



RUSSELL VALE COLLIERY

Response to Planning Assessment Commission Review Report Part 1

for

Wollongong Coal Limited

July 2015

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RUSSELL VALE COLLIERY
UNDERGROUND EXPANSION PROJECT

RESPONSE TO PLANNING ASSESSMENT COMMISSION REVIEW REPORT – PART 1

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For

Wollongong Coal Limited

1 INTRODUCTION

1.1 BACKGROUND

Wollongong Coal Limited (WCL) operates the Russell Vale Colliery located approximately 8 km north of Wollongong and 70 km south of Sydney. WCL is seeking Project Approval under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act) for the Underground Expansion Project (the Project).

On 9 December 2014, the Minister for Planning requested the NSW Planning Assessment Commission (PAC) to undertake a review of the Russell Vale Colliery Underground Expansion Project and assess the merits of the Project as a whole. The PAC was required to conduct a public hearing on the project. A public hearing was held on 3 February 2014, at the WIN Entertainment Centre, Wollongong.

The PAC published its report on the review of the Project (PAC Review Report) on 2 April 2015. The PAC's report included recommendations regarding additional assessment that needs to be completed before the Project can be determined. The PAC concluded (at p. 52) that:

> *"At this stage, the Commission does not have sufficient information or confidence to determine the merits of the proposal sufficient for a determination for approval. It may be possible for the proposal, or a modified proposal to be approved if all the additional information identified in this Review report provides a greater level of confidence for the protection of the water quality and quantity in the Sydney Catchment Area and satisfies all the other issues identified in this review."*

1.2 DOCUMENT PURPOSE

WCL and its technical specialists have considered each of the 15 recommendations made by the PAC and is responding to each. This document forms Part 1 of the proponent's Response to the PAC Review Report. Part 1 addresses the recommendations that relate to the proposed surface activities associated with the Project (i.e. Recommendations 5 to 15). This document is supported by technical responses from WCL's specialists which are provided in **Appendix A** to **Appendix F**.

Recommendations 1 to 4 (which relate to underground mining issues) will be responded to in Part 2 of the Response to the PAC Review Report.

2 RESPONSE TO PAC RECOMMENDATIONS

This section lists Recommendations 5 – 15 in the PAC Review Report, which relate to surface activities associated with the Project and provides a detailed response to each.

2.1 SOCIO-ECONOMIC

2.1.1 Recommendation 5

> *The proponent's economic assessment, in particular the estimated costs and benefits, should be updated to reflect the current economic climate.*

Response

WCL agrees with this recommendation.

As such, the *Russell Vale Colliery Underground Expansion Project Economic Assessment* was revised by Gillespie Economics in response to the PAC's recommendation. The revised Economic Assessment is included as **Appendix A** and summarised below.

The net production benefits of the Project have been re-calculated based on the latest projected coal prices and foreign exchange rates for the five year period from 2016 to 2020. The minimum net production benefit has been estimated based on an average annual production of 934,000 tonnes, with 52.6% coking coal at USD84/tonne and 28.6% thermal coal[1] at USD61/tonne, and a AUD/USD exchange rate of 0.73.

The Economic Assessment has determined net production benefits based entirely on royalties accruing to NSW. The Project may also generate unquantified company tax benefits to Australia and non-market employment benefits. However, these benefits have conservatively been excluded from the minimum threshold value.

The Benefit Cost Analysis (BCA) for the Project has been updated using the latest projected coal prices and foreign exchange rates. Gillespie Economics has determined that the Project will generate gross revenues of $323 million (present value). The minimum net production benefit accruing to Australia is estimated to be $23 million (present value) in royalties, based on a 7% discount rate. This is the minimum threshold value against which the residual social and environmental costs of the Project are to be compared.

The residual social and environmental costs would need to be valued at greater than $23 million (present value) for the Project to be considered questionable from an economic efficiency perspective.

Conservatively, a sensitivity analysis was also undertaken to determine the sensitivity of the minimum threshold value to changes in the following variables:

- 20% decrease in annual ROM production;
- Changes in product coal mix;

[1] This is equivalent to a product coal split of 65% coking coal and 35% thermal coal[1].

- 20% increase or decrease in the USD coal price; and
- Changes in the AUD/USD exchange rate.

The impacts of these changes on the minimum net production benefit are presented in **Appendix A**. In summary, the sensitivity analysis indicates that the minimum threshold value is most sensitive to a change in production levels and the USD price of coal. A 20% decrease in production or USD price would reduce the minimum threshold value to $18.6 million. An increase in coal prices by 20% would increase the Project minimum threshold value to $27.9 million.

In addition to the BCA, the Economic Assessment included a regional economic impact assessment to quantify the economic activity that would be generated by the Project. The Project will directly provide average annual output of $79 million and average annual income of approximately $34 million (based on an average wage of $120,000). Flow-on economic activity will also arise from:

- Production expenditure in the course of the operation of mine (production-induced effects); and
- Expenditure of employees (consumption-induced effects).

At the regional level, the Project is expected to generate the following economic activity annually:

- $114 million in direct and indirect output;
- $96 million in direct and indirect household income; and
- 1,498 direct and indirect jobs.

The regional economic impacts were calculated using multipliers developed for the Bulli Seam Operations Project (Gillespie Economics, 2009).

2.1.2 Recommendation 6

The final assessment and determination of the project should be informed by an independent analysis of the economic costs and benefits of the project, including any additional information/updated economic assessment provided by the Applicant. The independent analysis should be managed by the Department of Planning & Environment.

Response

Whilst this is a matter for the NSW Government, WCL notes its response to Recommendation 5 (see **Section 2.1.1**) and as such does not consider that an independent analysis is required.

2.2 NOISE

2.2.1 Recommendation 7

The Commission recommends that further consideration of the noise impacts of the project needs to be provided including consideration of further noise mitigation measures as recommended by the EPA. Detailed justification should be provided for any deviations from the existing noise limits in current planning approval. Also clarification should be provided on the outcomes and applicability of the noise audit required in the 2011 approval.

Response

A detailed response from Wilkinson Murray to this recommendation is provided in **Appendix B**. A summary of key points is provided below.

The noise modelling for the Project was undertaken by Wilkinson Murray (2014). This assessment was undertaken in accordance with the Industrial Noise Policy (INP) and considered adverse meteorological conditions.

There are inconsistencies between the predicted noise levels for the Project and the existing noise limits in the Project Approval (MP 10_0046) for the Preliminary Works Project (PWP). Wilkinson Murray explains that this is likely attributable to key differences in the assumptions for noise modelling undertaken for the Project and the PWP.

The PWP noise limits are based on the noise assessment undertaken by Environmental Resources Management Australia (ERM, 2010). The ERM noise assessment assumed that adverse meteorological conditions were not a feature of the area and therefore only predicted noise levels under neutral (calm) meteorological conditions. As a result, the existing noise limits are not representative of worst case conditions. Some of the existing PWP noise limits are lower than the Project Specific Noise Levels (PSNLs) for the Project, which were determined based on long-term noise monitoring. Additionally, Wilkinson Murray utilised actual sound power levels for the site in its assessment (see **Appendix B**).

Wilkinson Murray considered each of the additional noise mitigation measures recommended by the Environmental Protection Authority (EPA) and assessed the potential reductions in noise levels that these measures could produce. **Table 1** summarises these findings with further discussion below.

Table 1
EPA Noise Mitigation Recommendations and Response

EPA Suggestion	WCL Response
Conveyor runner bearing design	Conveyor RV1 is predominantly fitted with poly rollers. Steel rollers are used in only high wear areas. Conveyor RC4 is fitted with steel rollers. Conveyors RC1 and RC3 are yet to be constructed and will be fitted with poly rollers.

EPA Suggestion	WCL Response
	Conveyors do not contribute significantly to off-site noise levels due to the influence of more dominant noise sources.
Replacement of metal clips used to join conveyors with vulcanised joints	All surface belts at Russell Vale Colliery are vulcanised. All future belts will also be constructed with vulcanised joints.
Use of noise barriers on site boundaries and noise barriers around identified noise equipment on site	Modelling indicates some acoustic benefit may be achieved by construction a 6 m high barrier along part of the Russell Vale Site's north-eastern boundary (see **Figure 1**). Hatch has estimated that the cost of constructing such a barrier would be $1,075,200 for a concrete structure or $445,200 for a Steelpanel system (see **Appendix C**). A real-time noise monitoring program will be undertaken to confirm off-site noise levels prior to construction of any barrier, as well as consultation with the adjacent private neighbours to confirm their preference for such a barrier.
Maintaining a volume of coal in bins so that coal is not dumped into an empty bin	Coal bins will be operated such that a minimum coal level is maintained at all times. This will also assist in reducing noise and wearing of the structure.
Minimising dump height from mobile plant	Trucks will be loaded primarily via the loading bin, thereby limiting the use of front end loaders. Minimising the height of falling material is also feasible to some extent with tripper automation. This measure will be assessed with regard to the potentially increased noise generated by the tripper movement. WCL will undertake a trial to determine the lowest noise solution and implement this.
Noise dampening material in coal bins/deflection plates	Lining of the new coal loading bin would not be an effective measure because such linings wear rapidly. Noise from loading of coal is most appropriately managed by maintaining a minimum level of coal in the bin.
Noise cladding on conveyor winder houses and conveyor rope rollers	Belt drives at Russell Vale Colliery currently have cladding on the walls.
Enclosed motor rooms	RC1 drive is located within the sizer building. The drives for RC3 and RC4 are not enclosed. These drives are minor contributors to off-site noise levels. Mitigation of these noise sources would not materially reduce noise levels at private residences. Hatch has estimated the cost of partially enclosing these drives (see **Appendix C**). The minimal benefit to residents does not justify the costs of implementing these measures.

Haul trucks are currently loaded directly from the stockpile using front end loader. Truck loading during the Project will be undertaken primarily via the proposed loading bin. Front end loaders will only be used during conveyor / bin breakdowns or during longwall change-outs.

Wilkinson Murray observed that the noise generated by coal impacting on the stockpile was a relatively significant noise source. Currently, the coal falls an estimated 20 m to ground level when forming a stockpile, whilst the tripper remains in a static location. It was identified that the tripper system can be automated to move laterally, such that the coal is discharged onto the side of an already formed stockpile. It is considered that management of the stockpile in this manner and reduction of the average fall height of the coal may provide some noise reduction benefit. This measure will be assessed with regard to the potentially increased noise generated by the tripper movement. WCL will undertake a trial in order to determine the best outcome from a noise perspective and implement such an approach.

The EPA recommended enclosure of motor rooms to reduce noise. The drive for conveyor RC1 is currently enclosed as it is located within the sizer building. The drives for conveyors RC3 and RC4 are currently not enclosed. Hatch estimated the costs of enclosing these drives. Hatch identified two suitable options for enclosure of these drives:

- Ortech Durra 250 duplex sheet steel and Durra board panels; or
- Speedpanel 78 mm steel and concrete sandwich panels.

The cost of partially enclosing drive RC3 is estimated to be $12,084 for the Ortech option or $12,776 for the Speedpanel option. The cost of partially enclosing drive RC4 is estimated to be $4,219 for the Ortech option or $4,460 for the Speedpanel option. The cost calculations are presented in **Appendix C**. Wilkinson Murray advises that the drives are low level contributors to noise levels at private receivers. The mitigation of these noise sources would not result in a reduction of noise levels at residences. Due to the limited benefit to private receivers, the cost of enclosing the RC3 and RC4 drives would not be justified.

Detailed consideration has also been given to attenuating the D11 dozer. Modelling suggests that reducing the D11 sound power level by up to 5 dB (i.e. the level of attenuation that may be achieved by fitting an attenuation pack) would offer only a marginal noise level reduction at the closest private receivers (R1-R4) of less than 1 dB. Therefore, this measure is not considered to provide any substantial benefit. As such, attenuation of the D11 dozer is not considered reasonable and will not be implemented.

Wilkinson Murray assessed the noise control efficacy of establishing a noise barrier around the Russell Vale Site. This assessment considered a barrier along the entire perimeter of the Russell Vale Site and considered a 4 m high option and 6 m high option. The efficacy of the barriers under both neutral and prevailing conditions was modelled (see **Appendix B**). Due to the topography of the site, only a substantial barrier (i.e. the 6 m high barrier) is capable of material acoustic attenuation. Wilkinson Murray explains that attenuation of 1-2 dB is not likely to be noticeable to most people. Attenuation of 3-5 dB is the minimum level of attenuation that can be considered a material benefit.

The receivers to the north and north-west of the site (including R1-R7) are predominantly single storey dwellings, whereas the receivers to the south are mainly two storey dwellings. Noise barriers are less effective at noise attenuation for taller receivers. Wilkinson Murray determined that only some receivers to the north of the site would benefit from the construction of a 6 m high noise barrier. **Figure 1** shows the segment of the site boundary where the establishment of a noise barrier would result in a material benefit.

Hatch (**Appendix C**) has undertaken an estimate of the cost involved in the construction of the noise barrier shown in **Figure 1**. The noise barrier is approximately 280 m long and 6 m high. Hatch estimates that the cost of erecting such a barrier would be $1,075,200 for a concrete structure or $445,800 for a Speedpanel construction. Although the barrier may provide a benefit to some single-storey receivers immediately adjacent to such a barrier, Wilkinson Murray advises that the effectiveness of the barrier reduces as distance from the barrier increases. Accordingly, WCL does not consider that the benefit outweighs the cost of implementing such a barrier.

The construction of such a barrier will have visual impacts on nearby receivers. Due to the significant costs and potential visual implications of constructing such a barrier, WCL will undertake a real-time noise monitoring program to confirm off-site noise levels prior to the implementation of such a barrier. The existing noise monitoring network is shown in **Figure 2**. In addition, such a barrier can only be implemented in consultation with potentially affected landowners.

A noise audit of the Russell Vale Colliery was undertaken by PEL (2012). The PAC noted that there are differences between the noise levels measured during the noise audit and the existing noise levels calculated by the noise model. Wilkinson Murray (**Appendix B**) explains that the existing noise levels calculated by the noise model are higher because the model conservatively assumes that all plant is operating simultaneously and at full capacity. In contrast, the results of the noise audit represent the levels measured during the brief period of the audit. These levels are dependent on the plant that was operating at the time of the audit (which was not clear from the audit report).

Source: Wilkinson Murray (2015)

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Indicative Noise Barrier Location

FIGURE 1

2.3 AIR

2.3.1 Recommendation 8

The $PM_{2.5}$ emissions from the proposal need to be assessed prior to any determination of the application.

Response

In accordance with the PAC's recommendation, an assessment of $PM_{2.5}$ emissions was undertaken by PEL (see **Appendix D**). Atmospheric dispersion modelling was undertaken to predict $PM_{2.5}$ concentrations at sensitive receiver locations. PEL adopted the modelling approach previously used by ERM to assess TSP and PM_{10} emissions. The representative receiver locations considered in the assessment are outlined in Receptor IDs correlate with the locations on Table 3 in **Appendix D**.

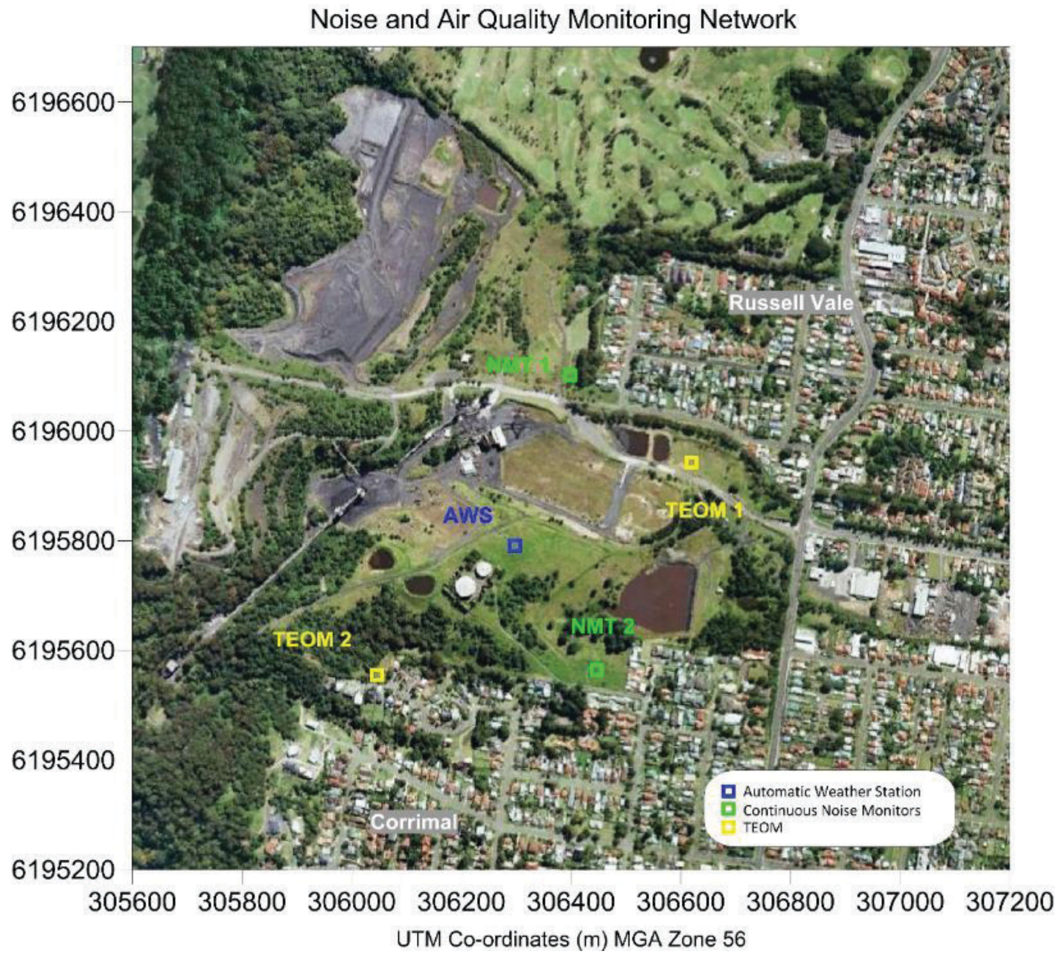
PEL applied $PM_{2.5}$ emissions factors to the emissions inventory (previously developed by ERM) to estimate $PM_{2.5}$ emissions. The emissions factors used in this assessment were sourced from the United States Environmental Protection Agency's AP-42 emission estimation database.

WCL currently measures $PM_{2.5}$ concentrations using two Tapered Electronic Oscillating Microbalances (TEOMs) located at the Russell Vale Site (as shown on **Figure 2**). Measured $PM_{2.5}$ concentrations were adopted as the background $PM_{2.5}$ concentrations for purposes of the cumulative assessment.

The predicted $PM_{2.5}$ concentrations at sensitive receiver locations are presented in **Table 2**. Predicted $PM_{2.5}$ concentrations were assessed against the NEPM advisory reporting standards (as EPA does not have criteria for $PM_{2.5}$). The modelling results indicate that all sensitive receivers are predicted to experience $PM_{2.5}$ concentrations within the criteria.

Table 2
Predicted Incremental and Cumulative $PM_{2.5}$ Concentrations

Receiver ID	$PM_{2.5}$ Concentration ($\mu g/m^3$)			
	24 hour		Annual	
	Incremental	Cumulative	Incremental	Cumulative
Assessment criterion	**N/A**	**25**	**N/A**	**8**
R1_1	7.5	24.4	0.8	6.6
R2_2	7.5	24.4	0.9	6.7
C5_3	3.2	20.1	0.2	6.0
C1_4	3.2	20.1	0.3	6.1
C2_5	4.0	20.9	0.6	6.4
C3_6	4.5	21.4	0.5	6.3
R4_7	5.9	22.8	0.6	6.4
C6_8	1.8	18.7	0.3	6.1
C4_9	4.4	21.3	0.4	6.2
R3_10	7.0	23.9	0.8	6.6



Source: PEL (2015)

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Air Quality and Noise Monitoring Network

FIGURE 2

2.3.2 Recommendation 9

Consideration of best practice standards needs to be provided to demonstrate that air emissions would be minimised and to justify the proposed increase in coal handling capacity.

Response

An evaluation of best practice dust management at Russell Vale Colliery was undertaken by PAEHolmes in 2012. This evaluation identified that the following components of the Project represent best practice dust management:

- New truck loading facility;
- Two new conveyors with enclosures;
- Underground reclaim;
- Secondary sizer building;
- Water sprays on moving tripper; and
- Upgrade fleet from 34t trucks to 44t trucks.

PAEHolmes (2012) also recommended that the following best practice measures are potentially achievable and were to be investigated:

- Vegetative windbreaks on stockpiles;
- Trial chemical wetting agents on stockpiles;
- Pave the surface of the haul roads; and
- Trial suppressants on the haul roads.

These recommendations have been reconsidered by PEL (see **Appendix D**).

Vegetative windbreaks can reduce dust during high wind conditions (by intercepting dust with leaves and branches, and reducing wind speed as it passes through the vegetation). However, as with other dust management measures, it is more effective to control the source (i.e. avoid the dust emissions) rather than control the emissions after release. Therefore, the potential benefits of vegetative windbreaks are limited at this site and do not justify their implementation.

WCL will trial chemical wetting agents on haul roads and stockpiles to reduce emissions and report the findings of the trial in the Annual Review.

WCL will also pave the proposed haul road through the stockpile area (as shown in **Figure 3**).

2.3.3 Recommendation 10

The mine's existing monitoring and reporting systems should be strengthened to clearly demonstrate compliance with current conditions, environmental standards and reporting goals (i.e. for $PM_{2.5}$ emissions).

<u>Response</u>

WCL continuously monitors PM_{10} and $PM_{2.5}$ concentrations using two TEOMs. TEOM 1 has been providing $PM_{2.5}$ data since September 2013 and TEOM 2 has provided data since November 2013 (see Figure 4 of **Appendix D**).

The locations of these TEOMs are shown in **Table 3** and **Figure 2**. The EnviroSuite environmental management software was commissioned in January 2014.

Table 3
Air Quality Monitoring Network

Description	Site	Address / Location	MGA 56 Easting (m)	MGA 56 Northing (m)
Continuous PM_{10} and $PM_{2.5}$ Monitor	TEOM 1	Near site entrance access road	306619	6195943
	TEOM 2	Lyndon Street	306046	6195555

WCL currently produces quarterly reports that reference the Environmental Protection Authority (EPA) air quality criteria for PM_{10}. There are no EPA criteria for $PM_{2.5}$. However, WCL logs and evaluates concentrations of the $PM_{2.5}$ size fraction for internal environmental management purposes.

In accordance with the PAC's recommendation, the results of $PM_{2.5}$ monitoring will be included in future reporting and published on WCL's website.

2.4 FLOODING

2.4.1 Recommendation 11

Any new approval should retain the existing requirement to realign Bellambi Creek or a full justification why this is no longer necessary to provide protection to the creek downstream from the pit top surface area.

<u>Response</u>

Cardno has provided a detailed response to this recommendation in **Appendix E**, as summarised below.

During the major floods in 1998, coal washout occurred as a result of large volumes of runoff being conveyed through the stockpile area. The Project has proposed flood controls to prevent a recurrence of this incident. Bellambi Gully currently flows through the Russell Vale Site via a pipeline beneath the stockpile area.

WCL originally proposed the realignment of Bellambi Gully via an open channel, as described in Beca (2010). This would have allowed clean runoff to be diverted around the stockpile area. The realignment of Bellambi Gully was approved as part of the Preliminary Works Project (MP 10_0046). In addition, the Project includes a 6 ML sediment dam to treat dirty runoff from within the stockpile area.

A separate flood study was undertaken by Cardno (2015) to develop an alternative to the approved realignment of Bellambi Gully for preventing coal washouts to Bellambi Lane. Cardno recommended a number of upgrades to the existing diversion pipeline to minimise runoff entering the stockpile area. In addition, the access road to the stockpile area will be raised to contain flows within the stockpile area.

Cardno (**Appendix E**) conducted a comparison of the flood controls proposed by Beca (2010) and Cardno (2015). This analysis showed that both approaches are effective at reducing flooding impacts to residences downstream from the site. The Beca (2010) strategy reduces coal washouts to Bellambi Lane for flows up to a 1 in 10 year storm event, whereas the Cardno (2015) approach reduces washouts for flows up to a 1 in 100 year event. The Cardno (2015) approach is more effective in this regard because the raising of the access road will allow flows to be contained within the stockpile area (for all storms up to a 1 in 100 year event). The full analysis of the two approaches is provided in **Appendix E**.

Although both approaches are effective at preventing impacts to local residences, the Cardno (2015) approach has the following advantages compared to the Beca (2010) approach:

- More effective at preventing coal washouts to Bellambi Lane;
- Does not require any additional land disturbance (whereas realignment of Bellambi Gully would occur in currently undisturbed areas); and
- More cost effective.

The realignment of Bellambi Gully would facilitate complete segregation of clean runoff and dirty runoff. The Cardno (2015) approach does not achieve complete segregation, which will result in some clean runoff entering the stockpile area. The Cardno (2015) approach overcomes this issue by raising the stockpile access road to ensure that the extra runoff volume is contained within the stockpile area. WCL will undertake further detailed design to ensure that the proposed dry sediment dam in the stockpile area has sufficient capacity to accommodate the Cardno (2015) approach. This will be undertaken prior to implementing the proposed flood controls.

2.5 TRAFFIC

2.5.1 Recommendation 12

The proponent should negotiate with Council and Roads & Maritime Services regarding maintenance contributions to mitigate impacts from the increase in truck movements along the haulage route.

Response

Bellambi Lane is currently managed and maintained by Wollongong City Council (WCC). WCL has commenced consultation with WCC in relation to making a reasonable financial contribution to the maintenance of Bellambi Lane that is commensurate to the Project's impacts.

2.5.2 Recommendation 13

Consideration should be given to further limiting the hours of truck movements.

Response

Russell Vale Colliery currently has approval to undertake coal transportation during the following time periods:

- 7 am to 10 pm on weekdays; and
- 8 am to 6 pm on weekends and public holidays.

The Project does not involve any change to these trucking hours.

2.5.3 Recommendation 14

Proponent should investigate and cost a number of options to reduce the noise impacts to the most effected residents along Bellambi Lane, particularly those near the intersections with the Princes Highway and the Northern Distributor. Options to be considered by the proponent, should include, but not be limited to:

a. construction of a coal truck parking area (for trucks to wait prior to the commencement of haulage hours) within the mine boundary;

b. construction of a noise barrier near the intersections of Bellambi Lane/Princes Highway and Bellambi Lane/Northern Distributor; and

c. use of pavement modifications along Bellambi Lane to reduce truck/trailer banging.

Response

a. A parking area for haul trucks is proposed as a component of the Project and is illustrated in the Environmental Assessment (ERM, 2013). The location of the parking area for which approval is sought is shown in **Figure 3**.

b. Construction of a noise barrier near the intersections of Bellambi Lane/Princes Highway is considered in Section 7 of **Appendix B**. It demonstrates that taking receiver heights into account, it is considered that the only the section of the site boundary shown in **Figure 1** would benefit from a barrier (which does not include the intersection).

   With respect to the suggested construction of a barrier on the corner of Bellambi Lane/Northern Distributor, it is assumed that the purpose of such a barrier is to reduce traffic noise for the residences on Bellambi Lane. Wilkinson Murray (2014) has assessed the traffic noise on Bellambi Lane and found that the increase in traffic noise levels due to the Project is predicted to be less than 2 dB. On that basis, it is considered that the impact associated with increasing the haulage is relatively minor and likely to be barely perceptible. Therefore, the construction of a barrier at the Bellambi Lane/Northern Distributor intersection is considered to provide no benefit.

Photo 1 and **2** illustrate the locations of private receivers in the vicinity of the intersections.

c. WCL advises that Roads and Maritime Services (RMS) has previously upgraded the pavement along Bellambi Lane. However, part of the road was unable to be upgraded due to objections from local residents regarding property access during these works. If required under its Project Approval, WCL will make a contribution to RMS for upgrading of the pavement along this part of the road. However, such work will be undertaken RMS and will be subject to the concurrence of landowners.

2.5.4 Recommendation 15

No increase in the currently approved maximum rate of extraction should be approved without clear demonstration that facilities can handle the additional volume without unacceptable impacts for local residents.

Response

Hatch assessed the ability of the proposed infrastructure to handle the increase in coal production from 1 Mtpa to 3 Mtpa. This assessment is presented in **Appendix F** and summarised below.

Hatch utilised a discrete event simulation model, which was run on an annual basis. It was assumed that each year included 48 weeks of production (i.e. 4 weeks for longwall changeout). The simulation considered the following infrastructure and equipment:

- Primary sizer;
- Secondary sizer;
- Stockpiles SP1, SP2 and SP3;
- Conveyors (stacking and reclaim);
- Surge bin; and
- Weigh bin.

The simulation assumed that all equipment is operated at design capacity, although the simulation accounts for unplanned breakdowns and maintenance.

The simulation determined that the stockpiles, conveyors and bins have sufficient capacity to handle up to 3 Mtpa.

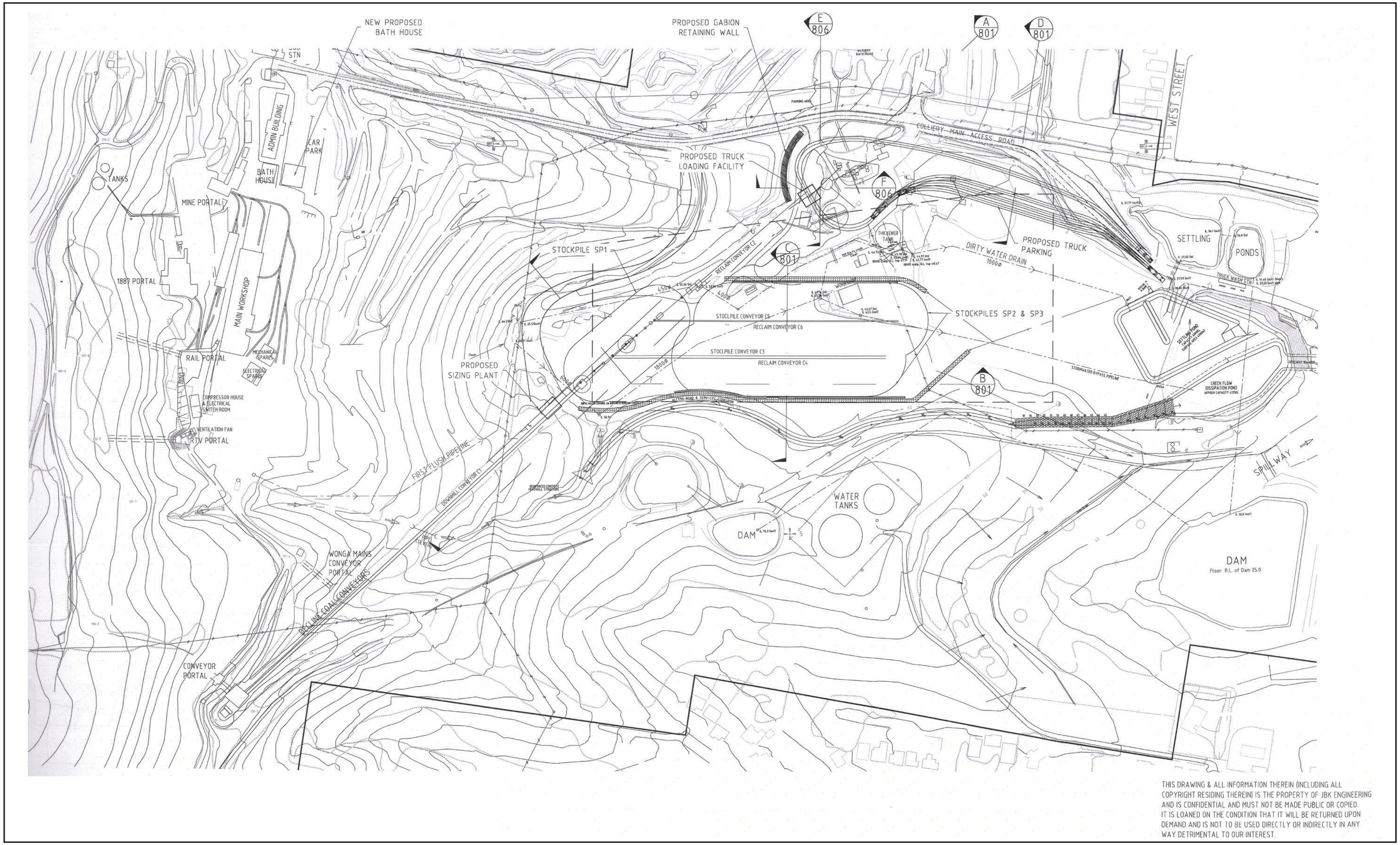
The air quality and noise assessments undertaken for the Project have both modelled an operational scenario with an annual coal production rate of 3 Mtpa. The air quality assessment (ERM, 2012) determined that incremental PM_{10} and TSP concentrations are predicted to be within the criteria. The cumulative 24-hour average PM_{10} criterion was predicted to be exceeded on one day. However, the incremental concentration generated the Project on this day was only 3.46 $\mu g/m^3$, compared to the background concentration of 48.5 $\mu g/m^3$. The assessment undertaken by PEL (see **Appendix D**) determined that $PM_{2.5}$ concentrations are predicted to be within the advisory reporting standards.

The noise assessment by Wilkinson Murray (2014) predicted noise levels generated by the existing Russell Vale Colliery, which represents a production rate of approximately 1 Mtpa (see Table 7.1 and 7.2 of Wilkinson Murray (2014) for the existing unmitigated and mitigated scenarios, respectively). These noise levels were compared to the predictions for the Project, which assumes a maximum production rate of 3 Mtpa (see Table 7.4 of Wilkinson Murray (2014) and **Appendix B**). **Table 4** summarises the P10 ($L_{Aeq,15min}$) results from Wilkinson Murray (2014, 2015) for the day, evening and night periods.

Table 4 below demonstrates that the predicted P10 levels ($L_{Aeq,15min}$) for the existing unmitigated scenario (which represents approximately 1 Mtpa of production) are higher than the predicted levels for Year 4 of the Project (where production has been modelled at 3 Mtpa). It is clear that the increase in production will not exacerbate impacts at the closest private receivers beyond than what is currently experienced. In fact, the Project is predicted to result in lower noise levels at private receivers. This is due to additional mitigation measures that WCL advises can be implemented, in part due to the benefits of the additional revenue generated by the Project.

Table 4
Comparison of Predicted P10 Noise Levels for Existing Operations and Year 4 of the Project

Scenario	Day				Evening				Night			
	Existing (Unmitigated)	Existing (Mitigated)	Year 4 (2014)	Year 4 (2015)	Existing (Unmitigated)	Existing (Mitigated)	Year 4 (2014)	Year 4 (2015)	Existing (Unmitigated)	Existing (Mitigated)	Year 4 (2014)	Year 4 (2015)
R1	51	51	50-51	50	54	53	52	52	45	41-43	43-46	43
R2	54	54	52-53	52	56	56	54	54	47	42-44	44-48	44
R3	53	53	52	52	55	55	53-54	53	46	41-44	44-47	44
R4	51	51	49	49	55	55	53	53	45	41-43	43-46	43
R5	52	52	49-50	49	55	55	52	52	43	39-41	41-44	41
R6	51	51	48-49	48	56	55	54	54	43	40-42	41-44	41
R7	52	52	43-44	43	56	56	49	49	44	41-43	42-44	42
R8	51	51	44-46	44	56	55-56	48-49	48	46	42-44	43-46	43
R9	44	43	43-45	43	47	47	46-48	46	42	41	43-47	43
R10	42	41	40-42	40	45	45	44-47	44	42	41	43-46	43
R11	40	40	38-39	38	43	42	41-42	41	40	38-39	39-40	39
R12	42	41	40-42	40	43	42-43	42-44	42	40	37-38	39-42	39
R13	45	44	42	42	46	45	43-44	43	42	38-40	39-40	39
R14	44	43-44	42-44	42	46	46	44-46	44	42	39-40	40-43	40



RUSSELL VALE COLLIERY

WOLLONGONG COAL | Hansen Bailey ENVIRONMENTAL CONSULTANTS

Indicative Infrastructure Layout

FIGURE 3

Plate 1
Bellambi Lane / Northern Distributor Intersection

Plate 2
Bellambi Lane / Princes Highway Intersection

3 ADDITIONAL COMMITMENTS

Following is a summary of additional commitments which WCL commits to from the additional work undertaken for this report:

- Implement the following noise mitigation measures:
  - Fitting surface conveyors with poly rollers wherever possible;
  - Maintain a volume of coal in bins at all times to minimise noise;
  - Undertake a trial to determine the efficiency of tripper automation to reduce noise produced by falling material;
  - Undertake real time noise monitoring to confirm the need for noise barriers;
- Implement the following dust mitigation measures:
  - Trial the use of chemical wetting agents on haul road and stockpiles, and report the results of the trial in the Annual Review;
  - Sealing of the proposed haul road; and
  - Include $PM_{2.5}$ monitoring results in regular monitoring reports.
- Undertake detailed design of the dry sediment dam to ensure that there is sufficient treatment capacity; and
- Consult with WCC regarding WCL's contribution to the maintenance of Bellambi Lane.

A revised Statement of Commitments will be included in full in Part 2 of the Response to the PAC Review Report.

4 CONCLUSION

WCL trusts that DP&E will duly consider the information provided within this Report during the preparation of its documentation to be provided to the PAC for determination.

Should you have any queries in relation to this Report or have any further questions regarding the Project, please contact David Clarkson of WCL on (02) 4223 6800.

* * *

For
HANSEN BAILEY

Andrew Wu
Environmental Engineer

Dianne Munro
Principal

5 ABBREVIATIONS

Term	Description
BCA	Benefit Cost Analysis
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPA	NSW Environmental Protection Authority
INP	Industrial Noise Policy
ML	Megalitre
Mtpa	Million tonnes per annum
NEPM	National Environment Protection Measures
PAC	NSW Planning Assessment Commission
$PM_{2.5}$	Particulate Matter <2.5 microns in diameter
PM_{10}	Particulate Matter <10 microns in diameter
PSNL	Project Specific Noise Levels
PWP	Preliminary Works Project
RMS	NSW Roads and Maritime Services
TEOM	Tapered Element Oscillating Microbalance
TSP	Total Suspended Particulates
WCL	Wollongong Coal Limited

6 REFERENCES

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- ERM (2010), *NRE No. 1 Colliery Noise Assessment Major Works Project.*
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- ERM (2013), *NRE No. 1 Colliery Project Application (09_0013) Environmental Assessment.*
- Gillespie Economics (2009), *Bulli Seam Operations Socio-Economic Assessment.*
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- Planning Assessment Commission (2015), *Russell Vale Colliery – Underground Expansion Project Review Report*.
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APPENDIX A

Economic Assessment

Russell Vale Colliery Underground Expansion Project
Economic Assessment

Prepared

for

Hansen Bailey

By

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TABLE OF CONTENTS

1 INTRODUCTION

This report examines the projected economic costs and benefits of the Russell Vale Colliery Underground Expansion Project (the Project), including the basis for their estimation, through benefit cost analysis (BCA). It is supplemented with the consideration of potential economic activity (including employment) impacts of the proposal at the local, regional and national levels. The analysis has been prepared by Gillespie Economics based on information provided by Wollongong Coal Limited (WCL) in the Preferred Project Report and updated price and exchange rate forecasts .

2 BENEFIT COST ANALYSIS

2.1 Introduction

Benefit Cost Analysis (BCA), undertaken at a national level, is the primary way that economists evaluate the net benefits of projects and policies (Boardman et al. 1990).

BCA has its theoretical underpinnings in neoclassical welfare economics. BCA applications in NSW are guided by these theoretical foundations as well as the NSW Treasury (2007). BCA applications within the NSW environmental impact assessment framework are further guided by the NSW Government (2012) *Draft Guidelines for the use of Cost Benefit Analysis in mining and coal seam gas proposals*. Guidelines for application of BCA at the Commonwealth level include *Handbook of Cost Benefit Analysis* (Commonwealth of Australia, 2006).

BCA is concerned with a single objective of governments (i.e. economic efficiency). It provides a comparison of the present value of aggregate benefits to society, as a result of a project, policy or program, with the present value of the aggregate costs. These costs and benefits are defined and valued based on the microeconomic underpinnings of BCA. In particular, it is the values held by individuals in the society that are relevant, including both financial and non-financial values. Provided the present value of aggregate benefits to society exceeds the present value of aggregate costs (i.e. a net present value of greater than zero), the project is considered to improve the well-being of society and hence is desirable from an economic efficiency perspective.

In attempting to value the impacts of a project on the well-being of people, there is also the practical principle of materiality. Only those impacts which are likely to have a material bearing on the decision need to be considered in BCA.

Even when no quantitative valuation is undertaken of the environmental, social and cultural impacts of a project, the threshold value approach can be utilised to inform the decision-maker of the economic efficiency trade-offs. The estimated net production benefits of a project provides the threshold value that the non-quantified environmental, social and cultural impacts of a project (based on the assessments in the EIS), after mitigation, offset and compensation by the proponent, will need to exceed for them to outweigh the net production benefits.

While BCA can provide qualitative and quantitative information on how costs and benefits are distributed, welfare economics and BCA are explicitly neutral on intra and intergenerational distribution of costs and benefits. There is no welfare criterion in economics for determining what constitutes a fair and equitable distribution of costs and benefits. Judgements about equity are subjective and are therefore left to decision-makers.

Similarly, BCA does not address other objectives of governments. Decision-makers therefore need to consider the economic efficiency implications of a project, as indicated by BCA, alongside the performance of a project in meeting other conflicting goals and objectives of governments.

2.2 Potential Costs And Benefits

Relative to the base case or "without" Project scenario, the Project may have the potential incremental economic benefits and costs shown in **Table 2.1**. The main potential economic benefit is the producer surplus (net production benefits) generated by the Project and any nonmarket employment benefits it provides, while the main potential economic costs relate to any environmental, social and cultural costs.

Table 2.1
Potential Incremental Economic Benefits and Costs of the Project

Category	Costs	Benefits
Net production benefits	Opportunity costs of capital equipment Opportunity cost of land[1] Development costs including labour, capital equipment and acquisition costs for impacted properties and offsets[1] Operating costs of mine including labour and mitigation, offsetting and compensation measures Rehabilitation and decommissioning costs at end of the Project life	Value of coal Residual value of capital equipment and land at end of Project life
Potential environmental, social and cultural impacts	Greenhouse gas impacts Noise impacts Air quality impacts Surface water impacts Groundwater impacts Ecology impacts Road transport impacts Infrastructure impacts Aboriginal heritage impacts Non-Aboriginal heritage impacts Visual impacts	Any nonmarket benefits of employment

[1] The value of foregone agricultural production is included in the value of land.

The costs and benefits of the Project can therefore be simplified to a trade-off between:

- The net production benefits of a project; and
- The environmental, social and cultural impacts (most of which are costs of mining but some of which may be benefits).

2.3 Net Production Benefits

By combining resources in ways that increase their value to society, mining projects create a net production benefit (a producer surplus). This net production benefit can be estimated based on market data on the projected financial[1] value of the resource minus the capital and operating costs of projects, including opportunity costs of capital and land already in the ownership of mining companies.

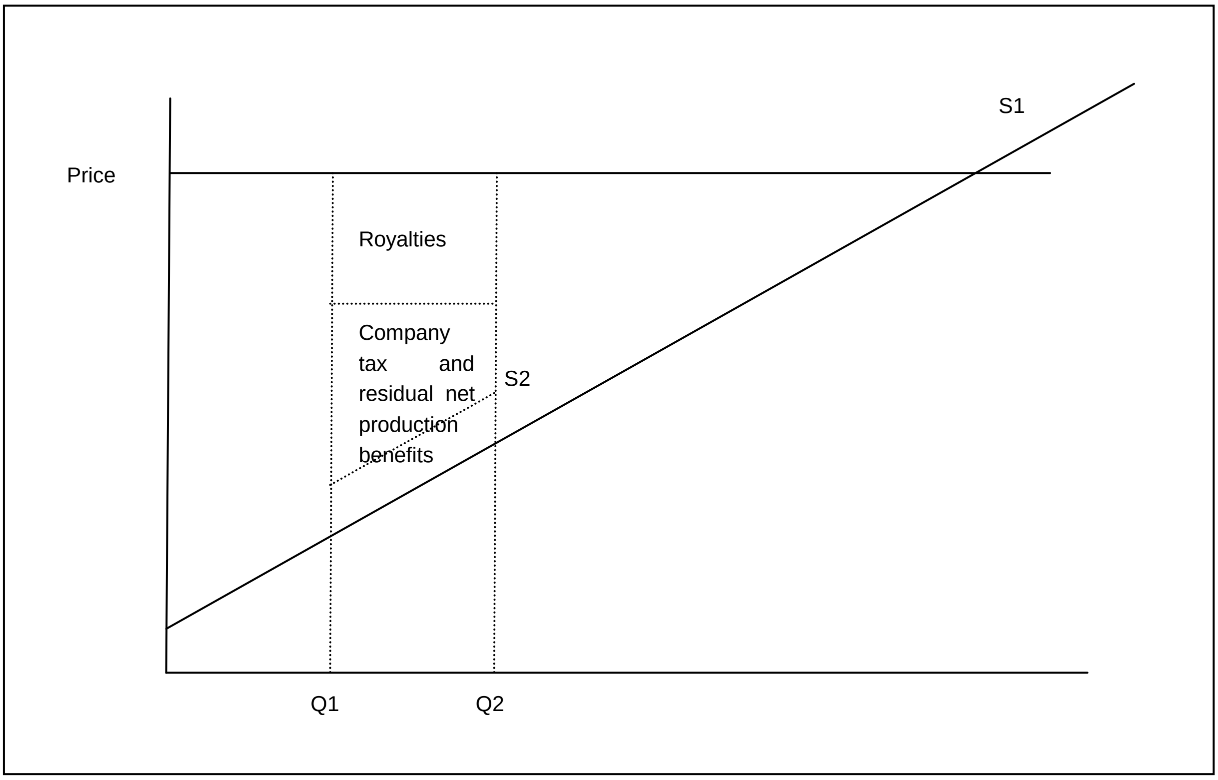
Net production benefits can be generally thought of as comprising royalties, company tax and residual net production benefits[2]. Where a project is foreign owned (as is the case for the Project), it is the

[1] In limited cases the financial value may not reflect the economic value and therefore it is necessary to determine a shadow price for the resource.

[2] It should be noted that this is not equivalent to profit because of the differences between economic analysis and financial analysis. It is a residual amount after royalties and company tax are subtracted from the estimated producer surplus of the Project.

royalties and company tax that accrue to Australia that comprise the net production benefits of the Project. Increases in the capital and operating costs of a project to mitigate, compensate or offset environmental, social and cultural impacts will reduce the company tax and residual net production benefit component of the net production benefits of a project but have no impact on the royalties component[3]. Refer to Figure 1 for a stylised representation of net production benefits of a project producing Q1 to Q2 in coal where supply costs increase from S1 to S2.

Figure 1 - Net Production Benefits of a Project Under Increasing Costs



The Project will result in Run-of-Mine (ROM) coal production of 4.7 million tonnes (mt) and gross revenue of $323 M[4] (present value at 7% discount rate). Based on recent coal price projections, the Project will generate total royalties of $28 M (undiscounted) based on an average royalty rate of 7.2%. Using a 7% discount rate the present value of royalties from the Project are estimated at $23 M. This is a minimum estimate of the net production benefits of the Project[5] and provides a minimum threshold value against which the environmental, social and cultural costs of the Project, after mitigation, offsetting and compensation, can be compared.

2.4 Environmental, Social And Cultural Impacts

Introduction

The consideration of nonmarket environmental, social and cultural impacts in BCA relies on the assessment of other experts contributing information on the biophysical impacts. The environmental

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[3] Because royalties are based on revenue only.
[4] Based on average annual ROM production of 934,000 tonnes, 52.6% coking coal and 28.6% thermal coal, WCL adjusted coal prices based on Energy & Metals Consensus Forecasts (August 2014) i.e. average of USD84/t for coking coal and USD61/t for thermal coal, and an AUD/USD exchange rate forecast of 0.73 based on NAB (2015) http://www.nab.com.au/business/international/financial-markets/exchange-rate-forecast.
[5] It is a minimum estimate since net production benefits to Australia also includes company tax. No estimate of company tax was available.

impact assessment process results in (nonmonetary) consideration of the environmental, social and cultural impacts of a project and the proposed means of mitigating the impacts. When environmental, social and cultural impacts are mitigated, offset or compensated to the extent where community wellbeing is insignificantly affected (i.e. costs are borne by the proponent), then no environmental, social or cultural economic costs should be included in the Project BCA apart from the mitigation, compensation or offset costs.

Greenhouse Gas

Over its 5 year lifetime, the Project is predicted to generate 767,789 t of direct carbon dioxide equivalent (CO_2-e) emissions associated with mining (Scope 1 emissions) and Scope 2 emissions from consumptions of grid electricity. In addition, the Project is predicted to generate 5,545 t of indirect (Scope 3) CO_2-e emissions associated with the road transport of product coal to the Port Kembla Coal Terminal (PKCT).[6]

To place an economic value on CO_2-e emissions, a shadow price of CO_2-e is required that reflects its global social costs. For the purpose of this analysis the Commonwealth Government's previous carbon tax price of AUD$23/t CO_2-e is used as a proxy for the global damage cost of carbon (i.e. the cost of carbon emissions to the population of the whole world). In the absence of any studies that have focused on the social damage cost of carbon emissions to Australians, some means of apportioning global damage costs borne by Australians is required. For the purpose of the economic assessment this has been undertaken using Australia's share of global GDP (around 1%). An alternative approach would be Australia's share of world population which is considerably less than 1%.

On this basis the present value of the cost of greenhouse gas emissions from the Project is estimated at $0.15 M. This is not offset, mitigated or compensated for and needs to be compared to the minimum net production benefits of the Project.

Noise Impacts

A revised noise assessment for the Project was undertaken in 2014. New noise criteria are specified in the draft Project Approval. Predicted noise levels exceed the criteria at 12 receiver locations. The exceedances are in the magnitude of 2-5 dBA. This potentially gives rise to management liabilities but not acquisition liabilities in accordance with the new Land Acquisition Policy (DP&E, 2015). These noise management costs would form part of the capital and operating costs of the Project. In the minimum threshold value framework adopted in this analysis, these costs would not be subtracted from the estimate of royalties but would reduce the unquantified level of company tax payable.

Air quality

No significant air quality impacts are predicted. While air quality modelling indicates potential exceedance of the PM_{10} 24-hr criterion at Receptor 1 on one day of the year, this is due to extraordinary events and under the Project Approval conditions is not considered to be an exceedance that gives rise to any acquisition liability. No material impact therefore arises that would be included in the BCA.

Surface water

Reductions in raw water supply due to groundwater depressurisation resulting from subsidence are estimated at 8.66 ML/year from the water supply catchment comprising a loss of:

- 6.83 ML/year from the tributaries flowing into Cataract Reservoir; and

[6] Other Scope 3 emissions associated with the shipping and use of coal are beyond the scope of a BCA of a mining project.

- 1.83 ML/year directly from the reservoir.

To the extent that this reduction in water supply impacts the water yield (the volume of water that can be supplied reliably over the long term[7]) there is an economic cost. One approach to valuing this economic cost is the cost of replacing it from alternative sources. Assuming an opportunity cost of water of $2,000 per ML/year and water loss occurring in perpetuity, these impacts equate to $235,000 (present value at 7% discount rate). These surface water costs would form part of the capital and operating costs of the Project. In the minimum threshold value framework adopted in this analysis, these costs would not be subtracted from the estimate of royalties but would reduce the unquantified level of company tax payable.

Groundwater

Groundwater inflows to underground mine workings were modelled using the MODFLOW-SURFACT numerical groundwater model. The maximum volumetric inflow to the mine workings is predicted to be 2.31 ML/day (834 ML/year).

WCL will require Water Access Licences (WALs) under the *Water Management Act 2000* to authorise these mine inflows. WCL currently holds an aquifer WAL with a share component of 365 ML/year. WCL has applied for the additional shares required. These shares are estimated to have an opportunity cost of $800/ML (i.e. $1.7 M). These groundwater costs would form part of the capital and operating costs of the Project. In the minimum threshold value framework adopted in this analysis, these costs would not be subtracted from the estimate of royalties but would reduce the unquantified level of company tax payable.

Ecology

Impacts on aquatic ecology and terrestrial ecology have been assessed as negligible. However, there will be 11 upland swamps that are completely or partially undermined by the Project. Undermining of swamps may not translate into actual impacts. However, if the Project has more than a negligible impact on swamps, offsets will be provided to compensate for lost swamp values. Provided the value held by the community for these offsets is equal to or greater than the value held by the community for the impacted swamps, then the community is no worse-off and it is the cost of providing these offsets that is the appropriate value to include in the BCA. These ecological offset costs would form part of the capital and operating costs of the Project. In the minimum threshold value framework adopted in this analysis, these costs would not be subtracted from the estimate of royalties but would reduce the unquantified level of company tax payable.

Traffic and Transport

Traffic and transport from the Project is associated with coal haulage to PKCT via Bellambi Lane, Northern Distributor, Southern Freeway, Masters Road, Springhill Road and Port Kembla Road, as well as employee, visitors and courier vehicles accessing the Colliery. The Road Traffic Assessment did not identify any significant issues from a road traffic performance or safety perspective. Consequently, there are no material economic effects for inclusion in the BCA.

Infrastructure

Negligible impacts are anticipated to Mt Ousley Road or Picton Road interchange and no impacts are predicted for Cataract Reservoir. Potential impacts could occur to a number of electrical transmission lines. A monitoring regime will be implemented and a technical committee comprising representatives from WCL, the power utility companies, the Mine Subsidence Board, and government regulators is

[7] Which changes with changes to inflows, infrastructure, demographics, the system design criteria, regimes of restrictions and the operating rules for the system.

proposed to manage potential impacts. The Mine Subsidence Levy paid by WCL is the mechanism by which preventative measures and structural repairs are funded. The levy forms part of the operating costs of the Project. In the minimum threshold value framework adopted in this analysis, these costs would not be subtracted from the estimate of royalties but would impact the unquantified level of company tax payable.

Aboriginal Cultural Heritage

Of the 21 Aboriginal cultural heritage sites potentially affected by the Project, one site of low scientific significance is estimated to be at greater than low risk of impact (moderate risk). Sites of low scientific significance are likely to have low community economic values and hence a moderate risk to these sites is unlikely to lead to any material economic effects for inclusion in the BCA.

Historic Heritage

No impacts are predicted for historic heritage sites and hence there are no material economic effects for inclusion in the BCA.

Visual Impacts

Russell Vale Colliery is well established in an area historically used for coal mining. Changes to the existing viewscape from the Project, to publicly accessible viewpoints outside the colliery, are minor. The management measures proposed will ensure that the Project will not significantly impact the visual amenity at any sensitive receiver. These management costs would form part of the capital and operating costs of the Project. In the minimum threshold value framework adopted in this analysis, these costs would not be subtracted from the estimate of royalties but would reduce the unquantified level of company tax payable.

Employment

In standard BCA, the wages associated with employment are considered an economic cost of production with this cost included in the calculation of net production benefits (producer surplus). Where labour resources used in a project would otherwise be employed at a lower wage or would be unemployed a shadow price of labour is included in the estimation of producer surplus rather than the actual wage (Boardman et al. 2001[8]). The shadow price of labour is lower than the actual wage and has the effect of increasing the magnitude of the producer surplus benefit of a project.

These treatments of employment in BCA relate to the market value or opportunity cost of labour resources. However, BCA also includes nonmarket values (i.e. the values that individuals in a community hold for things even though they are not traded in markets). For example, people have been shown to value environmental resources even though they may never use the resource. These are referred to as existence values and are underpinned by the view in neoclassical welfare economics that individuals are the best judge of what has value to them. As identified by Portney (1994[9]), the concept of existence values should be interpreted more broadly than just relating to environmental resources and may also apply to the employment of others.

Empirical evidence for these values was found in three choice modelling studies of mining projects in NSW. In a study of the Metropolitan Colliery in the NSW Southern Coalfields, Gillespie Economics (2008) estimated the value the community would hold for the 320 jobs provided over 23 years at $756 M (present value). In a similar study of the Bulli Seam Operations, Gillespie Economics (2009a)

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[8] Boardman, A., Greenberg, D., Vining, A. and Weimer, D. (2001) *Cost-benefit analysis: concepts and practice*, Prentice Hall, New Jersey.

[9] Portney, P. (1994) The Contingent Valuation Debate: Why Economists Should Care, *Journal of Economic Perspectives* 8:4, 3-18.

estimated the value the community would hold for the 1,170 jobs provided over 30 years at $870 M (present value). In a study of for the Warkworth Mine extension, Gillespie Economics (2009b) estimated the value the community would hold for 951 jobs from 2022 to 2031 at $286M (present value).

The Project will provide continued employment for up to 300 employees for a period of up to five years. Using benefit transfer from the more conservative Bulli Seam Operation study and applying the employment value to the estimated direct employment of the Project[10] gives an estimated $36 M for the nonmarket employment benefits of the Project. In the context of a fully employed economy there may be some contention about the inclusion of this value. However, the economy is not at full employment, with unemployment levels in the Illawarra region at 8.8% in May 2015 (ABS 2015)[11]. While this BCA of the Project recognises the potential for nonmarket employment benefits, these potential benefits are not included in the minimum threshold value, which is based entirely on royalties.

2.5 Net Social Benefits of the Project

The Project is estimated to have minimum net production benefits (royalties) of $23 M to Australia. In addition, there would be unquantified company tax benefits to Australia and potentially nonmarket benefits of employment of in the order of $36 M.

The estimated minimum net production benefits of $23 M (present value) can be used as a threshold value or reference value against which the relative value of the residual environmental impacts of the Project, after mitigation, may be assessed. This threshold value is the opportunity cost to society of not proceeding with the Project. The threshold value indicates the price that the Australian community must value any residual environmental impacts of the Project (be willing to pay) to justify in economic efficiency terms the no development option.

For the Project to be questionable from an economic efficiency perspective, all incremental residual environmental, social and cultural impacts from the Project, to Australia[12], after mitigation, offset and compensation, would need to be valued by the community at greater than the estimate of the Australian net production benefits (i.e. greater than $23 M).

Instead of leaving the analysis as a threshold value exercise, an attempt has been made to quantitatively consider the potential residual impacts of the Project that are not already mitigated, compensated or offset. No material impacts are considered likely in relation to air quality, traffic and transport, Aboriginal cultural heritage and historic heritage. Noise impacts, surface water impacts, groundwater impacts, visual amenity, upland swamp impacts and infrastructure impacts will be mitigated, compensated for or offset, with these costs forming part of the costs of the capital or operating costs of the Project. These costs would have no impact on the estimated minimum threshold value of the Project. Only impacts from greenhouse gas emissions would remain unmitigated and these impacts are estimated at in the order of $0.15 M, present value, which is considerably less than the estimated minimum Australian net production benefits.

Consequently, the Project is estimated to have net social benefits to Australia of a minimum of $23 M and hence is desirable and justified from an economic efficiency perspective.

[10] This is consistent with the non-market valuation studies which focused on direct employment.
[11] ABS Catalogue No. 6291.0.55.001 - Labour Force, Australia
[12] Consistent with the approach to considering net production benefits, environmental impacts that occur outside Australia would be excluded from the analysis. This is mainly relevant to the consideration of greenhouse gas impacts.

Any other residual environmental, cultural or social impacts that remain unquantified would need to be valued at greater than $23 M for the Project to be questionable from an Australian economic perspective.

2.6 Distribution of Costs and Benefits

Introduction

As identified above, BCA is only concerned with the single objective of economic efficiency. BCA and welfare economics provide no guidance on what is a fair, equitable or preferable distribution of costs and benefits. Nevertheless, BCA can provide qualitative and quantitative information for the decision-maker on how economic efficiency costs and benefits are distributed.

Intra-generational

The net production benefit of the Project is potentially distributed amongst a range of stakeholders including:

- The proponent in the form of residual net production benefits;
- The Commonwealth Government in the form of any Company tax payable (unquantified in this analysis) which is subsequently used to fund provision of government infrastructure and services across Australia and NSW, including the local and regional area;
- The NSW Government via royalties ($23 M present value) which are subsequently used to fund provision of government infrastructure and services across the State, including the local and regional area; and
- The environmental, social and cultural impacts of the Project may potentially initially accrue to a number of different stakeholder groups at the local, State, National and global level, however, the regulatory framework applying to coal mining aims to minimise the environmental, social and cultural costs and internalise these into the production costs of proponents by making proponents responsible for mitigation, offsetting and compensation.

As identified above, no material impacts are considered likely in relation to air quality, traffic and transport, Aboriginal cultural heritage and historic heritage. Noise impacts and visual impacts would initially accrue to members of the local community who own or rent residences that are adversely impacted but would be mitigated by management actions of the proponent.

Surface water and groundwater impacts will occur at the local level but will be internalised into the production costs of the Proponent through the acquisition of WALs. Infrastructure impacts will potentially effect government agencies who manage infrastructure on behalf of the community, however, these impacts will be internalised into the production costs of the proponent via the mine subsidence levy and managed by the Mine Subsidence Board. Upland swamp impacts would affect those people in the community who value the conservation of these environments. This may include members of the local, regional, state and national communities. However, to the extent that any negative impacts are adequately offset, no net impacts on these communities will arise. Greenhouse gas impacts from the Project will occur at the national and global level. Any nonmarket benefits associated with employment provided by the Project would accrue at the local or State level[13] to those people who value knowing that the employment of others is secure.

[13] It should be noted that the study from which the employment values were transferred, surveyed NSW households only.

Intergenerational

Some of the environmental, social and cultural impacts of the Project may be felt by future generations. This is particularly the case for nonmarket environmental impacts. However, as identified above, BCA is not concerned with distributional issues. The consideration of intergenerational equity issues is therefore outside the scope of BCA.

Nevertheless, it should be noted that the costs and benefits in BCA are defined and valued based on the microeconomic underpinnings of BCA. They are based on the values held by individuals in the current generation. There is no way to measure the value that future generations hold for impacts of current day projects as they are not here to express it.

Nevertheless, as identified by Boardman et al (2001) this is not considered a serious problem for BCA because:

- Few policies involve impacts that only appear in the far future. Consequently, the willingness to pay of people alive today can be used to predict how future generations will value them;
- Most people alive today care about the well-being of their children, grandchildren and great grandchildren, whether or not they have yet been born. They are therefore likely to include the interests of these generations to some extent in their own valuations of impacts. Because people cannot predict with certainty the place that their future offspring will hold in society, they are likely to take a very broad view of future impacts; and
- Discounting used in BCA also reduces the influence of costs and benefits that occur a long way into the future.

Furthermore, increased wealth (e.g. royalties and taxes) generated by projects that have a net benefit to the current community can be used to improve the services (e.g. health, school and community services) and environment (e.g. protected areas) that are passed on to future generations.

2.7 Sensitivity Analysis

The minimum threshold value approach used in this analysis is based an average annual production of 934,000 tonnes, with 52.6% coking coal at USD84/tonne and 28.6% thermal coal[14] at USD61/tonne and a AUD/USD exchange rate of 0.73.

The estimated minimum threshold value of the Project to Australia is based on a range of assumptions about production around which there is some level of uncertainty. Uncertainty in a BCA can be dealt with through changing the values of critical variables in the analysis (James and Gillespie, 2002) to determine the effect on the net present value.

In this analysis, as shown in **Table 2.3** the estimated minimum threshold value of the Project was tested for the following changes to variables at a 4%, 7% and 10% discount rate:

- 20% decrease in annual ROM production;
- Changes in product coal mix;
- 20% increase or decrease in the USD coal price; and
- changes in the AUD/USD exchange rate.

[14] This is equivalent to a product coal split of 65% coking coal and 35% thermal coal[14].

Table 2.1
Project Minimum Threshold Value Sensitivity Testing (Net Present Value $M)

Parameter	Discount Rate		
	4%	7%	10%
Core Result	$25.3	$23.2	$21.5
Decrease 20% production	$20.2	$18.6	$17.2
70%/30% metallurgical/thermal product coal split	$25.7	$23.6	$21.8
55% /45% metallurgical/thermal product coal split	$24.5	$22.6	$20.8
20% USD price decrease	$20.2	$18.6	$17.2
20% USD price increase	$30.3	$27.9	$25.8
AUD/USD exchange rate of 0.70	$26.3	$24.2	$22.4
AUD/USD exchange rate of 0.75	$24.6	$22.6	$20.9
AUD/USD exchange rate of 0.80	$23.1	$21.2	$19.6
AUD/USD exchange rate of 0.85	$21.7	$20.0	$18.4
AUD/USD exchange rate of 0.90	$20.5	$18.9	$17.4

What this analysis indicates is that the minimum threshold value is most sensitive to a change in production levels and the USD price of coal. A 20% decrease in production or USD price would reduce the minimum threshold value to $18.6 M. An increase in coal prices by 20% would increase the Project minimum threshold value to $27.9 M.

3 REGIONAL ECONOMIC IMPACT ASSESSMENT

The Project will provide economic activity to the local, regional, State and national economies for up to five years.

The Project will directly provide average annual output of $79 M, average annual income (wages) of approximately $34 M[15] and employment of 287[16].

Flow-on economic activity will also arise from:

- Production expenditure in the course of the operation of mine (production-induced effects); and
- Expenditure of employees (consumption-induced effects).

The level of this flow-on effect will depend on:

- The expenditure pattern of the Project and the ability of a region to manufacture and provide the goods and services required by the Project. Because of the long history of coal mining in the Wollongong and Illawarra region and high concentration of manufacturing in these areas relative to NSW, strong economic linkages and hence production-induced flow-ons are likely to occur; and
- The residential location of workers. As shown in **Table 3.1,** 63% of workers reside in the Wollongong LGA and 90% reside in the Illawarra Statistical Division and hence this area is likely to capture a considerable proportion of employee expenditure.

[15] Assuming an average wage of $120,000.
[16] Based on employment levels on 4 April 2013.

Table 3.1
Employee Residence Locations

Location	No. *	% of workforce
Local Region (Shellharbour, Wingecarribee, Wollondilly, Sutherland & Wollongong LGAs)	265	92%
Illawarra Statistical District (Shellharbour, Wingecarribee, Wollongong, Kiama and Shoalhaven LGAs)	259	90%
Wollongong LGA	182	63%
Local Area (Suburbs bounded by Mt Ousley Rd, Bulli Pass, the escarpment and coast)	97	34%

** NRE Employees Residential (287 total NRE No. 1 Colliery employees as of 4 April 2013)*

An indication of economic impact of the Project at a regional level can be obtained by using multipliers generated for the Bulli Seam Operations for the combined Illawarra Statistical Division and the Outer South Western Sydney Statistical Subdivision (Gillespie Economics, 2009). **Table 3.2** shows regional economic impacts from the Project.

Table 3.2
Regional Economic Impacts of the Project

Indicators	Direct	Production-induced flow-ons	Consumption-induced flow-ons	Total flow-ons	Total Impact
Output ($000)	78,904	25,249	9,468	35,507	114,411
Type 11A Ratio	1.00	0.32	0.12	0.45	1.45
Income ($000)	30,486	45,425	20,121	65,850	96,337
Type 11A Ratio	1.00	1.49	0.66	2.16	3.16
Employment (no.)	287	758	453	1,211	1,498
Type 11A Ratio	1.00	2.64	1.58	4.22	5.22

At the regional level the Project would have annual total impacts of up to:

- $114 M in direct and indirect output;
- $96 M in direct and indirect household income; and
- 1,498 in direct and indirect employment.

Type 11A ratio multipliers used in the analysis range from 1.45 for output to 5.22 for employment. The high ratio multiplier for employment and income reflect the relatively capital intensive nature of mining projects. Capital intensive industries tend to have a high level of linkages with other sectors in an economy thus contributing substantial flow-on employment and income while at the same time only having a lower level of direct employment and income. This tends to lead to high ratio multipliers for indicators that are related to employment (employment and income). A contributing factor to the high ratio multipliers is that the economy being examined is relatively large and with a long history of coal mining. Hence leakages from the economy are more limited than would be the case for a smaller or less specialised economy.

The level of multipliers are Project specific and depend on, among other things, the ratios of employment to output of a project, the profitability of a project, the expenditure profile of a project and how much is spent in the region, the residential location of the workforce, the size and structure of the region within which a project is located. There is no "universal" set of multipliers for coal mining projects. An analysis of the Metropolitan Coal Project (Gillespie Economics 2008) estimated an employment multiplier of 3.52. Studies in the Hunter Valley (BAE 2014; Economic Consulting Services 2012 and Hunter Valley Research Foundation 2009) suggest employment multipliers of between 1.49 and 4.79. Based on this range total employment impacts of the Project would be between 428 and 1,375.

At the local area level flow-on impacts would be less than reported in **Table 3.2** for the region as higher levels of expenditure would leak out the area to major centres such as Wollongong.

The economic impacts of the Project on the NSW and Australian economy would be larger than they are on regional economies because larger economies are able to capture more of the incremental expenditure and have greater intersectoral linkages.

Economic activity impacts discussed above represent the gross or positive economic activity associated with the Project. Where employed and unemployed labour resources in the region are limited and the mobility of in-migrating or commuting labour from outside the region is restricted there may be competition for regional labour resources that drives up regional wages. In these situations, there may be some 'crowding out' of economic activity in other sectors of the regional economy.

'Crowding out' would be most prevalent if the regional economy was at full employment and it was a closed economy with no potential to use labour and other resources that currently reside outside the region. However, the regional economy is not at full employment[17] and it has access to external labour resources. Consequently, little 'crowding out' of economic activity in other sectors in the region would be expected as a result of the Project. Crowding out would be expected to be greater at the NSW and national levels.

However, even where there is some 'crowding out' of other economic activities this does not indicate losses of jobs but the shifting of labour resources to higher valued economic activities. This reflects the operation of the market system where scarce resources are reallocated to where they are most highly valued and where society would benefit the most from them. This reallocation of resources is therefore considered a positive outcome for the economy not a negative.

4 CONCLUSION

The Project is estimated to have minimum net production benefits (royalties) of $23 M to Australia and NSW. In addition, there would be unquantified company tax benefits to Australia and potentially nonmarket benefits of employment of in the order of $36 M.

The estimated minimum net production benefits of $23 M can be used as a minimum threshold value or reference value against which the relative value of the residual environmental impacts of the Project, after mitigation, compensation and offset, may be assessed. For the Project to be questionable from an economic efficiency perspective, all incremental residual environmental, social and cultural impacts from the Project, to Australia, after mitigation, offset and compensation, would need to be valued by the community at greater than $23 M.

In this respect, no material impacts are considered likely in relation to air quality, traffic and transport, Aboriginal cultural heritage and historic heritage. Noise impacts, surface water impacts, groundwater impacts, visual amenity, upland swamp impacts and infrastructure impacts will be mitigated, compensated for or offset, with these costs forming part of the costs of the capital or operating costs of the Project. These costs would have no impact on the estimated minimum threshold value of the

[17] Unemployment level in Wollongong SA2 in September 2014 was 7.5% (Department of Employment (2014) Small Area Labour Markets)

Project. Only impacts from greenhouse gas emissions would remain unmitigated and these impacts are estimated at in the order of $0.15 M, present value, which is considerably less than the estimated minimum Australian and NSW net production benefits.

Consequently, the Project is estimated to have net social benefits to Australia and NSW of a minimum of $23 M and hence is desirable and justified from an economic efficiency perspective.

Any other residual environmental, cultural or social impacts that remain unquantified would need to be valued at greater than $23 M for the Project to be questionable from an Australian economic perspective.

The Project would also provide direct and indirect economic activity to the local, regional, State and national economies for up to five years. Flow-on economic activity would arise from production expenditure in the course of the operation of the mine and expenditure of employees who mainly reside within the region.

APPENDIX B

Response to Noise Issues Raised by the Planning Assessment Commission Review Report, Dated 2 April 2015

A C O U S T I C S   A N D   A I R

RUSSELL VALE COLLIERY

RESPONSE TO NOISE ISSUES RAISED BY THE PLANNING ASSESSMENT COMMISSION REVIEW REPORT, DATED 2 APRIL 2015

REPORT NO. 14141-A
VERSION B

JULY 2015

PREPARED FOR

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DOCUMENT CONTROL

Version	Status	Date	Prepared By	Reviewed By
A	Draft	13 July 2015	Sean Flaherty	John Wassermann
B	Final	15 July 2015	John Wassermann	-

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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.

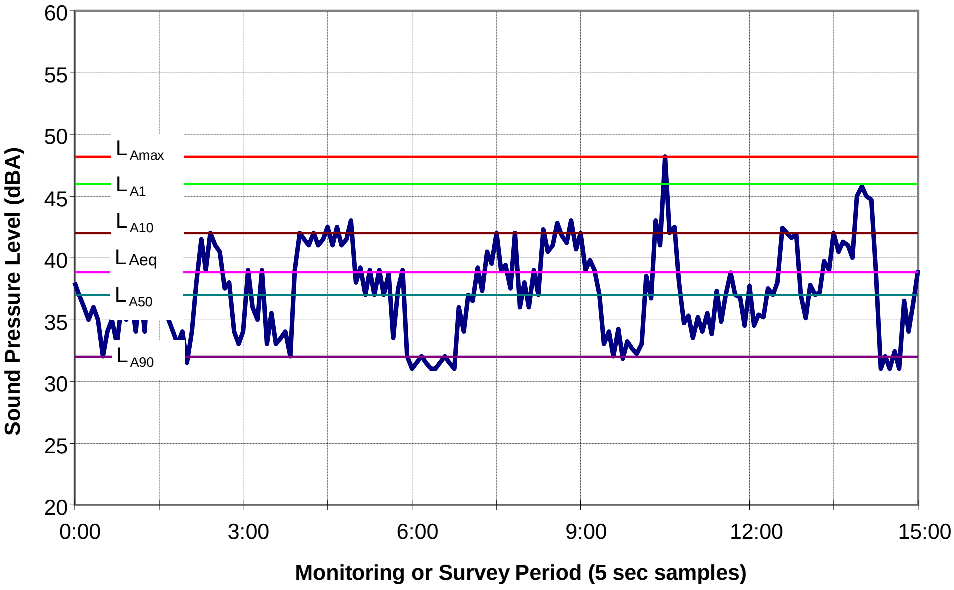
L_{A90} – The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level.

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 10th percentile (lowest 10th 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

Wollongong Coal Limited (WCL) is proposing to develop its Underground Expansion Project (UEP) (as modified by the *Underground Expansion Project Pt3A Preferred Project Report*, WCL, October 2013) over five years at the Russell Vale Colliery site (the Project).

Wilkinson Murray (WM) undertook a noise impact assessment for the Project, the findings of which were documented in the WM report dated 9 October 2014 (Report No 14141 Ver C).

The Planning Assessment Commission (PAC) has subsequently undertaken a review of the Russell Vale Colliery UEP. Following its review, the PAC has recommended that further consideration of the noise impacts of the Project needs to be provided including consideration of further noise mitigation measures (as recommended by the Environment Protection Authority – EPA). This report responds to the PAC's Recommendation 7.

The PAC Recommendation 7 notes:

Recommendation 7

The Commission recommends that further consideration of the noise impacts of the project needs to be provided including consideration of further noise mitigation measures as recommended by the EPA. Detailed justification should be provided for any deviations from the existing noise limits in current planning approval. Also clarification should be provided on the outcomes and applicability of the noise audit required in the 2011 approval.

1.1 Noise Mitigation Measures as Recommended by the EPA

As detailed in Section 6.1 of the PAC Review Report, in its letter to the Commission dated 13 March 2015, the EPA has put forward a number of comments and suggestions for the purpose of reducing off-site noise emissions. The EPA has recommended consideration of:

- *a) conveyor runner bearing design;*
- *b) replacement of metal clips used to join conveyors with vulcanised joints;*
- *c) use of noise barriers on site boundaries and noise barriers around identified noisy equipment on site;*
- *d) maintaining a volume of coal in bins so that coal is not dumped into an empty bin;*
- *e) minimising dump height from mobile plant;*
- *f) noise dampening material in coal bins/deflection plates;*
- *g) noise cladding on conveyor winder houses and conveyor rope rollers;*
- *h) enclosed motor rooms, etc.*

The EPA also suggests that modified coal handling and transport arrangements could reduce site noise:

i) *'The EPA recommends the PAC seek information on noise reductions with different load out operations, in particular longwall to conveyor to bin to truck, compared to longwall to conveyor to stockpile to FEL to truck. Some coal loading from stockpiles will be required to deal with longwall changeouts or underground production problems, however an assessment of different stockpile/bin loading ratios, between 100 per cent bin load out to 100 per cent stockpile load out could be useful. If bin use is found to reduce site noise, the PAC could consider requiring progressive implementation of bins, and/or regulating load out from stockpiles during times when it would provide lesser impact to residents.'* (NSW Environment Protection Authority, 2015, p. 3)

Recommendation 14 B

Proponent should investigate and cost a number of options to reduce the noise impacts to the most effected residents along Bellambi Lane, particularly those near the intersections with the Princes Highway and the Northern Distributor. Options to be considered by the proponent, should include, but no be limited to:

B. construction of a noise barrier near the intersections of Bellambi Lane/Princes Highway and Bellambi Lane/Northern Distributor

These points are addressed herein.

2 SITE DESCRIPTION

Figure 2-1 shows a locality map of the Russell Vale Colliery and identifies the potentially most exposed residential receivers to the site's noise emissions as identified by the previous WM assessment. Table 2-1 provides a summary of these residential receivers.

Table 2-1 Noise Sensitive Receivers Considered

Receiver ID	Dwelling Address
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

Figure 2-1 Site Location Plan Showing Noise Sensitive Receivers Considered in Wilkinson Murray's 2014 Assessment

3 DEVIATIONS FROM THE PWP NOISE LIMITS

To provide the required further consideration of the noise impacts for the PAC this report presents the rationale behind the noise assessment for the project, which includes a review of existing noise limits and how they were arrived at and the reasons for deviating from the existing noise limits.

3.1 Preliminary Works Project Noise Assessment

Environmental Resources Management Australia Pty Ltd (ERM) undertook a noise impact assessment for the continuation of mining and upgrade of associated surface facilities as part of Stage 1 of a major expansion of NRE No. 1 Colliery (PWP). The findings of this assessment are documented in the ERM report titled *NRE No.1 Colliery Preliminary Works Noise Assessment, dated October 2010 – Reference: 0079383.*

The ERM noise impact assessment determined the Project Specific Noise Levels (PSNLs) and predicted operational noise levels shown in Table 3-1. It should be noted that the ERM assessment assumed that adverse meteorological conditions were not a feature of the area of the subject site and therefore only predicted noise levels under neutral (calm) meteorological conditions.

The predicted levels assumed the implementation of mitigation measures addressed in Section 6 of the ERM report.

Table 3-1 PSNLs & Predicted Operational Noise Levels Determined by the ERM 2010 Assessment

ID	Daytime Calm		Evening Calm		Night Calm	
	Predicted Level	PSNL $L_{Aeq,15min}$	Predicted Level	PSNL $L_{Aeq,15min}$	Predicted Level	PSNL $L_{Aeq,15min}$
C1	38	42	37	41	37	37
C2	39	42	38	41	38	37
C3	39	42	37	41	36	37
C4	37	42	37	41	36	37
C5	40	44	40	43	40	**40**
C6	37	44	36	43	36	**40**
R1	43	43	**40**	39	**39**	37
R2	**44**	43	**40**	39	**39**	37
R3	43	43	**40**	39	**40**	37
R4	42	43	39	39	38	37

Note: All levels are dB(A).
Exceedances presented in **bold** text

The levels predicted by the ERM 2010 PWP assessment are somewhat lower than the levels predicted by WM's 2014 assessment. The reasons for the differences are considered to be principally due to the incorrect assumption that adverse meteorological conditions were not a feature of the area, and the adoption of different source sound power levels (e.g. ERM assumed a sound power level of 109 dBA for the D11 dozer, whereas WM has adopted a significantly higher level of 115 dBA based on measurements carried out on site).

3.2 PWP Noise Limits

The PWP approved limits are compared against the PSNLs and predicted operational noise levels determined by the ERM 2010 Assessment for the UEP in Table 3-2.

Table 3-2 PSNLs & Predicted Levels determined by ERM UEP Assessment compared against the PWP Noise Limits

Receiver	ERM Assessment		Approved Noise Limits*		
	PSNL	Predicted	Interim Limits	Medium Term Limits	Long Term Goals
		Day			
C1	42	38	39	39	39
C2	42	39	39	39	39
C3	42	39	38	38	38
C4	42	37	37	37	37
C5	44	40	40	40	40
C6	44	37	37	37	37
R1	43	43	45	43	43
R2	43	44	46	44	43
R3	43	43	45	43	43
R4	43	42	44	43	43
		Evening			
C1	41	37	38	38	38
C2	41	38	38	38	38
C3	41	37	37	37	37
C4	41	37	37	37	37
C5	43	40	40	40	40
C6	43	36	36	36	36
R1	39	40	43	40	39
R2	39	40	43	40	39
R3	39	40	43	40	39
R4	39	39	40	39	39
		Night			
C1	37	37	38	38	38
C2	37	38	38	38	38
C3	37	36	36	36	36
C4	37	36	36	36	36
C5	40	40	40	40	40

Receiver	ERM Assessment		Approved Noise Limits*		
	PSNL	Predicted	Interim Limits	Medium Term Limits	Long Term Goals
C6	40	36	36	36	36
R1	37	39	41	40	37
R2	37	39	42	39	37
R3	37	40	41	40	37

* Note: As detailed in the Project Approval the Interim Limits applied until 31 December 2013, the Medium Term Limits apply from 1 January 2014 and the Long Term Goals are goals that the proponent shall make continual endeavours to meet by reducing its noise emissions.

WM's review of the levels set out in Table 3-2 has indicated a general inconsistency with the limits, the PSNLs and the predicted noise levels. It should be 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.

Because of the assessment approach used in the Preliminary Works assessment the UEP assessment has reconsidered the full INP assessment process from the beginning, inclusive of:

- re-evaluation of the PSNLs (by the undertaking of further long term noise monitoring);
- re-evaluation of off-site noise levels, appropriately taking account of prevailing met conditions and updated on-site noise source (sound power level) inventory;
- subsequent re-evaluation of reasonable and feasible noise mitigation; and
- further consideration of residual impacts.

It is considered appropriate that the approved limits are reconsidered based on the findings of the recent noise assessment undertaken for the UEP.

4 RESPONSE TO EPA COMMENTS

Table 4-1 provides responses to the noise mitigation issues specifically raised by the EPA. Where issues have been found to be reasonable and feasible and hence adopted in the revised noise model, this is discussed in the table.

Table 4-1 EPA Noise Mitigation Recommendations

	EPA Suggestion	Detail	Comment*	Reasonable	Unfeasible
a.	Conveyor running design	eg. poly rollers, other	RV1 conveyor already has poly rollers installed with the exception of around 5% of rollers in high wear areas that are steel RC1, RC3 conveyors are not yet installed but steel rollers are already purchased RC4 (C7) is existing and has steel rollers Modelling has assumed poly rollers. It should be noted, however, that regardless of where poly or steel rollers are installed on the conveyors, they do not contribute significantly to the off-site noise levels, due to the influence of other more dominant on-site noise sources.	Yes	-
b.	Replacement of metal clips used to join conveyors with vulcanised joints	Conveyors	All surface belts are vulcanised. Modelling has assumed vulcanised belts	Yes	-
c.	Use of noise barriers on site boundaries and noise barriers around identified noise equipment on site	Refer to Section 7 of this report. WM has previously assessed the noise control efficacy of installing barriers within the site. These barriers were found to offer no material benefit. Details of this analysis is set out in the WM report dated 9 October 2014 (Report No 14141 Ver C).	Modelling indicates some acoustic benefit may be achieved by installing a barrier along a limited section of the site boundary. However, it is recommended that a real-time noise monitoring program is undertaken to confirm off-site noise levels prior to such an undertaking	Modelling results indicate limited acoustic benefit	-

	EPA Suggestion	Detail	Comment*	Reasonable	Unfeasible
d.	Maintaining a volume of coal in bins so that coal is not dumped into an empty bin	Best practice coal mine management	Yes. Bins are not currently in use. Surface bins will be run with a minimum level at which feeding out stops to assist in reducing wear on the structure	Yes	-
e.	Minimising dump height from mobile plant	Best practice coal mine management	Yes. Truck bin loading will reduce the requirement for FEL loading of trucks. Minimising the height of falling material is also feasible to some extent with tripper automation. This measure would, however, need to be assessed with regard to the potentially increased noise generated by the tripper movement. WCL will undertake a trial in order to determine the lowest noise solution and implement where feasible	Yes	-
f.	Noise dampening material in coal bins/deflection plates	e.g. lining	Typically damping material gets worn away by coal. Bins not in use at present but would be possible with new bins, however, maintaining a volume of coal in the bins (see d above) would reduce noise levels in a more practical way. It is possible to construct a barrier around the bins. However, the bins contribute low levels of noise to the closet residential receivers. Therefore mitigating these items would not result in a noticeable reduction of noise at the receivers	No	Yes
g.	Noise cladding on conveyor winder houses and conveyor rope rollers	Winder / transfer house	Belt drives have cladding on walls	Yes	-
h.	Enclosed motor rooms, etc.		RC1 drive is within the sizer building RC3 drive is not enclosed	No	-

	EPA Suggestion	Detail	Comment*	Reasonable	Unfeasible
			RC4 (C7) drive is not enclosed RC3 and RC4 drives contribute low levels of noise to the closet residential receivers. Therefore mitigating these items would not result in a reduction of noise at the receivers		
i.	Coal handling & transport arrangements (see EPA letter page 65 of Appendix 4 of PAC report): - Longwall to conveyor to bin to truck - Some coal loading from stockpiles, stockpile/bin loading ratios - Progressive implementation of bins		The intent of the original PWP was not to load from the stockpile by FEL but to construct the RV1 conveyor and upgrade the reclaim conveyors to transport coal to the truck loading bins. With the proposed UEP upgrades are in place, the majority of coal would be loaded from the truck loading bins. Following the proposed UEP upgrades FEL loading would only occur infrequently, during conveyor/bin breakdowns or during longwall changeouts	Yes	-

* Note: comments are relevant as at 30 June 2015 when extraction of LW 6 (365 m) was occurring.

5 RESPONSE TO RECOMMENDATION 14B

It is unclear what recommendation 14 B is requiring precisely, that is, is the recommendation in response to potential traffic noise impacts on Bellambi Lane or potential site noise impacts.

The investigation of a barrier near the intersections of Bellambi Lane/Princes Highway to mitigate site noise impacts is presented in Section 7 of this report.

With regard for a barrier on the corner of Bellambi Lane/Northern Distributor it is assumed that the reason for this barrier would be to reduce traffic noise for the residences on Bellambi Lane. WM has assessed the traffic noise on Bellambi Lane in the EIS report with specific details in the Appendix report dated 9 October 2014 (Report No 14141 Ver C).

The traffic noise assessment found that the increase in traffic noise levels are less than 2dB from the project and on that basis, it is considered that the impact associated with increasing the haulage is relatively minor and likely to be barely perceptible, therefore no barrier is required.

6 SITE VISIT AND REVISED YEAR 4 PREDICTIONS

6.1 Confirmation of Noise Source Sound Power Levels (SWLs)

A site visit was undertaken on Thursday, 11 June 2015 in order to carry out measurements of the existing SP1 tripper during operation. A combination of near-field and far-field measurements were undertaken with an NTi Type 1 integrating sound level meter during coal production.

Analysis of the measured levels indicate that the SP1 tripper operates with a sound power level at approximately 100 dBA. Whilst WM has no pre-mitigated noise measurement reference, the recent measurements would suggest that the mitigation measures reportedly recommended by Hatch and implemented by WCL appear to have achieved the target sound power level of 100 dBA (refer WM report, dated 9 October 2014 which accompanied the application (Report No 14141 Ver C)).

The noise generated by coal impacting the stockpile was noted, however, to constitute a further source of noise previously not considered. The sound power of this source has been calculated to be approximately 103 dBA.

In addition to the tripper measurements, further noise controls were sighted, as set out in Table 6-1.

Table 6-1 Noise Control Measures Sighted

Poly Rollers and vulcanised joints on RV1 Conveyor	

Noise cladding on conveyor winder houses and conveyor rope rollers	
On site measurements confirmed the SP1 tripper sound power level at approximately 100 dBA.	

6.2 Revised Predictions – Year 4

With the identified mitigation in place, WM predicts the day, evening and night-time noise levels under neutral and worst-case (P10) meteorological conditions as presented in Table 5-2.

It should be noted that these results are consistent with those set out in WM's 2014 UEP assessment report.

Year 4 has been considered as this scenario considers all the proposed UEP upgrades.

Table 5-2 Predicted $L_{Aeq,15min}$ Noise Levels from Project – Year 4

Rec ID	$L_{Aeq,15min}$ Noise Level(1) (dBA)								
	Day (7.00am – 6.00pm)			Evening (6.00pm – 10.00pm)			Night (10.00pm – 7.00am)		
	Calm $L_{Aeq,15min}$	P10 $L_{Aeq,15min}$	Criterion	Calm $L_{Aeq,15min}$	P10 $L_{Aeq,15min}$	Criterion	Calm $L_{Aeq,15min}$	P10 $L_{Aeq,15min}$	Criterion
R1	**48**	**50**	42	**48**	**52**	41	40	**43**	40
R2	**51**	**52**	42	**51**	**54**	41	42	**44**	40
R3	**50**	**52**	42	**50**	**53**	41	41	**44**	40
R4	**46**	**49**	42	**46**	**53**	41	38	**43**	40
R5	47	49	48	**47**	**52**	45	35	41	42
R6	46	48	48	**46**	**54**	45	36	41	42
R7	41	43	48	41	**49**	45	35	42	42
R8	42	44	48	**42**	**48**	45	37	**43**	42
R9	**41**	**43**	40	**41**	**46**	40	38	**43**	38
R10	38	40	40	38	**44**	40	36	**43**	38
R11	37	38	40	37	**41**	40	34	39	38
R12	39	40	40	39	**42**	40	36	39	38
R13	**41**	**42**	40	41	**43**	40	37	39	38
R14	40	**42**	40	39	**44**	40	37	40	38

Daytime noise levels under worst-case weather conditions generally exceed the noise criteria at the identified receivers with exceedances ranging up to 10dB. The worst affected receivers during the day are located in Russell Vale (R1-R4).

In the evening, noise levels under worst-case weather conditions are found to exceed the noise criteria at all identified receivers with exceedances ranging up to 13dB. The worst affected receivers in the evening are located in Russell Vale (R1-R4).

At night, 10^{th} percentile noise levels are generally found to exceed the criteria with exceedances ranging up to 5dB. The worst affected receivers in the night are located in Russell Vale (R1-R4).

Dominant Noise Sources

The results show that the D11 dozer is the most dominant noise source during the daytime and evening – particularly at the most impacted receivers in Russell Vale. Other notable contributing sources during the daytime and evening include the tripper arrangement, the primary sizer building, the new truck loading bins and the on-site haul roads.

During the night, the primary sizer building, the tripper and the tripper stockpile are found to be the most dominant noise sources.

Consideration of Further Noise Mitigation Measures

Detailed consideration has been given to attenuating the D11 dozer. Modelling suggests that reducing the D11 sound power level by up to 5 dB (i.e. the level of attenuation that may readily be achieved by fitting an attenuation pack) would offer only a marginal noise level reduction at the closest private receivers (R1-R4) of less than 1dB and therefore this measure alone would not be expected to provide any substantial benefit.

During the site visit, it was observed that the noise generated by coal impacting on the stockpile was a relatively significant noise source. Currently, the coal falls an estimated 20 m to ground level when forming a stockpile whilst the tripper remains in a static location.

It was identified that the tripper system may be automated to move laterally, such that the coal may be discharged on to the side of an already formed stockpile. It is considered that management of the stockpile in this manner and reduction of the average fall height of the coal may provide some noise reduction benefit and further evaluation of this would be recommended. Whilst this measure would need to be assessed with regard to the potentially increased noise generated by the tripper movement, WCL will undertake a trial in order to determine the lowest noise solution and implement.

7 PERIMETER NOISE BARRIER ANALYSIS

In accordance with the EPA's recommendation WM has undertaken an assessment of the noise control efficacy of establishing a barrier at the site boundary of the Russell Vale Colliery.

The day and evening 'Year 4' operating scenarios, as described in the Wilkinson Murray Report dated 9 October 2014 have been considered in the analysis (refer to Wilkinson Murray Report No. 14141 Ver C - prepared in support of the Underground Expansion Project).

For the purpose of this assessment the identified scenarios have been modelled (applying the confirmed 100 dBA tripper sound power level) and modified to include the 103 dBA stockpile sound power level, discussed in Section 5. Additionally the site topography has been updated with 1 m interval topographical data sourced from WCL.

The site location plan shown in Figure 6-1 identifies the site boundary. Initial modelling has considered establishing a contiguous barrier along the entire perimeter of the site in the location shown in Figure 6-1.

Figure 7-1: Location Plan – Site Boundary Indicated by Red Line

Figures 6-2 and 6-3 show predicted barrier attenuation maps under neutral meteorological conditions for barriers of 4 m and 6 m established around the entire perimeter of the site.

Figures 6-4 and 6-5 show predicted barrier attenuation maps under adverse meteorological conditions for barriers of 4 m and 6 m established around the entire perimeter of the site.

These maps show the predicted barrier loss at 1.5 m above ground level and therefore represent the attenuation expected to be achieved for single storey receivers. The predicted attenuation levels (at 1.5 m above ground level) at Receivers R1-R14 are shown on the figures. Significantly lower levels of attenuation may be expected for receivers with upper storeys. Figure 7-6 shows the attenuation that may be expected for second storey receivers.

Modelling results indicate that given the natural topography of the site, barriers of substantial height (e.g. approximately 6 m) would be necessary to achieve attenuation of material acoustic benefit. In this regard it should be noted that attenuation levels of 1-2 dB would not be expected to provide any real benefit as such reductions are not particularly noticeable to most people. WM considers that 3-5 dB is the minimum level of attenuation that should be achieved for there to be material acoustic benefit of installing a barrier.

It should additionally be noted that due to the site's natural topography, the barrier's shadow zone reduces appreciably with increasing distance from the structure and therefore the barrier noise performance reduces with increasing distance from the barrier. This can be seen in Figures 6-2 to 6-6.

In considering the efficacy of a barrier, attention to the receiver height should be a consideration. In this regard it should be noted that the receivers to the north and north-west of the site (including R1-R7) are noted to be predominantly single storey dwellings, whereas the receivers to the south are mainly two storey dwellings. Taking receiver heights into account, it is considered that the only a limited section of the site boundary would benefit from a barrier, this section is shown in Figure 7-7. Such a barrier would be approximately 280m long.

As noted a barrier of significant height (i.e. approximately 6m) at this location would be required to achieve material acoustic benefit and therefore the opinions of affected members of the community would need to be given some consideration.

Whilst modelling indicates that a barrier established on a limited section to the site boundary may provide some acoustic benefit, WM would recommend that a program of real-time noise monitoring is undertaken prior to installing any such barrier. The monitoring would be expected to provide further confidence in the actual noise levels arising due to the on-site activities in the vicinity of the proposed barrier location as indicated in Figure 7-7.

Figure 7-2: Barrier Attenuation at 1.5m Above Ground - Full Perimeter 4m Barrier, Neutral Meteorological Conditions, Year 4, Day & Evening

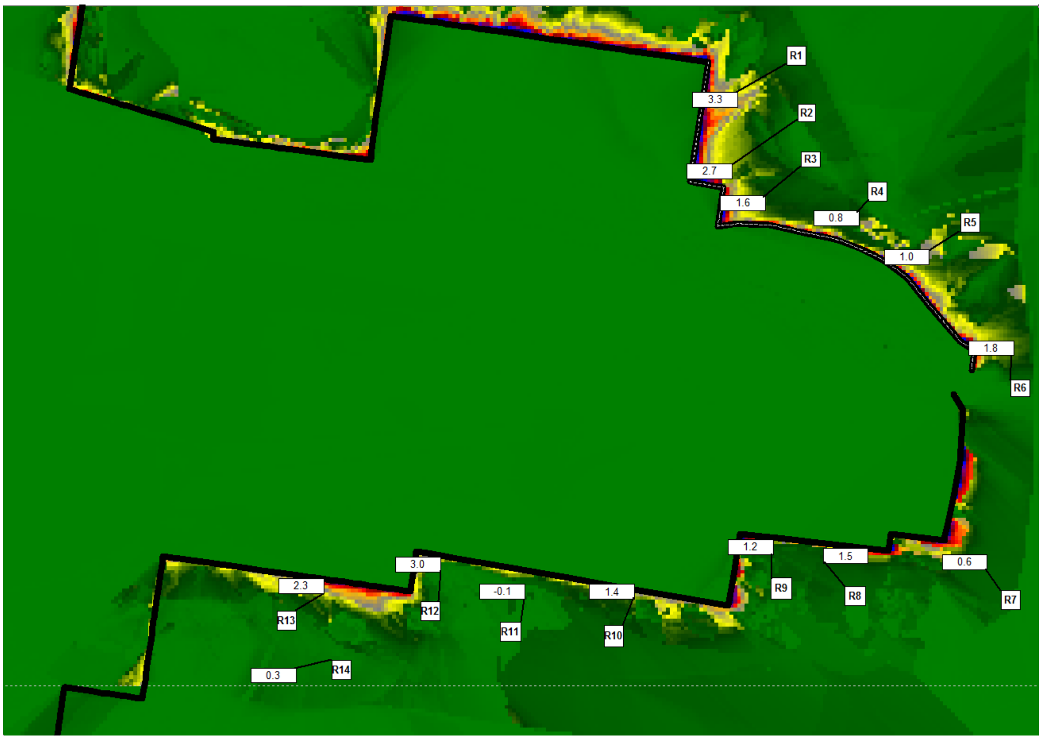


Figure 7-3: Barrier Attenuation at 1.5m Above Ground - Full Perimeter 6m Barrier, Neutral Meteorological Conditions, Year 4, Day & Evening

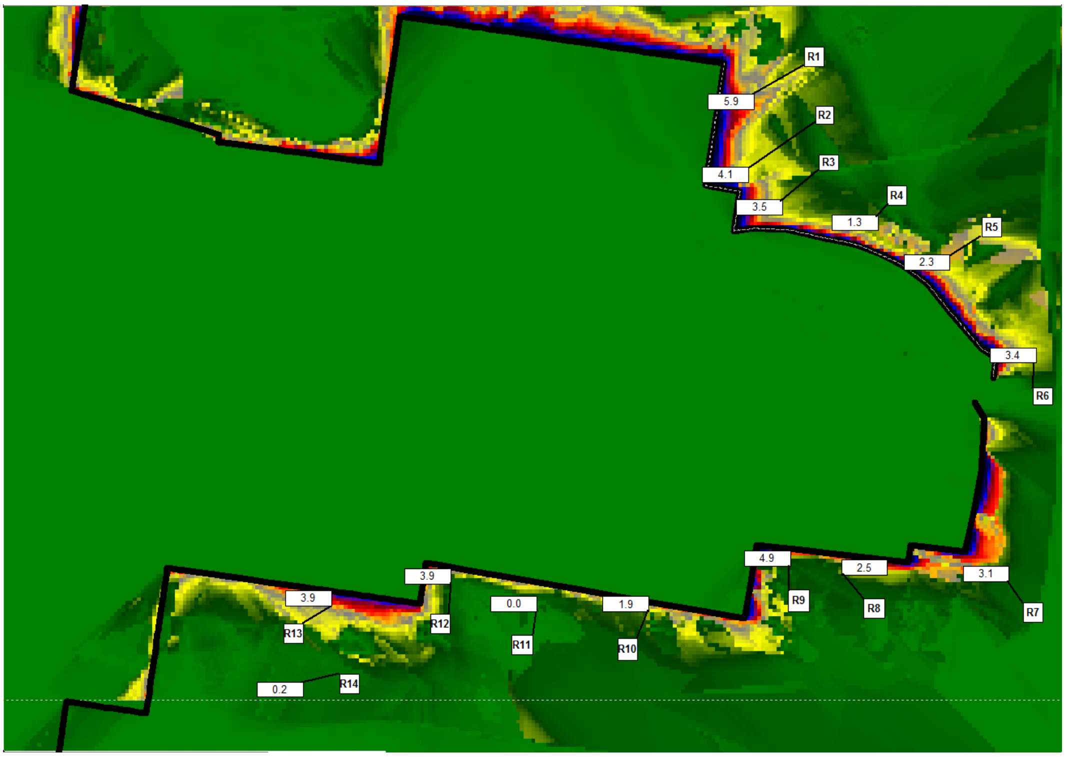


Figure 7-4: Barrier Attenuation at 1.5m Above Ground - Full Perimeter 4m Barrier, Adverse Meteorological Conditions, Year 4, Day

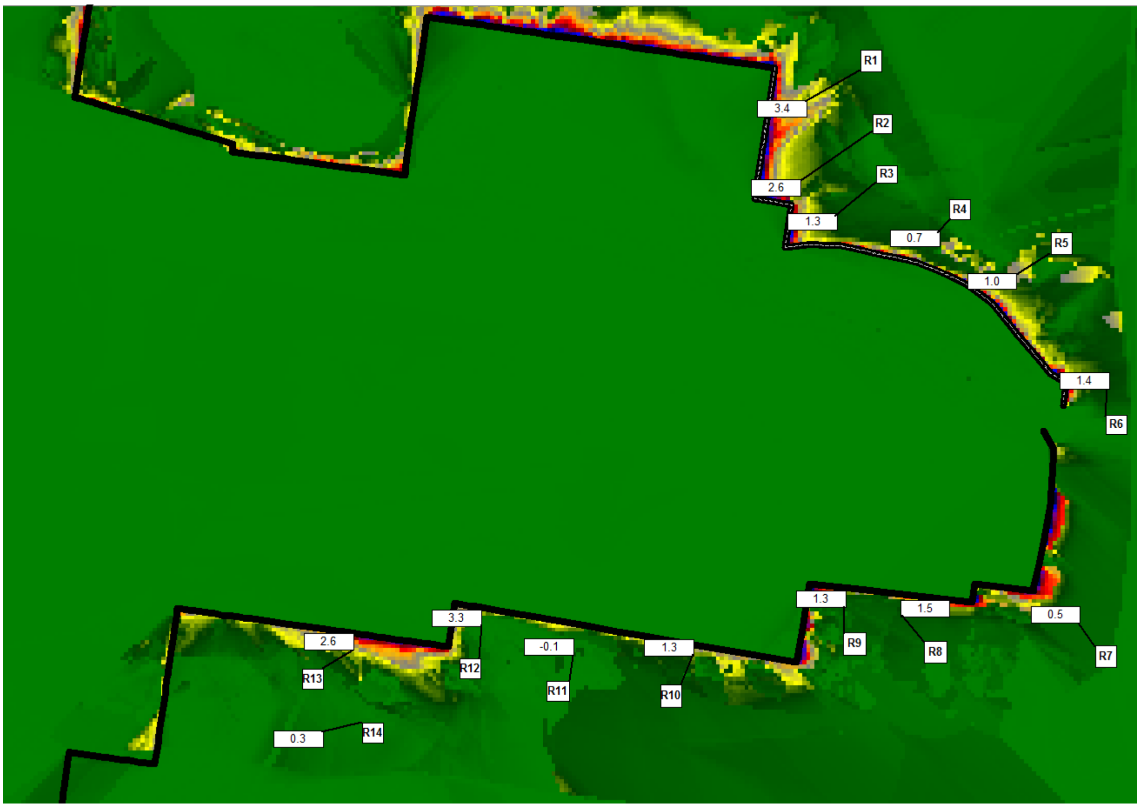


Figure 7-5: Barrier Attenuation at 1.5m Above Ground - Full Perimeter 6m Barrier, Adverse Meteorological Conditions, Year 4, Day

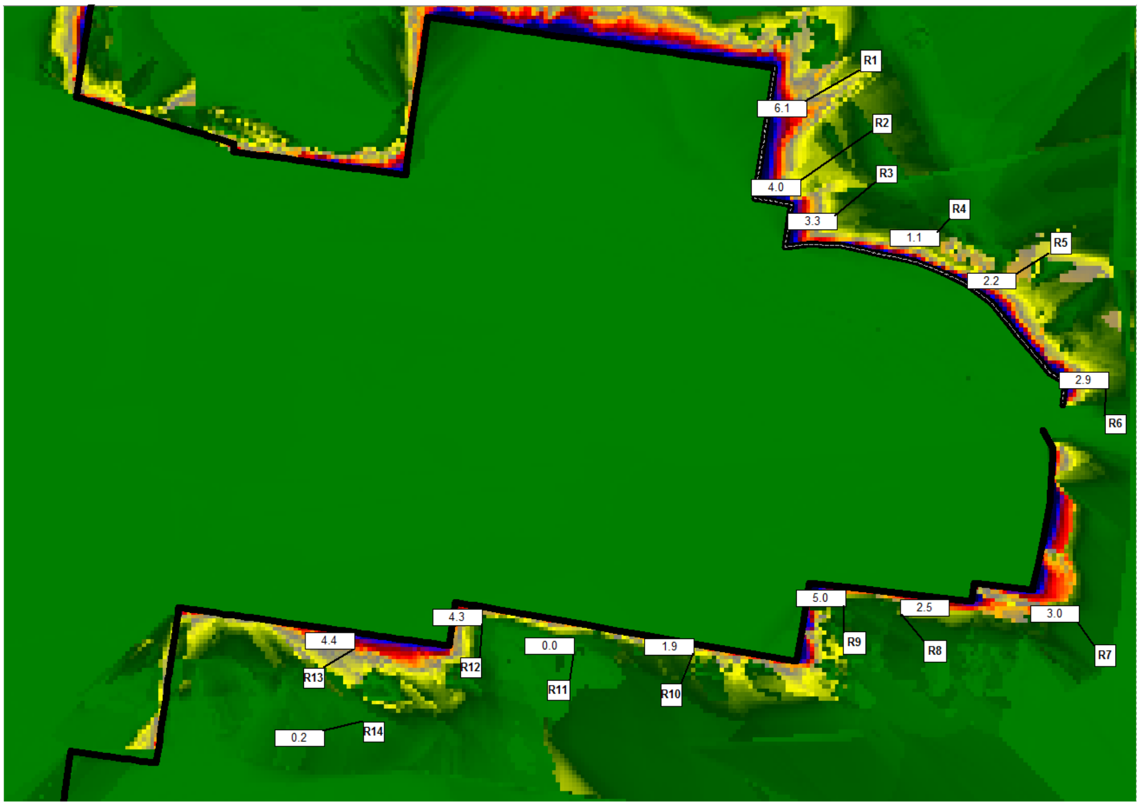


Figure 7-6: Barrier Attenuation at 4.5m Above Ground (Second Storey) - Full Perimeter 6m Barrier, Adverse Meteorological Conditions, Year 4, Day

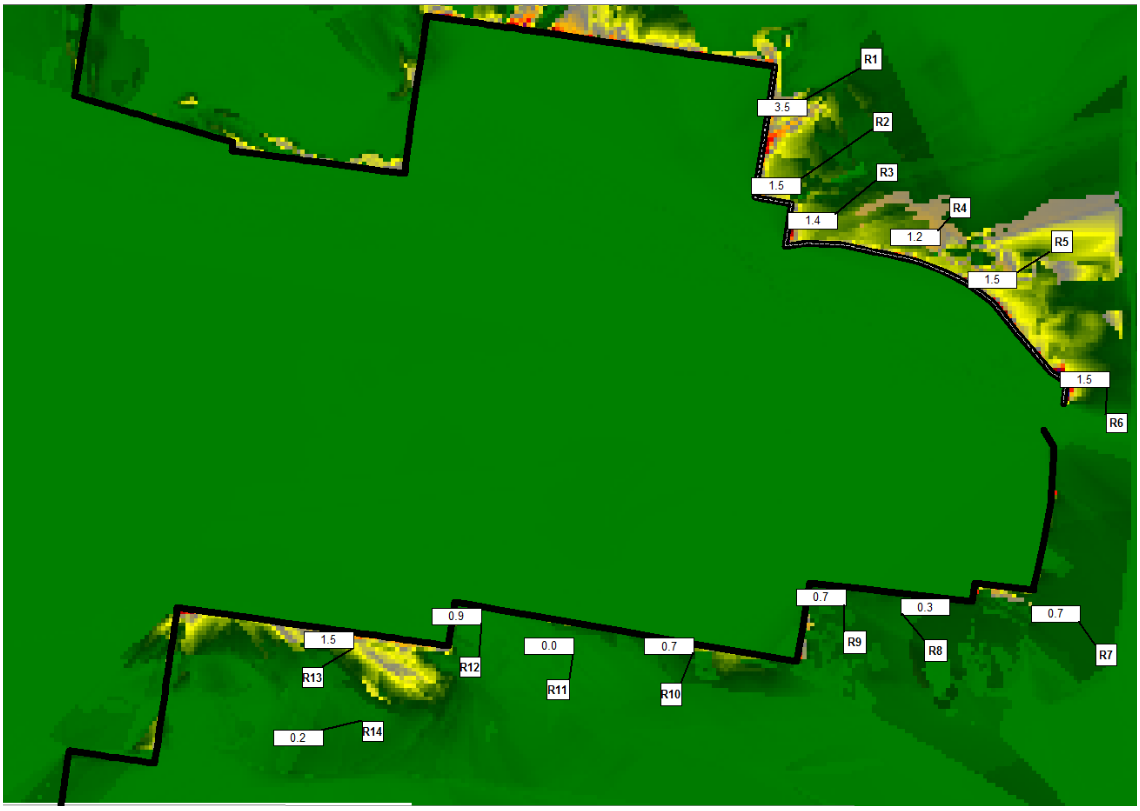


Figure 7-7: Section of Site Boundary that may benefit from 6m High Barrier

8 DISCUSSION OF 2012 AUDIT RESULTS AND APPROVAL LIMITS

Schedule 3, Condition 13 of the Project Approval relates to a Noise Audit of the Project and states:

The Proponent shall prepare and implement a Noise Audit for the project to the satisfaction of the Director-General. The audit must:

(a) be prepared by a suitably qualified acoustic consultant, whose appointment has been

approved by the Director-General;

(b) be prepared in consultation with OEH, and be submitted to the Director-General for approval by the end of December 2012;

(c) investigate and evaluate all reasonable and feasible measures to mitigate operational noise levels to comply with the long term noise goals in Table 5 (of the Project Approval); and

(d) include an action plan to implement the audit recommendations and a protocol for monitoring the effectiveness of these measures

Pacific Environment Limited undertook an audit for the site between 1 October and 21 December 2012 in accordance with Condition 13.

In relation to the results of the noise audit undertaken by Pacific Environment the PAC Review Report notes:

'The night time results from the noise audit are shown in Table 4 (reproduced below)*. There is a considerable difference between the results of the proponent's noise audit and those said to represent the existing operations and these differences need some explanation'.*

Table 4: Night time Noise levels (dBA) $L_{Aeq(15 min)}$

Location	2011 Approval, limit applies from 1 January 2014[*]	2011 Approval, long term noise goal[*]	2012 Noise Audit^	Existing ~	Department's proposed levels #
West St Russell Vale	39	37	44.3*	45-47	43-44
Broker St Russell Vale	40	37	38.6 – 43.8*	43-45	43
Midgley St Corrimal	36	36	35.1	42-46	43
Lyndon St Corrimal	38	38	37.8-38.2	40-42	39
Moreton St Russell Vale	38	37	37.8	unknown	48
Taylor Place Corrimal			38.2	42	40-42
Princes Hwy Russell Vale	35	35	NA	43	41
Princes Hwy Corrimal	35	35	NA	44	44
All other privately owned land	35	35	NA	NA	48

[*] Sourced from the 2011 conditions of approval for the current operation (Department of Planning & Infrastructure, 2011a)
^ attended monitoring with exclusion of insects and traffic (Pacific Environment Limited, 2012)
~ Sourced from the Department's preliminary assessment report (Department of Planning & Environment, 2014b)
# Sourced from the Department's recommended conditions (Department of Planning & Environment, 2014)
*exceedance said to be due to unauthorised heavy trucks accessing the site during the evening and night - with remedy action taken

In response to the PAC comment, it should be noted that the Department's proposed levels are based on assessment of the site at full capacity and reliant on modelling which has accounted for the simultaneous operation of all equipment operating concurrently and at full capacity.

It is to be expected that during typical site operations, the off-site noise levels will vary to some degree depending on exactly what activities are being undertaken. The 2012 audit noise levels represent the levels found to occur during the brief period of the audit. Whilst it is not clear from the audit report exactly which on-site noise sources influenced the measured noise levels, it is apparent that the results of the attended noise survey indicated compliance with the Interim Intrusive Noise limits outlined in the Project Approval.

We trust the details provided herein are sufficient. Please contact us if you have any further queries.

Yours Faithfully

Sean Flaherty
Wilkinson Murray

APPENDIX C

Noise Control Recommendations and Costs

Project Memo

H349494

July 16, 2015

To: Andrew Wu   From: Colin Tickell

cc: Brian Moore

Wollongong Coal - Hansen Bailey
PAC Review Report RV Colliery

Noise Control Recommendations and Costs

Disclaimer

This project memo was prepared Hatch Pty Ltd, for the sole and exclusive benefit of Wollongong Coal Limited (the "Owner") for the purpose of assisting the Owner to review opportunities and costs for noise management at the owner's site in response to requests from the NSW Planning Assessment Commission for additional information, and may not be provided to, relied upon or used by any third party. Any use of this report by the Owner is subject to the terms and conditions of the Hatch Professional Services Terms and Conditions provided with the proposal to the Owner dated 23 April 2015, including the limitations on liability set out therein.

This memo is meant to be read as a whole, and sections should not be read or relied upon out of context. The report includes information provided by the Owner and by certain other parties on behalf of the Owner. Unless specifically stated otherwise, Hatch has not verified such information and disclaims any responsibility or liability in connection with such information. In addition, Hatch has no responsibility for, and disclaims all liability in connection with, the sections of this report that have been prepared by the Owner.

This report contains the expression of the professional opinion of Hatch, based upon information available at the time of preparation. The quality of the information, conclusions and estimates contained herein is consistent with the intended level of accuracy as set out in this report, as well as the circumstances and constraints under which this report was prepared. However, this report is a review of an existing facility and, accordingly, all estimates and projections contained herein are based on limited and incomplete data. Therefore, while the work, results, estimates and projections herein may be considered to be generally indicative of the nature and quality of the Project, they are not definitive. No representations or predictions are intended as to the results of future work, nor can there be any promises that the estimates and projections in this report will be sustained in future work.

1. Introduction

The NSW Planning Assessment Commission (PAC) ***Review Report into Russell Vale Colliery – Underground Expansion Project from April 2015*** included requests for additional information on noise. Recommendation No.7 in the Executive Summary is as follows:

The Commission recommends that further consideration of the noise impacts of the project needs to be provided including consideration of further noise mitigation measures as recommended by the EPA. Detailed justification should be provided for any deviations from the existing noise limits in current planning approval. Also clarification should be provided on the outcomes and applicability of the noise audit required in the 2011 approval.

Page 40 of the PAC report describes a request from the EPA for additional information on a number of noise mitigation measures that have been suggested by the EPA. These include the following:

- Conveyor runner bearing design
- Replacement of metal clips used to join conveyors with vulcanised joints
- Use of noise barriers on site boundaries and noise barriers around identified noisy equipment on-site
- Maintaining a volume of coal in bins so that coal is not dumped into an empty bin
- Minimising dump height from mobile plant
- Noise dampening material in coal bins/deflection plates
- Noise cladding on conveyor winder houses and conveyor rope rollers
- Enclosed motor rooms etc.

Advice has been requested from Hatch to assist with responding to these recommendations and advise on the costs involved in implementing these noise controls, if WCL was required to do so.

It is noted that managing noise from mobile plant is an operational issue, as is bin levels being maintained above empty, rather than something that controls can be applied to and these will not be discussed.

The EPA also recommended the following, which is not part of the Hatch Scope:

> *"The EPA recommends the PAC seek information on noise reductions with different load out operations, in particular longwall to conveyor to bin to truck, compared to longwall to conveyor to stockpile to FEL to truck. Some coal loading from stockpiles will be required to deal with longwall changeouts or underground production problems, however an assessment of different stockpile/bin loading ratios, between 100 per cent bin load out to 100 per cent stockpile load out could be useful. If bin use is found to reduce site noise, the PAC could consider requiring progressive implementation of bins, and/or regulating load out from stockpiles during times when it would provide lesser impact to residents." (NSW Environment Protection Authority, 2015, p. 3)*

The Hatch scope has not allowed for the EPA recommendation to PAC regarding noise reductions with different load out operations, in particular longwall to conveyor to bin to truck, compared to longwall to conveyor to stockpile to FEL to truck. However, some of these were considered in other work Hatch provided for Wollongong Coal in 2015 on noise control design work for the following:

- RC1 (see figure 11002-0150-01);
- Secondary Sizer and sorting buildings;
- RC3;
- 600 t surge bin;
- RC4;

- Truck-loading bin and bin-truck loading.

2. Findings

All major noise emission sources at the Russell Vale site already in place have had recommendations provided for noise control engineering during 2013 to 2015 and earlier. All feasible and reasonable noise control measures have been installed in 2014 or are planned to be installed during 2015. Some of these controls are engineering noise control measures or design specifications for buildings or equipment, while others are operational management issues (mobile equipment operation, drop heights and bin levels).

Therefore there is no additional cost required for their implementation which has not already been done or included in design and specification reports for yet to be installed items. Costs for high-transmission-loss acoustic walls on yet to be constructed Secondary Sizer and Sorting buildings, as well as bin barriers and conveyor drive enclosures have been identified – see Section 2.1 and 2.2 below.

In summary, it is considered that all feasible and reasonable noise control design and management measures have been considered and will provide the opportunity for the major sources to achieve their equivalent contribution noise objectives. Assessment of the effectiveness of those controls installed to date has yet to be assessed during higher flow-rate continuous coal production.

2.1 Costs for Conveyor drive enclosures or barriers

Enclosure and noise barrier material costs have been obtained for the conveyor drives using Ortech Durra 250 duplex sheet steel and Durra board panels and Speedpanel 78mm steel and concrete sandwich panels. It should be noted that these are not quotes but are based on estimated costs per square metre. For the conveyor drive RC3, located outside the northern side of the sizer building, a partial enclosure to shield of the drive and pulley area of the conveyor is estimated to have a surface area of 32,2 m^2 and cost $12,084 for the Ortech system or $12,776 in Speedpanel.

For the conveyor drive RC4, located on top of the truck loading bin, a partial noise barrier enclosure area of 11.3 m^2 has a budget estimate cost of $4,219 for the Ortech system or $4460 using Speedpanel.

For the 600t Surge Bin, the Ortech system would not be suitable and costs have been identified using slab concrete panels from GC Civil, as well as Speedpanel. For the bin a partial enclosure would have a surface area of 954m^2 and have a cost of $610,725 in concrete or $378,330 in Speedpanel.

For the Truck-loading Bin, side barriers would be required having a total area of 191m^2. Costs are estimated to be $122,240 in concrete or $75,725 in Speedpanel.

2.2 Costs for Boundary Noise Barriers

Noise reduction from boundary barriers proposed on the north-eastern boundary is considered to only be effective for the adjacent houses and those immediately across the road. With increasing distance the barrier reduction effect diminishes. By the time the distance of the residence from the barrier is approximately four or five house blocks, the effect is minimal.

A boundary noise barrier has been proposed, as shown by the blue highlighted line in Figure 1, shown below. Potential heights of 4 m and 6 m have been suggested.

Supply and install costs for noise barriers have been obtained from GC Civil Pty Ltd of Unanderra. They have advised that on the basis of previously installed concrete barriers for heights of 4m and 6 m, approximately $640 per square metre should be used for budget estimation cost for supply and install. Costs using Speedpanel have also been calculated using a supply and install cost of $271.30 per square metre.

Based on the advised length of 280 lineal metres of boundary noise barriers, as shown in Figure 1, the approximate costs will be as follows:

Barrier Height	Approximate Cost for 690 m	
	Concrete	Speedpanel
4 m	$ 716,800	$ 303,866
6 m	$1,075,200	$ 455,800

Figure 1: Aerial view of Wollongong Coal Russell Vale site showing the advised location of boundary noise barrier – shown in blue. The approximate location of the Property boundary is shown in red.

Colin Tickell

CT:gcm

APPENDIX D

Response to Planning Assessment Commission Air Quality Recommendations

23 July 2015

Dianne Munro
Hansen Bailey

Email: dmunro@hansenbailey.com.au

Dear Dianne

SUBJECT: Russell Vale Colliery Underground Expansion Project – Response to Planning Assessment Commission Air Quality Recommendations

1 INTRODUCTION

Pacific Environment has been requested by Hansen Bailey on behalf of Wollongong Coal Limited (WCL) to provide a response to the Planning Assessment Commission (PAC) Review Report ('the PAC Review'; report dated 2 April 2015) recommendations as they relate to air quality. The PAC Review has been produced following a request that the PAC review the Russell Vale Colliery Underground Expansion Project (UEP).

Specifically, the PAC Review Report recommendations for 'Air' are:

8. *The $PM_{2.5}$ emissions from the proposal need to be assessed prior to any determination of the application.*

9. *Consideration of best practice standards needs to be provided to demonstrate that air emissions would be minimised and to justify the proposed increase in coal handling capacity.*

10. *The mine's existing monitoring and reporting systems should be strengthened to clearly demonstrate compliance with current conditions, environmental standards and reporting goals (i.e. for $PM_{2.5}$ emissions).*

This letter report addresses each of the above PAC Review recommendations sequentially below.

2 RECOMMENDATION 8 – $PM_{2.5}$ ASSESSMENT

A technical air quality assessment was prepared in support of the Environmental Assessment for the UEP (report titled *NRE No.1 Colliery Air Quality Assessment*, prepared for Gujarat Coking Coal Pty Ltd by ERM, dated November 2012; 'the air quality assessment'). The air quality assessment assessed other particulate matter size fractions and metrics (total suspended particulate, dust deposition and PM_{10}) however did not explicitly evaluate particulate matter less than 2.5 micrometres in aerodynamic diameter ($PM_{2.5}$).

To address the PAC Review recommendation that WCL provide an assessment of the $PM_{2.5}$ emissions, Pacific Environment has completed an atmospheric dispersion modelling exercise to evaluate $PM_{2.5}$ impacts at the nearest off-site sensitive receptors. This modelling exercise used the modelling approach / files previously developed by ERM to assess PM_{10} and TSP within the air quality assessment. A summary of this process, including predicted impacts, is provided below. Further detail on the modelling scheme can be found within the air quality assessment (**ERM, 2012**).

2.1 Emission Inventory Development

Pacific Environment has reviewed the particulate matter (PM) emissions inventory originally completed by ERM, and has replicated this earlier work for the $PM_{2.5}$ size fraction. A summary of the PM emission inventory is presented below.

2.1.1 ROM Coal Stockpile

The ROM coal extracted from underground mining is transferred to the stockpile area via conveyor. The ROM coal is then stockpiled at the stockpile area before being transferred to the truck loader via conveyor. Water sprays will be used on these stockpiles to minimise PM on an as needed basis.

Wind erosion will potentially generate PM from the ROM coal stockpile, which has been included in the dispersion model.

2.1.2 Loading Trucks

PM will potentially be generated as a result of loading coal into trucks via overhead loaders for transport offsite.

2.1.3 On Site Roads

PM will potentially be generated as a result of the movement of trucks around the site, particularly for unsealed roads.

2.1.4 Conveyor Transfer of Coal to the Stockpile Area

The conveyor RC1 will be partially covered, minimising the potential for PM generation. Conveyors RC2 and RC3 are located underground for most of their length. Emissions from the conveyor are anticipated to be minor compared to other sources considered and ERM therefore did not include this source in the model.

2.1.5 Screening and Sizing Plant

The screening and sizing plant will be fully enclosed, minimising the potential for PM generation. Emissions from the screening and sizing plant are anticipated to be minor compared to other sources considered and ERM therefore did not include this source in the model.

2.1.6 Transfer and Handling of Coal at the Stockpile Area

ROM coal will be conveyed from the surface stockpile area to the truck loadout using uncovered conveyors. The truck load outs are covered on the sides and top only. As the loader uses a drive-through open front and back, batch loading bin arrangement, emissions may occur. Emissions may also occur at the stockpile area. These sources have been included in the dispersion modelling.

2.1.7 Bulldozing at the Stockpile Area

Bulldozers have the potential to generate PM emissions as a result of disturbance and movement of material within the stockpile area and have been included in the dispersion modelling, operating at both the large (SP2, SP3) and small stockpile (SP1) locations.

2.1.8 Blasting

Blasting for this Project is occasionally undertaken underground at a low maximum instantaneous charge. Blasting is episodic, minor in magnitude and takes place within the underground mine. Therefore emissions from blasting have not been included in the dispersion model.

2.1.9 Ventilation Shafts

Ventilation shafts are mostly located in a catchment area away from any sensitive receptors. While there is a ventilation fan located at the Russell Vale Site, only minor emissions are expected. Therefore ERM did not include these potential emissions in the dispersion model.

2.1.10 Emissions Inventory Summary

Table 1 presents a summary of the emissions calculations adopted within the ERM assessment and this current assessment of $PM_{2.5}$ impacts. The $PM_{2.5}$ emission factors have been developed referencing specific ratios (k-factors) for this size fraction documented within the USEPA's AP-42 emission estimation database (**USEPA, 1998**).

Table 1: Emission Inventory Calculations

Activity	TSP emissions (kg/day)	PM_{10} emissions (kg/day)	$PM_{2.5}$ emissions (kg/day)	Intensity	Units	TSP emission factor	PM_{10} emission factor	$PM_{2.5}$ emission factor	Units	Operational hours/day
Conveyor Transfer – conveyor portal	2.6	1.2	0.2	8219	tonnes/day	0.0003	0.00015	0.00002	kg/t	15
Conveyor unloading to small stockpile	26.3	11.2	1.7	6575	tonnes/day	0.0040	0.0017	0.00026	kg/t	15
Conveyor unloading to large stockpile	6.6	2.8	0.4	1644	tonnes/day	0.0040	0.0017	0.00026	kg/t	15
Transfer - loading bins into road trucks [2]	4.6	1.9	0.3	11429	tonnes/day	0.00040	0.00017	0.00003	kg/t	15
Haulage from loading bins to site boundary - sealed road (loaded) [1]	2.0	1.0	0.2	129	VKT/day	0.0157	0.0076	0.0018	kg/VKT	15
Haulage from site boundary to loading bins -sealed road (unloaded) [1]	1.5	0.9	0.2	129	VKT/day	0.011448 6	0.006579	0.00159	kg/VKT	15
Dozer on small stockpile	112.2	26.4	2.5	6.6	h/day	17	4	0.4	kg/h	6.6
Dozer on large stockpile	112.2	26.4	2.5	6.6	h/day	17	4	0.4	kg/h	6.6
Wind erosion small –stockpile	7.7	3.8	0.6	0.7	hectares	0.44	0.22	0.033	kg/ha/h	24
Wind erosion large - stockpile	20.9	10.5	1.6	2.0	hectares	0.44	0.22	0.033	kg/ha/h	24
Total	**296.6**	**86.1**	**10.1**							

Note 1: Assuming maximum 616 movements per day (308 trips per day) and based on 0.41 km each way from bins to Princess Highway 129.36 VKT/day

Note 2: Emissions split between two load out points

The above emission inventory has then been apportioned over several emission sources of differing geometries, as summarised in **Table 2** below.

Table 2: Model Sources / Descriptions (after ERM, 2012)

Model ID	Source Type	Description	Easting mUTM56	Northing mUTM56	Release Height (m)	Y-init (m)	Z-init (m)
A1	volume	Small Stockpile	306005	6195882	11.5	29.7	10.7
A2	volume	Large Stockpile	306153	6195897	12.6	47.6	11.7
B	volume	Conveyor Transfer - Portal	305677	6195576	5	2.0	4.7
C	volume	Conveyor unloading to small stockpile	306005	6195882	11.5	2.0	10.7
D	volume	Conveyor unloading to large stockpile	306021	6195909	12.6	2.0	11.7
E	volume	Conveyor unloading to large stockpile	305979	6195869	12.6	2.0	11.7
F1	volume	Transfer - Loading Bins to Road Trucks	306176	6196019	5	2.0	4.7
F2	volume	Road (unloaded)	306171	6196025	5	2.0	4.7
1	volume	Road (unloaded)	306476	6195950	5	63.3	4.7
2	volume	Road (unloaded)	306365	6196014	5	63.3	4.7
3	volume	Road (unloaded)	306181	6196025	5	63.3	4.7
5	volume	Road (loaded)	306260	6196081	5	63.3	4.7
6	volume	Road (loaded)	306395	6196059	5	63.3	4.7
7	volume	Road (loaded)	306476	6195950	5	63.3	4.7
A1A	volume	Dozer on small stockpile	306005	6195882	11.5	29.7	10.7
A2A	volume	Dozer on large stockpile	306153	6195897	11.5	29.7	10.7

2.2 Applicable air quality criteria

There are currently no NSW EPA criteria for $PM_{2.5}$. However, in May 2003, the National Environment Protection Council (NEPC) released a variation to the *National Environment Protection Measure for Ambient Air Quality* (referred to as the Ambient Air-NEPM). The variation to the Ambient Air-NEPM included advisory reporting standards for $PM_{2.5}$. The purpose of the variation was to gather sufficient data nationally to facilitate the review of the Ambient Air-NEPM, which is currently underway. **Table 3** presents a summary of the advisory reporting standards for $PM_{2.5}$. It is proposed that the project is evaluated against this reporting standard.

Table 3: $PM_{2.5}$ advisory reporting standards

Pollutant	Advisory Reporting Standard	Averaging Period
PM< 2.5 µm ($PM_{2.5}$)	25 µg/m³	24-hour average
	8 µg/m³	Annual average

2.3 Sensitive Receptor Locations

We have adopted the same sensitive receptor locations for the prediction of maximum 24-hour and annual $PM_{2.5}$ concentrations, as summarised in **Table 4**.

Table 3: Sensitive Receptor Locations adopted within ERM, 2012

Receptor ID	Description	Easting m UTM56	Northing m UTM56
R1_1	6 Broker Street	306516	6196055
R2_2	29 West Street	306470	6196085
C5_3	Taylor Place	305889	6195417
C1_4	48 Lyndon Street West	305949	6195521
C2_5	48 Lyndon Street	306081	6195570
C3_6	Midgley Street	306558	6195596
R4_7	4 Broker Street	306746	6195951
C6_8	Robson Street	306187	6195291
C4_9	Bloomfield Avenue	306322	6195424
R3_10	Moreton Street	306568	6196087

2.4 Background Air Quality

We have referenced the $PM_{2.5}$ data collected by WCL using their continuous monitoring system to provide a conservative evaluation of background $PM_{2.5}$ concentrations for the cumulative assessment.

WCL has been collecting $PM_{2.5}$ data using two Tapered Element Oscillating Microbalances (TEOMs) located at their northern and southern site boundaries on a continuous basis since late 2013. The locations of these instruments are shown in **Figure 3**.

Further discussion of this data is provided in **Section 4**, however for the purposes of estimating background concentrations of $PM_{2.5}$, the following has been assumed:

- 24-hour average concentration equivalent to the higher of the 95th percentile 24-hour average values collected across the two monitors (16.9 µg/m³ recorded at TEOM2); and
- Annual average concentration equivalent to the higher of the average of all hourly data collected across the two monitors (5.8 µg/m³ recorded at TEOM1)

2.5 Impact Assessment

Consistent with the approach adopted within **ERM, 2012**, atmospheric dispersion model predictions have been made using the US EPA regulatory model AERMOD.

The predicted concentrations at the nearby sensitive receptors summarised in **Section 2.3** are presented in tabular form in **Table 4**.

The predicted incremental increases as a result of the Project alone are shown as 'increment', as well as cumulative impacts with the addition of existing background levels, as described in **Section 2.4**.

The modelling results show that no sensitive receptor is predicted to experience ground level concentrations of $PM_{2.5}$ greater than the relevant assessment criteria, due to the Project alone or cumulatively.

Table 4: Predicted incremental and cumulative ground level $PM_{2.5}$ concentrations

Receptor ID	$PM_{2.5}$			
	24 hour		Annual	
	Increment	Cumulative	Increment	Cumulative
Units				
Assessment criterion	**N/A**	**25**	**N/A**	**8**
R1_1	7.5	24.4	0.8	6.6
R2_2	7.5	24.4	0.9	6.7
C5_3	3.2	20.1	0.2	6.0
C1_4	3.2	20.1	0.3	6.1
C2_5	4.0	20.9	0.6	6.4
C3_6	4.5	21.4	0.5	6.3
R4_7	5.9	22.8	0.6	6.4
C6_8	1.8	18.7	0.3	6.1
C4_9	4.4	21.3	0.4	6.2
R3_10	7.0	23.9	0.8	6.6

Figure 1 and **Figure 2** provide contour plots of incremental $PM_{2.5}$ concentrations for maximum 24-hour and annual average timescales respectively. It is important to note that the contour plots are presented to provide a visual representation of the predicted impacts. To produce the contour plots, it is necessary to make interpolations, and as a result the contours will not always match exactly with predicted impacts at any specific location.

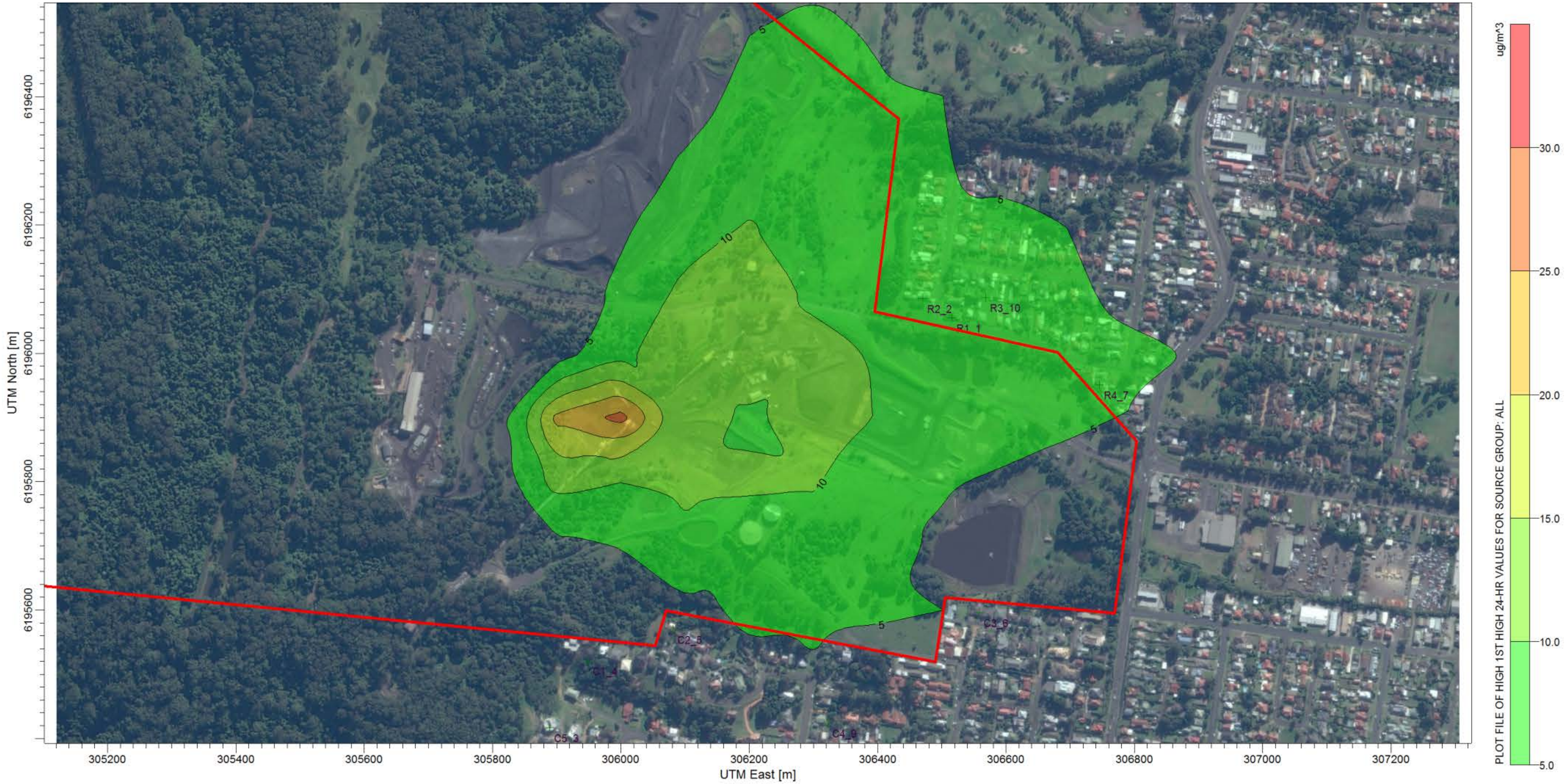


Figure 1: Maximum incremental 24-hour average ground level concentrations of $PM_{2.5}$

Figure 2: Incremental annual average ground level concentrations of $PM_{2.5}$

3 RECOMMENDATION 9 – CONSIDERATION OF BEST PRACTICE

In October 2012, WCL published an evaluation of best practice dust management at the Russell Vale Colliery (report *NRE No.1 Colliery Particulate Matter Control Best Practice Pollution Reduction Program*, prepared by PAEHolmes dated 25 October 2012 (**PAEH, 2012**); 'the Best Practice report').

The Best Practice report summarises the outcomes of a site-specific Best Management Practice (BMP) study and review of the practicability of implementing measures to reduce emissions of PM. It includes:

- The identification, quantification and justification of the measures that are currently being implemented to reduce PM emissions
- The identification, quantification and justification of 'best practice' measures that could be implemented to minimise PM emissions
- An evaluation of the practicability of implementing the best practice measures
- A proposed timeframe for implementing all practicable best practice measures

This study identified that the highest ranking activities at the Russell Vale Colliery in terms of PM generation include:

- Wind erosion of coal stockpiles
- Trucks unloading coal
- Material transfer of coal
- Wheel generated particulates on unpaved roads

Potential Best Practice control measures for the above activities were identified, and their practicability and cost evaluated. Measures that will be implemented at Russell Vale Colliery as part of the UEP that are considered best practice management measures are:

- New truck loading facility
- Two new conveyors with enclosures
- Underground reclaim
- Secondary sizer building
- Water sprays on moving tripper
- Upgrade fleet from 34t to 44t

Where practicable, these measures have been incorporated within the atmospheric emission inventory / dispersion model for the site. **PAEH, 2012** presents a full practicability assessment for the activities that can potentially be further managed by best practice controls. This includes identification of activities which are considered impractical on a regulatory, environmental, safety or compatibility basis.

Measures identified as potentially achievable at the Russell Vale Colliery, after the plant upgrade proposed within the UEP, were:

- Vegetative windbreaks on stockpiles
- Trial chemical wetting agents on stockpiles
- Pave the surface of the haul roads
- Trial suppressants on the haul roads

The above measures have been further evaluated since the production of the Best Practice Report, leading to a commitment to trial chemical wetting agents on stockpiles and haul roads.

Vegetative windbreaks can reduce dust under high wind conditions (by impacting PM on leaves and branches and reducing the wind speed as it passes through vegetation. However, as with other dust management activities, it is better to control the source (i.e. avoid the dust emission), rather than control the emission once it has been released. The use of chemical wetting agents on stockpiles will act to avoid the initial PM emission through stockpile surface stabilisation.

It is understood that WCL have committed to the paving of haul roads around the coal stockpiles as part of the UEP upgrade works.

4 RECOMMENDATION 10 – MONITORING AND REPORTING OF $PM_{2.5}$

As noted in Section 2.4, WCL maintains a network of two TEOM monitors at their northern and southern boundaries (see **Figure 3**) that continuously monitor the PM_{10} and $PM_{2.5}$ size fractions. Data is transferred to a cloud-based environmental management software (EnviroSuite) that provides real-time alerts to mine operators when short-term PM concentrations exceed trigger levels. The trigger levels are short-term (typically 1-hour) values that are set to alert the mine of the potential for exceedance of 24-hour criteria before the event, when mitigation can be applied.

The monitoring network is summarised in **Table 5** and presented in **Figure 3**.

Table 5: Russell Vale PM monitoring network

Description	Site	Address / Location	MGA 56 Easting (m)	MGA 56 Northing (m)
Continuous PM_{10} and $PM_{2.5}$ Monitor	TEOM 1	Near site entrance access road	306619	6195943
	TEOM 2	Lyndon Street	306046	6195555

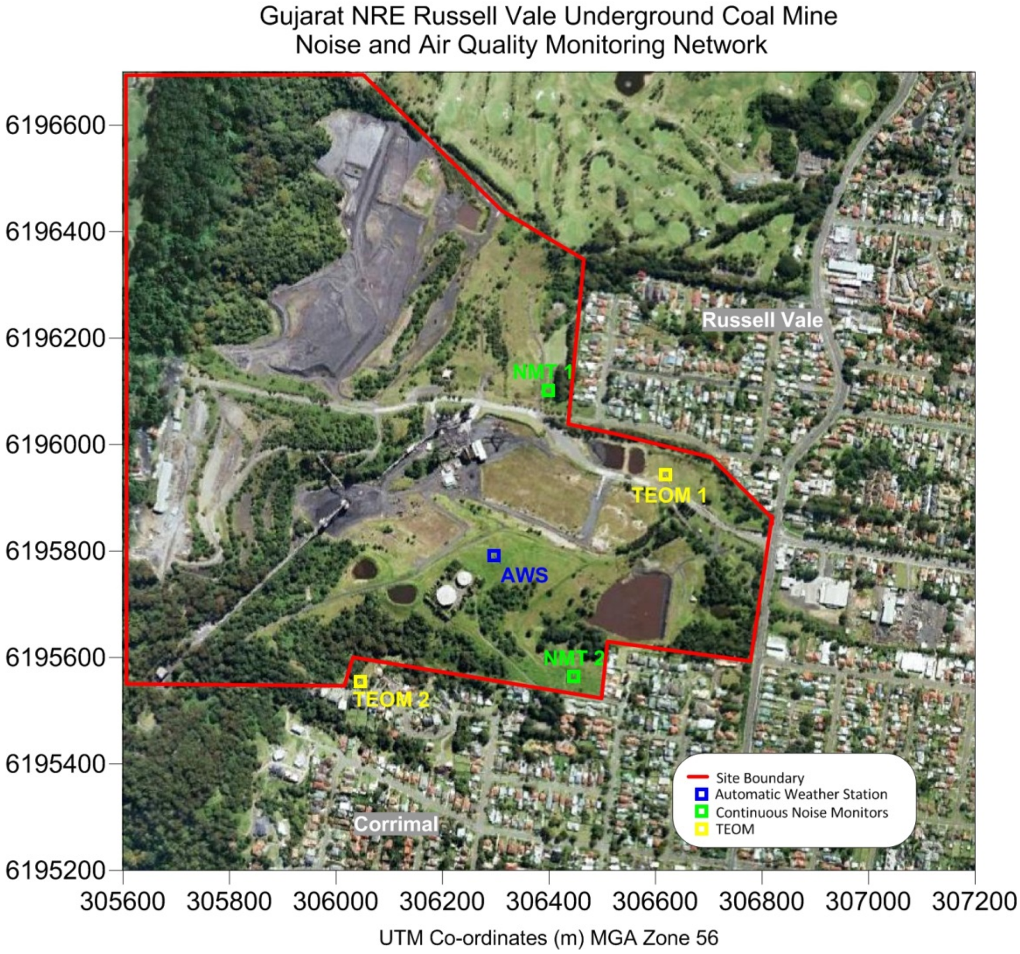


Figure 3: $PM_{2.5}$ Monitoring Locations (TEOM 1 and TEOM 2)

TEOM1 has been providing $PM_{2.5}$ data since September 2013, whilst TEOM2 has provided data from November 2013 onwards. The EnviroSuite environmental management software was commissioned in January 2014.

WCL currently produces quarterly reports that reference NSW EPA air quality criteria for PM_{10}. As noted in **Section 2.2**, there are currently no NSW EPA criteria for $PM_{2.5}$. However, WCL logs and evaluates concentrations of the $PM_{2.5}$ size fraction for internal environmental management purposes. In accordance with the PAC's recommendation, the results of $PM_{2.5}$ monitoring will be included in future quarterly reports.

A statistical summary of the annual $PM_{2.5}$ monitoring data collected to date at both TEOM air quality monitoring stations is provided in **Table 6**. Following data validation, the valid data recovery rate (for 24-hour average) was 94% at TEOM 1 and 96% at TEOM 2. A graph of 24-hour average $PM_{2.5}$ data to date is shown in **Figure 4**.

It is noted **Figure 4** shows elevated $PM_{2.5}$ concentrations between 21 and 25 June 2014 at TEOM 2. It is considered likely that community sources localised to TEOM 2 (such as domestic wood burning) are the primary cause of these elevated values as this pattern was not observed at the TEOM 1monitoring site. Further, there was an equipment malfunction at TEOM 2 on 2 March 2015, resulting in data gaps from this monitor since this date.

Table 6: PM2.5 Summary statistics for TEOM 1 and TEOM 2 (24-hour average) (µg/m³)

Location	Year	Average PM2.5	Median PM2.5	Maximum PM2.5
TEOM 1	2013	3.8	1.8	21.2
	2014	6.2	5.6	19.6
	2015	5.9	5.3	18.1
	All periods	5.8	5.3	21.2
TEOM 2	2013	6.8	5.8	18.4
	2014	5.4	4.0	47.4
	2015	4.0	1.9	36.9
	All periods	5.1	3.9	47.4

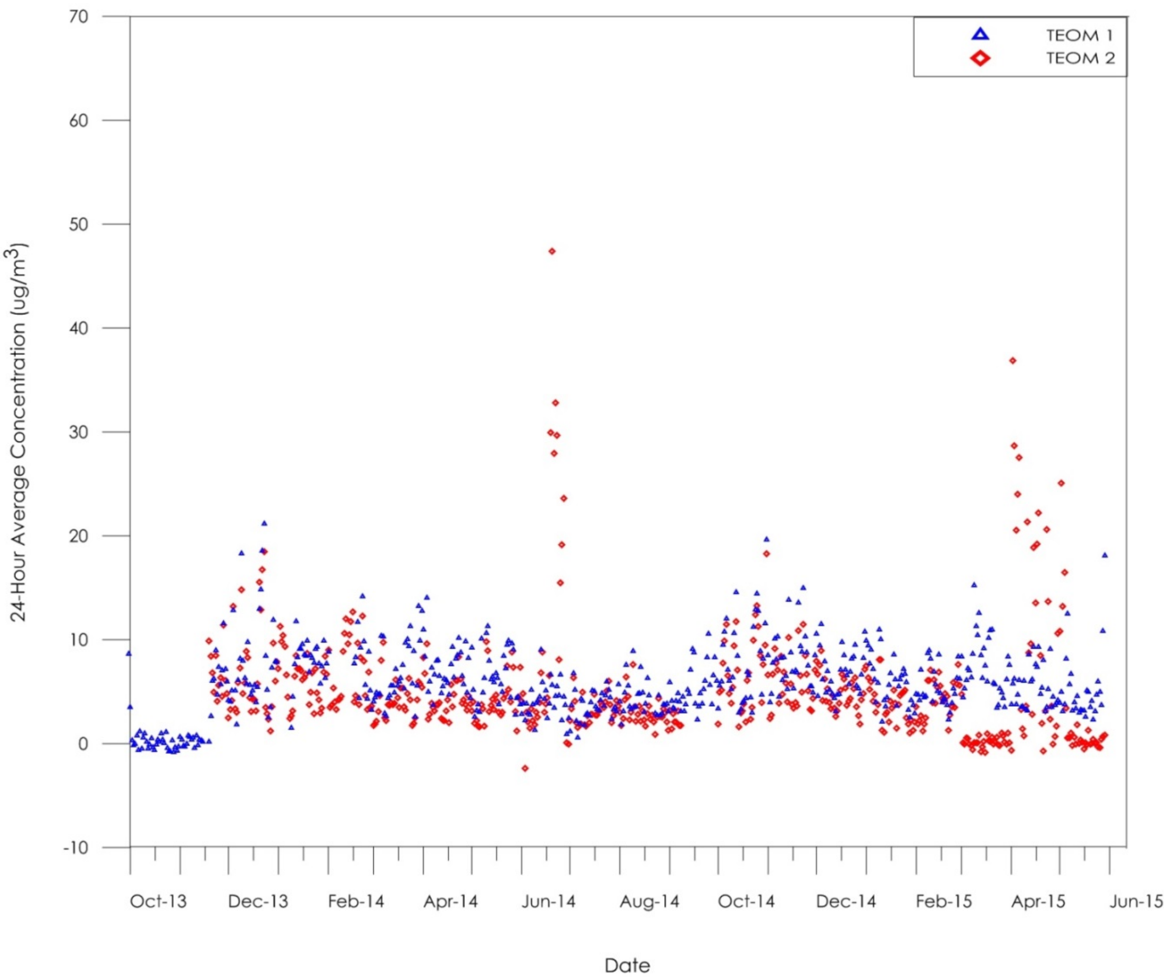


Figure 4: Summary of 24-hour average PM2.5 data at TEOM 1 and TEOM 2 (µg/m³)

5 CLOSURE

This letter report provides a response to the PAC Review recommendations as they relate to air quality.

I trust that the above provides adequate contextual information to address recommendations 8, 9 and 10 in the PAC Review. Do not hesitate to contact the undersigned if you would like clarification on any aspect of the above.

Best Regards,

D.A. Roddis

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Pacific Environment Limited
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Email: damon.roddis@pacific-environment.com

6 REFERENCES

ERM (2012). *NRE No.1 Colliery Air Quality Assessment*, prepared for Gujarat Coking Coal Pty Ltd by ERM, dated November 2012

PAEH (2012).*NRE No.1 Colliery Particulate Matter Control Best Practice Pollution Reduction Program*, prepared by PAEHolmes dated 25 October 2012. http://wollongongcoal.com.au/?ddownload=2390

USEPA (1998). AP-42 Compilation of Emission Factors, Section 13.2.4: Western Surface Coal Mining. October 1998. United States Environmental Protection Agency, Research Triangle Park, NC. http://www.epa.gov/ttnchie1/ap42/ch11/final/c11s09.pdf

APPENDIX E

Bellambi Gully Flooding Approach

Our Ref: NA82014089/ Letter 002 V01
Contact: Owen de Jong

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23 July 2015

WOLLONGONG COAL LIMITED
PO BOX 281
FAIRY MEADOW NSW 2519

Attention: Mr Dave Clarkson

Dear Sir,

RE: RUSSELL VALE COLLIERY – BELLAMBI GULLY FLOODING APPROACH

This letter has been compiled to address Recommendation no.11 of the *Russell Vale Colliery-Underground Expansion Project Review Report* (Planning Assessment Commission, April 2015), i.e.

> ***Flooding/Bellambi Creek***
> *11. Any new approval should retain the existing requirement to realign Bellambi Creek or a full justification why this is no longer necessary to provide protection to the creek downstream from the pit top surface area.*

Background

The Russell Vale Colliery site is located in the foothills of the Illawarra Escarpment, within the Bellambi Gully catchment of the Southern Coalfields Region of NSW. Runoff originating from the Illawarra Escarpment flows down the heavily vegetated steep slopes of the escarpment towards the Russell Vale Colliery site, where it enters the Bellambi Gully watercourse. Some reaches of the watercourse within the Colliery site have been replaced by pipe and channel infrastructure, to allow clean water (CW) runoff from the escarpment to bypass the stockpile area, before discharging into Bellambi Gully creek. Dirty water (DW) runoff from the stockpile area undergoes treatment before discharging via the licensed discharge point (LDP) into Bellambi Gully creek.

In 2009, a hydrological investigation of the CW system at the Russell Vale Colliery site was undertaken by BECA. This considered the 1998 major floods in the Illawarra, which caused coal washout from large volumes of runoff conveying through the coal stockpile area. The assessment included a revision of the existing stormwater system to identify inefficiencies in the system, and proposed measures and upgrades to reduce the likelihood of future failures. The outcome of the assessment led to a number of proposed mitigation measures, one of which being the re-alignment of Bellambi Creek around the stockpile area, via a bypass channel. Additionally, implementation of a wet and dry sediment basin to provide better treatment of DW runoff was proposed for the site.

Replacement of the underground diversion pipeline to a bypass channel was approved in 2011 as part of the Preliminary Works Project approval. Following this, an approval in 2012 was conditioned for the bypass channel works to be completed by 2013.

In 2014, Cardno was commissioned to undertake a flood study to determine the existing flood conditions at the Russell Vale Colliery site. The flood study aimed to present alternative mitigation measures to that presented in the BECA report (2010) in order to reduce flooding impacts downstream of the site, particularly those associated with the impact of coal stockpile washouts on downstream properties as a result of flooding. The scope of this study focused on ensuring that DW runoff from the stockpile area was controlled for the major storm, and directed to Bellambi Gully creek, while preventing contaminated runoff from entering Bellambi Lane. This approach is dependent upon the adequate treatment of controlled runoff, before discharge into Bellambi Gully creek. It is noted that assessment of stormwater treatment requirements was outside the scope of this study, which focused on stormwater conveyance only.

Existing Stormwater System

The stormwater system at the Russell Vale Colliery site currently consists of the DW system and CW system. The two existing stormwater systems are as follows:

1. DW – runoff primarily from the stockpile area and along the conveyor portal are directed to the DW stormwater system for treatment, before discharging into Bellambi Creek via the single licensed discharge point (LDP).
2. CW – runoff through the southern extent of the site flows through the natural Bellambi Gully watercourse before connecting to the 1800 mm diameter main stormwater pipeline. Runoff generated through the centre and along the northern access road falls towards the stockpile area, where it enters a 600 mm diameter pipe. The pipe then connects to the 1800mm diameter main stormwater pipeline. The main stormwater pipeline is 660m in length, and conveys runoff towards the Bellambi Creek licensed discharge point (LDP2), approximately 250m upstream of Princes Highway.

Blockages to the CW system in the past have resulted in flooding of the stockpile area, causing coal washout across the residential area and Bellambi Gully creek downstream of the Colliery site. An approach is required to mitigate this issue for future storm events.

Approach 1 – Clean Water Diversion Channel (BECA, 2009)

The Stormwater Hydrology Review (BECA, 2009) proposes a number of mitigation measures to separate CW runoff (originating from the steep escarpment slopes) from DW runoff (from the coal stockpile), through the provision of separate stormwater systems in events where possible failure would occur. A summary of the proposed measures is as follows:

1. DW – The implementation of both a wet and dry sediment basin is proposed to treat the existing DW from the site. The proposed dry sediment basin would be placed within the stockpile area, and act as the primary settlement basin. An upgrade to the existing sediment basin (wet sediment basin) across the stockpile area access road is proposed to provide secondary settlement treatment.
2. CW – Bund walls adjacent to the access roads, administration building carpark area and existing stormwater channels were proposed to ensure clean water runoff from the steep slopes are conveyed effectively into the existing stormwater channel. Upgrades to the existing diversion channels and flowpaths as well as new diversion drains were proposed upstream of the stockpile area, to ensure clean runoff is effectively captured. A clean water channel is also proposed to replace the existing stormwater pipe across the stockpile area and divert the clean water around the stockpile area.

While CW runoff will be diverted around the stockpile area through a proposed diversion channel, the DW runoff conveyed across the stockpile area would undergo a series of treatment measures prior to discharging into Bellambi Gully creek, immediately downstream of the pit top surface. This approach ensures that the creek downstream is protected as it receives clean storm water via the diversion channel as well as treated dirty stormwater from the stockpile area. A plan showing the proposed measures is provided within the BECA report (2009).

Approach 2 – Access Road Upgrade (Cardno, 2015)

Cardno explored alternatives to provide the suitable outcomes for Wollongong Coal Limited, as well as satisfy the requirements of Council, given that the approach proposed by BECA (2009) to divert CW runoff was considered impractical by Wollongong Coal Limited in terms of operational and cost efficiencies.

Three scenarios were assessed in the Cardno (2015) study, to assess the implications of various blockage scenarios within the system (summarised in **Table 1**).

Table 1 Blockage Scenarios Assessed by Cardno (2015)

Scenario	Details
1	Stormwater systems are completely blocked, i.e. catchment flows are entirely conveyed as overland flows.
2	20% blockage applied to stormwater pipes (i.e. CW and DW systems within the stockpile area). Flows exceeding the capacity of the pipes modelled as overland flows.
3	Stormwater systems are fully functional (i.e. CW and DW pipes are flowing full). Assumes debris control structures are constructed upstream, to reduce the likelihood of culvert blockage. Flows exceeding the capacity of the pipes were modelled as overland flows.

In all scenarios, it was established that runoff from the pit top stockpile areas overtops the stockpile area access road onto Bellambi Lane, causing impacts downstream.

A number of mitigation measures were proposed to reduce the volume of excess runoff entering the stockpile area (refer Cardno 2015 study). They included:

1. The implementation of Debris Control Structures at the existing culvert inlets (1800 mm pipe and M3 culvert) to minimise the probability of failure from blockage and maximise pipe capacities.
2. Rehabilitation of the existing M3 culvert inlet to allow for unrestricted flows at the opening.
3. Upgrade of the 600 mm existing clean stormwater pipe to 825 mm pipe to provide sufficient capacity to convey the 100 year ARI flows.
4. Formalisation of the swale upstream of the 600 mm existing pipe, to provide sufficient capacity to capture CW flows and minimise overtopping onto the stockpile area.
5. Maintenance of existing structures to ensure inlet screens are free from any debris.
6. Implementation of culverts across the access road along the northern site boundary to capture and discharge clean water runoff straight into Bellambi Creek.

While the measures proposed above were found to minimise runoff entering the stockpile area, overtopping onto Bellambi Lane was not eliminated. As such, it was proposed that the access road to the stockpile area be upgraded to ensure flows are contained entirely within the stockpile area. The upgrade proposes for the stockpile area access road level to be increased, and a proposed 6000W x 1200H box culvert be constructed beneath the new road, to convey flows towards a proposed swale before discharging into Bellambi Gully creek. The road should also be constructed with a low point (sag) to allow for overtopping of flows in excess of the culvert capacity. A plan showing the proposed measures is provided within the Cardno (2015) study.

The approved diversion of Bellambi Gully creek (as per BECA, 2009) is not included in this approach. In an event where blockage or system failure occurs, CW runoff upstream of the stockpile area combines with DW runoff from the stockpile area and discharges into Bellambi Gully creek. Treatment of the combined runoff is required in this approach, before discharging into the creek downstream. However, assessment of treatment requirements was beyond the scope of this study. The required treatment for this approach will need to be assessed upon the approval of the proposed flood mitigation works.

Comparison of Approach 1 & Approach 2

A comparison between Approach 1 and 2 is summarised in **Table 2**, with respect to key outcomes resulting from each approach.

Table 2 Comparison of Approach 1 & Approach 2

Details	Approach 1	Approach 2	Comments
Complete separation of CW and DW	Yes	No	CW system is separated from DW stockpile runoff via a diversion swale in Approach 1. In Approach 2, CW is conveyed across the stockpile area (as per existing) where it combines with DW runoff.
Reduce flood impacts on residential properties	Yes (up to 10 year ARI)	Yes (up to 100 year ARI)	Flows originating from the upper catchments (steep escarpment slopes) are diverted around the stockpile area, reducing the amount of flows within the stockpile area in Approach 1. It is predicted that flood impacts in the residential areas downstream of the site will decrease due to the diversion of flows through the proposed diversion channel. Overtopping on Bellambi Lane is eliminated in Approach 2, by means of upgrading the stockpile area access road. Flows are fully contained within the site, reducing flood impacts within the residential areas downstream of the site.
Reduce coal washout onto Bellambi Lane and residential area	Yes (up to 10 year ARI)	Yes (up to 100 year ARI)	Flows up to 10 year ARI will be treated via the proposed wet and dry sediment basins in Approach 1. This reduces/eliminates the amount of coal washout towards Bellambi Lane as well as the residential areas downstream of the site. Flows up to the 100 year ARI will be completely contained within the site in Approach 2. This eliminates overtopping onto Bellambi Lane and through the residential properties up to the 100 year ARI event.
Stormwater treatment	Yes	TBC	Both wet and dry sediment basin were proposed in Approach 1, for flows up to the 10 year ARI. Approach 2 is dependent upon provision of sufficient water quality treatment (note – measures from Approach 1 may be adopted).
Protection of Bellambi Creek (permissible discharge)	Yes	TBC	Discharge from the proposed wet and dry sediment basin in Approach 1 flows into the existing 62 ML control dam prior to discharging into Bellambi Gully via the licensed discharge point (LDP2). The outlet of the LDP2 will remain as existing. As such, the permissible discharge towards Bellambi Gully creek is maintained

Details	Approach 1	Approach 2	Comments
			in Approach 1. The measure proposed in Approach 2 does not account for any conveyance into the 62 ML control dam or other water quality treatment prior to discharge into Bellambi Gully creek. It is unclear if the permissible discharge through the licensed discharge points is still achieved in this approach until further assessed.

Discussion

It has been noted that Approach 2 is dependent upon the provision of sufficient treatment prior to discharge, to ensure protection to the creek downstream. Based on the Water Management Report (BECA, 2010), the permissible discharge into Bellambi Gully under dry weather conditions is 2.5 ML/day. It was noted by the NSW Planning Assessment Commission that monitoring at the licensed discharge point into Bellambi Gully in the current state is within the limits of the Environmental Protection Licence (EPL 12040). However, the Commission also noted that stricter compliance monitoring should be implemented given that the conditions of the Preliminary Work Project approval has changed. We also suggest that the water quality levels within Bellambi Gully creek be re-assessed upon the implementation of the proposed stockpile access road upgrade.

DW discharge through the LDP is expected to increase due to the implementation of the proposed stockpile access road upgrade. As previously advised in the Bellambi Gully Flood Study (Cardno, 2015) and Letter 001 V01 dated 29 August 2014 (Cardno), the proposed access road upgrade is subject to the implementation of a dry sedimentation basin within the proximity of the stockpile area. To ensure that the creek downstream is protected, the proposed dry sediment basin should be located upstream of the access road to ensure that dirty stormwater flows are treated prior to discharge through the LDP.

It is understood that the 6 ML dry sediment basin is proposed in the Stormwater Hydrology Review report (BECA, 2009) will be implemented to improve water quality discharging into Bellambi Gully from the pit top surface area. The proposed basin was based on the assessment that both existing and proposed dirty stormwater will be directed into the basin. However, the report indicated that the design is subject to change upon obtaining details of the stockpile. This condition, coupled with the implementation of the proposed road upgrade may necessitate a review of the proposed 6 ML dry sediment basin design.

Upon the approval of the proposed road upgrade works, the proposed dry sediment basin design should be reviewed/ revised to ensure that runoff conveyed across the stockpile area is treated adequately prior to discharge into Bellambi Gully. The review/ revised dry basin design (upon adoption of the proposed access road upgrade) shall then confirm that the receiving creek downstream of the pit top surface area is fully protected.

Conclusions

It is concluded that:

> Although Approach 1 provides full protection of the creek downstream of the pit top surface area, the option to divert the clean water around the stockpile area was considered impractical by Wollongong Coal Limited in terms of operational and cost efficiencies.

> An alternative approach was proposed (Approach 2), by means of upgrading the access road to the stockpile area (and associated culvert and channel upgrades), to control runoff and prevent coal washout onto Bellambi Lane.

> The proposed Approach 2 does not provide water quality protection to the creek downstream from the pit top surface area. The approach is dependent upon treatment being provided in the form of a dry sediment basin in the vicinity of the stockpile area, upstream of the proposed road upgrade.

> Coal washout onto Bellambi Lane and residential area would be reduced for storms up to the 10 year ARI for Approach 1, and up to 100 year ARI for Approach 2.

> A 6 ML dry sediment basin is to be implemented on the Russell Vale Colliery site based on the outcome of the Water Management Report (BECA, 2010).

> The proposed 6 ML dry sediment basin design may require review to ensure that runoff conveyed across the stockpile area is treated adequately prior to discharge into Bellambi Gully (upon the approval of the proposed road upgrade / channel works).

> Approach 1 and Approach 2 (with associated water quality provisions) provide protection to the creek downstream from the pit top surface area.

Please do not hesitate to contact me if you require clarification on any of the items above.

Yours faithfully,

Shaza Raini
Water Engineer
For **Cardno (NSW/ACT) Pty Ltd**

Reviewed by**,**

Owen de Jong
Senior Water Engineer– MIEAust CPEng
For **Cardno (NSW/ACT) Pty Ltd**

APPENDIX F

Materials Handling Assessment

Report

Wollongong Coal Russell Vale

Materials Handling Assessment

H349494-00000-244-066-0001

2015-07-16	1	Approved for Use	P.Fraser	B. Moore	B. Moore	Not Required
			16/7/2015	16/7/15	16/7/15	
DATE	REV.	STATUS	PREPARED BY	CHECKED BY	APPROVED BY	APPROVED BY

Table of Contents

List of Appendices

Safety • Quality • Sustainability • Innovation

Disclaimer

This assessment was prepared Hatch Pty Ltd, for the sole and exclusive benefit of Wollongong Coal Limited (the "Owner") for the purpose of assisting the Owner to review the materials handling facilities capacity at the owner's site in response to requests from the NSW Planning Assessment Commission for additional information, and may not be provided to, relied upon or used by any third party. Any use of this report by the Owner is subject to the terms and conditions of the Hatch Professional Services Terms and Conditions provided with the proposal to the Owner dated 23 April 2015, including the limitations on liability set out therein.

This assessment is meant to be read as a whole, and sections should not be read or relied upon out of context. The report includes information provided by the Owner and by certain other parties on behalf of the Owner. Unless specifically stated otherwise, Hatch has not verified such information and disclaims any responsibility or liability in connection with such information. In addition, Hatch has no responsibility for, and disclaims all liability in connection with, the sections of this report that have been prepared by the Owner.

This report contains the expression of the professional opinion of Hatch, based upon information available at the time of preparation. The quality of the information, conclusions and estimates contained herein is consistent with the intended level of accuracy as set out in this report, as well as the circumstances and constraints under which this report was prepared. However, this report is a review of an existing facility and, accordingly, all estimates and projections contained herein are based on limited and incomplete data. Therefore, while the work, results, estimates and projections herein may be considered to be generally indicative of the nature and quality of the Project, they are not definitive. No representations or predictions are intended as to the results of future work, nor can there be any promises that the estimates and projections in this report will be sustained in future work.

Findings

Wollongong Coal is proposing to upgrade the surface infrastructure of the Russel Vale Colliery. The objective is to increase the coal production capacity from 1 Mtpa to 3Mtpa. The project includes new coal handling facilities, a 2nd and 3rd Stockpile and associated reclaim systems along with new processing equipment and truck loading bin.

The proposed material handling equipment system capacity has been assessed and we confirm that proposed materials handling infrastructure has the system capacity to handle 3 Mtpa.

1. Introduction

Russel Vale Colliery is proposing an upgrade of the surface infrastructure for the colliery. The objective is to increase the ROM coal production capacity from 1 Mtpa to 3Mtpa.

The project includes new raw coal handling facilities, two new stockpiles and reclaim systems, along with additional processing equipment. The project is currently in a preliminary engineering phase, with an overall concept for raw coal handling, coal processing and trucking being developed to a prefeasibility level.

This report reviews the materials handling infrastructure capacity and the impact of the upgrade on logistics, which includes the planned stockpile sizes, truck traffic at the plant and plant availability/capacity. A simulation model has been applied to verify this production.

The purpose of this assessment is to confirm the annual design capacity of the conveyor and materials handling surface infrastructure.

2. Material Handling System Arrangement

Refer to Appendix A which presents the schematic of the proposed facility. References 1, 2 and 3 from the initial PAC submission have been referenced.

3. Objectives

The primary objectives of the logistics simulation are to assess the materials handling equipment and identify and monitor the following:

1. Stockpile Sizes :
2. Verify throughput capacity of the equipment nominated.

4. Data and Assumptions

The following assumptions and variables are incorporated in the simulation unless otherwise stated.

4.1 Operating Schedules

4.1.1 Plant Shift Schedule

The current colliery shift schedule has been utilised in the assessment of coal production and the materials handling infrastructure. It is assumed that operators are not required on site during all trucking operations (due to automatic operation), and that the materials handling surface infrastructure can be controlled from the control room to facilitate continued loading trucks during trucking hours.

4.1.2 Trucking Hours

Truck loading is available outside of curfew hours, being;

- 7am to 10pm Monday to Friday
- 8am to 6pm Saturdays and Sundays and Public Holidays.

For the purposes of the simulation, public holidays have not been modelled.

4.1.3 Plant Maintenance

Plant planned maintenance shifts have been incorporated based on current maintenance practices at the colliery.

4.2 Longwall Operation

Coal production from the Russel Vale colliery is mined based on the following:.

- Nominal longwall production peak of 2500tph for longwall
- 500tph x 3 units = 1500tph peak from continuous miner development units.

The impact of longwall changeouts has been incorporated in the assessment. A nominal longwall changeout duration of 4 weeks each year has been incorporated.

4.3 Stockpiles

The following stockpiles volumes have been incorporated as per the plant schematic (Appendix A). For the assessment, the initial starting level of the stockpiles has been assumed to be 45% of capacity.

Table 4-1: Product Stockpiles

Type	Total Capacity
SP1 Stockpile	60,000t to 80,000t with 60,000t applied in the model
SP2 Stockpile	140,000t
SP3 Stockpile	140,000t

The total stockpile volumes have been modelled without separately considering direct "free-fall" capacity (volume that direct flows from the hi-line trippers) and "push-out" capacity.

4.4 Truck Load Out Batch Weighing Bin

- This assessment has assumed a conceptual arrangement for the batch weigh bin as shown by Figure 4-1. Detail design of the batch weigh bin is to be undertaken prior to its construction.

Figure 4-1 Modeled truck Loading Arrangement

- Weigh Bin Capacity : 44t, and one truck loading lane
- Truck Capacity: 44t - B Double Truck (upgraded capacity) with trucks queued and available to be loaded.
- Truck loading time has been assumed to be based on the capacity of Conveyor RC4 rate of 2000tph. A weigh bin minimum cycle time of 80 seconds for a 44t load to be loaded into a truck has been incorporated.
- Additional random loading and post truck loading delays are incorporated as per Table 4-2.

Table 4-2 Truck Loading Delays

Loading Delays	Seconds
Minimum	10
Maximum	25
Most Likely	10

4.5 Plant Equipment Capacity

The equipment design capacity is as per the materials handling schematic, refer to Appendix A.

It is assumed that equipment is operated at design capacity.

Table 4-3 - Plant Equipment Capacity

#	Design Capacity	Comments	
CR1	4000tph	Primary Sizer (installed)	-150mm
RV1	4000tph	Stacking Conveyor (installed)	1800mm belt - 4m/s
SC2	4000tph	Stacking Conveyor	1800mm belt - 4m/s
SC3	4000tph	Stacking Conveyor	1800mm belt - 4m/s
RC1	2000tph	Reclaim Conveyor	1200mm belt – 4m/s
RC2	2000tph	Reclaim Conveyor	1200mm belt – 4m/s
RC2a	2000tph	Reclaim Conveyor	1200mm belt – 4m/s
TS1	2000tph	Double Deck Screen	
CR2	2000tph	Secondary Sizer	-50mm
RC3	2000tph	Reclaim Conveyor	1200mm belt – 4m/s
SB1	600t		Surge Bin
RC4	2000tph	Reclaim Conveyor	1200mm belt – 4m/s
WB	44t		Weigh Bin

4.6 Plant Equipment Availability

Equipment modelled in the simulation has unplanned outages that affect the availability of the equipment, simulating breakdowns and unplanned maintenance. The outages are based on a distribution which represents generally accepted equipment availability in the range of 95% to 99% of available operating hours.

5. Results and Discussion

The discrete event simulation was run on an annual basis representing 48 weeks production (accounting for a single longwall changeout of 4 weeks duration).

5.1 Annual Product Coal Production and Trucking

The materials handling equipment capacity has sufficient capacity for 3Mtpa.

The simulation outputs produced accommodate operational scenarios and production considerations.

1. Stockpiles

Additional stockpile capacity provided by SP2 and SP3 provide storage to enable longwall operational hours to be increased and provide surge capacity for longer outages for planned maintenance to be implemented. The combined capacity from the 60kt stockpile SP1 and 140kt SP2 and SP3 are sufficient for approximately 30 days trucking if the longwall is not in production.

2. Conveyor System

The conveyors are sized sufficiently to support 3Mtpa.

3. Truck Loading Batch Weigh Bin

Detail design has yet to be undertaken for the batch weigh bin. Figure 4-1 indicates the assumed and modelled bin arrangement for the simulation. Consideration should be given to the truck loading arrangement and fleet to suit the port stockpiling and vessel loading. The reclaim capacity of the plant is related to the required shipping schedule and timing for port deliveries and port stockpile residence time to PKCT.

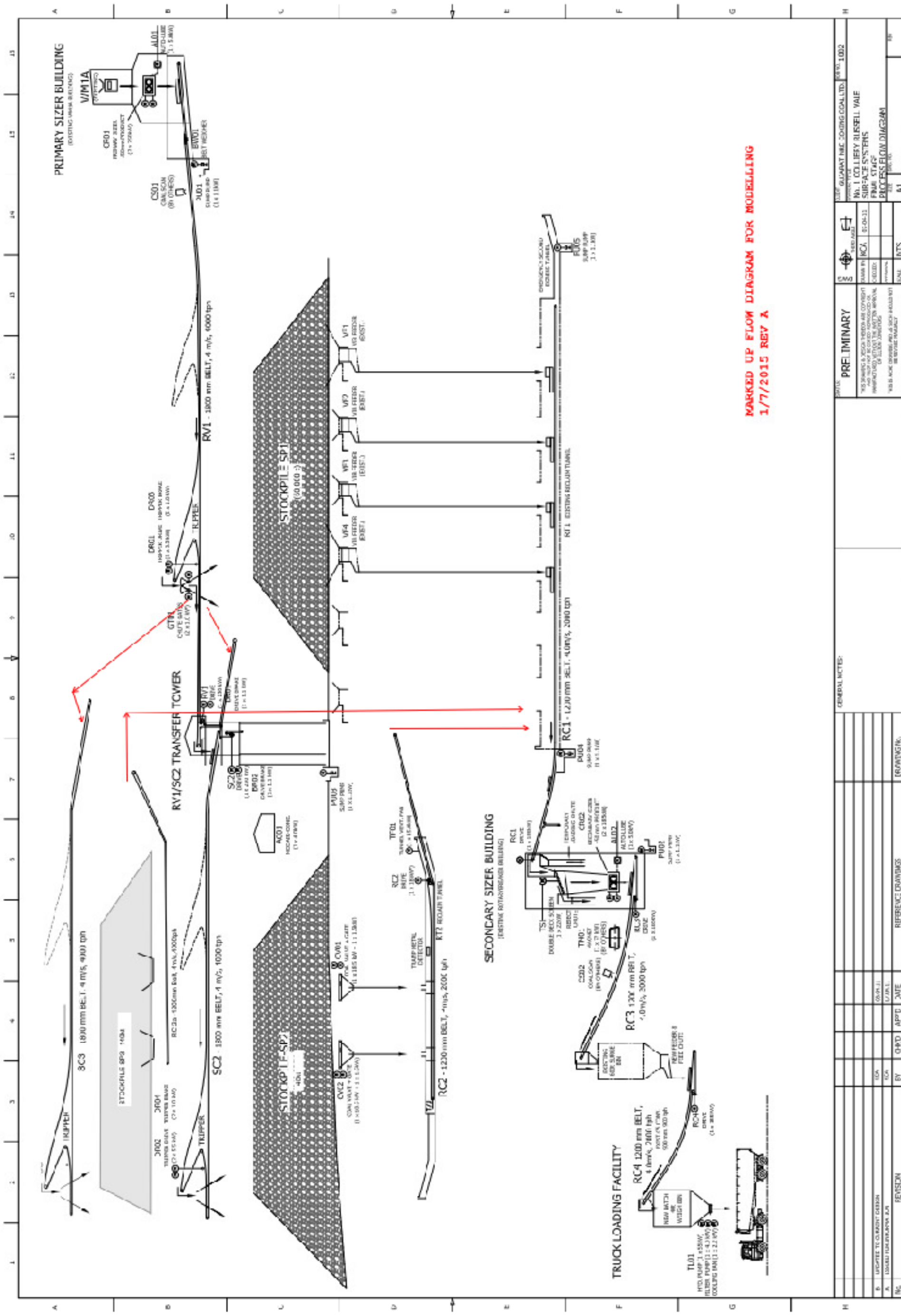
Truck movements are based on the minimum available loading cycle time of 80 seconds (based on design reclaim capacity of 2000tph).

The simulation indicates that the proposed surface infrastructure is sufficient to transport 3 Mtpa within the available truck operating hours.

6. References

1. JBK Engineering - Drawing 282800 Proposed Upgrade 300 kt Stockpile Project Plan, Rev.G
2. JBK Engineering - Drawing 282801 Proposed Upgrade 300 kt Stockpile Project – Long Sections, Rev.E,
3. JBK Engineering - Drawing 282806 Proposed Upgrade 300 kt Stockpile Project – Sections E & F, Rev.A

Appendix A Plant Schematic


PRIMARY SIZER BUILDING
RV1/SC2 TRANSFER TOWER
SECONDARY SIZER BUILDING
TRUCK LOADING FACILITY
MARKED UP FLOW DIAGRAM FOR MODELLING
1/7/2015 REV A
PRELIMINARY