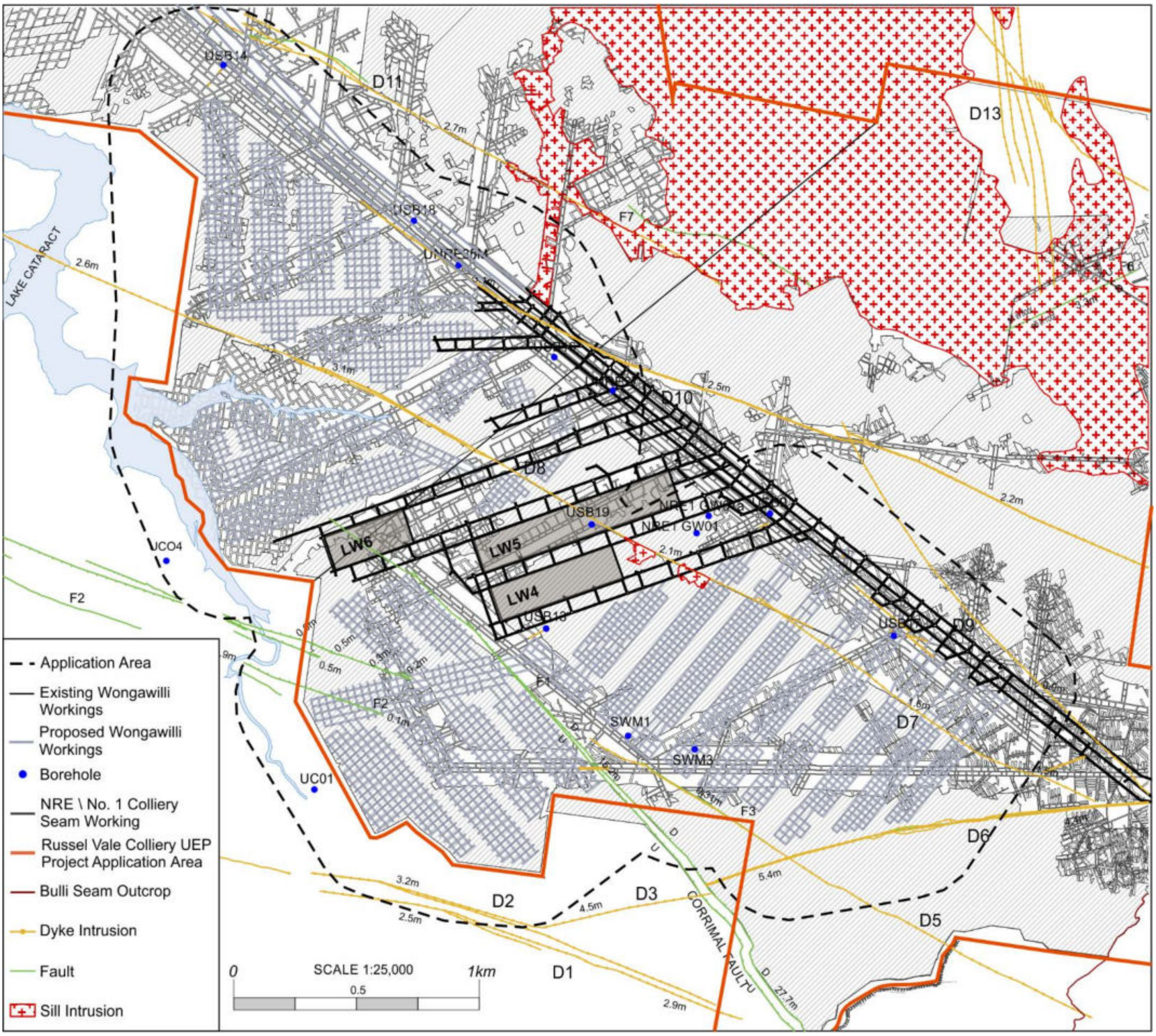

Figure 6: Plan showing geological structures and the extent of mining in the Bulli Seam level. (reproduced from Clark 2013).

The Balgownie Seam is located on average about 10m below the floor of the Bulli Seam ranging from 5m to 14m across the Application Area. Figure 7 shows the layout of the Balgownie Seam workings and the geological structure in the Balgownie Seam (reproduced from Clark 2013). The Balgownie Seam is approximately 1.2m thick, but detail presented on the mine plan, anecdotal evidence from miners who worked the seam and subsidence monitoring indicates that the mining height may have been up to 1.5m on the longwall faces to accommodate the mining equipment. It is understood the additional height was gained by mining the immediate floor strata.

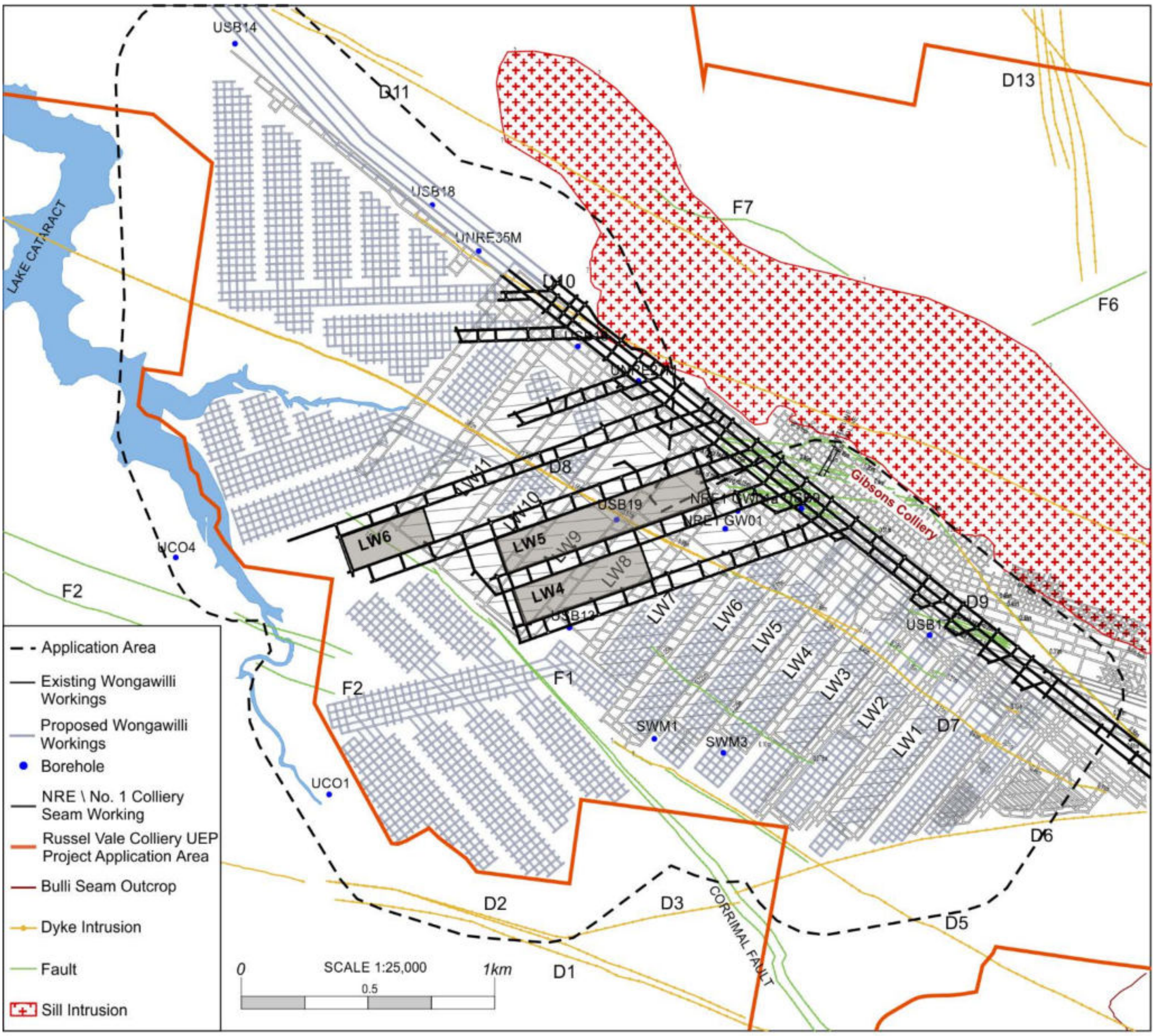

Figure 7: Plan showing geological structures and the extent of mining in the Balgownie Seam level. (reproduced from Clark 2013).

The Wongawilli Seam is located approximately 20m below the Balgownie Seam and ranges in thickness from about 8m to 12m. The lower section contains the best quality and bottom 2.4m of the seam section is the target height of the proposed mining.

Figure 8 shows a plan of the geological structure at the Wongawilli Seam level (reproduced from Clark 2013) and modified to include the Wongawilli Seam floor contours and up to date workings. The floor of the Wongawilli Seam ranges in elevation across the Application Area from approximately RL85mAHD in the east to approximately RL-25mAHD in the west. The dip of the seam between these two points is, for practical purposes, constant.

3.7.2 Geological Structures

The proposed mining system is not expected to mobilise ground movements on any of these structures, but it is nevertheless helpful to review the geological structure as a basis to understand their potential for subsidence impacts. The proposed first workings avoid interaction with geological structures where possible and the limited interaction is not expected to extend beyond the immediate vicinity of individual roadways.

The major geological structures of interest in the area are the Corrimal Fault, several other minor faults, a sill (horizontal igneous intrusion) and several dykes (vertical igneous intrusions). The vertically continuous structures are evident in the Bulli and Balgownie Seam and in the geomorphology on the surface. The positions of these features are well defined because of the underground exposures. The geological structures in each seam are shown in Figures 6-8.

The Corrimal Fault (F1) is the only major geological fault within the Application Area extending in a north-west south-east orientation across the southern part of the Application Area. The Corrimal Fault is apparent in the surface geomorphology and at seam level in the Bulli and Wongawilli Seams, so its location and characteristics are well defined. The fault diminishes to the northwest and has become insignificant as a series of minor features with total displacement of about 1m where it is intersected by the gateroads for Longwall 6 in the Wongawilli Seam (Cartwright 2014). The first 340m of Longwall 6 in the Wongawilli Seam mined through disturbed ground associated with the tail end of the Corrimal Fault without undue difficulty.

Other faults in the general area include the F2 faulting, Rixons Pass Fault and the Woonona Fault. Fault F2 is a series of minor displacements intersected in the Bulli Seam workings of both Russel Vale (previously South Bulli) Colliery and the adjacent Corrimal Colliery. This faulting is more prominent in Corrimal Colliery. The throws of these faults are recorded as less than 1m and generally of the order of 0.5m in the area of the proposed mining plan layout. This faulting is not expected to significantly impact the proposed mining or have any influence on subsidence.

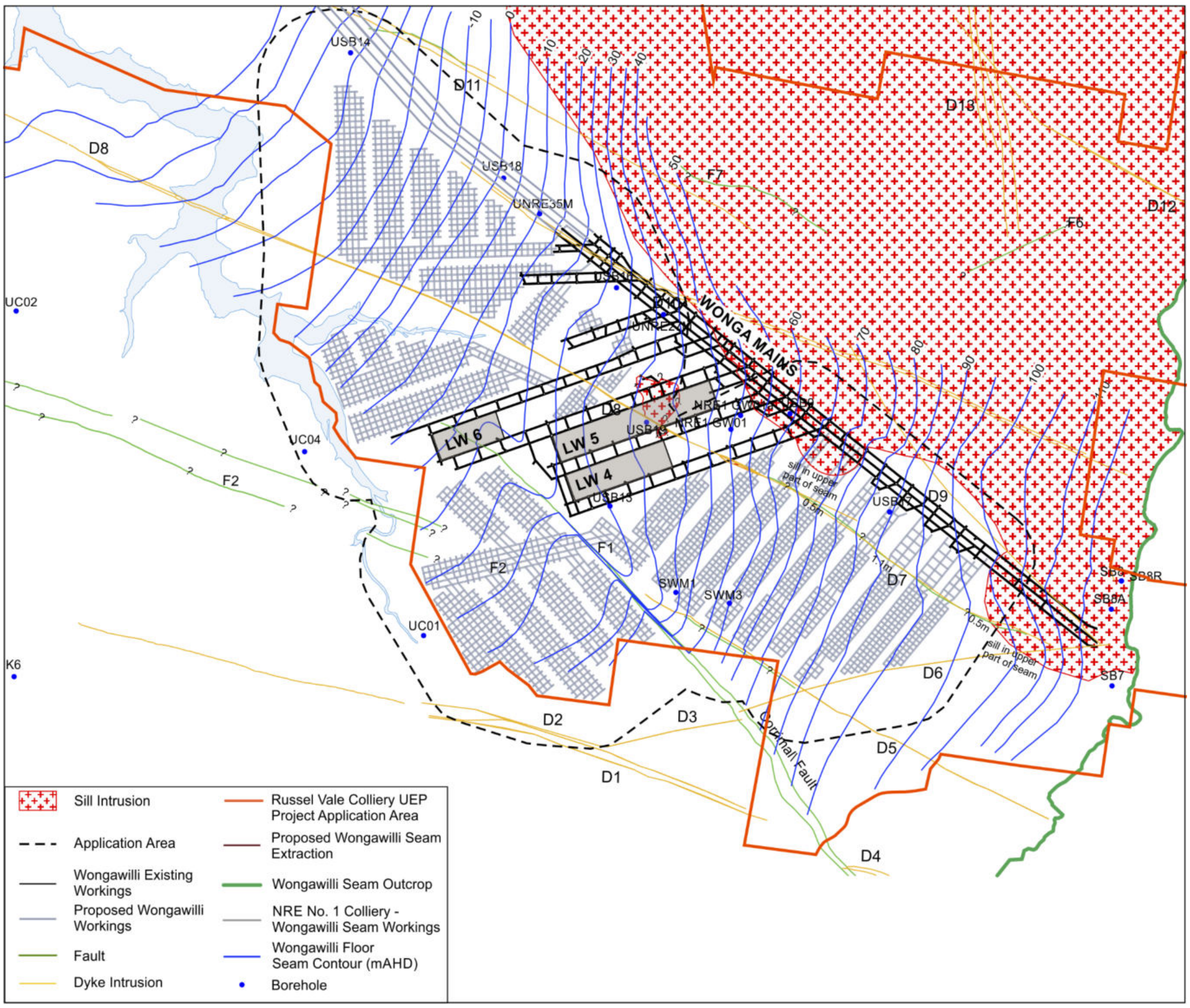

Figure 8: Plan showing geological structures in the Wongawilli Seam (reproduced from Clark 2013) and floor contours of the Wongawilli Seam based on floor contours in the Bulli Seam.

The Rixons Pass Fault identified to the east of the escarpment is not apparent in the mine workings. Dyke D10 may be an extension of this fault feature. Similarly, the Woonona Fault may align with a series of dykes and minor faulting reported in the workings of the Bulli Seam. Both of these regional geological features are remote from the proposed mining and are not considered likely to affect mining or to be affected in any significant way by the proposed mining.

An igneous sill has intruded into the Wongawilli Seam to the north of the main headings. The coal in this area is cindered and unsuitable to mine.

Several dykes exist within the Application Area with most having a west-north-west east-south-east orientation. Dykes are the vertical equivalent of sills and often form an intrusion that is vertically and laterally continuous for many kilometres in length. The dykes that have formed in the Southern Coalfield are generally less than a few tens of centimetres thick in the general strata but often increase in thickness at coal seam level. Dykes are usually hard to mine, dilute the coal product, cause damage to the mining equipment, and tend to be avoided where possible.

The site constraints within the Application Area mean that several of the proposed panels will need to mine access roadways through Dyke D8. This dyke has been previously encountered in the Bulli Seam, Balgownie Seam and existing Wongawilli Seam workings and its trace is apparent in the geomorphology on the surface indicating that it is vertically continuous to the surface. Longwall panels have potential to cause movements on dykes; individual roadways such as those proposed do not.

Dyke D5 and associated faulting has been intersected at numerous locations in the Bulli Seam. This structure forms part of the south east limit of Balgownie Seam workings.

3.7.3 Overburden Depth

Figure 9 shows a plan of the overburden depth to the Wongawilli Seam. The overburden depth ranges from a maximum of approximately 380m in the northwest to a minimum of about 250m in the east along the line of Cataract Creek.

3.8 Previous Mining

Figure 10 shows the location of the proposed workings in the Wongawilli Seam relative to existing workings in the Bulli, Balgownie and Wongawilli Seams. Bulli Seam mining extends over almost all the proposed mining area in the Wongawilli Seam. There are large areas of pillar extraction separated by large main heading barrier pillars and some smaller areas of standing pillars. Balgownie Seam longwall panels extend over approximately half the proposed mining area.

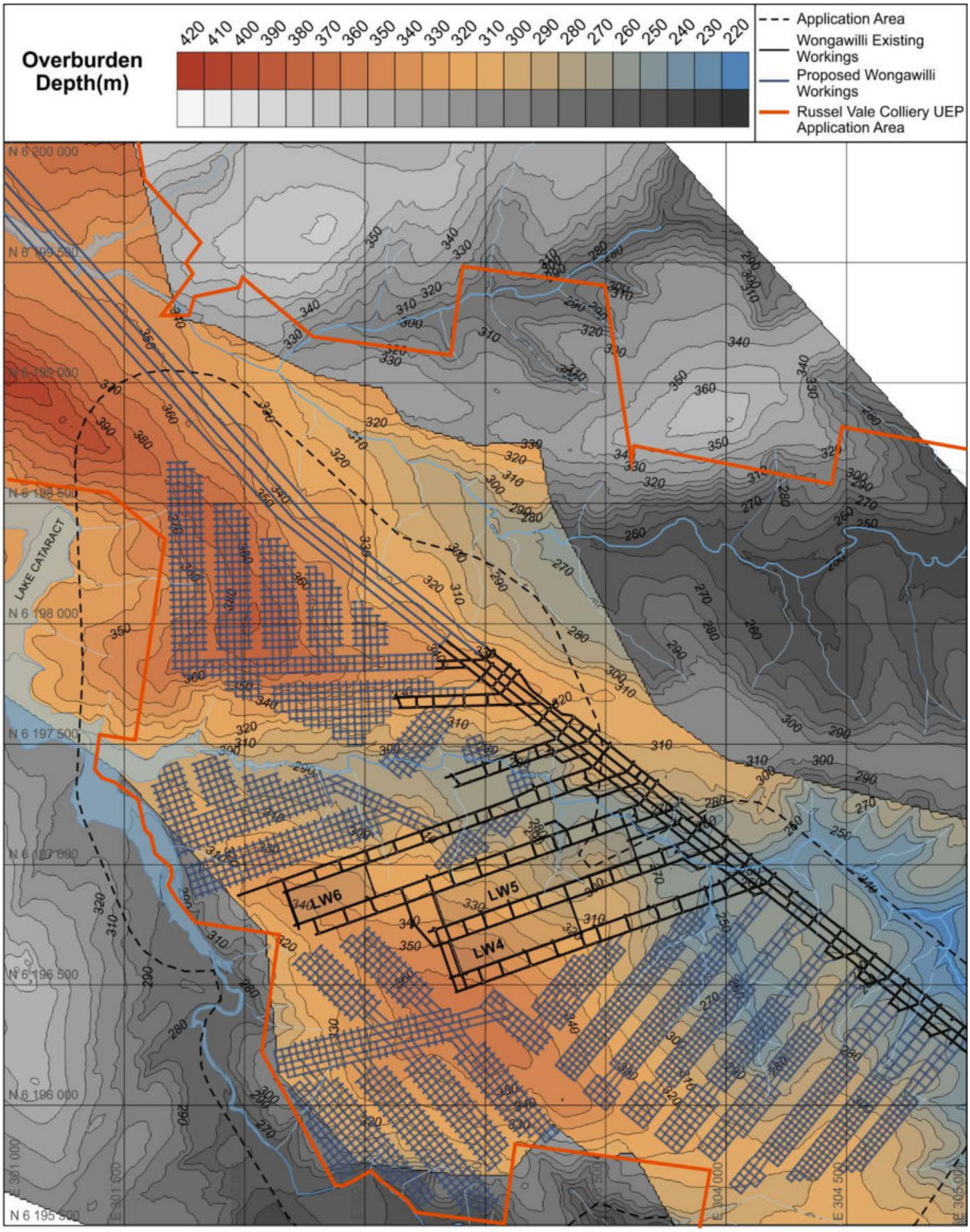

Figure 9: Depth of Overburden to the Wongawilli Seam.

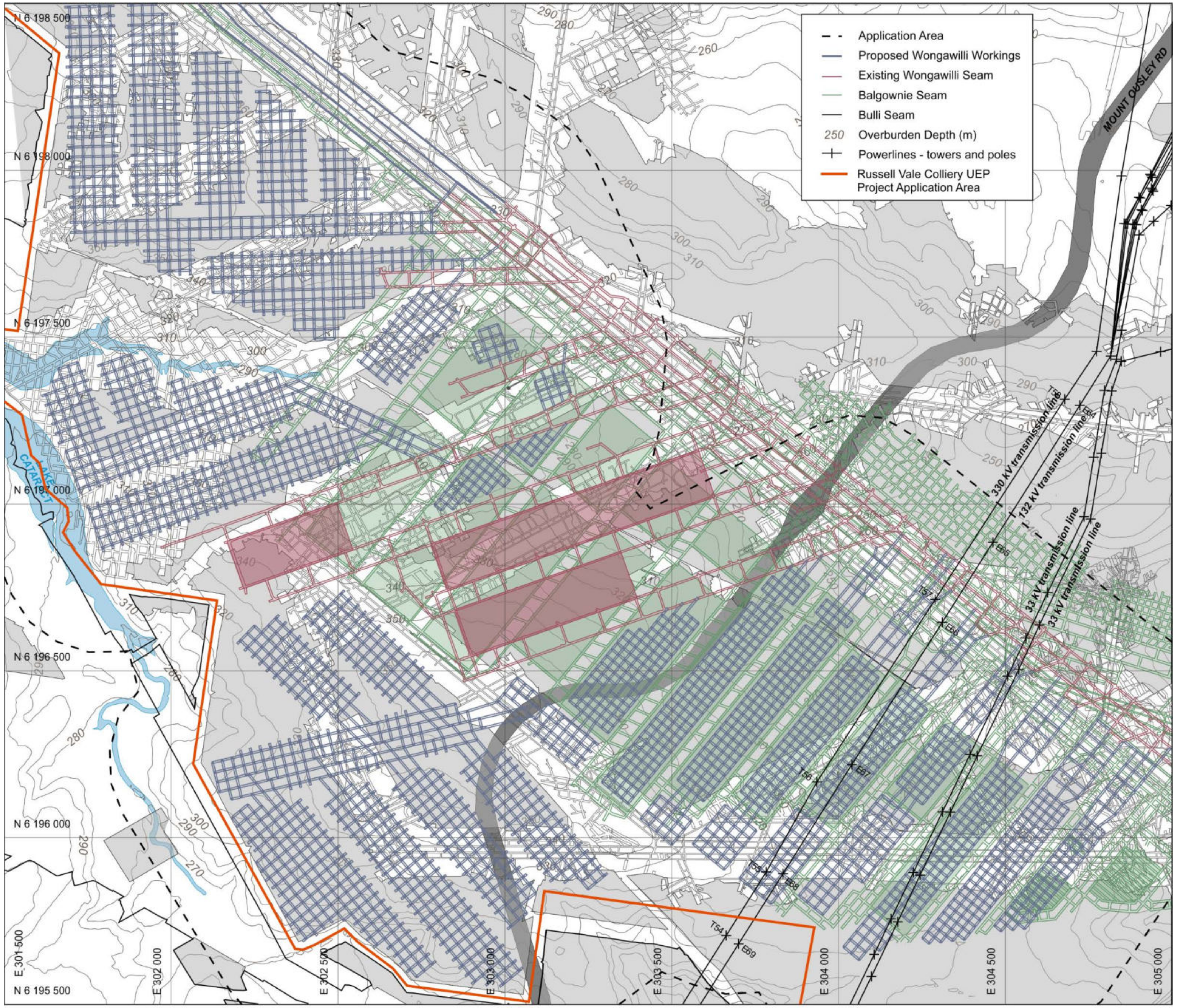

Figure 10: Existing Bulli, Balgownie and Wongawilli Seam workings and the proposed workings in this current application.

The proposed panels in the eastern area are aligned to fit directly below the extracted longwall panels in the Balgownie Seam to minimise interaction with the Balgownie Seam chain pillars. These chain pillars are supporting the weight of overburden strata across almost half the Application Area. By not mining directly below these chain pillars, the load bearing characteristics of the chain pillars are maintained, surface subsidence is reduced, and mining conditions are improved.

4. PILLAR STABILITY

In this section the stability of the proposed pillars is assessed based on the coal pillar design guidelines presented in AMIRA (1995). Comparison of pillar strengths derived using the University of New South Wales (UNSW 1999) formulae are also included. A review of the mechanics of pillar behaviour including the AMIRA (1995) study outcomes is discussed in Mills (2019).

4.1 Deformation Characteristics of Pillars

The strength and deformation characteristics of coal pillars are described in this section. The discussion presented shows how pillars of the size of those proposed to be formed at Russell Vale East continue to gain load carrying capacity as they deform so there is no potential for sudden collapse or load shedding at failure; characteristics that are observed in smaller pillars. The proposed mining is not expected to cause any perceptible subsidence at the surface.

Coal pillars derive their strength from two independent sources: cohesion and friction.

- Cohesive strength can be thought of as the strength that is derived from the chemical bonds that hold the fabric of the coal together. These bonds are variable in strength. The typical average in situ strength of most Australian coals is found to be approximately 6MPa. The cohesive strength of the bonds does not change significantly with external confinement. Once the bonds are broken, the material strength is lost and cannot be regained.

- Frictional strength can be thought of as the strength that is derived from confinement, much like the strength developed in sand. Frictional strength is zero without confinement but increases quickly with confinement at a rate of about 3-5MPa for every 1MPa of confinement. Frictional strength is effectively independent of cohesive strength and is retained even when the chemical bonds that generate cohesive strength have been broken. Frictional strength is much less variable than cohesive strength but its reliance on confinement means that it is sensitive to the geometry of the pillar and the strength characteristics of the roof and floor strata through which confinement is generated.

These two components contribute significantly to the different pillar behaviour observed for different sized pillars in different geological settings:

- Small pillars with a width to height of less than about three have a slender geometry that is unable to generate any significant confinement within the core of the pillar until all the cohesive strength has been exhausted and the pillar has collapsed. Their strength is clearly apparent as the point at which cohesive strength is lost and this strength varies with the variability of cohesive strength. Estimating pillar strength is a process that involves characterising the variability of cohesive strength. Probabilistic approaches have been found to be effective, provided there is sufficient margin between the average strength and the applied load.

- Larger pillars with a width to height ratio of greater than about eight in strong roof and floor conditions develop most of their strength from confinement provided to the core of the pillar. The variability in strength associated with the variability of cohesive strength is not a significant component of the strength of large pillars. Instead their strength is a function of the geological setting and the confinement that this setting provides to the core of the pillar.

- Larger pillars in low strength roof and floor conditions are not able to generate confinement at the same rate and their deformation behaviour becomes more dependent on cohesive strength when confinement cannot be effectively generated.

- Pillars with a width to height ratio between three and eight in strong roof and floor conditions show pillar deformation behaviour that is transitional between pillars that initially increase in strength and then lose strength as they deform, to pillars that maintain the same strength after they have reached peak load and on to pillars that, continue to increase in strength and load carrying capacity as they deform.

Figure 11 shows the pillar stress/strain relationship for pillars with width to height ratios from 1 to 10 (AMIRA 1995).

Despite Wongawilli Seam workings being categorised as having a weak coal/shale roof in a thick seam environment, monitoring of pillar behaviour reported in AMIRA (1995) indicates that Wongawilli Seam pillars display similar strength and deformation characteristics to Bulli Seam pillars in strong roof and floor conditions. This behaviour is contrary to the variable laboratory strength measurements for Wongawilli Seam coal and confirms the effect of frictional strength derived from confinement in larger pillars.

4.2 Pillar Loading

In multi-seam workings where, overlying seams have been partially or fully extracted, the vertical loads are not necessarily uniform and may become locally concentrated as a result of the overlying mining.

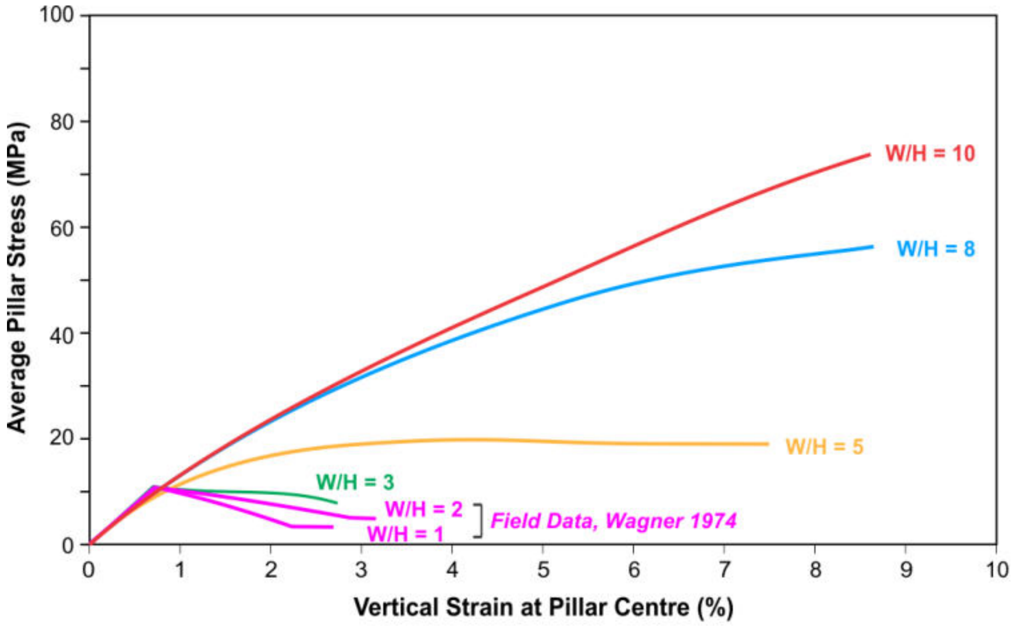

Figure 11: Pillar load/deformation characteristics for varying width/height ratios.

The loading conditions for the proposed pillars are expected to be variable due to the extraction geometries in the overlying seams. The variations could change from reduced loads under sections of goaf areas, to full tributary area loading below areas of reasonably sized first workings pillars, to elevated loading under chain pillars between the extracted Balgownie Seam longwall panels, or under abutment pillars and barrier pillars in both the Balgownie and Bulli Seams. These loading scenarios have been observed previously in Wongawilli Seam workings at Russell Vale East.

Areas of concentrated vertical stress are generally localised and easily identifiable on the mine plans. Unmined coal in these areas is effectively controlling the current subsidence levels from the previous mining.

Smaller pillars in the proposed layout for the Wongawilli Seam have minimum width to height ratios in the range of 8-10. These pillars are large enough to remain stable in the long term under the range of loading conditions anticipated, including in areas of elevated vertical load where the panel and adjacent barrier pillar geometries planned are able to share any increased load due to the stiffness and bridging capacity of the intact interburden strata.

4.3 Pillar Stability Assessment

The proposed pillars are expected to continue to gain load carrying capacity as they deform (as shown in Figure 11). In this circumstance, there isn't a critical "strength" value that represents a point of maximum load carrying capacity. Roadway deformation continues but the pillar load carrying capacity continues to increase. In this context, a factor of safety approach isn't very useful. Nevertheless, it is helpful to consider their nominal strength using traditional pillar design approaches.

The nominal strengths of the 25m and 30m square pillars indicated by the UNSW (1999) approach are 22MPa and 30MPa respectively. The nominal strength indicated by the Bieniawksi approach are 21MPa and 26MPa respectively.

Estimation of the pillar loading is more difficult because loading is expected to vary with overburden depth and relativity to previous mining in the overlying seams.

Under the extracted Balgownie Seam longwall panels where the 25m square pillars are located, maximum loading is expected to be reduced by the presence of the overlying extraction. As an upper limit, maximum loading is not expected to exceed the weight of the maximum overburden depth. The maximum overburden depth to the Wongawilli Seam in the areas of previous Balgownie Seam longwall extraction is estimated to be 350m. Tributary area loading on the 25m square pillars is estimated to be 14MPa. The 25m square pillars are therefore expected to be relatively lightly loaded compared to their nominal 21-22MPa strength.

Under areas in the Bulli and Balgownie Seam where there has been little or no nearby extraction, the maximum overburden depth is 380m. Maximum tributary area loading on 30m square pillars is estimated to be less than 15MPa. The 30m square pillars are therefore expected to be relatively lightly loaded compared to their 26-30MPa nominal strength.

In areas where the Bulli Seam has been extracted, vertical loading is expected to be less than tributary area loading and so the 30m square pillars are more lightly loaded than indicated above.

Under Bulli Seam and Balgownie Seam abutment areas, there is potential for higher vertical loading to develop where the weight of overburden strata is concentrated locally. The area over which abutment loading is concentrated is unlikely to be significantly greater than one or perhaps two pillars so the effect of this concentrated loading is expected to be relatively localised by comparison with the overburden depth.

Measured and inferred vertical abutment load distributions from longwall panels are expected to provide an upper limit on the pillar load concentrations around extracted pillar panels. The maximum abutment loading from a 200m longwall panel on a 30m wide pillar located at the goaf edge is estimated for 380m deep using the approach described by Mills (2001) as being 384MN/m or 19MPa distributed over a 24.5m square pillar. This load is approaching the 20MPa level where first workings are likely to become difficult to mine in a thick coal seam environment but is still less than the nominal strength of the 30m square pillars.

Even if the load calculations underestimate the actual loading, increased loads are likely to cause the large pillars proposed to have greater load carrying capacity as they deform. Under these circumstances, the roadways may become more difficult to develop but there is no potential for the pillars to collapse or for subsidence to increase suddenly as a result of such a collapse.

4.4 Pillars in Flooded Overlying Workings

Figure 12 shows the location of potential water lodgements in both the Bulli and Balgownie Seams relative to the existing workings and proposed mining layout in the Wongawilli Seam.

The largest of these potential water lodgements in the Bulli Seam is below the Full Supply Level (FSL) of and the 35° Angle of Draw offset to Cataract Reservoir in an area directly above the proposed Wongawilli Seam mining layout. In this section, this area is referred to as the subject area. The maximum water head in the subject area would be 13m. The maximum water head in the lodgement further to the west would be 17m.

Proposed mining in the Wongawilli Seam in the subject area includes two panels each comprising five headings. One of these panels extends approximately 120m horizontally below the edge of the potential lodgement within the subject area. The water here is estimated to be up to 6m deep.

The issue of pillar stability of the Bulli Seam workings in the subject area, if water is drained as part of inrush control measures for the proposed Wongawilli Seam mining, has been considered. The effect of draining the lodgement would be to reduce the buoyancy effect of the water and slightly increase the pillar loads. The effect is finite, but so small as to be negligible.

Our assessment of pillar stability indicates that the Bulli and Balgownie Seam pillars in the subject area are large enough to be long-term stable without any buoyancy effect.

4.4.1 Overlying Pillar Stability

Proposed first workings in the underlying Wongawilli Seam are not expected to have any significant effect on pillar loading in the overlying seams. The Bulli Seam is approximately 30m to 35m above the Wongawilli Seam. The formation of 5.5m wide roadways in the Wongawilli Seam is not expected to cause any significant change in loading in Bulli Seam pillars. Considerations of pillar stability in the Bulli Seam relate to the pre-existing stability of the pillar geometry and any effects associated with potentially draining the Bulli Seam.

Inspection of the Bulli Seam mine working plans and mine record tracings of the subject area (i.e. the 35^0 marginal zone) indicate that the first workings were mined between 1931 and 1942 with the secondary extraction of pillars from 1945 to 1947. The plans are consistent and are considered more reliable than plans for other pre-1931 areas and mining layouts in the Bulli Seam workings.

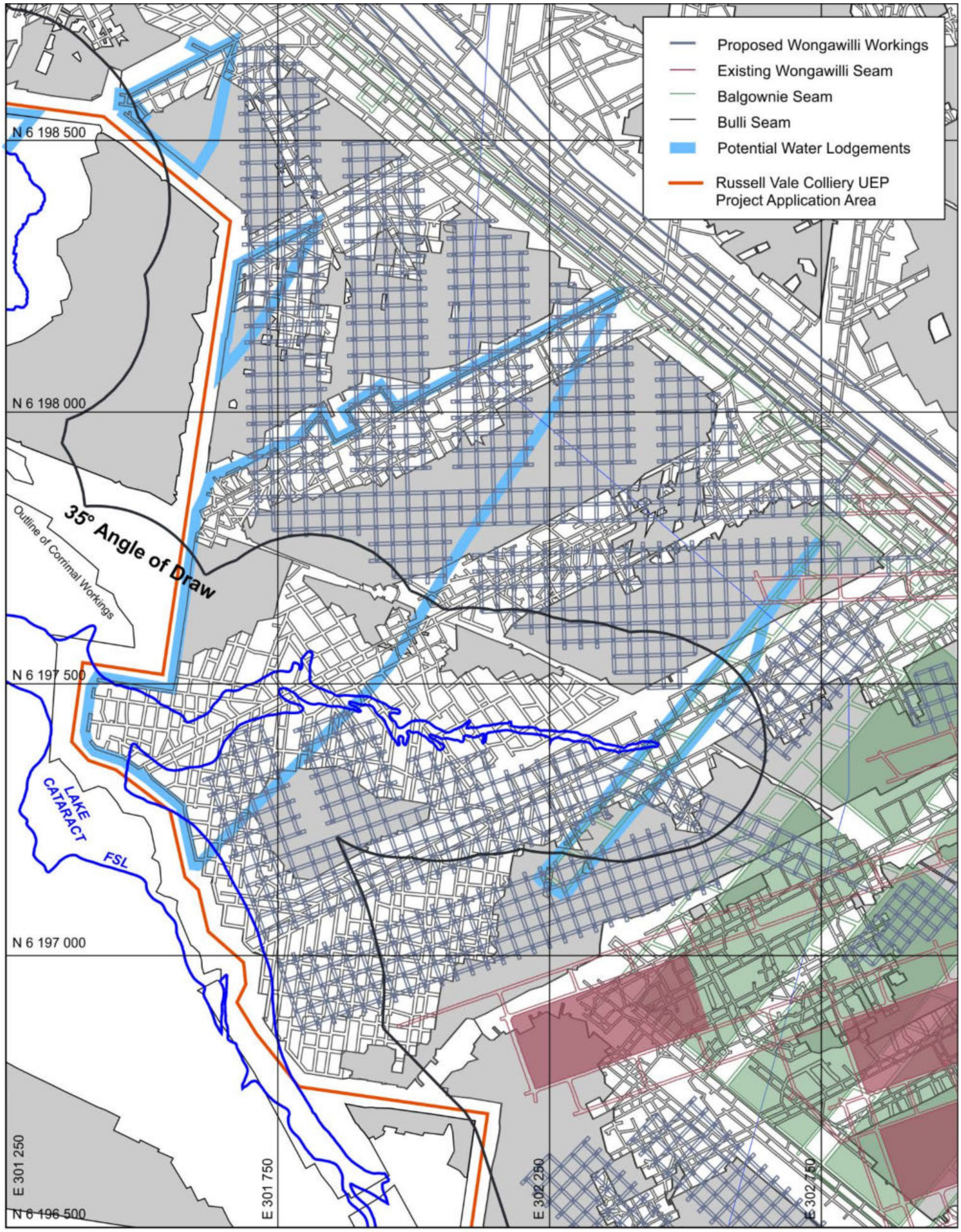

Figure 12: Potential water lodgements relative to existing workings and proposed mining.

The bord and pillar layout mined in the Bulli Seam in the subject area generally consisted of two heading panels and sub-panels. All pillar dimensions discussed in this section are coal rib to coal rib. The two parallel headings are separated by long, narrow pillars ranging in width from 12m to 15m. The pillars are typically rectangular in shape with the length being more than 1.5-2.0 times greater than width. Flanking the narrow two heading panels are wider pillars, generally 20m to 30m wide. Some irregular shaped pillars, including triangular pillars, were formed where the sub-panels intersect the two parallel headings.

The Bulli Seam pillars range in size from 12m by 24m up to 24m by 48m with many formed at 20m by 20m in size.

The overburden depth to the Bulli Seam in the subject area ranges from 270m to 300m and is 270m where the proposed Wongawilli Seam panels extend below the lodgement. The seam thickness and assumed mining height is 2.2m.

These pillars have a nominal width to height ratio in the range 5 to 11, but generally greater than 9. The pillars with larger width to height ratios, located in strong roof and floor conditions such as those typical of the Bulli Seam, would be expected to build strength as they become loaded. They are therefore not subject to becoming overloaded and losing strength.

Experience of monitoring pillar behaviour in the Bulli Seam reported in AMIRA (1995) indicates that pillar strength can be estimated using Bieniawski's pillar design formula:

$$Q_p = K\ (0.64+0.36\ W/H)$$

where Q_p is the nominal pillar strength, W is the pillar width, H is the pillar height and K is a constant to reflect the pillar geometry and the geological characteristics of the roof and floor conditions. A value of K = 6MPa provides a conservative estimate of the strength of square pillars in strong roof and floor conditions considered appropriate for the Bulli Seam at this location.

At an overburden depth of 270m, the Bulli Seam pillars across the subject area have a nominal strength of typically more than twice the load they are expected to carry under tributary area loading assuming roadway widths of 6m. The ratio of nominal strength to loading ranges from greater than 1 to about 2.6 and is more typically 2.1 for the 20m by 20m pillars. Close examination of the layout geometry in the subject area indicates the narrow (12m) pillars are flanked on both sides by pillars at least 24m wide. Assuming the unlikely scenario that the 12m pillars cannot carry any load, the tributary load of the overburden above these narrow pillars would then be required to be carried by the larger flanking pillars to maintain equilibrium. In this scenario the ratio of nominal factor of safety for 24m square pillars would be 1.8.

Using the UNSW (1999) pillar strength formulae the factor of safety for the 12m by 24m, 24m by 48m and 20 by 20m pillars would be 1.2, 3.6 and 2.3 respectively. In the scenario described above, the factor of safety for the 24m square pillars would be 2.3

Under these loading conditions, the Bulli Seam pillars within the subject area are expected to remain stable in dry conditions without any buoyancy effects associated with flooding.

For a maximum depth of water of 13m, the buoyancy effects are negligible for all practical purposes and wouldn't normally be considered in a pillar stability assessment. A maximum depth of 13m is estimated to reduce the vertical loading from 6.75MPa to 6.68MPa, a reduction of 1.1%. For the 12m, 20m and 24m square pillar geometries assessed this vertical stress reduction would increase the strength to load ratio of these pillars by about 4.0%.

A water lodgement is also thought to remain in the last gateroad development panel in the Balgownie Seam within the subject area. The maximum water depth in this panel is estimated to be 6m. The pillars in this panel are 40m wide with lengths ranging from approximately 40m to 70m. The seam thickness is around 1.3m and the mining height believed to be 1.5m. The nominal width to height ratio for these pillars is greater than 30 (for 1.3m seam thickness or approximately 27 for 1.5m mining height) and as such are long-term stable. Removing the water from this panel is not expected to have significant impact on the stability of these pillars or those above in the Bulli Seam.

5. FORECAST GROUND MOVEMENTS FOR THE PROPOSED WORKINGS

Some low-level deformation is expected as a result of the proposed mining due to elastic compression of the pillars and strata above and below these pillars. This compression has potential to result in low-level subsidence movements (less than 100mm and generally less than 30mm) with corresponding low levels of tilt and strain. Any such subsidence is likely to occur gradually. These movements are expected to be generally at or below survey monitoring tolerance particularly in areas where surface surveying techniques are constrained by environmental considerations. These subsidence movements are expected to be generally imperceptible and insignificant for all practical purposes.

Some ongoing horizontal movements may however continue; a legacy of previous mining. Any ongoing movements are likely to be small but nevertheless potentially noticeable along the section of Mount Ousley Road from near the topographic high point (ridge line south of Cataract Creek) down to areas adjacent to Cataract Creek.

Proposed mining in the Wongawilli Seam is not expected to cause any significant instability of pillars in the overlying seams. Stress concentrations from pillars in the overlying seam may cause locally higher deformation and instability around first working roadways at the Wongawilli Seam mining horizon. Geological features such as the Corrimal Fault and Dyke D8 are expected to locally concentrate stresses nearby, but increased deformations are likely to be generally limited to within a few metres of these features.

The proposed mining is not expected to contribute to significantly increased loading in the overlying Bulli Seam and therefore, in general, there is very limited potential for the proposed mining to lead to additional pillar instability in the Bulli Seam.

During recent longwall mining in the Wongawilli Seam, pillar instability in the overlying Bulli Seam has only been observed directly above extracted longwall panels. This pillar instability is a result of the significant ground disturbance caused by full extraction. Subsidence monitoring experience from longwall mining in the Balgownie Seam and the recent Wongawilli Seam longwalls indicates that the extent of any instability of remnant pillars in the Bulli Seam is likely to be limited to a few small areas where the Bulli Seam pillars are narrow and the voids between them wide enough that stability appears marginal irrespective of any further mining.

In these areas, there is some potential for pillar instability to lead to additional subsidence, potentially of the order of 1m to 2m should the pillars collapse over a large enough area. These areas of marginally stable pillars are located outside of areas of full extraction in the Bulli Seam, the Balgownie Seam and the Wongawilli Seam. Remnant pillars in the thinner Balgownie Seam are generally larger in plan area and are expected to generally display greater stability due to their higher width/height ratios.

Figure 13 shows one area of Bulli Seam pillars, adjacent to dykes, that were considered to be marginally stable when inspected in 2013. This area is below the conductors of the 33kV powerlines but away from the supporting pole structures. Sudden collapse of these pillars is possible and may result in surface subsidence but would not be expected to impact surface infrastructure.

The potential for pillar instability to lead to additional subsidence is discussed in detail in Section A1.1 of Appendix 1.

The probability of instability is difficult to estimate as uncertainty remains as to the reliability of the mine plans for some areas of Bulli Seam, and large areas of the Bulli Seam and Balgownie Seam workings are inaccessible, so confirmation of the current status of the pillars is not practical.

Targeted surface to seam drilling for groundwater monitoring (permeability testing and piezometer installation) in 2014 confirmed one area of Bulli Seam goaf to the east of Mount Ousley Road to be totally collapsed as expected. This borehole drilled down through the Bulli Seam goaf confirming it had collapsed as shown on the mine plan, through the Balgownie Seam chain pillar between Longwalls 5 and 6 and into the virgin Wongawilli Seam below. The area of Bulli Seam goaf was sufficiently large and the collapsed ground sufficiently tight that a column of water more than 200m high was able to be maintained in the borehole.

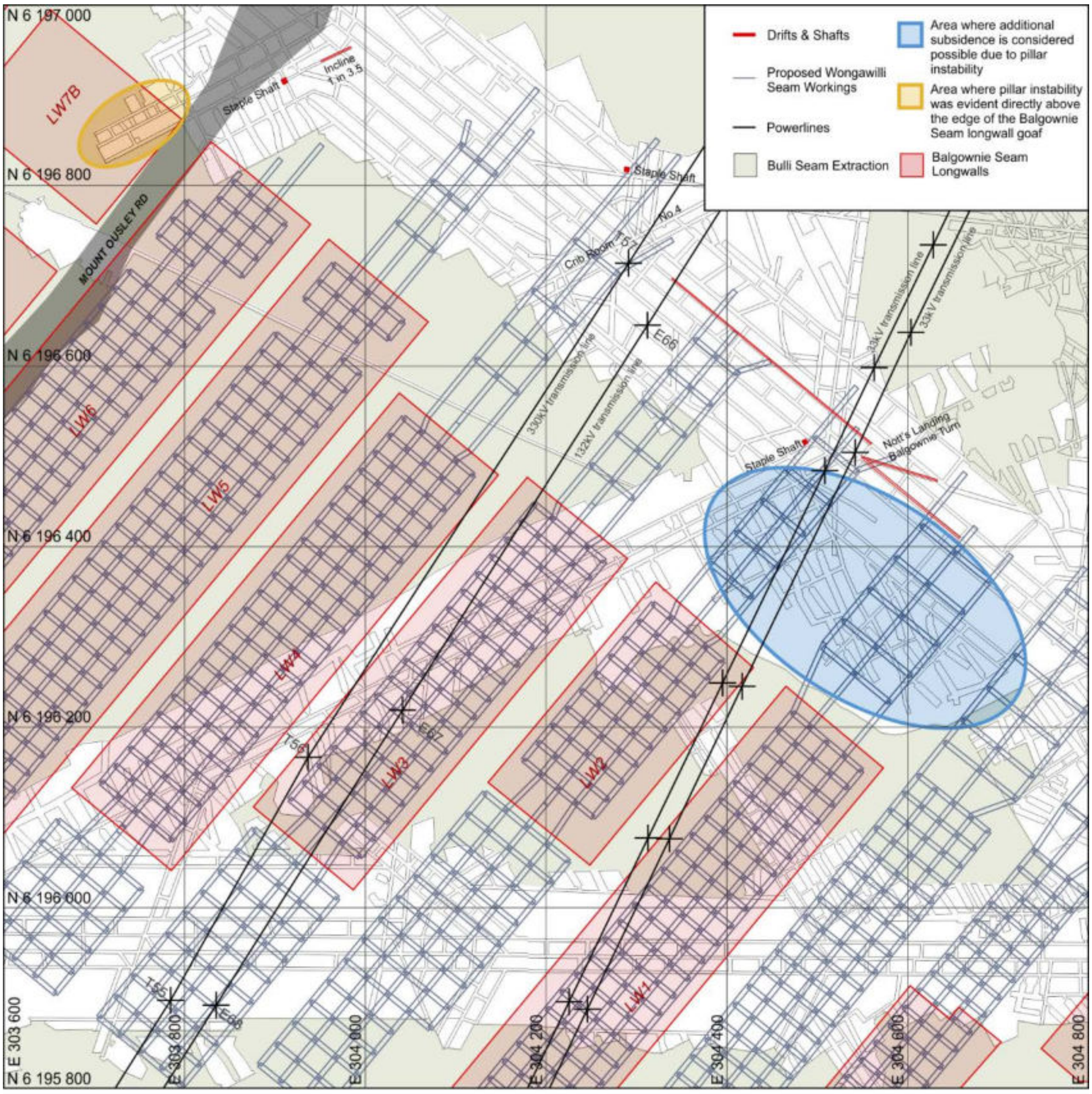

Figure 13: Plan showing areas of existing and potential pillar instability in overlaying Bulli Seam.

Viability approaches to manage the risk of Bulli Seam pillar instability causing surface impacts include:

- Accepting the risk as a pre-existing risk given that the hazard existed when the surface infrastructure was installed.
- Providing protection to subsidence sensitive infrastructure by installing, for instance, concrete cruciforms around the base of the power pylons to isolate them from potential impacts from mining subsidence.

6. IMPACT ASSESSMENT OF FORECAST GROUND MOVEMENTS

The subsidence movements forecast for the proposed layout are not expected to cause any significant impacts to natural surface features within the Application Area. Any additional impacts to the natural and built surface features from the proposed first workings would be difficult to distinguish from those associated with previous mining activities.

It is recognised that the proposed mining plan involves mining within the DSC Notification Area for Cataract Storage Reservoir. The proposed mining plan has minimum width/height pillars within the 1.2 times depth Restricted Zone, the 0.7 times depth (35^0 angle of draw) Marginal Zone and up to the FSL of the Reservoir. This mining will therefore require the consent of the Dams Safety Committee.

SCT Report WCRV4466A "Assessment of Corrimal Fault and Dyke D8 at Russell Vale East as Risks to the Stored Waters of Cataract Reservoir" (SCT 2015) concludes that there is no credible risk of inflow between the stored waters of Cataract Reservoir and the mining horizons through either the Corrimal Fault or Dyke D8 as a result of the proposed UEP-PPR mining layout for longwall extraction.

Any effects from mining first workings roadways in the Wongawilli Seam are expected to be generally limited to a few metres around the proposed roadways. No significant subsidence impacts or environmental consequences are expected from mining through or in the vicinity of the Corrimal Fault and Dyke D8 by the proposed first workings layout. The likelihood of impacts to the Corrimal Fault is considered to be very low. The consequences of any impacts to the Corrimal Fault are expected to be negligible. Any impacts on groundwater are expected to be limited to the immediate vicinity of the Wongawilli Seam and only in the area of the proposed mining.

Large areas of the surface within the Application Area are currently in limiting equilibrium (on the verge of moving) both naturally and because of previous mining, including Longwalls 4-6 in the Wongawilli Seam. Further narrow tension cracks and minor compression impacts to the Mount Ousley Road pavement are considered possible because of ongoing subsidence associated with this previous mining. Small additional valley closure movements across Cataract Creek may also continue regardless of any future mining. Effects such as increased groundwater levels following periods of high rainfall and seasonal temperature variations have potential to upset the equilibrium conditions and cause additional movements. The proposed mining is not expected to increase or otherwise change the potential for these effects to cause additional, perceptible impacts.

The small subsidence movements that are forecast for the proposed mining layout are not expected to cause perceptible impacts to any natural surface features including upland swamps, cliffs, steep slopes, drainage lines, creeks, Cataract Creek and Cataract Reservoir.

Proposed mining is not expected to increase interactions between the mine and surface water or impact surface water dependent ecosystems or groundwater at levels above those currently experienced.

There is no significant potential for additional interaction between surface water, groundwater and the underground mining horizons. The deformations associated with strata compression are small in magnitude. There is very limited potential to create additional zones where hydraulic conductivity would be increased.

The Illawarra Escarpment, in particular the section of Hawkesbury Sandstone outcrop at Brokers Nose, is remote from the Application Area and is not expected to be impacted by the proposed mining. It should be recognised that there is always potential for cliff falls to occur naturally as part of the ongoing erosion processes, but the proposed mining is not expected to increase this potential.

The telecommunications infrastructure at Brokers Nose and the bridge at the Picton Road Interchange are remote from the proposed mining. There is no potential for mining induced ground movements at this infrastructure from the proposed mining.

The 330kV and 132kV powerlines located east of Mount Ousley Road are both supported on steel truss pylons. These pylon structures are very sensitive to differential ground movements from subsidence, but the ground movements associated with the proposed mining are so low as to be well within the tolerance of these structures. The only potential for these structures to be impacted would be from subsidence movements associated with localised instability of any marginally stable Bulli Seam pillars.

Inspection of the workings shown on mine plans below the eight pylon towers located within the Application Area indicate that the potential for additional subsidence from destabilised pillars in the upper seams is low. However, this potential cannot be eliminated. While the probability of additional subsidence is considered low, the consequences to this critical infrastructure from greater subsidence than forecast is likely to pose an unacceptable risk to asset owners and regulators. A strategy to protect the towers from the potential for subsidence impacts from pillar instability is likely to be required. This strategy is likely to involve the use of cruciforms, relocating towers to areas where pillar stability can be confirmed or stabilising the mine voids using some form of cement stabilised fill material.

The two 33kV powerlines located further to the east are not expected to be impacted by the low levels of subsidence movements forecast for the proposed first workings mining. These powerlines are supported on single and double pole structures. Such structures are generally tolerant of subsidence movements. The potential for additional subsidence at these pole locations from destabilised pillars in the upper seams is also considered to be low.

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APPENDIX 1

Appendix 1 provides a review of the subsidence effects and subsidence impacts of previous mining activity in the Russell Vale East area as context for the imperceptibly low levels of ground movements expected from the proposed mining. This information was originally presented in SCT (2014) to support the UEP-PPR application. Sections of that report are presented together with additional monitoring or observations since the UEP-PPR application was lodged.

In the following sections the PPR Assessment Area is different to the Application Area for the current proposal. The PPR Assessment Areas included the 600m Study Area around the proposed longwall panels and the further 1.5km far-field effects zone.

A1. Review of Previous Mining Activity and Associated Impacts

An unusual characteristic of the PPR Application Area is the presence of previous mining activity in two other seams. Figure 14 shows the extent of previous secondary extraction in the Bulli, Balgownie and Wongawilli Seams within the PPR Application Area.

This previous mining provides a number of opportunities that are not usually available in single seam mining applications but also brings a number of differences as well. Geological structure and seam contour are much better known as a result of previous mining activity than would normally be possible for single seam mining.

Previous mining activity provides an opportunity to examine the mining impacts over timeframes of 50-100 years for the Bulli Seam and 30-40 year for the Balgownie Seam mining. The subsidence movements associated with the earlier mining have been estimated for the Bulli Seam and measured for the Balgownie Seam providing a baseline of impact experience and recovery that is not typically available.

The ongoing nature of the mining operation at Russell Vale Colliery provides the opportunity to inspect the mine workings in some areas of the Bulli Seam and the Balgownie Seam to better understand the nature of the potential interactions between seams and the potential for pillar instability, particularly in the Bulli Seam, to cause unexpected additional subsidence. For instance, a site visit was made by SCT on 21 June 2013 to inspect the workings in all three seams.

Subsidence monitoring data available from mining in the Balgownie Seam and more recently from three longwall panels in the Wongawilli Seam is available and this data provides a basis for confirming overburden behaviour and estimating the potential for further subsidence. This data indicates that while there are some significant differences in behaviour compared to single seam mining, the multi-seam behaviour is reasonably predictable and occurs predominantly within the bounds of the individual panels that were mined. This data and observations of previous ground movements indicate that the ground movements expected to result from the proposed mining are likely to be insignificant for all practical purposes.

Figure 14: Plan showing extent of previous secondary extraction in Bulli Seam (black), Balgownie Seam (red) and Wongawilli Seam (grey) in the Application Area.

A1.1 Bulli Seam Workings and Associated Subsidence

The Bulli Seam was mined initially using hand bord and pillar mining techniques from the 1890's through until pillar extraction became possible with improvements in mining technique and the arrival of mechanised mining. Some of the standing pillars associated with the main headings and original mining areas were extracted during the later stages of retreat. Mining in the Bulli Seam within the PPR Application Area had effectively finished by the 1950's. Areas of pillar extraction in Corrimal Colliery immediately to the south are also included in the estimation of subsidence from the Bulli Seam because they fall within the PPR Application Area.

There are no known records of subsidence monitoring for the period of mining in the Bulli Seam. However, it is possible to estimate the levels of subsidence that are likely to have occurred given the geometry of the panels mined and estimating the likely extraction percentages.

Figure 15 shows contours of the surface subsidence interpreted as being caused by pillar extraction operations in the Bulli Seam. This subsidence has been estimated based on subsidence monitoring results and subsidence profiles from mining in the Bulli Seam further to the west above the T and W (200 and 300 series) longwall panels at South Bulli and subsequent pillar extraction operations.

An underground site inspection conducted on 21 June 2013 showed that there are existing bord and pillar workings alongside the Bulli Seam main headings that may be destabilised if they were disturbed by further mining.

Similar workings were directly mined under by the Balgownie Seam longwall panels and it is clear from the underground inspection that these overlying pillars were destabilised in the area directly above the Balgownie Seam longwall goaf. Both these areas are shown in Figure 16. There did not appear to be any evidence that the footprint of instability extended significantly beyond the footprint of the underlying goaf, but it is considered possible that this potential may exist in some places where there are localised areas of standing pillars remaining.

The formation of isolated roadways in the Wongawilli Seam is not expected to have potential to cause instability in these Bulli Seam pillars. There is no known evidence of this effect at the Russell Vale site. However, the possibility cannot be ruled out completely.

Where large areas have been shaded (refer to Figure 14) to represent the completion of mining, the detail of the Bulli Seam extraction is not available. These areas are likely to include different levels of mining ranging from solid coal, large standing pillars, standing pillars associated with Welsh bords, and goaf areas where there has been pillar extraction or the pillars have previously collapsed.

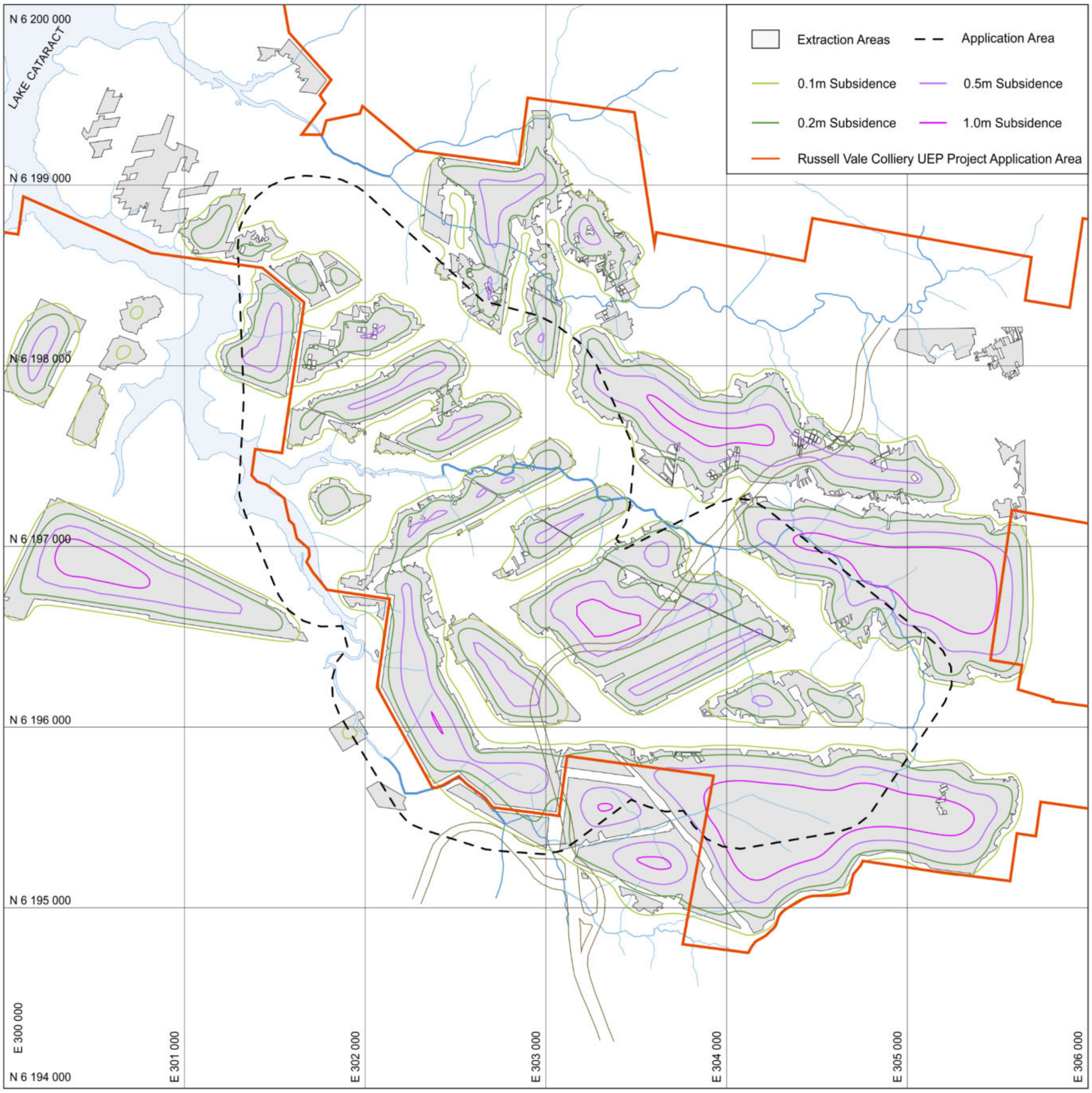


Figure 15: Plan showing estimated subsidence movements likely to have been associated with pillar extraction operations in the Bulli Seam.

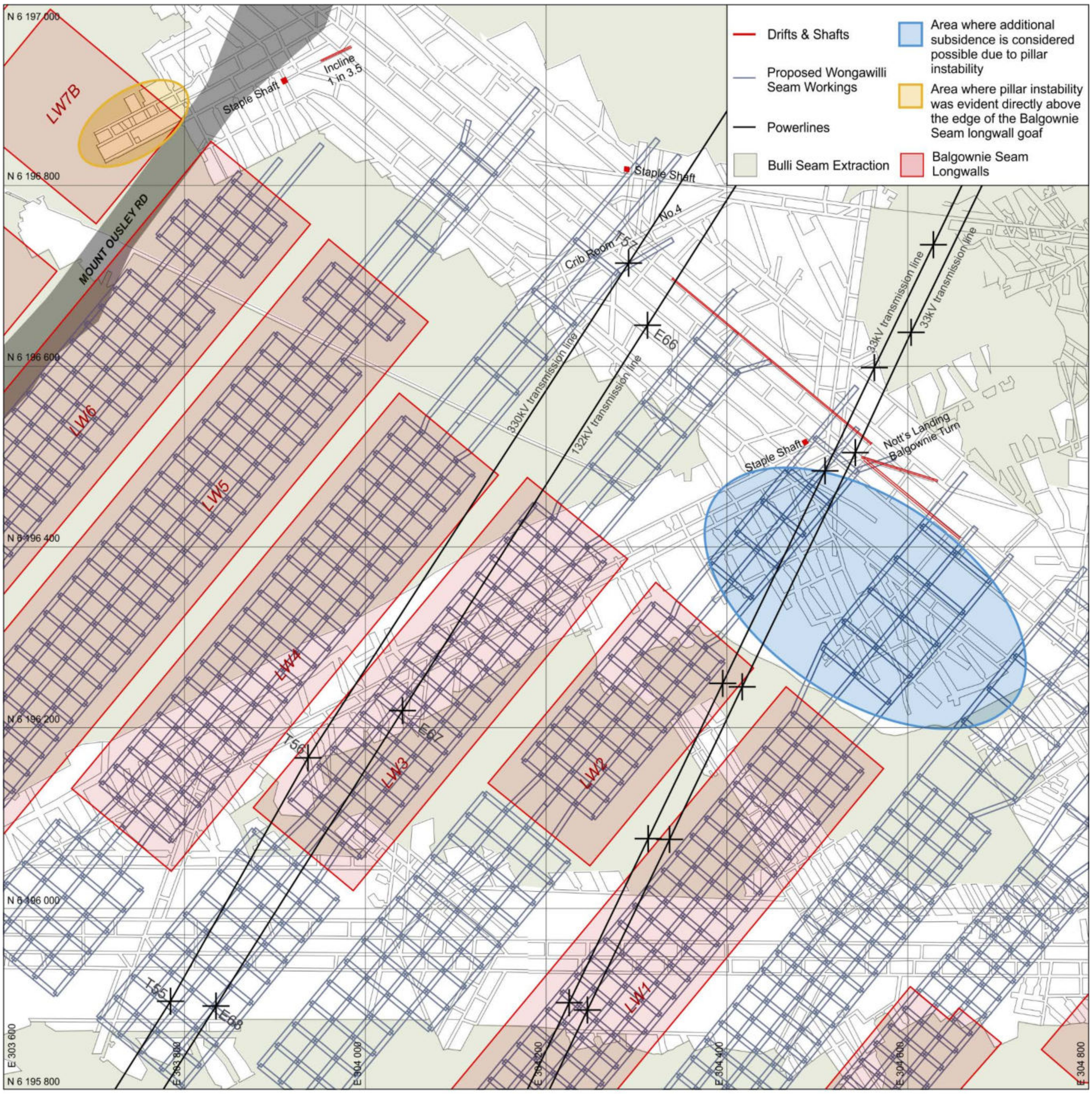


Figure 16: Plan showing areas of existing and potential pillar instability in overlaying Bulli Seam.

The downward movements that occurred during Balgownie Seam mining and were observed on the surface as subsidence provide a basis to differentiate these shaded areas where they have been directly mined under by the Balgownie Seam longwall panels. Small pillars that have been mined under by the Balgownie Seam longwall panels are considered likely to have been destabilised during the 1m to 1.5m downward movement in the Bulli Seam that would have occurred as these pillars were mined under.

Subsidence monitoring above the Balgownie Seam longwall panels is able to differentiate areas where there has been some additional subsidence consistent with pillar instability, areas where there has been additional consolidation of an existing Bulli Seam goaf, and areas where there has been either no mining in the Bulli Seam, or the Bulli Seam pillars are large enough to behave like solid coal.

Without having access to confirm, there is considered to be potential for some pillars in the Bulli Seam to remain standing just beyond the edges of the extracted Balgownie Seam longwall panels. The stability of these pillars is difficult to assess with confidence, particularly in areas in the Bulli Seam that are shaded to indicate pillar extraction but for which the detail is lacking. It is possible that these pillars are in a state of imminent instability that could lead to further subsidence in the future.

In the unlikely event of further subsidence due to pillar instability in the Bulli Seam without any further nearby mining activity in the Wongawilli Seam, any consequential impacts would be due to historic mining and any remediation costs would be covered by Subsidence Advisory NSW (formerly the Mine Subsidence Board). If, on the other hand, subsidence due to pillar instability in the Bulli Seam were to occur after mining in the Wongawilli Seam, even if only in the general vicinity, WCL would be in the position of needing to demonstrate the subsidence was not due to their recent mining activity to avoid being held responsible under the Work Health and Safety Act 2011 and specifically the Work Health and Safety (Mines and Petroleum Sites) Regulation 2014 for any impacts that may occur. This burden of proof may be difficult to support.

The Bulli Seam subsidence estimates shown in Figure 15 include refinements based on the ground behaviour observed during longwall mining in the Balgownie Seam. Although it is not possible to interpret the characteristics of some of the other large Bulli Seam goaf areas that have not been directly mined under in the Balgownie Seam, these other large goaf areas are remote from the areas where the PPR longwall panels are proposed.

The detail of the Bulli Seam pillars is available in some areas close to the main headings as shown in Figure 16. The site visit to this area indicated that additional subsidence due to pillar instability would be possible in this area if the pillars were to be destabilised for any reason although the surface subsidence that may result is likely to be relatively small given the narrowness of the panel at an overburden depth of 270m.

The issue of a "pillar run" in the Bulli Seam was raised in the Pt 3A submissions on the previous UEP mine plans. As indicated above, there is considered to be potential for a classical "pillar run" associated with pillar instability, but the geometries in the Bulli Seam and the evidence from previous mining in the Balgownie Seam make it unlikely that such an event would extend more than a few hundred metres from the goaf edge (i.e. the extent of the panel of standing pillars). The subsidence from such an event would be limited to low levels of less than a few hundred millimetres maximum due to the narrow panel width of standing pillars small enough to be destabilised and would be limited to only those areas where there are small standing pillars that have not previously been mined under in the Balgownie Seam.

The terms "pillar run" and "pillar creep" have been used in some of the submissions to describe the phenomenon that is perhaps better described as "stress redistribution" because of the relatively smaller ground movements involved, typically less than 100mm. As one area is subsided, pillars become more heavily loaded, and compress slightly causing lateral migration of low-level subsidence movements well beyond the limits of subsidence normally associated with single seam mining. This phenomenon is particularly common where panels are relatively narrow compared with overburden depth and surface subsidence is controlled mainly by elastic compression of the pillars between panels.

A similar process can also occur for horizontal movements as horizontal stresses are redistributed and dilation of subsiding strata causes horizontal movement in a downslope direction. Again, the ground movements tend to be small second order movements that may cause perceptible low-level cracking on hard surfaces such as sealed roads especially adjacent to topographic high points, but such movements are usually not significant because they tend to be of small magnitude and occur over large areas.

The proposed workings in the Wongawilli seam are not expected to cause any significant instability of pillars in the overlying seams.

A1.2 Balgownie Seam Workings and Associated Subsidence

Figure 7 shows the extent of the Balgownie Seam workings. There are eleven longwall panels extending to the south of the main headings. Apart from development headings, the remaining coal was recovered from three small panels of pillar extraction with continuous miners in the east and more recently as a panel of pillars formed up as first workings against the sill complex in the north.

Longwall mining in the Balgownie Seam started in September 1970 at Longwall 1 and finished in May 1982 at Longwall 11. The first six panels were located east of the current Mount Ousley Road alignment and ranged in width from 141m to 145m. The last five panels were located west of Mount Ousley Road and ranged in width from 185m to 189m. These later panels were split into two parts either side of the D8 Dyke. These longwalls mined directly below the road alignment.

A1.2.1 Vertical Subsidence

Surface subsidence was monitored along the centreline of each of the eleven longwall panels and on three cross-lines. The vertical subsidence was monitored at regular intervals during panel retreat above the initial panels and less frequently during mining of the last few panels. Surface strains were also measured during the last panel.

Figure 17 shows an example of the subsidence measured on the second cross-line that extends from the centre of Longwall 5 to the solid coal west of Longwall 11. The characteristics of the subsidence measured that are of relevance show:

- The chain pillars are clearly evident in the subsidence profile with 0.5m to 0.75m of subsidence directly over these pillars.
- Coal left in the Balgownie Seam around the dyke is clearly evident as reduced surface subsidence.
- The maximum sag subsidence in the centre of each panel is reduced in areas where the panels are narrower (0.2m in narrow panels compared to 0.5m above the wide panels).
- The sag subsidence is more in areas where the Bulli Seam has been extracted.
- The subsidence is greatest (1.42m) over Longwall 10 in an area on the fringe of Bulli Seam goaf where full subsidence during mining of the Bulli Seam was prevented by the presence of solid abutment coal or marginally stable pillars were destabilised.
- Surface subsidence occurred primarily within the geometry of the Balgownie Seam longwall panels.
- The goaf edge subsidence is greater and extends further when there is overlying Bulli goaf, but this effect is a second order effect.

These different characteristic behaviours have been considered for each of the subsidence lines and the maximum subsidence observed is able to be used to characterise the condition of the Bulli Seam goaf above.

Figure 18 shows the maximum subsidence observed for each of the longwall panels. The different areas can be divided up as shown in Table 1 based on where there are pillars and goaf in the two seams.

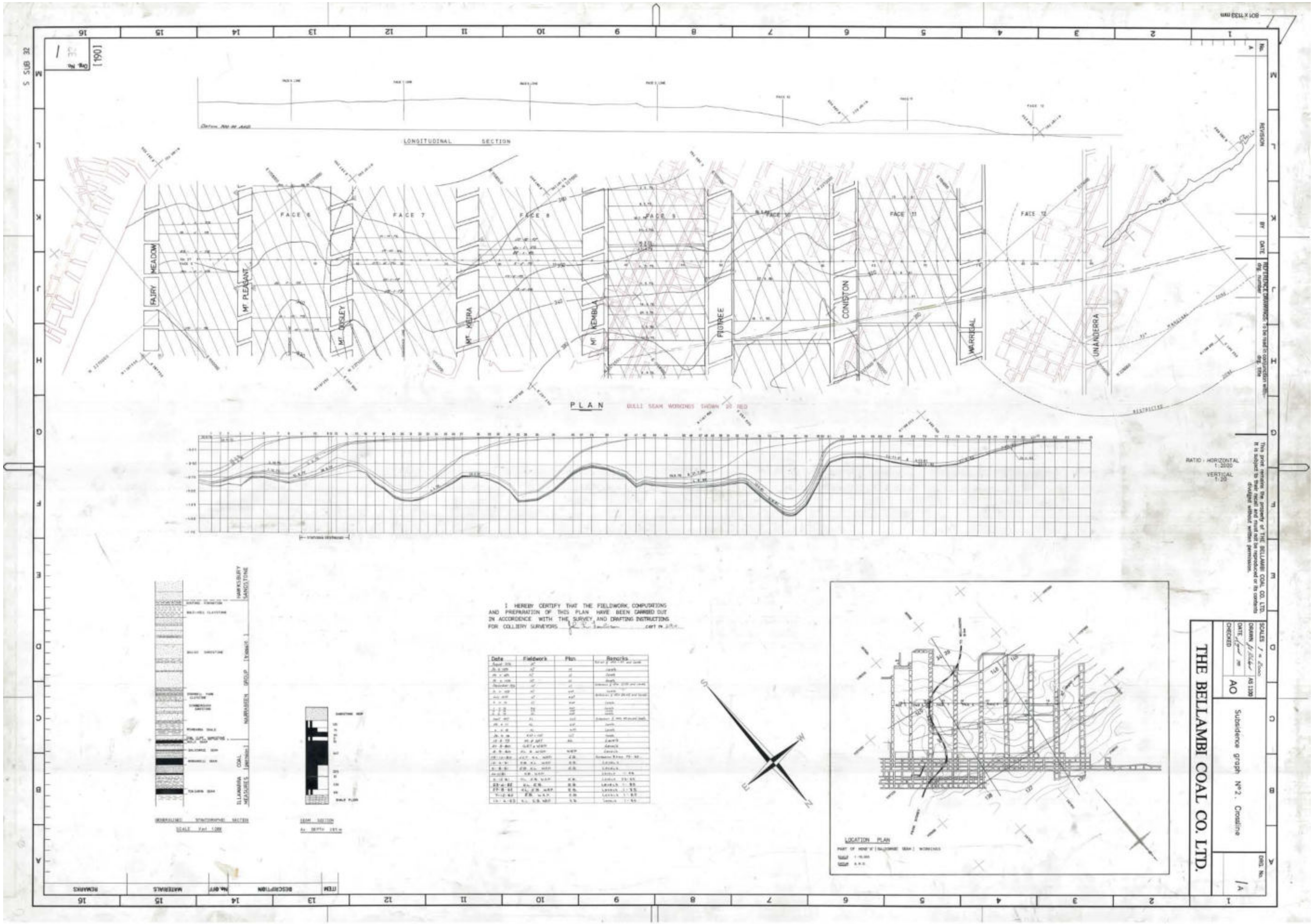


Figure 17: Example of subsidence monitoring of Balgownie Seam longwall panels.

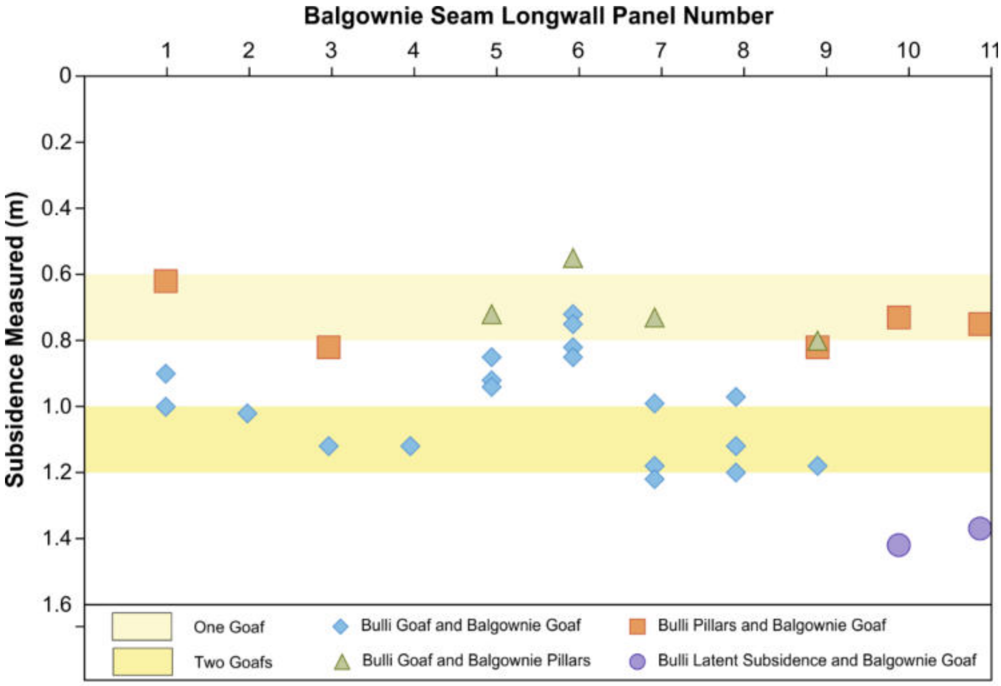


Figure 18: Maximum subsidence observed for each longwall panel in the Balgownie Seam.

Table 1: Subsidence Observed in Different Conditions

	Bulli Seam Pillars	Bulli Seam Goaf	Unstable Bulli Pillars
Balgownie Seam Pillars	Low-level subsidence (<0.2m)	0.6-0.8m	Low-level(<0.2m)
Balgownie Seam Goaf	0.6-0.8m	1.0-1.2m	1.4m

In areas where there are Balgownie chain pillars and pillars in the Bulli Seam, the subsidence directly over the chain pillars is less than 0.2m. In areas where there are pillars in one seam and extraction in the other seam, surface subsidence is between 0.6m and 0.8m. Where there has been extraction in both seams, the maximum incremental subsidence is in the range 1.0m to 1.2m – i.e. approaching 80% of the nominal mining height of the second seam mined.

In areas where there is clearly potential for either latent subsidence because the Bulli Seam goaf is narrow and bridging (such as the zone of high subsidence associated with mining Longwall 11 in the Balgownie Seam) or along a goaf edge where full subsidence has not been able to develop during mining the first seam (such as the high subsidence zone associated with mining Longwall 10 in the Balgownie Seam), the incremental subsidence reaches 1.4m and is of the order of 100% of the mining height of the second seam mined.

The 1.4m of subsidence observed in these circumstances is likely to have a component of destabilisation of standing pillars in the Bulli Seam caused by mining in the Balgownie Seam. Up to 0.7m of subsidence would be expected from mining below pillars in the Bulli Seam plus an additional 0.8m subsidence in the Bulli Seam of about 30% of the 2.2m mining height given an extraction ratio of about 30%. The total subsidence would therefore be about 1.5m and of the same magnitude as the subsidence observed.

Figure 19 shows the subsidence measured during mining the Balgownie Seam based on interpolation of the subsidence monitoring data. This data represents the incremental subsidence associated with mining the Balgownie Seam given that all the Bulli Seam subsidence had already occurred prior to the subsidence pegs being installed.

Maximum subsidence is 1.42m and 1.33m over Longwalls 10 and 11 respectively but in most of the areas, subsidence over the longwall goafs is in the range 0.6m to 1.2m.

A1.2.2 Horizontal Strains and Tilts

Maximum strains measured over Longwall 11 ranged from 3-4mm/m along the panel to peaks of 14mm/m in compression across the topographic low point of Cataract Creek and 9mm/m in tension on the slope beyond. For the maximum subsidence of 1.4m and an overburden depth to the Balgownie Seam of 260m at this location, the strain peaks measured indicate a relationship between maximum strain and maximum subsidence of:

$E_{max} = 500\ S_{max} / D$ for systematic strains and

$E_{max} = 1500\text{-}2500\ S_{max} / D$ for non-systematic strains associated with valley closure and steep topography.

These compare reasonably with the peak strain subsidence relationships presented by Holla and Barclay (2000) for the Southern Coalfield which indicate:

$$E_{max\ tensile} = 1500\ S_{max} / D$$
$$E_{max\ compressive} = 3000\ S_{max} / D$$
$$Tilt_{max} = 5000\ S_{max} / D$$

for peak strains and tilts that include non-systematic strains and tilts associated with valley closure and steep topography. The peak compressive strains tend to be apparent in topographic low points and the tensile strains tend to be more apparent at the start of panels in ground sloping in the same direction as mining, and along topographic high points such as ridges.

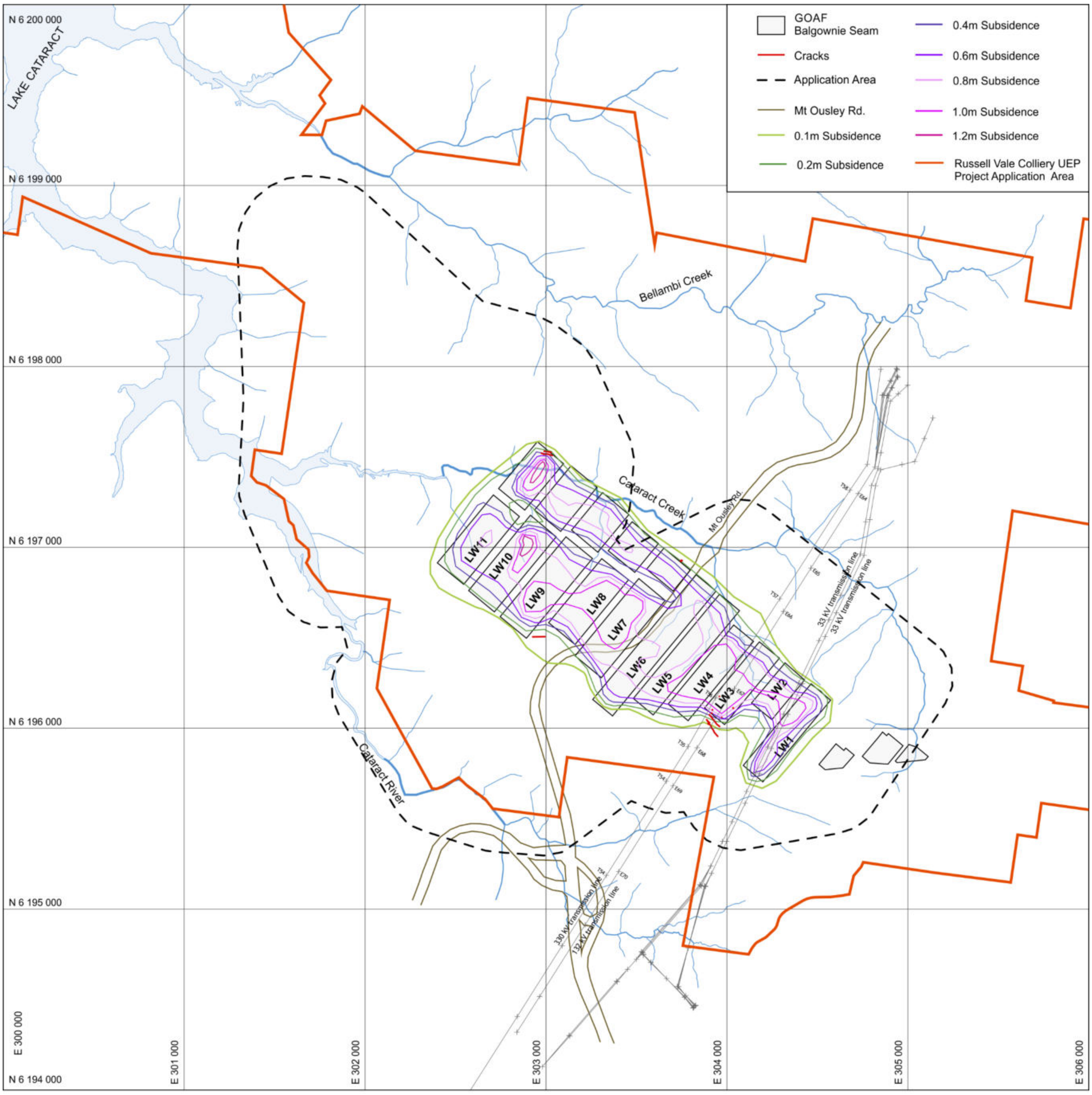


Figure 19: Contours of subsidence measured above the Balgownie Seam longwall panels.

A1.2.3 Valley Closure and Upsidence

The 14mm/m compressive strain peak measured across Cataract Creek on the centreline of Longwall 11 was measured between pegs spaced 18m apart. Compressive strain of 4mm/m was measured between the next two pegs spaced 15m apart. These measurements imply a total closure across the creek of about 310mm.

The ACARP method for estimating valley closure developed by Waddington and Kay (2002) indicates the incremental valley closure for Longwall 11 as being of the order of 200-300mm and is therefore consistent with the closure measured during mining of Longwall 11. The agreement is relatively close between measured and calculated even though the geometry associated with the short longwall panels is irregular and well outside the database of experience on which the ACARP method is based.

Valley closure at other locations is also evident as upsidence in the subsidence profiles that extend across Cataract Creek. Table 2 summarises the upsidence measured as well as the incremental upsidence calculated for each longwall panel to allow direct comparison with the upsidence measured for each longwall panel during mining of that panel.

Table 2: Comparison of Measured and Calculated Upsidence

Balgownie Longwall Panel	Distance from End of Panel (m) (positive over goaf)	Incremental Upsidence Indicated (mm) (not necessarily peak)	Overburden Depth (m)	Maximum Subsidence (m)	Calculated Upsidence for each panel individually (mm)
3	170	130	230	1.1	70
4	30	210	230	1.1	100
5	0	80	230	0.8	100
6	-75	30	240	0.8	120
8	-106	80	240	0.9	130
9	-30	120	250	0.9	110
10	20	100	260	0.9	100
11	116	100	260	1.4	90

Upsidence measurements shown in Table 2 are made at the peg locations. The pegs are 15m to 20m apart while the upsidence tends to peak over a distance of only a few metres. The location of the pegs may not necessarily coincide with the peak upsidence, so the measured upsidence is considered to be a lower bound estimate of the maximum upsidence that occurred. The measurements made during mining of the Balgownie Seam longwall panels indicate that Cataract Creek has already sustained upsidence in the range 100mm to 200mm from this mining with some additional upsidence likely to have occurred during mining in the Bulli Seam.

The ACARP method for estimating upsidence for single seam mining operations indicates upsidence and valley closure that are consistent with the values measured. This method appears likely to still be relevant for estimating upper bound upsidence and valley closure for future mining activity in the Wongawilli Seam even in a multi-seam mining environment

A1.2.4 Total Cumulative Subsidence

Figure 20 shows the total cumulative subsidence estimated by adding together the estimated subsidence from the Bulli Seam and the measured subsidence from the Balgownie Seam using Surfer and a 10m by 10m grid spacing. The locations of surface features that have or may have been impacted by subsidence from this previous mining are also shown.

The total cumulative subsidence associated with mining both the Bulli Seam and Balgownie Seam is an estimate because the Bulli Seam subsidence was not measured. The total subsidence is nevertheless useful as an indicator of maximum subsidence when interpreting subsidence impacts from previous mining activity.

Maximum cumulative subsidence is approximately 1.9m in the area above Longwalls 7 and 8 in the Balgownie Seam just to the west of the Mount Ousley alignment on the slope to the south of Cataract Creek. More generally the cumulative subsidence is in the range 0.3m to 1.3m.

A1.3 Wongawilli Seam Longwall Mining

In this section, the results of subsidence monitoring in Longwalls 4 and 5 are reviewed.

Three short longwall panels were mined in the Wongawilli Seam between 2012 and 2015 creating voids at the mining horizon that are 150m wide. Longwall 4 was extracted between 21 April and 21 September 2012. Longwall 5 was extracted between 15 January 2013 and early January 2014 although the panel was substantially complete by 18 December 2013. The first 340m of Longwall 6 was extracted between 5 May 2015 and 7 July 2015.

The subsidence from mining the first 340m of Longwall 6 has occurred in a separate small area. Although there has only been limited extraction whereby subsidence and disturbance of the overburden strata is yet to fully develop the measurements of subsidence effects and impacts observed are within expectation. This data set includes the observation of angle of draw and the extent of destabilisation of previous workings in the upper seams. SCT understands WCL intends to mine the remaining 25m of the approved length of Longwall 6 to facilitate the recovery of the longwall equipment. The equipment will then be removed and brought out of the mine.

It is convenient to discuss the surface subsidence as comprising two components. These two components are described in detail in Mills (1998).

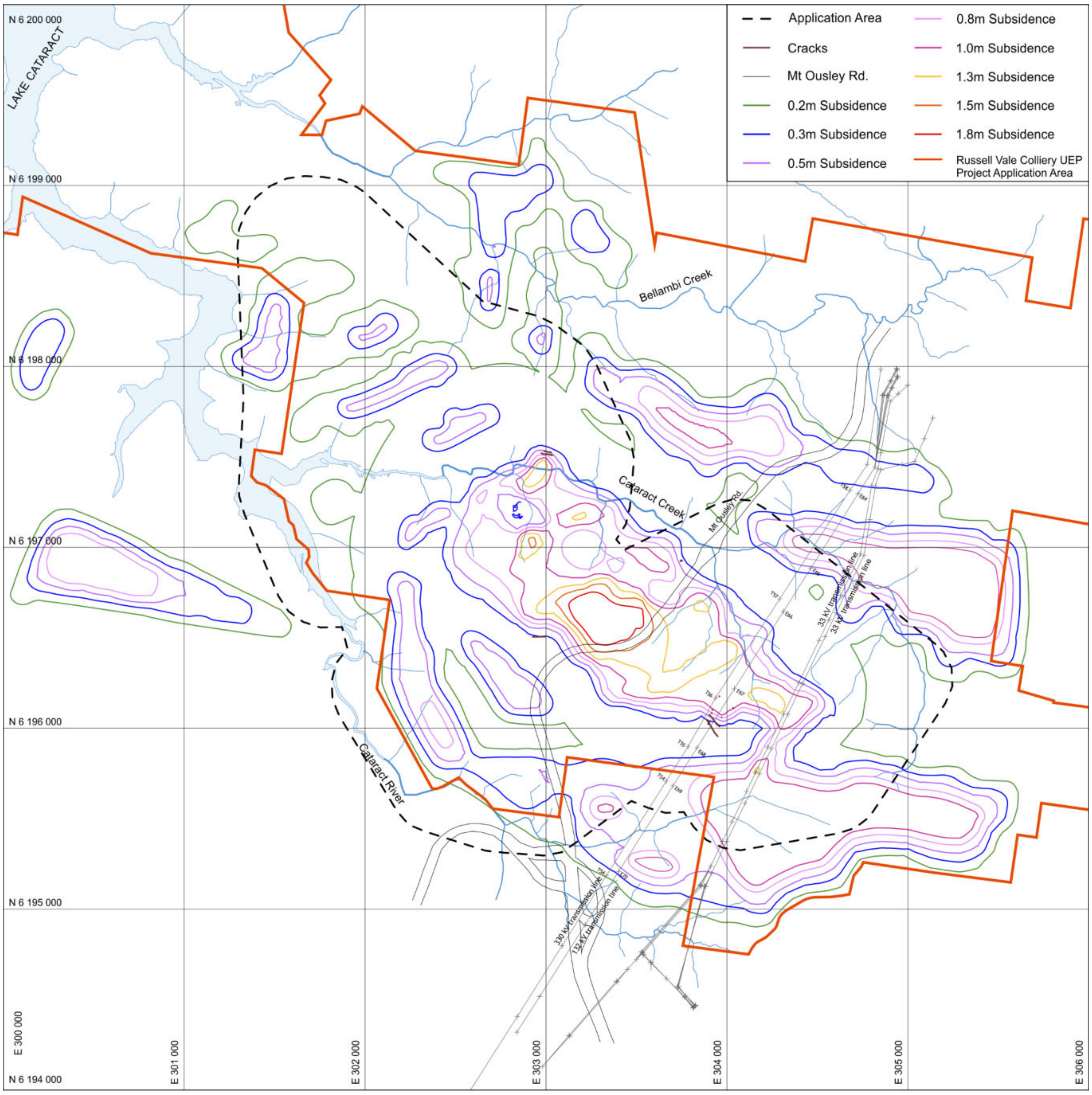


Figure 20: Contours of estimated cumulative subsidence for the Bulli Seam and the Balgownie Seam mining.

The first component, called sag subsidence, is the subsidence that results from the overburden strata draping down into the void created by each longwall panel. Sag subsidence increases with increasing panel width up to a maximum at a distance referred to as critical width. Sag subsidence also increases as the overburden depth reduces, as the thickness of the coal seam mined increases, and with the presence of previous mining activity in the overlying seams.

Sag subsidence is a measure of the capacity of the overburden strata to bridge across each longwall panel and in wide panels the vertical support able to be provided by the extracted goaf.

The second component, called strata compression subsidence, is the subsidence that results from compression of the chain pillar between panels and the rock strata above and below the chain pillar. The total strata compression is seen on the surface as subsidence. The increased load on rock strata above and below the chain pillar contributes almost all of the compression subsidence with compression of coal in the chain pillar contributing only a relatively small proportion of the total.

Strata compression subsidence increases with depth from less than 100mm when the overburden depth is less than 100m to 600-800mm at an overburden depth of 400m. Strata compression subsidence is function of the compression of the strata between panels and is largely independent of the sag subsidence and the capacity of the strata to bridge across each panel.

A1.1.1 Vertical Subsidence

Figures 21 a, b, c, d, and e show a summary of the results of subsidence monitoring over Longwall 4 and 5 on the two centreline subsidence lines and three cross-lines, including one short line, M Line, located across the chain pillar to measure strata compression above the chain pillar.

At the completion of Longwall 4, the maximum subsidence in the centre of the panel was 1.3m and this represents the sag subsidence for a single panel 150m wide and about 340m deep. When Longwall 5 had finished, centreline subsidence ranged from 1.1-1.8m and the centreline subsidence on Longwall 4 had increased to 1.6-1.8m consistent with strata compression at the intermediate chain pillar. Subsidence monitoring on M Line indicated that the total elastic chain pillar compression was approximately 0.7m based on superposition of the subsidence measured on M Line during Longwall 5 and goaf edge monitoring observed during mining of Longwall 4.

The increase in Longwall 4 centreline subsidence from 1.3m at the completion of Longwall 4 to 1.7m when Longwall 5 had been substantially mined is consistent with strata compression above the chain pillar between the panels of about 0.8m causing the surface above one side of the panel to be lowered 0.8m and the surface above the centre of Longwall 4 to be lowered a further 0.4m. There has been no significant increase in sag subsidence over Longwall 4 as a result of mining Longwall 5. The additional subsidence is due to strata compression above the chain pillar between Longwalls 4 and 5.

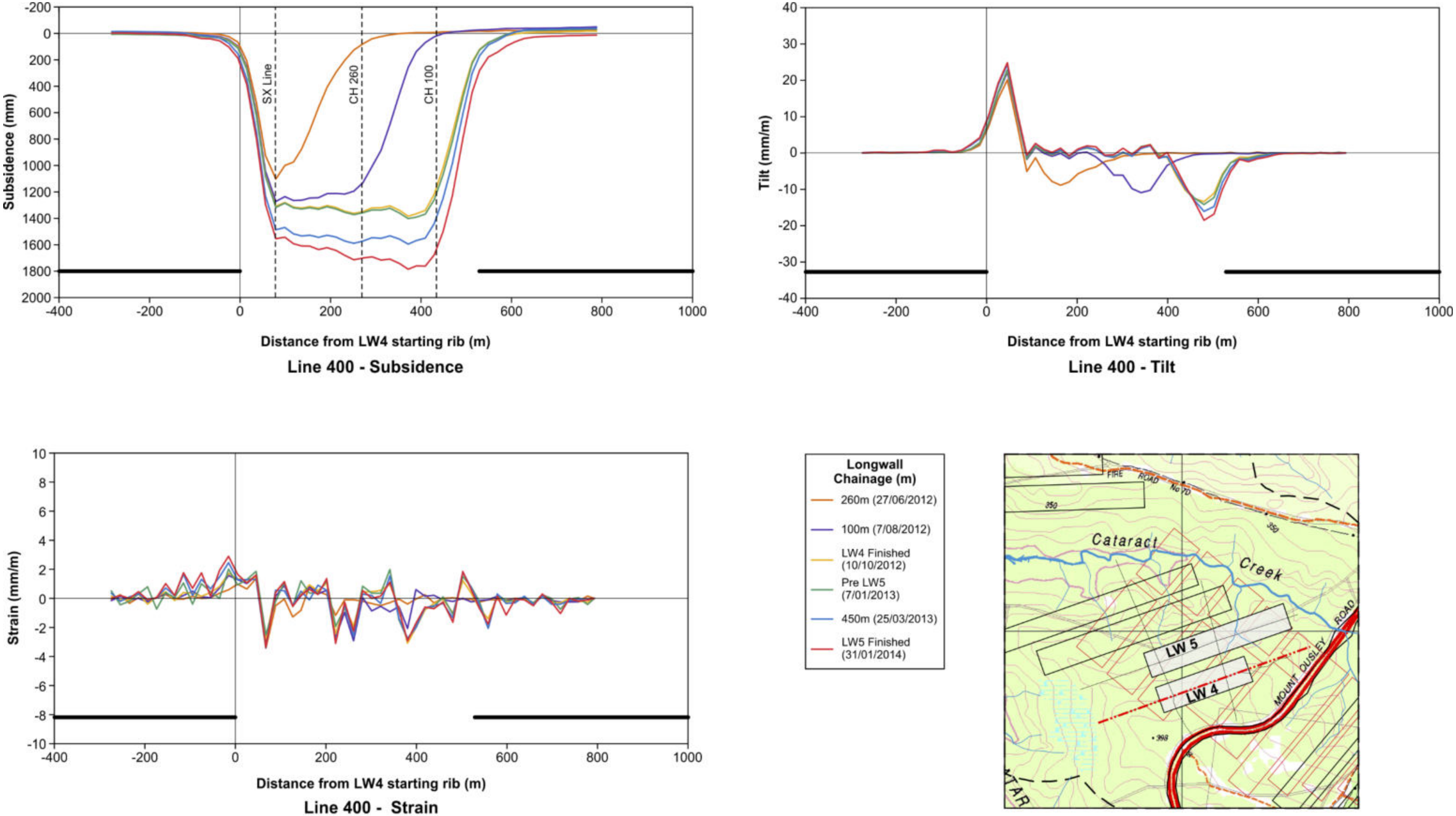


Figure 21a: Summary of Subsidence Monitoring Results from Longwalls 4 in the Wongawilli Seam.

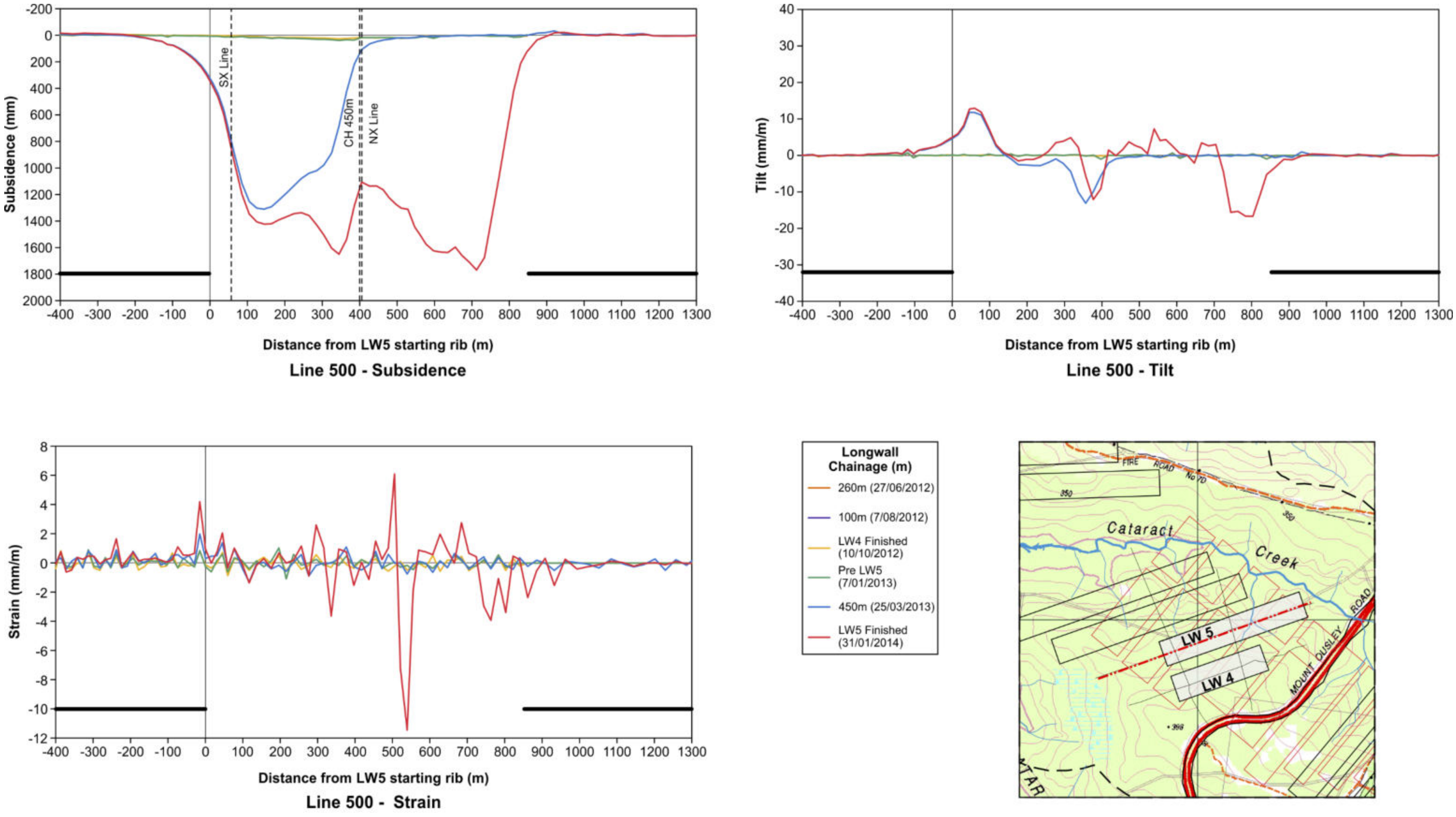


Figure 21b: Summary of Subsidence Monitoring Results from Longwall 5 in the Wongawilli Seam.

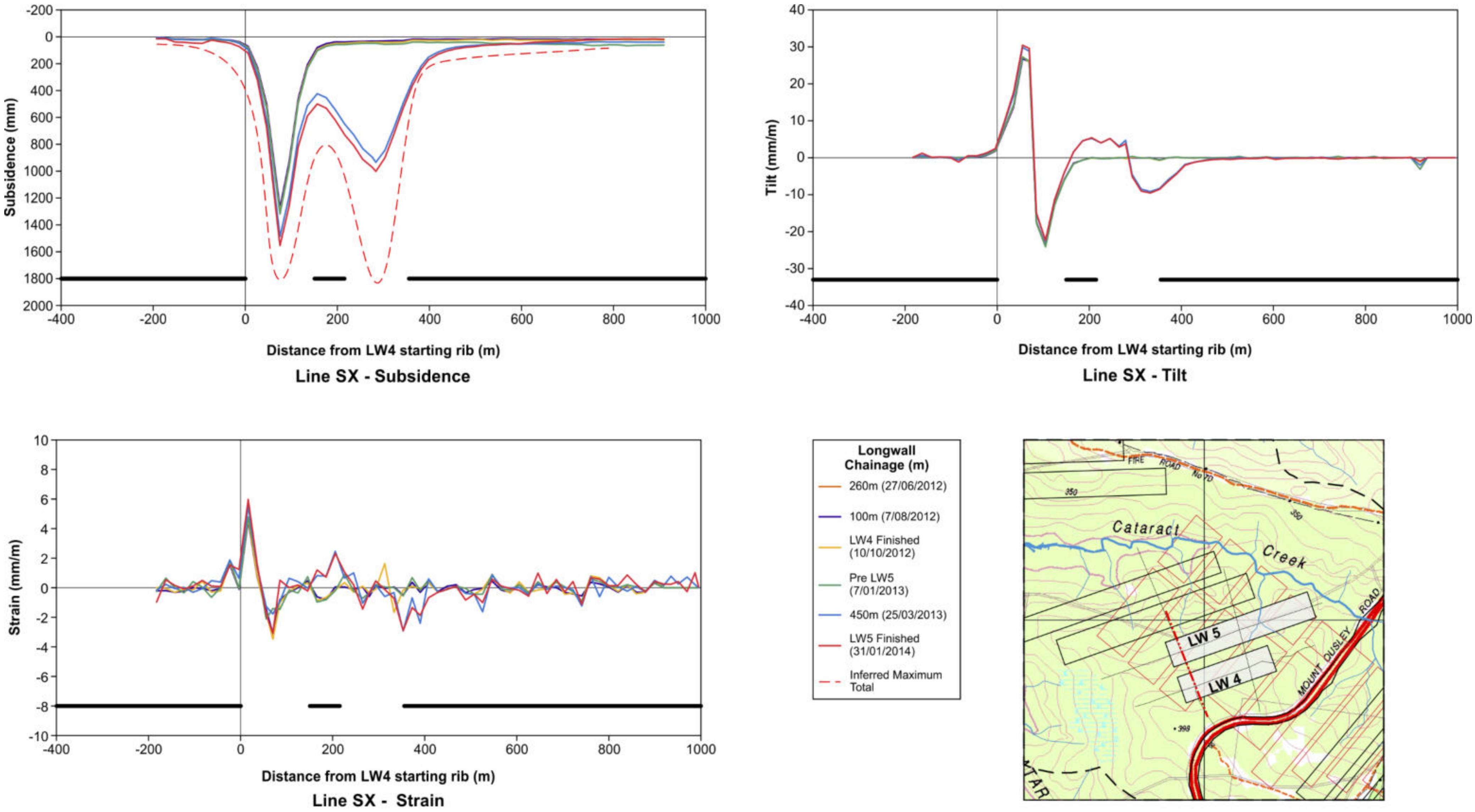


Figure 21c: Summary of Subsidence Monitoring on SX Cross Line – Longwalls 4 and 5 in Wongawilli Seam.

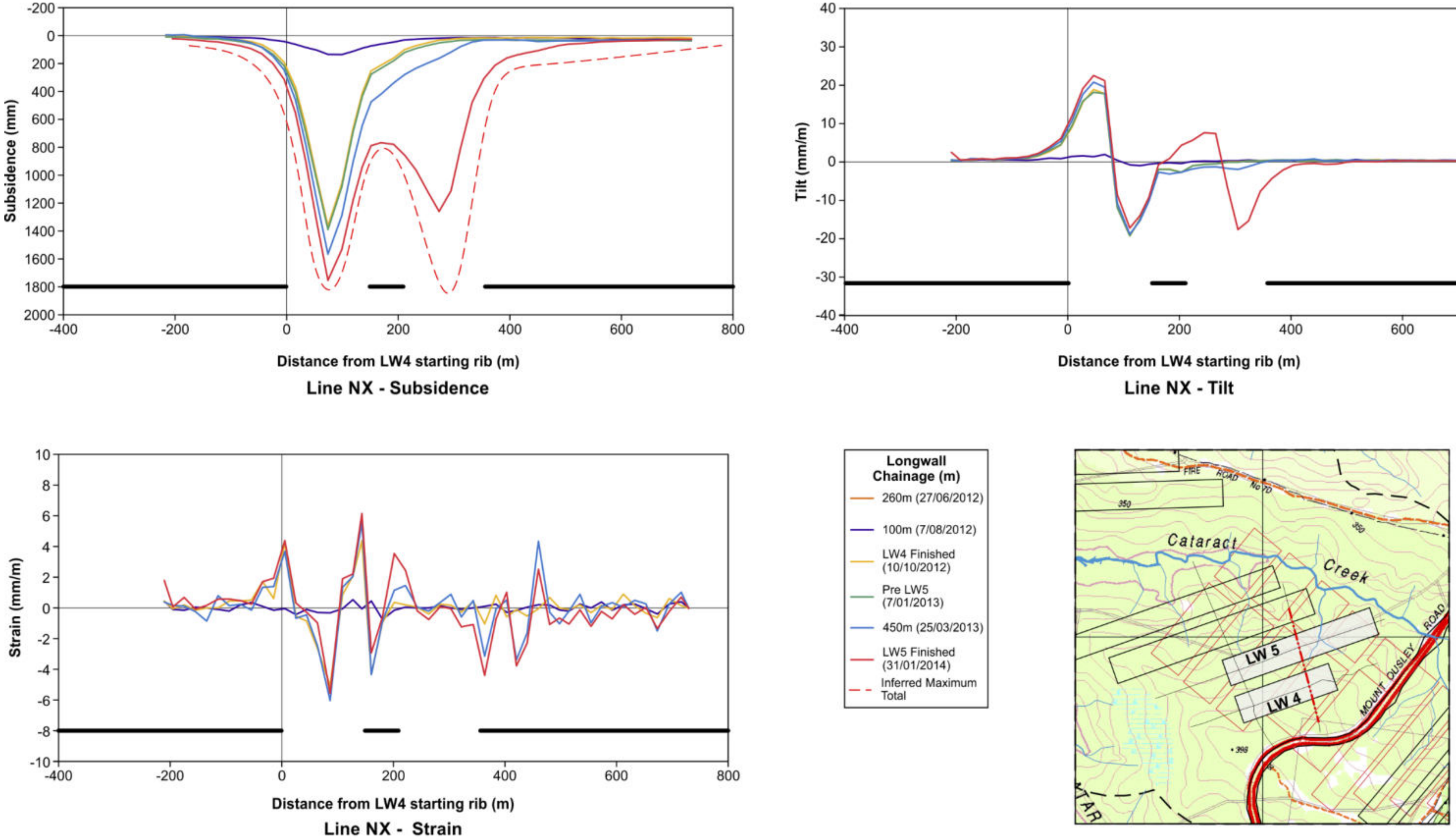


Figure 21d: Summary of Subsidence Monitoring on NX Cross Line – Longwalls 4 and 5 in Wongawilli Seam.

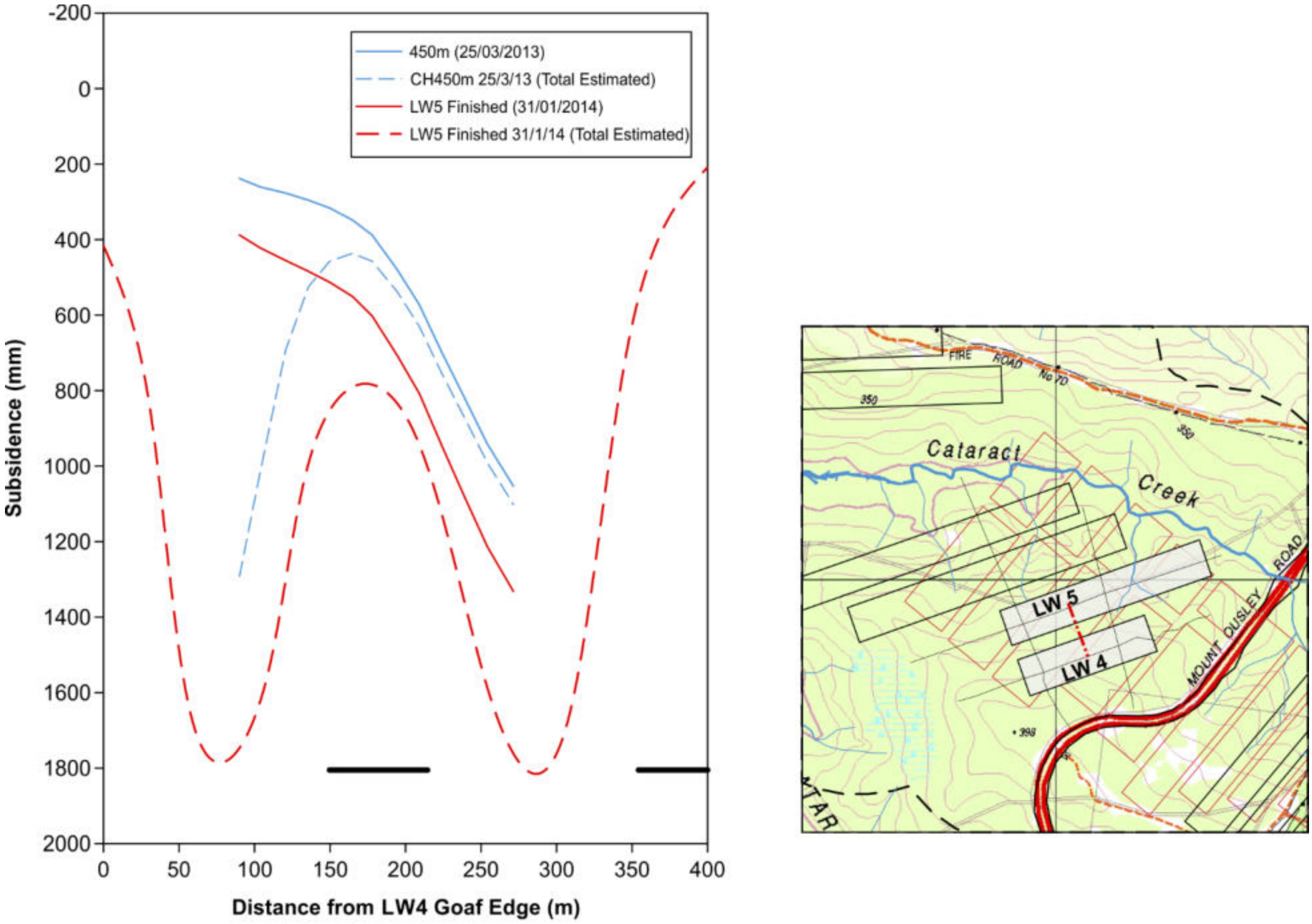


Figure 21e: Summary of Subsidence Monitoring on M Cross Line – Longwalls 4 and 5 in Wongawilli Seam.

The sag subsidence above Longwall 5 is of a similar magnitude to the sag subsidence above Longwall 4 although this does not show on the two cross-lines, SX and NX, because SX is too close to the end of the panel for full subsidence to develop and NX is located near the dyke pillar in the Balgownie Seam where subsidence is reduced. The presence of the full 1.8m of subsidence above Longwall 5 is apparent on the longitudinal 500 Line.

Figure 22 shows the sag subsidence plotted as a function of the panel width for Longwalls 4 and 5 and the sag subsidence that is commonly observed in undisturbed strata for a broad range of panel width to overburden depth ratios. Longwall 4 is mined in an area where there is both Bulli Seam goaf and Balgownie Seam goaf above most of the panel. Longwall 5 is mined in an area where there are Bulli Seam main heading pillars that have been partly mined and Balgownie Seam longwall goaf that has been completely extracted. The difference in disturbance to the overburden strata is clearly evident in the sag subsidence results plotted in Figure 22.

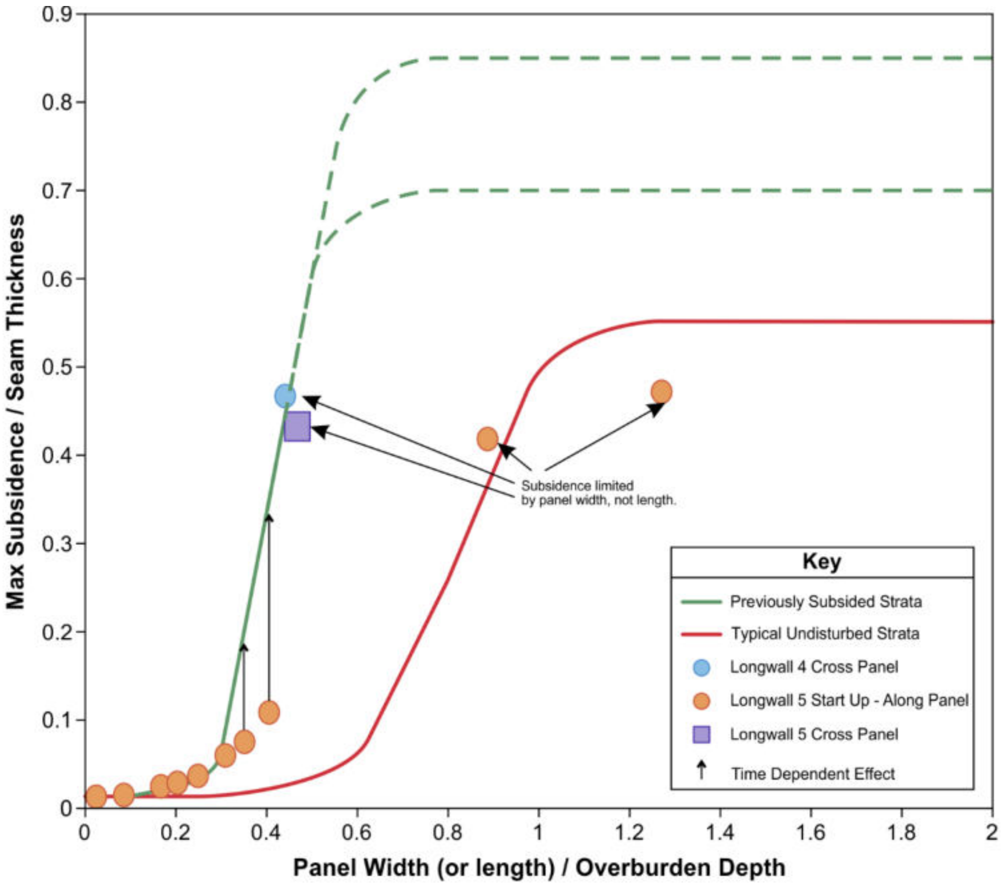


Figure 22: Summary of Sag Subsidence Measured at Start of Longwalls 4 and 5 in the Wongawilli Seam.

Above Longwall 5 where the Balgownie Seam has been fully extracted, the sag subsidence is significantly more than the sag subsidence that would be expected in previously undisturbed strata. Above Longwall 4, the Bulli Seam has also been mined, the sag subsidence is greater again consistent with the additional mining in the overlying Bulli Seam and the greater disturbance to the overburden strata that mining in both overlying seams has caused.

In narrow panels that depend on the overburden bridging to reduce the magnitude of surface subsidence as was the intention in the original Pt3A application, this reduction in the bridging capacity of the overburden strata has a profound effect on the maximum subsidence observed at the surface.

Another way to visualise the reduction in bridging capacity of overburden strata is through the goaf edge subsidence profiles. Figure 23 shows the range of goaf edge subsidence profiles observed in undisturbed strata compared to when one seam and two seams have been mined. These profiles show that as the number of seams mined increases and the disturbance to the overburden strata increases, the shear stiffness and rigidity of the overburden strata decreases.

The profiles in Figure 23 show that the sag subsidence behaviour above multiple goafs is consistent with subsidence behaviour observed over panels in single seam mining operations except that the shear stiffness or rigidity of the overburden strata is greatly diminished as a result of the previous mining activity. The reduced shear stiffness leads to reduced bridging capacity of the overburden strata and significantly increased maximum subsidence for the same overburden depth and longwall panel geometry.

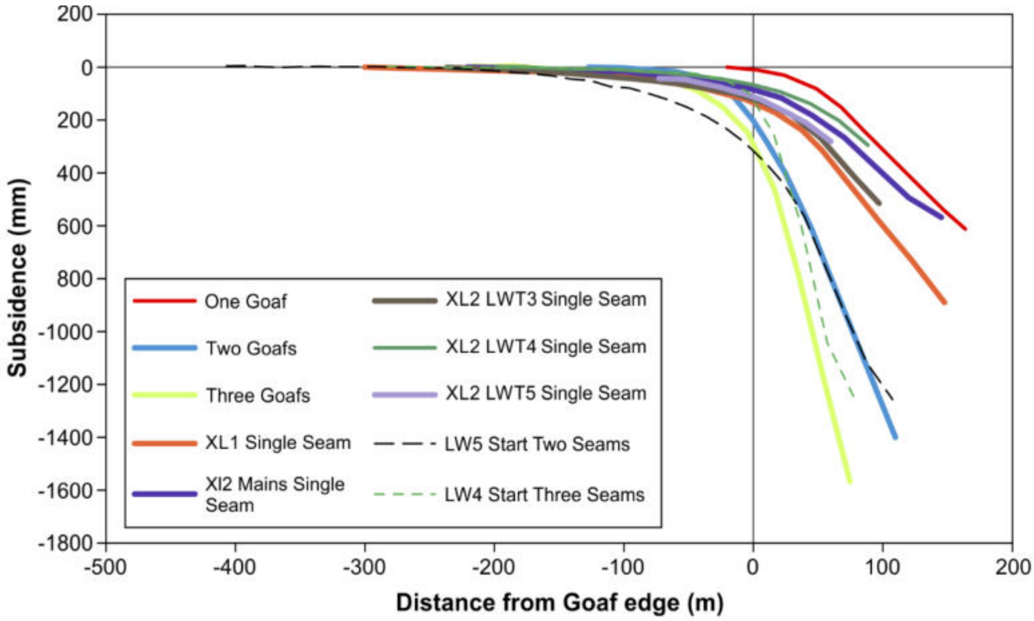


Figure 23: Summary of Goaf Edge Profiles for Mining in One, Two, and Three Seams.

In previously undisturbed overburden strata, the maximum subsidence above a 150m wide longwall panel at 300m to 360m would be of the order of 0.1m to 0.3m and barely perceptible for all practical purposes. The measured maximum sag subsidence has been 1.3m because softening of the overburden strata by previous mining has significantly increased the sag subsidence.

This phenomenon was also apparent in the Balgownie Seam longwall panels located below Bulli goaf compared to when the longwall panels were mined below solid pillars as summarised in Table 1 above.

Strata compression subsidence of 0.6m to 0.8m observed above the 60m wide chain pillar between Longwalls 4 and 5 is consistent with the level of strata compression subsidence that would be expected for the panel geometries at an overburden depth of 340m.

A significant characteristic of the subsidence observed over Longwalls 4 and 5 is that the additional sag subsidence caused by mining panels in the deeper seams is substantially limited to within the footprint of the panel, much the same as for single seam mining operations. This characteristic is clearly apparent despite the presence of an irregular overlying mining geometry. In some areas above Longwalls 4 and 5, there are overlying goafs in both seams, in others just one seam and not the other, and in other areas there are standing pillars. And yet, in all three circumstances, the surface subsidence is substantially limited to within the area that has been mined.

The form of the cross-panel subsidence profiles indicates that maximum subsidence in the centre of each panel is not being controlled by recompression of the strata directly above the longwall goaf but rather by the disturbance to the overburden strata from previous mining affecting the ability of the overburden strata to bridge.

There are subtle variations outside the goaf edge associated with previous mining in the overlying seams. More gradual subsidence profiles and greater goaf edge subsidence are evident where there are goaf areas in both the Bulli and Balgownie Seams as can be seen in Figure 24. Where there are goaf areas directly above the goaf edge in only one of the overlying seams, the subsidence profile is sharper and shows less subsidence outside the goaf. When there are no overlying goaf areas, the subsidence profile is sharpest and the subsidence profile beyond the goaf edge is the same as for single seam mining geometries.

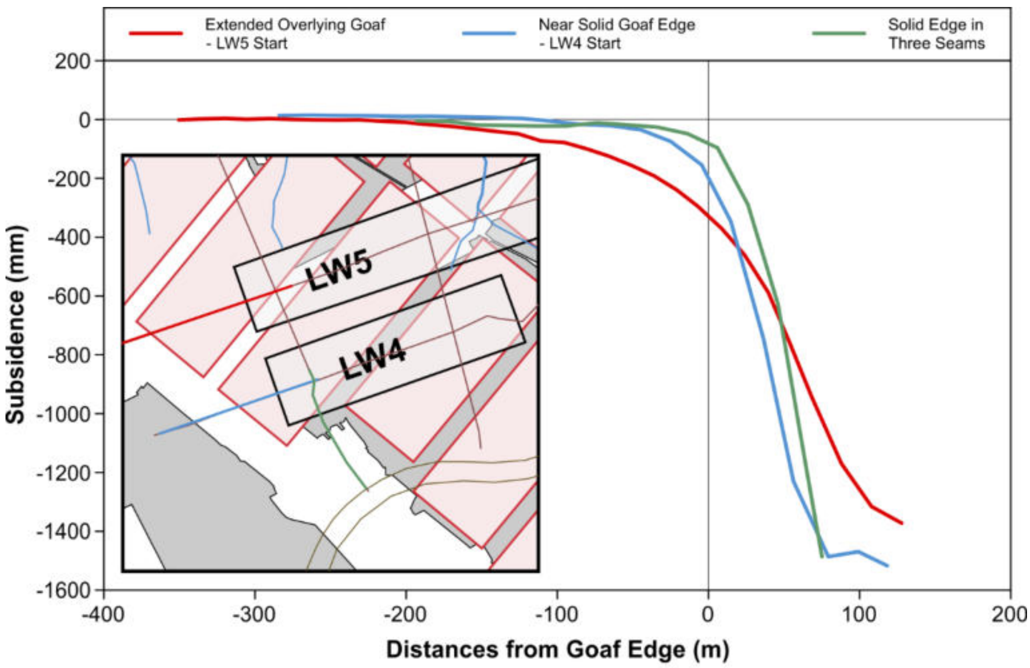


Figure 24: Goaf edge variations above Longwalls 4 and 5.

In areas where there are small standing pillars in the Bulli Seam above the goaf edge, there exists the possibility that mining in the Wongawilli Seam below will cause these pillars to be destabilised. If the pillars were destabilised, the resulting subsidence from the pillar destabilisation could then extend outside the Wongawilli Seam goaf edge to the edge of the overlying pillar panel in the Bulli Seam.

There has been no evidence of this type of behaviour so far from longwall mining in the Wongawilli Seam or in the Balgownie Seam but there is considered to be some opportunity for additional subsidence if additional longwalls panels are mined in proximity to areas of small standing pillars in the Bulli Seam. A panel of Welsh bords was visited during the site inspection on 21 June 2013 in an area of the Bulli Seam immediately above and to the northeast of the end of Longwall 1 as planned in the PPR layout. This area is shown in Figure 16.

A1.1.2 Extent of Vertical Subsidence Outside the Panel

Survey measurements conducted along the edge of the northbound lane of Mount Ousley Road have measured the influence of multi-seam mining based on the distance from the goaf edge providing evidence that vertical subsidence diminishes to low levels a short distance beyond the goaf edge.

Figure 25(a) and (b) show a summary of the vertical subsidence measured along Mount Ousley Road during mining of Longwall 4 and the timing of the subsidence that developed at key points. The projections of adjacent goaf areas in the Bulli, Balgownie, and Wongawilli Seams are also shown. The subsidence observed is of low-level reaching a maximum of approximately 40mm at the projected centre of Longwall 4 some 180m from the goaf edge at an overburden depth of 350m.

These measurements indicate the angle of draw to 20mm of subsidence is greater than 26.5° consistent with experience elsewhere in the Southern Coalfield at this overburden depth. At the projection of the north-eastern corner of Longwall 4 where both the Bulli Seam and the Balgownie Seam have been mined, subsidence at 230m from the goaf corner is 20mm at 320m deep indicates the angle of draw to 20mm off the corner of the panel is equal to 35°. At the south-eastern corner of Longwall 4, where the Balgownie Seam has not been mined but there are areas of mining in the Bulli Seam, the 14mm of subsidence at 225m at 360m overburden depth indicates an angle of draw off the corner of the panel of less than 32°. There does not appear to be any evidence of significant vertical subsidence outside the panel being mined associated with any type of pillar instability.

Other cross line measurements indicate the vertical subsidence is 50mm at between 20m and 100m from the goaf edge.

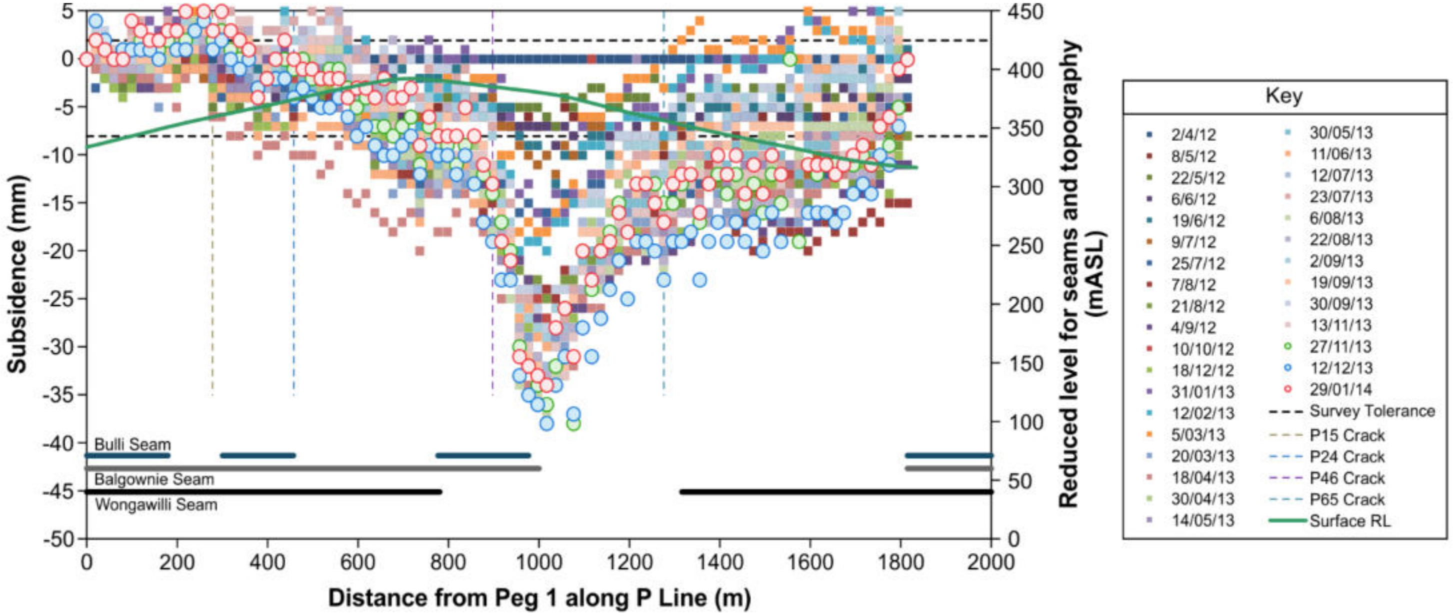
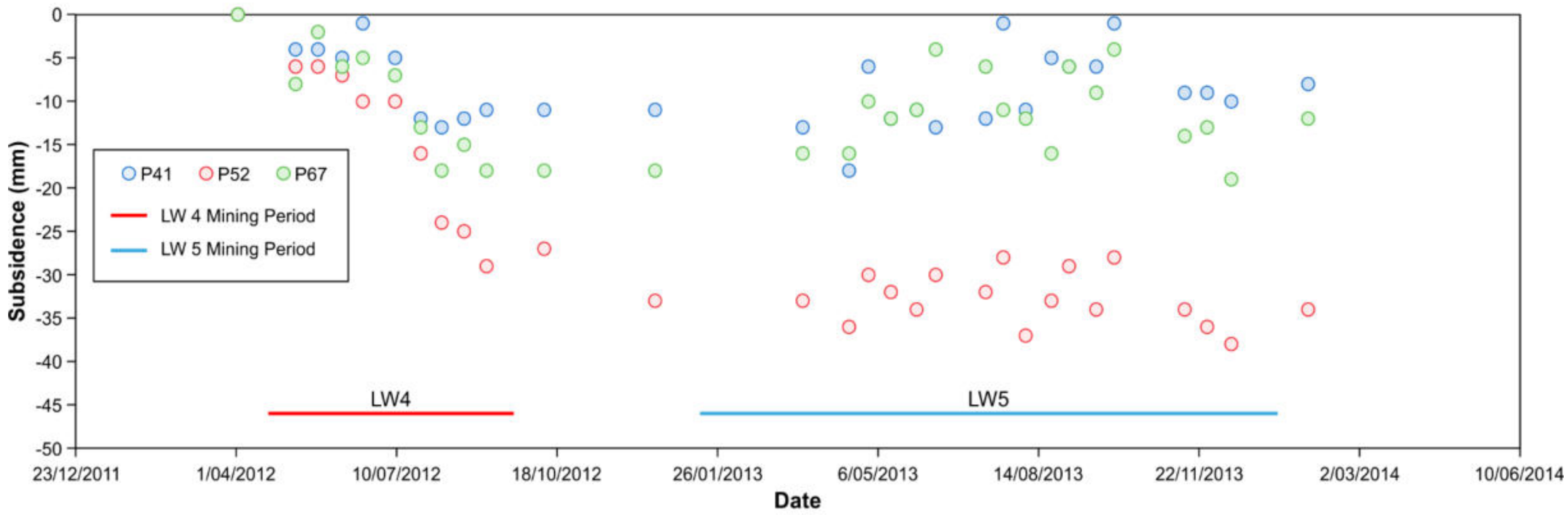


Figure 25a: Subsidence measured on P Line alongside Mount Ousley Road.



a) Development of P Line Subsidence over Time.

Figure 25b: Development of subsidence on P Line over time and as a function of longwall retreat.

On the basis of these measurements, the angle of draw to 20mm of subsidence is considered likely to be slightly greater than 35° in areas where both overlying seams have been mined and slightly less than 35° where only one overlying seam has been mined. The angle of draw is therefore not significantly different to the angle of draw that would be expected for mining in a single seam at similar overburden depths. If pillar instability were to occur near the edge of a Wongawilli Seam longwall panel, it is possible that that low-level subsidence may extend outside the panel edge and potentially increase the angle of draw slightly. However, the impact of any such increase is expected to be small.

A1.1.3 Far-Field Horizontal Movements

There are several sources of far-field horizontal subsidence measurements available from mining Longwalls 4 and 5. The Mount Ousley Road P Line and Picton Road Interchange provide measurements of horizontal movements based on three dimensional GPS controlled surveying and the closure measurements across Cataract Creek provide an indication of the horizontal movement in the middle distance. Observations of cracks on Mount Ousley Road provide an indication of the horizontal distance that changes potentially associated with mining have been observed.

The GPS controlled surveying does not show any convincing evidence of far-field horizontal movements. The survey tolerance of the systems being used is ±20mm. The monitoring at Picton Road Interchange is approximately 1300m from the southern end of Longwall 4 and there is no evidence that there has been any differential or even total movement at the interchange associated with mining Longwalls 4 and 5.

Figure 26a shows the closure measurements on Cataract Creek observed during mining of Longwall 5. Closure measurements across Cataract Creek first became evident at three of the four measurement points when Longwall 5 was approximately 450m from the finishing end of the panel (i.e. at longwall chainage CH400m). The longwall face at this position was approximately 320m from CC4, 420m from CC2, 530m from CC1, and 700m from CC3.

At Cataract Creek where the measurement points are located, the overburden depth to the Wongawilli Seam is approximately 280m, so the horizontal closure movements have been observed out to a distance from the goaf edge equal to between 1.1 and 2.9 times depth.

The closure measured on the Cataract Creek closure lines has steadily increased as Longwall 5 has continued to retreat. These measurements indicate that far-field downslope movements have been evident to a distance of up to about 450m from the approaching longwall panel but increase linearly with longwall retreat so that the longwall retreat required to generate a set amount of closure can be estimated with confidence.

Relatively fresh cracks that appeared on Mount Ousley Road at P24 and P25 during mining of Longwall 5 are approximately 500m from the southern end of Longwall 4 at an overburden depth of about 360m, so there is some evidence of small horizontal movements to a distance of about 1.4 times overburden depth.

Small far-field movements are evident from the longwall mining conducted so far in the PPR Assessment Area but these movements are of low magnitude and decrease with distance from mining. Figure 26b shows the closure measurements across Cataract Creek at the completion of mining the first 340m of Longwall 6.

A1.4 Historical Mining Impacts

While it is not possible to completely separate the impacts from previous mining in the Bulli Seam from the impacts associated with previous mining in the Balgownie Seam in areas where both have been mined, it is nevertheless helpful to review the impacts that have occurred previously as a basis for estimating the likely impacts of future mining.

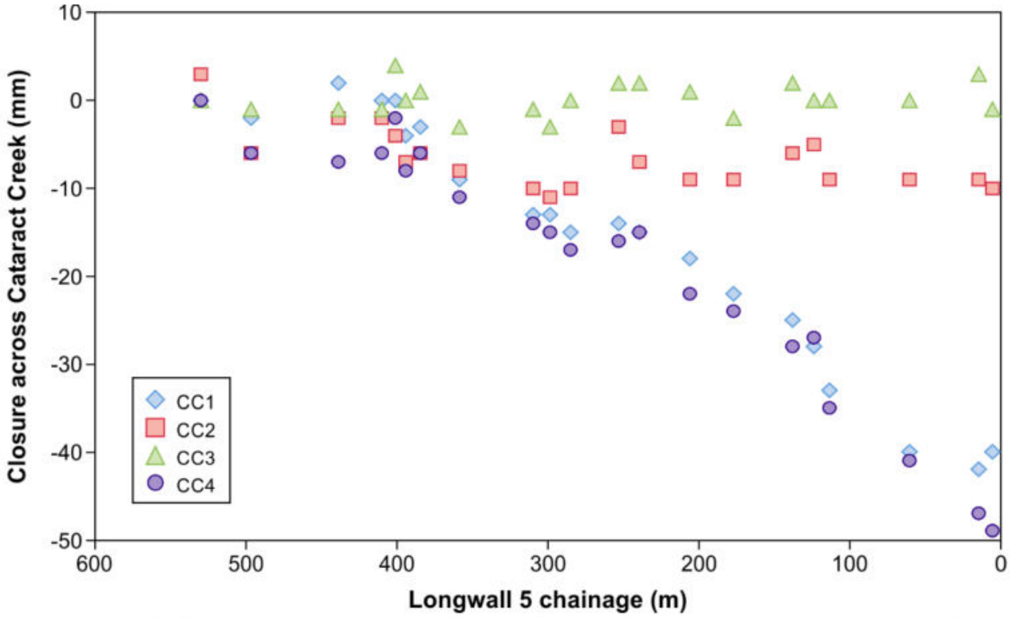
These impacts are most evident as rock falls and surface cracking on hard rock surfaces and changes in the character of stream channels such as upsidence cracking, iron staining, and sediment infilling in areas where the stream bed has been subsided. Other features where evidence of impacts is not so apparent include Mount Ousley Road, the power transmission lines, and natural features such as swamps and other vegetation.

A1.4.1 Surface Cracks

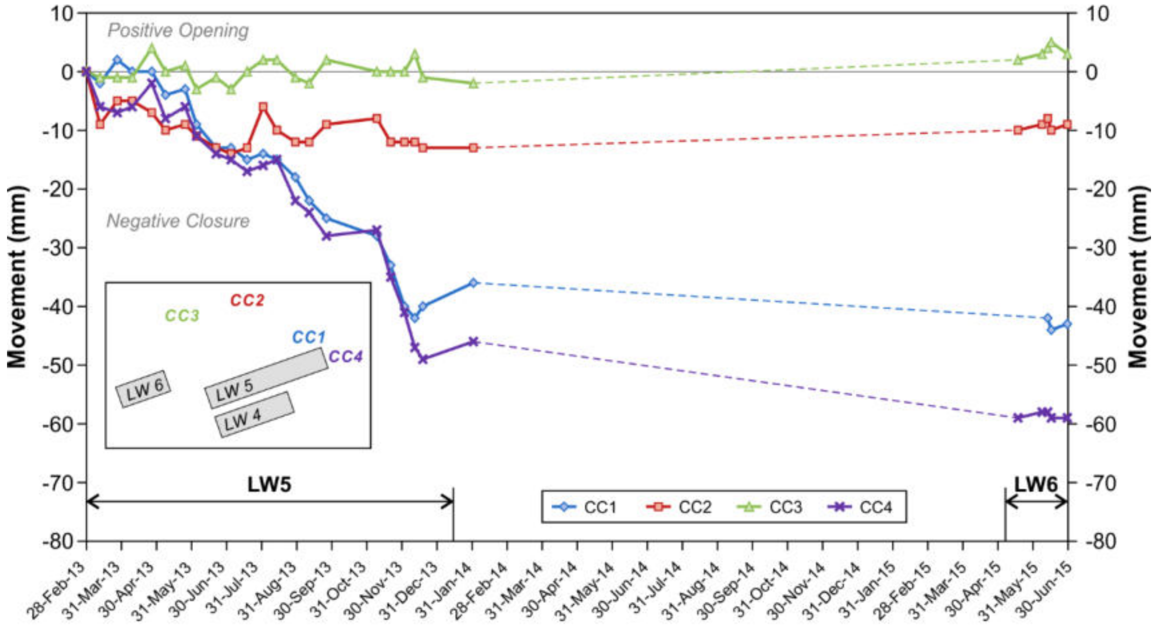
Surface cracking is documented on subsidence plans prepared during and after mining of the Balgownie Seam longwall panels. The cracks reported are mainly located near the start of Longwall 3 in the open terrain of the power transmission line easement.

These cracks are located near the start of the longwall panel on a topographic ridge in an area where the combination of systematic horizontal movements at the start of the panel and horizontal movements in a downslope direction would be expected and are commonly observed. Similar cracks are likely to have occurred at other locations but most of these would be in bushland locations where they would be difficult to detect.

For instance, a linear depression opened up near the southern corner of Longwall 4 in the Wongawilli Seam during mining of Longwall 5. This depression is considered to be associated with subsidence cracking. The depression and associated crack are located in an area where the goaf edges in all three seams are superimposed. The area is also near the top of the ridge between Cataract Creek and Cataract River where horizontal ground movements are expected to concentrate surface cracks.



a) Closures observed across Cataract Creek during mining of Longwall 5.



b) Valley closure across Cataract Creek after 340m of Longwall 6.

Figure 26: Measurement of Valley Closure across Cataract Creek.

The ground displacement indicated by this crack is of the order of 700mm but subsidence monitoring indicates that only a small part of this movement occurred during recent mining of Longwall 5 when the crack was first noticed. The implication of these measurements is that the crack developed during previous mining but was disguised below the soil and had been substantially infilled by soil material over the period since it formed.

Inspections conducted in association with cracking on the Mount Ousley Road show that there are a series of tension cracks and minor sinkholes evident along the northern side of the ridgeline between Cataract River and Cataract Creek. These cracks are locally aligned with the direction of one of the principal joint directions in the Hawkesbury Sandstone.

A1.4.2 Rock Falls

An inspection of cliff formations across the PPR Assessment Area conducted during the original subsidence assessment program informed by LiDAR interpretation indicated that there are several rock falls that are considered to be attributable to mining subsidence from both Bulli Seam and Balgownie Seam mining activity. These rock falls are small in volume and are barely discernible from natural rock falls that have occurred in the general area over the period since mining was completed.

A recent inspection of sandstone cliff formations on the southern side of Cataract Creek indicated the presence of several rock falls and subsidence cracks associated with previous mining.

A sandstone formation immediately downstream of CCUS4 showed evidence of previous mining impacts in the form of cracking and a section of overhanging cliff that had toppled over. The nature of the fracturing is consistent with mining induced subsidence from the Balgownie Seam longwall panels.

A length of cliff formation associated with archaeological site 52-2-3941 appears to have been subjected to fracturing and resultant rock falls which are likely to have been caused by subsidence associated with mining activity in the Bulli Seam. The nature of the fracturing and the age of the rock weathering appear consistent with the rock fall having occurred many decades ago.

A small rock fall of only a few cubic metres of material was also observed above Longwall 10 in the Balgownie Seam. The rock fall is located at the head of a small gully where the horizontal compression movements have been concentrated as the strata has subsided.

A rock fall located over the proposed Longwall 11 in the Wongawilli Seam was observed during a recent surface inspection. This rock fall involving several tens of cubic metres appears to have occurred from natural causes over the last few years. The site is remote from recent mining activity and there is evidence of tree root invasion at the back of the fall.

There are numerous examples of much older natural rock falls along the slopes below most of the cliff formations. These isolated boulders are consistent with the natural processes of erosion. Similar boulders are observed in areas where there has been no mining.

A1.4.3 Iron Staining

Water rich in iron is observed to be flowing into watercourses from the base of the sandstone cliff formations at several locations on the slopes above the southern side of Cataract Creek. These watercourses are dry upstream of the sandstone outcrop and show signs of iron staining downstream of the point where water flows from the strata into the creek.

This phenomenon is consistent with horizontal shear movement at the base of the Hawkesbury Sandstone outcrop caused by mining subsidence. The sandstone strata that is fractured, both naturally and as a result of mining subsidence, appears to be acting as a sub-surface reservoir that delivers water into watercourses downstream of the outcrop of the shear horizon even when there is no overland flow from upstream.

More intense iron staining observed during site inspections appears likely to be a result of recent mining in the Wongawilli Seam.

Proposed mining is not expected to perceptibly increase these impacts associated with previous mining activity.

A1.4.4 Cataract Creek

Subsidence monitoring above Longwall 11 in the Balgownie Seam indicates that Cataract Creek was subsided by more than 0.4m over a 400m length of the creek with maximum subsidence of 1.3m over about 40m. The same length of creek is also estimated to have been subsided 0.2-0.4m during mining in the Bulli Seam.

Inspection of the bed of Cataract Creek indicates that there is almost no physical disturbance to the rock strata in the bed of the creek that is attributable to mining activity despite the indicated closure of 310mm. This level of closure would typically be apparent as surface cracking in Hawkesbury Sandstone strata.

Geological mapping presented in Figure 4 indicates that this section of the creek is located in outcrop of the Bald Hill Claystone and Newport/Garie Formations immediately below it. The presence of the Bald Hill Claystone is considered likely to have contributed to the lack of physical disturbance evident in the bed of Cataract Creek.

The presence of iron staining in the water of Cataract Creek is consistent with previous mining activity in the area causing disturbance to the overlying Hawkesbury Sandstone. Recent mining of Longwall 4 in the Wongawilli Seam appears to have increased the level of iron rich precipitate in the tributary leading down from the area above Longwall 4.

A1.4.5 Power Transmission Towers

The power transmission towers T56 (on the 330kV line) and E57 (on the 132kV line) are located directly over Longwall 3 in the Balgownie Seam where there has been 1-1.2m of subsidence. The tower locations are noted on subsidence plans as T56 and T52 so it appears that they had been constructed prior to mining Longwall 3 in 1975, although this has not been able to be confirmed.

If they were constructed prior to mining, they do not appear to have been significantly impacted by previous mining in the Balgownie Seam. There does not appear to have been any mitigation or remediation.

A1.4.6 Mount Ousley Road

The construction of the Mount Ousley Road on its current alignment appears to have taken place after mining directly below the alignment in the Bulli Seam and Balgownie Seams was complete. Bulli Seam mining in the Russell Vale East areas was complete in the 1950's. By 1979 mining in the Balgownie Seam had progressed to Longwall 9 well to the west of the alignment.

There does not appear to have been any significant impact of historical mining on the operation of the highway despite up to approximately 1.0m of subsidence from Longwall 7 measured from 1976 to 1978 directly below the road alignment. The Cataract deviation was opened in 1980.

Recent longwall mining in the Wongawilli Seam has caused minor cracking on the hard surface of the Mount Ousley Road at several locations. This cracking is considered to be associated with large scale horizontal movement of the slope on the southern side of Cataract Creek in a northward direction toward the creek caused by a phenomenon widely known as valley closure. There is also evidence of minor cracking associated with the goaf edges of previous mining activity in the Bulli and Balgownie Seams and with transitions from cut to fill on the road formation itself.

The large scale horizontal movement caused by previous longwall mining appears to be ongoing at a low-level consistent with detailed observations made at other sites. These movements occur because the basal shear plane where the displacement occurs is at limiting equilibrium (on the verge of moving) as a result of previous subsidence. Only very small changes, such as changes in pore pressure caused by high intensity rainfall events, are required to cause further movement.

APPENDIX 6

Cadence Economics advice regarding Rehabilitation Costs

cadence|economics

12 November 2019

Ron Bush
Group Environment and Approvals Manager
Wollongong Coal Limited
rbush@wcl.net.au

George Michalas
Director
Cadence Economics Pty Limited
gmichalas@cadenceeconomics.com.au

Dear Ron,

ECONOMIC IMPACT ASSESSMENT OF THE RUSSELL VALE COLLIERY

The economic impact assessment of the Russell Vale Colliery includes costs termed as "rehabilitation" costs. As you have confirmed, these costs are broader than rehabilitation and should be termed "business discontinuity, closure, and rehabilitation" costs.

Kind regards,

George Michalas

George Michalas
Director
Cadence Economics Pty Limited

APPENDIX 7

EPA Response - Noise

28 November 2019

WM Project Number: 14141-E
Our Ref: Ltr EPA281119RH_Response to EPA Submission
Email: Peter.bloem@epa.nsw.gov.au

Peter Bloem
Environment Protection Authority
PO Box 513
WOLLONGONG NSW 2520

Dear Peter

Re: Russell Vale Colliery - Revised Underground Expansion Project (09_0013)

This letter was prepared in response to the Environment Protection Authority (EPA)'s request for further information and clarification to be provided to assist the Department of Planning, Industry and Environment in determination of the proposal for the Russell Vale Colliery Revised Underground Expansion Project (UEP) (the Revised Project).

Wilkinson Murray (WM) refers to the EPA letter dated 3 September 2019 (DOC19/645290-10) for key issues requiring further information and clarification.

The EPA letter addresses the revised project noise assessment report dated 17 July 2019 (*Russell Vale Colliery - Underground Expansion Project – Revised Project Noise Assessment*, Wilkinson Murray). It is important to note that since the receipt of the EPA letter, the configuration of noise bunds and barriers have been revised, resulting in new noise predictions and warranting a new version of the revised project noise assessment report (*Russell Vale Colliery Underground Expansion Project - Revised Noise Assessment*, dated 28 November 2019, Wilkinson Murray, Report No. 14141-E Version A Final).

For areas where the two versions of the revised project noise assessment report differ, the responses and information presented in this letter will account for changes reflected in the latest version of the report.

Responses and information/clarification for the key issues raised by the EPA are summarised below.

1. Background Noise Monitoring

The proponent has provided a new set of rating background levels (RBL) for receivers to the north and south of the premises. These new RBLs are generally higher than those determined in 2013 by ERM and Wilkinson Murray (WMPL) in 2014. The proponent must provide additional justification for the new RBLs; noting that they are higher than RBLs presented in previous assessments, are appropriate giving consideration to the length of period of monitoring, and the location of the monitoring relative to the most affected receivers and any other aspect pertinent to noise monitoring is in accordance with Fact Sheets A and B of the Noise Policy for Industry (NPfI) (EPA, 2017).

Rating Background Levels (RBLs) determined in 2013 by ERM were based on measurements over a three-week period. Monitoring conducted by WM in 2014 lasted approximately one full week (duration recommended by the *Noise Policy for Industry [NPfI]*). While the *NPfI* considers such durations of monitoring as suitable periods for determining an RBL, RBLs established over such durations may be influenced by small fluctuations in the local natural environment (e.g. insect noise quieter in winter than summer) and human activities (e.g. road network surrounding the site may be busier some periods than others) at various times of the year. As such, it is generally considered that the larger the sample period (monitoring period), the more accurate and representative the RBL.

Despite the Russell Vale Colliery going into care and maintenance in late 2015, WCL has continued to operate two long-term noise monitors on the site (NMT-1 and NMT-2). Due to the availability of this long-term noise monitoring data collected over an extended period when the colliery was not in operation, background noise levels for the entire year of 2016 were available for the Revised Project. It is considered that use of RBLs based on background noise levels measured over an entire year are more accurate and representative than RBLs based on one week's worth of data as long-term RBLs would account for fluctuations occurring at various times of the year.

Noise monitor location NMT-1, being shielded from Princes Highway traffic noise by structures located within the Russell Vale residential area between the monitor and the highway, is considered to be representative of the western façade (fronting the site) of northern receivers R1 and R2. RBLs measured by NMT1 may be conservative (i.e. RBLs lower than at the actual receivers) for receivers R3 and R4.

NMT2 is considered representative of the northern façade (fronting the site) of southern receivers R9 and R10. It is considered that although receivers R11 to R14 are located further away from Princes Highway, they are also located higher up the Illawarra Escarpment and as such are relatively exposed to the local road network to the east.

Long term noise monitoring data from NMT-1 or NMT-2 was not considered appropriate to establish an RBL for receiver areas with an acoustic environment dominated by traffic noise from the Princes Highway. Rather, reference is made to noise measurements undertaken by WM between 6-18 June 2014 (WM report dated 9 October 2014) at 11 Doncaster St, Corrimal (M1). Monitoring location M1 is considered representative of receivers R5 and R8. It is however conservative for receivers R6 and R7 which are considerably more exposed to the local road network to the east.

2. Assessed Scenarios

The 2019 noise report has assessed three scenarios:

- **Construction of bunds**
- **Phase-in which includes limited operations and coal processing infrastructure construction**
- **Full operation with all mitigation measures in place.**

The construction of bunds is proposed to occur prior to the phase-in scenarios for Bund #1 and the access road barrier, and for all other bunds during the phase-in scenario. The construction of bunds is predicted to exceed the Interim Construction Noise Guideline (ICNG) noise management levels by a significant amount. Chapter 2.4 of the noise report states that the rest of the bunds (Bunds #2-5) will be progressively extended and completed before the end of the phase-in period. The phase-in period is stated to last between 12 to 24 months. This indicates that there is potential for a significant impact to occur during the first two years of the 5-year project whilst bunds are being constructed. Based on this, the EPA advises:

a) It is not clear from the report why all the noise mitigation bunds/barriers are not constructed prior to the commencement of operations. It is expected that noise mitigation bunds/barriers are constructed prior to the commencement of operations, unless sufficient justification can be provided.

b) Noise mitigation measures should be constructed as early as possible, unless community engagement identifies an alternative preference.

c) The proponent should commit to a firm timeframe for completion of the bund construction so that any period of potentially significant impacts is limited and to inform the expectations of the community and regulators.

As stated in the newer version of the revised project noise assessment report, the Proponent has committed to constructing the container noise walls and the noise barrier along the northern boundary of the site prior to the phase-in operations commencing, and Bunds #2, #3 and #5 (which were primarily designed to mitigate noise associated with coal processing and transport infrastructure) within the first three months of the phase-in period.

Although construction of Bunds #2, #3 and #5 may take place at any time during the first three months of the phase-in period, the actual construction of the bunds will not last the entire three-month period and will be relatively short in duration. Furthermore, the potential noise impacts reported relate to the period when the mobile fleet is working at the closest and most exposed point within the bund/wall/barrier alignment, therefore the levels reported represent the worst case noise levels experienced at each receiver location over the three month period.

The relatively short durations during which noise impacts are anticipated would occur during the recommended standard hours and be well understood in advance and communicated to the community by Wollongong Coal. As stated in the report, the duration of bund construction works would be reduced to the greatest extent possible and equipment would be located behind the bund when possible to shield nearby residences from noise.

3. Proposed Noise Mitigation Measures

a) There is a significant reduction in predicted levels between the 2014/2015 noise reports and the 2019 noise report. The proponent should provide details of the predicted noise reductions associated with significant mitigation including engineering controls (including berms/barriers) and operational changes to demonstrate their individual and combined effectiveness.

Section 3.a) refers to the two following documents:

- *Russell Vale Colliery Underground Expansion Project - Revised Noise Assessment*, dated 28 November 2019, Wilkinson Murray, Report No. 14141-E Version A Final), herein referred to as the 2019 UEP noise report; and
- *Response to Noise Issues Raised by the Planning Assessment Commission Review Report, Dated 2 April 2015*, dated 15 July 2015, Wilkinson Murray, ref. 14141-A Version B Final, herein referred to as the 2015 UEP noise report; and
- It should be noted that the 2015 UEP noise report is based on assumptions found in *Russell Vale Colliery Underground Expansion Project - Noise Impact Assessment* (dated 9 October 2014, Wilkinson Murray, ref. 14141 Version C Final).

The reduction in predicted noise levels between the 2015 and 2019 UEP noise reports can be attributed to factors relating to source inventory, sound power levels (SWLs), meteorological conditions, site layout and shielding provided by bunds/walls/barriers, each of which are discussed further below.

<u>Factors relating to Source Inventory and Sound Power Levels</u>

The SWLs of the overall site (i.e. all noise sources combined) associated with the 2015 and 2019 UEP noise reports were calculated for the day, evening and night time periods and are summarised in Table 1. The SWLs assumed for the 2015 UEP noise report refers to 'Year 4' with all proposed upgrades in place.

Table 1 SWLs of the Overall Site

	Full Operation Overall SWL	
	2015 UEP Noise Report	**2019 UEP Noise Report**
Day	117.4	116.7
Evening	117.3	113.8
Night	111.2	111.3

The overall SWLs have reduced by approximately 1 dB and 3 dB during the day and evening periods, respectively. The overall SWL for the night time period was found to remain approximately the same.

The main factors relating to the design of the revised site operations pertinent to the reduction in overall site SWLs are summarised in Table 2.

Table 2 Pertinent Factors Relating to Design of Revised Site Operations

	Pertinent changes in design of the revised site operations from 2015 to 2019 UEP Noise Reports
Day	Addition of: • surge bin; • coal processing plant; • rejects circuit (including conveyor, front-end loader and trucks); • transfer station; and • on-site workforce vehicle movements. Removal of: • stackout conveyor system.
Evening	Addition of: • surge bin; • coal processing plant; • rejects circuit (conveyor only); • transfer station; and • on-site workforce vehicle movements. Removal of: • dozer; and • stackout conveyor system.
Night	Addition of: • on-site workforce vehicle movements. Removal of: • secondary sizer building; and • stackout conveyor system.

The following at-source noise mitigation measures, which were not assumed in the 2015 UEP noise report, have been assumed in the 2019 report:

- ROM stockpile dozer assumed to be a CAT D11 dozer in 2015 UEP noise assessment was replaced by a CAT D8 dozer and treated according to Hatch advice (Hushpack engine and grouser attenuation), resulting in a 3 dB reduction in SWL (i.e. from 115 dBA to 113 dBA).

- Secondary sizer building enclosed and treated according to Hatch advice (with acoustic building claddings [speed panel]), resulting in a 27 dB reduction in SWL (i.e. from 99 dBA to 72 dBA).

Although a number of noise sources were added to the 2019 design of daytime site operations, the removal of the stackout conveyor system and the reduction in SWLs of the dozer and secondary sizer building have resulted in an overall reduction of 1 dB. The largest reduction in overall site SWL (i.e. 3 dB) expected during the evening period is due to the removal of the stackout conveyor system and ROM stockpile dozer, and the reduction of the secondary sizer building SWL. At night, although the secondary sizer building and the stackout conveyor system have been removed, their SWLs are considered negligible in comparison with the overall site SWL and the latter is found to remain approximately the same.

Factors relating to Meteorological Conditions

Meteorological conditions assumed in the modelling process represent another factor with the potential to reduce noise levels when comparing the 2015 and 2019 UEP noise reports. Noise predictions presented in the 2015 report were provided as 10^{th} percentile exceedance or P10 noise levels (i.e. the level that is exceeded 10% of the time). The 2019 noise report presents noise levels under meteorological conditions as per Fact Sheet D of the *NPfI* – those can consist of standard or noise-enhancing conditions.

An analysis has revealed that noise predictions under P10 and *NPfI* meteorological conditions result in differences in noise levels for the various assessment periods.

- Day predictions in accordance with the *NPfI* are 1 to 3 dB lower than P10 predictions for the same period. This is due to the fact that no significant wind-related noise-enhancing conditions were identified for the day period in accordance with Fact Sheet D.

- Evening predictions in accordance with the *NPfI* are 2 to 6 dB lower than P10 predictions. To some extent, this is due to the fact that temperature inversions are not applicable to evening predictions according to the *NPfI* whereas meteorological conditions representative of the P10 predictions include the presence of temperature inversions. The reduction from P10 levels to *NPfI* levels is also accentuated given no significant wind-related noise-enhancing conditions were identified for the evening period.

- Night time and early morning shoulder predictions in accordance with the *NPfI* are 0 to 3 dB higher than P10 predictions. During those periods, the 2019 UEP assessment has identified a number of *NPfI* noise-enhancing meteorological conditions which are defined by strong temperature inversions (4 degrees Celsius per 100 m) generally combined with a source-to-receiver wind (with wind speed ranging 0.5-1.5 m/s). Although the P10 conditions from the 2015 UEP noise report were defined at times by stronger source-to-receiver wind speeds (i.e. 1-3 m/s), they included slightly weaker temperature inversions (i.e. 3 degrees Celsius per 100 m).

Factors relating to Site Layout and Shielding

When comparing the 2015 and 2019 UEP noise reports, the design of the revised site operations did not only involve changes in inventory of noise sources (as discussed above) but also in site layout. The revised layout has implications on the shielding provided by the natural site topography and effectiveness of potential noise bunds/walls/barriers, and this explains some of the reduction in noise emissions.

It is important to note that the 2015 UEP noise report does not propose noise bunds and barriers in addition to the existing ones. The 2019 assessment proposes an additional three noise bunds, two container noise walls, and one noise barrier.

The main source items common to both assessments and for which noise contributions have reduced at the surrounding receivers due to site layout and shielding effects are summarised as follows:

- The ROM stockpile dozer which was assumed at the eastern end of the proposed stockpiles (i.e. stockpiles SP2 and SP3) in the 2015 UEP noise report was shifted near the existing tripper system further west within the pit top area in the 2019 assessment. With a SWL of 115 dBA (2015 UEP noise report), the dozer represents the loudest noise source on site and moving it further west would have increased the distance separating it from the surrounding receivers as well as increased shielding from the natural site topography and proposed noise bunds.

- The reported levels in the 2015 UEP noise report conservatively assumed the tripper system in operation to be located at the eastern end of the proposed stockpiles (i.e. SP2 and SP3). As such, for the purpose of noise modelling, the tripper system has essentially been relocated further west where the existing tripper system is located, thus benefiting from additional distance attenuation and shielding. It should be noted that the tripper system represents a relatively important noise contributor (with an assumed SWL of 100 dBA in the 2015 UEP noise report) considerably exposed to the surrounding receivers (i.e. modelled at a height of 20 m above ground level).

- The proposed secondary sizer has been moved down the escarpment and placed further east within the pit top area. The change in location results in a considerable drop in elevation from a Reduced Level (RL) of 71 m down to an RL of 52 m. In addition, care was given to insert the secondary sizer behind a small 10 m drop in natural topography separating the existing truck loading bin area and the flat stockpile area in order to maximize shielding to the northern receivers (Russell Vale). As mentioned above, the most important change relevant to the secondary sizer is the considerable reduction in its SWL achieved through acoustic treatment.

- The truck loading bin and associated conveyor system has been shifted from the existing truck loading bin area down to the flat stockpile area. The change in location has resulted in a considerable drop in elevation from an RL of 62 m down to an RL of 46 m, thus providing more shielding to the northern receivers from the natural topography of the site, the container noise walls and the noise barrier along the northern boundary of the site.

- The internal coal haulage route has been realigned to access the revised truck loading bin location. As such, a considerable section of the internal route has been shifted from the site main access road down to the flat stockpile area. The change in alignment has resulted in a considerable drop in elevation, providing more shielding from the natural topography of the site, the container noise walls and the noise barrier (northern receivers).

- For the northern receivers, the reclaim tunnel fans (which represent a relatively loud noise source with a SWL of 108 dBA for both fans combined) now benefit from additional shielding from the container noise wall at the upper stockpile area and Bund #1.

Table 3 provides a summary of the typical noise reductions experienced at the identified receivers due to changes in site layout and shielding effects between the 2015 and 2019 UEP noise reports.

Table 3 Typical Noise Reduction due to Site Layout and Shielding

Receivers	Typical Reduction in Noise Levels
R1 – R4	4-7 dB
R5	10 dB
R6 – R14	1-4 dB

b) The phase-in scenario includes a 9m ROM coal stockpile as a noise control measure for the ROM stockpile dozer. However, this measure is only in place during the phase-in scenarios and not the operational scenario. It is currently not clear what mitigation measure replaces the 9m stockpile in the operational scenario to retain similar predicted noise levels at receivers. The proponent should provide clarification on how the dozer is mitigated in both the phase-in and operational scenarios.

The ROM coal stockpile bund has only been assumed during the phase-in period and provides shielding benefits only during the daytime as this is the only assessment period when the dozer operates. In order to address this query, a review of resultant noise contributions was conducted for northern receiver R2 as it is representative of receivers benefiting the most from the ROM coal stockpile bund. The review has revealed that the four most important noise contributors for the phase-in period (combined with construction associated with the site infrastructure and coal processing plant) under the driving *NPfI* meteorological condition are as follows:

- Construction fleet (site infrastructure and coal processing plant) – approx. 37 dBA
- Dozer (shielded by ROM coal stockpile bund) – approx. 32 dBA
- Internal coal haulage route – approx. 31 dBA
- Primary sizer building – approx. 30 dBA

During the full operation scenario, the four most important daytime noise contributors for the same receivers under the driving *NPfI* meteorological condition are as follows:

- Front-end loader – approx. 36 dBA
- Dozer (without ROM stockpile bund) – approx. 36 dBA
- Truck loading bin – approx. 34 dBA
- The internal coal haulage route – approx. 31 dBA

Although the phase-in scenario benefits from the ROM stockpile bund and less noise sources than the full operation scenario, the presence of the construction fleet associated with the site infrastructure and coal processing plant is expected to increase overall daytime noise levels. As such, northern receivers R1, R2 and R3 would be subject to comparable levels during the phase-in and full operation scenarios.

Post phase-in period the acoustic mitigation provided by the 9 m ROM stockpile would be replaced by the noise mitigation works proposed to be implemented during the phase-in period in order to achieve compliance during the day.

c) The proponent should clarify if the D8 dozer will have at source mitigation (Hushpack) applied prior to the phase-in scenario commencing.

Hushpack engine and grouser attenuation is proposed to be applied prior to commencement of the phase-in scenario. Table 6-4 of the report was amended to clarify this point.

d) Noise barriers and berms in a variety of configurations have been assessed in multiple previous noise assessments for the premises to be of limited acoustic benefit. The proponent must provide justification that the barriers and berms proposed in the 2019 noise report will have an appropriate level of acoustic benefit.

Project requirements have changed throughout the Project's history as the importance of noise impacts have gradually come to light. As such, new locations for potential noise barriers closer to noise sources (i.e. container noise walls) and receivers (i.e. noise barrier along northern boundary of the site) have been considered in order to provide more efficient acoustic shielding. Increased barrier heights and changes in site layout have also been proposed to maximize shielding effects from noise barriers and local topography.

Section 3.a) provides a summary of typical noise reductions experienced at the identified receivers due to changes in site layout, shielding effects and other factors such as sound power levels and meteorological conditions which can also influence resultant noise levels.

e) Table 7-3 presents the 27 receivers identified to exceed the Project Noise Trigger Levels (PNTLs), with a maximum exceedance of 2 dB. It would aid the assessment of the proposal and the assessment of reasonable and feasible mitigation if the proponent provided more detail on which were the major sources that contribute to the exceedances at these receivers.

Section 7.3 of the report was amended accordingly.

f) Previous noise assessments for the site have identified a range of different outcomes including no mitigation, mitigation with significant residual impacts and mitigation with no significant residual impacts. It would assist the assessment of the application if the proponent provided an indication of the scale and potential for different outcomes that could eventuate if there were under or overestimations of the effectiveness of the mitigation measures. The noise report should present additional contingency and safeguard mitigation measures that could be deployed should operational noise levels exceed predicted values.

Noise predictions include some level of conservatism associated primarily with:

- noise sources (i.e. assuming that all sources would be operating continuously and simultaneously, operations would be operating to cater for unexpected Port closures or interruptions, etc.); and
- meteorological conditions (i.e. assuming noise-enhancing conditions are present during worst-case operations although such conditions are expected to occur for a small percentage of the time).

Although the effectiveness of noise mitigation measures may vary due to a number of factors, the level of conservatism built into the modelling process would ensure that noise levels are generally overpredicted.

It should be noted that the Proponent has advised that they would consider noise walls along adjacent property boundaries as additional noise mitigation measures should noise levels be underestimated.

Contingency and other mitigation measures that would be implemented if operational noise levels exceed predicted values include:

Management Measures

- Review of site real time noise monitoring data;
- Attended noise monitoring;
- Review plant scheduling;
- Review mobile plant operations to determine if relocation of mobile plant would provide beneficial noise outcomes; and
- Review temporary shutting down of plant for short durations during periods of adverse weather conditions.

Additional Noise Mitigation Measures

- Review of further extension of noise bunding or walls along rear of West Street property boundaries (following consultation with property owners) to determine if would provide beneficial noise outcomes.

4. Operational Noise Assessment

a) The EPA does not recommend or endorse any particular noise prediction method or software. The proponent is responsible for demonstrating the method they have used is suitable.

Section 6.1 of the report was amended accordingly.

b) The proponent must provide more information regarding the difference in predicted levels between the 2019 noise report and the 2015 noise report. Predicted noise levels have reduced by between 2 and 15 dB during the day and evening. During the night period, some receivers have reduced noise levels, and some have increased noise levels compared to the 2015 noise report. The proponent should provide more detail on the difference between the two sets of predictions and the reasons for the differences.

Further information regarding differences in noise predictions between the 2015 and 2019 UEP noise reports has been provided in Section 3.a).

c) The low frequency noise assessment in Chapter 7.5 of the 2019 noise report has not followed the NPfI procedure. Section 2.2 of the NPfI states that noise levels should be rounded to the nearest integer. This means that the numbers in Table 7-4 of the 2019 report should be reported as integers. This would mean the R2 and R11 have a C-A weighted noise level difference of 15 dB. One part of the trigger for the low frequency correction in NPfI Table C-1 is where the C-A weighted level difference is 15 dB or more. Since the difference at R2 and R11 is 15 dB (rounded to the nearest integer), the proponent should further investigate the potential for low frequency noise impacts and the applicability of a low frequency penalty.

The new version of the revised project noise assessment report includes a revised low-frequency noise assessment which account for the EPA comments. Note that the C-weighted noise level minus A-weighted noise level assessment has resulted in a slightly different outcome for some of the northern receivers due to the different barrier configuration.

d) Table 6-4 of the 2019 noise report states the sound power level (SWL) used in the modelling but also in some cases also states the mitigated noise level. The proponent should clarify which SWL has been used to generate the predicted noise levels.

Table 6-4 of the report was amended accordingly.

e) The assumptions regarding the front-end loader (FEL) in Table 6-5 state that it would only be used for 2 minutes per 15 minutes due to operational limitations on the number of trucks. The proponent should provide further justification that this is a reasonable assumption.

The new version of the revised project noise assessment report has assumed the front-end loader would operate continuously throughout the entire 15-minute period. This is considered conservative as the front-end loader would generally not be expected to operate continuously.

f) The proponent should confirm which type of truck will be used to haul rejects. For example, will an articulated dump truck (i.e. CAT 740 style truck) or another type of truck be used? There is potential for different truck types to generate higher noise levels.

The assessment has assumed a sound power level of 102 dBA for rejects haulage which is consistent with road trucks travelling at 40 km/hr. This assumes trucks are road worthy and properly maintained.

5. Sleep Disturbance Assessment

a) The predictions from the tripper in Table 8-1 are about 1 dB higher than the $L_{eq,15min}$ noise levels. Further explanation is requested as this currently implies that the dominant noise sources would not have a maximum noise level substantially above their $L_{eq,15min}$ noise level.

The overall sound power level of the site was calculated to be 111.3 dBA for the night time period and 111.4 dBA for the early morning shoulder period. Those are noted to be greater than the L_{AFmax} sound power levels used in the maximum noise level event assessment (i.e. 108 dBA for the mitigated tripper arrangement and 102 dBA for trucks in the early morning shoulder period) and as such the predicted L_{AFmax} noise levels at the surrounding receivers are expected to be comparable to the predicted $L_{Aeq,15min}$ levels.

As a conservative measure, it was assumed in the new version of the report that maximum noise level events would occur at the same time as worst case $L_{Aeq,15min}$ level and the L_{AFmax} levels were added to the predicted $L_{Aeq,15min}$ levels before assessment against the Project's L_{AFmax} trigger levels for the maximum noise level event screening assessment.

b) The proponent should provide more information on the SWL, type of locations of L_{max} sources assumed for truck movements.

Section 8 of the report was amended to provide characterisation of the early morning shoulder truck movement sound power levels. Other assumptions related to the maximum noise level event assessment for the early morning shoulder period were also included.

6. Project Noise Trigger Levels

The proponent has assumed that there are no existing and no future industrial noise sources in the area other than the subject premises in their determination of the amenity level. The proponent should provide further information on the potential for the existing, planned or zoned commercial and industrial premises on Bellambi Lane and the area surrounding the mine to influence industrial noise levels at relevant sources.

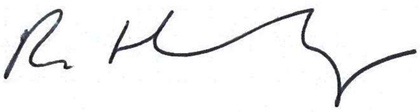
Land to the North and South of the Russell Vale Colliery Pit Top is zoned for a mixture of low density residential and public recreational land uses. No existing or future significant noise generating land uses are present or permitted to be present within these areas. Review of the current Wollongong Local Environmental Plan zoning map shows that the only area where potentially noise-generating land uses could be permitted within the vicinity of the site is the block directly south of Bellambi Lane which is zoned as light industrial.

The results of a search from Wollongong Council's Development Application (DA) tracking site and observations made during various site visits indicate that all current and approved DAs for lots along Bellambi Lane do not consist of developments with the potential to generate relatively high industrial noise potentially impacting on receivers surrounding the site. It is noted also that any future industrial development within this block would be similarly constrained by the presence of residential dwellings in the immediate vicinity.

As such, it can be concluded that there are no existing or currently proposed industrial premises in the vicinity of the site with the potential of generating ambient industrial noise at receivers potentially impacted by the Revised Project.

I trust this information is sufficient. Please contact us if you have any further queries.

Yours faithfully
WILKINSON MURRAY



Roman Haverkamp
Senior Engineer

Note
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APPENDIX 8

EPA Response – Air Quality

Memo

To	Gabrielle Allan
From	Jane Barnett
Date	27 November 2019
Reference	0481296
Subject	3687D: EPA Submission on Russell Vale - AQIA

Dear Gabby

Please find below our responses to the questions raised by the EPA in their letter reference DOC19/645290-10.

Kind regards

Jane Barnett

Partner

1. Assessment does not include a meteorological data selection process

The EPA recommends that:

(a) The proponent should incorporate a meteorological analysis that includes at least five years of meteorological data at or near the site and re-assess if 2016 meteorological data is representative.

ERM response:

The EPA has noted the minimal number of calm winds represented in the 2016 meteorological dataset. Their concern is that this may not capture the worst-case impacts as these can often occur under calm wind conditions. While it is true that these conditions will generally represent a worst case for dispersion, calm conditions also lead to lower estimates of emissions for those sources that are wind speed dependent. These sources include wind erosion and material transfer and these make up nearly 25% of the total PM_{10} emissions, and nearly 30% of $PM_{2.5}$ emissions. These are not insignificant proportions and would be reduced considerably if there was a higher percentage of lower wind speeds.

The assessment should use meteorological data that is representative of the site, as noted in the Approved Methods. As these data are taken from the on-site weather station they are considered site representative, even if not necessarily 'worst-case' with regard to dispersion.

Regardless, further analysis has been carried out on the data available for the five year from 2014 – 2018 (inclusive). Note that wind direction data are not available for 2018 so wind roses could not be made for that year.

Figures 1 – 4 present wind rose plots for years 2014 – 2017. All show a very low percentage of calms. In addition, the annual trends are similar from year to year, indicating that 2016 is a typical and representative year for the site. The summary of rainfall, temperature and wind speed data from 2014 – 2018 presented in Figure 5 also support the use of 2016 as a representative year.

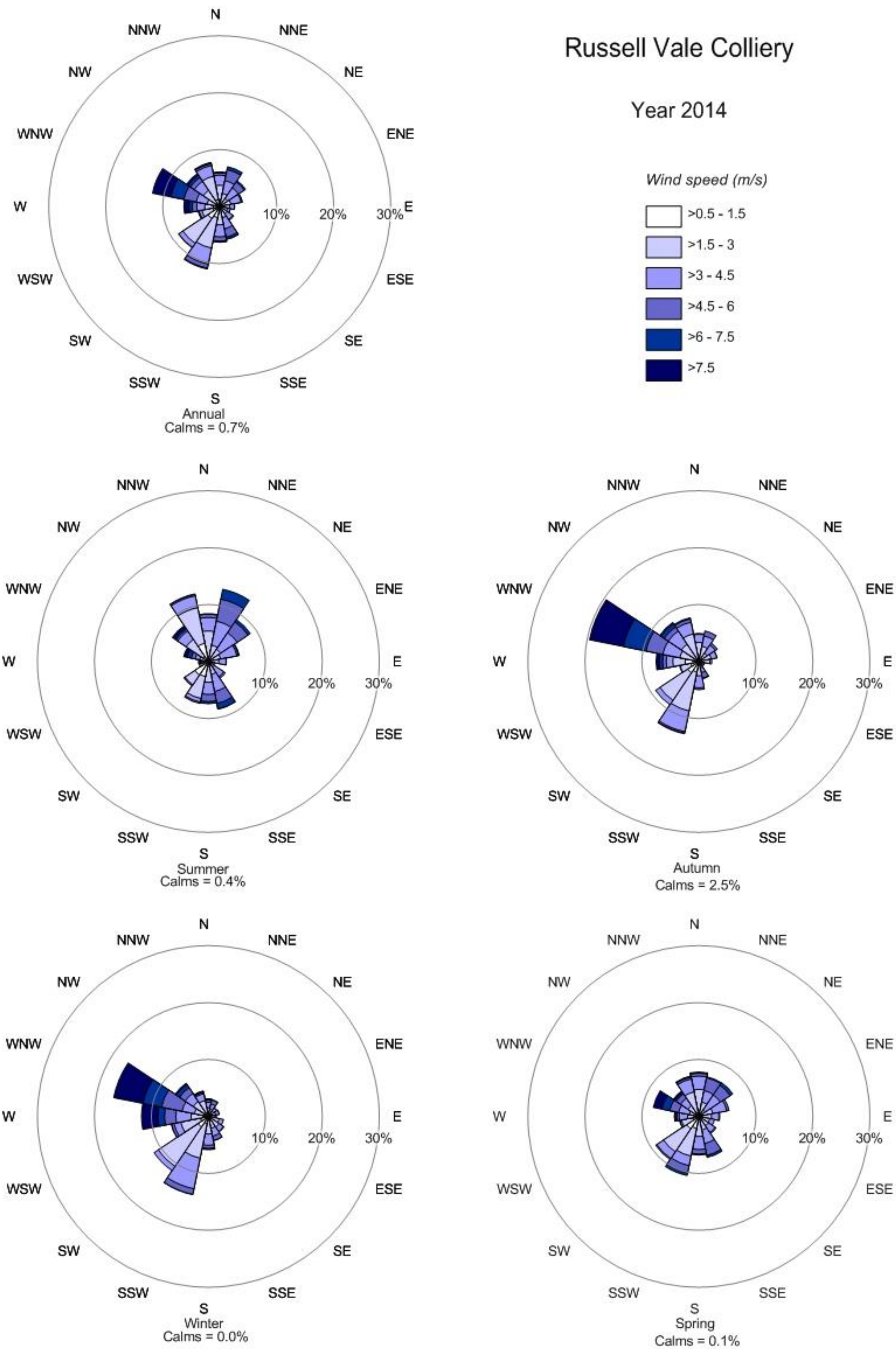

Figure 1: Annual and seasonal wind roses for 2014

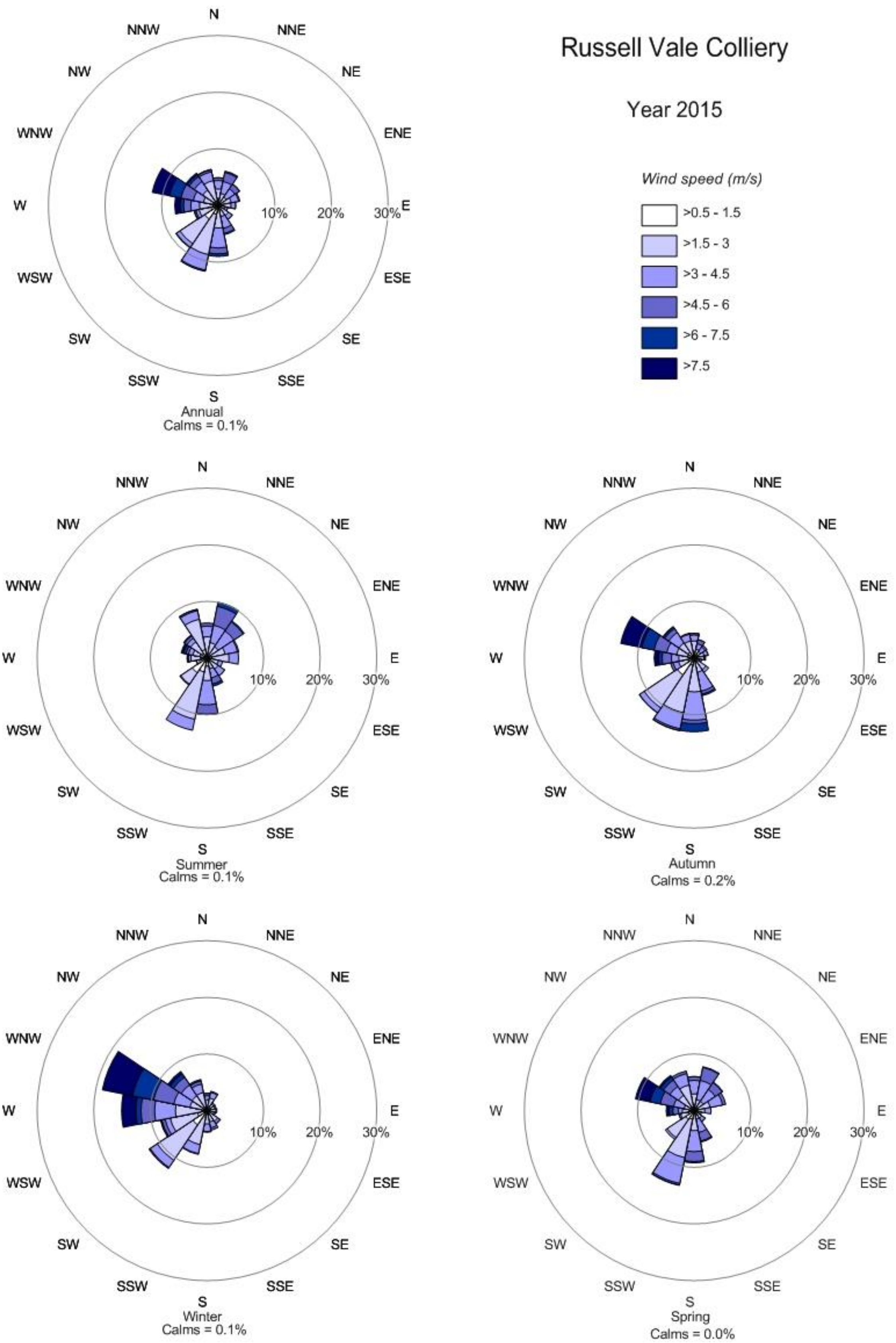

Figure 2: Annual and seasonal wind roses for 2015

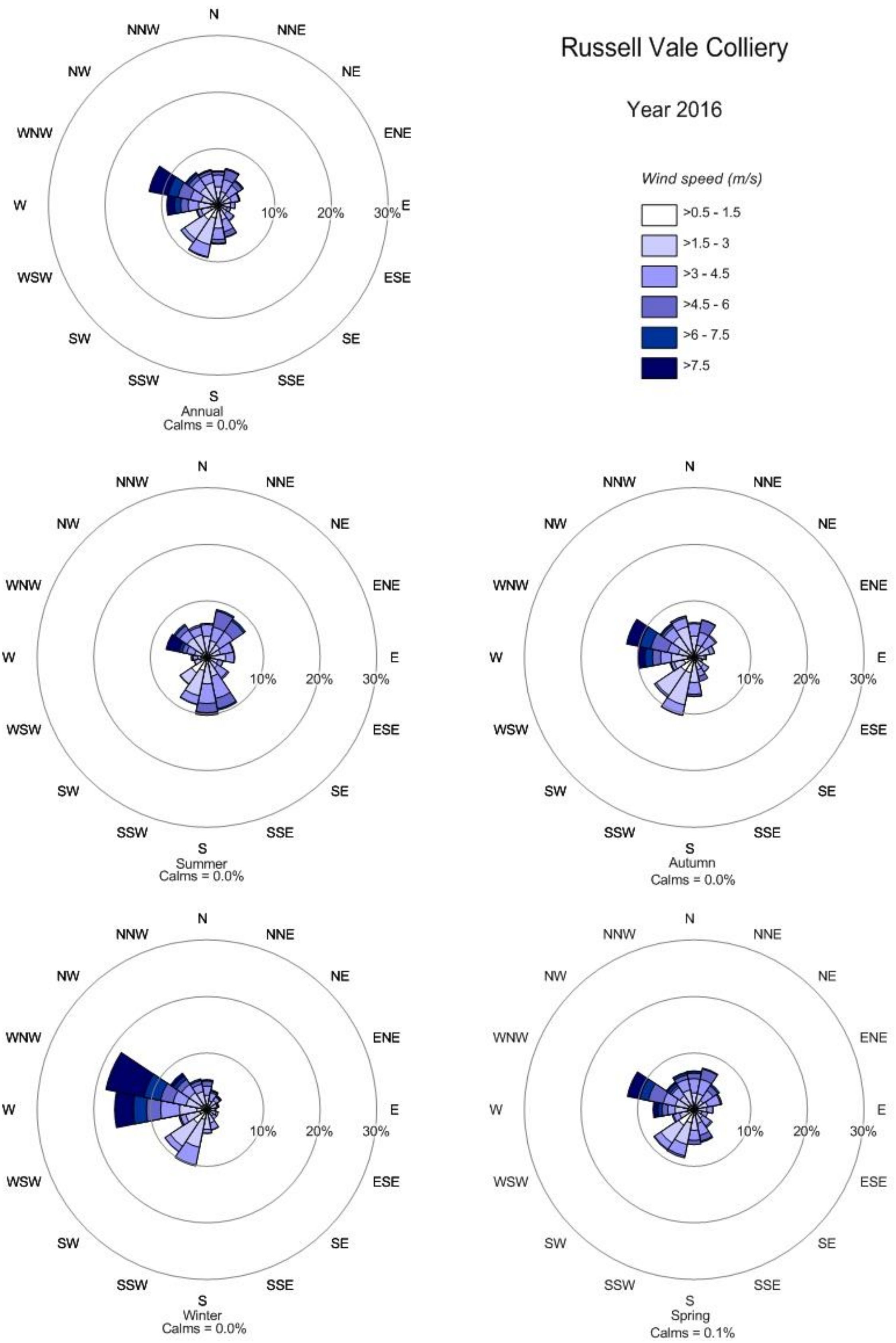

Figure 3: Annual and seasonal wind roses for 2016

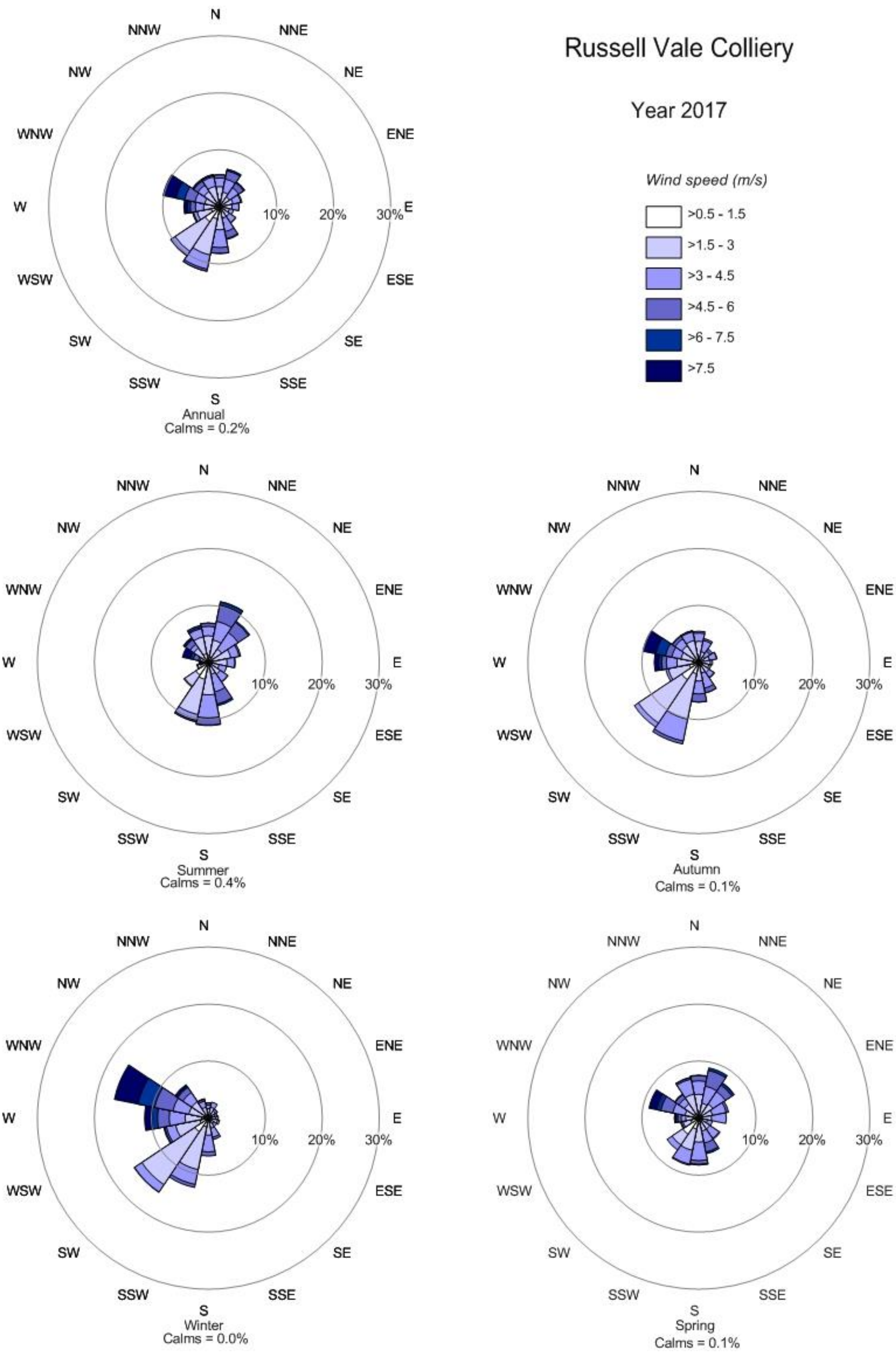

Figure 4: Annual and seasonal wind roses for 2017

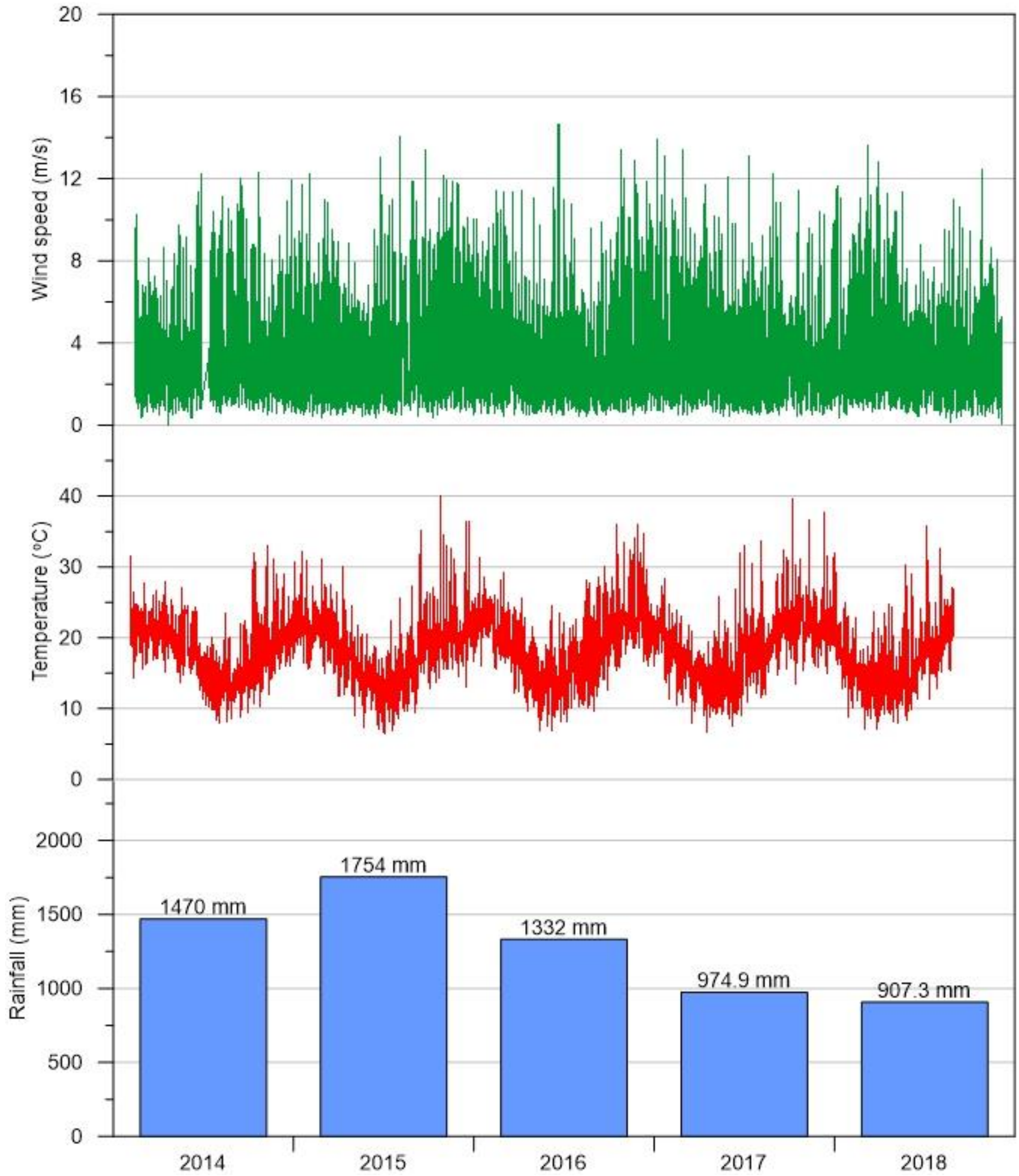

Figure 5: Summary of rainfall, temperature and wind speed data from 2014 – 2018

2. Adopted background levels data

The EPA recommends that:

(a) The assessment should be revised to include all available ambient air quality data at or near the site to robustly characterise background air quality surrounding the project site and characterise local air quality impacts in the vicinity of the proposal in the context of historic operations.

ERM response:

The background levels assumed are reasonable as they were measured while the site was not operating. This provides a more accurate representation of background levels to which the modelled project contributions can be added, as has been done in the assessment. There are no other data sets available that are as representative of the local area.

These data were also contemporaneous with the meteorological data used and so enables a better 24-hour cumulative assessment. That is, measurements are relevant to concentrations experienced on a specific day, so when combined with predicted levels made using the meteorological information for that same day, it is a more realistic estimate of total cumulative concentrations.

3. Unclear calculations to establish the emissions inventory

The EPA recommends that:

(a) Detailed information for the calculation of the emissions inventory should be provided to enable the EPA to replicate emissions. In particular, this information is to be provided for those activities (hauling, wind erosion for exposed areas, FEL loading) with the largest contribution to the total emissions.
(b) The proponent should present the location of the modelled sources for both scenarios.

ERM response:

The dust emission inventories have been prepared for each modelling scenario using the operational description of the project and the US EPA's AP42 emission factors.

Estimated emissions are presented for all significant dust generating activities associated with the operations. The relevant emission factors used for the study are described below.

Dust from wind erosion is assumed to occur over 24-hours per day, however, wind erosion is also assumed to be proportional to the third power of wind speed. This will mean that most wind erosion occurs during the day when wind speeds are highest.

The source locations used in the modelling are shown in Figure 6 (Scenario 1) and Figure 7 (Scenario 2). Figure 8 presents a copy of the calculation summary.

<u>Loading / transferring material</u>

Each tonne of material loaded will generate a quantity of dust that will depend on the wind speed and the moisture content. The equation below shows the relationship between these variables and the appropriate k-factor for each particle size fraction.

$$E = k \times 0.0016 \times [(U/2.2)^{1.3} / (M/2)^{1.4}] \text{ kg/t}$$

Where:

k = 0.74 for TSP

$k = 0.35$ for PM_{10}
$k = 0.053$ for $PM_{2.5}$
U = wind speed (m/s)
M = moisture content (%)

Dozers working on coal

Emissions from dozers on coal have been calculated using the US EPA AP-42 emission factor equations shown below.

$E_{TSP} = 35.6 \times (s^{1.2}/M^{1.3})$ kg/hour

$E_{PM10} = 6.33 \times (s^{1.5}/M^{1.4})$ kg/hour

$E_{PM2.5} = 0.022 \text{ x } E_{TSP}$ kg/hour

Where,
S = silt content (%)
M = moisture (%)

Hauling material / product on unsealed surfaces

The emission estimates of wheel generated dust are based the US EPA AP42 emission factor equations for unpaved surfaces at industrial sites, as shown below.

$E_{TSP} = (0.4536/1.6093)\times\ 4.9 \times(s/12)^{0.7}\times((W/1.1023)/3)^{0.45}]$ kg/VKT

$E_{PM10} = (0.4536/1.6093)\times\ 1.5 \times(s/12)^{0.9}\times((W/1.1023)/3)^{0.45}]$ kg/VKT

$E_{PM2.5} = (0.4536/1.6093)\times\ 0.15 \times(s/12)^{0.9}\times((W/1.1023)/3)^{0.45}]$ kg/VKT

Where:
S = silt content of road surface
W = mean vehicle weight in metric tonnes

The mean vehicle weight used in the emissions estimates is an average of the loaded and unloaded gross vehicle mass, to account for one empty trip and one loaded trip.
A control factor of 85% has been applied for watering and the use of chemical suppressants on unpaved roads.

Loading/unloading coal

The US EPA AP42 emission factor equations for each particle size fraction are shown below.

$E_{TSP} = 0.580 / M^{1.2}$ kg/t

$E_{PM10} = 0.0447 / M^{0.9}$ kg/t

$E_{PM2.5} = 0.019 \text{ x } E_{TSP}$ kg/t

Where,
M = moisture (%)

Wind erosion

The default US EPA AP42 emission factors for wind erosion on exposed surfaces are shown below for each particle size fraction

$E_{TSP} = 0.1$ kg/ha/h

$E_{PM10} = 0.5 \times E_{TSP}$ kg/ha/h

$E_{PM2.5} = 0.075 \times E_{TSP}$ kg/ha/h

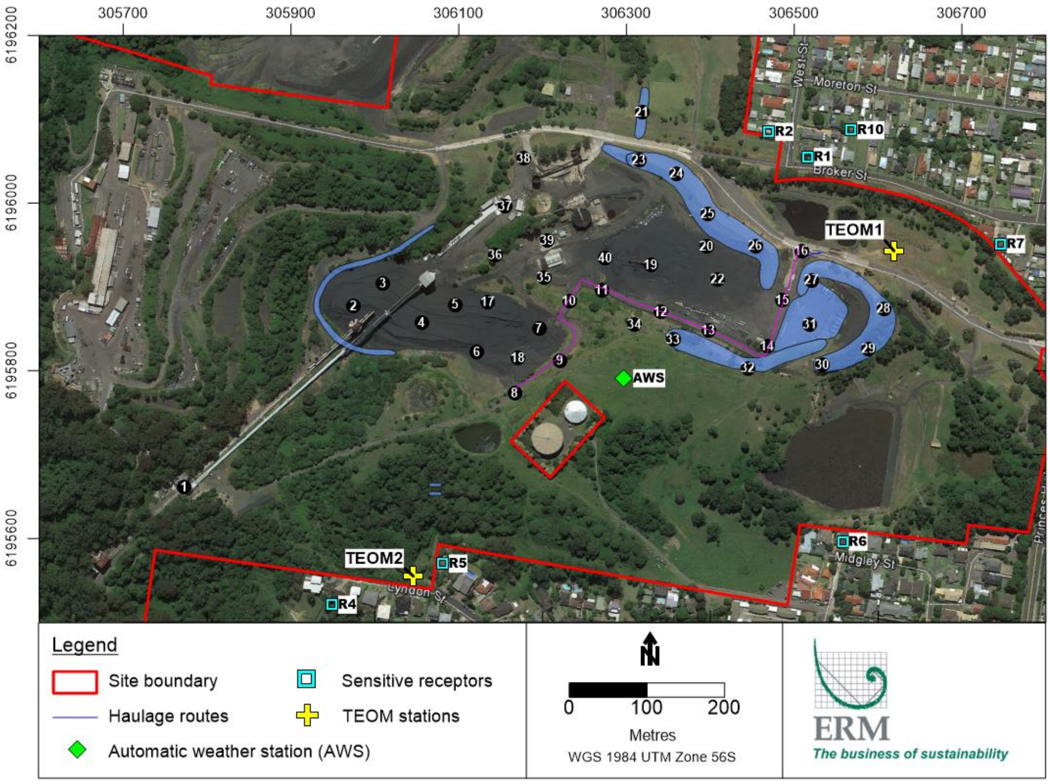

Figure 6: Location of sources modelled in Scenario 1

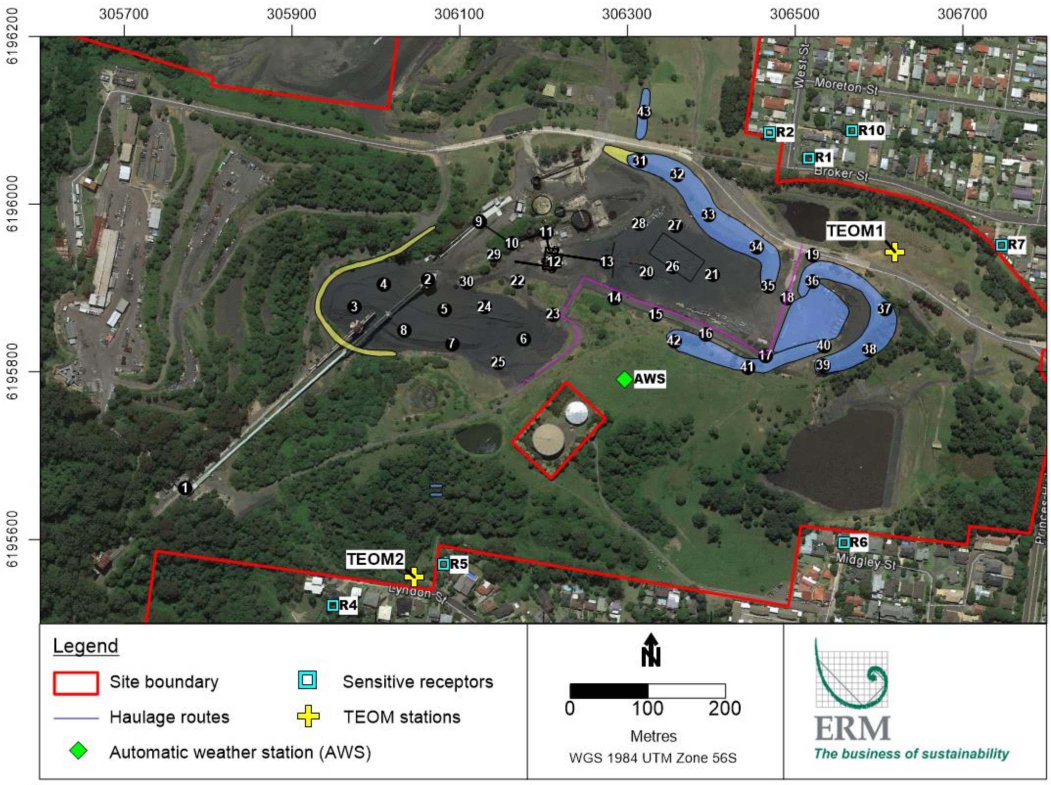

Figure 7: Location of sources modelled in Scenario 2

Emission calculations																										
Russell Vale Colliery							Emission factors																			
Surface facilities	Annual emissions (kg/y)						TSP		PM10		PM2.5		Variables													
Activity	TSP	PM10	PM2.5	Control (%)	Intensity	Units	Factor	Units	Factor	Units	Factor	Units	Area (m2)	(ws/2.2)^1.3	Moisture (%)	Drop distance (m)	kg/VKT (TSP)	kg/VKT (PM10)	kg/VKT (PM2.5)	payload (t)	GVM (t) - average of empty and full	km/trip	Silt (%)	Speed (km/h)	h/year	Silt loading (g/m2)
ROM - transfer to primary sizer building	4	2	0.3	99	500,000	t/y	0.00071	kg/t	0.00034	kg/t	0.00005	kg/t	-	1.8132	4.4	-	-	-	-	-	-	-	-	-	-	-
ROM - crushing in primary sizer building	14	6	6	99	500,000	t/y	0.0027	kg/t	0.0012	kg/t	0.0012	kg/t	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ROM - transfer to ROM stockpile area	356	168	25.5	0	500,000	t/y	0.00071	kg/t	0.00034	kg/t	0.00005	kg/t	-	1.8132	4.4	-	-	-	-	-	-	-	-	-	-	-
ROM - Dozers on ROM stockpile	3,024	645	67	50	312	h/y	19.4	kg/h	4.1	kg/h	0.427	kg/h	-	-	4.4	-	-	-	-	-	-	-	3	-	-	-
FEL loading ROM coal to trucks	18,298	2,814	348	0	500,000	t/y	0.0366	kg/t	0.0056	kg/t	0.0007	kg/t	-	-	10	-	-	-	-	-	-	-	-	-	-	-
ROM coal-haulage off site (unsealed road)	4,034	936	94	75	500,000	t/y	0.0323	kg/t	0.0075	kg/t	0.0007	kg/t	-	-	-	-	1.5059	0.3494	0.0349	28	28.5	0.6	3	-	-	-
FELs loading berm material to trucks	7,319	1,125	139	0	200,000	t/y	0.0366	kg/t	0.0056	kg/t	0.0007	kg/t	-	-	10	-	-	-	-	-	-	-	-	-	-	-
Haulage to berms for construction	1,613	374	37	75	200,000	t/y	0.03227	kg/t	0.00749	kg/t	0.00075	kg/t	-	-	-	-	1.5059	0.3494	0.0349	28	28.5	0.6	3	-	-	
Dumping material to berms	45	21	3	0	200,000	t/y	0.00023	kg/t	0.00011	kg/t	0.00002	kg/t	-	1.8132	10	-	-	-	-	-	-	-	-	-	-	-
Dozers on berms	2,080	409	46	0	312	h/y	6.7	kg/h	1.3	kg/h	0.147	kg/h	-	-	10	-	-	-	-	-	-	-	3	-	-	-
Construction of new infrastructure	1,002	13	1	50	1300.0	km/y							-	-	-	-	1.5411	0.0193	0.0019		30	1300.0	3	-	-	-
Wind erosion - ROM stockpile area	1,402	701	105	0	1.6	ha	876.0	kg/ha/y	438.0	kg/ha/y	65.7	kg/ha/y	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wind erosion - inactive areas	876	438	66	0	1.0	ha	876.0	kg/ha/y	438.0	kg/ha/y	65.7	kg/ha/y	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	**40,066**	**7,651**	**937**																							

Figure 8: Example of calculations summary for Scenario 1

4. Assessment does not include a worst-case scenario

The EPA recommends that:

(a) The proponent should revise the AQIA to include a worst-case scenario. This scenario should include emissions at daily maximum processing quantity.

ERM response:

ERM has conducted a modelling exercise for an additional worst-case scenario to take into account for maximum daily ROM throughput and product transfer. The modelling has assumed these maximum rates will occur on every day of the year, to determine maximum 24-hour average PM_{10} and $PM_{2.5}$ concentrations. These will occur when the maximum production coincides with worst case dispersion conditions. Annual average predictions are not relevant for this scenario.

The following assumptions were made:

- Maximum daily ROM throughput of 5,000 tonnes per day
- Maximum product coal production of 6,000 tonnes per day
- A dozer operating for 2 hours per day, every day of the year
- Stockpile areas remain unchanged
- Truck sizes and haulage distances remain unchanged

The results for maximum 24-hour average $PM_{2.5}$ and PM_{10} predicted concentrations are shown in Figure 9 and Figure 10, respectively. When compared to Figures 6.7 and 6.8 in the assessment, the predictions are slightly higher than for the general operations, as expected. The $PM_{2.5}$ criterion is not predicted to be exceeded. However, there are predicted to be exceedances of the 24-hour average PM_{10} criterion, when combined with the 95th percentile measured value for background, a relatively conservative assumption.

Time series for PM_{10} for the three most impacted residences R1, R2 and R10, are also presented in Figures 11 – 13 which combine these worst-case predictions with daily measured background levels corresponding to the same meteorological data used in the modelling. It can be seen from these figures that the highest measured levels do not occur on the same days as the highest predictions at those three residences. It is also shown that there are no exceedances of the 24-hour PM_{10} air quality assessment criterion due to the Project.

Note that there were no monitoring data available for the months of February and March 2016. The 95th percentile was used here to ensure a conservative background value was available for the cumulative assessment for this period.

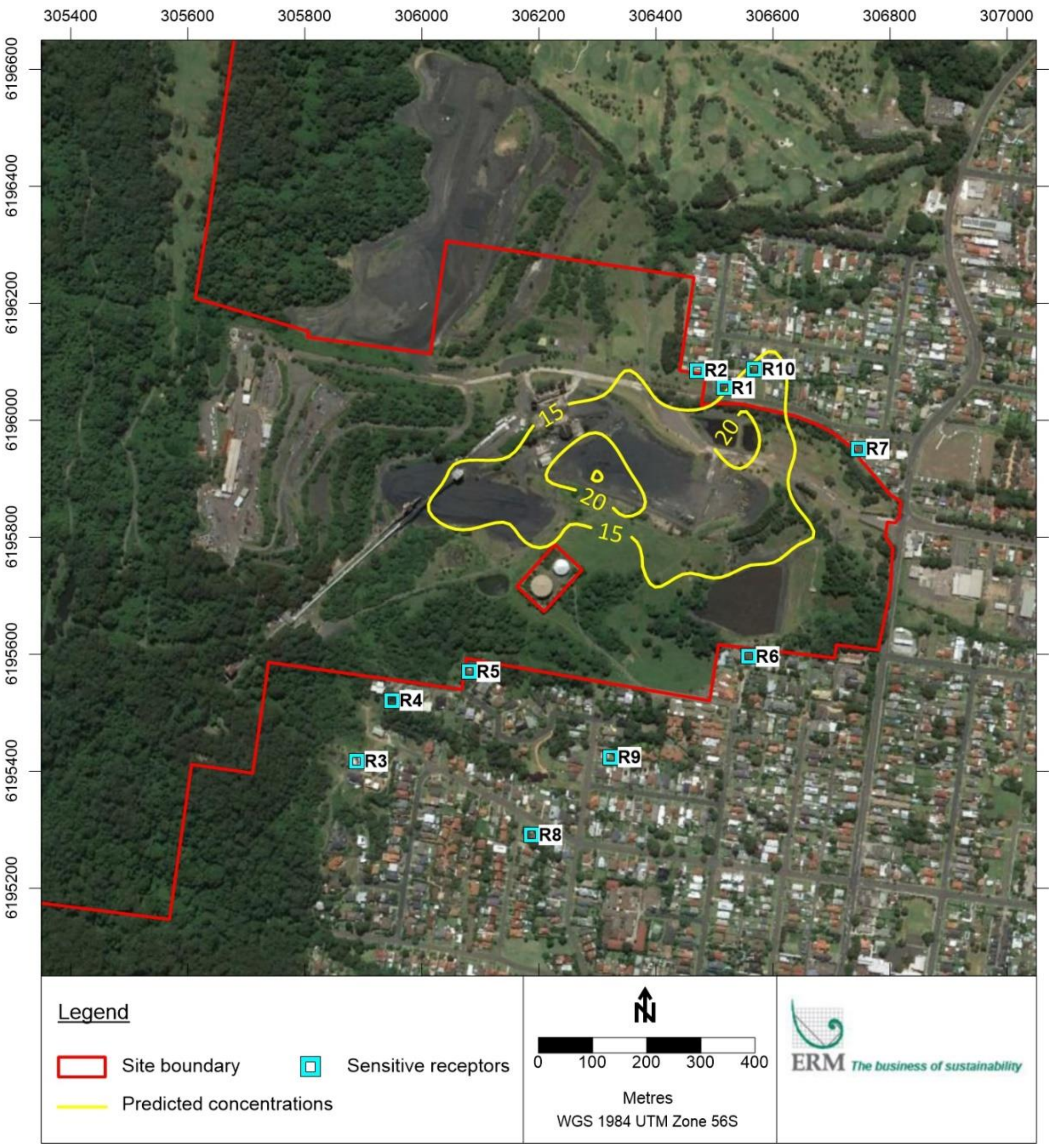

Figure 9: Predicted maximum 24-hour average $PM_{2.5}$ concentrations when the maximum production coincides with worst case dispersion conditions

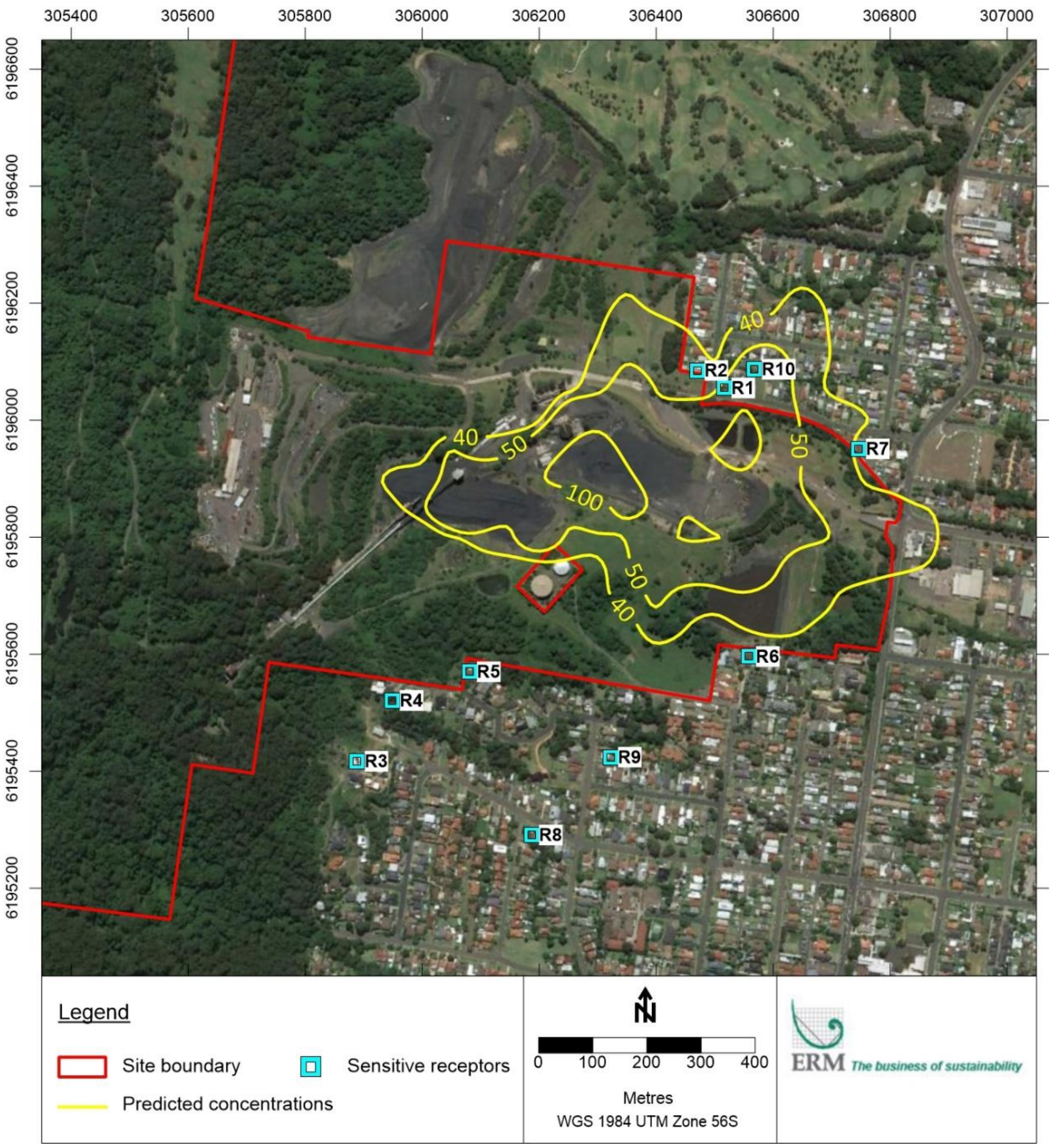

Figure 10: Predicted maximum 24-hour average PM_{10} concentrations when the maximum production coincides with worst case dispersion conditions

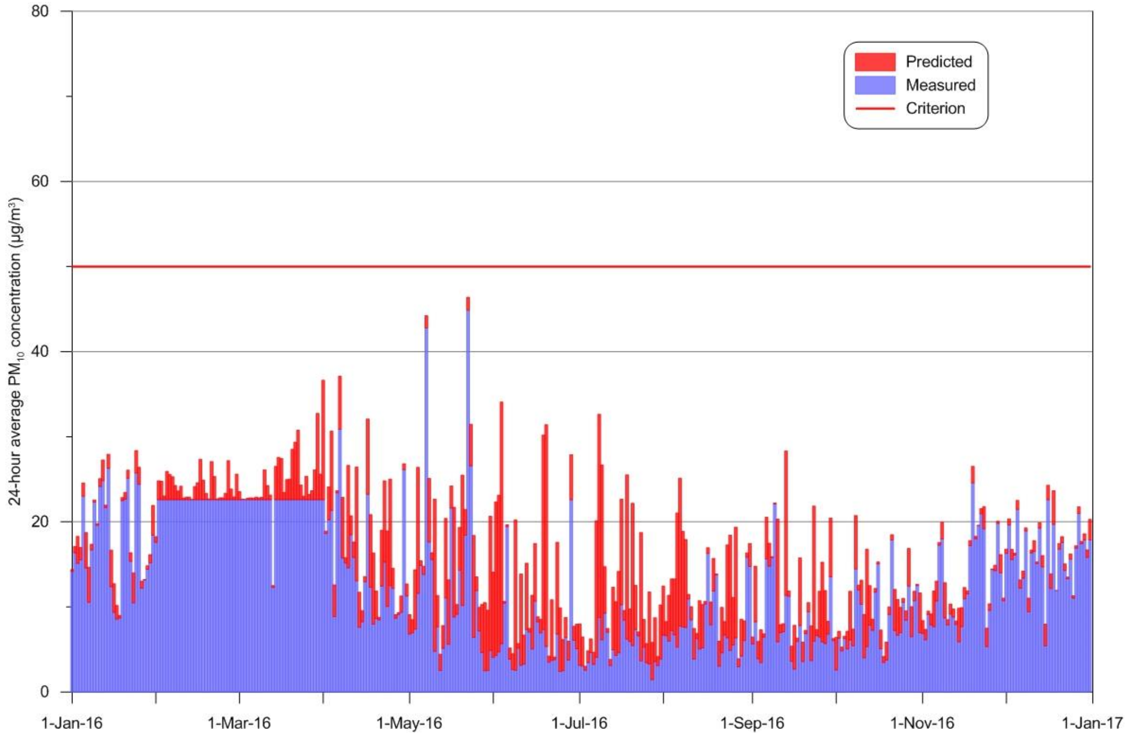

Figure 11: Predicted maximum 24hr average PM_{10} at Receptor 1

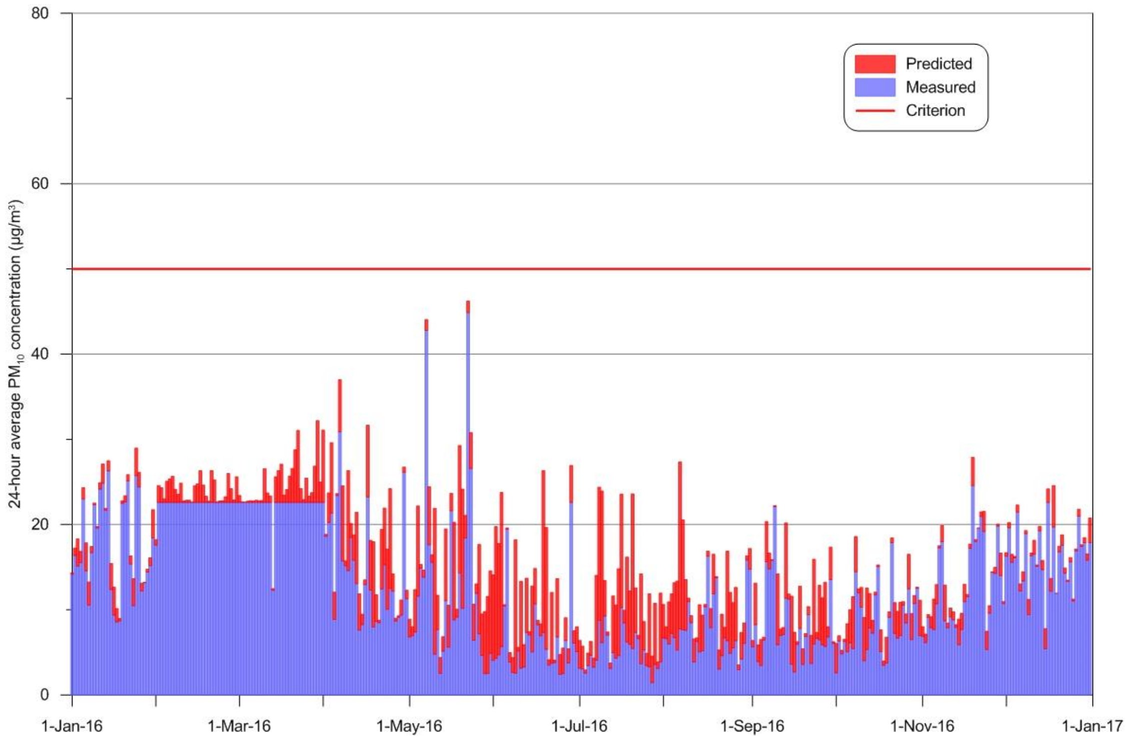

Figure 12: Predicted maximum 24hr average PM_{10} at Receptor 2

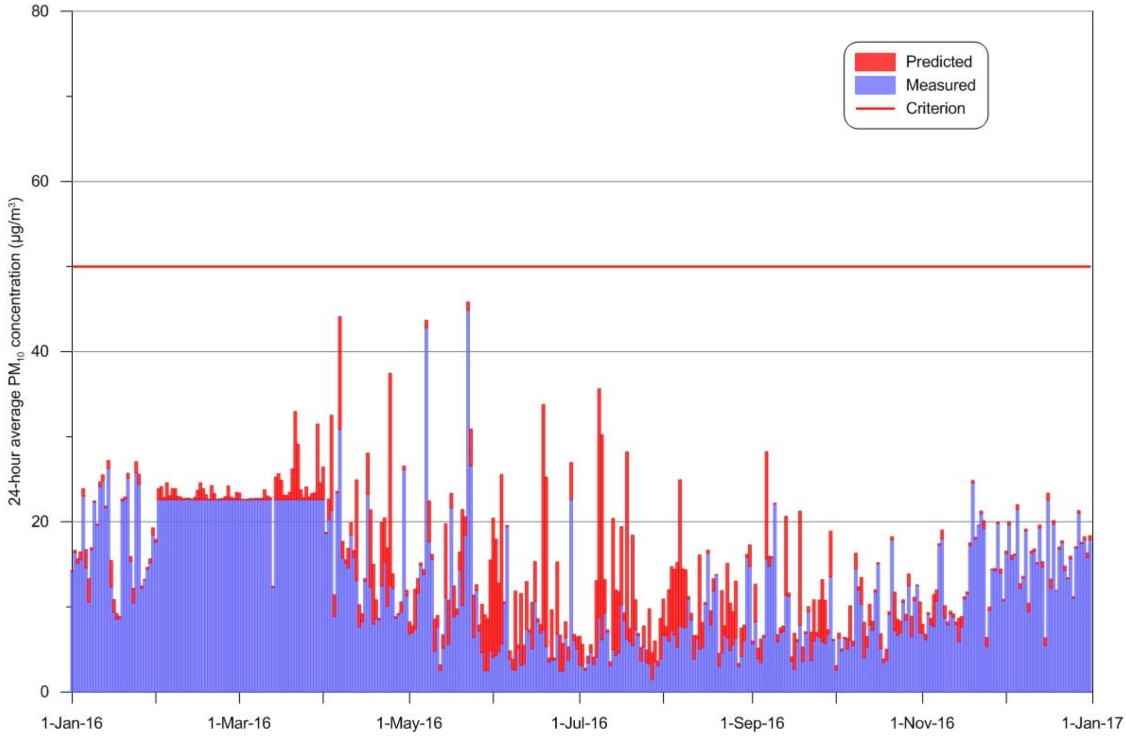

Figure 13: Predicted maximum 24hr average PM_{10} at Receptor 10

APPENDIX 9

Reject Geochemical Review

Wollongong Coal Limited

Russell Vale Colliery

Reject Geochemical Review

November 2019

Document Control	
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Document ID:	WCL RV EC RPT 004
Document Type:	Report
Date Published:	04 November 2019
Document Title:	Russell Vale Colliery Reject Geochemical Review
Version Number:	1
Document Author:	Ron Bush Group Environment and Approvals Manager Wollongong Coal Limited

EXECUTIVE SUMMARY

The reject material produced from the proposed mining of the Wongawilli Coal Seam at Russell Vale Colliery is expected to total up to 200,000 tonnes per annum and is proposed to be either emplaced underground in disused workings or marketed for beneficial use.

The reject material is has negligible total sulphur and can be regarded as a NAF. The reject material has excess ANC and a high factor of safety with respect to potential acid generation.

The metal concentrations in the reject material is unlikely to present any environmental issues from heavy metals or the generation of saline run-off. The reject material impact on the quality of surface water and groundwater is expected to be low.

The reject material is capable of meeting the EPA standards for beneficial use.

TABLE OF CONTENTS

1 INTRODUCTION

1.1 Background

Wollongong Coal Limited (**WCL**) owns the Russell Vale Colliery, which is an underground metallurgical coal mine located in the Illawarra region of the Southern Coalfield. Currently, the Russell Vale Colliery is on care and maintenance.

Russell Vale Colliery has extracted coal from the Bulli, Balgownie and Wongawilli seams. Russell Vale Colliery is planning to resume mining in the East Domain within the Wongawilli Coal Seam via bord and pillar mining using the place change mining method. The place change mining method was selected to improve operational efficiency, reduce costs, minimise surface subsidence and maximise production rates.

It is planned that workings will be limited to the basal 2.4m section of the Wongawilli Coal Seam to minimise ash content of the ROM coal. The ROM coal, with expected ash to range from about 28 - 32%, will be crushed, screened and then subject to a simple beneficiation process. The beneficiation process will reduce the ROM coal ash by about 8% to provide a yield of about 80%.

It is anticipated that approximately up to 200,000 tonnes per annum of rejects will be generated that will either be emplaced underground within former mine workings or will be beneficially used as fill material, under the EPA's Coal Washery Rejects Order 2014 and Exemption 2014.

This report reviews chemical properties of the projected reject material to be generated and its suitability for emplacement underground within former mine workings or for beneficial use as fill material. The scope of this report is to provide geochemical characterisation representative of the anticipated reject material and to recommend environmental management measures related to reject emplacement or beneficial reuse.

1.2 Glossary and Abbreviations

ABA	Acid-base account
AMD	Acid Mine Drainage
ANC	Acid Neutralising Capacity
CEC	Cation exchange capacity
EPA	Environment Protection Authority
LOR	Limits of reporting
MPA	Maximum Potential Acidity
Mtpa	Million tonnes per annum
NAF	Non-acid-forming
NAPP	Net Acid Production Potential
PAF	Potentially-acid-forming
ROM	Run of mine
tpa	Tonnes per annum
UC	Uncertain category
WCL	Wollongong Coal Limited

2 REJECT PRODUCTION

The Russell Vale Colliery Project proposes to mine at a rate of up to 1.2 Mtpa ROM coal that will result in production of up to 1 Mtpa of product coal.

The proposed Coal Processing Plant will comprise a coal sizing plant that will remove oversized rock material using crushing and a simple beneficiation process. No washing of coal will occur on site.

There will be approximately 200,000 tpa of rejects produced, which will be managed by the following methods:

- Emplacement underground within former mine workings and voids;
- Beneficial reuse with the reject material transported off site as fill if it meets the EPA requirements for beneficial reuse; and
- Use on site for rehabilitation of the site.

3 GEOLOGY

3.1 Southern Coalfield

The Russell Vale Colliery is located in the NSW Southern Coalfield within the southern portion of the Permo-Triassic Sydney Basin. The Late Permian Illawarra Coal Measures contain a number of workable seams in the Southern Coalfield.

Above the Illawarra Coal Measures, the stratigraphy consists of a sequence of sandstone, shale and claystone units within the Narrabeen Group which are, in turn, overlain by the Hawkesbury Sandstone. Overburden consists of approximately 156m off Hawkesbury Sandstone, 280m of Narrabeen Group (consisting of thick bedded Sandstone, and Claystone units), and 42m of Illawarra Coal Measures (to the base of the Wongawilli Seam).

A typical stratigraphic section is shown on **Figure 1.**

3.2 Wongawilli Coal Seam

Mineable areas of the Wongawilli Coal Seam have been identified within the underground mining areas. The Wongawilli Coal Seam ranges up to about 10 metres thick across the Southern Coalfield and contains numerous bands of non-coal partings.

The Wongawilli Coal Seam dips gently between 1:25 and 1:30 to the WNW from the outcrop on the Illawarra Escarpment. Occasional normal faulting trends in a NW-NNW direction, and roof joints trend NNE.

The economic working section of the Wongawilli Coal Seam targeted by coal operations is the basal 2.8-3.6m section due to numerous stone bands and high ash coal in the remaining seam section. The Farmborough Tuff which is approximately 1m thick and located 5-5.5m above the working floor separates the Wongawilli Coal Seam into upper and lower sections. The basal 2.8-3.6m section is the lowest ash content portion of the Wongawilli Coal Seam.

Wollongong Coal proposes a mining height of about 2.4 metres in the basal section of the Wongawilli Coal Seam. Coal resources will be left in the immediate mining roof in order to manage the geotechnical and safety constraints associated with the place change mining method.

The immediate roof of the Wongawilli Coal Seam consists of 6m of interbedded coal seams (Hargraves and Cape Horn) and mudstones. The floor consists of grey to white sandstone of the Kembla Sandstone.

The Wongawilli Coal Seam is a highly banded mix of dull and bright coal with carbonaceous and tuffaceous sediments. The ash content is variable, but commonly high up to 30%. The unit grades from coal to interbedded coal to carbonaceous and tuffaceous rocks. The lower, workable coal is bright with disseminated matter and stone bands, and has a vitrinite range of between 60% and 80% and is a moderate to high ash coking coal.

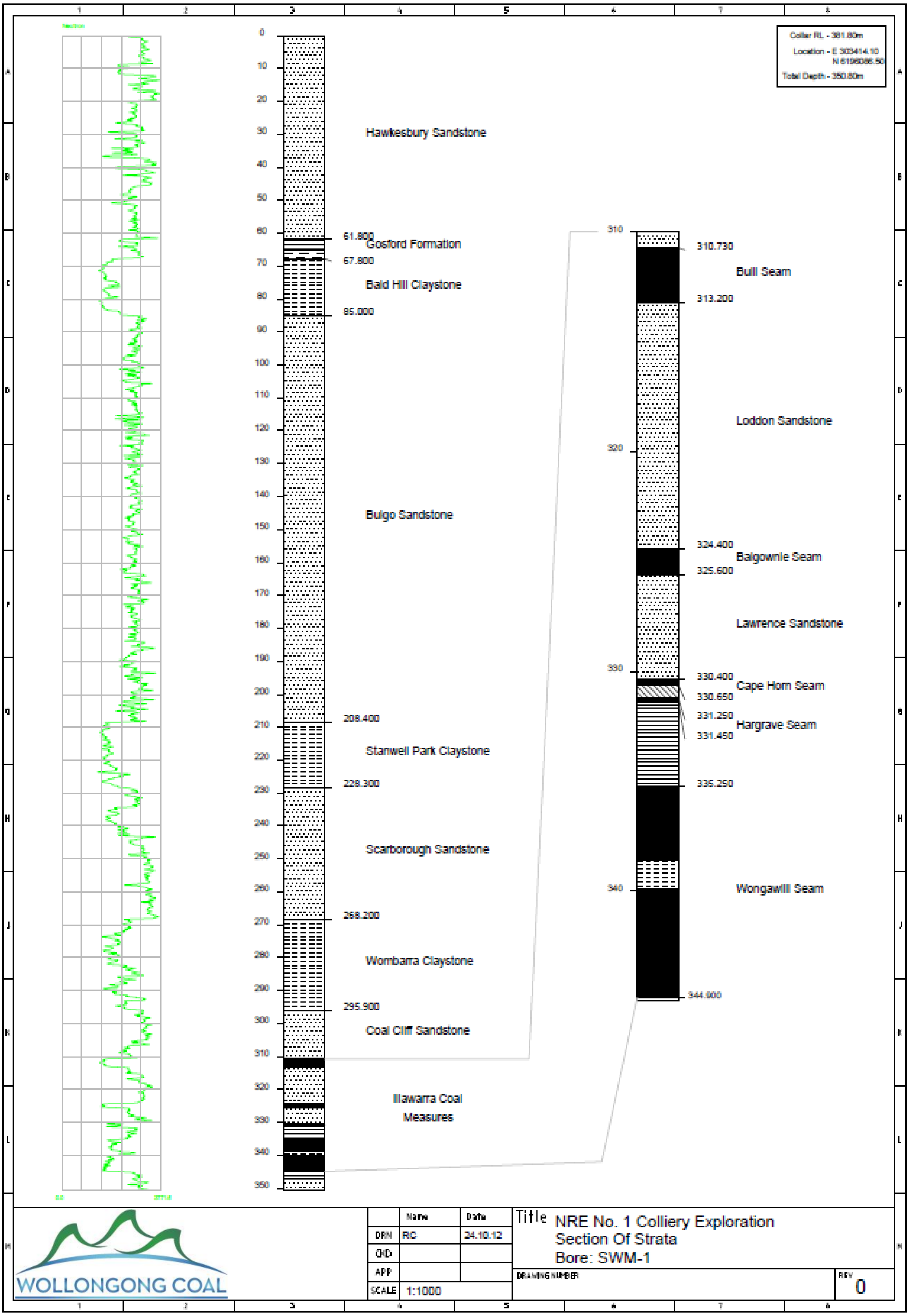

Figure 1: Typical Stratigraphic Section

4 GEOCHEMICAL BACKGROUND

A potential environmental issue associated with emplacement or reuse of coal reject material is from possible oxidation of sulfide minerals within the rejects that can become acidic and can potentially lead to acid mine drainage (**AMD**).

Under conditions in which aquifers have a limited buffering capacity, seepage of AMD can cause groundwater to become acidic and to contain elevated concentrations of metals. This can pose health risks to groundwater users and affect groundwater-dependent ecosystems where the watertable is shallow or where groundwater discharge takes place.

4.1 Oxidisation Processes

The generation of acid (H+) occurs typically when iron sulfide minerals are exposed to both oxygen (from air) and water. This process can be strongly catalysed by bacterial activity under the right conditions (acid pH, availability of nutrients and oxygen).

The complete oxidation of pyrite to produce sulphuric acid and an orange precipitate, ferric hydroxide ($Fe(OH)_3$), is provided as an example in **Reaction 1**:

$$FeS_2 + 3.75\,O_2 + 3.5\,H_2O \Leftrightarrow Fe(OH)_{3(s)} + 2\,SO_4^{2-} + 4\,H^+ \qquad \textbf{\textit{(Reaction 1)}}$$

Iron sulfide + Oxygen + Water ⇔ Ferric hydroxide + Sulfate + Acid
(orange precipitate)

4.2 Self-Heating and Auto-Ignition

The oxidation of iron sulfides is an exothermic (heat-generating) process. The faster the rate of reaction, the greater the rate of production of heat. In certain circumstances, the rate of heat production by an oxidising mass of sulfide-containing material can exceed the rate of heat loss. If this happens, the temperature can rise such that the mass ignites and sulphur dioxide gas is liberated to the atmosphere.

This process is widely known as 'spontaneous combustion'.

Spontaneous combustion potential of coal from the Wongawilli Coal Seam at Russell Vale Colliery was characterised by Simtars Queensland (Report OG420191P1, dated 9 March 2012) using proximate, ultimate, calorific value, R_{70}, crossing point analysis and calculation of Self Heating Temperature. Gas chromatographic analysis of the gases evolved when the sample of coal was heated in a laboratory vessel using air was also examined.

The results of the testing carried out, as shown on **Figure 2** and **Figure 3**, indicate that the coal from the Wongawilli Coal Seam at the Russell Vale Colliery has a low inherent spontaneous combustibility.

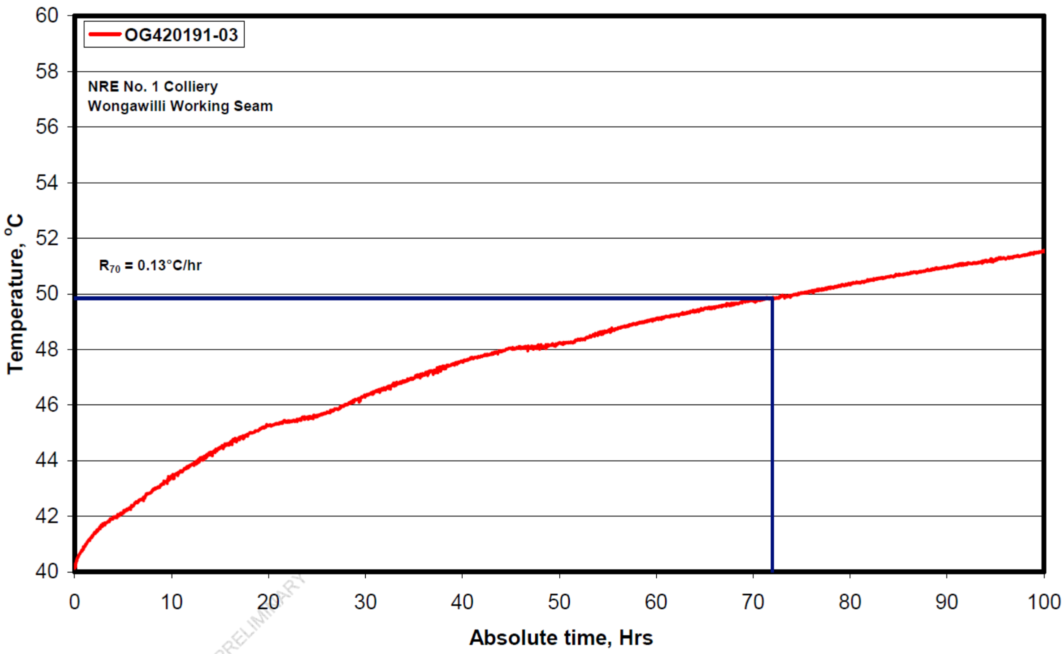

Figure 2: Wongawilli Coal R_{70}

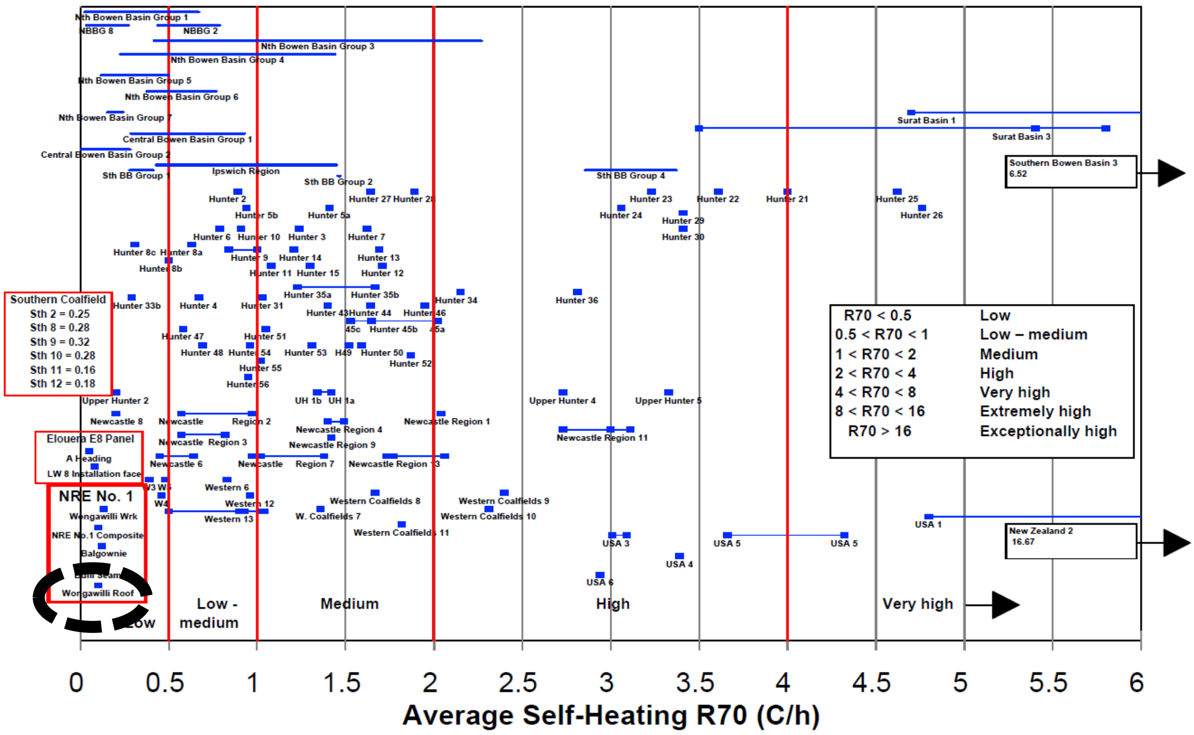

Figure 3: Wongawilli Coal Classification

5 GEOCHEMICAL CHARACTERISATION

5.1 Overview

The key aims of reject material characterisation are to determine:

- The potential extent or magnitude of AMD generation;
- The suitability for reject emplacement underground; and
- The suitability for beneficial reuse as an engineering and general fill material.

5.2 Acid Base Account

The Acid Base Account (**ABA**) estimates the balance between the potential for a material to generate acid and to neutralise acid. The output from an ABA is a value known as the Net Acid Producing Potential (**NAPP**), expressed in units of kilograms of sulphuric acid per tonne (kg H_2SO_4/t).

The NAPP test determines the Maximum Potential Acidity (**MPA**) and the maximum inherent Acid-Neutralising Capacity (**ANC**) of a sample. NAPP calculates a theoretical net acid producing (or consuming) value of a sample by subtracting the theoretical acid neutralising capacity, or ANC of a sample (CaO + MgO for example), from the maximum potential acidity of a sample (total Sulphur).

The total sulphur content is commonly used as a conservative estimate of pyritic sulphur (that is, all S is assumed to be present in the form of pyrite) to calculate the MPA (MPA = weight% S x 30.6). The use of total sulphur is a conservative approach because some sulphur may be present in forms other than pyrite.

The ANC is typically determined by the addition of a known quantity of concentrated hydrochloric acid to a sample, followed by back-titration with sodium hydroxide to quantify the maximum amount of acid consumed by the inherent neutralising capacity of the material.

Two measures of the ABA are calculated from the MPA and ANC:

- NAPP; and
- ANC/MPA ratio.

The NAPP is a qualitative measure of the difference between the capacity of a sample to generate acid (MPA) and its capacity to neutralise acid (ANC). The NAPP, MPA and ANC are expressed in units of kg H_2SO_4/t and the NAPP is calculated as follows:

- NAPP = MPA – ANC

If the MPA is less than the ANC, then the NAPP is negative, indicating that the sample may have sufficient ANC to prevent acid generation. Conversely, if the MPA exceeds the ANC, then the NAPP is positive, indicating that the material may be acid-generating.

The ANC/MPA ratio provides an indication of the relative margin or factor of safety (or lack thereof) for a given material. Various ANC/MPA values are referenced in the literature for indicating safe values for the prevention of acid generation. Those values typically range from 1.5 to 3. As a general rule, an ANC/MPA ratio of 2 or more signifies that there is a high probability that the material will remain near-neutral in pH and should not be problematic in terms of acidity generation and resultant acidic drainage.

5.3 Geochemical Classification Criteria

The geochemical criteria used to classify the acid forming nature of the reject samples is outlined within **Table 1**.

Table 1: Geochemical Classification Criteria

Geochemical Classification	Total Sulfur (%)	NAPP (kg H_2SO_4/t)	ANC/MPA Ratio
NAF - Barren	≤ 0.1	-	-
NAF	> 0.1	≤ - 10	> 2
Uncertain (NAF)	> 0.1	> - 10 and ≤ 0	-
Uncertain (PAF)	> 0.1	> 0 and ≤ 10	< 2
PAF	> 0.1	> 10	< 2

6 METHODOLOGY

6.1 Sampling and Geochemical Testing Program

There are no specific regulatory requirements regarding the number of samples required to be obtained and tested for overburden and potential coal reject materials at mines in NSW.

As such, existing technical guidelines for geochemical assessment of mine waste in Australia (AMIRA, 2002; DITR, 2007) and worldwide (INAP, 2009) are used as a framework for developing the sampling (and testing) program.

The sampling program consisted of inspecting the Reject Emplacement Area (**REA**) at Russell Vale Colliery and sampling different types of rejects based upon lithology to provide a representation of the different lithologies expected to be present within rejects generated. The REA was sampled on 10 October 2019.

The different types of lithologies present within the REA consisted of the following:

- Sandstone – representing the Kembla Sandstone at the floor of the Wongawilli Seam;
- Shale – representing claystone/mudstone parting within the roof of the Wongawilli Seam;
- Carbonaceous Shale - representing claystone/mudstone parting within the roof of the Wongawilli Seam; and
- Coaly Shale - representing claystone/mudstone parting and thin coal band within the roof of the Wongawilli Seam.

The location of the REA reject samples collected are outlined on **Figure 4** and described within **Table 2**:

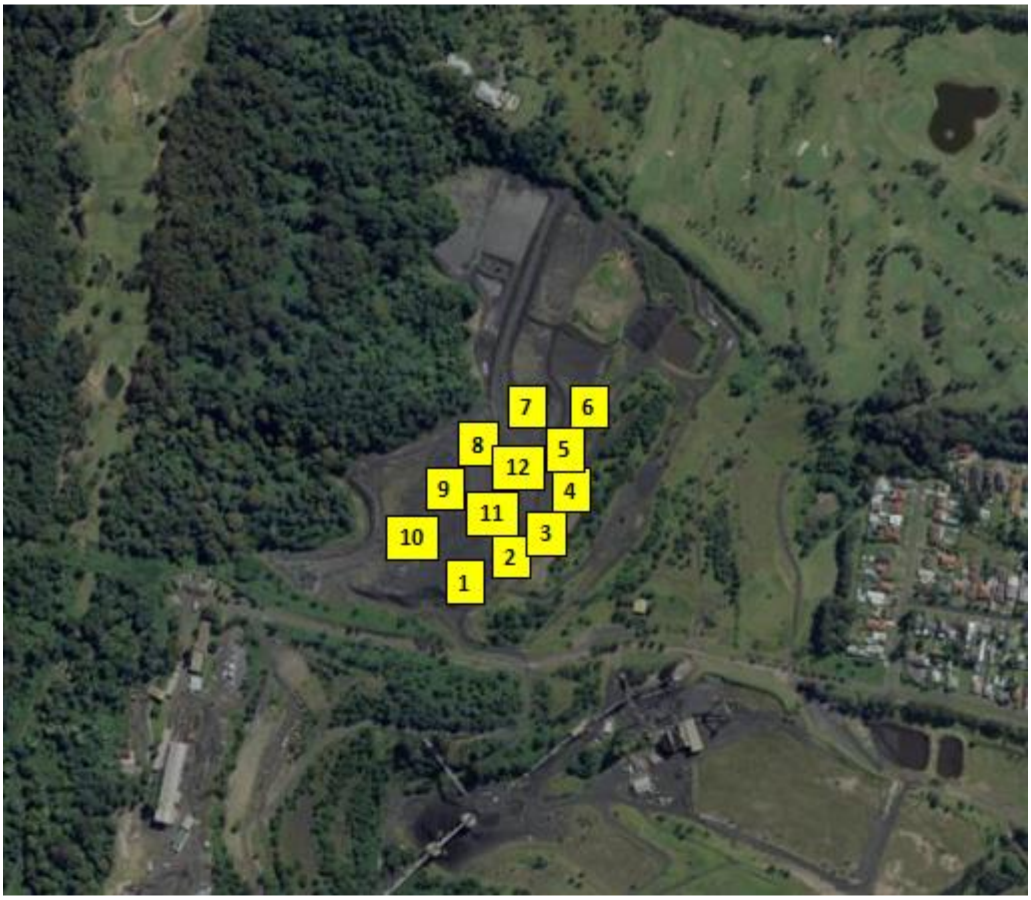

Figure 4: Reject Sample Locations

Table 2: REA Reject Samples and Lithology

Field Sample Number	ALS Laboratory Sample Number	Lithology
REA01	EB1927112001	Carbonaeous Shale
REA02	EB1927112002	Shale
REA03	EB1927112003	Shale
REA04	EB1927112004	Carbonaeous Shale
REA05	EB1927112005	Shale
REA06	EB1927112006	Sandstone
REA07	EB1927112007	Shale
REA08	EB1927112008	Sandstone
REA09	EB1927112009	Shale
REA10	EB1927112010	Sandstone
REA11	EB1927112011	Coaly Shale
REA12	EB1927112012	Coaly Shale

6.2 Geochemical Static Testing

A core suite of standard procedures has been developed to assess the potential for AMD generation from sulfidic materials. In general, the procedures are designed to take account of both:

- Acid-generating reactions, which are promoted by the oxidation of reactive sulfide minerals once exposed to atmospheric oxygen; and
- Acid-neutralising reactions, which result from the dissolution of reactive alkaline minerals, mainly carbonates.

The REA reject samples were subjected to ABA geochemical testing. The REA reject samples where sent ALS Brisbane and were crushed and pulverised and subjected to a series of static geochemical tests. The geochemical test program was designed to assess the degree of risk from oxidation of pyrite, acid generation, and leaching of soluble metals and salts.

The static geochemical assessment test program also included characterisation of standard soil parameters including salinity, cation exchange capacity, sodicity, potential nutrients and major metal compositions.

Specifically, each sample was tested for:

- pH and Electrical Conductivity (EC) (1:5);
- Total sulphur;
- Acid neutralising capacity (ANC); and
- Net acid producing potential (NAPP).

The REA reject samples were further subjected to multi-element testing on solid and soluble fractions of these composite samples. Composite samples were tested for:

- pH and EC (1:5 solid:water);
- Total sulpur;
- Alkalinity or acidity (pH dependent) (1:5);
- Total metals (Al, As, B, Cd, Cr, Co, Cu, Fe, Pb, Mn, Mo, N, Ni, Sb, Se, Zn) in solids;
- Total cations (Ca, Mg, Na, K);
- Soluble metals (Al, As, B, Cd, Cr, Co, Cu, Fe, Pb, Mn, Mo, Ni, Sb, Se, Zn) in 1:5 (solid:water) extracts;
- Soluble cations (Ca, Mg, Na, K) and soluble anions (Cl, SO4);
- Exchangeable cations (Ca, Mg, Na, K) and Cation Exchange Capacity (CEC); and
- Exchangeable Sodium Percentage (ESP).

The ALS laboratory reports are contained within Appendix 1.

7 GEOCHEMICAL TEST RESULTS

7.1 Acid Base Account Results

The test results for the 12 REA reject samples are outlined in **Table 3**. All but 1 REA reject samples are classified as being NAF Barren or NAF. One REA reject sample was classified as Uncertain (NAF). All REA rejects samples are show to be Non Acid Forming and have a high factor of safety in relation to acid generation.

Table 3: Acid Base Results for Russell Vale Colliery REA Reject Samples

	Lithology	pH	EC	Sulphur	MPA	ANC	ANC/MPA Ratio	NAPP	Classification
REA01	Carbonaceous Shale	9.3	122	0.18	5.508	11.7	2.1	-6.2	NAF
REA02	Shale	9	137	0.02	0.612	24.5	40.0	-23.9	NAF Barren
REA03	Shale	8.8	85	0.03	0.918	9.4	10.2	-8.5	NAF Barren
REA04	Carbonaceous Shale	8.9	127	0.16	4.896	53.2	10.9	-48.3	NAF
REA05	Shale	9.4	130	0.02	0.612	11.2	18.3	-10.6	NAF Barren
REA06	Sandstone	8.7	214	0.005	0.153	11.3	73.9	-11.1	NAF Barren
REA07	Shale	9.6	144	0.005	0.153	11.5	75.2	-11.3	NAF Barren
REA08	Sandstone	8.2	120	0.01	0.306	6.2	20.3	-5.9	NAF Barren
REA09	Shale	9.1	96	0.005	0.153	8.3	54.2	-8.1	NAF Barren
REA10	Sandstone	8.4	130	0.005	0.153	12.4	81.0	-12.2	NAF Barren
REA11	Coaly Shale	9.2	88	0.18	5.508	14.4	2.6	-8.9	Uncertain (NAF)
REA12	Coaly Shale	9.4	85	0.2	6.12	23.3	3.8	-17.2	NAF
	Minimum	8.2	85	0.005	0.153	6.2	2.1	-48.3	
	Mean	9.0	123	0.068	2.091	16.5	32.7	-14.4	NAF Barren
	Median	9.05	125	0.020	0.612	11.6	19.3	-10.9	NAF Barren
	Maximum	9.6	214	0.200	6.120	53.2	81.0	-5.9	
	Count	12	12	12	12	12	12	12	
	Std Dev	0.42	36	0.08	2.55	12.8	30.7	11.8	
	95 UCL	9.2	143	0.12	3.533	23.7	50.1	-7.7	NAF

The Queensland DME Technical Guidelines provide some advice in relation to pH and Electrical Conductivity, and this criterion is outlined on **Table 4**.

Table 4: pH and EC Criteria

	Very Low	Low	Medium	High	Very High
pH	< 4.5	4.5 – 5.5	5.5 – 7.0	7.0 – 9.0	> 9.0
EC	< 150	150 - 450	450 - 900	900 – 2,000	> 2,000

The pH of the REA reject samples are outlined on **Figure 5**. The pH of the REA reject samples are all alkaline and range from 8.8 to 9.6, which, from **Table 4**, can be considered as high to very high.

The Electrical Conductivity of the REA reject samples are also outlined on **Figure 5** . The EC of the REA reject samples are low and range from 85 uS/cm to 214 uS/cm, which, from **Table 4**, is within the very low to low salinity range.

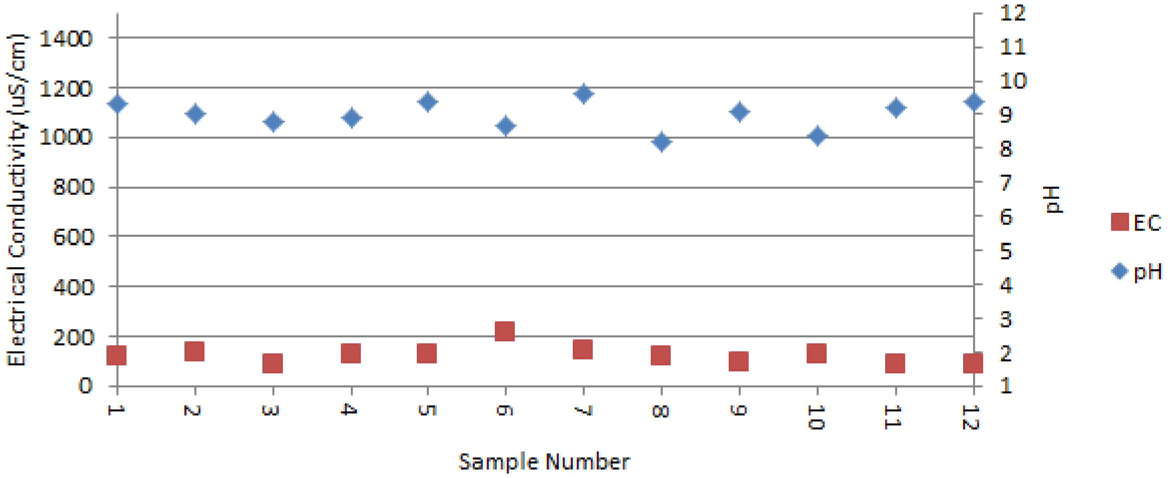

Figure 5: REA Reject Samples pH and EC

The Total Sulpur of the REA reject samples are outlined on **Figure 6**. The Total Sulpur of the REA reject samples are low and range from 0.005 to 0.2, with the higher sulphur results being found in the carbonaceous shale and coaly shale samples.

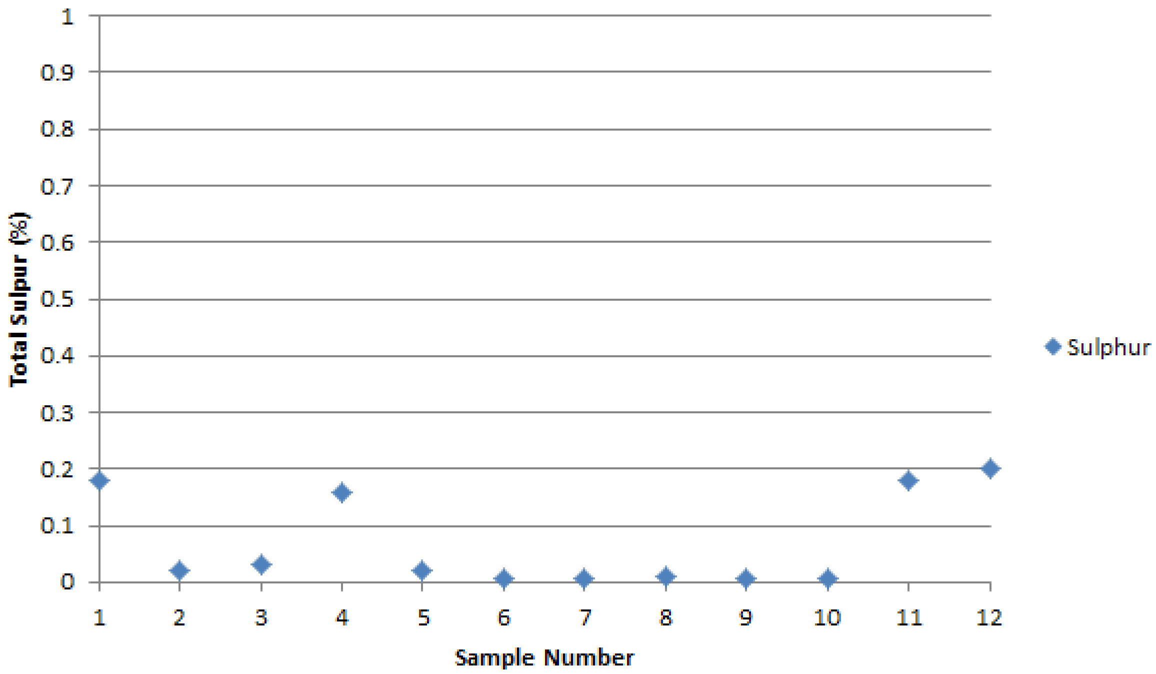

Figure 6: REA Reject Samples Total Sulphur

The MPA of the REA reject samples are outlined on **Figure 7**. The MPA of the REA reject samples are low and range from 0.153 kg H_2SO_4/t to 6.12 kg H_2SO_4/t. The higher MPA results are experienced with the carbonaceous shales and the coaly shale samples.

The ANC of the REA reject samples are also outlined on **Figure 7**. The ANC of the REA reject samples are moderate and range from 6.2 kg H_2SO_4/t to 53.2 kg H_2SO_4/t.

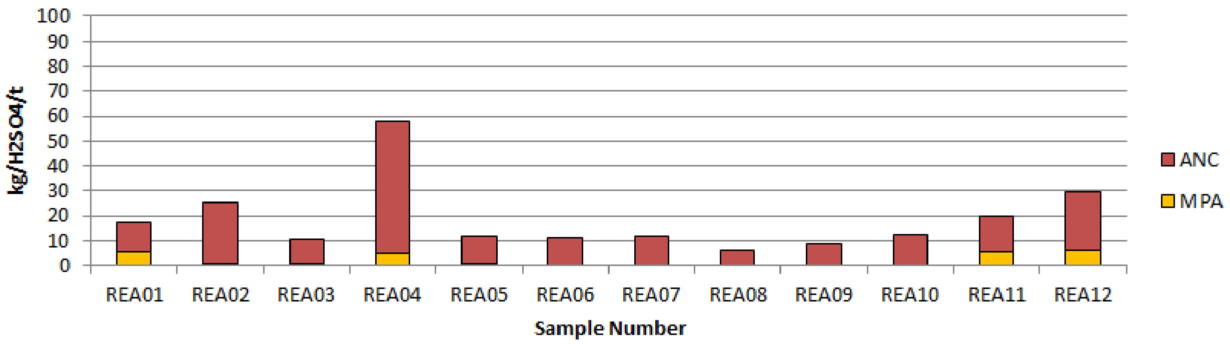

Figure 7: REA Reject Samples MPA and ANC

A plot of ANC versus MPA for the REA reject samples is shown on **Figure 8**. ANC/MPA ratio lines have been plotted to illustrate the factor of safety associated with the samples. Generally those samples with an ANC/MPA ratio of greater than 2 and greater than 3 are considered to have a low or negligible risk of acid generation and a high factor of safety in terms of potential for AMD (DITR, 2007; INAP, 2009). All REA reject sample ANC/MPA ratio results were greater than 2 and most greater than 3, showing that there is negligible to low risk of acid generation.

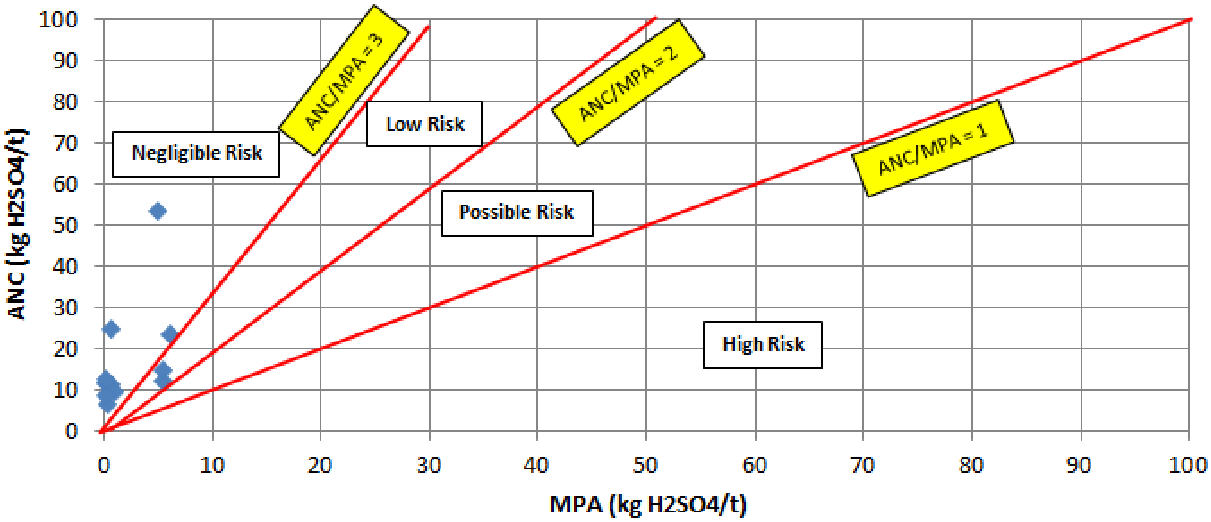

Figure 8: REA Reject Samples ANC v MPA

7.2 Multi-Element Concentrations in Solids

Multi-element analysis are completed to identify any elements (particularly metals) present at concentrations that may be of environmental concern with respect to revegetation and vegetation health.

The results are compared to the relevant guideline criteria to determine any concerns related to mine operation and final rehabilitation. The relevant guideline criteria is the NEPC (2013) Guideline on Investigation Levels for Soil and Groundwater, HIL (C) – recreation open spaces.

The results from multi-element testing (metals) of the REA reject samples are presented in **Table 5**.

The acquired data indicates that the total metal concentrations in the reject material are all relatively low and are within the criteria for HIL (C). The total metal concentrations, except for one minor exceedance for manganese in REA04, would all actually comply with HIL (A) – residential, which is the highest NEPC soil chemical concentration criteria standard.

Table 5: Reject Multi-Element Test Results

Parameters	LOR	Unit	NEPC HIL (C)	REA01	REA02	REA03	REA04	REA05	REA06	REA07	REA08	REA09	REA10	REA11	REA12
Aluminium (Al)	50	mg/kg	-	1420	3,240	3,060	780	2,850	2,560	2,510	3,090	2,750	2,180	900	920
Antimony (Sb)	5	mg/kg	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Arsenic (As)	5	mg/kg	300	<5	<5	<5	<5	<5	15	<5	59	<5	35	<5	<5
Boron (B)	50	mg/kg	20,000	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	1	mg/kg	100	<1	<1	<1	1	<1	<1	<1	<1	<1	<1	<1	<1
Calcium (Ca)	10	mg/kg	-	920	2,270	830	25,400	440	1,490	720	510	670	1,190	3,880	8720
Chromium (Cr) total	2	mg/kg	240	<2	<2	<2	<2	<2	10	<2	4	<2	10	<2	<2
Cobalt (Co)	2	mg/kg	300	<2	<2	<2	<2	<2	12	<2	25	<2	14	<2	<2
Copper (Cu)	5	mg/kg	20,000	12	18	10	<5	20	15	16	14	18	19	6	8
Iron (Fe)	50	mg/kg	-	11,900	47,900	4,110	79,800	11,800	15,900	8,410	920	8,040	38,600	21,000	29,100
Lead (Pb)	5	mg/kg	600	7	26	18	6	19	11	20	18	21	14	7	8
Magnesium (Mg)	10	mg/kg	-	930	5,000	520	12,800	1,320	1,070	1,120	430	1,090	2,000	2,280	4,250
Manganese (Mn)	5	mg/kg	9,000	338	479	58	3,360	148	429	161	12	168	1,420	654	1,050
Molybdenum (Mo)	2	mg/kg	-	<2	<2	<2	<2	<2	<2	<2	4	<2	<2	<2	<2
Nickel (Ni)	2	mg/kg	800	2	7	5	<2	4	40	3	66	4	54	<2	<2
Potassium (K)	10	mg/kg	-	1,080	1,040	780	280	1,620	500	1,610	430	1,260	370	440	600
Selenium (Se)	5	mg/kg	700	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Sodium (Na)	10	mg/kg	-	720	1,370	1,440	250	1,360	970	1,270	1,080	1,330	900	260	370
Zinc (Zn)	5	mg/kg	30,000	37	31	31	12	17	50	18	68	24	61	31	18

7.3 Multi-Element Concentration in Water Extracts

The results from multi-element testing of soluble metals concentrations in water extracts (1:5 solid:water) from the composite overburden and potential coal reject samples are presented in **Table 6**.

The results are compared to the relevant guideline criteria for both freshwater (ANZECC, 2000 – Trigger Value for Freshwater (95% and 80% and Irrigation)) and groundwater (NEPC, 2013 – Groundwater Investigation Level – Fresh Water) to determine any water quality concerns related to fresh water and groundwater exposure.

The dominant major soluble cation is sodium, with low concentrations of calcium, magnesium and potassium. The dominant major soluble anions are bicarbonate, carbonate and sulphate, with low chloride.

The concentrations of trace metals tested in the water extracts are all very low to low, and predominantly below the analytical detection limit. Some samples presented higher results for Aluminium and Arsenic compared to the water quality guidelines for both fresh water and groundwater. The higher Aluminium results are a function of the higher levels of Aluminium within shale, which predominately consists of alumina-silicate minerals.

Arsenic concentrations in sedimentary rocks can be variable and organic-rich shales typically have higher concentrations of arsenic, where the arsenic is generally concentrated in the clay minerals.

Overall, the results from multi-element testing of soluble metals concentrations in water extracts indicate that most elements are sparingly soluble at the current pH of the water extracts, unlikely to become mobile, are typically below the range of typical water quality conditions expected from within the Wongawilli Coal Seam and are unlikely to impact on surface water or groundwater water quality.

Table 6: Reject Multi-Element in Water Extracts Test Results

Parameters	LOR	Units	ANZEC Freshwater (95%)	ANZEC Freshwater (80%)	ANZEC Irrigation	NEPC Groundwater Freshwater	REA01	REA02	REA03	REA04	REA05	REA06	REA07	REA08	REA09	REA10	REA11	REA12
Aluminium (Al)	0.2	mg/L	0.055	0.15	20	0.055	0.4	0.4	0.4	0.1	0.6	0.1	0.8	0.1	0.4	0.1	0.1	0.1
Antimony (Sb)	0.02	mg/L	-	-	-	-	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.08	0.01	0.01	0.01	0.01
Arsenic (As)	0.02	mg/L	0.013	0.14	2	0.013	0.06	0.12	0.04	0.01	0.3	0.04	0.16	1.8	0.16	0.32	0.01	0.01
Boron (B)	0.2	mg/L	0.37	1.3	5	0.37	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Cadmium (Cd)	0.02	mg/L	0.0002	0.0008	0.05	0.0002	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Chromium (Cr) total	0.02	mg/L	0.001	0.04	1	0.001	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Cobalt (Co)	0.02	mg/L	-	-	0.1	-	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Copper (Cu)	0.02	mg/L	0.0014	0.0025	5	0.0014	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Iron (Fe)	0.2	mg/L	-	-	10	-	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Lead (Pb)	0.02	mg/L	0.0034	0.0094	5	0.0034	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Manganese (Mn)	0.02	mg/L	1.9	36	10	1.9	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Molybdenum (Mo)	0.02	mg/L	-	-	-	-	0.01	0.06	0.01	0.01	0.01	0.04	0.02	0.06	0.01	0.04	0.01	0.01
Nickel (Ni)	0.02	mg/L	0.011	0.017	-	0.011	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Selenium (Se)	0.02	mg/L	0.011	0.034	0.05	0.011	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Zinc (Zn)	0.02	mg/L	0.008	0.031	5	0.008	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01

7.4 Effective Cation Exchange Capacity and Sodicity

The Cation Exchange Capacity (**CEC**) is the capacity of a soil to hold and exchange cations. CEC provides a buffering effect to changes in pH, available nutrients, calcium levels and soil structural changes. CEC is an important controlling agent for soil structural stability. The ratings for effective CEC are outlined on **Table 7**.

Table 7: CEC Ratings

CEC Rating	CEC meq/100g
Very Low	<6
Low	6-12
Moderate	12-25
High	25-40
Very High	>40

Sodicity is the amount of exchangeable sodium cations within the soil or a sample and provides an indication on the likely dispersion on wetting and shrink-swell properties. Sodicity is determined using the Exchangeable Sodium Percentage (ESP) with the Rating outlined on **Table 8.**

Table 8: ESP Ratings

Exchangeable Sodium Percentage	Rating
Non-sodic	<5
Marginally sodic	>10
Highly sodic	5-10

The reject samples tested CEC and Sodicity results are outlined on **Table 9**. The CEC results indicate that the reject material has a very low to low CEC and fertilizer would be required to be added to provide a reasonable growth medium for vegetation. The results also indicate that the reject materials is sodic, which is associated with the higher pH of the reject material. The reject material shows that the Exchangable Calicum, Exchangable Magnesium and Exchangable Potassium as all low and the Exchangable Sodium is high, which is not preferred for the material to be used as a growth medium for vegetation. However, benefitical use of the reject material will be for civil engineering works and as general fill and not as a direct growth medium. The Ca:Mg Ratio is indicative of a low Ca material.

Table 9: CEC and Sodicity Test Results

Parameters	LOR	Units	REA01	REA02	REA03	REA04	REA05	REA06	REA07	REA08	REA09	REA10	REA11	REA12
Exch. Calcium	0.1	meq/100g	0.3	1.2	2.8	1.2	0.6	1.3	1.4	1.5	1.4	2.2	0.5	1
Exch. Magnesium	0.1	meq/100g	<0.2	1.6	1.2	0.9	0.8	1.2	1.3	1.5	1.4	2	0.4	0.8
Exch. Potassium	0.1	meq/100g	<0.2	0.3	0.6	<0.2	0.3	<0.2	0.4	0.3	0.4	0.3	<0.2	<0.2
Exch. Sodium	0.1	meq/100g	2.8	3	2	0.5	4.4	0.9	4.2	1	3.6	1	0.8	1.3
Cation Exchange Capacity	0.1	meq/100g	3.2	6.2	6.7	2.6	6	3.6	7.4	4.3	6.7	5.5	1.8	3.1
Exchangeable Sodium Percentage	0.1	%	86.4	48.4	30.5	18	72.6	25.8	57.6	23.1	53.1	18.9	47.2	42
Calcium/Magnesium Ratio	0.1	%	----	0.8	2.2	1.3	0.8	1.1	1.1	1	1	1.1	1.1	1.3

8 BENEFICIAL USE

The NSW has two Resource Recovery Orders and Exemptions under the *Protection of the Environment Operations (Waste) Regulation 2014* that govern coal washery reject management and beneficial reuse, which are:

- Coal Washery Rejects Order 2014 and Coal Washery Rejects Exemption 2014; and
- Coal Washery Rejects (Coal Mine Void) Order 2014 and Coal Washery Rejects (Coal Mine Void) Exemption 2014.

The Order applies to the supplier of the material and the Exemption applies to the user of the material that intends to apply the material to land.

Copies of the Coal Washery Rejects Orders and Exemptions are contained within **Appendix 2**.

8.1 Coal Washery Rejects Order and Exemption

The Coal Washery Rejects Order applies in the circumstances where rejects are proposed to be marketed for sale to an off site user for beneficial use as an engineering material or general fill material. The Order has requirements for sampling and chemical and other testing that needs to be conducted before the material can be used for beneficial use. The chemical and other testing criteria are outlined on **Table 10**, as is the test results from the REA samples.

The testing regime permits sampling on a continuous process (ie while in production mode) with both characterisation testing, generally from a batch with a composite of 20 samples and routine testing, requiring 5 samples from every 10,000 tonnes or 5 composite samples every 6 months. Alternatively, if there is not a continuous process, the testing regime also can be on a batch basis, with 10 composite samples for every 4,000 tonnes.

Additionally the Order requires that the generator must provide a written statement of compliance certifying that the requirements set out in the Order have been met, plus provide a copy of both the Order and Exemption to the end user.

The Exemption has the effect of exempting the user of the rejects from the provisions of the *POEO Act* for the purposes of using the reject material for application to land in earthworks for civil engineering applications at a premises, provided that the reject material meets the chemical and other requirements of the Order. The Exemption has some restrictions to where the reject material can be applied to land.

Table 10: Coal Washery Reject Order - Reject Test Results

	Mercury	Cadmium	Lead	Arsenic	Chromium (total)	Copper	Nickel	Selenium	Zinc	EC	pH	Combustible Content	Sulphur
Absolute Maximum Conc.	1	1	100	20	150	100	80	5	200	2 dS/m	7-12	40%	1
REA01	Not Tested	0.5	7	2.5	1	12	2	2.5	37	0.122	9.3	Not Tested	0.18
REA02	Not Tested	0.5	26	2.5	1	18	7	2.5	31	0.137	9.0	Not Tested	0.02
REA03	Not Tested	0.5	18	2.5	1	10	5	2.5	31	0.085	8.8	Not Tested	0.03
REA04	Not Tested	1	6	2.5	1	2.5	1	2.5	12	0.127	8.9	Not Tested	0.16
REA05	Not Tested	0.5	19	2.5	1	20	4	2.5	17	0.130	9.4	Not Tested	0.02
REA06	Not Tested	0.5	11	15	10	15	40	2.5	50	0.214	8.7	Not Tested	0.005
REA07	Not Tested	0.5	20	2.5	1	16	3	2.5	18	0.144	9.6	Not Tested	0.005
REA08	Not Tested	0.5	18	59	4	14	66	2.5	68	0.120	8.2	Not Tested	0.01
REA09	Not Tested	0.5	21	2.5	1	18	4	2.5	24	0.96	9.1	Not Tested	0.05
REA10	Not Tested	0.5	14	35	10	19	54	2.5	61	0.130	8.4	Not Tested	0.05
REA11	Not Tested	0.5	7	2.5	1	6	1	2.5	31	0.088	9.2	Not Tested	0.18
REA12	Not Tested	0.5	8	2.5	1	8	1	2.5	18	0.085	9.4	Not Tested	0.2
Characterisation Max. Average Conc.	0.5	0.5	50	10	75	50	40	2	100	1 dS/m	8 - 11	30%	0.5
Routine Maximum Average Conc.	NR	NR	50	NR	75	50	40	NR	100	1 dS/m	NR	30%	0.5
Average	Not Tested	0.5	14.6	10.9	2.8	14.2	17	2.5	33.1	0.123	9.0	Not Tested	0.068

The reject material sample results indicate that the reject samples meet the chemical criteria of the Order with the exception of the average concentration for Arsenic, which is slightly over the average concentration and two exceedance of the absolute maximum concentration. Note that Mercury and Combustable Content were not tested in this sampling program.

8.2 Coal Washery Rejects (Coal Mine Void) Order and Exemption

The Coal Washery Rejects (Coal Mine Void) Order and Exemption applies in the circumstances where rejects are proposed to be applied to land as fill for coal mine voids.

The Exemption restricts filling coal mine voids to the original ground level and also compliance with a rehabilitation plan approved by the Resources Regulator.

Under the Order a coal mine void is defined as an artificially created pit within a Mining Lease (as defined by the *Mining Act 1992*) from which coal is or has been extracted. The generally accepted definition of pit is a large hole in the ground that implies an open cut mine void. As such, it is generally taken that the Coal Washery Rejects (Coal Mine Void) Order and Exemption does not apply for reject emplacement within underground mining voids and emplacement underground would be governed by the development consent and associated sub-ordinate management plans.

9 DISCUSSION

9.1 Acid Base Account

The results of the ABA tests, indicate that all REA reject samples tested are likely to be NAF and have a high factor of safety with respect to potential acid generation.

All REA reject samples have negligible total sulphur content and a moderate ANC.

In general, the REA reject samples can be regarded as a NAF and contain excess ANC.

9.2 Multi-Element Composition

The results indicate that metal concentrations in reject material samples are unlikely to present any environmental concern.

9.3 Water Quality

Water extract results indicate that initial surface run-off and seepage from reject material is likely to be pH neutral to slightly alkaline.

Run-off and seepage from reject material is likely to have low salinity (EC) values. The risk of saline run-off and seepage from reject material significantly impacting the quality of surface and groundwater is expected to be low. The results from multi-element testing of soluble metals concentrations are unlikely to impact on surface water or groundwater water quality.

9.4 Beneficial Reuse

The results of the chemical testing indicate that the reject material is capable, with further routine testing, of meeting the Coal Washery Rejects Order 2014 and will be suitable for beneficial use as an engineering material or general fill material.

10 CONCLUSION AND RECOMMENDATIONS

10.1 Conclusion

The reject material produced from the proposed mining of the Wongawilli Coal Seam at Russell Vale Colliery is expected to total up to 200,000 tonnes per annum and is proposed to be either emplaced underground in disused workings or marketed for beneficial use.

The reject material is has negligible total sulphur and can be regarded as a NAF. The reject material has excess ANC and a high factor of safety with respect to potential acid generation.

The metal concentrations in the reject material is unlikely to present any environmental issues from heavy metals and generation of saline run-off. The reject material impact on the quality of surface water and groundwater is expected to be low.

The reject material is capable of meeting the EPA standards for beneficial use.

10.2 Recommendations

It is recommended that once the mine moves into production mode, the reject material be further tested for Acid Base Account parameters on a 6 monthly basis.

It is also recommended that once production commences the rejects generated be tested in accordance with the EPA's Coal Washery Reject Order 2014 in order to be able to market the reject material for beneficial reuse applications.

11 REFERENCES

AMIRA (2002). *ARD Test Handbook: Project 387A Prediction and Kinetic Control of Acid Mine Drainage*. Australian Minerals Industry Research Association, Ian Wark Research Institute and Environmental Geochemistry International Pty Ltd, May 2002.

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Hazelton, P.A. and Murphy, B.W (Eds). (2016). *Interpreting Soil Test Results: What do all the numbers mean?* [3rd edn.] CSIRO Publishing, Collingwood, Victoria.

INAP (2009). *Global Acid Rock Drainage Guide*. International Network on Acid Prevention (INAP). June 2009 (http://www.inap.com.au/).

NEPC (2013). National Environmental Protection Council (NEPC). National Environmental Protection (Assessment of Site Contamination) Measure (NEPM). *Guideline on investigation levels for soil and groundwater.*

Simtars (2012) *Determination of the spontaneous combustion propensity of coal from NRE No.1 Colliery*. Report OG420191P1. 9 March 2012.

APPENDIX 1

CERTIFICATE OF ANALYSIS

Work Order	: **EB1927112**	Page	: 1 of 11
Client	: **WOLLONGONG COAL LTD**	Laboratory	: Environmental Division Brisbane
Contact	: RESULTS Russell Vale	Contact	: Customer Services EB
Address	: CORNER BELLAMBI LANE AND PRINCES HIGHWAY RUSSELL VALE NSW, AUSTRALIA 2517	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 02 4223 6800	Telephone	: +61-7-3243 7222
Project	: ----	Date Samples Received	: 14-Oct-2019 11:40
Order number	: ----	Date Analysis Commenced	: 21-Oct-2019
C-O-C number	: ----	Issue Date	: 29-Oct-2019 08:45
Sampler	: ----		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 12		
No. of samples analysed	: 12		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Kim McCabe	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- ED006 (Exchangeable Cations on Alkaline Soils): Unable to calculate Magnesium/Potassium Ratio for some samples as the required results for Magnesium/Potassium are below LOR.
- ED006 (Exchangeable Cations on Alkaline Soils): Unable to calculate Calcium/Magnesium Ratio for sample EB1927112-001 (RU-REA-01) as the required results for Calcium/Magnesium are below LOR.
- ED037 (Alkalinity): NATA accreditation does not cover the performance of this service.
- ALS is not NATA accredited for the analysis of Exchangeable Aluminium and Exchange Acidity in soils when performed under ALS Method ED005.
- ALS is not NATA accredited for the analysis of Exchangeable Cations on Alkaline Soils when performed under ALS Method ED006.
- ASS: EA013 (ANC) Fizz Rating: 0- None; 1- Slight; 2- Moderate; 3- Strong; 4- Very Strong; 5- Lime.
- ED007 and ED008: When Exchangeable Al is reported from these methods, it should be noted that Rayment & Lyons (2011) suggests Exchange Acidity by 1M KCl - Method 15G1 (ED005) is a more suitable method for the determination of exchange acidity (H+ + Al3+).

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	RU-REA-01	RU-REA-02	RU-REA-03	RU-REA-04	RU-REA-05
			Client sampling date / time	10-Oct-2019 00:00	10-Oct-2019 00:00	10-Oct-2019 00:00	10-Oct-2019 00:00	10-Oct-2019 00:00
Compound	CAS Number	LOR	Unit	EB1927112-001	EB1927112-002	EB1927112-003	EB1927112-004	EB1927112-005
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	9.3	9.0	8.8	8.9	9.4
EA009: Nett Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	-6.2	-23.9	-8.5	-48.3	-10.6
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	122	137	85	127	130
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	11.7	24.5	9.4	53.2	11.2
ANC as CaCO3	----	0.1	% CaCO3	1.2	2.5	1.0	5.4	1.1
Fizz Rating	----	0	Fizz Unit	1	1	1	2	1
ED006: Exchangeable Cations on Alkaline Soils								
ø Exchangeable Calcium	----	0.2	meq/100g	0.3	1.2	2.8	1.2	0.6
ø Exchangeable Magnesium	----	0.2	meq/100g	<0.2	1.6	1.2	0.9	0.8
ø Exchangeable Potassium	----	0.2	meq/100g	<0.2	0.3	0.6	<0.2	0.3
ø Exchangeable Sodium	----	0.2	meq/100g	2.8	3.0	2.0	0.5	4.4
ø Cation Exchange Capacity	----	0.2	meq/100g	3.2	6.2	6.7	2.6	6.0
ø Exchangeable Sodium Percent	----	0.2	%	86.4	48.4	30.5	18.0	72.6
ø Calcium/Magnesium Ratio	----	0.2	-	----	0.8	2.2	1.3	0.8
ø Magnesium/Potassium Ratio	----	0.2	-	----	5.2	2.1	----	2.5
ED037: Alkalinity								
ø Total Alkalinity as CaCO3	----	1	mg/kg	1080	1800	1420	13900	3280
ø Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/kg	700	1590	1240	13700	758
ø Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/kg	385	210	175	168	2530
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	60	50	60	70	100
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	0.18	0.02	0.03	0.16	0.02
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	10	mg/kg	<10	<10	<10	<10	<10
ED093S: Soluble Major Cations								
Calcium	7440-70-2	10	mg/kg	<10	<10	<10	50	<10
Magnesium	7439-95-4	10	mg/kg	<10	<10	<10	40	<10
Sodium	7440-23-5	10	mg/kg	180	170	100	170	140
Potassium	7440-09-7	10	mg/kg	<10	<10	<10	20	<10

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	RU-REA-01	RU-REA-02	RU-REA-03	RU-REA-04	RU-REA-05
			Client sampling date / time	10-Oct-2019 00:00	10-Oct-2019 00:00	10-Oct-2019 00:00	10-Oct-2019 00:00	10-Oct-2019 00:00
Compound	CAS Number	LOR	Unit	EB1927112-001	EB1927112-002	EB1927112-003	EB1927112-004	EB1927112-005
				Result	Result	Result	Result	Result
ED093T: Total Major Cations								
Sodium	7440-23-5	50	mg/kg	1080	1040	780	280	1620
Potassium	7440-09-7	50	mg/kg	720	1370	1440	250	1360
Calcium	7440-70-2	50	mg/kg	920	2270	830	25400	440
Magnesium	7439-95-4	50	mg/kg	930	5000	520	12800	1320
EG005(ED093)S : Soluble Metals by ICPAES								
Aluminium	7429-90-5	1	mg/kg	2	2	2	<1	3
Antimony	7440-36-0	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Arsenic	7440-38-2	0.1	mg/kg	0.3	0.6	0.2	<0.1	1.5
Boron	7440-42-8	1	mg/kg	<1	<1	<1	<1	<1
Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium	7440-47-3	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Cobalt	7440-48-4	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Copper	7440-50-8	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Iron	7439-89-6	1	mg/kg	<1	<1	<1	<1	<1
Lead	7439-92-1	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Manganese	7439-96-5	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Molybdenum	7439-98-7	0.1	mg/kg	<0.1	0.3	<0.1	0.1	<0.1
Nickel	7440-02-0	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Selenium	7782-49-2	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Zinc	7440-66-6	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
EG005(ED093)T: Total Metals by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	1420	3240	3060	780	2850
Antimony	7440-36-0	5	mg/kg	<5	<5	<5	<5	<5
Arsenic	7440-38-2	5	mg/kg	<5	<5	<5	<5	<5
Boron	7440-42-8	50	mg/kg	<50	<50	<50	<50	<50
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	1	<1
Chromium	7440-47-3	2	mg/kg	<2	<2	<2	<2	<2
Cobalt	7440-48-4	2	mg/kg	<2	<2	<2	<2	<2
Copper	7440-50-8	5	mg/kg	12	18	10	<5	20
Iron	7439-89-6	50	mg/kg	11900	47900	4110	79800	11800
Lead	7439-92-1	5	mg/kg	7	26	18	6	19
Manganese	7439-96-5	5	mg/kg	338	479	58	3360	148
Molybdenum	7439-98-7	2	mg/kg	<2	<2	<2	<2	<2
Nickel	7440-02-0	2	mg/kg	2	7	5	<2	4

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	RU-REA-01	RU-REA-02	RU-REA-03	RU-REA-04	RU-REA-05
			Client sampling date / time	10-Oct-2019 00:00	10-Oct-2019 00:00	10-Oct-2019 00:00	10-Oct-2019 00:00	10-Oct-2019 00:00
Compound	CAS Number	LOR	Unit	EB1927112-001	EB1927112-002	EB1927112-003	EB1927112-004	EB1927112-005
				Result	Result	Result	Result	Result
EG005(ED093)T: Total Metals by ICP-AES - Continued								
Selenium	7782-49-2	5	mg/kg	<5	<5	<5	<5	<5
Zinc	7440-66-6	5	mg/kg	**37**	**31**	**31**	**12**	**17**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	**0.2**	**0.2**	**0.3**	**0.1**	**0.2**
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	**1450**	**930**	**990**	**2140**	**940**
EK062: Total Nitrogen as N (TKN + NOx)								
^ **Total Nitrogen as N**	----	20	mg/kg	**1450**	**930**	**990**	**2140**	**940**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	RU-REA-06	RU-REA-07	RU-REA-08	RU-REA-09	RU-REA-10
			Client sampling date / time	10-Oct-2019 00:00	10-Oct-2019 00:00	10-Oct-2019 00:00	10-Oct-2019 00:00	10-Oct-2019 00:00
Compound	CAS Number	LOR	Unit	EB1927112-006	EB1927112-007	EB1927112-008	EB1927112-009	EB1927112-010
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	8.7	9.6	8.2	9.1	8.4
EA009: Nett Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	-11.3	-11.5	-5.9	-8.3	-12.4
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	214	144	120	96	130
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	11.3	11.5	6.2	8.3	12.4
ANC as CaCO3	----	0.1	% CaCO3	1.2	1.2	0.6	0.8	1.3
Fizz Rating	----	0	Fizz Unit	1	1	1	0	1
ED006: Exchangeable Cations on Alkaline Soils								
ø Exchangeable Calcium	----	0.2	meq/100g	1.3	1.4	1.5	1.4	2.2
ø Exchangeable Magnesium	----	0.2	meq/100g	1.2	1.3	1.5	1.4	2.0
ø Exchangeable Potassium	----	0.2	meq/100g	<0.2	0.4	0.3	0.4	0.3
ø Exchangeable Sodium	----	0.2	meq/100g	0.9	4.2	1.0	3.6	1.0
ø Cation Exchange Capacity	----	0.2	meq/100g	3.6	7.4	4.3	6.7	5.5
ø Exchangeable Sodium Percent	----	0.2	%	25.8	57.6	23.1	53.1	18.9
ø Calcium/Magnesium Ratio	----	0.2	-	1.1	1.1	1.0	1.0	1.1
ø Magnesium/Potassium Ratio	----	0.2	-	----	2.8	5.6	3.1	7.1
ED037: Alkalinity								
ø Total Alkalinity as CaCO3	----	1	mg/kg	1850	2270	1180	1680	1560
ø Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/kg	1850	2110	1180	1520	1560
ø Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/kg	<5	168	<5	168	<5
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	100	70	170	60	150
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	<0.01	<0.01	0.01	<0.01	<0.01
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	10	mg/kg	<10	<10	<10	<10	<10
ED093S: Soluble Major Cations								
Calcium	7440-70-2	10	mg/kg	<10	<10	<10	<10	<10
Magnesium	7439-95-4	10	mg/kg	<10	<10	<10	<10	<10
Sodium	7440-23-5	10	mg/kg	220	150	120	110	140
Potassium	7440-09-7	10	mg/kg	50	<10	20	<10	20

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	RU-REA-06	RU-REA-07	RU-REA-08	RU-REA-09	RU-REA-10
			Client sampling date / time	10-Oct-2019 00:00	10-Oct-2019 00:00	10-Oct-2019 00:00	10-Oct-2019 00:00	10-Oct-2019 00:00
Compound	CAS Number	LOR	Unit	EB1927112-006	EB1927112-007	EB1927112-008	EB1927112-009	EB1927112-010
				Result	Result	Result	Result	Result
ED093T: Total Major Cations								
Sodium	7440-23-5	50	mg/kg	500	1610	430	1260	370
Potassium	7440-09-7	50	mg/kg	970	1270	1080	1330	900
Calcium	7440-70-2	50	mg/kg	1490	720	510	670	1190
Magnesium	7439-95-4	50	mg/kg	1070	1120	430	1090	2000
EG005(ED093)S : Soluble Metals by ICPAES								
Aluminium	7429-90-5	1	mg/kg	<1	4	<1	2	<1
Antimony	7440-36-0	0.1	mg/kg	<0.1	<0.1	0.4	<0.1	<0.1
Arsenic	7440-38-2	0.1	mg/kg	0.2	0.8	9.0	0.8	1.6
Boron	7440-42-8	1	mg/kg	<1	<1	<1	<1	<1
Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium	7440-47-3	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Cobalt	7440-48-4	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Copper	7440-50-8	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Iron	7439-89-6	1	mg/kg	<1	<1	<1	<1	<1
Lead	7439-92-1	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Manganese	7439-96-5	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Molybdenum	7439-98-7	0.1	mg/kg	0.2	0.1	0.3	<0.1	0.2
Nickel	7440-02-0	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Selenium	7782-49-2	0.1	mg/kg	<0.1	<0.1	0.1	<0.1	<0.1
Zinc	7440-66-6	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
EG005(ED093)T: Total Metals by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	2560	2510	3090	2750	2180
Antimony	7440-36-0	5	mg/kg	<5	<5	<5	<5	<5
Arsenic	7440-38-2	5	mg/kg	15	<5	59	<5	35
Boron	7440-42-8	50	mg/kg	<50	<50	<50	<50	<50
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg	10	<2	4	<2	10
Cobalt	7440-48-4	2	mg/kg	12	<2	25	<2	14
Copper	7440-50-8	5	mg/kg	15	16	14	18	19
Iron	7439-89-6	50	mg/kg	15900	8410	920	8040	38600
Lead	7439-92-1	5	mg/kg	11	20	18	21	14
Manganese	7439-96-5	5	mg/kg	429	161	12	168	1420
Molybdenum	7439-98-7	2	mg/kg	<2	<2	4	<2	<2
Nickel	7440-02-0	2	mg/kg	40	3	66	4	54

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	RU-REA-06	RU-REA-07	RU-REA-08	RU-REA-09	RU-REA-10
			Client sampling date / time	10-Oct-2019 00:00	10-Oct-2019 00:00	10-Oct-2019 00:00	10-Oct-2019 00:00	10-Oct-2019 00:00
Compound	CAS Number	LOR	Unit	EB1927112-006	EB1927112-007	EB1927112-008	EB1927112-009	EB1927112-010
				Result	Result	Result	Result	Result
EG005(ED093)T: Total Metals by ICP-AES - Continued								
Selenium	7782-49-2	5	mg/kg	<5	<5	<5	<5	<5
Zinc	7440-66-6	5	mg/kg	50	18	68	24	61
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	0.5	0.2	0.4	0.2	0.4
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	240	980	440	1030	260
EK062: Total Nitrogen as N (TKN + NOx)								
^ Total Nitrogen as N	----	20	mg/kg	240	980	440	1030	260

Analytical Results

Sub-Matrix: SOIL
(Matrix: SOIL)

Compound	CAS Number	LOR	Unit	RU-REA-11	RU-REA-12	----	----	----
Client sampling date / time				10-Oct-2019 00:00	10-Oct-2019 00:00	----	----	----
				EB1927112-011	EB1927112-012	--------	--------	--------
				Result	Result	----	----	----
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	**9.2**	**9.4**	----	----	----
EA009: Nett Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	**-8.9**	**-17.2**	----	----	----
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	**88**	**85**	----	----	----
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	**14.4**	**23.3**	----	----	----
ANC as CaCO3	----	0.1	% CaCO3	**1.5**	**2.4**	----	----	----
Fizz Rating	----	0	Fizz Unit	**1**	**1**	----	----	----
ED006: Exchangeable Cations on Alkaline Soils								
ø Exchangeable Calcium	----	0.2	meq/100g	**0.5**	**1.0**	----	----	----
ø Exchangeable Magnesium	----	0.2	meq/100g	**0.4**	**0.8**	----	----	----
ø Exchangeable Potassium	----	0.2	meq/100g	<0.2	<0.2	----	----	----
ø Exchangeable Sodium	----	0.2	meq/100g	**0.8**	**1.3**	----	----	----
ø Cation Exchange Capacity	----	0.2	meq/100g	**1.8**	**3.1**	----	----	----
ø Exchangeable Sodium Percent	----	0.2	%	**47.2**	**42.0**	----	----	----
ø Calcium/Magnesium Ratio	----	0.2	-	**1.1**	**1.3**	----	----	----
ED037: Alkalinity								
ø Total Alkalinity as CaCO3	----	1	mg/kg	**2700**	**2440**	----	----	----
ø Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/kg	**2440**	**2190**	----	----	----
ø Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/kg	**253**	**253**	----	----	----
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	**40**	**50**	----	----	----
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	**0.18**	**0.20**	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	10	mg/kg	<10	<10	----	----	----
ED093S: Soluble Major Cations								
Calcium	7440-70-2	10	mg/kg	<10	<10	----	----	----
Magnesium	7439-95-4	10	mg/kg	<10	<10	----	----	----
Sodium	7440-23-5	10	mg/kg	**160**	**200**	----	----	----
Potassium	7440-09-7	10	mg/kg	<10	<10	----	----	----
ED093T: Total Major Cations								

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	RU-REA-11	RU-REA-12	----	----	----
			Client sampling date / time	10-Oct-2019 00:00	10-Oct-2019 00:00	----	----	----
Compound	CAS Number	LOR	Unit	EB1927112-011	EB1927112-012	--------	--------	--------
				Result	Result	----	----	----
ED093T: Total Major Cations - Continued								
Sodium	7440-23-5	50	mg/kg	**440**	**600**	----	----	----
Potassium	7440-09-7	50	mg/kg	**260**	**370**	----	----	----
Calcium	7440-70-2	50	mg/kg	**3880**	**8720**	----	----	----
Magnesium	7439-95-4	50	mg/kg	**2280**	**4250**	----	----	----
EG005(ED093)S : Soluble Metals by ICPAES								
Aluminium	7429-90-5	1	mg/kg	<1	<1	----	----	----
Antimony	7440-36-0	0.1	mg/kg	<0.1	<0.1	----	----	----
Arsenic	7440-38-2	0.1	mg/kg	<0.1	<0.1	----	----	----
Boron	7440-42-8	1	mg/kg	<1	<1	----	----	----
Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	----	----	----
Chromium	7440-47-3	0.1	mg/kg	<0.1	<0.1	----	----	----
Cobalt	7440-48-4	0.1	mg/kg	<0.1	<0.1	----	----	----
Copper	7440-50-8	0.1	mg/kg	<0.1	<0.1	----	----	----
Iron	7439-89-6	1	mg/kg	<1	<1	----	----	----
Lead	7439-92-1	0.1	mg/kg	<0.1	<0.1	----	----	----
Manganese	7439-96-5	0.1	mg/kg	<0.1	<0.1	----	----	----
Molybdenum	7439-98-7	0.1	mg/kg	<0.1	<0.1	----	----	----
Nickel	7440-02-0	0.1	mg/kg	<0.1	<0.1	----	----	----
Selenium	7782-49-2	0.1	mg/kg	<0.1	<0.1	----	----	----
Zinc	7440-66-6	0.1	mg/kg	<0.1	<0.1	----	----	----
EG005(ED093)T: Total Metals by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	**900**	**920**	----	----	----
Antimony	7440-36-0	5	mg/kg	<5	<5	----	----	----
Arsenic	7440-38-2	5	mg/kg	<5	<5	----	----	----
Boron	7440-42-8	50	mg/kg	<50	<50	----	----	----
Cadmium	7440-43-9	1	mg/kg	<1	<1	----	----	----
Chromium	7440-47-3	2	mg/kg	<2	<2	----	----	----
Cobalt	7440-48-4	2	mg/kg	<2	<2	----	----	----
Copper	7440-50-8	5	mg/kg	**6**	**8**	----	----	----
Iron	7439-89-6	50	mg/kg	**21000**	**29100**	----	----	----
Lead	7439-92-1	5	mg/kg	**7**	**8**	----	----	----
Manganese	7439-96-5	5	mg/kg	**654**	**1050**	----	----	----
Molybdenum	7439-98-7	2	mg/kg	<2	<2	----	----	----
Nickel	7440-02-0	2	mg/kg	<2	<2	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	RU-REA-11	RU-REA-12	----	----	----
			Client sampling date / time	10-Oct-2019 00:00	10-Oct-2019 00:00	----	----	----
Compound	CAS Number	LOR	Unit	EB1927112-011	EB1927112-012	--------	--------	--------
				Result	Result	----	----	----
EG005(ED093)T: Total Metals by ICP-AES - Continued								
Selenium	7782-49-2	5	mg/kg	<5	<5	----	----	----
Zinc	7440-66-6	5	mg/kg	**31**	**18**	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	**0.4**	**0.5**	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	**4840**	**4920**	----	----	----
EK062: Total Nitrogen as N (TKN + NOx)								
^ Total Nitrogen as N	----	20	mg/kg	**4840**	**4920**	----	----	----

QUALITY CONTROL REPORT

Work Order	: **EB1927112**	Page	: 1 of 8
Client	: **WOLLONGONG COAL LTD**	Laboratory	: Environmental Division Brisbane
Contact	: RESULTS Russell Vale	Contact	: Customer Services EB
Address	: CORNER BELLAMBI LANE AND PRINCES HIGHWAY RUSSELL VALE NSW, AUSTRALIA 2517	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 02 4223 6800	Telephone	: +61-7-3243 7222
Project	: ----	Date Samples Received	: 14-Oct-2019
Order number	: ----	Date Analysis Commenced	: 21-Oct-2019
C-O-C number	: ----	Issue Date	: 29-Oct-2019
Sampler	: ----		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 12		
No. of samples analysed	: 12		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Kim McCabe	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG005(ED093)S : Soluble Metals by ICPAES (QC Lot: 2651319)									
EB1927112-010	RU-REA-10	EG005S: Antimony	7440-36-0	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
		EG005S: Arsenic	7440-38-2	0.1	mg/kg	1.6	1.5	0.00	0% - 50%
		EG005S: Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
		EG005S: Chromium	7440-47-3	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
		EG005S: Cobalt	7440-48-4	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
		EG005S: Copper	7440-50-8	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
		EG005S: Lead	7439-92-1	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
		EG005S: Manganese	7439-96-5	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
		EG005S: Molybdenum	7439-98-7	0.1	mg/kg	0.2	0.2	0.00	No Limit
		EG005S: Nickel	7440-02-0	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
		EG005S: Selenium	7782-49-2	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
		EG005S: Zinc	7440-66-6	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
		EG005S: Aluminium	7429-90-5	1	mg/kg	<1	<1	0.00	No Limit
		EG005S: Boron	7440-42-8	1	mg/kg	<1	<1	0.00	No Limit
		EG005S: Iron	7439-89-6	1	mg/kg	<1	<1	0.00	No Limit
EB1927112-001	RU-REA-01	EG005S: Antimony	7440-36-0	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
		EG005S: Arsenic	7440-38-2	0.1	mg/kg	0.3	0.3	0.00	No Limit
		EG005S: Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
		EG005S: Chromium	7440-47-3	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
		EG005S: Cobalt	7440-48-4	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
		EG005S: Copper	7440-50-8	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
		EG005S: Lead	7439-92-1	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
		EG005S: Manganese	7439-96-5	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
		EG005S: Molybdenum	7439-98-7	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
		EG005S: Nickel	7440-02-0	0.1	mg/kg	<0.1	<0.1	0.00	No Limit

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
				Laboratory Duplicate (DUP) Report					
EG005(ED093)S : Soluble Metals by ICPAES (QC Lot: 2651319) - continued									
EB1927112-001	RU-REA-01	EG005S: Selenium	7782-49-2	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
		EG005S: Zinc	7440-66-6	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
		EG005S: Aluminium	7429-90-5	1	mg/kg	2	2	0.00	No Limit
		EG005S: Boron	7440-42-8	1	mg/kg	<1	<1	0.00	No Limit
		EG005S: Iron	7439-89-6	1	mg/kg	<1	<1	0.00	No Limit
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 2652745)									
EB1927112-001	RU-REA-01	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.00	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	<2	<2	0.00	No Limit
		EG005T: Cobalt	7440-48-4	2	mg/kg	<2	<2	0.00	No Limit
		EG005T: Molybdenum	7439-98-7	2	mg/kg	<2	<2	0.00	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	2	<2	0.00	No Limit
		EG005T: Antimony	7440-36-0	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	12	11	0.00	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	7	7	0.00	No Limit
		EG005T: Manganese	7439-96-5	5	mg/kg	338	316	6.96	0% - 20%
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	37	36	2.75	No Limit
		EG005T: Aluminium	7429-90-5	50	mg/kg	1420	1320	7.72	0% - 20%
		EG005T: Boron	7440-42-8	50	mg/kg	<50	<50	0.00	No Limit
		EG005T: Iron	7439-89-6	50	mg/kg	11900	10900	8.46	0% - 20%
EB1927112-011	RU-REA-11	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.00	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	<2	<2	0.00	No Limit
		EG005T: Cobalt	7440-48-4	2	mg/kg	<2	<2	0.00	No Limit
		EG005T: Molybdenum	7439-98-7	2	mg/kg	<2	<2	0.00	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	<2	<2	0.00	No Limit
		EG005T: Antimony	7440-36-0	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	6	6	0.00	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	7	7	0.00	No Limit
		EG005T: Manganese	7439-96-5	5	mg/kg	654	658	0.686	0% - 20%
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	31	30	0.00	No Limit
		EG005T: Aluminium	7429-90-5	50	mg/kg	900	870	3.47	0% - 50%
		EG005T: Boron	7440-42-8	50	mg/kg	<50	<50	0.00	No Limit
		EG005T: Iron	7439-89-6	50	mg/kg	21000	21100	0.582	0% - 20%
EA002: pH 1:5 (Soils) (QC Lot: 2651314)									
EB1927112-011	RU-REA-11	EA002: pH Value	----	0.1	pH Unit	9.2	9.2	0.00	0% - 20%
EB1927112-001	RU-REA-01	EA002: pH Value	----	0.1	pH Unit	9.3	9.4	0.00	0% - 20%
EA010: Conductivity (1:5) (QC Lot: 2651315)									

Sub-Matrix: **SOIL**

Laboratory Duplicate (DUP) Report

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA010: Conductivity (1:5) (QC Lot: 2651315) - continued									
EB1927112-011	RU-REA-11	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	88	79	10.4	0% - 20%
EB1927112-001	RU-REA-01	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	122	122	0.820	0% - 20%
EA013: Acid Neutralising Capacity (QC Lot: 2654272)									
EB1927112-001	RU-REA-01	EA013: ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	11.7	10.0	15.9	0% - 20%
EB1927112-012	RU-REA-12	EA013: ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	23.3	23.9	2.31	0% - 20%
ED006: Exchangeable Cations on Alkaline Soils (QC Lot: 2654682)									
EB1927112-001	RU-REA-01	ED006: Exchangeable Calcium	----	0.2	meq/100g	0.3	0.3	0.00	No Limit
		ED006: Exchangeable Magnesium	----	0.2	meq/100g	<0.2	<0.2	0.00	No Limit
		ED006: Exchangeable Potassium	----	0.2	meq/100g	<0.2	<0.2	0.00	No Limit
		ED006: Exchangeable Sodium	----	0.2	meq/100g	2.8	3.3	16.9	0% - 50%
		ED006: Cation Exchange Capacity	----	0.2	meq/100g	3.2	3.8	16.3	0% - 50%
EB1927112-011	RU-REA-11	ED006: Exchangeable Calcium	----	0.2	meq/100g	0.5	0.4	0.00	No Limit
		ED006: Exchangeable Magnesium	----	0.2	meq/100g	0.4	<0.2	76.7	No Limit
		ED006: Exchangeable Potassium	----	0.2	meq/100g	<0.2	<0.2	0.00	No Limit
		ED006: Exchangeable Sodium	----	0.2	meq/100g	0.8	0.8	0.00	No Limit
		ED006: Cation Exchange Capacity	----	0.2	meq/100g	1.8	1.2	35.9	No Limit
ED037: Alkalinity (QC Lot: 2651316)									
EB1927112-011	RU-REA-11	ED037: Total Alkalinity as CaCO3	----	1	mg/kg	2700	2740	1.55	0% - 20%
		ED037: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/kg	2440	2480	1.71	0% - 20%
		ED037: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/kg	253	253	0.00	0% - 20%
EB1927112-001	RU-REA-01	ED037: Total Alkalinity as CaCO3	----	1	mg/kg	1080	1080	0.00	0% - 20%
		ED037: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/kg	700	700	0.00	0% - 20%
		ED037: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/kg	385	385	0.00	0% - 20%
ED040S: Soluble Major Anions (QC Lot: 2651321)									
EB1927112-010	RU-REA-10	ED040S: Sulfate as SO4 2-	14808-79-8	10	mg/kg	150	150	0.00	0% - 50%
EB1927112-001	RU-REA-01	ED040S: Sulfate as SO4 2-	14808-79-8	10	mg/kg	60	50	0.00	No Limit
ED042T: Total Sulfur by LECO (QC Lot: 2656120)									
EB1926596-001	Anonymous	ED042T: Sulfur - Total as S (LECO)	----	0.01	%	1.03	1.00	3.34	0% - 20%
EB1927112-004	RU-REA-04	ED042T: Sulfur - Total as S (LECO)	----	0.01	%	0.16	0.19	13.4	0% - 50%
ED045G: Chloride by Discrete Analyser (QC Lot: 2651320)									
EB1927112-011	RU-REA-11	ED045G: Chloride	16887-00-6	10	mg/kg	<10	<10	0.00	No Limit
EB1927112-001	RU-REA-01	ED045G: Chloride	16887-00-6	10	mg/kg	<10	<10	0.00	No Limit
ED093S: Soluble Major Cations (QC Lot: 2651318)									
EB1927112-010	RU-REA-10	ED093S: Calcium	7440-70-2	10	mg/kg	<10	<10	0.00	No Limit
		ED093S: Magnesium	7439-95-4	10	mg/kg	<10	<10	0.00	No Limit
		ED093S: Sodium	7440-23-5	10	mg/kg	140	140	0.00	0% - 50%
		ED093S: Potassium	7440-09-7	10	mg/kg	20	20	0.00	No Limit

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
				Laboratory Duplicate (DUP) Report					
ED093S: Soluble Major Cations (QC Lot: 2651318) - continued									
EB1927112-001	RU-REA-01	ED093S: Calcium	7440-70-2	10	mg/kg	<10	<10	0.00	No Limit
		ED093S: Magnesium	7439-95-4	10	mg/kg	<10	<10	0.00	No Limit
		ED093S: Sodium	7440-23-5	10	mg/kg	180	160	10.6	0% - 50%
		ED093S: Potassium	7440-09-7	10	mg/kg	<10	<10	0.00	No Limit
ED093T: Total Major Cations (QC Lot: 2652746)									
EB1927112-009	RU-REA-09	ED093T: Sodium	7440-23-5	50	mg/kg	1260	1260	0.00	0% - 20%
		ED093T: Potassium	7440-09-7	50	mg/kg	1330	1330	0.00	0% - 20%
		ED093T: Calcium	7440-70-2	50	mg/kg	670	670	0.00	0% - 50%
		ED093T: Magnesium	7439-95-4	50	mg/kg	1090	1090	0.00	0% - 20%
EB1927112-001	RU-REA-01	ED093T: Sodium	7440-23-5	50	mg/kg	1080	1090	0.00	0% - 20%
		ED093T: Potassium	7440-09-7	50	mg/kg	720	720	0.00	0% - 50%
		ED093T: Calcium	7440-70-2	50	mg/kg	920	910	1.53	0% - 50%
		ED093T: Magnesium	7439-95-4	50	mg/kg	930	920	0.00	0% - 50%
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 2651317)									
EB1927112-011	RU-REA-11	EK059G: Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	0.4	0.4	0.00	No Limit
EB1927112-001	RU-REA-01	EK059G: Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	0.2	0.1	0.00	No Limit
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 2652747)									
EB1927112-001	RU-REA-01	EK061G: Total Kjeldahl Nitrogen as N	----	20	mg/kg	1450	1470	0.922	0% - 20%
EB1927112-011	RU-REA-11	EK061G: Total Kjeldahl Nitrogen as N	----	20	mg/kg	4840	4620	4.53	0% - 20%

Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Spike (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG005(ED093)S : Soluble Metals by ICPAES (QCLot: 2651319)								
EG005S: Aluminium	7429-90-5	1	mg/kg	<1	2.5 mg/kg	103	78.0	112
EG005S: Antimony	7440-36-0	0.1	mg/kg	<0.1	0.5 mg/kg	106	70.0	130
EG005S: Arsenic	7440-38-2	0.1	mg/kg	<0.1	0.5 mg/kg	111	83.0	111
EG005S: Boron	7440-42-8	1	mg/kg	<1	2.5 mg/kg	106	70.0	130
EG005S: Cadmium	7440-43-9	0.1	mg/kg	<0.1	0.5 mg/kg	102	87.0	112
EG005S: Chromium	7440-47-3	0.1	mg/kg	<0.1	0.5 mg/kg	103	91.0	110
EG005S: Cobalt	7440-48-4	0.1	mg/kg	<0.1	0.5 mg/kg	102	70.0	130
EG005S: Copper	7440-50-8	0.1	mg/kg	<0.1	0.5 mg/kg	103	84.0	111
EG005S: Iron	7439-89-6	1	mg/kg	<1	2.5 mg/kg	103	70.0	130
EG005S: Lead	7439-92-1	0.1	mg/kg	<0.1	0.5 mg/kg	98.1	90.0	112
EG005S: Manganese	7439-96-5	0.1	mg/kg	<0.1	0.5 mg/kg	97.2	70.0	130
EG005S: Molybdenum	7439-98-7	0.1	mg/kg	<0.1	0.5 mg/kg	104	70.0	130
EG005S: Nickel	7440-02-0	0.1	mg/kg	<0.1	0.5 mg/kg	103	82.0	112
EG005S: Selenium	7782-49-2	0.1	mg/kg	<0.1	0.5 mg/kg	99.3	70.0	130
EG005S: Zinc	7440-66-6	0.1	mg/kg	<0.1	0.5 mg/kg	104	94.0	110
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 2652745)								
EG005T: Aluminium	7429-90-5	50	mg/kg	<50	13267 mg/kg	105	70.0	130
EG005T: Antimony	7440-36-0	5	mg/kg	<5	----	----	----	----
EG005T: Arsenic	7440-38-2	5	mg/kg	<5	98 mg/kg	100	84.0	123
EG005T: Boron	7440-42-8	50	mg/kg	<50	----	----	----	----
EG005T: Cadmium	7440-43-9	1	mg/kg	<1	----	----	----	----
EG005T: Chromium	7440-47-3	2	mg/kg	<2	15.4 mg/kg	104	83.0	125
EG005T: Cobalt	7440-48-4	2	mg/kg	<2	9.8 mg/kg	93.4	82.0	118
EG005T: Copper	7440-50-8	5	mg/kg	<5	48 mg/kg	100	86.0	122
EG005T: Iron	7439-89-6	50	mg/kg	<50	27922 mg/kg	109	70.0	120
EG005T: Lead	7439-92-1	5	mg/kg	<5	50 mg/kg	99.7	84.0	119
EG005T: Manganese	7439-96-5	5	mg/kg	<5	482 mg/kg	101	84.0	113
EG005T: Molybdenum	7439-98-7	2	mg/kg	<2	----	----	----	----
EG005T: Nickel	7440-02-0	2	mg/kg	<2	12.4 mg/kg	107	81.5	118
EG005T: Selenium	7782-49-2	5	mg/kg	<5	----	----	----	----
EG005T: Zinc	7440-66-6	5	mg/kg	<5	115 mg/kg	95.8	80.0	120
EA002: pH 1:5 (Soils) (QCLot: 2651314)								
EA002: pH Value	----	----	pH Unit	----	4 pH Unit	100	98.0	102
				----	7 pH Unit	101	98.0	102

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
				Result	Concentration	LCS	Low	High
EA010: Conductivity (1:5) (QCLot: 2651315)								
EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	1412 µS/cm	98.3	97.0	103
EA013: Acid Neutralising Capacity (QCLot: 2654272)								
EA013: ANC as H2SO4	----	----	kg H2SO4 equiv./t	----	9.9 kg H2SO4 equiv./t	108	82.0	120
ED006: Exchangeable Cations on Alkaline Soils (QCLot: 2654682)								
ED006: Exchangeable Calcium	----	0.2	meq/100g	<0.2	7.0676 meq/100g	85.8	70.0	130
ED006: Exchangeable Magnesium	----	0.2	meq/100g	<0.2	5.5895 meq/100g	80.7	70.0	130
ED006: Exchangeable Potassium	----	0.2	meq/100g	<0.2	1.3505 meq/100g	73.2	70.0	130
ED006: Exchangeable Sodium	----	0.2	meq/100g	<0.2	2.0578 meq/100g	80.1	70.0	130
ED006: Cation Exchange Capacity	----	0.2	meq/100g	<0.2	16.0654 meq/100g	82.2	70.0	130
ED037: Alkalinity (QCLot: 2651316)								
ED037: Total Alkalinity as CaCO3	----	----	mg/kg	----	500 mg/kg	99.2	93.0	103
ED040S: Soluble Major Anions (QCLot: 2651321)								
ED040S: Sulfate as SO4 2-	14808-79-8	10	mg/kg	<10	750 mg/kg	98.6	90.0	114
ED042T: Total Sulfur by LECO (QCLot: 2656120)								
ED042T: Sulfur - Total as S (LECO)	----	0.01	%	<0.01	1.57 %	97.9	70.0	130
ED045G: Chloride by Discrete Analyser (QCLot: 2651320)								
ED045G: Chloride	16887-00-6	10	mg/kg	<10	50 mg/kg	99.9	83.0	119
				<10	5000 mg/kg	102	83.0	119
ED093S: Soluble Major Cations (QCLot: 2651318)								
ED093S: Calcium	7440-70-2	10	mg/kg	<10	250 mg/kg	98.8	80.0	120
ED093S: Magnesium	7439-95-4	10	mg/kg	<10	250 mg/kg	99.1	80.0	120
ED093S: Sodium	7440-23-5	10	mg/kg	<10	250 mg/kg	100.0	80.0	120
ED093S: Potassium	7440-09-7	10	mg/kg	<10	250 mg/kg	94.5	80.0	120
ED093T: Total Major Cations (QCLot: 2652746)								
ED093T: Sodium	7440-23-5	50	mg/kg	<50	----	----	----	----
ED093T: Potassium	7440-09-7	50	mg/kg	<50	----	----	----	----
ED093T: Calcium	7440-70-2	50	mg/kg	<50	----	----	----	----
ED093T: Magnesium	7439-95-4	50	mg/kg	<50	----	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2651317)								
EK059G: Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	2.5 mg/kg	91.2	83.2	111
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2652747)								
EK061G: Total Kjeldahl Nitrogen as N	----	20	mg/kg	<20	848 mg/kg	114	73.0	121
				<20	3644 mg/kg	103	73.0	121

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 2652745)							
EB1927112-002	RU-REA-02	EG005T: Arsenic	7440-38-2	100 mg/kg	89.8	70.0	130
		EG005T: Cadmium	7440-43-9	25 mg/kg	91.2	70.0	130
		EG005T: Chromium	7440-47-3	100 mg/kg	93.5	70.0	130
		EG005T: Cobalt	7440-48-4	100 mg/kg	92.6	70.0	130
		EG005T: Copper	7440-50-8	100 mg/kg	94.6	70.0	130
		EG005T: Lead	7439-92-1	100 mg/kg	88.4	70.0	130
		EG005T: Manganese	7439-96-5	100 mg/kg	# Not Determined	70.0	130
		EG005T: Nickel	7440-02-0	100 mg/kg	90.9	70.0	130
		EG005T: Zinc	7440-66-6	100 mg/kg	86.8	70.0	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2651317)							
EB1927112-002	RU-REA-02	EK059G: Nitrite + Nitrate as N (Sol.)	----	2 mg/kg	92.7	70.0	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2652747)							
EB1927112-002	RU-REA-02	EK061G: Total Kjeldahl Nitrogen as N	----	500 mg/kg	84.2	70.0	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EB1927112**	Page	: 1 of 10
Client	: **WOLLONGONG COAL LTD**	Laboratory	: Environmental Division Brisbane
Contact	: RESULTS Russell Vale	Telephone	: +61-7-3243 7222
Project	: ----	Date Samples Received	: 14-Oct-2019
Site	: ----	Issue Date	: 29-Oct-2019
Sampler	: ----	No. of samples received	: 12
Order number	: ----	No. of samples analysed	: 12

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **Matrix Spike outliers exist - please see following pages for full details.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **Analysis Holding Time Outliers exist - please see following pages for full details.**

Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EG005(ED093)T: Total Metals by ICP-AES	EB1927112--002	RU-REA-02	**Manganese**	7439-96-5	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

Outliers : Analysis Holding Time Compliance

Matrix: **SOIL**

Method / Container / Client Sample ID(s)		Extraction / Preparation: Date extracted	Extraction / Preparation: Due for extraction	Extraction / Preparation: Days overdue	Analysis: Date analysed	Analysis: Due for analysis	Analysis: Days overdue
EA002: pH 1:5 (Soils)							
Snap Lock Bag							
RU-REA-01,	RU-REA-02,	21-Oct-2019	17-Oct-2019	**4**	----	----	----
RU-REA-03,	RU-REA-04,						
RU-REA-05,	RU-REA-06,						
RU-REA-07,	RU-REA-08,						
RU-REA-09,	RU-REA-10,						
RU-REA-11,	RU-REA-12						
EA010: Conductivity (1:5)							
Snap Lock Bag							
RU-REA-01,	RU-REA-02,	21-Oct-2019	17-Oct-2019	**4**	----	----	----
RU-REA-03,	RU-REA-04,						
RU-REA-05,	RU-REA-06,						
RU-REA-07,	RU-REA-08,						
RU-REA-09,	RU-REA-10,						
RU-REA-11,	RU-REA-12						

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation: Date extracted	Extraction / Preparation: Due for extraction	Extraction / Preparation: Evaluation	Analysis: Date analysed	Analysis: Due for analysis	Analysis: Evaluation

Work Order : EB1927112
Client : WOLLONGONG COAL LTD
Project : ----

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation: Date extracted	Due for extraction	Evaluation	Analysis: Date analysed	Due for analysis	Evaluation
EA002: pH 1:5 (Soils)								
Snap Lock Bag (EA002)								
RU-REA-01,	RU-REA-02,	**10-Oct-2019**	**21-Oct-2019**	17-Oct-2019	×	**21-Oct-2019**	21-Oct-2019	✓
RU-REA-03,	RU-REA-04,							
RU-REA-05,	RU-REA-06,							
RU-REA-07,	RU-REA-08,							
RU-REA-09,	RU-REA-10,							
RU-REA-11,	RU-REA-12							
EA010: Conductivity (1:5)								
Snap Lock Bag (EA010)								
RU-REA-01,	RU-REA-02,	**10-Oct-2019**	**21-Oct-2019**	17-Oct-2019	×	**21-Oct-2019**	18-Nov-2019	✓
RU-REA-03,	RU-REA-04,							
RU-REA-05,	RU-REA-06,							
RU-REA-07,	RU-REA-08,							
RU-REA-09,	RU-REA-10,							
RU-REA-11,	RU-REA-12							
EA013: Acid Neutralising Capacity								
Pulp Bag (EA013)								
RU-REA-01,	RU-REA-02,	**10-Oct-2019**	**22-Oct-2019**	09-Oct-2020	✓	**22-Oct-2019**	19-Apr-2020	✓
RU-REA-03,	RU-REA-04,							
RU-REA-05,	RU-REA-06,							
RU-REA-07,	RU-REA-08,							
RU-REA-09,	RU-REA-10,							
RU-REA-11,	RU-REA-12							
ED005: Exchange Acidity								
Snap Lock Bag (ED005)								
RU-REA-01,	RU-REA-02,	**10-Oct-2019**	**21-Oct-2019**	07-Nov-2019	✓	**22-Oct-2019**	07-Nov-2019	✓
RU-REA-03,	RU-REA-04,							
RU-REA-05,	RU-REA-06,							
RU-REA-07,	RU-REA-08,							
RU-REA-09,	RU-REA-10,							
RU-REA-11,	RU-REA-12							
ED006: Exchangeable Cations on Alkaline Soils								
Snap Lock Bag (ED006)								
RU-REA-01,	RU-REA-02,	**10-Oct-2019**	**21-Oct-2019**	07-Nov-2019	✓	**22-Oct-2019**	07-Nov-2019	✓
RU-REA-03,	RU-REA-04,							
RU-REA-05,	RU-REA-06,							
RU-REA-07,	RU-REA-08,							
RU-REA-09,	RU-REA-10,							
RU-REA-11,	RU-REA-12							

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
ED007: Exchangeable Cations								
Snap Lock Bag (ED007)								
RU-REA-01,	RU-REA-02,	**10-Oct-2019**	**21-Oct-2019**	07-Nov-2019	✓	**22-Oct-2019**	07-Nov-2019	✓
RU-REA-03,	RU-REA-04,							
RU-REA-05,	RU-REA-06,							
RU-REA-07,	RU-REA-08,							
RU-REA-09,	RU-REA-10,							
RU-REA-11,	RU-REA-12							
ED008: Exchangeable Cations								
Snap Lock Bag (ED008)								
RU-REA-01,	RU-REA-02,	**10-Oct-2019**	**21-Oct-2019**	07-Nov-2019	✓	**22-Oct-2019**	07-Nov-2019	✓
RU-REA-03,	RU-REA-04,							
RU-REA-05,	RU-REA-06,							
RU-REA-07,	RU-REA-08,							
RU-REA-09,	RU-REA-10,							
RU-REA-11,	RU-REA-12							
ED037: Alkalinity								
Snap Lock Bag (ED037)								
RU-REA-01,	RU-REA-02,	**10-Oct-2019**	**21-Oct-2019**	07-Apr-2020	✓	**21-Oct-2019**	07-Apr-2020	✓
RU-REA-03,	RU-REA-04,							
RU-REA-05,	RU-REA-06,							
RU-REA-07,	RU-REA-08,							
RU-REA-09,	RU-REA-10,							
RU-REA-11,	RU-REA-12							
ED040S : Soluble Sulfate by ICPAES								
Snap Lock Bag (ED040S)								
RU-REA-01,	RU-REA-02,	**10-Oct-2019**	**21-Oct-2019**	07-Nov-2019	✓	**22-Oct-2019**	18-Nov-2019	✓
RU-REA-03,	RU-REA-04,							
RU-REA-05,	RU-REA-06,							
RU-REA-07,	RU-REA-08,							
RU-REA-09,	RU-REA-10,							
RU-REA-11,	RU-REA-12							
ED042T: Total Sulfur by LECO								
Pulp Bag (ED042T)								
RU-REA-01,	RU-REA-02,	**10-Oct-2019**	**22-Oct-2019**	07-Nov-2019	✓	**22-Oct-2019**	07-Nov-2019	✓
RU-REA-03,	RU-REA-04,							
RU-REA-05,	RU-REA-06,							
RU-REA-07,	RU-REA-08,							
RU-REA-09,	RU-REA-10,							
RU-REA-11,	RU-REA-12							

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation: Date extracted	Due for extraction	Evaluation	Analysis: Date analysed	Due for analysis	Evaluation
ED045G: Chloride by Discrete Analyser								
Snap Lock Bag (ED045G)								
RU-REA-01,	RU-REA-02,	**10-Oct-2019**	**21-Oct-2019**	07-Nov-2019	✓	**22-Oct-2019**	18-Nov-2019	✓
RU-REA-03,	RU-REA-04,							
RU-REA-05,	RU-REA-06,							
RU-REA-07,	RU-REA-08,							
RU-REA-09,	RU-REA-10,							
RU-REA-11,	RU-REA-12							
ED093S: Soluble Major Cations								
Snap Lock Bag (ED093S)								
RU-REA-01,	RU-REA-02,	**10-Oct-2019**	**21-Oct-2019**	07-Apr-2020	✓	**22-Oct-2019**	07-Apr-2020	✓
RU-REA-03,	RU-REA-04,							
RU-REA-05,	RU-REA-06,							
RU-REA-07,	RU-REA-08,							
RU-REA-09,	RU-REA-10,							
RU-REA-11,	RU-REA-12							
ED093T: Total Major Cations								
Snap Lock Bag (ED093T)								
RU-REA-01,	RU-REA-02,	**10-Oct-2019**	**21-Oct-2019**	07-Apr-2020	✓	**21-Oct-2019**	07-Apr-2020	✓
RU-REA-03,	RU-REA-04,							
RU-REA-05,	RU-REA-06,							
RU-REA-07,	RU-REA-08,							
RU-REA-09,	RU-REA-10,							
RU-REA-11,	RU-REA-12							
EG005(ED093)S : Soluble Metals by ICPAES								
Snap Lock Bag (EG005S)								
RU-REA-01,	RU-REA-02,	**10-Oct-2019**	**21-Oct-2019**	07-Apr-2020	✓	**22-Oct-2019**	07-Apr-2020	✓
RU-REA-03,	RU-REA-04,							
RU-REA-05,	RU-REA-06,							
RU-REA-07,	RU-REA-08,							
RU-REA-09,	RU-REA-10,							
RU-REA-11,	RU-REA-12							
EG005(ED093)T: Total Metals by ICP-AES								
Snap Lock Bag (EG005T)								
RU-REA-01,	RU-REA-02,	**10-Oct-2019**	**21-Oct-2019**	07-Apr-2020	✓	**21-Oct-2019**	07-Apr-2020	✓
RU-REA-03,	RU-REA-04,							
RU-REA-05,	RU-REA-06,							
RU-REA-07,	RU-REA-08,							
RU-REA-09,	RU-REA-10,							
RU-REA-11,	RU-REA-12							

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Snap Lock Bag (EK059G)								
RU-REA-01,	RU-REA-02,	**10-Oct-2019**	**21-Oct-2019**	07-Apr-2020	✓	**22-Oct-2019**	07-Apr-2020	✓
RU-REA-03,	RU-REA-04,							
RU-REA-05,	RU-REA-06,							
RU-REA-07,	RU-REA-08,							
RU-REA-09,	RU-REA-10,							
RU-REA-11,	RU-REA-12							
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Snap Lock Bag (EK061G)								
RU-REA-01,	RU-REA-02,	**10-Oct-2019**	**22-Oct-2019**	07-Apr-2020	✓	**22-Oct-2019**	07-Apr-2020	✓
RU-REA-03,	RU-REA-04,							
RU-REA-05,	RU-REA-06,							
RU-REA-07,	RU-REA-08,							
RU-REA-09,	RU-REA-10,							
RU-REA-11,	RU-REA-12							

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type / *Analytical Methods*	*Method*	*Count QC*	*Count Regular*	***Rate (%) Actual***	***Rate (%) Expected***	*Evaluation*	*Quality Control Specification*
Laboratory Duplicates (DUP)							
Acid Neutralising Capacity (ANC)	EA013	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Alkalinity in Soil	ED037	2	12	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Cations - soluble by ICP-AES	ED093S	2	12	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride Soluble By Discrete Analyser	ED045G	2	12	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Electrical Conductivity (1:5)	EA010	2	12	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations on Alkaline Soils	ED006	2	12	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Anions - Soluble	ED040S	2	12	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations by ICPAES - Total	ED093T	2	12	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx)- Soluble by Discrete Analyser	EK059G	2	12	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
pH (1:5)	EA002	2	12	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Soluble Metals by ICPAES	EG005S	2	12	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfur - Total as S (LECO)	ED042T	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TKN as N By Discrete Analyser	EK061G	2	12	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	2	12	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Acid Neutralising Capacity (ANC)	EA013	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Alkalinity in Soil	ED037	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Cations - soluble by ICP-AES	ED093S	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride Soluble By Discrete Analyser	ED045G	2	12	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Electrical Conductivity (1:5)	EA010	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations on Alkaline Soils	ED006	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Anions - Soluble	ED040S	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx)- Soluble by Discrete Analyser	EK059G	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
pH (1:5)	EA002	2	12	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Soluble Metals by ICPAES	EG005S	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfur - Total as S (LECO)	ED042T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TKN as N By Discrete Analyser	EK061G	2	12	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Cations - soluble by ICP-AES	ED093S	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride Soluble By Discrete Analyser	ED045G	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Electrical Conductivity (1:5)	EA010	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations on Alkaline Soils	ED006	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Anions - Soluble	ED040S	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Method Blanks (MB) - Continued							
Major Cations by ICPAES - Total	ED093T	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx)- Soluble by Discrete Analyser	EK059G	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Soluble Metals by ICPAES	EG005S	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfur - Total as S (LECO)	ED042T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TKN as N By Discrete Analyser	EK061G	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Nitrite and Nitrate as N (NOx)- Soluble by Discrete Analyser	EK059G	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TKN as N By Discrete Analyser	EK061G	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
pH (1:5)	EA002	SOIL	In house: Referenced to Rayment and Lyons 4A1 and APHA 4500H+. pH is determined on soil samples after a 1:5 soil/water leach. This method is compliant with NEPM (2013) Schedule B(3)
Net Acid Production Potential	EA009	SOIL	In house: Referenced to Coastech Research (Canada)(Mod.). NAPP = Acid Production Potential (APP or MAP-Maximum Acid Potential) minus Neutralising Capacity (ANC). NAPP may be +ve, zero or -ve.
Electrical Conductivity (1:5)	EA010	SOIL	In house: Referenced to Rayment and Lyons 3A1 and APHA 2510. Conductivity is determined on soil samples using a 1:5 soil/water leach. This method is compliant with NEPM (2013) Schedule B(3)
Acid Neutralising Capacity (ANC)	EA013	SOIL	In house: Referenced to USEPA 600/2-78-054, I. Miller (2000). A fizz test is done to semiquanititatively estimate the likely reactivity. The soil is then reacted with an known excess quanitity of an appropriate acid. Titration determines the acid remaining, and the ANC can be calculated from comparison with a blank titration.
Exchange Acidity by 1M Potassium Chloride	* ED005	SOIL	In house: referenced to Rayment and Lyons, (2011), method 15G1. This method is unsuitable for near neutral and alkaline soils. NATA accreditation does not cover performance of this service.
Exchangeable Cations on Alkaline Soils	* ED006	SOIL	In house: Referenced to Soil Survey Test Method C5. Soluble salts are removed from the sample prior to analysis. Cations are exchanged from the sample by contact with alcoholic ammonium chloride at pH 8.5. They are then quantitated in the final solution by ICPAES and reported as meq/100g of original soil.
Exchangeable Cations	ED007	SOIL	In house: Referenced to Rayment & Lyons (2011) Method 15A1. Cations are exchanged from the sample by contact with Ammonium Chloride. They are then quantitated in the final solution by ICPAES and reported as meq/100g of original soil. This method is compliant with NEPM (2013) Schedule B(3) (Method 301)
Exchangeable Cations with pre-treatment	ED008	SOIL	In house: Referenced to Rayment & Higginson (2011) Method 15A2. Soluble salts are removed from the sample prior to analysis. Cations are exchanged from the sample by contact with Ammonium Chloride. They are then quantitated in the final solution by ICPAES and reported as meq/100g of original soil. This method is compliant with NEPM (2013) Schedule B(3) (Method 301)
Alkalinity in Soil	* ED037	SOIL	In house: Referenced to APHA 2320 B Alkalinity is determined and reported on a 1:5 soil/water leach.
Major Anions - Soluble	ED040S	SOIL	In house: Soluble Anions are determined off a 1:5 soil / water extract by ICPAES.
Sulfur - Total as S (LECO)	ED042T	SOIL	In house: Dried and pulverised sample is combusted in a high temperature furnace in the presence of strong oxidants / catalysts. The evolved S (as SO2) is measured by infra-red detector
Chloride Soluble By Discrete Analyser	ED045G	SOIL	In house: Referenced to APHA 4500-Cl- E. The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride.in the presence of ferric ions the librated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm. Analysis is performed on a 1:5 soil / water leachate.
Cations - soluble by ICP-AES	ED093S	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010 (ICPAES) Water extracts of the soil are analyzed for major cations by ICPAES. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM (2013) Schedule B(3)
Major Cations by ICPAES - Total	ED093T	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010 (ICPAES) Major cations are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM (2013) Schedule B(3)

Analytical Methods	*Method*	*Matrix*	*Method Descriptions*
Soluble Metals by ICPAES	EG005S	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Soluble metals are determined following an appropriate soil / water extraction of the soil. The ICPAES technique ionises samples in a plasma, emitting characteristic spectrums based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards.
Total Metals by ICP-AES	EG005T	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM (2013) Schedule B(3)
Nitrite and Nitrate as N (NOx)- Soluble by Discrete Analyser	EK059G	SOIL	In house: Thermo Scientific Method D08727 and NEMI (National Environmental Method Index) Method ID: 9171. This method covers the determination of total oxidised nitrogen (NOx-N) and nitrate (NO3-N) by calculation, Combined oxidised Nitrogen (NO2+NO3) in a water extract is determined by direct colourimetry by Discrete Analyser.
TKN as N By Discrete Analyser	EK061G	SOIL	In house: Referenced to APHA 4500-Norg-D Soil samples are digested using Kjeldahl digestion followed by determination by Discrete Analyser.
Total Nitrogen as N (TKN + NOx) By Discrete Analyser	EK062G	SOIL	In house: Referenced to APHA 4500 Norg/NO3- Total Nitrogen is determined as the sum of TKN and Oxidised Nitrrogen, each determined seperately as N.

Preparation Methods	*Method*	*Matrix*	*Method Descriptions*
Exchangeable Cations Preparation Method (Alkaline Soils)	ED006PR	SOIL	In house: Referenced to Rayment and Lyons 2011 method 15C1.
Exchangeable Cations Preparation Method	ED007PR	SOIL	In house: Referenced to Rayment & Higginson (1992) method 15A1. A 1M NH4Cl extraction by end over end tumbling at a ratio of 1:20. There is no pretreatment for soluble salts. Extracts can be run by ICP for cations.
TKN/TP Digestion	EK061/EK067	SOIL	In house: Referenced to APHA 4500 Norg- D; APHA 4500 P - H. Macro Kjeldahl digestion.
Drying at 85 degrees, bagging and labelling (ASS)	EN020PR	SOIL	In house
1:5 solid / water leach for soluble analytes	EN34	SOIL	10 g of soil is mixed with 50 mL of reagent grade water and tumbled end over end for 1 hour. Water soluble salts are leached from the soil by the continuous suspension. Samples are settled and the water filtered off for analysis.
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	In house: Referenced to USEPA 200.2. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM (2013) Schedule B(3) (Method 202)
Dry and Crush	EN84	SOIL	In house
Dry and Pulverise (up to 100g)	GEO30	SOIL	#

Please forward to Brisbane 23/10

CHAIN OF CUSTODY

ALS Laboratory: please tick →

Environmental Division
Brisbane
Work Order Reference
EB1927112

Telephone : + 61-7-3243 7222

CLIENT: Wollongong Coal (GUSNRE)		TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g., Ultra Trace Organics)	☐ Standard TAT (List due date): ☐ Non Standard or urgent TAT (List due date):
OFFICE: Russell Vale			
PROJECT:	PROJECT NO.:	ALS QUOTE NO.: EN/222	COC SEQUENCE NUMB COC: 1 2 3 4 OF: 1 2 3 4
ORDER NUMBER:	PURCHASE ORDER NO.:	COUNTRY OF ORIGIN:	
PROJECT MANAGER:	CONTACT PH:		
SAMPLER:	SAMPLER MOBILE:	RELINQUISHED BY:	RECEIVED BY: Au [signature]
COC Emailed to ALS? (YES / NO)	EDD FORMAT (or default):	DATE/TIME:	DATE/TIME: 9:30 10/10/19
Email Reports to (will default to PM if no other addresses are listed):			
Email Invoice to (will default to PM if no other addresses are listed):			

Circle) Yes No N/A
Yes No N/A
°C

RECEIVED BY: Renata
DATE/TIME: 14.10.19 11:40

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.	
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	pH & EC (1:5)	Total Sulfur	ANC, NAPP	Alkalinity (1:5)	Total Metals: Al, As, B, Cd, Cr, Co, Cu, Fe, Pb, Mn, Mo, Ni, Sb, Se, Zn	Total Cations: Ca, Mg, Na, K (+ Exchangeable)	Soluble Metals: Al, As, B, Cd, Cr, Co, Cu, Fe, Pb, Mn, Mo, Ni, Sb, Se, Zn (Hg)	Soluble Cations: Ca, Mg, Na, K Soluble Anions: Cl, SO4	Cation Exchange Capacity (e CEC)	Exchangeable Sodium Potential (ESP)
1	RV-REA-01	10/10/19	~~B~~ S	B	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2	RV-REA-02	↓	~~B~~ S	B	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3	RV-REA-03		~~B~~ S	B	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
4	RV-REA-04		~~B~~ S	B	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
5	RV-REA-05		~~B~~ S	B	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
6	RV-REA-06		~~B~~ S	B	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
7	RV-REA-07		~~B~~ S	B	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
8	RV-REA-08		S	B	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
9	RV-REA-09		S	B	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
10	RV-REA-10		S	B	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
11	RV-REA-11		S	B	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
12	RV-REA-12	↓	S	B	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
				TOTAL	12	12	12	12	12	12	12	12	12	12	12

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag; LI = Lugols Iodine Preserved Bottles; STT = Sterile Sodium Thiosulfate Preserved Bottles.

APPENDIX 2

Resource Recovery Order under Part 9, Clause 93 of the Protection of the Environment Operations (Waste) Regulation 2014

The coal washery rejects order 2014

Introduction

This order, issued by the Environment Protection Authority (EPA) under clause 93 of the Protection of the Environment Operations (Waste) Regulation 2014 (Waste Regulation), imposes the requirements that must be met by suppliers of coal washery rejects to which 'the coal washery rejects exemption 2014' applies. The requirements in this order apply in relation to the supply of coal washery rejects for application to land in earthworks for civil engineering applications.

1. Waste to which this order applies

1.1 This order applies to coal washery rejects. In this order, coal washery rejects means the waste resulting from washing coal (including substances such as coal fines, soil, sand and rock resulting from that process).

2. Persons to whom this order applies

2.1 The requirements in this order apply, as relevant, to any person who supplies coal washery rejects that have been generated, processed or recovered by the person.

2.2 This order does not apply to the supply of coal washery rejects to a consumer for land application purposes at a premises for which the consumer holds a licence under the POEO Act that authorises the carrying out of the scheduled activities on the premises under clause 39 'waste disposal (application to land)' or clause 40 'waste disposal (thermal treatment)' of Schedule 1 of the POEO Act.

3. Duration

3.1 This order commences on 24 November 2014 and is valid until revoked by the EPA by notice published in the Government Gazette.

4. Generator requirements

The EPA imposes the following requirements on any generator who supplies coal washery rejects.

Sampling requirements

4.1 On or before supplying coal washery rejects, the generator must:

4.1.1 Prepare a written sampling plan which includes a description of sample preparation and storage procedures for the coal washery rejects.

4.1.2 Undertake sampling and testing of the coal washery rejects as required under clauses 4.2 and 4.3 below. The sampling must be carried out in accordance with the written sampling plan and Australian Standard 1141.3.1-2012 Methods for sampling and testing aggregates – Sampling – Aggregates (or equivalent).

4.2 Where the coal washery rejects are generated as part of a continuous process, the processor must undertake the following sampling:

4.2.1. Characterisation of the coal washery rejects by collecting 20 composite samples of the waste and testing each sample for the chemicals and other attributes listed in Column 1 of Table 1. Each composite sample must be taken from a batch, truckload or stockpile that has not been previously sampled for the purposes of characterisation. Characterisation must be conducted for coal washery rejects generated and processed during each 2-year period following the commencement of the continuous process; and

4.2.2. Routine sampling of the coal washery rejects by collecting either 5 composite samples from every 10,000 tonnes (or part thereof) processed or 5 composite samples every 6 months (whichever is the lesser); and testing each sample for the chemicals and other attributes listed in Column 1 of Table 1 other than those listed as 'not required' in Column 3. Each composite sample must be taken from a batch, truckload or stockpile that has not been previously sampled for the purposes of routine sampling. However, if characterisation sampling occurs at the same frequency as routine sampling, any sample collected and tested for the purposes of characterisation under clause 4.2.1 may be treated as a sample collected and tested for the purposes of routine sampling under clause 4.2.2.

4.3. Where the coal washery rejects are not generated as part of a continuous process, the generator must undertake one-off sampling of discrete batches, truckloads or stockpiles, by collecting 10 composite samples from every 4,000 tonnes (or part thereof) generated and testing each sample for the chemicals and other attributes listed in Column 1 of Table 1. The test results for each composite sample must be validated as compliant with the maximum average concentration or other value listed in Column 2 of Table 1 and the absolute maximum concentration or other value listed in Column 4 of Table 1 prior to the supply of the coal washery rejects.

Chemical and other material requirements

4.4. The processor must not supply coal washery rejects to any person if, in relation to any of the chemical and other attributes of the coal washery rejects:

4.4.1. The concentration or other value of that attribute of any sample collected and tested as part of the characterisation or the routine or one-off sampling of the coal washery rejects exceeds the absolute maximum concentration or other value listed in Column 4 of Table 1, or

4.4.2. The average concentration or other value of that attribute from the characterisation or one-off sampling of coal washery rejects (based on the arithmetic mean) exceeds the maximum average concentration or other value listed in Column 2 of Table 1, or

4.4.3. The average concentration or other value of that attribute from the routine sampling of coal washery rejects (based on the arithmetic mean) exceeds the maximum average concentration or other value listed in Column 3 of Table 1.

4.5. The absolute maximum concentration or other value of that attribute in any coal washery rejects supplied under this order must not exceed the absolute maximum concentration or other value listed in Column 4 of Table 1.

Table 1

Column 1	**Column 2**	**Column 3**	**Column 4**
Chemicals and other attributes	**Maximum average concentration for characterisation** (mg/kg 'dry weight' unless otherwise specified)	**Maximum average concentration for routine testing** (mg/kg 'dry weight' unless otherwise specified)	**Absolute maximum concentration** (mg/kg 'dry weight' unless otherwise specified)
1. Mercury	0.5	Not required	1
2. Cadmium	0.5	Not required	1
3. Lead	50	50	100
4. Arsenic	10	Not required	20
5. Chromium (total)	75	75	150
6. Copper	50	50	100
7. Nickel	40	40	80
8. Selenium	2	Not required	5
9. Zinc	100	100	200
10. Electrical Conductivity	1 dS/m	1dS/m	2 dS/m
11. pH*	8 to 11	Not required	7 to 12
12. Combustible content	30%	30%	40%
13. Sulphur %	0.5%	0.5%	1%

*Note: The ranges given for pH are for the minimum and maximum acceptable pH values in the coal washery rejects.

Test methods

4.6. The generator must ensure that any testing of samples required by this order is undertaken by analytical laboratories accredited by the National Association of Testing Authorities (NATA), or equivalent.

4.7. The generator must ensure that the chemicals and other attributes (listed in Column 1 of Table 1) in the coal washery rejects it supplies are tested in accordance with the test methods specified below or other equivalent analytical methods. Where an equivalent analytical method is used the detection limit must be equal to or less than that nominated for the given method below.

4.7.1. Test method for measuring the mercury concentration:

4.7.1.1. Analysis using USEPA SW-846 Method 7471B Mercury in solid or semisolid waste (manual cold-vapor technique), or an equivalent analytical method with a detection limit < 20% of the stated absolute maximum concentration in Table 1, Column 4 (i.e. < 0.2 mg/kg dry weight).

4.7.1.2. Report as mg/kg dry weight.

4.7.2. Test methods for measuring chemicals 2 - 9:

4.7.2.1. Sample preparation by digestion using USEPA SW-846 Method 3051A Microwave assisted acid digestion of sediments, sludges, soils, and oils.

4.7.2.2. Analysis using USEPA SW-846 Method 6010C Inductively coupled plasma - atomic emission spectrometry, or an equivalent analytical method with an appropriate detection limit.

4.7.2.3. Report as mg/kg dry weight.

4.7.3. Test methods for measuring the electrical conductivity and pH:

4.7.3.1. Sample preparation by mixing 1 part coal washery rejects with 5 parts distilled water.

4.7.3.2. Analysis using Method 103 (pH) and 104 (Electrical Conductivity) in Schedule B (3): Guideline on Laboratory Analysis of Potentially Contaminated Soils, National Environment Protection (Assessment of Site Contamination) Measure 1999 (or an equivalent analytical method).

4.7.3.3. Report electrical conductivity in deciSiemens per metre (dS/m).

4.7.4. Test methods for measuring the combustible content and sulphur content:

4.7.4.1. Australian Standard 1038 Coal and coke (or an equivalent analytical method).

4.7.4.2. Report combustible content and sulphur content as %.

Notification

4.8. On or before each transaction, the generator must provide the following to each person to whom the generator supplies the coal washery rejects:

- a written statement of compliance certifying that all the requirements set out in this order have been met;
- a copy of the coal washery rejects exemption, or a link to the EPA website where the coal washery rejects exemption can be found; and
- a copy of the coal washery rejects order, or a link to the EPA website where the coal washery rejects order can be found.

Record keeping and reporting

4.9. The generator must keep a written record of the following for a period of six years:

- the sampling plan required to be prepared under clause 4.1.1;
- all characterisation, routine and/or one-off sampling results in relation to the coal washery rejects supplied;
- the quantity of the coal washery rejects supplied; and

- the name and address of each person to whom the generator supplied the coal washery rejects.

4.10. The generator must provide, on request, the most recent characterisation and sampling (whether routine or one-off or both) results for coal wash rejects supplied to any consumer of the coal washery rejects.

4.11. The generator must notify the EPA within seven days of becoming aware that it has not complied with any requirement in clause 4.1 to 4.7.

5. Definitions

In this order:

application or apply to land means applying to land by:

- spraying, spreading or depositing on the land; or
- ploughing, injecting or mixing into the land; or
- filling, raising, reclaiming or contouring the land.

composite sample means a sample that combines five discrete sub-samples of equal size into a single sample for the purpose of analysis.

consumer means a person who applies, or intends to apply, coal washery rejects to land.

continuous process means a process that produces coal washery rejects on an ongoing basis.

generator means a person who generates coal washery rejects.

transaction means:

- in the case of a one-off supply, the supply of a batch, truckload or stockpile of coal washery rejects that is not repeated.
- in the case where the supplier has an arrangement with the recipient for more than one supply of coal washery rejects, the first supply of coal washery rejects as required under the arrangement.

Manager Waste Strategy and Innovation

Environment Protection Authority

(by delegation)

Notes

The EPA may amend or revoke this order at any time. It is the responsibility of each of the generator and processor to ensure it complies with all relevant requirements of the most current order. The current version of this order will be available on www.epa.nsw.gov.au

In gazetting or otherwise issuing this order, the EPA is not in any way endorsing the supply or use of this substance or guaranteeing that the substance will confer benefit.

The conditions set out in this order are designed to minimise the risk of potential harm to the environment, human health or agriculture, although neither this order nor the accompanying exemption guarantee that the environment, human health or agriculture will not be harmed.

Any person or entity which supplies coal washery rejects should assess whether the material is fit for the purpose the material is proposed to be used for, and whether this use may cause harm. The supplier may need to seek expert engineering or technical advice.

Regardless of any exemption or order provided by the EPA, the person who causes or permits the application of the substance to land must ensure that the action is lawful and consistent with any other legislative requirements including, if applicable, any development consent(s) for managing operations on the site(s).

The supply of coal washery rejects remains subject to other relevant environmental regulations in the POEO Act and Waste Regulation. For example, a person who pollutes land (s. 142A) or water (s. 120), or causes air pollution through the emission of odours (s. 126), or does not meet the special requirements for asbestos waste (Part 7 of the Waste Regulation), regardless of this order, is guilty of an offence and subject to prosecution.

This order does not alter the requirements of any other relevant legislation that must be met in supplying this material, including for example, the need to prepare a Safety Data Sheet. Failure to comply with the conditions of this order constitutes an offence under clause 93 of the Waste Regulation.

Resource Recovery Exemption under Part 9, Clauses 91 and 92 of the Protection of the Environment Operations (Waste) Regulation 2014

The coal washery rejects exemption 2014

Introduction

This exemption:

- is issued by the Environment Protection Authority (EPA) under clauses 91 and 92 of the Protection of the Environment Operations (Waste) Regulation 2014 (Waste Regulation); and
- exempts a consumer of coal washery rejects from certain requirements under the *Protection of the Environment Operations Act 1997* (POEO Act) and the Waste Regulation in relation to the application of that waste to land, provided the consumer complies with the conditions of this exemption.

This exemption should be read in conjunction with 'the coal washery rejects order 2014'.

1. Waste to which this exemption applies

1.1. This exemption applies to coal washery rejects that are, or are intended to be, applied to land in earthworks for civil engineering applications.

1.2. Coal washery rejects is the waste resulting from washing coal (including substances such as coal fines, soil, sand and rock resulting from that process).

2. Persons to whom this exemption applies

2.1. This exemption applies to the any person who applies, or intends to apply, coal washery rejects to land as set out in 1.1.

3. Duration

3.1. This exemption commences on 24 November 2014 and is valid until revoked by the EPA by notice published in the Government Gazette.

4. Premises to which this exemption applies

4.1. This exemption applies to the premises at which the consumer's actual or intended application of coal washery rejects is carried out.

5. Revocation

5.1. 'The coal washery rejects general exemption 2009' which commenced on 1 November 2009, is revoked from 24 November 2014.

6. Exemption

6.1. Subject to the conditions of this exemption, the EPA exempts each consumer from the following provisions of the POEO Act and the Waste Regulation in relation to the consumer's actual or intended application of coal washery rejects to land in earthworks for civil engineering applications at the premises:

- section 48 of the POEO Act in respect of the scheduled activities described in clauses 39 and 42 of Schedule 1 of the POEO Act;
- Part 4 of the Waste Regulation;
- section 88 of the POEO Act; and
- clause 109 and 110 of the Waste Regulation.

6.2. The exemption does not apply in circumstances where coal washery rejects are received at the premises for which the consumer holds a licence under the POEO Act that authorises the carrying out of the scheduled activities on the premises under clause 39 'waste disposal (application to land)' or clause 40 'waste disposal (thermal treatment)' of Schedule 1 of the POEO Act.

7. Conditions of exemption

The exemption is subject to the following conditions:

7.1. At the time the coal washery rejects are received at the premises, the material must meet all chemical and other material requirements for coal washery rejects which are required on or before the supply of coal washery rejects under 'the coal washery rejects order 2014'.

7.2. The coal washery rejects can only be applied to land in earthworks for civil engineering applications. Approval does not apply to any of the following applications:

7.2.1. Construction of dams or related water storage infrastructure,

7.2.2. Mine site rehabilitation,

7.2.3. Quarry rehabilitation,

7.2.4. Sand dredge pond rehabilitation,

7.2.5. Back-filling of quarry voids,

7.2.6. Raising or reshaping of land used for agricultural purposes, and

7.2.7. Construction of roads on private land unless:

(a) the coal washery rejects are applied to land to the minimum extent necessary for the construction of a road, and
(b) a development consent for the development has been granted under the relevant Environmental Planning Instrument (EPI), or
(c) it is to provide access (temporary or permanent) to a development approved by a Council, or
(d) the works undertaken are either exempt or complying development.

7.3. The consumer can only apply coal washery rejects to land where it is not applied in or beneath water, including groundwater.

7.4. The consumer must keep a written record of the following for a period of six years:

- the quantity of any coal washery rejects received; and
- the name and address of the supplier of the coal washery rejects received.

7.5. The consumer must make any records required to be kept under this exemption available to authorised officers of the EPA on request.

7.6. The consumer must ensure that any application of coal washery rejects to land must occur within a reasonable period of time after its receipt.

8. Definitions

In this exemption:

application or apply to land means applying to land by:

- spraying, spreading or depositing on the land; or
- ploughing, injecting or mixing into the land; or
- filling, raising, reclaiming or contouring the land.

consumer means a person who applies, or intends to apply, coal washery rejects to land.

Manager Waste Strategy and Innovation
Environment Protection Authority
(by delegation)

Notes

The EPA may amend or revoke this exemption at any time. It is the responsibility of the consumer to ensure they comply with all relevant requirements of the most current exemption. The current version of this exemption will be available on www.epa.nsw.gov.au

In gazetting or otherwise issuing this exemption, the EPA is not in any way endorsing the use of this substance or guaranteeing that the substance will confer benefit.

The conditions set out in this exemption are designed to minimise the risk of potential harm to the environment, human health or agriculture, although neither this exemption nor the accompanying order guarantee that the environment, human health or agriculture will not be harmed.

The consumer should assess whether or not the coal washery rejects is fit for the purpose the material is proposed to be used for, and whether this use will cause harm. The consumer may need to seek expert engineering or technical advice.

Regardless of any exemption provided by the EPA, the person who causes or permits the application of the substance to land must ensure that the action is lawful and consistent with any other legislative requirements including, if applicable, any development consent(s) for managing operations on the site(s).

The receipt of coal washery rejects remains subject to other relevant environmental regulations in the POEO Act and the Waste Regulation. For example, a person who pollutes land (s. 142A) or water (s. 120), or causes air pollution through the emission of odours (s. 126), or does not meet the special requirements for asbestos waste (Part 7 of the Waste Regulation), regardless of having an exemption, is guilty of an offence and subject to prosecution.

This exemption does not alter the requirements of any other relevant legislation that must be met in utilising this material, including for example, the need to prepare a Safety Data Sheet (SDS).

Failure to comply with the conditions of this exemption constitutes an offence under clause 91 of the Waste Regulation.

Resource Recovery Order under Part 9, Clause 93 of the Protection of the Environment Operations (Waste) Regulation 2014

The coal washery rejects (coal mine void) order 2014

Introduction

This order, issued by the Environment Protection Authority (EPA) under clause 93 of the Protection of the Environment Operations (Waste) Regulation 2014 (Waste Regulation), imposes the requirements that must be met by suppliers of coal washery rejects to which 'the coal washery rejects (coal mine void) exemption 2014' applies. The requirements in this order apply in relation to the supply of coal washery rejects for application to land as fill for coal mine voids.

1. Waste to which this order applies

1.1. This order applies to coal washery rejects. In this order, coal washery rejects means the waste resulting from washing coal (including substances such as coal fines, soil, sand and rock resulting from that process).

2. Persons to whom this order applies

2.1. The requirements in this order apply, as relevant, to any person who supplies coal washery rejects that have been generated, processed or recovered by the person.

2.2. This order does not apply to the supply of coal washery rejects to a consumer for land application at a premises for which the consumer holds a licence under the POEO Act that authorises the carrying out of the scheduled activities on the premises under clause 39 'waste disposal (application to land)' or clause 40 'waste disposal (thermal treatment)' of Schedule 1 of the POEO Act.

3. Duration

3.1. This order commences on 24 November 2014 and is valid until revoked by the EPA by notice published in the Government Gazette.

4. Generator requirements

The EPA imposes the following requirements on any generator who supplies coal washery rejects.

Notification

4.1. On or before each transaction, the generator must provide the following to each person to whom the generator supplies the coal washery rejects:

- a written statement of compliance certifying that all the requirements set out in this order have been met;
- a copy of the coal washery rejects exemption, or a link to the EPA website where the coal washery rejects exemption can be found; and
- a copy of the coal washery rejects order, or a link to the EPA website where the coal washery rejects order can be found.

5. Definitions

In this order:

application or apply to land means applying to land by:

- spraying, spreading or depositing on the land; or
- ploughing, injecting or mixing into the land; or
- filling, raising, reclaiming or contouring the land.

coal mine void is an artificially created pit within a Mining Lease (as defined by the *Mining Act 1992*) from which coal is or has been extracted.

consumer means a person who applies, or intends to apply, coal washery rejects to land.

generator means a person who generates coal washery rejects.

transaction means:

- in the case of a one-off supply, the supply of a batch, truckload or stockpile of coal washery rejects that is not repeated.
- in the case where the supplier has an arrangement with the recipient for more than one supply of coal washery rejects, the first supply of coal washery rejects as required under the arrangement.

Manager Waste Strategy and Innovation

Environment Protection Authority

(by delegation)

Notes

The EPA may amend or revoke this order at any time. It is the responsibility of each of the generator and processor to ensure it complies with all relevant requirements of the most current order. The current version of this order will be available on www.epa.nsw.gov.au

In gazetting or otherwise issuing this order, the EPA is not in any way endorsing the supply or use of this substance or guaranteeing that the substance will confer benefit.

The conditions set out in this order are designed to minimise the risk of potential harm to the environment, human health or agriculture, although neither this order nor the accompanying exemption guarantee that the environment, human health or agriculture will not be harmed.

Any person or entity which supplies coal washery rejects should assess whether the material is fit for the purpose the material is proposed to be used for, and whether this use may cause harm. The supplier may need to seek expert engineering or technical advice.

Regardless of any exemption or order provided by the EPA, the person who causes or permits the application of the substance to land must ensure that the action is lawful and consistent with any other legislative requirements including, if applicable, any development consent(s) for managing operations on the site(s).

The supply of coal washery rejects remains subject to other relevant environmental regulations in the POEO Act and Waste Regulation. For example, a person who pollutes land (s. 142A) or water (s. 120), or causes air pollution through the emission of odours (s. 126), or does not meet the special requirements for asbestos waste (Part 7 of the Waste Regulation), regardless of this order, is guilty of an offence and subject to prosecution.

This order does not alter the requirements of any other relevant legislation that must be met in supplying this material, including for example, the need to prepare a Safety Data Sheet. Failure to comply with the conditions of this order constitutes an offence under clause 93 of the Waste Regulation.

Resource Recovery Exemption under Part 9, Clauses 91 and 92 of the Protection of the Environment Operations (Waste) Regulation 2014

The coal washery rejects (coal mine void) exemption 2014

Introduction

This exemption:

- is issued by the Environment Protection Authority (EPA) under clauses 91 and 92 of the Protection of the Environment Operations (Waste) Regulation 2014 (Waste Regulation); and
- exempts a consumer of coal washery rejects from certain requirements under the *Protection of the Environment Operations Act 1997* (POEO Act) and the Waste Regulation in relation to the application of that waste to land, provided the consumer complies with the conditions of this exemption.

This exemption should be read in conjunction with 'the coal washery rejects (coal mine void) order 2014'.

1. Waste to which this exemption applies

1.1 This exemption applies to coal washery rejects that are, or ares intended to be, applied to land as fill for coal mine voids.

1.2 Coal washery rejects are the waste resulting from washing coal (including substances such as coal fines, soil, sand and rock resulting from that process).

2. Persons to whom this exemption applies

2.1 This exemption applies to any person who applies, or intends to apply, coal washery rejects to land as set out in 1.1.

3. Duration

3.1 This exemption commences on 24 November 2014 and is valid until revoked by the EPA by notice published in the Government Gazette.

4. Premises to which this exemption applies

4.1 This exemption applies to the premises at which the consumer's actual or intended application of coal washery rejects is carried out.

5. Revocation

5.1 'The coal washery rejects (coal mine void) exemption 2009' which commenced on 1 November 2009, is revoked from 24 November 2014.

6. Exemption

6.1 Subject to the conditions of this exemption, the EPA exempts each consumer from the following provisions of the POEO Act and the Waste Regulation in relation to the consumer's actual or intended application of coal washery rejects to land as fill for coal mine voids at the premises:

- section 48 of the POEO Act in respect of the scheduled activities described in clauses 39 and 42 of Schedule 1 of the POEO Act;
- Part 4 of the Waste Regulation;
- section 88 of the POEO Act; and
- clause 109 and 110 of the Waste Regulation.

6.2 The exemption does not apply in circumstances where coal washery rejects is received at the premises for which the consumer holds a licence under the POEO Act that authorises the carrying out of the scheduled activities on the premises under clause 39 'waste disposal (application to land)' or clause 40 'waste disposal (thermal treatment)' of Schedule 1 of the POEO Act.

7. Conditions of exemption

The exemption is subject to the following conditions:

7.1 The coal washery rejects can only be applied to land to fill a coal mine void to the original ground level.

7.2 The consumer can only apply coal washery rejects to land where it complies with a rehabilitation plan for the site as approved by Industry and Investment NSW.

7.3 The consumer must ensure that any application of coal washery rejects to land as fill for coal mine voids must occur within six months of its receipt.

8. Definitions

In this exemption:

application or apply to land means applying to land by:

- spraying, spreading or depositing on the land; or
- ploughing, injecting or mixing into the land; or
- filling, raising, reclaiming or contouring the land.

coal mine void is an artificially created pit within a Mining Lease (as defined by the *Mining Act 1992*) from which coal is or has been extracted.

consumer means a person who applies, or intends to apply, coal washery rejects to land.

original ground level means the ground level prior to any mining activities, as indicated on a survey map described in Australian Height Datum or Relative Level.

Manager Waste Strategy and Innovation
Environment Protection Authority
(by delegation)

Notes

The EPA may amend or revoke this exemption at any time. It is the responsibility of the consumer to ensure they comply with all relevant requirements of the most current exemption. The current version of this exemption will be available on www.epa.nsw.gov.au

In gazetting or otherwise issuing this exemption, the EPA is not in any way endorsing the use of this substance or guaranteeing that the substance will confer benefit.

The conditions set out in this exemption are designed to minimise the risk of potential harm to the environment, human health or agriculture, although neither this exemption nor the accompanying order guarantee that the environment, human health or agriculture will not be harmed.

The consumer should assess whether or not the coal washery rejects is fit for the purpose the material is proposed to be used for, and whether this use will cause harm. The consumer may need to seek expert engineering or technical advice.

Regardless of any exemption provided by the EPA, the person who causes or permits the application of the substance to land must ensure that the action is lawful and consistent with any other legislative requirements including, if applicable, any development consent(s) for managing operations on the site(s).

The receipt of coal washery rejects remains subject to other relevant environmental regulations in the POEO Act and the Waste Regulation. For example, a person who pollutes land (s. 142A) or water (s. 120), or causes air pollution through the emission of odours (s. 126), or does not meet the special requirements for asbestos waste (Part 7 of the Waste Regulation), regardless of having an exemption, is guilty of an offence and subject to prosecution.

This exemption does not alter the requirements of any other relevant legislation that must be met in utilising this material, including for example, the need to prepare a Safety Data Sheet (SDS).

Failure to comply with the conditions of this exemption constitutes an offence under clause 91 of the Waste Regulation.

umwelt
Environmental & Social Consultants

Newcastle
75 York Street
Teralba NSW 2284

Perth
First Floor
12 Prowse Street
West Perth WA 6005
PO Box 783
West Perth WA 6872

Canberra
2/99 Northbourne Avenue
Turner ACT 2612
PO Box 6135
O'Connor ACT 2602

Sydney
50 York Street
Sydney NSW 2000

Brisbane
Level 13
500 Queen Street
Brisbane QLD 4000

Orange
Office 1
3 Hampden Street
Orange NSW 2800

T| 1300 793 267 E| info@umwelt.com.au www.umwelt.com.au