COALPAC CONSOLIDATION PROJECT
ENVIRONMENTAL ASSESSMENT

RESPONSE TO SUBMISSIONS

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For:

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for
Coalpac Pty Limited

1 INTRODUCTION

1.1 BACKGROUND

Since 1989, Coalpac Pty Limited (Coalpac) has owned and operated the Invincible Colliery near the township of Cullen Bullen, located approximately 25 km northwest of Lithgow, NSW. Coalpac acquired the adjacent Cullen Valley Mine and the Lithgow Coal Company in 2008 and each mine operates as an individual entity with separate planning approvals under the *Environmental Planning and Assessment Act 1979* (EP&A Act).

Under the existing development consent for Cullen Valley Mine (DA 200-5-2003 (as modified)), Coalpac has approval to operate an open cut, underground and highwall mining coal mine and associated infrastructure within the Ben Bullen State Forest, producing up to 1.0 Million tonnes of product coal per annum.

Additionally, under the existing Project Approval for Invincible Colliery (PA 07_0127 (as modified)), Coalpac has approval to operate open cut and highwall mining and associated infrastructure within the Ben Bullen State Forest, producing up to 1.2 Million tonnes of product coal per annum.

A Project Application (Number 10_0178) for the Coalpac Consolidation Project (the Project) under Part 3A of the EP&A Act was accepted by the Director-General of the Department of Planning and Infrastructure (DP&I) in October 2010. Environmental Assessment Requirements (EARs) for the Project were issued by the Director-General on 16 December 2010.

The *Coalpac Consolidation Project Environmental Assessment* (EA) (March 2012) was subsequently prepared by Hansen Bailey. The public exhibition period for the EA was during the period 10 April 2012 to 1 June 2012.

1.2 REPORT PURPOSE & STRUCTURE

This report has been prepared in response to the submissions received via DP&I from interested stakeholders during the exhibition period. Input into this report has been provided by the relevant specialists involved in the preparation of the EA, where required. This includes input to **Sections 4.2**, **4.4**, **4.5**, **4.6**, **4.7**, **4.8**, **4.9**, **4.13**, **4.14** and **4.17**.

A summary of all submissions received and the issues raised in each is included in **Appendix A** and a further summary of individual issues raised is included in **Appendix B**. **Appendix C** to **Appendix G** provides supplementary information relating to the noise, blasting, ecological and economic assessments, respectively.

A revised Statement of Commitments (SOC) is included in **Section 5** of this document.

2 SUBMISSIONS

DP&I provided 938 submissions to the EA including those from Government Agencies, Special Interest Groups (SIGs) and individual members of the public. Submissions were received from 15 Government Agencies including:

- Department of Primary Industries – Office of Agricultural Sustainability and Food Security;
- Department of Primary Industries – NSW Office of Water (NOW);
- Lithgow City Council (LCC);
- NSW Environmental Protection Authority (EPA);
- NSW Health – Nepean Blue Mountains Local Health District;
- NSW Office of Environment and Heritage (OEH) – Conservation and Regulation Division;
- NSW Office of Environment and Heritage (OEH) – Environment & Conservation Programs;
- NSW Roads and Maritime Services (RMS);
- Sydney Catchment Management Authority (Sydney CMA);
- Central-West Catchment Management Authority (CW CMA);
- Department of Sustainability, Environment, Water, Population and Communities (SEWPaC);
- Department of Primary Industries – Fisheries NSW;
- Department of Primary Industries – Forests NSW (Forests NSW);
- Country Rail Infrastructure Authority (CRIA); and
- Department of Trade & Investment, Regional Infrastructure & Services - Division of Resources & Energy (DRE).

Additionally, submissions were received from 24 SIG's, including the: Blue Mountains Conservation Society (BMCS), Canberra Bushwalking Club (CBC), Colong Foundation for Wilderness (Colong Foundation), Cumberland Bird Observers Club (CBOC), Delta Electricity (Delta), Greater Blue Mountains World Heritage Advisory Committee (GBMWHAC), Hawkesbury Environment Network Inc. (HEN), Lithgow Environment Group Inc. (LEG), Nature Conservation Council of NSW (NCC), Oatley Flora and Fauna Conservation Society (OFFCS), Confederation of Bushwalkers (COB), Canopy Native Forest Committee (CNFC), The Colo Committee, Columban Mission Institute (CMI), Macquarie Explorers Club Inc. (MEC), Manildra Group, Mountain Devils Bushwalking & Social Club (MDBSC), The Greens NSW, Port Kembla Port Corporation, Ryde - Hunter's Hill Flora and Fauna Preservation Society (RHHFPS), Siteplus, Total Environment Centre Inc. (TEC), TRUenergy, Environmentally Concerned Citizens of Orange (ECCO).

899 submissions were also received from the public. Of these submissions, 767 noted their opposition and 133 expressed support for the Project.

3 SUMMARY OF ISSUES

Submissions from stakeholders provided by DP&I in relation to the Project are listed in **Appendix A**, that presents the various environmental impact categories under which each of the issues can be broadly classified and a dot represents where a stakeholder has raised that issue.

To ensure that the specific issues were appropriately investigated and responded to, a consolidated list of issues was developed and is presented in **Appendix B**. This consolidated list has been categorised according to the environmental issues provided in **Appendix A** allowing the various issues identified by individual stakeholders to be tracked. The consolidated list of issues in **Appendix B** notes where each of the issues raised is addressed within this Response to Submission (RTS) Report.

4 RESPONSE TO ISSUES

This section provides a response to each issue raised in the submissions as summarised in **Appendix A** and indicates by whom each issue was raised.

4.1 SUBSIDENCE

4.1.1 Highwall Mining Subsidence Impacts

Submissions: R6, R11, R15, BMCS, SIG1, SIG3 – SIG9, SIG13, Sig14, SIG21, Petition, P8, P10, P14, P20, P34, P43, P65, P68, P69, P95, P147, P161, P164, P169, P176 -177, P108 - 110, P186 - 7, P191, P198, P208 - 209, P214, P220, P230, P232, P235, P238, P246, P248, P252, P255, P261, P263, 276, P278, P281 - 2, P284 - 290, P292 - 293, P303, P317, P329, P331, P341, P344, P346, -P349 - 50, P352, P360, P370, P372, P380 - 2, P387, P390, P397, P400, P402, P413 - 417, P420, P424, P438 - 42, P446, P449, P452, P458, P472, P475, P477, P484, P489, P491 - 92, P496, P498, P511 - 514, P518, P520, P522, P527, P546, P548 - 51, P558, P561 -565, P569 - 572, P587 - 88, P593 - 595, P599, P605 - 608, P613, P615, P619, P621, P625, P629 – 632, P634, P638, P640 – 642, P645, P652 - 655, P662, P670, P673, P678 - 679, P688, P699, P706 – 707, P717, P724, P728 – 733, P739, P745 – 746, P752, P768 – 779, P781 - 783, P786, P801, P810, P813, P818, P820, P821, P824, P838, P841, P844, P846, P849, P852 – 854, P856 – 857, P872, P874, P879, P886, P895, P899 - 901

A number of submissions raised concerns regarding the highwall mining methods proposed for the Project. In particular, the potential for cumulative subsidence impacts to the stability of the sandstone pagoda and escarpment formations within the Project Boundary due to the highwall mining method of the target seams was raised. A number of individual submissions also noted that the highwall mining method would be inherently dangerous for the Project workforce.

Highwall mining is a well proven and widely applied mining method with more than 70 systems currently operating around the world in a wide range of mining conditions and is based on sound, well researched geotechnical design parameters.

Highwall mining is analogous with first workings in an underground coal mine which are routinely permitted beneath subsidence sensitive areas (such railway lines, gas pipelines, etc) in that it is configures so to not trigger surface subsidence. As noted in Section 8.1 and Appendix F of the EA (GEONET 2011), the highwall mining method is proposed for the Project under sensitive escarpment and pagodas to minimise surface impacts to these features to less than 20 mm. This is in marked contrast to longwall mining or pillar extraction systems which rely on significant surface subsidence as a result of either secondary extraction or caving and as a core part of the mining process.

Highwall mining geotechnical design relies on two key stability components:

- The immediate roof of the entry or tunnel; and
- The coal pillars left between entries.

The entry or tunnel is typically 3 m in width compared with 5.5 to 6 m for conventional underground workings. However, highwall mining entries rely entirely upon the self-supporting capacity of the immediate roof, whereas conventional underground roadways have roofbolts and other geotechnical support systems installed to reinforce the roof.

In highwall mining, where the stability of the immediate roof cannot be achieved, due to localised jointing or faulting for example, the entry will either be stopped short of the target penetration length or abandoned completely.

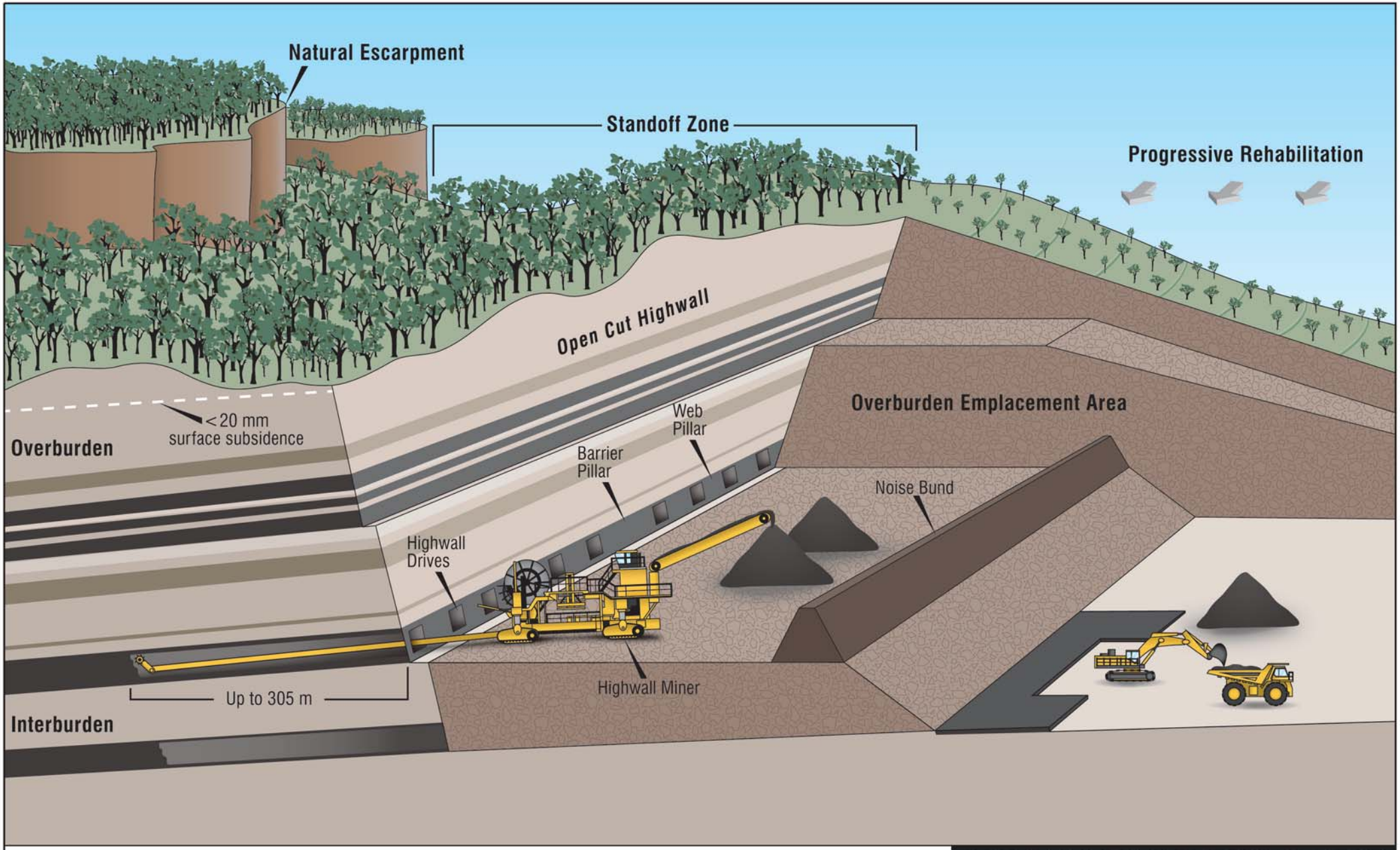
The stability of the immediate roof of the entries can be continuously monitored via the video link to the continuous miner as it progresses down the entry. The narrow width of the entry limits the impact of any instability in one entry on adjacent entries.

The coal pillars left between highwall mining entries are unusual (when compared to pillars in an underground bord and pillar mining layout) in that they are typically up to 305 m in length. This extreme geometry compared to conventional rectangular underground pillars greatly increases their strength and hence their stability. In addition, larger width barrier pillars are left at regular intervals to add a further layer of support to the overall mining layout (see **Figure 1**). The layout of highwall mining panels also allows for flexibility in pillar and barrier pillar widths, thereby permitting a rapid response to changing geological conditions (i.e. pillar widths can be immediately increased (or decreased) as geological and geotechnical conditions change). Areas where the risk of instability is unacceptable can be avoided by not mining selective highwall mining entries.

The stability of the coal pillars can similarly be continuously monitored via the video feed from the continuous miner. In addition the guidance system on the continuous miner provides an accurate record of the location, width and height of the coal pillar.

The overall stability of the mining layout can be monitored longer term via regular aerial digital photogrammetric surveys providing detailed information regarding any movement in the cliffs and without the need to physically survey the pagoda and the cliff top habitats. This data can be used to validate the Subsidence Management Plan (SMP) in the same way that reviews of the effectiveness of other underground mining methods are conducted.

The condition of the cliff faces and immediate cliff top areas would also be monitored before, during and after highwall mining to manage and minimise any impact from mining operations. This process is described in more detail in **Section 4.1.2**, with measures to manage potential blast impacts to the escarpments and pagodas outlined in **Section 4.6.5**.



Hansen Bailey

Coalpac Pty Ltd

COALPAC CONSOLIDATION PROJECT

Highwall Mining Schematic

Filename:1153-30-40 Fig 16 Highwall Mining Schematic.ai	Date: 14.12.11	Drawn: BD	Figure 1

4.1.2 Highwall Mining Management and Mitigation

Submissions: R6, R11, R12, R15, BMCS, SIG1, SIG3 – SIG9, SIG13, Sig14, SIG21, Petition, P8, P10, P14, P20, P34, P43, P65, P68, P69, P95, P147, P161, P164, P169, P176 - 177, P108 - 110, P186 - 7, P191, P198, P208 - 209, P214, P220, P230, P232, P235, P238, P246, P248, P252, P255, P261, P263, 276, P278, P281 - 2, P284 - 290, P292 - 293, P303, P317, P329, P331, P341, P344, P346, -P349 - 50, P352, P360, P370, P372, P380 - 2, P387, P390, P397, P400, P402, P413 -17, P420, P424, P438 - 42, P446, P449, P452, P458, P472, P475, P477, P484, P489, P491 - 92, P496, P498, P511 - 514, P518, P520, P522, P527, P546, P548 - 51, P558, P561 -565, P569 - 572, P587 - 88, P593 - 595, P599, P605 - 608, P613, P615, P619, P621, P625, P629 – 632, P634, P638, P640 – 642, P645, P652 - 655, P662, P670, P673, P678 - 679, P688, P699, P706 – 707, P717, P724, P728 – 733, P739, P745 – 746, P752, P768 – 779, P781 - 783, P786, P801, P810, P813, P818, P820, P821, P824, P838, P841, P844, P846, P849, P852 – 854, P856 – 857, P872, P874, P879, P886, P895, P899 - 901

As outlined above in **Section 4.1.1**, the potential for the highwall mining methods proposed for the Project to impact on the stability of the sandstone escarpment and pagoda formations within the Project Boundary was raised in a number of submissions. As noted in Section 8.1 of the EA, the Assessment of Stability and Subsidence completed for the Project highwall mining operations by GENOET (2011) was undertaken in accordance with the intent of the *NSW Department of Mineral Resources Subsidence Management Plan* (2003) and Department of Trade and Investment, Regional Infrastructure and Services – Mineral Resources *Mine Safety Operations Guideline, Coal Technical Reference CTR-001* (2008). The assessment found that Project highwall mining operations can be designed to ensure that no subsidence impacts will endanger surface features or ecology.

Further, in accordance with Section 8.1.5 of the EA, Coalpac will prepare a detailed Mining, Rehabilitation and Environmental Management Plan (MREMP) for the Project prior to the commencement of highwall mining operations. This document will be prepared in consultation with DTIRIS-DRE and to the approval of DP&I and include specific design reports or an extraction plan to ensure that appropriate management and mitigation measures are included in highwall mining designs and Highwall Mining Management Plan to be prepared for the Project. These mitigation and management measures (consistent with those outlined in Section 8.1.5 of the EA) include the following:

- Final highwall positions and orientations will be assessed to take structural geology into account to promote stability in the exposed jointed highwalls;
- Limiting designed surface subsidence to below the relevant 20 mm criteria;
- Design highwall mining panels to minimise the potential impact upon any nearby pagoda and escarpment formations;

- Design of pillars will take into account the likely entry azimuth deviations based on Original Equipment Manufacturer's advice; this will be further mitigated by a suitable guidance system;
- Groundwater modelling for the Project confirmed that minor water inflows are expected from the Lithgow seam (Section 8.10.3 of the EA). However, investigation is required of the groundwater table in the rock mass so as to be aware of potential releases that could occur in highwall mining drives. Further, while it is considered that the large volume of water stored in the historic flooded underground workings of Old Invincible Colliery will remain unaffected by the Project, further monitoring of the condition of these historic groundwater volumes stored in these workings will be undertaken;
- Highwall mining drives in the Lithgow Seam will maintain a minimum 20 m offset from previous underground mining operations in order to avoid breaching any flooded workings or initiating instability from previously damaged rock mass conditions;
- Conducting gas measurements from exploration bore cores prior to highwall mining to establish the background levels of gas and to confirm negligible risk. Since public exhibition of the EA, Coalpac commissioned emissions testing of a number of exploration cores within the proposed Project Boundary by CSG Partners (2012). Based on the total desorption values and the analysis of the cores for fugitive emissions, background gas levels were found to be in the "low gas" zone;
- Barrier pillars are an essential part of highwall mining panel design; they effectively create a panel of entries and pillars, and isolate that panel from the next, allowing stress to arch from one panel to the next. Barrier pillars will be created by leaving a minimum of one entry unmined. This will create barrier pillars that are stable in the long term. Barrier pillars will be located at the sub-critical spans that are calculated from the combined influence of overburden thickness (creating overburden load or vertical stress) and highwall mining entries or underground workings in other seams above or below the seam for which the design is being completed. The effect of barrier pillars located at sub-critical spans is to reduce overburden stress loading conditions by forming a stable stress arch in the overburden which in turn minimises subsidence of the surface strata as part of the overall design methodology; and
- Conduct and document regular surveys and inspections associated with the highwall joint conditions, joint orientations and overall stability of the highwalls, to be undertaken by appropriately qualified geotechnical specialists. Geotechnical mapping of highwalls and regular pagoda and escarpment inspections via physical or photogrammetric methods will be carried out as design and risk assessment inputs; and

- Preparation of a Highwall Mining Plan based on the results of site investigation, design, mapping and inspection regimes. This document shall include (but not be limited to) the following:
    - o A Hazard Map (vertical elevation) of the highwall, defining and locating any significant hazards and potential zones of localised (small scale) instability. The highwall mining layout will be aligned with a surveyed baseline. This baseline will be set out and validated by the mine surveyor. Any other localised hazards or restrictions to work practices shall be included on the Hazard Map;
    - o Highwall Mining Plan (plan view) showing the pillars and Barrier Pillars, survey baseline, toe position, crest position, surface features including pagodas and escarpments/cliffs and any other significant features;
    - o Risk Assessment specifically addressing the risk of instability of the highwall (large scale) that could threaten any surface cliff and pagoda features, and the risk of pillar instability and surface subsidence >20 mm (the design criteria); and
    - o The above three instruments of the Highwall Mining Plan shall be signed off by a competent and suitably experienced highwall mining geotechnical engineer, the Manager of Mining Engineering for the Project, and wherever applicable, the DRE Inspector of Mines.

4.1.3 Highwall Mining Safety Issues

Submission: SIG3

One submission noted that the proposed highwall mining method is inherently dangerous to the Project workforce.

The highwall mining equipment is remotely operated with no operators required to enter the underground entries at any stage. The highwall mining equipment has no personnel within 10 m of the highwall, a zone from the highwall face wherein the majority of rockfalls commonly occur. The equipment also offers Falling Object Protection structures (rated to Australian Standards) for personnel away from and outside of this 10 m zone.

A key objective of the Project Stability and Subsidence Assessment (GEONET 2011) was to design the proposed highwall mining operations for the Project to ensure that surface subsidence would be minimised to less than the 20 mm criteria. This criterion ensures a design that will create a stable pillar layout at the highwall for workforce safety; this occurs automatically as a result of effectively designing pillars for the maximum overburden thickness which occurs at a distance away from the open cut highwall.

As discussed in **Section 4.1.2**, the design of highwall mining operations will be undertaken in consultation with DRE and to the approval of DP&I and include a number of mitigation and management measures that shall be incorporated into the Project MREMP and Highwall Mining Management Plan.

In addition to the discussion of design parameters, these plans will outline operating procedures to ensure the safety of the Project workforce during highwall mining operations. As outlined above, the highwall mining system is operated in a highly controlled and well-engineered environment, affording operators safe working conditions.

4.2 AIR QUALITY

4.2.1 Proactive Air Quality Monitoring

Submission: R3

A proactive real-time monitoring system will be installed to form the centrepiece of the Air Quality Management Plan (AQMP) to be prepared in consultation with relevant regulators for the Project. Management commitments additional to that presented in the EA to be included in the AQMP are outlined in **Section 4.2.18** of this RTS.

4.2.2 Mitigation Measures for Bund Construction

Submission: R3

This submission noted the potential for additional dust impacts to occur from the construction of the Project amenity mitigation bunds.

Dust from the short term construction work such as the construction of visual and noise bunds will be managed and mitigated to minimise dust emissions. These mitigation measures will include:

- The use of suitably rated water sprays during dust generating operations;
- Immediate rehabilitation (using native grass seed or hydroseeding where bunds are adjacent to public areas such as the Castlereagh Highway) for those bunds which are to remain in place for more than six months;
- The application of chemical dust suppressants or other binding agents to short term soil stockpiles or those that will not be progressively rehabilitated; or
- Limiting earthmoving operations to favourable meteorological conditions.

The appropriate mitigation measure will depend on the location of the bunds and duration of the activities, as well as determining what is practical for the local terrain.

4.2.3 Sealing of the Main Internal Haul Road

Submission: R3

One submission requested that the option of sealing the internal haul road be considered to minimise dust impacts.

While consideration has been given to such options as part of the EA process, it was been considered impractical due to the transient nature of the road and the type of surface required to facilitate the movement of fully laden haul trucks.

As described in Section 11.3 of the Project Air Quality Impact Assessment (AQIA), Coalpac is committed to reducing dust emissions from haul trucks travelling on the internal haul road by the use of water carts to apply Level 2 watering. Further detail on Coalpac's commitments to leading practice dust management is included in **Section 4.2.6** and **Section 4.2.18**.

4.2.4 Deficiencies in AQIA Emissions Inventory

Submission: R4, R5

In their submission, the EPA noted two main deficiencies in the emissions inventory presented in the AQIA for the Project, being:

> *"1. No site specific parameterisation was provided to quality emission variables; and*
>
> *2. Wind blown dust emission estimation techniques used are not the most up to date methods."*

Responses to each of the issues raised by the EPA are below:

1. It should be noted that the dispersion modelling for this Project was carried out many months before the Dust Stop Pollution Reduction Program (PRP) process was implemented. As such, the outcomes of that process did not explicitly form part of the Project AQIA. The most recent PRP for Coalpac, submitted on 29 June 2012 for the Cullen Valley Mine (Cullen Valley PRP 2012) included a plan for measuring site specific parameters on a regular and ongoing basis. These parameters include silt and moisture contents of overburden, ROM and product coal, as well as silt content of unsealed haul routes. This plan will be incorporated into the AQMP and adopted for the Project, if approved. Further detail on this issue is provided in **Section 4.2.5**.
2. The emission factor used to determine wind-blown dust on exposed areas was 0.4 kg/ha/hr (SPCC 1983), and was readily adopted and accepted at the time of modelling. The more recent AP-42 factor of 0.1 kg/ha/hr, is 75% lower and therefore less conservative than that applied in the Project AQIA.

4.2.5 Use of site specific data

Submission: R4, R5

One submission noted that site specific data should be used as input variables for the emission factor equations to enhance the reliability of the emissions estimation techniques applied in the AQIA.

As discussed in **Section 4.2.18**, a measurement plan has been developed as part of Coalpac's response to the PRP requirements for the Cullen Valley Mine, and this will be adopted throughout their operations as part of the Project, should it be approved. The parameters to be measured and the frequency of these measurements are summarised in **Table 1**.

Table 1
Site Specific Control Efficiencies

Parameter	Measurement Method / Standard	Frequency
% moisture content (overburden dumps, ROM coal and product coal)	US EPA AP42 Appendix C.1 Procedures for Sampling Surface / Bulk Dust Loading US EPA AP42 Appendix C.2 Procedures for Laboratory Analysis of Surface Dust Loading Samples	Annual
% silt content (overburden dumps, ROM coal and product coal, haul roads)	US EPA AP42 Appendix C.1 Procedures for Sampling Surface / Bulk Dust Loading US EPA AP42 Appendix C.2 Procedures for Laboratory Analysis of Surface Dust Loading Samples	Annual
Threshold Friction Velocity for coal piles and exposed areas	US EPA AP42 Chapter 13.2.5	Annual
Dust Extinction Moisture Level (DEM[1]) (ROM and product coal)	AS 4156.6 – 2000 Coal Preparation Part 6: Determination of dust/moisture relationship for coal	One off (for each coal type or new seam)

[1] DEM is defined as the moisture level at which dustiness is reduced to a level of 10 (i.e. minor dust emissions expected during bulk handling operations).

4.2.6 PRP Reporting for Existing Operations

In their submission, the EPA referred to the recent Dust Stop PRP report submitted by Coalpac for Invincible Colliery (i.e. post-EA exhibition) and noted the relevance of the document review to the Project in terms of site specific data in emissions estimates. The EPA also considered that the particulate emission control efficiencies reported in the AQIA had not been clearly justified.

It is understood that the Invincible PRP (Invincible PRP 2011) review is relevant for the Project going forward. However, it must be noted that the AQIA modelling for the Project was completed well in advance of the implementation of the PRP process. The Cullen Valley Mine PRP has adopted the relevant review comments and proposed a plan for measurement and monitoring that will be carried over to the Project's AQMP should it be approved (see **Section 4.2.5**).

Further, on 9 May 2012 (more than 12 months after the modelling for the AQIA was completed), the EPA held an information session and workshop to provide feedback to consultants and mining companies on the dust PRPs received to date.

A key outcome of the workshop was that the control effectiveness of both existing and proposed best practice should be measured and reported, as follows:

"*Control effectiveness must be supported by:*

- *Key performance indicator*
- *Monitoring method*
- *Location, frequency and duration of monitoring*
- *Monitoring data records and analysis*
- *Management procedures*"

In accordance with EPA expectations, the following Key Performance Indicators (KPIs) were proposed as options for the Cullen Valley Mine PRP. These KPIs will be adopted across all operations as part of the Project, if approved, and included in the AQMP.

KPI-1 – Emissions of PM_{10} per tonne of ROM coal

This headline KPI will provide an indication of the overall 'dustiness' of the mine relative to its production, as a combination of all activities. It makes direct use of the emissions inventory compiled for the PRP process, and rather than simply measuring the total dust emissions, it is expressed as a proportion of the production rate.

The value of KPI-1 will change each year as the generation of PM_{10} is dependent on any changes in the distribution of mining activities such as lengths of haul roads and dozer hours. However, if these things remain relatively similar each year, a downward trend in the KPI over time will indicate the effectiveness of the control measures that are implemented. KPI-1 will be recalculated on an annual basis (for the Annual Review).

This KPI will be improved by using the site specific input data listed in **Table 1**. Further details for this KPI are outlined in **Table 2**, along with objectives, targets and reporting requirements. A site specific procedure will be developed for this KPI if the Project is approved.

KPI-2 – Control of PM10 Emissions

This KPI will quantify the progress of the Project towards achieving best practicable controls on PM_{10} emissions. It provides a measure of improvement of the mine as a whole, by combining the efficiency of each individual control. It is therefore not dependent on such variables as productivity, VKT and dozer hours as is the case for KPI-1.

The current control measure for each mining activity is compared to the best practically achievable control measure for that activity. This ratio is then weighted according to the contribution of that uncontrolled activity to the total uncontrolled annual emission. A mine that is operating with best practicable controls on activities producing the majority of emissions would score close to 100.

This KPI will be recalculated annually and it is recommended that it be improved by using site specific data, as outlined **Table 1**. Further details about the KPI, including the metric, objectives, targets and reporting requirements are outlined in **Table 2**.

A site specific procedure will be developed and included in the AQMP for this KPI if the Project is approved.

KPI-3 – Opacity (visible dust emissions)

This KPI is designed to provide an indication of visibility dust emissions at the mine site. There are various methods for monitoring opacity, and the chosen method would determine the monitoring locations and intervals.

Further details for KPI-3 are outlined in **Table 2**, including the various methods and standards for measurement, objectives and targets and reporting requirements.

A site specific procedure will be developed for this KPI for inclusion in the AQMP if the Project is approved, relevant to the chosen opacity monitoring method.

KPI-4 – Watering intensity for haul roads

Hauling on unpaved roads is the major contributor to total dust emissions. Controlling emissions from this activity is therefore important, and there are measures which can produce significant reductions, including:

- Increasing watering rates;
- Use of chemical dust suppressants; and
- Use of low silt aggregate materials.

A control efficiency of 75% was assumed for the Project assessment, equivalent to Level 2 watering (see Section 11.3 of the AQIA). The existing site specific control efficiency for haul roads for watering is unknown, but this will be determined for inclusion in the AQMP.

Where the site specific control efficiency is found to be less than 75%, the watering application rate required to achieve 75% control can be determined and used for tracking and reporting against this KPI.

Further details for this KPI are outlined in **Table 2**, including objectives and targets and reporting requirements. A site specific procedure for the Project will be developed for this KPI, relevant to the chosen monitoring method. The options for the measurement of site specific control efficiencies are outlined in **Table 3**.

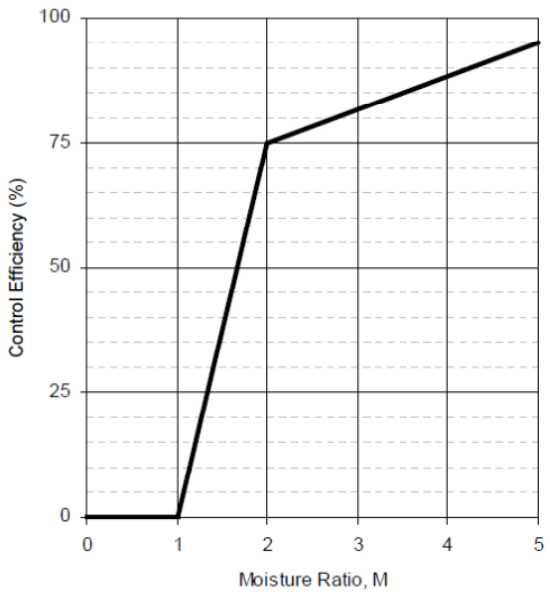
Table 2
KPIs for Best Practice Air Quality Management

Metric	Method / Standard	Objective / Target	Frequency	Report
KPI-1 – Annual emissions of PM_{10} per tonne of ROM coal (kg PM_{10}/t ROM)				
This KPI is defined as follows: $$K1_y = \left(\frac{E_{PM10}}{M_{ROM}}\right)_y$$ Where: K1y is the value of KPI-1 (in kg of PM_{10} per tonne of ROM coal) in year y E_{PM10} is the total emission of PM_{10} from the mine (in kg, with current controls) in year y M_{ROM} is the mass of ROM coal (in tonnes) mined in year y	Annual dust emissions inventory using PRP emissions inventory template	Downward trend in PM_{10}/ROM ratio until best practicable control is achieved	Annual (matching 12 month reporting period for Annual Return)	Include in AEMR
KPI-2 – PM_{10} Emission Control (%)				
This KPI is defined as follows: $$K2_y = \left(\frac{CF_i}{CF_{i-B}}\right) \times 100$$ Where: K2y is the value of KPI-2 (%) in year y CF_i is the current control factor for activity i in year y $CF_{i\text{-}B}$ is the best practicable control factor for activity i	Annual dust emissions inventory using PRP emissions inventory template in conjunction with site specific measurements of individual parameters and control efficiencies.	Progression towards 100%. This indicates that the mine is doing everything practicable and achievable within the constraints of operations, to reduce emissions.	Annual (matching 12 month reporting period for Annual Return)	Include in AEMR

Metric	Method / Standard	Objective / Target	Frequency	Report
KPI-3 – Opacity (Visible Dust Emissions)				
This KPI is defined as follows: $K3_y = \bar{k}_y$ Where: K3y is the value of KPI-3 (dimensionless) in year y $\bar{k}$y is the average opacity in year y	Visual Observations US EPA Method 9 – Visual Determination of the opacity of emissions from stationary sources San Joaquin Valley Air Pollution Control District (SJVAPCD) Rule 8011 General Requirements (Appendix A – Visual Determination of Apacity)	<20% Opacity at source - hauling, open pit and stockpile area	Weekly	Weekly operators log.
	Digital Imagery ASTM WK 30382 *"New Test Method for Determining the Opacity of Fugitive Emissions in the Outdoor Ambient Atmosphere, Using Digital Imagery"*	<20% Opacity at source	Continuous	
KPI 4 - Watering Intensity for Hauling (L/VKT)				
This KPI is defined as follows:	N/A	No less than the level of watering (L/VKT) to achieve the site specific control efficiency.	Annual	Include in AEMR

Metric	Method / Standard	Objective / Target	Frequency	Report
$K4_y = \left(\frac{W_{Haul}}{VKT_{Haul}}\right)_y$ Where: K4y is the value of KPI-3 (in litres per vehicle-kilometre) in year y W_{Haul} is the total amount of water applied to haul roads in year y VKT_{Haul} is the total number of vehicle-kilometres on haul roads in year y		(Derived through site specific determination of watering control effectiveness)		

Table 3
Site Specific Control Efficiencies

Parameter	Measurement Method / Standard	Frequency
Site Specific Watering Control Effectiveness	Mobile emissions monitoring device for unpaved roads. Method uses equipment designed to make direct measurements of dust concentrations as a result of vehicle traffic on the roadway as it travels. The system was developed by PAEHolmes for ACARP (publication pending).	Seasonal
	Control Efficiency determined by linear relationship between control efficiency and moisture content of surface, shown below.  Moisture Ratio (M) as defined by US EPA AP 42 Chapter 13.2.2 Unpaved Roads: $$M = \frac{Moisture\ content\ of\ watered\ road}{Moisture\ content\ of\ unwatered\ road}$$ Moisture Content determined by: - STM D2216-10 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass - STM D1557-09 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft (2,700 kN-m/m))	Seasonal

4.2.7 Emissions Factor for Wind Blown Dust Emissions

Submission: R4

The OEH noted that:

> *"The assessment calculated wind blown dust emissions based on the State Pollution Control Commission (SPCC) emission factor of 0.4 kg/ha/hour published in 1983. The EPA advises that this is not the most up to date emission factor available."*

In their submission, the EPA stated that the wind blown dust emissions factor used for the AQIA was not the most up to date.

As discussed in the **Section 4.2.4**, the factor used in the AQIA is more conservative than the AP-42 0.1 kg/ha/hr factor suggested by the EPA.

4.2.8 Emissions Estimation Methods

Submission: R4

The EPA submission included comment on the requirement for USEPA AP-42 emissions estimation techniques to be used, with US EPA (2006), AP-42 Chapter 13.2.5 Industrial wind erosion to be used to estimate emissions on shorter time scales.

The method contained within USEPA AP-42 Chapter 13.2.5 takes into account site specific wind data, site-specific erodible material properties (threshold friction velocity, particle size distribution of the material eroded) and the frequency of material disturbance. Notwithstanding the data intensiveness of this approach, exercises in applying this method in Hunter Valley coal mines to date (e.g. Integra Complex, Ravensworth Operations) have resulted in little or no wind initiated dust lift-off emissions being predicted from active mine sites due to the magnitude of the measured frictional velocities. Furthermore, the meteorological parameters required to use this equation effectively are not measured anywhere in Australia, including at Bureau of Meteorology monitoring stations. It is PAEHolmes' opinion that the best approach was to use the conservative emission factor of 0.4 kg/ha/hr (see **Section 4.2.4**).

4.2.9 Threshold Frictional Velocity Measurements

Submission: R4

The EPA submission also noted that:

> *"The assessment chose not to use the US EPA methodology on account of no site specific threshold friction velocity information being available. The EPA notes that mining operations are already occurring on the proposed project site. Additionally, Invincible Colliery has submitted a report to the EPA under the requirements of Dust Stop PRP. On this basis, site specific information such as threshold friction velocity should have been available and used in the assessment."*

As noted in **Section 4.2.5**, the threshold frictional velocity is one of the parameters that will be measured as part of the plan to determine site specific emissions for the Project (see **Table 1**).

4.2.10 Calculation of Wind Erosion and Dust Emissions

Submission: R4

The EPA noted in their submission that wind erosion for the Invincible Colliery component of the Project had been calculated in accordance with the methodology presented in USEPA (1998) and stated that the wind blown dust emissions for the Project as a whole may be significantly under estimated.

Three sources of wind erosion were identified in the Invincible mining area emissions inventory for Year 2 of the Project. These were the active mining area, the active dumping areas, and the main coal stockpiles. **Table 4** shows the respective emissions calculated for the Project assessment, and those presented by the EPA in their response.

Table 4
Estimated Emissions from Wind Erosions at Invincible Mining Area (Year 2)

Wind erosion source	Project AQIA calculated TSP emissions (kg)	EPA calculated TSP emissions (kg)	Difference[a] (kg)
Active mining areas	10,862	2,635	8,227
Active dump areas	38,719	9,393	29,326
ROM and product stockpile	5,859	80,417	-74,558
Total	55,440	92,445	-37,005

[a] *A negative value equates to an under-estimate in the Project assessment according to the EPA calculation*

As noted above in **Section 4.2.8**, all wind erosion estimates made in the Project assessment used the 0.4 kg/ha/hr emission factor. The EPA calculations for wind erosion on active mining and dumping areas use the 0.1 kg/ha/hr factor presented in Chapter 11.9, Table 11.9-4 of the AP-42.

As shown in **Table 4**, by applying the EPA's calculations, the Project AQIA has therefore over-estimated emissions from these sources by a factor of 4. However, it appears the EPA has used a different factor (1.8 x wind speed) from Table 11.9-2 of the same AP-42 chapter to quantify wind erosion emissions from the ROM and product stockpile.

While it is true that this would result in a higher total emission (using an average wind speed of 3 m/s), half of this increase is cancelled out by the over-estimation from the other two wind erosion sources.

The resultant under-estimate of emissions from wind erosion is therefore just over 37,000 kg for that year. This equates to a small fraction (approximately 1%) of the total TSP emission from the Project and based on PAEHolmes experience in dispersion modelling of coal mines, an increase in emissions at the source of less than 10 - 20% will have minimal impact on predictions at receptors.

4.2.11 Emission Control Efficiency

Submission: R4

In their submission, the EPA noted that:

> *"Emission control efficiencies are included in tables C.1, C.2, C.3 and C.4 of the assessment. Hauling on unpaved roads and wind erosion are the only two source types that have an emission control efficiency applied to the calculated emission factor."*

This statement is correct.

4.2.12 Haulage Emissions

Submission: R4

The EPA provided the following comparison of controlled and uncontrolled hauling emissions in their response:

> *"All hauling emissions are assumed to be controlled by 75% through "Level 2 watering" (assessment Table 11.1). Predicted project hauling emissions are summarised and compared to total project particulate emissions in Table 1 below.*
>
> *Table 1: Summary of Hauling Emissions (TSP)*

Emission Quantity	***Controlled Hauling Emissions***	***Uncontrolled Hauling Emissions***	***Difference Uncontrolled to Controlled Emission***
Total hauling emissions (kg/year)	*920,157*	*3,680,628*	*2,760,471*
Total project emissions (kg/year)	*2,287,280*	*5,627,751*	*2,760,471*
Hauling as percent of total project emissions	*32%*	*65%*	*96%*[1]

1 - Emission difference as a percentage of modelling emissions

> *Based on the assumed haul road control, Table 1 above shows a 2,760,471 kg/year reduction in particle emissions. The calculated emission reduction from haul road control is equivalent to·96% of total modelled particulate emissions from the consolidation project (Year 2). On this basis, it is critical that hauling emission controls assumed in the assessment are achieved in practice."*

It is unclear why the difference in uncontrolled and controlled haulage emissions has been compared in this way to the controlled Project emissions other than to show that haulage is the dominant source and therefore needs to be controlled as much as practicable. The percentage of the total emission that haulage comprises is reduced from 65% to 32% by implementing the watering control.

It is noted that the critical nature of controlling emissions from haulage has been identified in both the Invincible and Cullen Valley PRP documents (Cullen Valley 2012 and Invincible Colliery 2012) prepared subsequently to the Project AQIA and that options for implementing these controls have were costed accordingly as part of that process. Methods to ensure that these control efficiencies are met in practice are also outlined in the Cullen Valley PRP, and committed to for the Project in **Section 4.2.6**.

The graph in **Table 3** presents the relationship between the instantaneous control efficiency due to watering and the resulting increase in surface moisture. The moisture ratio "M" (shown on the x-axis) is calculated by dividing the surface moisture content of the watered road by the surface moisture content of the uncontrolled road. As the watered surface dries, both the ratio (M) and the predicted instantaneous control efficiency (shown on the y-axis) decrease. The graph shows that between the uncontrolled surface moisture content and a value twice as large, a small increase in moisture content results in a large increase in control efficiency. Beyond that, control efficiency grows slowly with increased moisture content.

For example, if the uncontrolled surface moisture content was 2%, and the addition of water increased this to 4%, the moisture ratio (M) would be 2.0 and a 75% reduction in emissions could be achieved. However, increasing the surface moisture content further to 6% (M=3) would only result in an additional 5% control.

Notwithstanding the above, it is clear that while returns diminish beyond 75% control, theoretical control efficiencies from the application of water alone may reach up to 95%. In the absence of any site specific testing for the Project, a conservative assumption of 75% control for haulage emissions is therefore reasonable.

4.2.13 Wind Blown Dust Emissions

Submission: R4

This submission provided the following comment in relation to wind blown dust emissions:

> *"Wind blown emissions from exposed surfaces have an assumed control efficiency of 50%, while wind blown emissions from stockpiles are not assigned a control efficiency. Predicted project wind blown emissions are summarised and compared to total project particulate emissions in Table 2 below.*
>
> *Table 2: Summary of Wind Blown Emissions (TSP)*

Emission Quantity	***Controlled Hauling Emissions***	***Uncontrolled Hauling Emissions***	***Difference Uncontrolled to Controlled Emission***
Total hauling emissions (kg/year)	*184,811*	*358,522*	*173,711*
Total project emissions (kg/year)	*2,867,280*	*3,040,991*	*173,711*
Hauling as percent of total project emissions	*6%*	*12%*	*6%[1]*

> *1 - Emission difference as a percentage of modelling emissions"*

The purpose of this specific comparison is not clear, other than to show wind blown dust is a relatively significant source. It is not as significant as haulage.

4.2.14 Wind Blown Dust Emission Controls

Submission: R4

The submission noted that it was likely that the total wind blown dust emissions from the Project has been significantly under estimated and on that basis, that it was critical that the controls assumed in the AQIA could be feasibly and reasonably achieved.

For the reasons outlined in **Section 4.2.10**, PAEHolmes does not believe that wind blown dust has been significantly under-estimated. Given the over-estimate of emissions for two wind erosion sources and the under-estimation of the other, the resulting emissions amount to only 1% of the total TSP emissions for the Project and would not affect the results of the assessment, as accepted by the EPA in their submission (see **Section 4.2.15**).

As noted in the Section 8.3.4 of the EA, Coalpac is committed to leading practice dust management for the Project and every practicable effort will be made to reduce and control wind blown emissions.

This will include the identification of progressive rehabilitation targets to keep disturbed areas to a minimum to be detailed in an AQMP for the Project.

4.2.15 Exceedances of EPA Impact Assessment Criteria

Submissions: R4, SIG9

While the submissions raised a number of potential deficiencies (due to changes in contemporary standards) in relation to the emissions inventory used for the Project, it was noted by the EPA that these findings were unlikely to change the primary findings of the AQIA.

PAEHolmes concur that the issues identified by the EPA regarding wind blown dust emissions are unlikely to change the findings of the assessment. However, it is misleading to say that 'numerous' sensitive receptors will experience exceedances of the EPA's impact assessment criteria.

Out of a total of 479 properties modelled, only 17 are predicted to experience exceedances of relevant criteria in over the life of the Project, as shown in Table 23 of the EA and Table 8.12 of the AQIA (Appendix G).

Of these 17 properties, nine are either currently owned by Coalpac or within the Mining Lease Area and under negotiation with Coalpac. A further two are Crown owned and another is Government owned.

The remaining five are privately owned (Receptor IDs 216, 258, 325, 327 and 426), none of which are predicted to exceed the annual impact assessment criteria either for PM_{10}, TSP or deposition. There are predicted to be some exceedances of the 24-hour PM_{10} criterion at these five residences. However, these exceedances are predicted to be small and infrequent. The most affected residence is 426 which is predicted to experience a maximum 24-hour PM_{10} concentration of 62 $\mu g/m^3$ and only three exceedances in Year 2 of the Project. Residence 216 is predicted to exceed on two occasions in Year 20 and the remaining three residences only exceed on one occasion.

4.2.16 PM_{10} Impacts

Submission: R4

One submission noted that assessment results, as presented in Table 8.12 of the assessment show predicted exceedances of the PM_{10}, TSP and deposited dust impact assessment criteria at identified sensitive receptor locations on an annual average and 24-hour (PM_{10}) average basis.

The submission confirmed the air quality impact predictions made for the Project, noting that the EA assessment showed a number of sensitive receptor locations where relevant impact criteria would be exceeded.

As discussed above in **Section 4.2.15**, no private properties are predicted to experience exceedances of the annual air quality criteria for PM_{10}, TSP or dust deposition.

Five private properties are predicted to experience exceedances of the 24-hour PM_{10} criterion. However, these exceedances are predicted to occur on 3 days or less in the year under a worst-case modelling scenario.

These short-term impacts will be managed as part of the AQMP real-time monitoring system which is discussed further in **Section 4.2.18**.

4.2.17 Modelling Scenario for Additional Controls

Submission: R4

One submission stated that the AQIA did not include a scenario where additional control measures were included to ensure that no exceedances occurred.

There was no need to model further scenarios for annual predictions as the conservatism in the emissions and inherent in the model has indicated that annual cumulative impacts are unlikely.

The exceedances predicted are of the 24-hour criterion. Due to the particularly variable nature of Project operations on a day to day basis, it is very difficult to accurately predict 24-hour impacts. For cumulative impacts these difficulties are compounded by the variability in ambient dust levels and the spatial and temporal variation in other anthropogenic activities, including domestic solid fuel heating.

There is perhaps therefore little benefit in carrying out numerous modelling scenarios in this regard, as it is better to manage short-term impacts rather than predict them.

Incorporating real-time monitoring with triggers and alarms into the Project AQMP is therefore an important aspect of impact management. Measurements at the source also play a significant role in effectively and efficiently reducing total emissions from the site, and plans for the implementation of these measures are discussed in **Section 4.2.5** and **Section 4.2.6**.

4.2.18 Air Quality Management System and Plan

Submission: R4, R5, SIG8, SIG9, SIG13

The submission noted Coalpac's commitment to develop an AQMP for the Project and provided a number of requirements around the content of the document. The relevant section of outlining the requirements of the EPA is provided below:

> *"The EPA notes that the proponent commits to utilising technologies and initiatives to achieve the air quality outcomes described in the EA (Statement of Commitments - Ref. 9). The EPA supports this commitment. A key aspect of this commitment is the development of an Air Quality Monitoring Program (AQMP). The EPA would require the AQMP to include, as a minimum requirement, the need for performance based outcomes aimed at minimising particulate emissions from the following sources:*
>
> *• Wheel generated dust;*

- *Wind erosion of overburden;*
- *Wind erosion of exposed areas;*
- *Loading overburden;*
- *Dumping overburden; and*
- *Bulldozing overburden.*

The AQMP should include the following parts:

- *Key performance indicators;*
- *Monitoring methods;*
- *Location, frequency and duration of monitoring;*
- *Record keeping;*
- *Response mechanisms; and*
- *Compliance reporting."*

NSW Health also noted that that the proposed "real-time management system" to reduce peak particulate matter emissions for the Project would have no impact on reducing the overall increase in long-term exposure to particulate matter for local residents. It was recommended that Coalpac conduct further evaluation into measures to prevent or minimise dust impact. Measures to reduce air quality impacts to Cullen Bullen as far as feasible were requested.

Coalpac acknowledges that it is paramount that an effective AQMP is developed and implemented for the Project. This AQMP will not remain static but develop and adapt over time as operations change over the life of the Project.

Plans for the measurement of site-specific parameters and the development of KPIs have already commenced through the PRP process for the existing Coalpac operations of Cullen Valley Mine and Invincible Colliery, as outlined in **Section 4.2.5** and **Section 4.2.6**.

In addition to adopting these KPIs if the Project is approved as part of the AQMP, Coalpac proposes to implement a system that includes the following components:

1. Meteorological forecasting data;
2. Real-time air quality management system; and
3. Reactive and proactive mitigation measures.

Each of the components proposed for the Project air quality management system is discussed further below.

Meteorological Forecasting Data

Coalpac proposes to implement a predictive meteorology capability, where an hourly weather forecast is generated every day for a period of 2 days ahead to identify weather conditions with high dust risks before they occur.

Weather forecast models are available that can be set up specifically for the region and include detail for the local area around the Project. These models can operate in a system to provide hourly forecasted weather predictions, two days in advance, and an automated report can be regularly delivered to the operations.

Real-time Air Quality Management System

Real-time monitors will be set up at locations between open cut / surface operations and the nearest private receivers, specifically for the purpose of day to day dust management.

Coalpac will install up to six (varying from time to time as mining progresses in relation to receptors) real-time PM_{10} monitors (such as E-Samplers or BAM1020) at suitable locations between operations and nearest receptors. The sites of all air quality monitoring instruments should comply with Standards Australia AS3580.1.1:2007: *Methods for sampling and analysis of ambient air – Guide to siting air monitoring equipment* and be sited by a suitably qualified air quality professional to ensure that sites comply with the EPA's requirements.

Particular note will be made to ensure that there are no extraneous sources of dust within the vicinity of the instruments, including possible vehicle generated dust from private dirt roads. Proximity to buildings and trees should follow those guidelines described in AS 3580.1.1:2007.

Some of the real-time monitors will also be suitable to be used for compliance monitoring, one of which would be placed in the township of Cullen Bullen. Others may be mobile units to enable relocation as the Project proceeds.

Reactive and Proactive Mitigation Measures

Real-time monitoring data and predictive meteorology data will be transmitted to a central data repository and analysed. The analysis will inform the Triggered Action Response Plan (TARP), set up with pre-defined triggers, and send notifications to alert operations personnel when a dust risk is predicted.

The system will also recommend dust control options for consideration depending on the data analysis. The TARP will be updated as the system implementation progresses and adverse conditions for various operations and mining areas are identified.

Potential Locations for Boundary Dust Monitors and Additional Weather Stations

An array of approximately six boundary monitors would provide good upwind-downwind coverage for the proposed operations under predominant wind conditions.

Figure 2 provides an indication of initial areas that may be suitable for locating dust monitors. As the active areas move throughout the life of the Project some of these monitors may be moved to remain between operations and the nearest receptors.

Due to the complex nature of the terrain in the area, Coalpac will install at least one additional weather station to supplement the data already collected at the Invincible Colliery and Cullen Valley Mine monitoring sites.

A potential site for this additional station is shown in **Figure 2**. This additional information will be utilised for complaints management in additional to identifying the source of dust at particular times.

4.2.19 Project Approval Conditions for Air Quality

Submission: R4

In their submission, EPA recommended that the following are incorporated into any Project Approval for the Project:

> *"1. Any conveyor must:*
>
> *• be fully enclosed;*
>
> *• incorporate water sprays at all loading points; and*
>
> *• have dust curtains installed and used at all transfer points.*
>
> *and*
>
> *2. All Haul trucks used for project of must be capable of hauling a minimum of 90 tonne per trip."*

These requirements are consistent with that assumed in the EA for modelling purposes. The new 90 tonne haul trucks proposed for the Project will be implemented from Year 2 as part of the new equipment fleet committed to in the EA (see **Section 4.5.4** of this RTS). Coalpac will commit to these requirements and incorporate in relevant management plans.

4.2.20 Health Impacts from Coarse Particulates

Submission: R5

The submission provided by NSW Health noted the concerns of that agency regarding the health impacts from coarse particulates associated with mining operations, citing a growing body of evidence that populations subjected to elevated coarse particulate matter emissions from mines have an increased risk of adverse health outcomes, particularly on the respiratory system. It was also noted that preliminary investigations by NSW Health in the Hunter Valley have also found an indication that mine emission affected communities may also be subject to increased rates of cardiovascular disease, a concern which is undergoing further investigation.

Without reference to the evidence noted by NSW Health, it is not possible to comment specifically on their submission. Nevertheless it is important to keep particle emissions at the source and at the Project boundary as low as possible and Coalpac is committed to this through the implementation of leading practice management and mitigation measures discussed in the EA and this document.

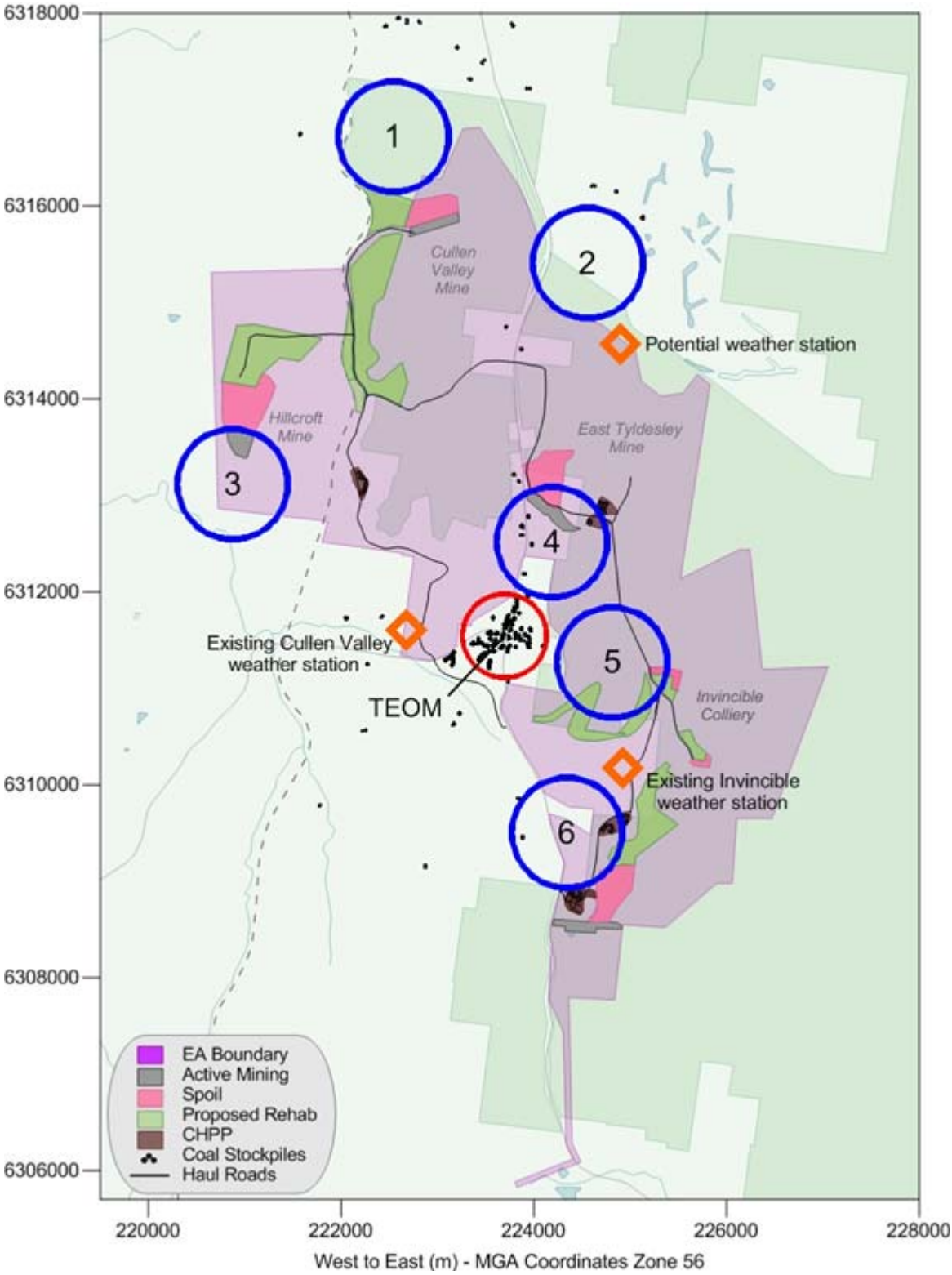


Figure 2
Indicative Locations for Monitors and Weather Stations

Note: Tapered Element Oscillating Microbalance (TEOM) component proposed for continuous air quality monitoring in Cullen Bullen.

Both natural and anthropogenic processes contribute to the atmospheric load of particulate matter. Coarse particles ($PM_{2.5-10}$) are derived primarily from mechanical processes resulting in the suspension of dust, soil, or other crustal materials from roads, farming, mining, dust storms, and so forth. Coarse particles also include sea salts, pollen, mould, spores, and other plant parts.

Fine particles or $PM_{2.5}$ are derived primarily from combustion processes, such as vehicle emissions, wood burning, coal burning (for home heating as well as power generation), and natural processes, such as bush fires. Fine particles also consist of transformation products, including sulphate and nitrate particles, and secondary organic aerosol from volatile organic compound emissions. Mining dust is predominantly composed of coarse particulate matter (and larger particles).

The size of particles determine their behaviour in the respiratory system, including how far the particles are able to penetrate, where they deposit, and how effective the body's clearance mechanisms are in removing them. This is demonstrated in **Figure 3** which shows the relative deposition by particle size within various regions of the respiratory tract. Additionally, particle size is an important parameter in determining the residence time and spatial distribution of particles in ambient air, key considerations in assessing exposure.

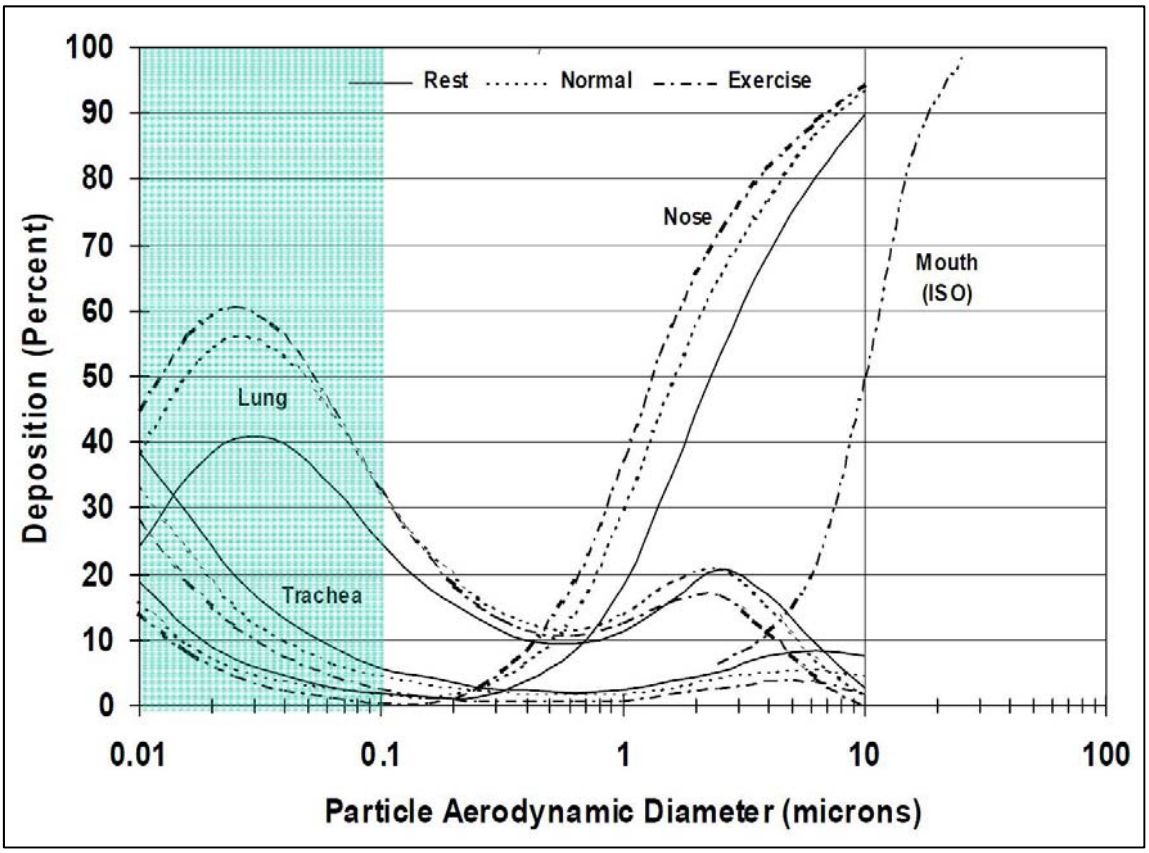


Figure 3
Particle Deposition within the Respiratory Tract (Source: Chow, 1995)

4.2.21 Background Levels for PM_{10} and Depositional Dust

Submission: R5

NSW Health noted that:

> *The annual average background levels for PM_{10} and dust deposition used in the Air Quality Assessment were derived from monitors that are in close proximity to the township of Cullen Bullen and were established as:*
>
> *- Annual average PM_{10} = 12.8 µg/m^3, and*
>
> *- Annual average dust deposition = 0.9 µg/m^2/month*
>
> *The annual average TSP was estimated from PM_{10} concentrations to be 31.9 µg/m^3. These values include existing mining operations in the area and reflect the generally good level of air quality currently enjoyed by this community."*

Noted. It is assumed the dust deposition units noted by this response are a typographical error and should be g/m^2/month not µg/m^2/month.

4.2.22 High Level Particulate Matter Impacts

Submission: R5

This submission noted that several residences within the boundary of the project are predicted to be subject to particulate matter impacts from the project that exceed EPA assessment criteria and are already under Agreement, or under negotiation toward an Agreement. Due to the predicted high level particulate matter impacts from mining these properties should not be leased or otherwise occupied during the period they are subject to mine emissions.

This submission noted the residences (195, 196, 197, 198 and 199) predicted to be subject to particulate matter impacts from the Project in exceedance of EPA assessment criteria and noted that these properties should not be leased or occupied during the period they are subject to mine emissions. Table 23 of the EA presents a summary of predicted air quality exceedances for the Project.

Of the five properties noted above, Coalpac has an agreement to acquire property 197 and is negotiating an agreement with the landholders of residences 195, 198 and 199 regarding implementation of air quality mitigation measures (e.g. insulation, air filters, a first flush roof water drainage system and/or air conditioning). Should the Project be approved, the landholders of residences 195, 198 and 199 would also have the right to be acquired by Coalpac upon request.

Block 196 is held by the Crown.

4.2.23 Cumulative Particulate Exposure on Cullen Bullen

Submission: R5

> This response noted *"…that beyond the project boundary there is also concern for long-term cumulative particulate matter exposure on the town of Cullen Bullen. For each of the years modelled (Years 2, 8, 14 and 20), there is a predicted incremental annual average PM_{10} in Cullen Bullen of 30 – 100%. This represents up to a doubling of the exposure to dust particles in the township and its community and thus an increase in the risk of residents experiencing respiratory problems known to be associated with coarse particulate matter exposure such as asthma. The World Health Organization guidelines indicate that an incremental exposure to PM_{10} of this magnitude could be associated with an increase mortality risk of 3%."*

Cumulative annual average PM_{10} predictions in the AQIA are shown to remain below the EPA air quality criterion at privately owned properties at Cullen Bullen, as discussed in **Section 4.2.15** and **Section 4.2.16**.

4.2.24 Blast Impacts to Air Quality

Submissions: R5, SIG8, P689, P846

A number of submissions raised concerns regarding the potential impacts of Project blasting on air quality, particularly on receivers within Cullen Bullen.

Samples of blasting plumes taken at the Ravensworth Open Cut Mine in 1992 measured a maximum nitrogen dioxide (NO_2) concentration of 3 ppm over an exposure period of six minutes at a distance of approximately 400 m from the blast. Scientific reviews suggest that no adverse health effects would be expected due to this exposure (Health and Safety Executive, 1999). Given that the concentration at the nearby residences for the Project would be significantly lower than the 3 ppm measured on-site at Ravensworth, due to the smaller blast areas, it is unlikely that there would be any adverse air quality impacts due to NO_2 emissions from the blasting proposed for the Project.

A detailed measurement program of NO_x in blast plumes in the Hunter Valley was made by Attalla et. al. (2008). The results from 27 blasts are presented in the paper. The measured peak concentrations of NO_2 in the plumes were in the range 0 to 7 ppm. The estimates made of NO_2 emission rates were then been used with a Gaussian dispersion model to predicted ground-level concentrations of NO_2 at various downwind receptors at ranges 200, 300 and 5000m downwind. When the results are adjusted for averaging time and downwind distance the estimated ground-level concentrations are remarkably consistent with the 3 ppm concentrations [6-minute average] measured at ground-level in the earlier less extensive work undertaken at Ravensworth in 1992.

This study by Attalla et al. (2008) using remote sensing techniques concluded that NO_2 concentrations decrease rapidly between 200 m and 2 km from the site of the blast, and are undistinguishable from background levels with 5 km.

For the majority of the time blasts will occur at distances greater than 2 km from the township and the school. As such, and together with an effective management plan in place, Coalpac is confident these issues can be negated.

Blast fumes will be managed as part of the AQMP and Blast Management Plan. The management of blasting impacts on air quality will be incorporated as part of the system (discussed in **Section 4.2.18**) and will involve forecasting meteorological conditions daily to enable all blasting for the Project to occur under favourable conditions.

Dust emissions from blasting have been included in the total emissions inventories for each modelling year and generally constitute less than 0.5% of the total emissions. The blast management tool will also be implemented as part of the AQMP.

4.2.25 Health Risk Assessment for Blast Emissions

Submission: R5

NSW Health recommended that a site-specific health risk assessment of blast emissions is undertaken for Cullen Bullen in general and the Cullen Bullen Public School in particular. It was also recommended that systems are put in place to receive and respond to community concerns in relation to blast emissions.

A health risk assessment of blast emissions was not in the Director Generals Requirements (DGRs) for the AQIA.

The Cullen Bullen Public School is located a minimum of 1 km from any active mining area. At distances of this magnitude, resultant blast fume emissions will be extremely minor. In conjunction with the proposed blast management system, blasting activities will be dependent on local meteorological conditions and carried out at times when the school and Cullen Bullen township are upwind of blast areas.

4.2.26 Dust Emissions from Equipment

Submission: SIG6

A submission stated that the Project will considerably add truck and machinery movement as well as increase Australia's carbon emissions and release dust and fine particles into the atmosphere likely affecting the township of Cullen Bullen.

Particulate emissions from the movement of trucks have been addressed as part of the AQIA for the Project. Carbon emissions from fleet movements were assessed in the Greenhouse Gas section of the air quality impacts assessment and discussed further in **Section 4.4** of this document.

4.2.27 Contamination of Rainwater Tanks

Submissions: SIG1, SIG9, Petition

Some submissions state that the primary adverse social impact is on the amenity of the inhabitants of Cullen Bullen. There are also concerns that homes, cars and clothes will be difficult to keep clean and that rainwater tanks may be contaminated.

Dust fallout levels were assessed in the AQIA for nuisance and amenity impacts. Deposition levels were assessed and found to comply with the relevant air quality criteria in the township of Cullen Bullen.

Recent research conducted in close proximity to the Dalrymple Bay Coal Terminal (Queensland), investigated the potential health risks as a result of elements contained in coal dust deposited on rooftops entering rainwater tanks systems used for potable supply (Lucas et. al., 2009).

Leaching tests were conducted on numerous coal types to identify the potential for trace element release into rainwater in the tank. In addition, rainwater samples were collected from both the rainwater tanks and taps of three homes within the dust deposition zone of Dalrymple Bay area.

The leaching tests indicated that negligible amounts of trace elements in coal dust were released in the rainwater, and all trace elements were below the Australian Drinking Water Guidelines (ADWG). The ADWG provide the threshold levels considered safe for human consumption. The analysis of the rainwater from homes also showed that no trace element exceeded the ADWG.

The research concluded: "…tank and tap samples were all below ADWG and indicated a minimal likelihood of coal dust being an issue with respect to human health".

Additional research conducted in 2008 by Associate Professor Barry Noller from the Centre for Mined Land Rehabilitation, University of Queensland was undertaken in order to investigate the relationship between mining and levels of lead in the air and in rainwater tanks. The village of Camberwell and an outlying rural area of Muswellbrook were chosen for the study because of their close proximity to coal mining operations and local homes. Thirty-six houses were involved in the sampling study.

This research involved an extensive sampling program covering local rainwater tanks, soils, airborne particles and house dust. The key findings were:

- No tank water exceeded Australian Drinking Water Guidelines for lead;
- There was no significant difference in drinking water lead levels between houses close to coal mining operations and those obtained from background sites including Newcastle town water;
- Some tanks contained elevated lead levels in historical sludge, however, this was not contaminating the tank water;

- Lead levels in mined overburden, coal and topsoil were low and within normal background lead levels;
- Airborne particles (Total Suspended Particulates) taken by High Volume Air Samplers indicated there is no significant transfer of lead from mine overburden material; and
- Out of all dust sampling undertaken within houses, only two window tracks were found to contain elevated lead levels (possibly from historic house dust or lead in paint).

The results of the study show there is no demonstrated health risk from lead associated with coal mining in the Hunter Valley. The review found that air and water lead levels are significantly below the relevant national standards. It is likely that results would be similar for Cullen Bullen.

It is noted, however that all rainwater tanks should be maintained by private owners in accordance with the advice outlined in *NSW Health's Rainwater Tanks brochure* to ensure water is safe for drinking.

Regardless of the above, it is good practice for owners of any rain water collection system in any location to install a simple first flush system to prevent particulate matter (or any other undesirable materials) that have collected on the roof being washed into the rain water tank. This is not specific to coal mining areas.

4.2.28 Air Quality Impacts on Cullen Bullen

Submissions: R4, R5, SIG1, SIG8, SIG9, SIG13, SIG14, SIG15, SIG18, SIG20, SIG22, Petition, P8, P34, P115, P160, P191, P198, P208, P235, P252, P261, P278, P281, P284, P292, P297, P303, P317, P332, P329, P331. P345 – 346, P348, P362, P369, P372, P387, P390, P400, P402, P414, P417, P424, P430, P438, P442, P445, P476, P477, P484, P489, P492, P496, P500 – 501, P504, P514, P516 - P518, P520, P5252, P532 – 534, P541, P545, P561, P564, P573 – 574, P594, P597 – 601, P605 – 609, P613 – 615, P621, P624, P629, P634, P637 – 638, P685, P687, P689, P691, P693 – 694, P702, P707, P709, P711, P720, P723, P725, P733, P739, P743, P773, P778, P779, P792, P794, P797 - 798, P810 – 811, P813, P818, P820, P844, P846, P851, P853 – 854, P656, P860, P866, P877, P885

Various submissions noted that the possible impact on nearby residents of the town of Cullen Bullen of fine particles generated by the mine was a matter of concern.

As noted above in **Section 4.2.15**, the AQIA predicted up to 3 exceedances of the 24-hour PM_{10} air quality criteria for receivers surrounding the Project in a worst case modelling scenario.

No private residences in the township of Cullen Bullen are predicted to experience air quality impacts from the Project above annual EPA criteria. 24-hour PM_{10} impacts are minimal and will be effectively managed at the source through the air quality management system described in **Section 4.2.18**. The submission from NSW Health (Section 4.1.21) also stated that current monitoring levels "reflect the generally good level of air quality currently enjoyed by this community".

The AQIA includes predictions for $PM_{2.5}$ levels, as shown in Appendix D in the report, and shows minimal impact at Cullen Bullen. It should also be noted that $PM_{2.5}$ modelling results are conservative and likely to be much lower than those presented in Appendix D. Highway vehicle exhaust and domestic solid fuel heating will be much more significant sources of these fine particles than coal mining. The Project will contribute dust to Cullen Bullen under certain meteorological conditions and depending on the activities in operation, along with these sources, as predicted in the AQIA. On site management plans dealing with emissions at the source and timing, will minimise impacts.

A number of submissions noted Western Australian EPA recommended separation distances of 1 - 2 km between mining areas and sensitive receptors. The closest that active mining areas come to the township and the school is approximately 1 km. It should also be noted that Coalpac does and will operate within NSW legislative requirements which require modelling for each individual sensitive receptor in the vicinity of the mine. The AQIA modelled private receivers within 4.5 km of the site.

Coalpac will place a compliance monitor measuring $PM_{2.5}$ and PM_{10}, in the vicinity of Cullen Bullen Public School to monitor long-term and short-term levels in consideration of relevant standards and siting requirements. It should also be noted that air quality criteria are set to protect the most vulnerable in society such as children, the elderly and those with respiratory problems.

4.2.29 Watering of Overburden Emplacements

Submissions: P689, P846

One submission requested that OEAs should be watered regularly to minimise dust pollution.

Dust control measures have been investigated as part of the PRP process and recommendations made depending on their practicability. These will be continually reviewed and managed as part of the AQMP, including consideration of watering accessible sections of OEAs in the vicinity of private neighbours in adverse weather conditions.

4.2.30 Air Quality Modelling Inputs

Submission: P877

One submission questioned the quality of the modelling input data, stating:

> *"…. Analytical modelling is only as good as the quality of the input data. The environmental consultancy firm, PAEHolmes, uses historical data from the air quality monitors at the Invincible and Cullen Valley mines as raw inputs for their modelling. Significant questions arise as to the quality of this data. Under the current EA, Coalpac commits to real-time monitoring. However this has not applied to date.*

> *Coalpac has not had the best record in terms of its monitoring standards to date and has been subject to a number of non-compliance penalties, including relating to its monitoring practices. It is quite possible, given the non comprehensive nature of the monitoring to date (only one out of every 6 days has monitoring been completed), that selective monitoring practices may have occurred - such as non-recording on blast/high dust days. Such questions raise concerns about the nature of the input data, which in turn could lead to resultant modelling errors."*

The 6-day cycle for monitoring with High Volume Air Samplers (HVAS) is used to meet the relevant requirements for HVAS monitoring and potentially coincide with data collected as part of the EPA monitoring network, also collecting on a one in six day cycle (see **Table 5** taken from the EPA website *http://www.environment.nsw.gov.au/air/nepm/4.htm#t28*).

One of the reasons for the 6-day cycle is to capture a range of mining operations and activities as well as meteorological conditions, and so avoid sampling on the same day each week.

It is not selective monitoring as suggested in the submission, to coincide with non-blasting or high activity days. Continuous monitoring will be put in place for the Project, as committed to in **Section 4.2.18**.

Table 5
Methods and techniques for other Pollutants

PM_{10}	*AS3580.9.6-1990*	*Ambient Air - Determination of Suspended Particulate Matter PM_{10} - High Volume sampler with Size Selective Inlet Gravimetric Method*	*Size Selective Inlet (one in six day cycle)*
PM2.5	*No current Australian Standard*	*Manufacturers Method*	*Tapered Element Oscillating Microbalance (TEOM)*
Light Scattering (visibility)	*AS2724.4-1987*	*Ambient Air - Particulate Matter - Determination of Light Scattering Integrating Nephelometer Method*	*Light Scattering/ Nephelometry*

Source: EPA (2012)

4.2.31 Temperature Inversions and Atmospheric Instability

Submission: P877

One submission stated it appeared that temperature inversions had not been considered in the Project AQIA. This comment is reproduced below:

> *"… It should be noted that, while mentioned in the Executive Summary and the Acoustics Impact Assessment, I could find no mention in the Air Quality Impact Assessment of the temperature inversions that mark a relevant aspect of this region's climate. This would seem highly relevant to air pollution considerations with this mining proposal and it is a concern, in terms of quality, that this report should fail to mention it. Putting these input quality issues to the side, the analysis offered does suggest that a number of residences (up to 25% in some of the data sets) are likely to experience air quality conditions that do not meet recommended guidelines. Many of these residences have no contractual arrangements with Coalpac."*

Noted. Temperature inversions and atmospheric stability are indeed most relevant to the dispersion of air pollutants. Section 6.4.2 of the AQIA specifically covers this issue with regard to local conditions at each of the four mining locations.

> *"Class A is described as highly unstable and occurs in association with strong surface heating and light winds, leading to intense convective turbulence and much enhanced plume dilution. At the other extreme, class F denotes very stable conditions associated with strong temperature inversions and light winds, which commonly occur under clear skies at night and in the early morning."*

Table 6.1 in the AQIA shows the percentage occurrence of each of the Pasquill-Gifford atmospheric stability classes A to F. F-class (strong temperature inversions) are estimated to occur for a significant proportion of the time at each of the four sites, and these conditions have been included in the modelling.

4.2.32 Adverse Health Impact from Mining Equipment

Submission: P877

One submission noted that:

> *"3. It would appear that the health risks, at least the respiratory disease risks, are not in dispute with Coalpac. PAEHolmes states in its Air Quality Impact Assessment, "There are potential risks to human health associated with exposure of blast fume. Acute and short term risks may include; coughing, shortness of breath, irritations of the mucous membranes of the eyes, nose and throat and pulmonary oedema. Medium and long term effects may include Reactive Airways Dysfunction Syndrome (RADS), in rare cases bronchiolitis obliterans and chronic respiratory insufficiency (AEISG, 2011)."*

> *What they do not specifically mention in their report is that blast fumes represent only one of a number of adverse health impacts that an open cut mining project can have on the local community. Fumes and dust related to operational machines and transport vehicles, health aspects of the noise and vibration associated with blasting and transportation and industrial accidents also need consideration."*

Dust from operational machines and transport vehicles has been included in the assessment as emissions from haulage on unsealed roads. Fumes from these vehicles have not been included in the assessment as they are minor in comparison to other emissions on site. Fumes from blasting have been addressed in Section 4.1.24 and will be managed for both employees and off site receivers as part of the Blast Management Plan.

4.2.33 Assessment of Small Particulates ($PM_{2.5}$)

Submission: SIG1, SIG9, P877

Three submissions noted the potential health impacts associated with small particulates ($PM_{2.5}$) generated by the mining operations proposed by the Project.

One submission (P877) referred to the potential for increased health risks associated with particles less than 10 microns, particularly $PM_{2.5}$. Specifically, this submission noted that:

> *"... The Department of the Environment, Climate Change and Water currently only requires analyses for Total Suspended Particles (TSP) and airborne particles above PM_{10}. This is unfortunate, to say the least, given the body of research that now suggests that smaller particulate sizes, such as those less than $PM_{2.5}$, may be more hazardous to human health. Smaller particles are less easily filtered away by the body's airway defences from reaching the deeper aspects of the lungs. Once present at an alveolar level the smaller particles are then thought to be able to cross into the blood stream. Many of these particles are toxic to human biology. This may represent one of the principal modalities whereby the extra-pulmonary disease manifestations that are seen in coal communities are mediated - hence facilitating the cardiovascular, renal, and cognitive health disparities that are observed in these communities. Thus it is possible that the most significant public health risks derived from the open cut mining process have not been accounted for in the EA. Cullen Bullen Public School will sit in the centre of the encompassing proposed mine, at some points at only just over 1 km from mining activities. This poses a particular health concern as children, with their smaller airways, are more prone to asthma and related respiratory dysfunction when exposed to environmental triggers."*

Appendix D of the AQIA provides contour plots of predicted $PM_{2.5}$ emissions for the Project. These show that two private receivers (ID 196 and 197) are predicted to have results over the 24-hour $PM_{2.5}$ advisory reporting standard in one modelled year.

As noted in Table 23 of the EA, Coalpac is negotiating an agreement with Receiver 196 for predicted air quality impacts and has an agreement in place with Receiver 197. No private receivers in Cullen Bullen are predicted to receive emissions over the 24-hour $PM_{2.5}$ advisory reporting standard.

We note that the submission mentions that the EPA *"… only requires analyses for Total Suspended Particles (TSP) and airborne particles above PM_{10}."* It is important to clarify that PM_{10} refers to all particulates less than 10 microns, and not above. In other words, $PM_{2.5}$ (particles less than 2.5 microns) is a subset of PM_{10} and *"airborne particles above PM_{10}"* are actually considered TSP.

4.3 SUBSURFACE HEATING

4.3.1 Subsurface Heating Management

Submission: R2, R3, R15, SIG3, SIG13, P8

Some submissions referred to the existing subsurface heating issue in the historic underground workings at Cullen Valley Mine and requested that the management controls of the existing Heating Response Plan continue to be implemented for the Project.

The DRE submission also noted that the ultimate aim of the subsurface heating program should be to extinguish and rehabilitate impacted areas. A commitment to permanently extinguish and rehabilitate the subsurface heating issue was sought by DRE.

Coalpac has recently prepared a Plan of Management, Subsurface Heating Area for Cullen Valley Mine to provide a definitive view on the most effective path to long term containment and ultimate extinguishment of the heating in the old underground workings and rehabilitation for the consideration of DRE.

Coalpac has already undertaken extensive work to cap and seal venting from the underground heating, to remove and quench near surface heating affected material and installed a subsurface monitoring system to track the temperature trend over time.

The near surface heating affected material will continue to be removed and quenched. The deeper seated heating affected material will be capped and sealed. It is also proposed to extend the sub-surface temperature monitoring network and include water level monitoring in the adjacent underground workings.

The surface area will be progressively rehabilitated. It is proposed that the effectiveness of the capping and sealing of the underground heating be monitored in terms of temperature trending. Any additional steps required to extinguish the underground heating would be considered in the light of the effectiveness of this strategy and draw upon the data gathered in the process.

While the DRE submission suggests a limit of mining within 1 km of the subsurface heating area, there is no firm basis for this limit and further investigation is required to better understand the nature and behaviour of the underground heating (which forms part of the Plan of Management, Subsurface Heating Area for Cullen Valley Mine).

Coalpac is committed to the remediation of the heating area through the development of a robust management plan that is based on sound research, available data and advice from specialist consultants. Coalpac will continue to work closely with DRE on this process.

4.4 GREENHOUSE GAS

4.4.1 Fugitive Gas Emissions Estimates

Submission: R4

The EPA noted that the accuracy of the Scope 1 emissions estimates from fugitive gas could not be adequately assessed due to insufficient information being provided.

The GHG assessment for fugitive gas emissions was completed following the NGER's Technical Guidelines.

The site specific borehole sample data used in the AQIA was taken from the document 'Gas Content Testing: Borehole CP111' prepared by GeoGas (2011) on behalf of Coalpac. This document lists the sample results in Tables 4.1 and 4.2 (as provided in Appendix E of the AQIA) and provides information on sampling in Section 3. Additional sampling of exploration cores was also undertaken by CSG partners in April 2012 which showed generally low gas levels consistent with previous research in the Western Coalfields, and methane levels below the Limits of Detection (i.e. essentially nil).

4.4.2 Diesel Fuel Consumption

Submission: R4

One submission noted that while the diesel fuel use factor was similar to other open-cut operations, the accuracy of the estimated emissions for the Project could not be verified.

As stated in Section 12.3.1 of the AQIA, the quantity of diesel consumed in each year for the Project was based on a derived diesel intensity rate (mega litres per million tonnes per annum of run of mine coal [ML/Mtpa ROM]) calculated from the 2009 average diesel consumption (7.62 ML) and ROM rate of 1.5 Mtpa at the existing operations.

As correctly stated by the EPA, the fuel intensity factor was calculated to be approximately 5 L of diesel/tonne of ROM coal which was then applied to each proposed year of Project and is considered appropriate for the Project.

4.4.3 Scope 2 Emissions Estimates

Submission: R4

The EPA submission noted that the Scope 2 emissions from electricity use have been estimated using an appropriate methodology.

4.4.4 Scope 3 Emissions Estimates

Submission: R4, SIG22

The EPA noted that the while Scope 3 emissions from electricity and fuel supply and the transport of product coal to the customer had been adequately estimated in the AQIA, the estimates of emissions from product transport by rail appear to not include emissions from the return trip.

It was also noted that the AQIA adequately estimated Scope 3 emissions from the combustion of the product coal.

The return trip to Port Kembla assumed in the Greenhouse Gas (GHG) assessment was 191 km, which was an incorrect value. The correct return trip to Port Kembla is approximately 312 km. Therefore, Table 12.5 from the AQIA is updated and is presented below in **Table 6**. The total $CO_{2\text{-}e}$ for coal transportation by rail for the life of the Project is 80,590 t CO_2-e and averages 3,838 CO_2-e per annum (compared to an annual average of 2,348 CO_2-e per annum as presented in the EA).

Table 12.8 of the AQIA provided a summary of GHG emissions both as annual averages and total over the life of the Project. The revised total annual average Scope 1-3 emissions are 6,990,955 t CO_2-e and the total over the 21 proposed mining years is 146,744,315 t CO_2-e. This equates to a 0.02% increase from total Scope 1-3 emissions presented in the AQIA. It should also be noted that GHG emissions from the transport of coal are categorised as a Scope 3 emission (transport-related activities in vehicles not owned or controlled by the reporting entity).

Table 6
Project GHG Emissions

Year	Maximum Product coal (t)	Total CO_2-e from transport (t)
Year 1	1,000,000	3,838
Year 2	1,000,000	3,838
Year 3	1,000,000	3,838
Year 4	1,000,000	3,838
Year 5	1,000,000	3,838
Year 6	1,000,000	3,838
Year 7	1,000,000	3,838
Year 8	1,000,000	3,838

Year	Maximum Product coal (t)	Total CO_2-e from transport (t)
Year 9	1,000,000	3,838
Year 10	1,000,000	3,838
Year 11	1,000,000	3,838
Year 12	1,000,000	3,838
Year 13	1,000,000	3,838
Year 14	1,000,000	3,838
Year 15	1,000,000	3,838
Year 16	1,000,000	3,838
Year 17	1,000,000	3,838
Year 18	1,000,000	3,838
Year 19	1,000,000	3,838
Year 20	1,000,000	3,838
Year 21	1,000,000	3,838
TOTAL	**21,000,000**	**80,590**

4.4.5 Greenhouse Gas Impacts and Alternative Energy

Submissions: R4, SIG1, SIG3, SIG7 – SIG9, SIG11 – SIG13, SIG18, SIG22, SIG24, Petition, P8, P42, P150, P168, P177, P180, P186, P191, P230, P235, P238, P249, P278, P285, P289 – P290, P293, P303, P326, P344, P346, P350, P356, P369, P387, P390, P397, P400, P404, P413, P430, P442, P449, P455, P472, P475, P489, P492, P496, P513, P514, P558, P564, P574, P578, P594, P599, P608, P617, P621, P632, P648, P650, P665, P671, P678, P689, P877, P691, P707, P709, P728, P729, P733, P743, P757, P773 – 774, P778, P779, P792, P797, P819, P854, P874, P877, P882

In their submission, BMCS noted that:

> *"2. General considerations*
>
> *2.1 Greenhouse gas emissions (GGE) and climate change*
>
> *A price on carbon seems to be inevitable. NSW and Australia will struggle to meet GGE targets. 'Clean coal with geosequestration' continues to be experimentally feasible, but is far from being a practicable solution to coal-fired power production.*

> *At best, the technology (when/if finally developed on a commercial basis) will be applied on a limited scale in Queensland, but costs will generally be prohibitive and render it uncompetitive with renewable energy sources. The alternative is even more outrageous government (=taxpayer) subsidisation of the coal-fired power industry, which may attract the attention of the Australian Consumer and Competition Commission (see Brian Robins, Coalmine subsidy will harm competition…, SMH Dec 22 2010, News p6)."*

A number of other responses also noted the Project impacts on climate change due to greenhouse gas emissions and that alternative renewable energy sources should be used in preference to the extraction and burning of coal for electricity generation.

Noted. The implications of the pricing of carbon on the Project in included in **Section 4.17.5** of this RTS.

As noted in **Section 4.21.6**, the potential for renewable energy sources to meet baseload power demand was considered in the preparation of the EA. However, it is considered that there will be a continuing requirement for coal to meet basic energy needs and in particular, for electricity generation.

4.4.6 Use of Project Coal Resource

Submission: SIG3

One submission noted that those determining fossil fuel proposals, including the Project, should adopt a policy of permanently sequestering the carbon embodied in coal resources and move toward sterilise carbon-based energy resources in order to address the issue if climate change:

> *"Keeping carbon in the ground is the best way to prevent climate change disaster."*

Noted. While not specifically related to the AQIA, the above comment relates to the determination of the greenhouse gas impacts associated with the proposed extraction of the Project coal resource. A discussion on the Project mine plan design and justification is provided in **Section 4.21.1**.

4.4.7 Inferior Project Coal Resource

Submissions: SIG3, SIG7, P513

Some submissions raised concerns regarding the perceived inferiority of the coal resource and the generation of greenhouse gas impacts that would arise from the use of product coal from the Project.

In terms of scale of GHG emissions estimated as a result of the Project, the AQIA concluded that the estimated average annual Scope 1 emissions are approximately 0.01% of Australia's 1990 emissions reported under the Kyoto Protocol. This contribution represents approximately a quarter of that from a typical NSW coal mine operation.

The Greenhouse gas emissions per tonne of coal for inferior quality coal are lower, due to the reduced energy content.

4.4.8 Greenhouse Gas Calculation Errors

Submissions: SIG3, SIG8, SIG9, SIG12, SIG13, SIG22, Petition, P8

A number of submissions stated that the greenhouse gas assessment component of the AQIA had not accurately calculated and reported the level of impacts from the Project operations. In particular, a number of the submissions with concerns regarding the greenhouse gas assessment noted that a significant hundred-fold error had been identified.

It was also noted that:

> "*Australia's carbon footprint is 546.3 Mt C02e (Aust. Nat. Greenhouse Accounts, Dec 2011) so 7 Mt is 1.3% of Australia's total carbon footprint". . The proposed mining requires excessive amounts of energy to extract and clean the coal to a useable condition. These proposed coal resources are inferior. Upon combustion they generate significant amounts of greenhouse gases, as well as consuming large amounts of high-quality energy (diesel and electricity) during the proposed mining operation."*

The submissions regarding a 'hundred-fold error' in calculating the percentage of GHG emissions from the Project in terms of the world's current carbon dioxide load (3,000 Gt of CO_2-e) is incorrect. The calculation is as follows:

7 Mt / 1,000,000,000 = 0.007 Gt

That is, 0.007 Gt (Project's estimated contribution)/3,000 Gt (world's current carbon dioxide load) * 100 = 0.00023% (rounded to 0.0003% in the AQIA for conservatism).

Further, as noted in **Section 4.4.7**, inferior quality coal results in lower Greenhouse gas emissions.

Dr Washington has compared the total annual average (Scopes 1, 2 and 3) estimated GHG emissions for the Project with Australia's carbon footprint for 2011. Comparing the total (all scopes) estimated GHG emissions with Australia's footprint is inappropriate. This is as Scope 2 and 3 emissions from the Project are classed as 'indirect' emissions, e.g. GHG associated with consumption of purchased electricity (Scope 2) and the burning of the coal produced to generate electricity (Scope 3) (National Greenhouse Accounts Factors, July 2011).

Australia's contribution of GHG emissions in 2011 of 546.3 Mt $CO_{2\text{-}e}$ would already include the Scope 2 and 3 emissions associated with domestic consumption of coal as reported by the power stations that generate the electricity as their Scope 1 emissions. Similarly, any coal bound for export markets (currently accounted for within the Project's Scope 3 emissions) will comprise part of Australia's annual GHG emissions.

Therefore, including the Project's Scope 2 and 3 emissions in a comparison to Australia's emissions would lead to double-counting of emissions, and these values are more appropriately captured by other industries as Scope 1 emissions.

4.4.9 Increase in Australia's Greenhouse Gas Emissions

Submission: SIG7, SIG9, SIG11, SIG12, SIG13, SIG18, Petition

A number of submissions noted that the Project would result in an increase in Australia's carbon emissions.

The GHG assessment in the AQIA has shown the Project to contribute approximately 0.01% of estimated GHG emissions (Scope 1 annual average emissions) to Australia's 1990 emissions under the Kyoto Protocol and 0.0003% of the current global CO2–e atmospheric load.

4.4.10 Greenhouse Gas Impacts from Forest and Woodland Clearing

Submission: SIG8

One submission noted a recent study on the impacts for deforestation on greenhouse gas impacts. The role of forest communities in the earth's climatic system as carbon sinks to 'soak up' carbon emissions from anthropogenic sources was also discussed. This submission also raised concern on the impacts to greenhouse gas emissions from the clearance of forest and woodland vegetation communities by the Project.

The estimated emissions of GHG over the life of the Project for vegetation clearing are 377,458 t CO2-e which equates to a 0.26% increase from the total estimated Scope 1 - 3 emissions of the Project as outlined in the AQIA and Section 8.5 of the EA. Further, it should be noted that full area of vegetation clearance proposed within the Project Disturbance Boundary would not occur immediately, but rather progressively over the life of the Project.

As noted in Section 8.24 of the EA, a key objective of Project is to progressively rehabilitate disturbed areas and key areas within the Project Boundary and Biodiversity Offset properties to develop vegetation communities that are generally consistent with the surrounding landscape, aiming to connect remnant native vegetation communities to be retained within the Project Boundary (787 ha) with re-established habitat areas.

In accordance with the commitments outlined in Section 8.24.8 of the EA, Coalpac will develop a Rehabilitation and Landscape Management Plan (RLMP) for the Project to ensure that rehabilitation objectives and targets are met and that sustainable forest and woodland communities can be re-established in the long term. The rehabilitation strategy for the Project will also focus on biodiversity and the establishment of habitat for Threatened species and vegetation communities.

The Project mine plan has also been modified during the preliminary stages of the EA to avoid disturbance of native vegetation, threatened species and ecological communities (see **Section 4.21**).

4.4.11 Renewable Energy Alternatives

Submissions: SIG1, SIG9, SIG13, SIG22, SIG24, Petition, P8, P671,

A number of submissions raised issues in relation to the consideration of renewable energy alternatives in the EA and in the justification of the Project. In particular, one submission noted that:

> *The EA argues essentially that if the proponent does not mine this coal, then someone else will mine and burn it elsewhere. The EA claims that alternate sources of energy are not viable in the short to middle term. This seriously misrepresents both the current status and ability of renewable energy to meet energy needs. Note the excerpt below from the forthcoming book 'Human Dependence on Nature' (Washington, 2012)6:*
>
> *Renewable energy supplied an estimated 16% of global final energy consumption at the end of 2010 (REN21 2011). In regard to electricity, renewables produced 1,320 GW (312 GW excluding hydroelectricity) of electricity in 2010. By early 2011, renewables comprised 25% of electricity capacity from all sources. They accounted for approximately half of the estimated 194 GW of new electric capacity added globally during 2010. ... Civilisation can reach a 95% sustainably sourced energy supply by 2050. There are up front investments required to make this transition in the coming decades (1-2% of global GDP), but they will turn into a positive cash flow after 2035, leading to a positive annual result of 2% of GDP in 2050 (WWF 2011). A large-scale wind, water, and solar energy system can reliably supply all of the world's energy needs, with significant benefit to climate, air quality, water quality, ecological systems, and energy security, at reasonable cost (Delucchi and Jacobson 2011)."*

This issue is a broader, large-scale issue which is beyond the scope of the GHG assessment provided in the AQIA. The AQIA assessed information provided by the client.

Section 4.21 of this RTS includes a discussion of the alternatives considered for the Project. It is beyond the scope of the AQIA to comment on the accuracy of the commentary on alternatives to the Project.

4.4.12 Project Climate Change Impacts

Submission: SIG3, SIG9, SIG12 - SIG13, SIG22, Petition, P8

A number of submissions noted the level of carbon emissions predicted for the Project and associated climate change impacts. One submission referred to the calculation of greenhouse gas impacts predicted for the Project, noting that:

Australia's carbon footprint is 546.3 Mt C02e (Aust. Nat. Greenhouse Accounts, Dec 2011) so 7 Mt is 1.3% of Australia's total carbon footprint. Checking up on Appendix G (PAE Holmes), p. 110 of this report shows that the consultant actually stated that 'The estimated quantity of carbon dioxide stored in the atmosphere now is 3000 Gt' (my emphasis).

They are speaking of the carbon pool in the atmosphere, not annual emissions! The two are totally different. Coalpac has thus deliberately mis-stated what was said in the PAE Holmes report. This either represents incompetence in regard to understanding climate science, or deliberately seeks to play down what is a major GHG emission in this project. The PAE Holmes figure of 3,000 Gt atmospheric pool is unreferenced but not far off other figures for the atmospheric pool of CO2, such as 2,752 Gt (Globe Project). The Coalpac Consolidation Project would thus be a major contributor to greenhouse gases, adding 1.3% to Australia's carbon footprint. In no way can it be said that 'there will be no increase or measurable impact on climate change' (said on p. x Exec Summary). This is a scientific fallacy and a logical impossibility. The project clearly will contribute to Australia's already high carbon footprint (per capita the highest in the world).

In response to the comment regarding the Project contribution of 1.3% of Australia's total carbon footprint please see **Section 4.4.9**. The AQIA also states that the GHG assessment in the AQIA has shown the Project to contribute approximately 0.01% of estimated GHG emissions (Scope 1 annual average emissions) to Australia's 1990 emissions under the Kyoto Protocol.

The Executive Summary of the EA also notes that 'applying the principles of ecologically sustainable development, it is considered that there will be no increase or measurable impact on climate change as a result of the project, since the supply of coal to the Mt Piper Power Station by the Project will be supplied either from this or another project' (see **Section 4.21** of this RTS).

4.4.13 Level of Detail Presented on Greenhouse Gas Impacts

Submission: SIG22

In their submission, LEG notes that:

> *"The Air Quality Assessment (PAEHolmes, 2011) fails to provide the level of detail required for the Minister to make an informed decision on the GHG impact of the Project. It contains irrelevant, inconsistent and incorrect information, which has potential to be misleading and does not provide an adequate assessment of cumulative impacts of the Projects GHG's.*
>
> *Some Scope 1 emissions are included while others are left out, for example emissions from the shipping of product coal are not included. The justification for this omission is unreasonable, "emissions from shipping of product coal are not included due to the difficulties in emission estimates, including uncertainty in export markets and destination of product in the future…" (PAEHolmes, 2011). It also does not include Scope 1 emissions from employee travel.*
>
> *Further, the air quality impact assessment incorrectly classifies the scope type of the emission sources, for example, emissions from the transport of coal is identified as a Scope 3 emission, when in fact, it is a Scope 1 emission.*

> *The correct identification of the scope of this emission source was identified earlier in the GHG assessment, "scope one emissions include…transportation of materials, products…"*
>
> *The assessment of Scope 3 emissions, in particular from the burning of the coal product, is not comprehensive. It does not include a satisfactory "detailed assessment" of the cumulative impact of the Project's GHG's. Rather it estimates the individual impact of the Project's GHG emissions and calculates this as a percentage of total global GHG emissions to argue that "the emissions estimated for this Project will not individually have any significant impact on global warming" (PAEHolmes, 2011, at s12.5). The Court in the case of Gray determined that "the fact there are many contributors globally [to climate change] does not mean the contribution from a single large source...should be ignored in the environmental assessment process"5. Further, the Court determined that viewing impacts in a piecemeal fashion undermines the planning process (Bach and Brown, 2009)."*

In response to the comment regarding the omission of shipping of product coal, it is first noted that this activity is not a Scope 1 emission but is classed as a Scope 3 emission. Section 1 of the National Greenhouse Accounts Factors (July 2011) describes a 'direct' or Scope 1 emission as,

> *"transportation of materials, products, waste and people; for example, use of vehicles owned and operated by the reporting organisation."*

Section 1 of the National Greenhouse Accounts Factors then continues to describe 'indirect' or Scope 2 and 3 emissions as:

> *"emissions generated in the wider economy as a consequence of an organisation's activities (particularly from its demand for goods and services), but which are physically produced by the activities of another organisation' and,*
>
> *'Other examples of indirect emissions from an organisation's activities include upstream emissions generated in the extraction and production of fossil fuels, downstream emissions from transport of an organisation's product to customers, and emissions from contracted/outsourced activities."*

While the AQIA does not specifically address the Scope 3 emissions from shipping transport, as the report has stated, there is much uncertainty in estimating these impacts due to potential changes in export markets and product destinations. Whilst assumptions may be made, the estimations of CO_2-e emissions from this activity would be crude and would potentially under/overestimate impacts. Further to this, as per Section 12.3.5.1 of the AQIA, Coalpac is only seeking to transport 1 Mt of product coal to Port Kembla for export. The remaining and majority of the product coal produced by the Project will be transported to the nearby power stations for use in domestic energy generation.

In response to the comment regarding emissions from staff vehicles, emissions from staff vehicles are generally a very minor contributor of CO_2-e at a coal mine site and particularly in relation to other activities at the site. However, an estimate of these emissions from the Project is given below, with assumptions including:

- 120 full time employees (as per the EA);
- Maximum of a 60 km return trip per employee (conservatively assumed as the average of distances for staff over a variety of suburbs);
- Conservatively assumed that each employee travels individually and in a Ford Falcon with a fuel consumption rate equivalent to that of an urban area (N.B: Vehicle type assumed to be the highest fuel consumer in the top 20 list of popular vehicles in Australia; see http://www.greenvehicleguide.gov.au/GVGPublicUI/SearchResults.aspx;
- Conservatively assumed that each employee travels 365 days a year to work; and
- Each car is powered by unleaded petrol.

Based on the above assumptions, it has been conservatively estimated that fuel consumption from staff vehicles would contribute 43 t $CO_{2\text{-}e}$ per year of Scope 1 emissions and 3.8 t $CO_{2\text{-}e}$ per year of Scope 3 emissions for each year of the Project. This represents a 0.0004% increase in total (all scopes) emissions over the life of the Project.

In response to the final paragraph of the above submission, it is unclear as to what the submission means by the AQIA not providing a 'cumulative impact of the Project's GHG's'. The AQIA has estimated GHGs emissions from a range of activities proposed and then goes on to compare the Project's emissions with Australia's 1990 baseline emissions reported under the Kyoto Protocol. The Australian baseline level of 547.7 Mt $CO_{2\text{-}e}$ of GHG emissions (per Section 12.5 of the AQIA) includes all other reported sources of GHG emissions and therefore the calculation of the Project's emissions and comparison against this level is in itself a cumulative assessment.

4.5 NOISE

4.5.1 Noise Attenuation of existing plant and equipment

Submission: R4

In commenting on their concerns regarding Coalpac's commitment and ability to effectively implement noise mitigation measures, EPA referred to a previous example at Invincible Colliery regarding the Invincible Coal Preparation Plant (ICPP) at the site. It was noted that Coalpac committed noise attenuation works at the ICPP to reduce the Sound Power Level (SPL) of the facility from 120 dBA to 110 dBA and that these works were subsequently incorporated into a Pollution Reduction Program (PRP) on the Environment Protection Licence (EPL) for Invincible Colliery.

In outlining their concern regarding the previous implementation of noise attenuation at Invincible Colliery, the EPA noted that the replacement of high pitch reversing alarms on all mobile equipment with broad-spectrum alarms had not been fully implemented as at August 2010.

Coalpac undertook the works at the ICPP (in 2008) and provided a report soon after to the EPA confirming that these had been undertaken, however did not achieve desired reductions in noise levels. DECC (now OEH) then removed the Noise PRP from EPL 1095 in their letter dated 27 April 2009. However, as noted by the EPA in their submission regarding the Project, while these works were undertaken in accordance with the PRP conditions, only a negligible reduction in the ICPP SPL was achieved.

Due to the status of ongoing acquisition negotiations with affected landholders at that time (the owners of the Billabong and Hillview properties, ID 393 and ID 394 on Figure 2 of the EA), Coalpac did not pursue the installation of any additional noise attenuation for the ICPP to reduce the SPL of the facility. Negotiations with the then landholders of properties 393 and 394 continued during this time until agreement was reached in mid-2010 and the property settled on 15 December 2010.

Since the acquisition of properties ID 393 and ID 394 by Coalpac, no noise complaints relating to the operation of the ICPP or Bradford Breaker have been received. Under current operating conditions, the ICPP including the Bradford Breaker is not a source of environmental noise impact to the closest private receiver. The Bradford breaker operating at 121 dB(A) in its current location and under existing land tenure arrangements has not created adverse environmental noise impacts at sensitive receptor locations since 2010.

However, it is considered that the implementation of additional noise attenuation works for the ICPP proposed for the Project in the acoustics impact assessment are reasonable and can feasibly achieve the reduction in the SPL of the facility from 121 dBA to 109 dBA.

These additional noise attenuation works committed to by Coalpac to ensure leading practice noise mitigation in accordance with the AIA will be undertaken by Year 2 and include:

- Removal of the existing building cladding on the western side of the ICPP;
- Addition of 9 mm compressed fibre cement sheets or equivalent on a suitable support structure over the entire north and west building faces; and
- Re-installation of the steel cladding over the fibre cement for weather protection and appearance over the north and western sides of the ICPP.

Coalpac implemented broad-spectrum reversing alarms for all existing mobile equipment at Invincible Colliery by September 2010.

4.5.2 Background Noise Levels

Submission: R3, R5, P328, P504

Several submissions raised concern around the background noise levels adopted for the Project noise impact assessment, stating that the nominal level of 30 dBA may not be reflective of the actual background noise level at many of the receivers greater than 500 m from the Castlereagh Highway, given that night time measurements at a number of places are shown as within the 20-30 dBA range.

LCC considered that this would result in an increase of up to 10 dBA at night-time for some residences and the perception of impacts at residence locations that could result in ongoing noise complaints. It was also noted that this issue may mean that some affected parties would not be afforded a landholder agreement or the compulsory acquisition process as the EA indicates compliance with the noise criteria at their property.

As discussed in Section 8.6 of the EA, the acoustics impact assessment for the Project was undertaken in accordance with the *NSW Industrial Noise Policy* (INP) (EPA 2000), with background noise levels determined using results from quarterly monitoring at Cullen Valley Mine and Invincible Colliery and from attended and unattended noise surveys undertaken in 2011. Project operational noise criteria adopted for receivers located more than 500 m from the Castlereagh Highway of 30 dBA are considered appropriately conservative for the noise impact assessment, being the lowest rating background level (RBL) that can be adopted under the INP.

A higher RBL of 32 dBA for the day period was adopted for all receivers located within 500 m of the Castlereagh Highway, with evening and night RBLs of 30 dBA.

4.5.3 Noise Mitigation included in Acoustics Impact Assessment

Submission: R4, R5, Public

EPA referred to the operational noise modelling predictions for receiver locations presented in the EA, citing that they are based on the incorporation of extensive noise mitigation works and other controls (including significant reductions in mobile plant sound power levels, significant engineering controls for coal preparation plants, bins and crushers to lower the sound power levels and also the provision of numerous bunds). EPA notes that even with these extensive noise mitigation measures in place, that the noise modelling predicts adverse impacts at 9 locations during the day and 36 residential receivers at night.

The EPA submission is correct in that modelling predictions of the Project acoustic impact assessment incorporated all feasible and reasonable noise controls and mitigation works committed to by Coalpac to minimise impacts to receivers. These measures were put in place due to initial noise modelling for the optimal resource extraction mine plan option indicating that comprehensive mitigation measures were required to be implemented to minimise noise impacts at receiver properties.

As such, Coalpac committed to implementing leading practice mitigation measures for the Project operations to reduce noise impacts as far as is reasonable and feasible. These measures are discussed in Section 4.4 of the AIA and Section 8.6.4 of the EA and include:

- Construction of noise management bunds in key locations within the Project Boundary to enhance the noise mitigation effects provided by topography and proposed OEAs (see **Section 4.7.1**);
- Implementation of a range of controls and operating procedures to reduce and mitigate noise impacts associated with the Project construction phase;

- Acquisition, operation and maintenance of a noise attenuated equipment fleet and key infrastructure (see **Section 4.5.4**);
- Identification of 'management zones' within open cut mining areas for the Project where operations would either cease or be modified under certain weather conditions. These are 'management zones' are identified in Figure 26 of the EA. Note that additional areas requiring reactive noise management have subsequently been identified in response to regulatory submissions and are outlined below; and
- Preparation of a Noise Monitoring Program and Noise Management Plan (NMP) for the Project, to be developed in consultation with and to the approval of relevant regulatory agencies. These documents will confirm the commitments made in the EA for leading practice monitoring and operational management to minimise Project noise impacts.
- Noise monitoring proposed for the Project will be undertaken to be representative of closest sensitive receivers and shall include:
    - Quarterly operator attended noise monitoring (including a review of data collected by the semi-permanent directional real time noise monitoring system that would move between sensitive receptor locations as the mining operation progresses);
    - Regular correlation of real time noise monitoring results with the site meteorological monitoring data to proactively manage operational noise during enhancing weather conditions when mining activities are approaching the intrusive criterion; and
    - A network of real time noise monitors.

The system will include the development of trigger levels to generate alarms to notify site Supervisors of noisy operations that may require attention. As per the commitment outlined in Section 8.6.4 of the EA, the NMP to be developed for the Project by Coalpac will incorporate practical measures for noise minimisation, including:

- Mobile plant including excavators, front end loaders, trucks, drills, dozers and water carts will be fitted with leading practice exhaust silencers and engine attenuation packages to reduce noise emissions;
- The mobile overburden fleet will be directed to higher, exposed areas during favourable weather conditions (generally during the day) and to lower, more shielded areas during noise enhancing weather conditions (shown in Table 26 of the EA);
- Tracked dozers will be operated at slow speed, particularly in reverse, in exposed areas of the site during noise enhancing weather conditions to minimise audible track noise;
- Vehicle warning devices (e.g. reverse alarms, horns and start alarms) will be selected and installed to produce the lowest possible noise levels consistent with safe operation;

- Mobile and coal handling equipment will be maintained in good condition to minimise unnecessary noise;
- Noise suppression will be included on the conveyor system and transfer points, where practical;
- Management measures would be adopted to minimise rail loadout noise and avoid train wagon bunching noise during train movements;
- A real time noise monitoring system will be installed to assist with the proactive management of operations to minimise adverse noise impacts on neighbouring receivers. Indicative monitoring locations proposed during the life of the Project are shown in Figure 25 of the EA; and
- Notification will be provided to all land holders listed in Table 27 that are predicted to exceed the relevant assessment criteria, including details regarding their rights under the Project Approval.

In response to a number of submissions to the EA, Coalpac has also identified those areas within the Project Disturbance Boundary where 'unshielded' operations may need to be monitored and managed under different meteorological scenarios to ensure that noise impacts to sensitive receptors will be further minimised. This is outlined in **Section 4.5.5** and the procedures to manage operations in these areas will be included in the Project NMP.

4.5.4 Noise Attenuation of Project Plant and Equipment

Submission: R4

EPA raised concerns with the noise attenuation of plant and equipment that was nominated as being required for the Project in the acoustic impact assessment. Specifically, these issues related to the ability of noise attenuation nominated in the acoustics impact assessment to be achieved, the commitment and ability of Coalpac to effectively implement and maintain an attenuated noise equipment fleet and the cost implications associated with these commitments.

As discussed in the EA and accompanying acoustic impact assessment, the noise attenuation for plant and equipment nominated as necessary to reduced noise impacts to receivers are considered to be both technically feasible and able to be maintained over the life of the Project. Coalpac provides a further commitment to these controls and management measures in Table 69 of the EA.

In light of EPA's concerns regarding Coalpac's ability to implement and maintain the noise attenuation control measures, a list of major types of attenuated equipment proposed for the Project and associated implementation timeline is presented in **Table 7**. This table also includes dynamic attenuated sound power levels for each equipment type as confirmed during testing in accordance with *Australian Standard 2012.1-1990* (1990).

When compared to Section 4.4.1 of the AIA, it can be seen that the sound power levels modelled for the attenuated Project fleet are either consistent with or more conservative than those recorded during testing by the supplier. It should be noted that the timing for implementation listed in **Table 7** is based on anticipated delivery times as at July 2012 and this may change depending on the timing of any approval for the Project and market forces at that time.

Should the Project be approved, Coalpac is committed to having the attenuated equipment fleet as described in the EA in operation prior to the end of Year 2 of the Project and having adequate resources in place to maintain the effectiveness of noise attenuated plant and equipment at these levels in the long term through a regular maintenance program. As with other major costs associated with the leading practice environmental management proposed (see **Section 4.17.21**), Coalpac will be able to source the required funding to acquire and maintain the attenuated equipment fleet if the Project is approved.

Consistent with the EPA's requirements, a suitably qualified acoustic consultant will be employed to provide certification that the sound power levels from relevant plant and equipment for the Project site are at or below those levels used in the noise assessment modelling prior to being used on the site.

Coal production will not increase from the currently approved volume of 2.2 Mtpa (combined Cullen Valley Mine and Invincible Colliery volumes) to the 3.5 Mtpa sought for the Project until the new attenuated equipment is on site.

Any plant and equipment found to have defective or missing sound attenuation components will not be used operationally until repaired/reinstated.

Table 7
Project Attenuated Equipment Fleet and Implementation

Equipment	Project AIA Sound Power Level (dB(A) Leq)	AS2012.1-1990 Dynamic Sound Power Level (dB(A) Leq)	Implementation Timing (months post Project Approval)
Excavators (CAT6030, or equivalent)	116	114	Up to 12 months
Coal and Overburden Trucks (CAT785C / CAT777F, or equivalent)	114 / 114	114 / 114	Up to 18 months
Water Cart (CAT777F, or equivalent)	114	114	Up to 12 months
Push to Fill and Bench Dozers (CAT D11T, or equivalent)	114	114	Up to 12 months

Equipment	Project AIA Sound Power Level (dB(A) Leq)	AS2012.1-1990 Dynamic Sound Power Level (dB(A) Leq)	Implementation Timing (months post Project Approval)
Overburden and Rehabilitation Dozers (CATD10T, or equivalent)	114	113	Up to 12 months
Front End Loader (CAT992K, or equivalent)	116	114	Up to 12 months
Grader (CAT16M, or equivalent)	113*	104	Up to 12 months
Blasthole Drill (Bucyrus SKF-98, or equivalent)	114	114	Up to 12 months

** Equipment assumed as standard in the Project AIA*

4.5.5 Predicted Noise Impacts and Implementation of Mitigation Measures

Submissions: R3, R4, R5, SIG1, SIG9, SIG22, Petition, P235, P261, P281, P297, P331, P348, P369, P390, P402, P414, P424, P471, P477, P492, P504, P520, P534, P541, P556, P582, P586, P593, P589 - 599, P601, P606, P613, P623, P638, P650, P655, P663, P670, P673, P679, P685, P689, P691, P693, P695, P707, P714, P720, P725, P730, P733, P743, P766, P773, P778, P791, P798, P810, P811, P813, P818, P820, P839, P846, P851, P853 - 854, P866, P877, P885

Several submissions raised concern regarding the overall number of receivers predicted to be impacted by Project noise levels above the relevant criteria. This includes the submission from the EPA who cited 'considerable reservations' about the ability of Coalpac to successfully implement and maintain noise mitigation measures committed to in the EA and accompanying acoustics impact assessment.

As discussed in Section 8.6.3 of the EA and detailed in the Project acoustic impact assessment (Appendix H of the EA), predicted noise levels for both construction and operational activities include all feasible and reasonable noise management and mitigation measures. All of these measures have been included in the noise impact modelling and results presented in the EA. In particular, the EA includes an assessment of noise levels during construction of the various noise control bunds. It includes a commitment to construct bunds ahead of the mining operation, to control noise at all times while mining, and to only construct bunds during the day where required to control construction noise levels.

The summary of the private residences and properties (contiguous lots with a common landholder) where the Project is predicted to result in an exceedance of PSNC is reproduced below in **Table 8** (Table 27 from the EA) and **Table 9** (Table 28 from the EA). It should be noted that potentially significant noise impacts are shown in bold text and that where a higher noise level has been predicted at a residence in **Table 8**, the associated property was not duplicated in **Table 9**.

Table 8
Predicted Noise Level Exceedance of Intrusive Criteria at Private Residences

Receiver ID	Description	Intrusive Criteria Day / Night	Predicted Maximum Noise Level (dBA L_{Aeq}, 15 min)			
			Year 2	Year 8	Year 14	Year 20
SIGNIFICANT						
194	JGQ Nominees Pty Ltd ***	37 / 35	45.3	40.5	41.1	43.6
195	KJ Blackley **	37 / 35	43.8	39.0	40.3	40.2
197	BE & CE Leisemann & IL & KID Follington ***	37 / 35	40.4	36.2	36.0*	36.1*
205	D Dino & J Seraglio **	35	40.6	35.9	36.3	36.5
MODERATE						
139	RI & GM Larkin	35 / 35	-	37.7	35.7	-
142	PG Desch & KC Farrugia	35	35.7	37.3	-	38.1
143	DB Speirs	35	36.4	37.9	35.7	37.6
144	DA & DM Muldoon	35	38.0	38.7	36.6*	37.1
179	RK Dickens **	35	39.7	36.9	36.4	-
198	DA Tilley**	37 / 35	39.7	-	-	38.8*
199	DA Tilley **	37 / 35	39.5	-	-	39.8*
217N	Crown (includes residence)	37 / 35	37.2	-	-	-
349	RM Crane	35	37.8	38.4	35.8	37.7
364	JR Gracey	35	38.7	36.2	37.6	36.5
367	JR Gracey	35	38.9	36.8	37.2	37.2
368	RA Fuller	35	37.1	-	35.8	35.4

Receiver ID	Description	Intrusive Criteria Day / Night	Predicted Maximum Noise Level (dBA L_{Aeq}, 15 min)			
			Year 2	Year 8	Year 14	Year 20
372	RE Gilmore	35	39.3	37.5	37.4	37.7
373	WF Fitzgerald	35	37.1	36.4	36.4	37.1
383	BS Bretherton & B Chandwick	35	37.7	35.9	37.0	36.6
386	TJ Griffiths	35	37.7	36.2	37.0	37.0
392	IG Palmer	35	38.4	39.0	39.0	39.5
412	V & F Fava, C Rositano, F Tedesco & E Todorello	35	38.4	36.8	36.5	36.9
MILD						
106	A & M Abou-Touma	35	-	35.2	-	-
108	PJ & CI DI Mauro	35	-	35.2	-	-
109	J, P, GG & CG Piccione	35	-	35.2	-	-
112	J Hannouche	37 / 35	-	35.9	-	-
113	MB & AM Ringin	37 / 35	-	36.5	-	-
114	PJ & EJ Isaacson	37 / 35	-	36.0	-	-
209	DJ Ryan	35	35.1	-	-	35.4
384	A Tabone	35	36.6	-	35.4	
385	Ceedive Pty Ltd	35	36.3	-	35.1	-
388	VA McFadden	35	35.8	35.2	35.6	35.2
391	MG Bulkeley	35	36.9	36.1	36.4	37.0
403	BR & E Brown	35	36.4	-	-	-
404	BR & E Brown	35	35.9	-	-	-
426	JWJ & SM Taylor	35	36.3	35.8	-	35.1

Bold text denotes noise levels exceeding criteria by more than 5 dBA.

* *Denotes where exceedances are associated with day/evening prevailing condition only*

** *Agreement being negotiated with landholder.*

*** *Agreement in place with Coalpac.*

Table 9
Predicted Noise Level Exceedance of Intrusive Criteria Over 25% Contiguous Property

Receiver ID	Description	Intrusive Criteria	Predicted Maximum Noise Level (dBA $L_{Aeq,15min}$)			
			Year 2	Year 8	Year 14	Year 20
SIGNIFICANT						
170	Coalpac (formerly BE Nakhle)*	37 / 35	61.3	63.1*	59.2*	60.3*
173-175, 178-186	RK Dickens^ **	35	41.1	-	-	-
198, 199	DA Tilley^ **	37 / 35	46.6	43.2	43.2	43.9
200	BE & CE Leisemann & IL & KID Follington ***	37 / 35	49.6*	44.2	43.8	44.7*
MODERATE						
176	GE Orellana	35	40.0	-	-	-
201	KD & RL Kellam **	37 / 35	39.4	-	-	35.8*
209	DJ Ryan	35	38.5	35.1	35.2	35.5
216	BM Emmott	37 / 35	37.6	-	-	-
370	JA, SE Byron & DC Hutton	35	39.1	37.0	37.1	37.3
371	MA & JL Taylor	35	38.1	36.3	36.5	37.0
411, 415,416,420-425	SJ & DS Taylor	35	39.0	39.4	38.6	39.1
387	JR Embleton & KJ Kelly	35	37.1	36.0	36.6	37.0
MILD						
107	G & M Gebrael	35	-	36.9	-	-
111	A & R Salman	37 / 35	-	35.2	-	-
119	LN Goldspink	37 / 35	-	35.3	-	-
122	JL Macphee	37 / 35	-	35.1	-	-
210	FC & K Tilley	35	36.1	-	-	-

Receiver ID	Description	Intrusive Criteria	Predicted Maximum Noise Level (dBA $L_{Aeq,15min}$)			
			Year 2	Year 8	Year 14	Year 20
220	KL Bunyon	37 / 35	-	-	-	35.9*
348	RE Gilmore & MG & PJ Bulkeley	37 / 35	35.2	35.3	-	-
350	Tanwind Pty Ltd	37 / 35	35.2	-	-	-
362	RE Gilmore & MG & PJ Bulkeley	37 / 35	37.0	37.0	35.6	36.0
406	P W Griffiths	35	36.2	-	-	-
408	RH Griffiths	35	35.4	-	-	-
410	PJ & SL McFadden	35	36.4	35.6	35.7	36.1
417-419	AP & KA Brown	35	36.7	35.7	-	35.5

Bold text denotes noise levels exceeding criteria by more than 5dBA.

* *Denotes where exceedances are associated with day/evening prevailing conditions.*

^ *Predicted to exceed a higher criteria at private residence presented in Table 27.*

** *Agreement being negotiated with landholder*

*** *Agreement in place.*

Significant Noise Impacts

As noted in Section 8.6.3 of the EA, the AIA predicted significant noise impacts (5 dBA or more above the Project intrusive noise criteria) at four private residences and four private properties. Coalpac does not have a noise agreement with the landholders of two of these residences and two of these properties, although discussions with these landholders are progressing.

Coalpac will use best endeavours to pursue noise agreements with these landholders. These residences and properties will also be subject to acquisition by Coalpac at market value upon request of the landholder and in accordance with the procedures required under any approval conditions for the Project, should it be approved.

Further to the above, Coalpac will also implement additional reasonable and feasible noise mitigation measures at these residences upon receipt of a request from the landholder.

Moderate Noise Impacts

As noted in Section 8.6.3 of the EA, the AIA predicted moderate noise impacts (2 - 5 dBA over the Project intrusive noise criteria) at 18 private residences and eight private properties.

Coalpac will use best endeavours to pursue noise agreements with these landholders.

Coalpac will also implement reasonable and feasible noise mitigation measures in accordance with any conditions of Project Approval at these residences upon receipt of a request from the landholder.

Mild Noise Impacts

As noted in Section 8.6.3 of the EA, the AIA predicted that 14 private residences (owned by 13 landholders) have been predicted to experience mild noise impacts (up to 2 dBA over the Project intrusive noise criteria). Eight of these private residences are predicted to receive impacts within 1.5 dBA greater than intrusive noise criteria in one modelled year of the Project only.

A further 13 properties (owned by 11 landholders) are expected to receive a mild noise impact from the Project in one or more modelled years and time periods over more than 25% of the land area in a contiguous landownership. Nine of these are predicted to be mildly affected by noise in a single modelled year only.

While the AIA predicted that the above residences and properties would receive mild noise impacts during at least one modelled year for the Project, the leading practice management measures to be implemented for the Project (including the use of real time monitoring network and predictive meteorological system) are predicted to minimise noise levels at these locations to below 35 dBA (where no landholder agreement is in place).

In addition to the network of real time noise monitors to be put in place, plans have been prepared by Bridges Acoustics (2012) to identify specific areas of the site where 'unshielded' Project operations would result in impacts to sensitive receivers under various temperature inversion and meteorological conditions. The methodology for the determination of shielded areas where the noise attenuated Project operations could occur under all conditions and the identification of areas where additional mitigation or modified operations would be required are presented in **Appendix C**. It should be noted that these 'unshielded' areas where modified operations may be required under certain conditions are in addition to the three zones where Coalpac has committed to modified activities in the AIA and Section 8.6.4 of the EA.

The management of Project operations in unshielded areas will be achieved by utilising the predictive meteorological component of the Air Quality Management System proposed for the Project (**Section 4.2.18**) to proactively identify the areas of the site where operations will need to be managed, relocated or temporarily halted to ensure that any impacts to 'mild' receptors remain below 35 dBA (where no Agreement is in place).

Further discussion on the implementation of noise mitigation commitments for the Project is provided in **Section 4.5.4** and **Section 4.2.18** of this document.

4.5.6 Public Health Risks due to Project Noise

Submissions: R5, SIG3, SIG8, SIG13, SIG14, SIG20

The submission from NSW Health noted the increasing evidence of the potential risks to public health associated with long-term expose to environmental noise on annoyance, sleep disturbance, children's performance at school, hypertension and ischemic heart disease.

As noted above, the Project AIA was completed in accordance with the INP criteria and requirements set by the EPA which stipulates that a range of noise impacts including operational noise, road and rail noise, construction noise, cumulative noise impacts, sleep disturbance and low frequency noise be considered. INP noise criteria have been developed by the EPA considering relevant outcomes from local and overseas research regarding the effects of environmental noise on health and amenity.

The noise criteria compare favourably with equivalent criteria adopted by other Australian states and comparable industrialised countries.

Potential noise impacts associated with mining operations, construction noise, sleep disturbance, low frequency noise, traffic noise (road and rail) and cumulative effects from other industry in the local area were considered in the Project AIA, with results summarised in Section 8.6.3 of the EA.

Noise impacts predicted in the AIA are outlined in **Section 4.5.5**.

4.5.7 Noise Impacts to Receivers in Cullen Bullen

Submissions: R3, R4, R5, SIG1, SIG9, SIG22, Petition, P235, P261, P281, P297, P331, P348, P369, P390, P402, P414, P424, P471, P477, P492, P504, P520, P534, P541, P556, P582, P586, P593, P589 - 599, P601, P606, P613, P623, P638, P650, P655, P663, P670, P673, P679, P685, P689, P691, P693, P695, P707, P714, P720, P725, P730, P733, P743, P766, P773, P778, P791, P798, P810, P811, P813, P818, P820, P839, P844, P846, P851, P853 - 854, P866, P877, P885

Submissions received noted concerns regarding predicted noise impacts to receivers in Cullen Bullen presented in the EA and the Cullen Bullen Public School in particular. Several submissions also noted that Project noise would impact on the ambience and rural character of the town.

The predicted noise impact to receivers presented in Table 27 and Table 28 of the EA represent worst case noise levels for all modelled scenarios across the life of the Project with all reasonable and feasible mitigation measures in place.

No receivers within the Cullen Bullen township are predicted to receive noise levels above Project Specific Noise Criteria (PSNC). Extensive noise modelling scenarios, including additional mitigation measures and commitments, were undertaken during the development of the mine plan (as described in Section 4.4 of the AIA) to ensure no significant exceedances of the PSNC would result for private receivers in the township of Cullen Bullen.

Specifically, no exceedance of noise impact criteria is predicted for Cullen Bullen Public School for the Project, being less than the relevant INP residential criteria of 37 dBA during the day. As noted in Appendix C of the Project AIA, all residences, properties and lots that were predicted to receive less than 35 LAeq, 15 min during all time periods and weather conditions assessed were omitted from the discussion of noise impact predictions. Predicted noise levels for the Project are therefore at least 10 dBA less than the internal noise criterion of 35 $L_{Aeq,\ 1\ hour}$ for a school classroom as recommended in the INP, which is approximately equivalent to an external criterion of 45 $L_{Aeq,\ 1\ hour}$ and would be significantly less than the 50 LAeq,9 hr amenity criterion recommended for residential properties during the day.

As noted in **Section 4.5.5**, Coalpac will seek agreements with all landholders where moderate noise impacts (2 - 5 dBA above the Project intrusive noise criteria) are predicted. Coalpac will also implement reasonable and feasible noise mitigation measures upon receipt of a request from the landholder.

As noted in **Section 4.5.13** of this document, Coalpac will implement a range of noise management and mitigation measures for the Project to ensure that noise levels are reduced for all receivers.

One submission (R5) also noted that a higher number of residences would be impacted by Project noise levels when measuring over 25% of the total property area. In addition to the prediction of noise levels for residential blocks presented in Table 27 of the EA, Table 28 shows those properties where predicted noise levels will exceed the relevant intrusive criteria over to 25% of the total property area. These results are reproduced and discussed in **Section 4.5.5** of this document.

4.5.8 Road Traffic Noise

Submissions: SIG8, SIG22, P447, P328, 504,

Adverse health and amenity impacts from the heavy vehicle movements along the existing Cullen Valley Mine Private Haul Road were raised by several submissions.

Section 8.6.3 and Appendix H of the EA includes the assessment of road traffic noise during both the construction and operational phases of the Project. The assessment found the traffic noise criterion would be met at any residence at least 50 m from the Castlereagh Highway.

A key benefit of the Project, should it be approved, is to remove the requirement for the haulage of coal from Cullen Valley Mine to the Invincible Colliery via the existing Cullen Valley Mine Private Haul Road and the Castlereagh Highway. As stated in Section 8.2.1 of the EA, the Cullen Valley Mine Private Haul Road will not be used by coal trucks upon completion of the proposed Castlereagh Highway bridge, and only intermittently after Year 2 by light vehicles or by limited heavy vehicle deliveries accessing and returning from the Cullen Valley Mine Offices or workshop area.

4.5.9 ETCPP Noise Impacts

Submission: P673

One submission raised concern that the noise generated by the ETCPP would not be able to be screened at a distance of 1 km.

The influence of the ETCPP facility was included in the assessment of operational impacts for the Project discussed in the AIA and Section 8.6 of the EA. The site of the ETCPP was purposefully located at the lowest level possible to provide the maximum shielding from surrounding OEAs.

4.5.10 Rail Siding Noise Impacts

Submission: P673, P813

Several submissions noted the impacts of the rail siding proposed for the Project.

Specifically, one submission noted that the noise contour figures in the EA show that the Forest Lodge property would be impacted up to 45 dBA, mainly by the rail siding proposed for the Project. This submission suggested that a more efficient solution for Project rail haulage would be for Coalpac to use the existing Baal Bone Rail Loop (immediately to the north of the Project Boundary).

Maximum noise impact levels predicted for the Forest Lodge property (Residential Receiver ID 139) would occur during the construction phase of the Project. As outlined in Section 4.8.3 of the AIA:

> *"…predicted noise levels due to rail siding construction work, and in particular construction of the noise bund adjacent to the rail siding, would produce up to 42 LAeq,15min at Residence 139 under both neutral and prevailing weather conditions,"*

Contour plans for the Project construction phase are presented in Appendix A of the AIA (Figures A16 and A17).

As shown on **Table 8** and **Table 9** the maximum operational noise levels predicted for the Forest Lodge property would be moderate, at 37.7 dBA during Year 8 of the Project, with impacts of up to 35.7 dBA during Year 14. In addition to mining sources, the predicted impacts include the contributions to maximum noise levels from operation of the proposed rail siding. As noted in **Section 4.5.5**, Coalpac will seek an agreement with the landholder of the Forest Lodge property due to the prediction of moderate noise impacts at Residence 139.

Coalpac considered the use of the Baal Bone Colliery Rail Loop in the development of the Project mine plans, however access to this infrastructure was not available from the owner.

4.5.11 Operational Hours

Submissions: R4, R5, SIG8, SIG15, Petition, P813

A number of submissions referred to the 24 hour operations proposed for the Project and noted the constant impacts that would be experienced by residents in the proximity of mining activity. The 24 hour operations proposed for the Project were assessed in the AIA and a range of leading practice measures were put in place to ensure that impacts to receivers are minimised as far as is reasonable and feasible (see **Section 4.5.3**).

Coalpac responses to the noise impacts to residents predicted in the AIA are discussed in **Section 4.5.5**. The maximum noise impacts predicted in the NIA included the consideration of night-time operations proposed for the Project.

4.5.12 Cullen Bullen Acoustic Impact Buffer

Submissions: SIG1, SIG3, SIG8, SIG9, Petition, P877,

A number of submissions noted that noise impacts predicted for the Project would impact on the amenity of Cullen Bullen (see **Section 4.5.7**). As a management response to reduce these impacts, several submissions requested that a buffer zone be established to restrict mining operations from within a 3 – 5 km radius of Cullen Bullen.

A response to submissions regarding blast impacts for Cullen Bullen is provided in **Section 4.6**.

4.5.13 Noise Management Plan

Submissions: R3, R4, R5, SIG1, SIG9, SIG22, Petition, P235, P261, P281, P297, P331, P348, P369, P390, P402, P414, P424, P471, P477, P492, P504, P520, P534, P541, P556, P582, P586, P593, P589 - 599, P601, P606, P613, P623, P638, P650, P655, P663, P670, P673, P679, P685, P689, P691, P693, P695, P707, P714, P720, P725, P730, P733, P743, P766, P773, P778, P791, P798, P810, P811, P813, P818, P820, P839, P846, P851, P853 - 854, P866, P877, P885

As noted in Section 8.6.4 of the EA, Coalpac will develop and implement a comprehensive NMP for the Project. This document will be prepared in consultation with the relevant regulators to the approval of DP&I and incorporate all reasonable and feasible noise minimisation, monitoring and management measures included in the AIA for construction and operation of the Project. Key components of the NMP will include:

- A leading practice noise monitoring network surrounding the site which is representative of the closest sensitive receivers. This network will be implemented to include a predictive meteorological component as discussed in **Section 4.5.5** and a real time component to allow pro-active and reactive management of these operations to minimise noise impacts at sensitive receptor locations and ensure compliance with the relevant PSNC;

- Detail on noise mitigation for the Project equipment fleet and a commitment to maintain equipment at attenuated noise levels, consistent with the predicted levels in the EA, as outlined above in **Section 4.5.4**;
- Procedures for the modification of Project operations and equipment use in specific mining areas under unfavourable weather conditions; and
- Notification of all landholders that are predicted to exceed the intrusive noise criteria for the Project and their rights under the conditions of any Project Approval.

4.5.14 Preliminary Noise Management Procedure

Submissions: R3, R4, R5, SIG1, SIG9, SIG22, Petition, P235, P261, P281, P297, P331, P348, P369, P390, P402, P414, P424, P471, P477, P492, P504, P520, P534, P541, P556, P582, P586, P593, P589 - 599, P601, P606, P613, P623, P638, P650, P655, P663, P670, P673, P679, P685, P689, P691, P693, P695, P707, P714, P720, P725, P730, P733, P743, P766, P773, P778, P791, P798, P810, P811, P813, P818, P820, P839, P846, P851, P853 - 854, P866, P877, P885

Areas within the Project Disturbance Boundary where management or modification of mining activities will be required under adverse meteorological scenarios are shown in **Figure 4** to **Figure 9**.

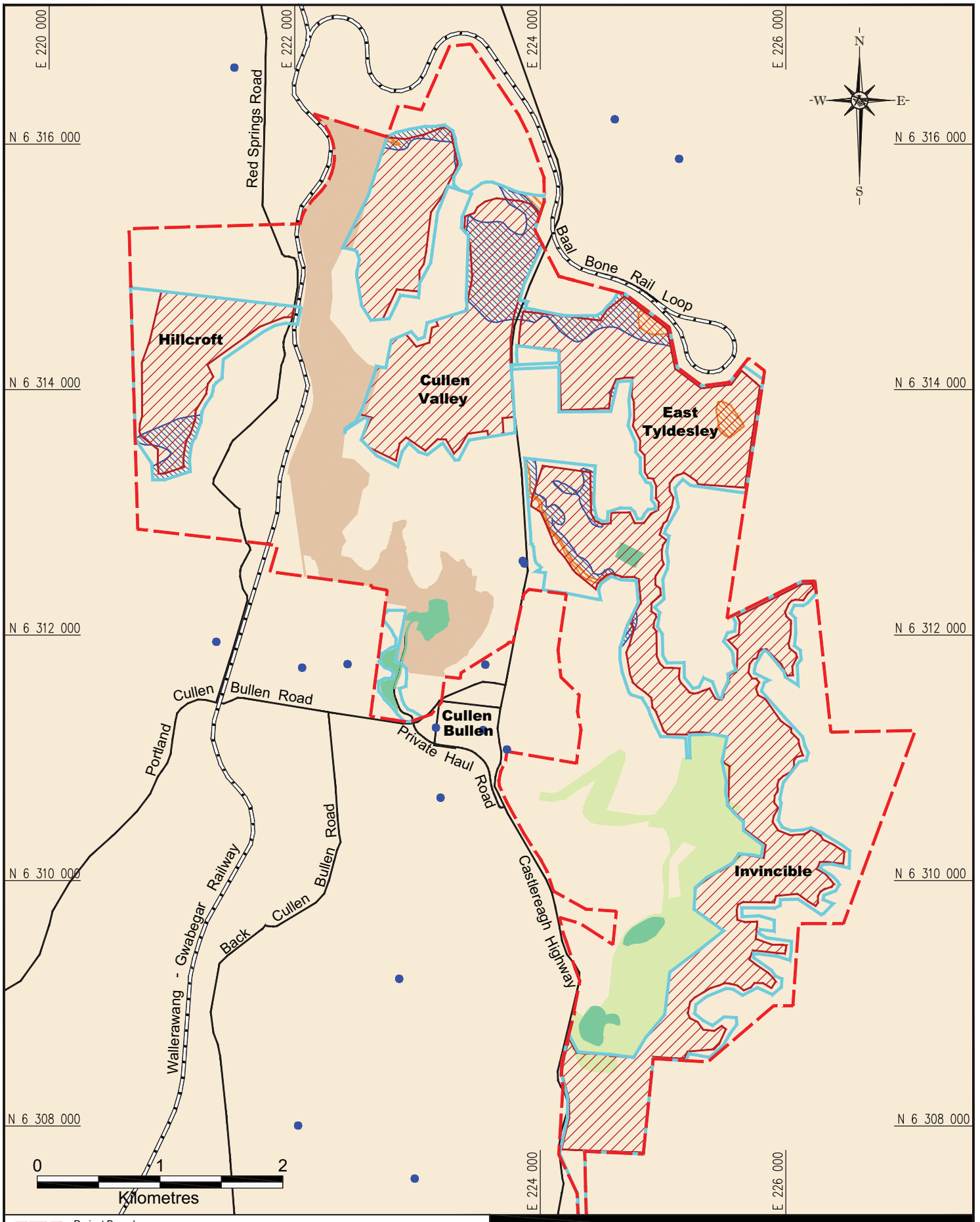
Figure 4 to **Figure 9** provide an outline of those areas under the five meteorological scenarios considered in the AIA where noise impacts at the nearest sensitive receptor locations are predicted to occur in the range of 35 – 40 dBA (Noise Management Zone 1) and in the range from 40 – 45 dBA (Noise Management Zone 2).

A draft Noise Management Procedure (see **Appendix C**) has been developed for up to Year 2 of the Project which indicates under what meteorological conditions operations will be required to be modified in key mining areas.

The Noise Management Procedure will be used in conjunction with real time monitoring and the predictive meteorological monitoring system (see **Section 4.2.17**) to manage potential noise impacts on private receivers. It discusses practical operational controls for various mining areas under various weather conditions.

The Noise Management Procedure will be revised on a 6 monthly basis to incorporate real time data and actual operating conditions with plans for mining operations after Year 2 and developed in consultation with EPA.

Further, in response to the submissions raised in relation to Coalpac's ability to implement the noise controls considered in the AIA (**Sections 4.5.1**, **4.5.3**) the NMP will also include procedures for the ongoing monitoring and maintenance of all equipment and infrastructure SPLs at the attenuated levels assessed.



Project Boundary
Project Disturbance Boundary
Existing Cullen Valley Mine
Existing Invincible Colliery
Infrastructure
Open Cut Coal Mining
Noise Management Zone 1
Noise Management Zone 2
Sensitive Receiver Locations

Hansen Bailey

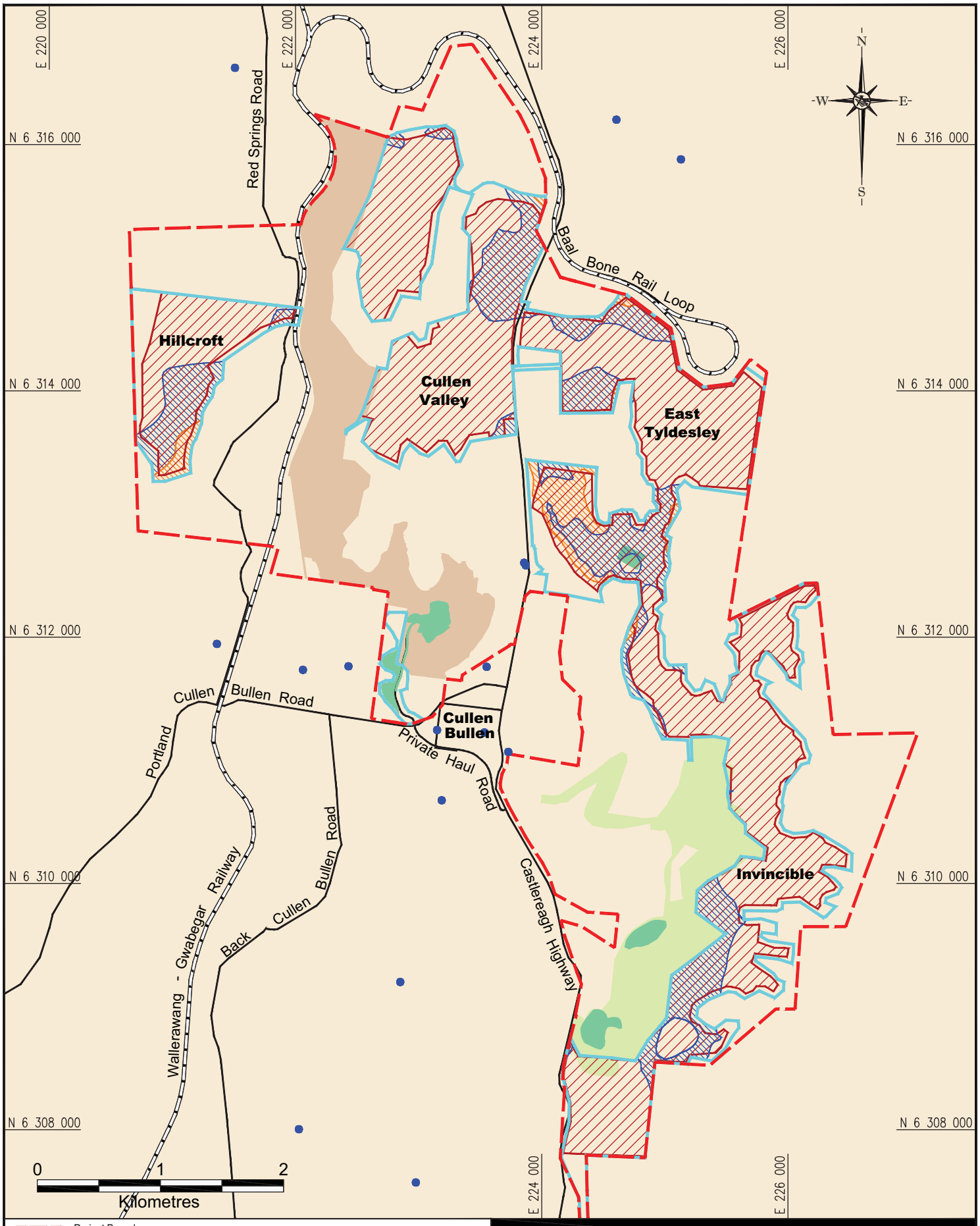
Coalpac Pty Ltd

Coordinate System: MGA Zone 56

COALPAC CONSOLIDATION PROJECT

Day Evening Neutral

Cad File: 08607B.dwg	Date: 08.08.12	Drawn: CP	Figure 4



Project Boundary
Project Disturbance Boundary
Existing Cullen Valley Mine
Existing Invincible Colliery
Infrastructure
Open Cut Coal Mining
Noise Management Zone 1
Noise Management Zone 2
Sensitive Receiver Locations

Hansen Bailey

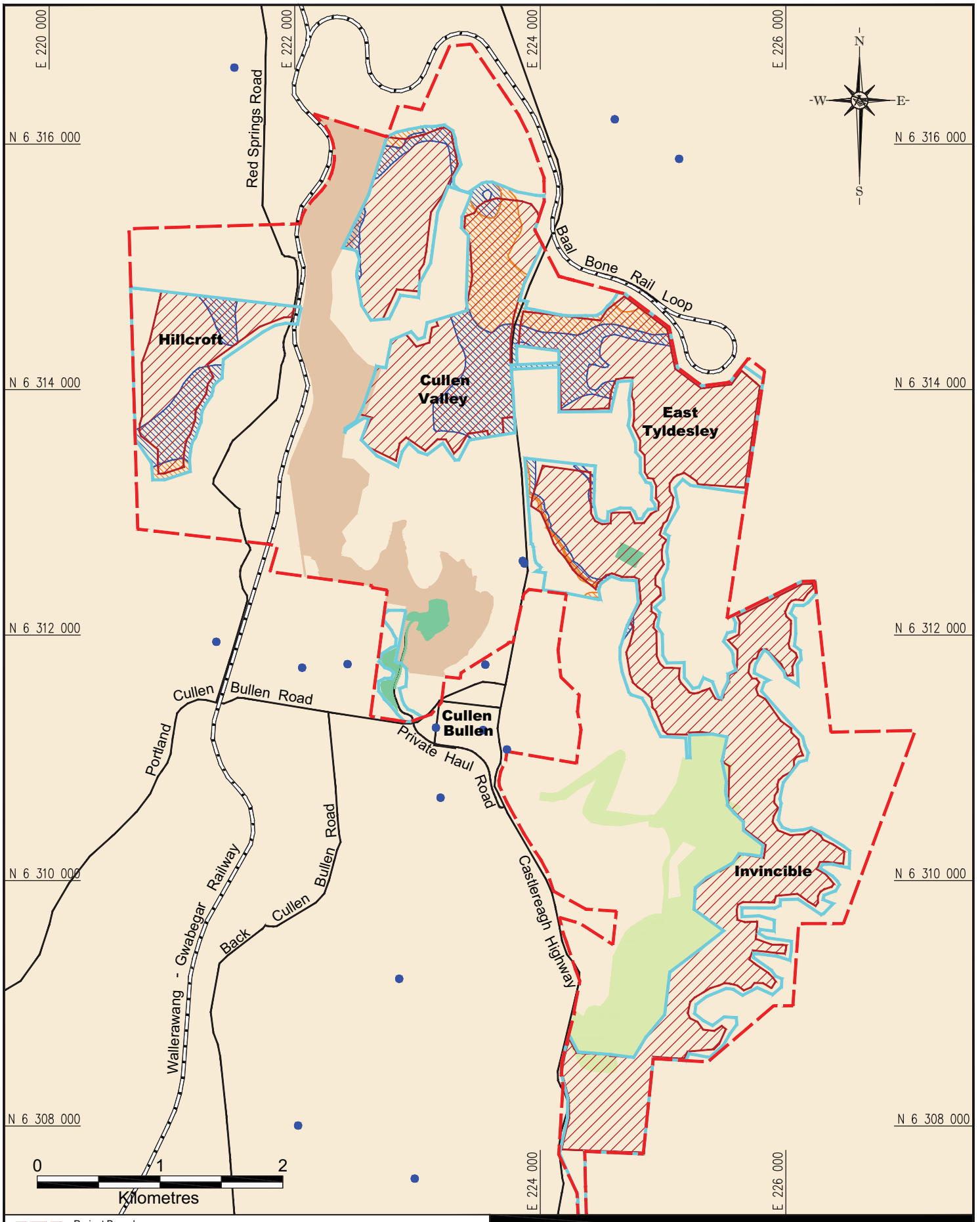
Coalpac Pty Ltd

Coordinate System: MGA Zone 56

COALPAC CONSOLIDATION PROJECT

Day Evening NE Wind

Cad File: 08608B.dwg	Date: 08.08.12	Drawn: CP	Figure 5



Project Boundary
Project Disturbance Boundary
Existing Cullen Valley Mine
Existing Invincible Colliery
Infrastructure
Open Cut Coal Mining
Noise Management Zone 1
Noise Management Zone 2
Sensitive Receiver Locations

Hansen Bailey

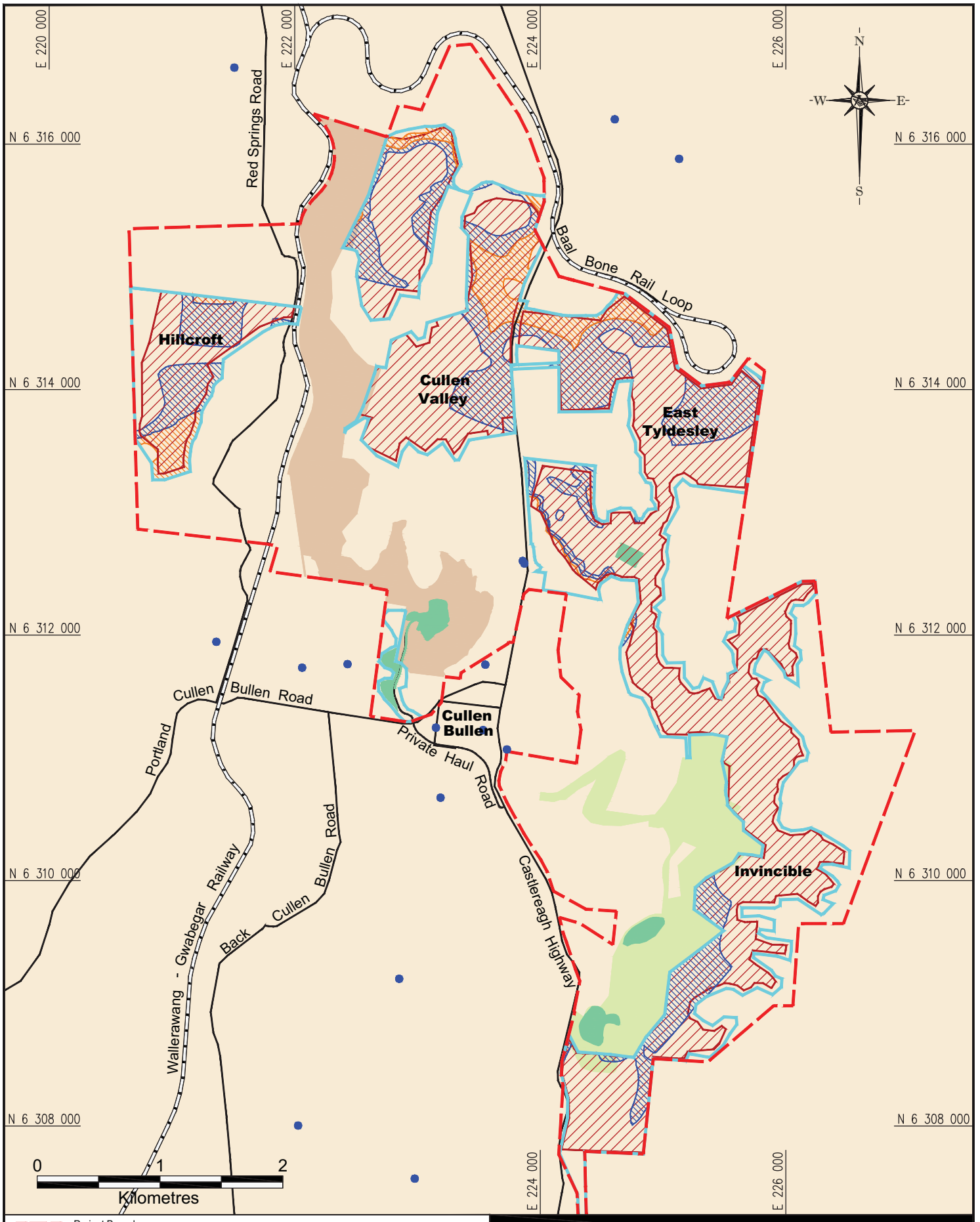
Coalpac Pty Ltd

Coordinate System: MGA Zone 56

COALPAC CONSOLIDATION PROJECT

Day Evening West Wind

Cad File: 08609B.dwg	Date: 08.08.12	Drawn: CP	Figure 6



Project Boundary
Project Disturbance Boundary
Existing Cullen Valley Mine
Existing Invincible Colliery
Infrastructure
Open Cut Coal Mining
Noise Management Zone 1
Noise Management Zone 2
Sensitive Receiver Locations

Hansen Bailey

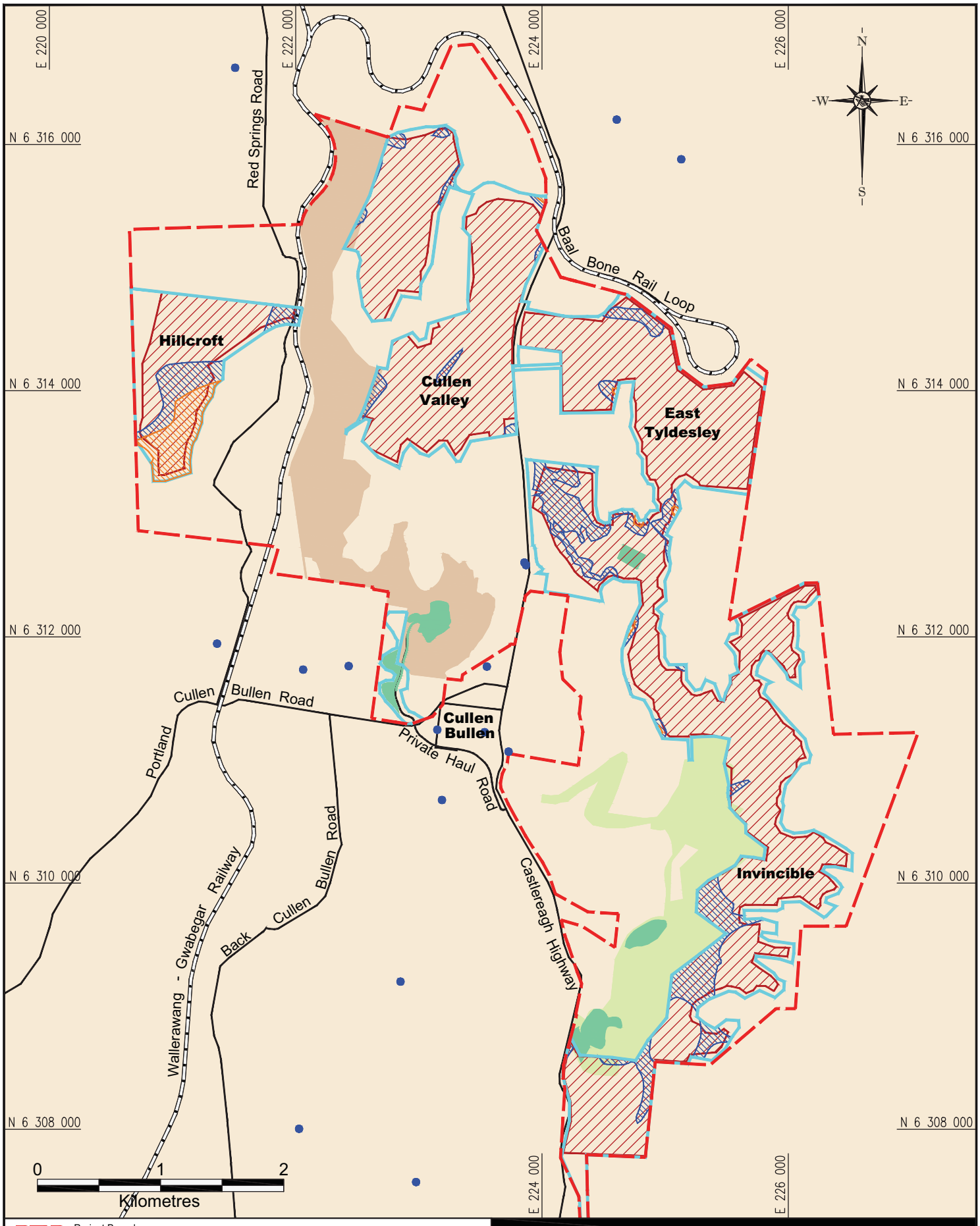
Coalpac Pty Ltd

Coordinate System: MGA Zone 56

COALPAC CONSOLIDATION PROJECT

Night Inversion Noise Zones

Cad File: 08600C.dwg	Date: 08.08.12	Drawn: CP	Figure 7



Project Boundary
Project Disturbance Boundary
Existing Cullen Valley Mine
Existing Invincible Colliery
Infrastructure
Open Cut Coal Mining
Noise Management Zone 1
Noise Management Zone 2
Sensitive Receiver Locations

Hansen Bailey

Coalpac Pty Ltd

Coordinate System: MGA Zone 56

COALPAC CONSOLIDATION PROJECT

Night NE Wind Noise Zones

Cad File: 08599C.dwg	Date: 08.08.12	Drawn: CP	Figure 8

4.6 BLASTING

4.6.1 Blast Impacts to Receivers

Submissions: R3, R4, R5, SIG3, SIG8 – SIG9, Petition, P3, P660, P689, P813, P846, P877

A number of submissions raised the issue of predicted blast impacts to receivers surrounding the Project, particularly residences in Cullen Bullen.

Section 8.7 of the EA presents a summary of the blast impacts for the Project to private receivers. This section of the EA and the blast component of the AIA prepared for the Project (Bridges Acoustics 2012) demonstrated that by limiting MIC, effectively designing blasts and monitoring ground vibration and overpressure at sensitive receptors locations, impacts can be managed to meet relevant criteria. In addition, Coalpac will implement a real-time meteorological, dust and noise monitoring system for the Project, enabling decisions to be made in a short time as weather conditions change (i.e. blast initiation can be delayed if weather conditions have rapidly changed at the scheduled blast time).

Should the Project be approved, Coalpac will prepare a revised Blast Management Plan as described in **Section 4.6.4**.

4.6.2 Blast Fume Impacts

Submissions: R3, R4, R5, SIG1, SIG3, SIG8 – SIG9, Petition, P3, P328, P504, P660, P725, P877

A submission noted a concern regarding the potential for blast fume impacts to receivers, particularly within Cullen Bullen. It also requested that a detailed health risk assessment of blast impacts be undertaken and that measures to minimise exposure of residents to blast emissions be undertaken.

The AQIA undertaken for the EA assessed potential impacts associated with blast fumes. As noted above in Section 8.7.4 of the EA, the existing Blast Management Plan will be revised in consideration of the Project. This document will include detailed blast management procedures to ensure that all Project blasts are designed and implemented to ensure that the potential for blast fume impacts at receiver locations and for the Project workforce is minimised as far as possible. These management measures will include (at least) the following practices to ensure that any potential for blast fume impacts are minimised:

- Blasting under favourable wind conditions when wind will transport fume away from the sensitive receptors (real-time meteorological monitoring);
- Blasts being delayed where possible during rainfall;
- Blast size and depth to be minimised;
- Bench heights to be reduced where practical; and
- Bench design to be constructed for effective water runoff.

In combination with the proposed Air Quality Management System, Coalpac will develop a predictive tool for weather conditions unfavourable for blast fume (primarily wind direction and speed) and utilise it prior to initiating blasts. Where unfavourable weather conditions are predicted by this system, blasts will be delayed or otherwise relevantly managed in accordance with the Blast Management Plan.

4.6.3 Baseline Structural Surveys

Submission: R3, SIG1, SIG3, SIG8 – SIG9, Petition, P3, P586, P613, P660, P844

A number of submissions requested that an independent process should be implemented for any structural surveys requested by community landholders to assess potential blast impacts to residences.

Coalpac has an existing procedure in place for the assessment of private residences on request that will be reviewed and updated for the Project. Coalpac will ensure that all private residences within 2 km of active blast areas for the Project will have an independent baseline structural survey undertaken prior to Project mining, upon receipt of a written request from the landowner. The independent contractor would be approved by DP&I prior to the surveys being undertaken. Following a baseline survey, a landowner may request another survey if they believe their residence has been affected by blasting. Any required works that are attributed to Project operations in the inspection reports would be remediated in consultation with the landowner and DP&I.

The updated Blast Management Plan will be revised for the Project as committed to in Section 8.7.4 of the EA, in consultation with relevant regulators (including LCC) to the approval of DP&I.

4.6.4 Blast Management Plan

Submission: R3, R4, R5, SIG1, SIG3, SIG8

A number of submissions noted the general need for Project blasting to be effectively managed and controlled to reduce potential impacts to receivers and the landscape.

As noted in Section 8.7.4 of the EA, a revised Blast Management Plan will be prepared for the Project. This document will be prepared in consultation with LCC and include management measures to reduce blast impacts to ensure compliance with relevant blast criteria. As noted in **Section 4.6.2**, the predictive Air Quality Management System for the Project will be utilised as a tool for the management of Project blasts and included in the revised Blast Management Plan.

The potential for impacts to the Cullen Bullen General Cemetery and management procedures to avoid disturbance to funeral services will also be included in the document, along with the consideration of the operational hours of Cullen Bullen Public School in blast scheduling.

The management measures to ensure protection of the escarpments and pagodas of the Ben Bullen State Forest described in **Section 4.6.5** will also be incorporated into the Blast Management Plan.

4.6.5 Potential Blast Impacts to Sandstone Pagodas and Escarpments

Submissions: R3, R6, R15, SIG1, SIG3 – SIG4, SIG7 – SIG9,SIG11, SIG12 -SIG14, SIG17 – SIG18, SIG24, Petition, P8, P220, P328, P417, P504, P513 – P514, P613, P746, P844

A number of submissions raised concerns regarding impacts of Project blasting on the sandstone pagodas and escarpments located within and adjacent to the Project Boundary. Key issues raised in responses included those associated with proposed blast management measures, blast monitoring program and the minimum 50 m standoff zone proposed between these features and any proposed open cut highwall crest.

Section 8.7.4 of the EA provides a number of mitigation and management measures for blast impacts predicted for the Project which wil be included in the Blast Management Plan. The location of these significant sandstone and escarpment features within the Project Boundary are shown on Figure 5 in the EA.

In response to the issues raised in submissions, an additional study has been undertaken by Terrock Consulting Engineers (2012) to review the blast management commitments made in the EA and to provide specific advice on any additional controls required to ensure that impacts from the Project will not affect the sensitive sandstone escarpment and pagoda formations. A copy of the Terrock (2012) report is included in **Appendix D**.

In their review, Terrock considered previous blast data collected, studies undertaken by Coalpac under existing operations and the assessment of blast impacts to Aboriginal heritage rock shelter sites completed for the EA. Starting at the distance committed to in the EA for a minimum 50 m additional standoff zone distance between the open cut highwall crest and any sandstone escarpment of outcrop, ground vibration levels (PPV mm/s) were predicted for the various interburden bench blasts required up to the final highwall position.

This assessment showed that with the exception of the larger interburden thickness between the Upper Irondale to Moolarben Coal Seams, Project blasting would not approach the nominated 100 mm/s limit set to mitigate impacts. To allow the Upper Irondale to Moolarben interburden bench to be blasted at a distance closer than 130 m from the highwall crest, two decks of explosives will be utilised, resulting in a PPV less than the 100 mm/s target limit. Similarly, decking and reduced charge weights will be utilised to control PPV for more sensitive features, including those with lower PPV limits. Where PPV cannot be reduced to those limits, the standoff distance will increase beyond the 50 m limit proposed as discussed in Section 8.7.4 of the EA.

It was found that airblast impacts generated by Project blasting will have little to no effect on the sandstone escarpments and pagoda formations. This is due to the level of airblast impacts predicted to occur for the Project being considerably less than changes in air pressure generated by the effect of wind in the area.

That is, natural changes in air pressure from wind can be in the order of 821 Pa which is roughly equivalent to an airblast of 150 dBL which in turn is 30 dBL higher than the current Approval limits. These limits are well below possible damage levels (see **Appendix D**, Terrock (2012)).

4.7 VISUAL & LIGHTING

4.7.1 Bund Construction

Submission: R3

LCC stated that the EA provides only minimal information on the proposed bund wall heights, widths, construction materials and rehabilitation and requested that they be consulted during the approval of the proposed bunds, particularly around visual impacts.

The conceptual mine plans presented in the EA (Figure 10 to Figure 14) show indicative locations for the noise and visual bunds proposed for the Project. As noted in Section 8.6.4 of the EA, noise mitigation bunds will be progressively constructed and rehabilitated early in the Project construction program to provide for the early mitigation of impacts.

Detailed commitments on the proposed bund and Overburden Emplacement Area (OEA) heights and construction timing are provided in Section 4.4.3 of the AIA (Bridges 2012), which states:

- *"Bund A (all years) immediately west of the rail siding at least 10m above the level of the rails or coal pad, whichever is higher, and extending at least 100m north and south of the loading area* (it should be noted that this bund has largely been completed during current Cullen Valley Mine operations)*;*
- *Bund B (all years in which the Cullen Valley crushing area would be used) along the western side of the Cullen Valley processing area at least 8m above the ground on which the noise sources (crushing plant, mobile plant) operate. This is an existing bund;*
- *Bund C (all years) along the northern and eastern side of the haul road extending south from the Highway bridge for a distance of 550m and a height of 6m above the haul road;*
- *Bund D (all years) a bund 5m high from the southern side of the cemetery (property 193) then increasing to a minimum RL 940m (up to 14m height) from 150m south of the cemetery to the RL 940m contour approximately 650m south of the cemetery;*

- *Bund E (all years) extending south from Bund D for a distance of 500m is more a natural ridge than a bund but should remain at RL 940m at the northern end and RL 960m at the southern end, or higher, without being removed by mining;*
- *Bund F (all years) from a point no more than 350m east of the Invincible gate and extending generally north east for a distance of 2300m along the western side of the haul road. The bund should be 5m above the road no more than 50m horizontally from the centre of the haul road, or 6m above the road no more than 80m from the centre of the road;*
- *OEA Bunds in various years and locations along the closest edges of OEA benches to prevent line of sight from any privately owned residence to OEA equipment such as trucks and dozers. Recommended bund heights are 6m to protect equipment working within 2400m from a residence or 8m for equipment working within 1800m from a residence. OEA bunds are generally required in Years 2, 8 and 14 in the southern part of the site and in Years 8, 14 and 20 in the north eastern part of the site, as shown in the source location and noise contour figures, and are not required where OEA equipment is well shielded by existing terrain. All OEA bunds would be 'constructed' and extended as part of normal overburden placement operations, with overburden placed on the bunds during the day (or during favourable weather conditions) and behind the bunds during the night (or during noise enhancing weather conditions). As the overburden material can be directed to an area exposed to receivers or redirected to a shielded area from time to time, this proposed mitigation measure is both responsive and effective."*

4.7.2 Impacts to Pagoda and Escarpment Landscapes

Submission: R3, R6, R15, SIG1 - SIG4, SIG6 – SIG9, SIG11, SIG12 -SIG14, SIG17 – SIG18, SIG24, Petition, P8, P14, P68, P115, P191, P200, P220, P231, P235, P328, P243, P248, P261, P276, P285, P288, P303, P317, P331, P341 – P342, P346, P348 – 9, P356, P360, P380, P381, P383, P390, P413 – 414, P417, P424, P430, P438 – P439, P442, P449, P472, P477, P489, P502, P504, P511, P513 – P514, P516, P518, P520, P522, P527, P533, P541, P545, P546, P548, P564, P572, P574, P586, P595, P599, P613 – P614, P626, P630, P634, P638, P649, P670 – P671, P693, P695, P702, P707, P720, P725, P730, P733, P746, P746, P773, P781, P791, P796, P798, P808, P810, P811, P813, P816, P818, P819, P820, P827, P831, P836, P838, P839, P843, P844, P846, P848, P850, P851, P854, P856, P869, P872, P879, P885, P895, P901

A number of submissions referred to the significance of the sandstone pagoda features and escarpment landscapes located along the western edge of the Great Dividing Range in lands within the Wollemi National Park, Gardens of Stone National Park and the Ben Bullen State Forest. The importance of these landforms in terms of their outstanding scenic and geodiversity values and concern that these features would be destabilised or destroyed by Project mining operations and blasting activities was also an issue raised in various submissions to the EA.

A number of submissions also suggested that the minimum buffer zone presented in the EA was inadequate to ensure that impacts to the escarpments and pagodas would not occur.

Coalpac acknowledges the significance of the sandstone pagodas, escarpments and cliffs within and surrounding the Project Boundary and the Project mine plans and mitigation measures include a number of commitments specific to these features. Coalpac (and the former Lithgow Coal Company) have been mining adjacent to cliffs and pagodas for the past 12 years, in some cases within 100 m distance, and with no impact on the stability of these features.

This experience and the blasting parameters derived from hundreds of blast events will ensure an ongoing commitment to the preservation of these important landscape features and the mitigation of blast impacts (see **Section 4.6.5**). Coalpac will not directly impact these areas and has excluded sandstone pagodas, escarpments and cliffs from its open cut mining areas and has committed to a range of monitoring and management procedures to minimise potential indirect impact.

These measures included the implementation of a minimum 50 m buffer zone and 100 m risk review zone between open cut mining operations and these environmentally sensitive features (as identified in Figure 5 of the EA). Only the low impact highwall mining method will be used in the vicinity of these features to ensure their stability and reduce impacts to the vegetation communities and habitat of the pagodas.

Coalpac is committed to undertaking Project operations in such a way as to ensure that the visual and scenic value of the pagodas and escarpments within the Project Boundary are not degraded in the long term. Section 8.8.2 of the EA notes the importance of these features in providing a scenic background or horizon for a range of viewing locations in the region, including from private residences to the north, west and south of the Project Boundary, Cullen Bullen General Cemetery, the Castlereagh Highway and areas within the Ben Bullen State Forest and Gardens of Stone National Parks.

Coalpac will implement a number of visual mitigation treatments to minimise the high level of visual impacts created by the progression of elevated open cut mining operations in proximity to the pagodas and the period over which these impacts would occur. As outlined in Section 8.8.4 of the EA, such mitigation measures would include rapid progressive rehabilitation of OEAs post mining.

Additionally, the establishment of visual and ecological forest planting patterns in rehabilitation areas will be undertaken to emulate areas of existing forest in the surrounding environment of the Ben Bullen State Forest in the long term. OEA structures will be designed in accordance with the surrounding topography and retaining the screening effects provided by existing vegetation located outside of the Project Disturbance Boundary.

Discussion of the management measures to minimise ecological, subsidence and blasting impacts to pagodas and escarpments within the Project Boundary in response to issues raised in submissions are also included in **Section 4.1**, **4.6** and **4.13**.

4.7.3 Level of Visual Impacts

Submission: SIG8

One submission noted the 'erroneous claims that this Proposal will have negligible visual impact', referring to a previous visual impact assessment for Invincible Colliery and the level of impacts created by views to existing mining operations at that site.

Section 8.8.3 of the EA includes a summary of the visual impacts that are predicted to occur as a result of the Project, based on the visual impact assessment matrix presented in Table 31 of the EA and the review of conceptual mine plans, aerial photography and photomontage analysis. The prediction of impacts from key viewing locations were categorised into one of five view sectors in the region within and surrounding the Project Boundary.

In the analysis of view sectors and key viewing locations presented in Section 8.8.3 of the EA, the potential for significant and high visual impacts resulting for mining operations in each of the Project mining areas is predicted at a number of locations in the medium term as rehabilitation develops. These include nearby private residences with direct views toward the Project mining areas, travellers on the Castlereagh Highway, elevated areas of the Ben Bullen State Forest to the east of the Project Disturbance Boundary and access trails, walking tracks or adjacent exposed pagodas and escarpments in the Gardens of Stone National Park with a southerly or westerly aspect.

In order to reduce the visual impacts predicted for the Project, Coalpac proposes to establish a range of mitigation treatments. These will be established both onsite (to reduce visual effects) and offsite (to reduce visual sensitivity). As noted in Section 8.8.4 of the EA, onsite treatments will involve rehabilitation of landforms while offsite treatments could involve a range of treatments to screen views, filter views and / or reorientate primary views should this be needed. Onsite treatments are already incorporated in the design and operating plans for the Project as they relate to the OEA establishment and a commitment for progressive rehabilitation.

These treatments and the implementation of other mitigation measures for sensitive viewing locations will be included in the RLMP to be prepared for the Project (as per Section 8.8.4 of the EA).

4.7.4 Visual Impacts to Regional Landscape

Submissions: SIG8, SIG20, Petition, P744, P798

A number of submissions raised concern regarding the potential for cumulative visual impacts to the region, specifically that the:

> *"Western Gateway to the Capertee Valley and Greater Blue Mountains World Heritage area would become a corridor or degraded land."*

As noted in Section 8.8.2 of the EA, the Project Visual Impact Assessment divided the area within and surrounding the Project Boundary into five distinct viewing sectors. This included the consideration of visual impacts in the Central View Sector, which would represent the main area where travellers accessing the Capertee Valley and Greater Blue Mountains World Heritage area may be exposed to visual impacts associated with the Project.

Section 8.8.3 of the EA includes a discussion on impacts to the Central View sector. This section notes that high visual impacts will result in this sector due to the close proximity of Project mining areas and OEAs to the Castlereagh Highway. One of the primary mitigation measures will involve visual bunds constructed adjacent to the Castlereagh Highway. These will be constructed progressively in advance of mining operations and rehabilitated progressively to provide for screening of mining and coal haulage activities for those road users travelling in either direction on the Castlereagh Highway. Rapid seed germination techniques (such as the application of hydromulch) will be utilised to minimise visual impacts immediately after bunds have been constructed. Visual impact mitigation measures to be implemented by Coalpac for the Project are summarised in the EA and **Section 4.7.3** of this RTS.

4.8 SURFACE WATER

4.8.1 Project Surface Water Discharges

Submission: R4

The EPA notes that the Project will generally be a nil discharge site under typical operating conditions and that the existing licensed surface water discharge points for both Cullen Valley and Invincible Colliery will be retained.

Noted.

4.8.2 Project Sediment Dams

Submission: R4

The EPA noted that a sizeable number of small sediment dams will be constructed throughout the life of the Project and that Coalpac plans to design and manage these dams such that there will be minimal water discharged via these dams. Should the Project be approved, EPA noted that it would be their intention to require these miscellaneous smaller dams to be consolidated into a single point on the Environment Protection Licence (EPL) with associated monitoring requirements and discharge limits.

The EPA also noted that they would discuss these requirements with the proponent as part of the preparation of the revised Surface Water Management Plan proposed for the Project.

As noted in Section 8.9.4 of the EA, the sediment basins for the Project are proposed to be design in accordance with the Landcom (2004) and DECC (2008) guidelines entitled *Managing Urban Stormwater Soil and Construction Volume 1, Volume 2E,* which require these storages to be drained and pumped out within a 5-day period following rainfall.

It is proposed to release the captured water to the downstream environment if it meets the water quality objectives and pump it into the water management system if it does not. It is expected that the sediment basins will provide sufficient treatment of runoff to meet water quality criteria and therefore releases are expected following most rainfall events.

4.8.3 MPPS Conveyor Sediment Controls

Submission: R9

The SCA considered that there could be water quality impacts related to construction works and operation of the southern section of the overland conveyor.

SCA requested that the water quality impacts resulting from the construction and operation of the overland conveyor be addressed in Conditions of any Approval as part of the Surface Water Management Plan.

As noted in Table 4.1 in Surface Water Impact Assessment (SWIA) (Appendix N of the EA (WRM, 2011)), appropriate sediment and erosion control measures will be put in place during construction of the conveyor.

It is anticipated that coal spillage from the conveyor during operations would be insignificant due to the design of the conveyor, which will be fully enclosed and regularly maintained.

Regardless, sediment and erosion control measures from the construction phase will be maintained during operation of the conveyor, and modified to include stormwater sumps to collect and settle any coal affected water which may be produced by the conveyor.

4.8.4 Acid Mine Water Discharge

Submissions: R15, SIG1, SIG3, SIG9, SIG11, SIG13, SIG15, SIG20, Petition, P388, P547,

A number of submissions raised concerns around the discharge of contaminated water from the site, particularly in relation to the potential for acid mine drainage.

As noted in Section 8.9.4 of the EA, no runoff from disturbed or coal affected areas will be discharged from the Project Boundary without appropriate treatment (also see Section 5.4.1 of the SWIA). All runoff from coal affected catchments will be collected for reuse on-site. Further, any releases from Project surface water storages will comply with relevant water quality discharge limits to ensure no adverse impacts on downstream environments.

4.8.5 Water Balance Modelling

Submissions: SIG1

BMCS noted the influence of La Nina and El Nino cycles and the anticipated impacts of climate change.

The use of a long term water balance model incorporating 121 years of climate data (see Section 6 WRM, 2011) was undertaken to ensure that the proposed surface water management system for the Project is robust and has been used to investigate the behaviour of the surface water management system under a range of climatic conditions.

4.8.6 Surface Water Quality Impacts

Submission: SIG1

> *"PEA pp55-58 looks at the potential impacts and the assessment methodology in a discrete context. Form a discrete viewpoint, the Society is mainly concerned with (i) impacts to surface water quality from the saline Coal Measures stratigraphy, (ii) impacts to surface water quality arising from soluble oils, diesel and other chemicals associated with the mining and treatment processes, and (iii) impacts on drainage paths and catchment yields. Very little of this is directly addressed in the PEA's assessment methodology. Assurances are given, but more is required in the context of the overall Murray-Darling Management Plan."*

Section 8.9.4 of the EA and Section 5.4.1 of the SWIA discuss the proposed surface water management strategy for the Project which will minimise releases of dirty and contaminated water, including the collection and reuse of runoff from coal affected and mine infrastructure areas.

Due to the proposed Surface Water Management System discussed above, the Project will not have any impact on water quality or quantity in the wider Murray-Darling basin.

4.8.7 Water Quality Monitoring

Submissions: SIG1, SIG9,

A number of submissions refer to the surface water management and monitoring methods described in the EA and the testing regime likely to be required under the EPL proposed for the Project.

The proposed Surface Water Management System described in Section 5.4.1 of the SWIA complies with current industry best practice. Further, the proposed monitoring program for the Project (see Section 7.4 of the SWIA) proposes monitoring of a range of pollutants that are not currently included in EPLs for existing Coalpac operations within the Project Boundary. Discharge limits for Total Suspended Solids (TSS), pH and Oil and Grease are provided in existing EPLs for the Invincible Colliery and Cullen Valley Mine.

The monitoring program proposed for the Project will test for pH, TSS, Total Dissolved Salts (TDS), Turbidity, Oil and Grease and Electrical Conductivity. Should other pollutants of concern be identified by site staff or the relevant regulatory agencies, the proposed monitoring program will be amended to include these pollutants.

The regional water quality data (in particular turbidity, conductivity and pH) described in Section 2.3 of the SWIA is consistent with ANZECC (2000) guideline values for upland rivers and streams in south-east Australia. No ANZECC (2000) guideline values are available for TSS and Oil and Grease, however the background TSS concentrations presented in Section 2.3 of Appendix N are typically lower than the 30mg/L TSS discharge limit given in the existing EPL for Invincible Colliery.

Further background water quality data will be collected in Cullen and Dulhunty's Creeks during Project operations as per Section 8.9.4 and Section 7.4 of Appendix N of the EA. This will allow a more accurate assessment of existing water quality in the streams draining the Project, and refinement of the EPL discharge limits for the Project to reflect and protect water quality in the downstream environment.

Water quality data and testing results are not expressed and reported as averages. All background and site water quality data presented in the SWIA includes results from individual samples, as well as average data. EPL conditions state that all water released from licensed discharge points must comply with discharge limits, and testing must be carried out during any release event. This indicates that average water quality data is in no way related to compliance with EPL water quality criteria.

4.8.8 Cumulative Surface Water Impacts

Submission: SIG1, SIG9

One submission noted that:

> *'Water pollution from the existing mines and their proposed extensions (within the project area), will compound the cumulative regional damage from mining, irrespective of whether the system flows ultimately to the Darling or to Warragamba.'*

Several submissions also raised similar concerns that there is the potential for surface water flows from within the Project Boundary to compound cumulative regional impacts to the surface water regime.

Impacts to the surface water catchments due to the mining operations proposed for the Project are outlined in **Section 4.8.14**. Further, as noted in Section 8.9.4 of the EA, the proposed Surface Water Management System will minimise any releases of dirty and contaminated water, including the collection and reuse of runoff from coal affected and mine infrastructure areas. This system will be supported by the proposed Surface Water Monitoring Program to help ensure that water quality criteria are met.

4.8.9 Downstream Impacts of Surface Water Discharge

Submissions: SIG1, SIG8 – SIG9

In their submission, LEG noted that:

> *'In section 3.3 of a recent submission to the Department of Planning, the Lithgow Environment Group notes that water discharged from coal mines has a "…detrimental downstream effects on water chemistry, and aquatic ecosystem integrity, health and diversity." The principal issues are identified as:*
>
> *(a) Salinity*
>
> *(b) Heavy metals*
>
> *(c) Solcenic oil residues*
>
> *(d) Thermal pollution*
>
> *(e) Dissolved oxygen*
>
> *As implied with item (e), the above factors behave synergistically in that their combined impact on water quality and water-dependent ecosystems exceeds the sum of the parts. Individual monitoring is only effective if the target levels are set with due regard for synergistic behaviour.*
>
> *Particularly under El Niño conditions, the Society is concerned that relatively undiluted discharges will impact on riparian ecosystems, bleed into the groundwater regime, and possibly impact on bores and stock dams in the region west of the project. These potential impacts should be considered from discrete and cumulative viewpoints. The Society concurrently notes that the combined mining activities in the region of headwater creeks feeding the west-flowing rivers could, through water harvesting, reduce essential run-off."*

Reference should be made to Section 5.4.1 of the SWIA with regards to the proposed surface water management strategy. This strategy has been designed to minimise any releases of dirty and contaminated water, including the collection and reuse of runoff from coal affected and mine infrastructure areas. In addition, the volumes of releases are small in comparison to the overall catchment runoff further mitigating the principal issues raised with regards to thermal pollution, dissolved oxygen. The release dams are shallow and releases are made from the surface of the dams, rather than from the bottom, so water temperature and dissolved oxygen levels are expected to be the same as the background levels in receiving waters during release events.

Further, the monitoring program for the Project (see Section 7.4 of the SWIA) proposes monitoring of a range of pollutants that are not currently included in EPLs for operations at the site. Discharge limits for Total Suspended Solids (TSS), pH and Oil and Grease are provided in existing EPLs for Cullen Valley Mine and Invincible Colliery.

The proposed monitoring program will test for pH, TSS, Total Dissolved Salts (TDS), Turbidity, Oil and Grease and Electrical Conductivity. Should other pollutants of concern be identified by site environmental staff or the regulators, the proposed monitoring program will be amended to include these pollutants (including heavy metals).

It should also be noted that the regional water quality data for surrounding catchments (in particular turbidity, conductivity and pH) described in Section 2.3 of the SWIA is consistent with the ANZECC (2000) guideline values for upland rivers and streams in south-east Australia. No ANZECC (2000) guideline values are available for TSS and Oil and Grease, however the background TSS concentrations presented in Section 2.3 of the SWIA are typically lower than the 30mg/L TSS discharge limit given in the existing EPL for Invincible Colliery. Further background water quality data will be collected in Cullen and Dulhunty's Creeks during Project operations as described in Section 7.4 of the SWIA.

This will allow a more accurate assessment of existing water quality in the streams draining the Project Boundary, and refinement of the EPL discharge limits for the Project to better reflect and protect water quality in the downstream environment.

Section 6.10 of the SWIA also indicates that releases from the Project Site in median runoff years will range from 0 – 8 ML, which are lower than for the existing operations of Invincible Colliery and Cullen Valley Mine. No releases from the Project Boundary are predicted during El Nino years (80^{th} percentile of rainfall conditions).

Further, releases of water from the Project Boundary would only occur following significant rainfall events when there are flows in the creeks draining the Project Boundary (i.e. no dry weather releases are proposed). The proposed Site Water Management System is designed to minimise the capture of runoff from undisturbed upstream catchments, and to release water captured on site when possible, providing that this water meets the relevant EPL discharge limits.

The impact of the Project on the catchments areas draining to Cullen Creek, Dulhunty's Creek and Jews Creek is discussed in Section 8.9.3 of the EA and Section 5.5.1 of Appendix N. The catchment area draining to Cullen Creek and Dulhunty's Creeks will increase during Project operations as rehabilitation progresses. By Year 2 of the Project, the catchment areas draining to Cullen Creek and Dulhunty's Creek will have increased beyond those under existing conditions (Year 0). Section 5.5.1 of the SWIA also indicates that less than 2% of the Jews Creek catchment would be captured during Project operations. This minimal loss of catchment is not expected to impact on local water tables or flows in the river systems downstream of the Project.

4.8.10 Erosion and Sediment Control of Rehabilitation

Submission: SIG3

One submission noted that:

> *"Rehabilitation will instead create a biologically depauperate, fragile and unstable landform; a human artefact, prone to erosion and further degradation. The rehabilitation proposed for the areas mined by open-cut methods cannot restore near-surface groundwater levels and the stream flows dependent upon them. Any remaining surface waters and groundwater that discharge from the project area will be highly contaminated with metal salts, particularly iron and manganese. These discharges may also be acidic"*

Consistent with existing practices, rehabilitated areas will initially be deep ripped to promote infiltration and allow vegetation to become established, however over time the soil profile in these areas will consolidate and the vegetation will become well established and widespread, with runoff characteristics similar to that of nearby natural catchments. Further detail on the management of Project rehabilitation (including for erosion and sediment control) is provided in Section 8.24 of the EA, with responses to submissions on rehabilitation issues provided in **Section 4.19** of this document.

Available water quality data from the nearby monitoring sites (as outlined in Section 2.3 of Appendix N) indicates iron levels in the catchments draining the Project are typically in line with guideline values provided in ANZECC (2000) (i.e. <0.3mg/L). There is no data available to suggest that iron levels in surface water discharged from the Project site would exceed background levels. No data is available on likely manganese concentrations in runoff from the area.

Runoff from existing rehabilitation areas at the Project is not acidic (see Section 3.1.6 and 3.2.6 of Appendix N) and there is no evidence to suggest that runoff from rehabilitation areas proposed as part of the Project would be acidic.

4.8.11 Discharge from Existing LDPs

Submission: SIG3

One submission referred to the existing Licensed Discharge Point LD001 held for Invincible Colliery and that previous discharges from the site had recorded high salinity levels in relation to background levels of the Upper Coxs River catchment.

As noted in Section 8.9.1 of the EA, there has been no discharge from the Long Swamp Gully LDP001 since May 2008 when pumping was voluntarily suspended. No further discharges from LDP001 are likely to be required as part of the Project; however the LD001 discharge point will be retained as a flexibility. If it becomes necessary to discharge water from LD001, any releases would be required to meet the EPL1095 discharge limits and be subject to monitoring in accordance with any EPL and the requirements of OEH.

4.8.12 Legislative Requirements

Submission: SIG8

One submission referred to the legislative requirements for coal mining operations under SEPP 58, noting that:

> *"LEG has since learned that mining companies in NSW are exempt from SEPP 58, just as they are exempt from almost all legislation designed to protect water quality and the environment.*
>
> *LEG has also since learned that Coalpac re-opened the old Borehole LD1 in Long Swamp at the request of Delta Electricity as they needed the water because of the drought at that time.*
>
> *This again raises questions about the relationship between local coal mines and Government-owned Delta Electricity. Coal mines are being forced by Delta to extract coal using the most environmentally destructive methods possible, and in this case were asked to ignore the dire implications of water pollution on an endangered swamp community and Sydney water users."*

Mining operations in NSW are not exempt from environmental legislation. All EPL discharge limits for the Project are set based on regional and background water quality data (where available), and are in line with ANZECC (2000) guidelines and NSW Water Quality guidelines for regional watercourses. As noted in **Section 4.8.3**, Coalpac will implement a number of controls for the construction and operation of the MPPS conveyor to ensure that potential impacts to the Sydney catchment are appropriately managed.

Reference should also be made to **Section 4.9.1** which discusses the Long Swamp LDP001.

4.8.13 Aquatic Ecology

Submission: SIG8

One submission raised concerns regarding water quality impacts due to mine water releases from the Project and impacts to aquatic ecology, noting that:

> *"LEG once again questions the EA's findings on the likely impacts on water quality. Despite the rhetoric, water quality at Coalpac mines is likely to be similar differ to Baal Bone, Ivanhoe North, Pine Dale, Lamberts Gully and all other local mines operating in the Lithgow Coal Seam. Regardless of whether this minewater is released into the Cox's River or the Turon River, the environmental implications for aquatic life and water consumers is exactly the same.*
>
> *LEG strongly recommends that the Sydney Drinking Water Catchment Audit 2010 be taken into consideration as part of this proposal. http://www.environment.nsw.gov.au/water/sdwc2010.htm.*

> *It (Sydney Drinking Water Catchment Audit 2010) provides the most recent comprehensive analysis of the current condition of the Coxs River catchment, and contradicts many of claims made by Coalpac. The most relevant sections are:*
>
> - *Chapter 3: Land Use and Human Settlement, pages 30 - 32;*
> - *Appendix C: Sub-Catchment Summaries, pages 9 - 20;*
> - *Chapter 7: Audit Recommendations.*
>
> *(see above in submission)"*

See **Section 4.8.8** for a summary of the proposed surface water management for the Project Site and management measures to ensure collection of coal affected and dirty water.

Following the receipt of the submission from LEG, WRM have reviewed the recommendations of the SDWCA 2010 audit, and note that they have no relevance to the Project. The Project is not conducting longwall mining and is not proposing to mine or impact upon upland swamp areas, and hence cannot contribute to the cumulative impact of mining with the SCA area. With the exception of the proposed conveyor (part of which is located within the Coxs River catchment), the Project will not impact on catchments within the SCA, and hence the SDWCA 2010 has limited relevance to the Project. All active mining areas are located to the north or west of the SCA boundary.

4.8.14 Reduced Surface Water Flows in Cullen, Dulhunty's and Jews Creeks

Submission: SIG9

In their submission, the NCC made reference to the water management system, noting that it:

> *"…ensures that substantial amounts of the operational water are recycled, or, if surplus to needs, are sent to the old underground workings. This means that for the duration of mining (21 years) the three main creeks (Cullen, Dulhuntys, and Jews) will have reduced flows. This in turn could influence the local water table, the conservation of aquatic and riparian communities, and the water levels in agricultural or domestic water bores."*

The impact of the Project on the catchments areas draining to Cullen, Dulhunty's and Jews Creek is discussed in Section 5.5.1 of the SWIA. The catchment area draining to Cullen and Dulhunty's Creeks will increase during Project operations as rehabilitation progresses. By Year 2 of Project operations the catchment areas draining to Cullen and Dulhunty's Creek will have increased beyond existing conditions (Year 0) catchment areas. Section 5.5.1 of the SWIA indicates that less than 2% of the Jews Creek catchment would be captured during Project operations. This minimal loss of catchment is not expected to impact on local water tables or environmental flows in downstream watercourses.

4.8.15 Access Licence Requirements

Submission: R2

NOW noted that the EA surface water assessment did not provide any detail regarding licensing requirements for the capture and use of surface water. The requirement for an access licence for any take of surface water through capture of rainfall runoff which exceeds the Maximum Harvestable Right Dam Capacity (MHRDC) was also outlined:

> *"Limited surface water and groundwater baseline data has been collected as part of the EA with some data from adjacent mining operations being presented to characterise the water levels and quality within the project catchment areas. Further baseline monitoring is required to allow for full characterisation of the water sources and the development of trigger criteria.*
>
> *The site water balance presented in the surface water assessment does not clearly define the groundwater ingress into the pits, amount of groundwater to be pumped from mine voids for operational use and how much water from the storage dams will be placed into the mine voids."*

Clean water and overland flow from undisturbed catchments will be diverted around mining and other Project related disturbance areas where practical. In the event that overland flow from undisturbed or clean catchments captured by the mine water management system in excess of the basic landholder's harvestable right, it is understood that this may need to be licensed under the *Water Management Act 2000*.

The harvestable right for the Project is 341 ML estimated using a coefficient of 0.08 and an area of 4,268 ha (area of Coalpac mining leases). The estimated average annual runoff from undisturbed or clean catchments (including rehabilitated areas) draining to the open cut pits and mine water dams for the various stages of the Project is given in **Table 10**. The average annual runoff was estimated using average annual rainfall of 690 mm and a volumetric runoff coefficient of 0.13, based on the calibrated Neubecks Creek AWBM model (see Sections 6.8.2 and Section 6.8.3 of the SWIA).

The intercepted average annual runoff from the mining areas and mine water dams are less than the harvestable right of 341 ML in all yeas of Project operations. No water access licenses will be required for capture of surface water by the Project.

The monitoring program for the Project (Refer Section 7.4 of the SWIA) proposes monitoring of a range of pollutants that are not currently included in EPLs for operations at the site. Further background water quality data will be collected in Cullen and Dulhunty's Creeks prior to and during Project operations as per Section 7.4 of the SWIA. This will allow a more accurate assessment of existing water quality in the streams draining the Project Site, and refinement of the EPL discharge limits for the Project to better reflect and protect water quality in the downstream environment.

Table 10
Project Intercepted Runoff Overland Flow Harvestable Right Calculation

Project Year	Intercepted Undisturbed Catchment Area (ha)	Average Annual Runoff Captured (ML)
Year 2	244.4	219.2
Year 8	306.2	274.7
Year 14	337.7	302.9
Year 20	301.8	270.7

Discharge limits for Total Suspended Solids (TSS), pH and Oil and Grease are provided in existing EPLs for the Project Site. The proposed monitoring program will test for pH, TSS, Total Dissolved Salts (TDS), Turbidity, Oil and Grease and Electrical Conductivity. Should other pollutants of concern be identified by site environmental staff or the regulators, the proposed monitoring program will be amended to include these pollutants (including heavy metals).

The Project Groundwater Impact Assessment (AGE 2011) indicates that groundwater inflows to active pits are likely to be negligible (0.02 ML/m seepage face/yr) when compared with inflows of runoff from contributing surface water catchments which are predicted to range from 250ML/year in a median year to 425 ML/year during a wet (20^{th} percentile) runoff year (as per Sections 6.9.2 to 6.9.5 in the SWIA). Due to the insignificant volumes of groundwater predicted to enter the active pits, this has been excluded from the surface water balance model. If significant groundwater inflows to active pits are experienced during Project operation, the water balance model and Water Management Plan will be revised to reflect this.

Further, Section 5.4.2 of the SWIA indicates that during a median runoff year extractions from the flooded underground workings will exceed predicted recharge of the flooded underground from surface water runoff within the Project Boundary, resulting in limited scope for the groundwater level to increase in the flooded underground workings and increase seepage into active pits.

Coalpac will continue to consult with NOW over a number of applications (currently under review) to ensure that required water licensing and allocations are in place during the life of the Project.

4.8.16 Impacts to Surface Water Flows

Submissions: Petition, P442

A number of submissions noted that:

> *'The* (Project) *open-cut mine poses risks to the quality and quantity of westward-flowing surface water, and the quality of north-eastern flowing groundwater.'*

Refer Section 5.4.1 of the SWIA outlines the proposed surface water management strategy for Project which will minimise any releases of dirty and contaminated water, including the collection and reuse of runoff from coal affected and mine infrastructure areas. All runoff from coal affected catchments will be collected for reuse on-site. Further, any releases from surface water storages at the Project will comply with specified discharge limits to ensure no adverse impacts on downstream environments.

The impact of the Project on the catchments areas draining to Cullen, Dulhunty's and Jews Creek is discussed in Section 5.5.1 of the SWIA. The catchment area draining to Cullen and Dulhunty's Creeks will increase during Project operations as rehabilitation progresses. By Year 2 of Project operations, the catchment areas draining to Cullen and Dulhunty's Creek will have increased beyond existing conditions (Year 0) catchment areas. Section 5.5.1 of the SWIA indicates that less than 2% of the Jews Creek catchment would be captured during Project operations. This minimal loss of catchment is not expected to impact on local water tables or environmental flows in downstream watercourses.

4.8.17 Surface Water Impacts on Domestic Water Supplies

Submission: P746

'I have noted polluted water [heavy metals] still draining into domestic water supplies.'

Section 5.4.1 of to the SWIA outlines the proposed surface water management strategy for the Project which will minimise any releases of dirty and contaminated water, including the collection and reuse of runoff from coal affected and mine infrastructure areas.

Further, it should be noted that domestic water supplies for Lithgow, Cullen Bullen and Portland are all supplied from the Fish River Water Supply Scheme. The main source of water for the Fish River Water Supply Scheme is Lake Oberon, which is located approximately 45km south of the Project Boundary. Water originating from the Project does not drain into Oberon Dam.

4.8.18 Impacts to Cullen Creek Tributaries within the Project Boundary

Submission: P673

One public submission from a Cullen Bullen resident noted that:

> *'As shown on topographic map 8931-3-N as a watercourse it has always been known as a creek by the locals, and in the 40 year I have lived here it has always flowed as either a trickle or a torrent after rain. At present, it is a nice gentle flowing creek. The creek starts North East of Cullen Bullen fed by springs and old underground workings. This is on an area that Coalpac class as the East Tyldesley lease; Coalpac intends to build a bund wall across the creek and open cut it at its source as told to me at the Coalpac open day, which will stop the flow of water. I have included a photo (1A) which shows this area.*
>
> *The creek flows through private properties before flowing into Cullen Creek as shown on photo 2A, the photos were taken after heavy rain to highlight their course. The creek must be preserved as it is part of Cullen Bullen's heritage.'*

The creek referred to is an unnamed tributary of Cullen Creek, and has a catchment area of approximately 226 ha upstream of Cullen Bullen township. The proposed Pine Lodge mitigation bund will be constructed across the main creek line on the eastern side of the Castlereagh Highway, and the catchment area upstream of the Pine Lodge mitigation bund (Bund D) will be disturbed by mining and the construction of the East Tyldesley CHPP and associated mine water dam.

The construction of the East Tyldesley CHPP and associated mine water dam, as well as proposed open cut mining in the East Tyldesley mining area will result in a maximum of 77 ha of catchment area being captured by the Project surface water management system. The remaining catchment area on the eastern side of the Castlereagh Highway will still drain to Cullen Creek, however it will be treated by a sediment basin and diverted around the northern end of the Pine Lodge bund, before flowing south towards Cullen Bullen.

The catchment area of the creek on the western side of the Castlereagh Highway will be untouched. Figure 4.1 of the SWIA shows the proposed surface water drainage structures proposed for this part of the Project. When mining is completed and the catchment is rehabilitated, the full catchment area will be returned to the creek.

During the construction of the mitigation Bund D, an appropriately designed diversion channel will be constructed along the western toe of the bund to convey runoff from the upper creek catchment (from both the eastern and western side of the Castlereagh Highway) where the bund is proposed to obstruct the natural creek line.

The diversion channel will be designed to ensure the outcomes specified in the *Management of stream/aquifer systems in coal mining developments* (DIPNR 2005) are achieved, namely:

- That the diversion channel will have a similar length and grade to the original stream;
- That the diversion channel will be maintained with minimal erosion; and

- Control of erosion within the diversion will be maintained primarily by vegetation controls.

The diversion channel will be designed to cater for the full post-mining catchment draining to the creek, hence the capacity of the proposed diversion channel will match or possibly exceed the capacity of the existing creek channel.

Any other relevant guidelines and design criteria will be adopted during design of the diversion channel.

4.9 GROUNDWATER

4.9.1 Discharge of Water from Underground Workings

Submissions: SIG3

Several sections of one submission raised concern about the potential for water stored in the old Invincible Colliery underground workings to be discharged into the Long Swamp and Coxs River. The potential for this water to be of a poor quality and impact on the ecosystems was also raised.

Coalpac holds licence to discharge water contained within the abandoned underground workings of the Invincible Colliery via bore LD001 under EPL 1095). This EPL entitles Coalpac to discharge up to 2 ML/day of the water stored within the abandoned underground workings into Long Swamp (a tributary of the Coxs River). However under the Project there is no intention to draw water from Invincible Colliery underground workings as it is required for onsite management activities including coal washing, quarrying and dust suppression.

As outlined in Section 7.5.3 of the Groundwater Impact Assessment (GIA) (AGE, 2012), water samples were collected from the abandoned Invincible Colliery void via the bore LD001 during the 2010/11 exploration program undertaken by Coalpac.

Anecdotal evidence had suggested that the water stored within the flooded underground working was of good quality and laboratory analyses confirmed that the water stored within the underground workings is very fresh, low salinity water with an electrical conductivity value of150 µS/cm (AGE 2012). The low salinity of the water stored within the Invincible Colliery void indicates it is predominantly surface water runoff, not groundwater seepage. Although discharge is not proposed from the abandoned Invincible Colliery void, the Long Swamp would not be expected to be impacted by such a discharge given the low salinity of the water in the void.

Should regular monitoring show the presence of dissolved iron and manganese above relevant criteria in the void water, simple treatment methods such as aeration will be implemented to remove these elements prior to any discharge. This will be addressed in the Site Water Management Plan.

4.9.2 Discharge of Water from Baal Bone Colliery

Submissions: SIG3, SIG8

Several submissions suggested that the discharge of water from the Baal Bone Colliery was impacting ecosystems and should be monitored by Coalpac. It was also suggested that the EA had underestimated the flow of water to the old underground workings in the Project Boundary from the Baal Bone Colliery.

The monitoring of water quality and downstream impacts from the Baal Bone Colliery is the responsibility of the owner of that operation in accordance with its approvals. The EA assumed the Baal Bone Colliery would flood over time, and therefore the estimates of seepage from Baal Bone Colliery into the Project are valid.

As noted in Section 15.2 of the GIA, several monitoring bores are currently installed near the Coxs River Swamp and managed by Xstrata in accordance with the environmental conditions relevant to Baal Bone Colliery operations. Coalpac will seek an environmental monitoring data sharing agreement with Xstrata for these bores to allow for the assessment of cumulative groundwater impacts following any changes in operations or the closure of Baal Bone Colliery.

4.9.3 Usage of Water from Underground Workings

Submission: SIG1

A submission suggested supplementing operational water supplies by pumping from the old underground mines would impact on the groundwater regime west of the Project Boundary.

Testing of water samples from the abandoned Invincible Colliery underground void has shown the void is filled with surface water runoff that is very fresh and with low salinity (Section 7.5.3 of the GIA). The void water will be used when required for coal washing, quarrying and dust suppression. Where used for coal or sand washing, the void water will leave the site as moisture held in product and will not enter the groundwater regime.

The void water is of an excellent quality for dust suppression and will not impact on the groundwater regime when used for this purpose.

4.9.4 Analysis of Interconnection between Flooded Underground Workings and Project Mining Areas

Submission: SIG3

Some submissions suggested the mining areas will directly intersect flooded underground workings, and that the assessment of seepage from the flooded underground workings to the proposed mining areas was not robust.

As noted in Section 10.5 of the GIA the proposed open cut mine plan for the Cullen Valley and East Tyldesley mining areas are located proximal and down-hydraulic-gradient from the flooded underground Old Tyldesley Colliery. The open cut mine plans have been carefully designed such that mining of the Lithgow Coal Seam will not intersect the flooded underground workings and a barrier of solid coal of a specified width will be left in place between the flooded underground mine and the open cut pits. The open cut pits will be further developed above the flooded underground workings where the upper coal seams will be targeted. Water stored within flooded underground mine workings will seep through the coal seam barrier separating the flooded abandoned underground mine and into the adjacent open cut mining areas.

The groundwater study assessed both the seepage rate for a range of coal seam barrier widths and permeability. The assessment found that seepage was relatively low, even when the coal seam barrier was limited and the permeability at the upper end of the expected range.

4.9.5 Available data and Further Assessment

Submission: R2

NOW concluded that limited baseline data had been collected and further monitoring is required to allow for full characterisation of the water sources and the development of trigger criteria. Further predictive modelling was also required to assess the aquifer depressurization and groundwater inflow to the individual mine pits and Water Sharing Plan water sources.

In early 2012 Coalpac installed a further two groundwater monitoring loggers and two surface water monitoring points to obtain additional background data. Should the Project be approved, a Water Management Plan will be prepared. The Water Management Plan will detail water level and water quality monitoring requirements for groundwater and surface water resources. Coalpac will seek expert advice from surface water and groundwater specialists to assist in the design of any revised monitoring network and the establishment of appropriate trigger levels and include in WMP. The monitoring will be designed so that additional data will be collected to allow for trigger levels to be derived and numerical modelling undertaken.

This additional data, ongoing monitoring and modelling will seek to validate the key findings of the surface water and groundwater assessments undertaken for the Project.

A period of baseline monitoring of between two and five years will be collated to ensure sufficient additional data is available to enable appropriate trigger levels to be derived and confirmation modelling be undertaken. The WMP and any additional modelling will be peer reviewed by an independent hydrogeologist to ensure its accuracy and verify the findings of any revised assessment.

Mining in the Cullen Bullen area has been occurring for more than 100 years. Monitoring to date has not identified any adverse impacts to groundwater resources within the vicinity of existing underground and open cut mining activities. There is no evidence or trends from existing groundwater monitoring data that suggests mining activities are adversely impacting groundwater resources. Evidence to date indicates that water levels, particularly in the old underground mine workings, is significantly influenced by precipitation rates.

In the unlikely event that adverse impacts to surface water and groundwater resources from mining activities beyond those identified in the EA occur, Coalpac will implement feasible and reasonable measures to minimise any potential environmental harm.

4.10 GEOCHEMISTRY

4.10.1 Acid Mine Drainage Potential

Submissions: R15, SIG1, SIG3, SIG9, SIG13, Petition, P518, P732, P739, P750, P848, P849

A number of submissions raised concerns regarding the potential for the Project to create impacts associated with acid mine drainage suggesting this had historically caused localised issues.

As noted in Section 8.11.3 of the EA:

> ***"Overburden***
>
> *The majority of overburden materials for the Project are likely to have negligible (<0.2%) total sulphur content low to moderate ANC and are therefore classified as Non Acid Forming (NAF) barren. One sample from the Marrangaroo Sandstone contained significantly elevated total sulphur content (0.82%) to Maximum Potential Acidity (MPA) ratio (ANC / MPA ratio less than two) and consequently may have an increased risk of acid generation. Overall, from an acid-base perspective, the overburden material can generally be regarded as a NAF unit that typically has low total sulphur content, low ANC and elevated ANC / MPA values. Materials represented by these samples are expected to have a low to negligible risk of acid generation and a high FoS* (Factor of Safety) *in terms of potential for Acid and Metalliferous Drainage (AMD). The single sample with some potential to generate acid is located in the Marrangaroo Sandstone and comprises conglomerate, sandstone and carbonaceous mudstone.*
>
> *The concentration of total metals in overburden solids in the materials sampled is well below applied guideline criteria for soils and is unlikely to present any environmental issues associated with revegetation and rehabilitation. Most overburden materials were predicted to generate pH neutral and relatively low salinity runoff and seepage following surface exposure. The dominant soluble cation is generally sodium and the dominant soluble anion is generally sulphate, with lesser amounts of bicarbonate and chloride.*

The concentrations of trace metals tested in the water extracts from sampled overburden materials are typically very low, and predominantly below the analytical detection limit. The low concentrations of dissolved metals in initial and ongoing runoff and seepage from overburden materials is unlikely to present any significant environmental issues associated with surface water and groundwater quality as a result of the Project. Overburden materials below 10 m depth have been predicted to be non-sodic (and as such non-dispersive) and may be suitable for revegetation and rehabilitation activities (in final surfaces or as a growth medium). Some materials below the topsoil layer and in the first 10 m depth from surface may have some potential to be sodic and prone to dispersion and erosion…

Coal Rejects

Most potential coal reject materials were found to have negligible total sulphur content (< 0.1%) and are therefore classified as NAF-barren. These materials have a high FoS with respect to potential acid generation. A small proportion of the potential coal reject materials associated with the Lithgow Seam have a relatively high total sulphur content and negligible buffering capacity (and hence a low FoS) and are classified as Potentially Acid Forming - High Capacity (PAF - HC). In contrast, the tailings materials generated from processing the Lithgow Seam at the ICPP appear to be NAF.

The results indicate that whilst the majority of coal reject materials from the Project are likely to be NAF and have an elevated FoS with respect to acid generation, some coal reject materials are present that have uncertain geochemical characteristics or are classified as PAF. The PAF materials appear to be limited to parts of the Lithgow Coal Seam and mainly report to coarse rejects in the coal washing process.

The tailings materials from the Lithgow Seam appear to be NAF as most sulphur is present as organic sulphur. PAF samples have some capacity to generate acid and materials represented by these samples will need to be managed for the Project to avoid any issues associated with AMD…"

Management of Potentially Acid Forming (PAF) material in Project is summarised below in **Section 4.10.2**. The mitigation measures to be incorporated in the Project to ensure that potential acid mine drainage issues are appropriately managed are outlined in **Sections 4.8.1**, **4.8.4**, and **4.9.1**.

4.10.2 Management of PAF Material

Submissions: R15, SIG1, SIG3, SIG9, SIG13, Petition, P518, P732, P739, P750, P848, P849

Several submissions were also received in relation to the management of PAF material for the Project and acid mine drainage.

As per Section 8.11.4 of the EA, Coalpac has put in place a number of management measures to manage the geochemistry of PAF overburden and reject materials for the Project and ensure the suitability of these materials for used in proposed construction and rehabilitation activities. These measures include:

"Overburden

- *Pre-stripping topsoil from areas to be mined for use in final rehabilitation activities (surface cover or vegetation growth medium) consistent with that described in Section 8.18 of the EA;*
- *Placement of overburden within the OEAs in a manner that limits the risk of surface erosion;*
- *Additional sampling and testing to further define the geochemical characteristics of the Marrangaroo Sandstone prior to potential utilisation as a resource if required, to confirm the extent of any PAF material and any link to lithological rock type;*
- *Field trials to identify the most appropriate topsoil and overburden materials for the revegetation and rehabilitation of final landforms; and*
- *Surface water and groundwater monitoring associated with runoff or seepage from the emplacement areas will be incorporated into the EMP and monitored on a regular basis for pH, EC, TSS and dissolved metals (including arsenic, molybdenum and selenium).*

Coal Rejects

- *Placement of NAF coal rejects materials in the open pit and / or co-disposal with overburden. For the co-disposal method, placement of NAF coarse reject material in a manner that limits the risk of erosion;*
- *Deep (in-pit) burial of PAF coal reject materials from the Lithgow Seam;*
- *PAF coarse rejects will be covered as soon as practical (within a few weeks) with 5 m of NAF overburden material to minimise the length of exposure time to oxidising conditions (and minimise the potential for AMD);*
- *The time for covering PAF coarse reject materials and the depth of cover will be optimised by using data from kinetic leach column tests and cover design investigations; and*

- *Ongoing consideration of the geochemistry of coal rejects materials generated by the ICPP and ETCPP in relation to potential impact risk from these materials.*

Coalpac will also include the consideration of PAF material management measures and provide detail on a PAF monitoring and management in the RLMP for the Project. This plan will be prepared in accordance with the most recent Mining Operations Plan guideline, as requested by DRE.

4.11 ABORIGINAL ARCHAEOLOGY & CULTURAL HERITAGE

4.11.1 Aboriginal Cultural Heritage Management Plan

Submission: R6 – R7, P68, P160, P339, P472, P480, P565, P621, P729, P741, P857

OEH referred to their review of the Aboriginal Archaeology and Cultural Heritage Impact Assessment presented in the EA and noted that they had found the assessment to be adequate for the Project. OEH then provided detail on the requirements in relation to the Aboriginal Archaeology and Cultural Heritage Management Plan proposed for the Project.

As noted in Section 8.12.4 and Section 9 of the EA, Coalpac are committed to the preparation of an Aboriginal Archaeology and Cultural Heritage Management Plan for the Project in the event that approval is granted. This plan will be prepared in consultation with OEH and in accordance with the *Preparation and Implementation of an Aboriginal Cultural Heritage Management Plan* checklist provided.

4.11.2 Adequacy of Indigenous Heritage Impact Assessments

Submission: SIG8

LEG raised serious concerns in their submission regarding the accountability of previous indigenous heritage assessments from mining proposals in the Ben Bullen State Forest and the recording of indigenous heritage sites, particularly rock shelters and examples of indigenous cave art. The LEG submission went on to note that they held little confidence in the Project assessment and requested an independent assessment of the Aboriginal Archaeological and Cultural Heritage Impact Assessment for the Project.

While comment on the adequacy of previous indigenous heritage assessments undertaken for other mining proposals or the request for an independent assessment of indigenous heritage impacts cannot be made, it should be noted that a comprehensive assessment of Aboriginal archaeology and cultural heritage was undertaken for the Project (see Appendix K (AECOM 2012)).

This assessment included a pedestrian field survey component undertaken over a total of 21 days in consultation with members of the seven local Aboriginal community groups.

During this survey, an emphasis placed on those landform types considered as having a higher archaeological potential (such as higher order creek lines and sandstone ridgelines and cliffs. All Aboriginal archaeological sites identified during the survey were recorded to the standard required by the *Code of Practise for Archaeological Investigation of Aboriginal Objects in New South Wales* (OEH 2010).

A discussion of the Aboriginal archaeological sites recorded during the survey and an assessment of impacts for each is provided in Section 8.12.3 of the EA. Proposed mitigation and management measures for the Project are outlined in the following section of the EA (8.12.4) and include the development of an Aboriginal Archaeology and Cultural Heritage Management Plan. This plan will be prepared in consultation with the Aboriginal community stakeholders and OEH, to the approval of DP&I.

As noted in Section 8.7.4 of the EA, Coalpac will also implement geotechnical monitoring and blast management procedures to limit the potential for indirect impacts on the rock shelter heritage sites identified in the Project assessment. These commitments will be included in the Blast Management Plan for the Project.

As noted in **Section 4.11.1**, the OEH has reviewed the Project Aboriginal Archaeology and Cultural Heritage study and found the assessment to be adequate.

4.12 NON-ABORIGINAL HERITAGE

4.12.1 Impacts to Cullen Bullen General Cemetery

Submissions: R3, P629

Several submissions noted that the Project should not impact on the Cullen Bullen General Cemetery. As noted in **Sections 4.6.4**, **4.7.1**, **4.7.2** and **4.22.2**, a number of mitigation measures have been included in the Project mine plan design and associated impact assessments to ensure that potential impacts to the Cullen Bullen General Cemetery are minimised to remain below relevant criteria. In Section 8.7.4 of the EA, Coalpac also committed to consultation with the LCC and relevant stakeholders to ensure that:

- No blasting will occur on days when services are scheduled at Cullen Bullen General Cemetery; and
- No mining or coal haulage within a 1,500 m radius will occur within two hours of formal services at Cullen Bullen General Cemetery.

Communication and management procedures for the above commitments will be included in the Blast Management Plan for the Project.

A Visual Landscape Management Plan will also be developed for the site in consultation with relevant stakeholders and a full archival recording completed for inclusion in the Historic Heritage Management Plan and RLMP, should the Project be approved. As noted in Section 8.13.4 of the EA, the archival recording will be carried out prior to any blasting activities within 500 m of the site.

In addition, blasts required for any mining activities within 500m of the Cullen Bullen General Cemetery (the closest point being a distance of 178 m) will be designed to manage vibration and overpressure to levels below that which could result in any disturbance likely to result in any damage to structures within the cemetery. As noted in Table 30 of the EA, a ground vibration criterion of 50 mm/s was considered appropriate for the site for blasts at a distance of 200 m.

4.13 ECOLOGY

All references to the Ecological Impact Assessment (EIA) in this section refer to Appendix J of the EA, as exhibited.

4.13.1 Clarification of Biodiversity Impacts

Submissions: R6, R11

Clarification has been sought on minor discrepancies of biodiversity impact areas between the EA (Table 48) and Table 4.1 and Table 6.2 of the Ecological Impact Assessment (EIA) prepared for the Project (Appendix J of the EA). To clarify, 221.7 ha of Critically Endangered Ecological Community (CEEC) White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland (here after referred to as Box Gum Woodland and Derived Native Grassland) occurs in the offset properties proposed in the exhibited EA. Yarran View contains 186.8 ha CEEC Box Gum Woodland and Hillview/Billabong contains 34.9 ha of CEEC Box Gum Woodland (see Table 6.1 of the EIA).

Table 4.1 of the EIA identifies a total of 957.98 ha of vegetation to be removed. Throughout the EA and EIA, 835 ha (834.63 ha) refers to impacts upon all shrubland, forest and woodland (listed and non-listed) in particular, as the majority of impacted fauna species prefer forest and woodland habitats. The sum of non-listed forest and woodland in Table 4.1 of the EIA is 818.41 ha not 818.71 ha shown in Table 6.1 of the EIA. Total biodiversity impacts of the Project are identified in Table 6.2 of the EIA and include Box Gum Woodland and Derived Native Grassland CEEC listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and *Threatened Species Conservation Act 1995* (TSC Act). Impacts to Box Gum Woodland and Derived Native Grassland Endangered Ecological Community (EEC) listed solely under the TSC Act are also identified.

Non-listed derived native grasslands and low diversity derived native grasslands are not included in these calculations. Table 6.2 of the EIA has been reproduced below as **Table 11** showing the error (highlighted in red).

After reviewing the amounts in Table 6.2 and Table 4.1 of the EIA, 818.41 ha of non-listed forest and woodland have been confirmed. Therefore the total biodiversity impacts should be adjusted by 0.3 ha to 836.85 ha *not* 837.15 ha as indicated in Table 6.2 of the EIA. A revised version of Table 6.2 from the EIA with amended values is presented below in **Table 12**. For simplicity, the amended Table 6.2 of the EIA above has combined the quantity of CEEC and EEC recorded in the Project Disturbance Boundary (see **Table 13**).

Table 11
Reproduction of Exhibited EIA Table 6.2

Vegetation Type	Project Boundary Disturbance[1] (ha)	Proposed Offset[2] (ha)	Proposed Offset Ratio
CEEC	16.48	221.7	13.5
EEC^	1.96	221.7	113.1
Non C/EEC (native only)	818.71	1,530	1.9
Total	**837.15**	**1,752**	**2.1**

[1] Does not include areas of low diversity native grassland and exotic grasslands

[2] Includes areas of low diversity native grasslands

^ EEC Box Gum Woodland conforming under the TSC Act

Table 12
Amended Exhibited EIA Table 6.2

Vegetation Type	Project Boundary Disturbance[1] (ha)	Proposed Offset[2] (ha)	Proposed Offset Ratio
CEEC	16.48	221.7	13.5
EEC^	1.96	221.7	113.1
Non C/EEC (native only)	818.41	1,530	1.9
Total	**836.85**	**1,752**	**2.1**

[1] Does not include areas of low diversity native grassland and exotic grasslands

[2] Includes areas of low diversity native grasslands

^ EEC Box Gum Woodland conforming under the TSC Act

Table 13
Exhibited Biodiversity Offset Package

Vegetation Type	Project Disturbance Boundary (ha)	Proposed Offset (ha)	Proposed Offset Ratio
CEEC and EEC[1]	18.44	221.7	12.0
Non C/EEC (native only)	818.41	1,530	1.9
Total	**836.85**	**1,752**	**2.1**

[1] includes EPBC Act and TSC Act Box Gum Woodland and Derived Native Grassland.

4.13.2 Inadequacy of Offsets

Submissions: R6, SIG1, SIG3, SIG6, SIG8 – SIG9, SIG13, SIG18, SIG24, Petition, P8, P660, P846, P689, P877

A number of submissions received suggested that the Biodiversity Offset Strategy presented in the EA was inadequate for the impacts proposed for the Project.

The exhibited offset strategy comprised four offset properties with a total area of over 1,752 ha, which included:

- **Hillcroft Offset** (see **Plate 1**): property west of the Project Boundary supports 327 ha of known *Eucalyptus cannonii* habitat, 450 ha of suitable *E. cannonii* habitat requiring rehabilitation, 86 ha of *Persoonia marginata* habitat, adjoins a population of the Booroolong Frog (*Litoria booroolongensis*), suitable habitat for the Spotted-tailed Quoll and a suite of woodland birds and micro-bats. It contains similar vegetation and derived grasslands capable of being rehabilitated to vegetation communities consistent with those occurring within the Project Disturbance Boundary. Ultimately, reforestation of this property will link Sunny Corner State Forest to Ben Bullen State Forest;
- **Yarran View Offset** (see **Plate 2**): property in Bylong Valley supports CEEC Box Gum Woodland and Derived Native Grassland and contains suitable habitat for the Regent Honeyeater, Swift Parrot, Spotted-tailed Quoll and a suite of woodland birds;
- **Hillview/Billabong Offset** (see **Plate 3**): two adjoining properties to the west of the Project Boundary supports CEEC Capertee Rough-barked Apple Red Gum Yellow Box Woodland and Derived Native Grassland, known *Eucalyptus cannonii* habitat and similar vegetation impacted by the Project; and
- **Hyrock Hartley Offset** (see **Plate 4**): property within Hartley Vale supporting similar sandstone habitats to that within the Project Boundary, particularly sandstone escarpment complexes, and with historical records of the Spotted-tailed Quoll, Giant Dragonfly and Blue Mountains Water Skink.

The Hyrock Hartley property also provides suitable habitat for the Brush-tailed Rock-wallaby, Large-eared Pied Bat, Broad-Headed Snake and a suite of woodland birds.

4.13.2.1 Revised Biodiversity Offset Strategy

In response to submissions received, Coalpac has commissioned further searches for suitable offset properties since the public exhibition of the EA and has proposed amendments to the Biodiversity Offset Strategy for the Project (Revised BOS).

Coalpac has been conducting these additional offset searches in consultation with DP&I, OEH and SEWPaC. This review included investigations of additional offset properties through extensive online searches of a range of regional real estate data bases and other online resources and contacting a number of real estate agencies in each of the locality. A particular focus of these searches was for those properties identified by OEH as preferred offsets, which are presented below in **Table 14**, along with the status of each (where it could be determined). This table presents a summary of each property along with any information that was found for each during searches completed by Coalpac during preparation of the Revised BOS.

In addition to those properties provided by OEH as potential offsets, four other properties were investigated as potential for inclusion in the Revised BOS. A summary of these properties and their respective value as potential offsets is provided in **Table 15**.

Plate 1
View of Williwa Creek on Hillcroft Offset Property

Plate 2
Views of Box Gum Woodland and White Box on Yarran View Offset Property

Plate 3
Capertee Rough-barked Apple – Red Gum – Yellow Box on Billabong / Hillview Offset Property

Plate 4
Blue Mountains Escarpment Complex Vegetation on Hyrock Hartley Offset Property

Table 14
Regional Offset Properties Preferred by OEH

Property	Locality	Values / Notes	Status
Gospers Mountain & Mt Wirraba, Lts 1, 2, DP 753787	Rylstone	Most significant inholding in Wollemi wilderness. High biodiversity values.	Not for Sale
Lot 39 DP 720321	Ulan	Adjoins GRNP and the Drip. High conservation values, connects the Drip to Lot 37	Availability Undetermined**
Part Lot 42 DP 750750	Durridgere	Adjoins GRNP. High conservation values.	Availability Undetermined
Lot 2 DP755439	Durridgere	Small isolated inholding - boundary rationalisation, access control. Native vegetation in good condition with high biodiversity values and GWBW EEC.	Availability Undetermined
Thompson's Flat - Lots 118,124,122,101,98,99 DP 750757, Lot 14,15 DP 755422, Lot 138 DP 720348 Parishs Munmurra and Comiala	Durridgere	Boundary rationalisation, access and stock control. Extensive riparian zones and river frontage. Native vegetation in good condition with high biodiversity values.	Availability Undetermined

Property	Locality	Values / Notes	Status
Poggy Lot 19 DP 750966	Ringwood Rd - Poggy	Small isolated inholding - boundary rationalisation, access control. Native vegetation in good condition	Availability Undetermined
Coggan Creek - DP 755 443 Lots 65,63,66,62. Lot 4 DP 750966	Bylong	Inholding blocks, good condition veg with high conservation values	Sold
Pt 28 Parish Tomimbil DP750769	Turril	Boundary rationalisation, access control. 95% native vegetation in good condition with high biodiversity values.	Availability Undetermined
Lt 7 DP 588745	Mudgee	Needs investigation, open forest, headwaters of MacDonald Creek, abuts western side of reserve.	Availability Undetermined
"Snakehaven" Dunns Swamp - Lt 68 & 42 Parish Never Never	Olinda	High conservation values and key inholding adjacent to Dunns Swamp. NP walking and Management trails cross freehold	Not for Sale
Mt Cooroongooba, Lt 28 DP 753777	Olinda	High biodiversity values, Forest Redgum Grassy Woodland on basalt. Inholding.	Availability Undetermined
Mt Towinhingy, Lt 57 DP 755775	Olinda	Grassy woodland on basalt, high biodiversity values. Rare fauna and flora. Inholding	Availability Undetermined
Mogo Road - "No Name" DP 755422 Lots 7, 49, 33,34,42,6,36,35,38 DP755455 lot 144 DP 728702 Lot 144 DP750757 lots 126,133 DP 807261 lot 111	Wollar	Scattered blocks within GRNP along Mogo Rd in variable condition but mostly native veg with some areas of GWB EEC	Availability Undetermined
Cullingral Rd DP 750916 Lots30,115,26 DP 750 927 lots 15,17,35,1,7,21	Merriwa river	Isolated inholdings with problematic access issues. Generally good veg with some disturbance	Not for Sale
Horvath Blocks - Pt 116 DP 750757 Parish Munmurra	Durridgere	Boundary rationalisation, access control. Native vegetation in good condition with high biodiversity values. Includes Goulburn river frontage and 111 ha EEC.	Availability Undetermined
Death Adder Lot 11 DP 750927	Merriwa	Small isolated inholding - boundary rationalisation, access control. Highly disturbed	Not for Sale
part "Crowie - Pt 1 Parish Munmurra DP 750757	Durridgere	Boundary rationalisation, access control. Native vegetation in fair condition with some biodiversity values. Includes Goulburn River frontage and 65 ha EEC.	Availability Undetermined
Lot 48 DP 720315	Ulan	Improved reserve management and catchment protection. Alluvial flat forest. Some grazed/disturbed areas. Compliments potential Drip additions	Availability Undetermined

Property	Locality	Values / Notes	Status
Part "Forest Lodge" Lots 71 and 48 DP 750736 and Lot 2 DP 575059 Parish Bobadeen	Turril	Moderate conservation values - some ironbark woodland, minimal boundary rationalisation but compliments reserve design	Availability Undetermined
Part "The Range" Lots 30,4,9 Parish Nullo	Nullo Mountain	Grassy box woodland EEC on basalt, high biodiversity values. Some boundary rationalisation values	Not for Sale
part Hillview Pt 77 Parish Bylong, Pt 84 Parish Lee	Bylong	Boundary rationalisation, access control. Native vegetation in good to fair condition with biodiversity values. Includes GWBW EEC.	Not for Sale
Part "Seven Oaks" Pt 91,92,108,109 DP 750757 Parish Munmurra	Durridgere	Boundary rationalisation, access control. 50% native vegetation in good condition with high biodiversity values - balance regenerating	Availability Undetermined
Parsons Gully DP 750916 Lot 99	Merriwa	Good veg - already under VCA	Not for Sale
East of Cullingral Rd DP 700676 Lot 2	Merriwa	Good veg with detailed biodiversity info available	Not for Sale
Rowans Hole Lots 37, 40, 41 & 94 DP 755759 (two properties under different owners?)	Capertee	Gardens of Stone NP inholding.	Not for Sale
"Singlong Grange", Lt 3 DP 597207 & "The Pines", Lt 8 Port Macquarie Rd, Rylstone (subdividing Lt 3 DP 1048048), 2358 Glen Alice Rd, Rylstone .	Capertee	"The Pines" is on the open market. "Singlong" is on offer to OEH and was found to be on offer as a total package only. While of suitable size, the vegetation is dominated by Ironbarks or other species not found in the Project Boundary and is inconsistent or not “like for like” with vegetation types of the Project Boundary.	For Sale
Lt 14 DP 755757, inholding in Capertee NP.	Capertee	On the open market. This property is only approximately 20 ha which is not adequate for Project requirements.	For Sale
"Laidley" Lt 34 DP 755763, Lt 65 DP 704742, Lt 28 DP 755763, Lt 9 DP 877578	Capertee	On the open market. This property contains vegetation types similar to Singlong and Pines properties above. It is dominated by Ironbarks and other species not recorded in the Project Boundary, and is inconsistent or not “like for like” with vegetation types of the Project Boundary.	For Sale

Table 15
Additional Properties Investigated for Revised BOS

Property	Locality	Values / Notes	Status
Property 176 Lt 261 DP755769	Cullen Bullen	This property adjoins Hillcroft to the south and is likely to have similar to the Project Boundary such as, Tableland Gully Snow Gum – Ribbon Gum Grassy Forest, Scribbly Gum – Red Stringybark Grassy Woodland and Tableland Broad-leaved Peppermint – Brittle Gum – Red Stringybark Grassy Open Forest on the slopes. Other comments: • This property is small and covers only 167 ha; • Potential habitat for Eucalyptus cannonii and Persoonia marginata; • From aerial photography a large portion of the property looks to be severely degraded; • Quality of grassland is unknown – potential for grasslands to be heavily disturbed and largely exotic; • Does not connect to a National Park.	For Sale
34 and 35 Jamieson Rd Lt 34 and 35 DP 755796	Upper Nile	This property is located in the north-western arm of the Upper Nile, north-west of Glen Alice. It neighbours Wollemi National Park and the majority of the property is forested. It covers approximately 64 ha. The mapped vegetation is inconsistent with vegetation types of the Project Boundary. Vegetation types include: • Permian Widden Talus Woodland • Dominant Trees - Eucalyptus dawsonil, Eucalyptus punctata and E. moluccana, E. albens • Permian Capertee Talus Woodland • Dominant Trees - Eucalyptus punctata, Eucalyptus dawsonii, Eucalyptus cannonii, Eucalyptus cypellocarpa, Angophora floribunda, Eucalyptus rossii, Eucalyptus macrorhyncha • Permian Grey Box Woodland • Domiant Trees – Eucalyptus moluccana, Eucalyptus albens, Eucalyptus crebra. • Agricultural.	For Sale
Como Valley Lt 2 DP 502588 Lt 24, 25, 77, 99, 119 DP 755769 Lt 15, 53, 76 DP 755767 Lt 7, 8, 9, 10, 76 DP 755759	Cullen Bullen	This property is located to the west of the Project Boundary and immediately north of Hillcroft. It covers approximately 724 ha and would expand upon Project's strategic corridor between Sunny Corner State Forest to Ben Bullen State Forest. The vegetation on the property is similar to Project Boundary. Other comments include: • Borders Williwa Creek which connects to Sunny Corner National Park. • Close to the Project Boundary. o greater chance of supporting habitat for Eucalyptus cannonii and Persoonia marginata,	For Sale

Property	Locality	Values / Notes	Status
		o provide habitat for displaced fauna during mining operations. • Has Williwa Creek frontage (creek easement is a separate title i.e. crown land); o Potential Boorooloong Frog habitat.	
Unnamed Lt 38 DP 755759 Lt 120 DP 704711 Lt 119 DP 704710	Cullen Bullen/ Capertee	This property is located north west of the Project Boundary. It covers approximately 750 ha and abuts Turon National Park. This property is unsuitable as it relies heavily on grasslands rehabilitation and does not address potential time lags. Broad scale mapping identifies four broad vegetation types across the site: • Stringybark – Box – Gum Woodland; • Broad-leaved Peppermint – Long-leaved Box woodland; • River Oak Riparian woodland; and • Scribbly Gum Woodland.	For Sale

From the searches completed, an additional offset property, 'Gulf Mountain', has been surveyed and is proposed for inclusion in the Revised BOS (see **Appendix E**). Gulf Mountain is a large property of 1,277 ha located approximately 24 km north-east from the Project Boundary. The property is covered in remnant native vegetation of good condition with few weeds. The vegetation resembles tableland vegetation and has affinities with the Project Boundary. The dominant tree species found on Gulf Mountain are similar to those within the Project Disturbance Boundary and include Scribbly Gum (*Eucalyptus rossii*), Red Stringybark (*Eucalyptus macrorhyncha*), Broad-leaved Peppermint (*Eucalyptus dives),* Brittle Gum (*Eucalyptus mannifera*), Mountain Gum, (*E. dalrympleana*) and Ribbon Gum (*E. viminalis*). A figure showing the vegetation communities present within the Gulf Mountain property is included in **Appendix E**.

The drainage lines within Gulf Mountain are both lined with dense shrubs and grassy understoreys and provide habitat for small woodland birds. Other key habitat features recorded within the property include an abundance of fallen logs and debris, permanent and ephemeral drainage lines (including the Turon River), hollow-bearing trees (hollows of various sizes), stags, extensive rocky outcrops, nectar-producing trees, mistletoes and koala feed trees (including *Eucalyptus viminalis* and a variety of secondary feed species).

These habitats occur at a range of altitudes including along ridgelines, steep and gently sloping topography and along the Turon River. Two threatened species which occur at the Project, the Scarlet Robin and Varied Sittella, were recorded on the property. A summary of the biodiversity values of Gulf Mountain and photographs of that property is provided in **Appendix E**. Photos of the Gulf Mountain property are provided in **Appendix E** have been reproduced below in **Plate 5** to **Plate 11**.

Plate 5
Overview of south-western hillside – River Oak in foreground and Scribbly Gum in background

Plate 6
Scribbly Gum Woodland on Rocky Outcrops

Plate 7
Broad-leaved Peppermint – Brittle Gum Woodland with abundant fallen timber

Plate 8
Scribbly Gum Woodland with abundant fallen timber and hollows

Plate 9
Riparian River Oak Forest along the Turon River. Potential Booroolong Frog habitat

Plate 10
Ribbon Gum Open Forest in drainage line

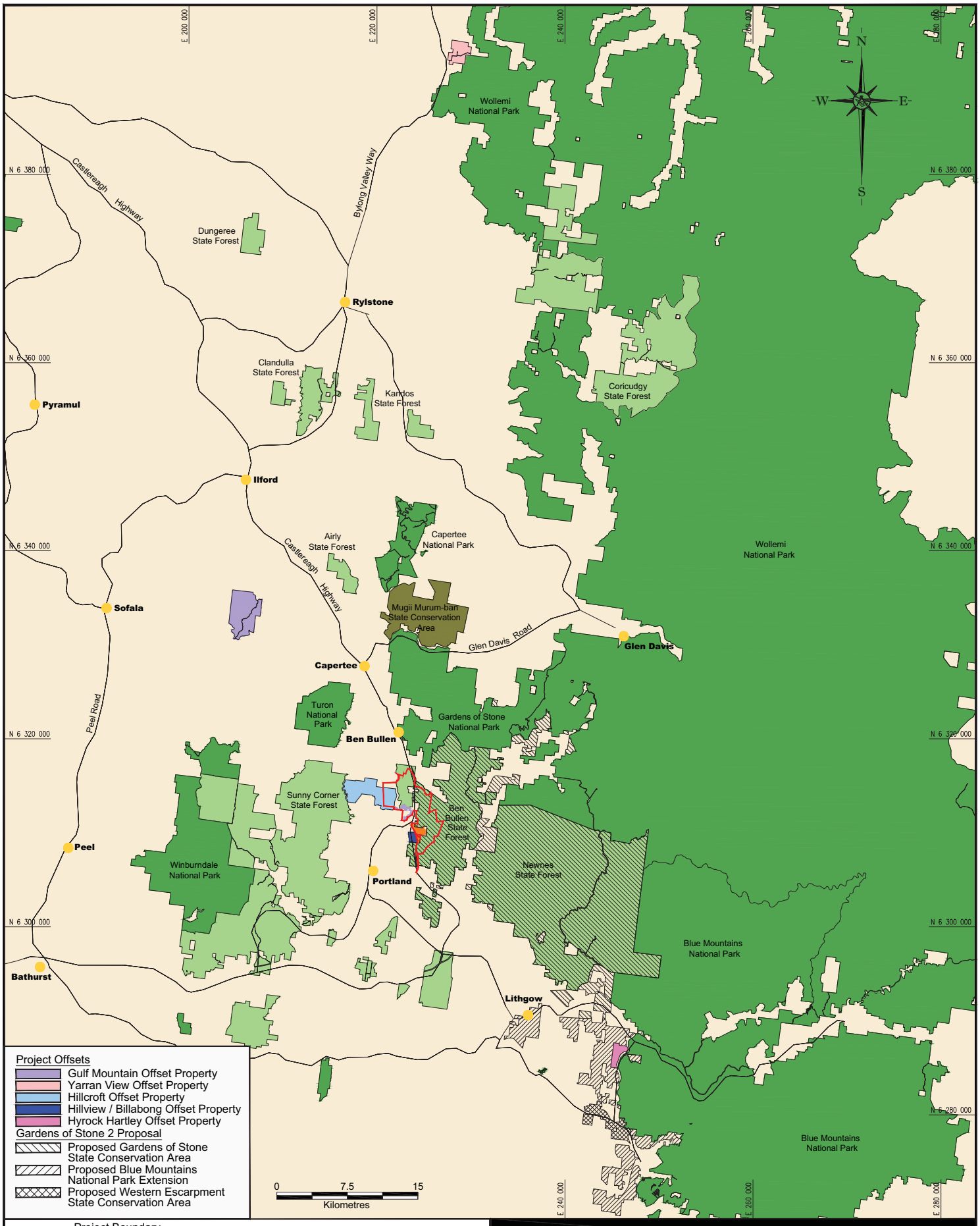
Plate 11
Ribbon Gum & Mountain Gum at Gully Head

A summary of the Revised BOS including Gulf Mountain is provided in **Appendix E** and has been reproduced below in **Table 16**. The location of the Project offsets in a regional context is shown on **Figure 9**. This figure has been revised from that presented in the exhibited EA to include the Gulf Mountain property.

Table 16
Revised BOS (including Gulf Mountain Property)

Vegetation Type	Project Disturbance Boundary (ha)	Proposed Offset (ha)	Proposed Offset Ratio
CEEC & EEC[1]	18.44	221.7	12.0
Non C/EEC (native only)	818.41	2,808	3.4
Total	**836.85**	**3,030**	**3.6**

Notes: [1] includes EPBC Act and TSC Act Box Gum Woodland and Derived Native Grassland.



Hansen Bailey

Coalpac Pty Ltd

Coordinate System: MGA Zone 56
Source: Colong Foundation, 2006

COALPAC CONSOLIDATION PROJECT

Project Ecological Offsets in Regional Setting

Cad File: 08589A.dwg	Date: 31.07.12	Drawn: JD	Figure 9

The Project BOS has been developed to compensate for the removal of threatened species habitat and a threatened ecological community. This includes the provision of offsets properties and rehabilitation of forest and woodland on impacted areas following mining operations. The Revised BOS will result in a net gain in native vegetation and fauna habitat in the long term by adding over 2,353 ha of existing native vegetation such as swamps, shrubland and heath, forest and woodland to conservation tenure. The strategy also commits to regenerating over 677 ha of grassland within the Project Boundary and offset properties back to forest and woodland. These areas are also provided in Table B.1 and Table B.2 of **Appendix F**.

The addition of the Gulf Mountain property addresses expressions of an unbalanced and inadequate offset strategy made in the submissions on the EA during public exhibition. A concern raised by OEH on the exhibited offset strategy was the proportion of forest and woodland to grasslands. OEH was concerned about potential "time lags" for grassland rehabilitation to form forest and woodland habitat for flora and fauna. The proportion of forest and woodland to grassland of the Revised BOS comprises approximately 71% forest and woodland, providing immediate habitat for impacted flora and fauna, at a 2.8:1 ratio compared to a 1.3:1 ratio provided in the BOS presented in the EA.

As noted above, an offset summary table (including the Gulf Mountain property) has been prepared outlining the quantity of habitat to be conserved and rehabilitated for threatened species and threatened ecological communities in **Appendix F**. This has been reproduced in **Table 16**.

4.13.2.2 Indirect Biodiversity Offsets

Submission: R6

During consultation with OEH and SEWPaC, some minor shortfalls in the Revised BOS were identified. To address these minor shortfalls, further discussions were held around indirect offsets for a suite of threatened species.

Indirect offsets are a range of other measures that improve our knowledge, understanding and/or management of environmental values leading to improved conservation outcomes for the impacted threatened species (SEWPaC 2011).

According to Commonwealth guidelines (SEWPaC 2011), indirect offsets may include:

- Implementing priority actions outlined in the relevant recovery plans, biodiversity action plans or management plans;
- Enhancing habitat quality or reducing threats to the protected matter on a site that is not part of the direct offset, for example by removing invasive species; or
- Contributing to relevant research or education programs.

Two examples of recent approvals or proposed biodiversity offsets that include indirect offsets are provided below.

A recent approval that included indirect offsets as part of the overall offsetting package was Xstrata's Ravensworth North Mine approval. The offsetting package in this instance included 1,654 ha of biodiversity offset, rehabilitation of mined land to native vegetation communities, and provision of $900,000 to Birds Australia to fund recovery actions in the region.

Coal and Allied's Mt Pleasant Mine proposes to offset 12,432.5 ha of Box Gum Woodland variant and commit to contributing $1,000,000 towards research into the management of St John's Wort. St John's Wort has invaded extensive areas of Box Gum Woodland and without control, can dominate native grasslands (DECCW (NSW) 2010).

In addition to increasing the size of offsets, the Revised BOS also includes the provision of indirect offsets. Coalpac has therefore committed to sponsor a number of key recovery actions for a suite of threatened species.

In addition to the compensatory habitat provided in the biodiversity offset properties (see **Section 4.13.3**), Coalpac commits to providing indirect offsets in the Revised BOS through contributions towards recovery actions for the following threatened species:

- Broad-headed Snake: the University of Sydney in partnership with OEH are trialling the use of artificial rock and vegetation manipulation as restoration techniques to address habitat loss and modification. Other recovery actions include site protection, monitoring key populations and bushrock removal regulation;
- Brush-tailed Rock Wallaby;
- Woodland Birds; and
- Koala.

In Section 9 of the EA, Coalpac committed to support the progressive establishment of the BMCS and Colong proposal for the Gardens of Stone Stage 2 (GoS2) through a monetary contribution to OEH (or another relevant body) per tonne of product coal sold during the life of the Project. Following further consultation with OEH, this commitment has been revised. Instead, in addition to the Gulf Mountain offset property, Coalpac will now provide support to the indirect offset measures outlined above as part of the RTS, totalling $300,000 to be spent equally for these four species in the first five years of the Project.

4.13.3 Quantify the amount and condition of habitat for EPBC Act and TSC Act listed species and communities in Project Boundary and offsets

Submissions: R11

A number of submissions requested summaries of the quantity and condition of habitat for state and nationally listed threatened species and ecological communities within the Project Boundary and Revised BOS.

Extensive habitats occur within the proposed offsets for a suite of EPBC Act and TSC Act listed flora and fauna.

Approximately 3,030 ha of native shrubland and heath, forest, woodland, watercourses, swamps and grassland habitat within the offset lands will be permanently conserved for wildlife. This includes 47.2 ha of good/moderate shrubland and heath, 3.4 ha of good/moderate swamp (not included in Table B.1 and B.2 of Appendix B as it provides habitat for non-impacted fauna and a non impacted threatened ecological community), 432.2 ha of good/moderate forest, 1,869.9 ha of good/moderate woodland and 677.0 ha of low condition grasslands to be restored back to good/moderate forest and woodland.

More specifically, the Revised BOS will conserve habitat for the following EPBC Act and TSC Act listed species:

- 221 ha of CEEC and EEC Box Gum Woodland and Derived Native Grassland;
- 327 ha of known Capertee Stringybark habitat and 450 ha of land suitable for Capertee Stringybark rehabilitation;
- 86 ha of Clandulla Geebung habitat;
- 188 ha of habitat for the Broad-headed Snake (see **Appendix F**), comprising 20 ha of winter habitat and 168 ha of summer habitat;
- 2,349 ha of habitat for the Large-eared Pied Bat;
- 2,302 ha of habitat for the Regent Honeyeater and Swift Parrot; and
- 2,349 ha of habitat for the Spotted-tail Quoll.

Approximately 677 ha of grasslands will be restored to provide forest and woodland habitat for the above mentioned threatened species.

The revised BOS will conserve habitat for the following TSC Act listed species:

- 2,302 ha of habitat for woodland birds such as Varied Sittella, Speckled Warbler, Little Lorikeet, Brown Treecreeper, Diamond Firetail, Scarlet Robin and Gang Gang Cockatoo;
- 2,302 ha of habitat for blossom dependant birds such as Black-chinned Honeyeater and Painted Honeyeater;
- 2,302 ha of habitat for Forest Owls (Powerful Owl, Barking Owl, Masked Owl);
- 886 ha of habitat for the Koala, comprising 45 ha of primary habitat and 841 ha of secondary habitat;
- 2,302 ha of habitat for the Squirrel Glider and Yellow-bellied Glider; and
- 2,302 ha of habitat for bats such as Eastern Bentwing Bat, Eastern False Pipistrelle, Eastern Freetail Bat.

Approximately 677 ha of grasslands will be restored to provide forest and woodland habitat for the above mentioned threatened species.

The Revised BOS will also provide habitat for the majority of species predicted to be impacted by the Project. In recognition of potential shortfalls for some threatened species, indirect offsets will be used to compensate for this and will include monetary contributions towards research, implementing recovery actions of the following threatened species: Swift Parrot, Regent Honeyeater, Broad-headed Snake, Brush-tailed Rock Wallaby and Koala (see **Section 4.13.2.1**).

Appendix F provides summary tables quantifying the amount and condition of habitat for each threatened species and threatened ecological community listed under the TSC Act and EPBC Act that is predicted to be impacted by the Project and conserved and rehabilitated in the BOS. The tables also estimate the condition of resorted forest and woodland (from grassland) after 50 years.

4.13.4 Justification for excluding non-listed grasslands in biodiversity impacts

Submission: *R6*

Further justification has been requested for excluding areas of non-listed derived native grassland from impact calculations presented in the EIA. The non-listed derived native grasslands in question are derived from the following non-listed vegetation communities described by DECC (NSW) (2006):

- Tableland Gully Mountain Gum Broad-leaved Peppermint Grassy Forest;
- Tableland Slopes Brittle Gum – Broad-leaved Peppermint Grassy Forest; and
- Tableland Gully Ribbon Gum Blackwood Applebox Forest.

Around Ben Bullen State Forest, large areas of grasslands occur and most have been subject to pasture improvement and/or intensive grazing for many years. The grasslands of the Project Boundary are made up of discrete livestock paddocks of various sizes (**Plate 12**). In these areas, trees and shrubs are essentially absent, and to a large extent the diversity of native groundcover is low. In some of the paddocks immediately adjacent to forest edges, a narrow band of native herbaceous plant cover has been observed.

The paddocks are typically grasslands that are dominated by a few hardy grazing-tolerant native species such as *Austrodanthonia* spp. (Wallaby Grass), *Eragrostis leptostachya, Aristida* spp. (three-awn grass) and *Microlaena stipoides* (Weeping Meadow Grass) (especially at sites where paddocks were not sown or fertilised) (**Plate 14**), perennial pasture species such as *Loluim* spp. (Rye Grass), *Cynodon dactylon* (Couch), and *Anthoxanthum odoratum* (Sweet Vernal Grass) (more common in paddocks that have been improved); and a scattering of pioneering native herbs.

The condition of grasslands within the Project Boundary is variable. In many of these ex-livestock paddocks, the presence and sometimes dominance of perennial exotic pasture grasses and exotic herbs is common and it would be unlikely to change in species composition (**Plate 13**). In the EIA, Cumberland Ecology termed these paddocks “low diversity derived native grasslands” (**Plate 13**).

Cumberland Ecology also termed other paddocks in slightly better condition with more native grass cover as "derived native grasslands" (**Plate 14**). Even though some of the areas are dominated by a few native grasses (hence the community name) they are nonetheless highly degraded, species poor and do not provide habitat for native species of flora and fauna. These communities do not have conservation significance in their own right as they are not an EEC.

Plate 12
Typical paddocks mapped as "low diversity derived native grassland" and "derived native grassland"

Note the presence of horses and greener colour of the low diversity derived grasslands.

Plate 13
Typical ground cover of paddocks mapped as "low diversity derived native grassland" from a non-listed vegetation community

Note the dominance of exotic herb Hypocharis radicata.

Plate 14
Typical ground cover of paddocks mapped as "derived native grassland" from a non-listed vegetation communities

Note these paddocks contain a small number of grazing tolerant native grasses and very few native herbs.

4.13.5 Impacts to Threatened Biodiversity

Submissions: R6, R11, SIG1, SIG3 - SIG4, SIG6 – SIG9, SIG12, SIG14, SIG18, SIG20, SIG22, Petition, P8, P10, P14, P20, P32, P24, P42 – P43, P49, P56, P65, P68 – P69, P95, P106, P145, P147, P150, P160 – P161, P164, P167 – P168, P176 - :177, P180 – P181, P191 – P193, P196, P198, P200, P203, P208 – P209, P214, P218, P227, P230 – P232, P235, P243, P248 – P249, P252, P255, P261, P263, P273, P274, P276, P278, P279, P281 – P282, P284 – P290, P292 – P293, P297, P303, P317, P322 – P323, P329, P331 – P333, P339, P344, P436, P348 – P350, P356, P360, P362, P380 – P381, P387, P389 – P390, P397, P400, P402, P404, P413, P414 – P417, P410, P424, P438, P442, P445 – P446, P449, P452, P455, P458. P471 – P472, P480, P484 - 492, P496, P498 – P499, P502, P512, P514, P516, P520, P522, P537, P541, P545 – P551, P558, P561, P563 – P566, P578, P580, P583, P586- P588, P590, P593 – P609, P621, P625, P629 – P632, P634, P637 – 638, P640 – P642, P648, P650, P652 – P655, P622, P665, P667, P669, P670, P672, P678, :679, P685 – P690, P693, - P694, P699 – P7--, P702, P706 – P707, P711, P713, P717 P719, P721, P723, P724, P730 – P748, P750, P753, P757, P758, P762 – P764, P774 –775, P778, P779, P781 – P783, P786, P794, P796 – P797, P800 – P801, P804 – P821, P824, P828, P289, P839, P841, P843, P844, P848 – P849, P852 – P854, P856, P859, P862, P869, P872, P874, P877, P882, P885 – P886, P895, P900 – P903

4.13.5.1 Impacts to Threatened Species

A number of submissions were concerned on the level of impacts to threatened flora and fauna species known to occur and with potential to occur in the Project Boundary.

While it is noted that the Project will remove large areas of habitat for a number of threatened species, the EIA has considered all threatened species that are known or with potential to occur within Project Boundary. The EIA also considered the habitat requirements of all species, the extent of direct habitat clearance, probable indirect impacts (e.g. edge effects, noise, dust, etc), and the potential to avoid, mitigate and/or compensate for the impacts predicted.

The EIA concluded that the impacts of the Project could be ameliorated for all species by a combination of avoidance, mitigation and compensation. This was to be achieved by staged clearing and progressive rehabilitation of disturbed areas, avoidance of some areas of forest and woodland clearance, active fauna management as part of the Biodiversity Management Plan (BMP), and provision of a comprehensive BOS, both adjacent to the Project Boundary and in the surrounding region.

The EIA also reached the conclusion that in the medium to long term, the BOS and rehabilitation strategies proposed for the Project would result in a larger area of habitat being restored and conserved (3,030 ha) than what is proposed to be disturbed (836.85 ha). The revised BOS comprises two parts: direct offsets and indirect offsets.

Part of the BOS proposes to improve habitat availability and connectivity through the increased area of conserved forest and woodland and the creation of a substantial wildlife corridor to link between the western slopes and tablelands (connecting the Sunny Corner State Forest to Ben Bullen State Forest). The proposed offsets also conserve large areas of intact forest and woodland habitat for threatened flora and fauna, as well as restoring proportionate areas of grasslands back to forest and woodland. Collectively the BOS properties will conserve 327 ha of Capertee Stringybark (*Eucalyptus cannonii*) habitat and rehabilitate 450 ha of habitat suitable for this species. Capertee Stringybark is easily propagated and is currently being planted successfully in existing offsets managed under existing Coalpac approvals. Moreover, a review on the distribution and conservation status of Capertee Stringybark by Hunter and White (1999) consider the species to be adequately conserved in NSW National Parks and Reserves, such as Wollemi National Park, Gardens of Stone National Park and Winburndale Nature Reserve.

Progressive rehabilitation of land mined for the Project using local progeny collected from the Project Boundary, including Capertee Stringybark, will maintain gene flow and genetic diversity. Approximately 86 ha of *Persoonia marginata* (Clandulla Geebung) habitat will also be conserved in the proposed offset properties. In total, the combination of mine rehabilitation, avoidance and offsetting measures for the Project will result in 1,684 ha of Capertee Stringybark habitat and 102 ha of Clandulla Geebung habitat being conserved or rehabilitated after mining.

4.13.5.2 Impacts to Broad-headed Snake

Two submissions noted concerns regarding the Project's impacts on the Broad-headed Snake. OEH and SEWPaC also noted potential impacts to this species during consultation during the RTS process. It was noted in submissions that a recent sighting was found outside the Project Boundary (according to the location of NSW Atlas of Wildlife records). To consider potential impacts to this species as a result of the Project, the extent of habitat within the Project Boundary has been predicted conservatively and is based on scientific findings of the species.

Approximately 1,212 ha of habitat for the Broad-headed Snake is predicted to occur in the Project Boundary and a total of 561 ha will be cleared, comprising 309 ha of predicted winter habitat and 252 ha of summer habitat. No pagodas (winter habitat) will be directly impacted and indirect impacts from surface subsidence are expected to be negligible (less than 20 mm). The Project will remove summer habitat for this species; however this is not expected to impose a significant impact on the species as large areas of habitat will be retained in the Project Boundary and exist in other adjacent areas of Ben Bullen State Forest to the east of areas of potential mining impacts. The Project is not expected to fragment habitat or isolate the species as accessible habitat (winter and summer) will remain east of the Project Disturbance Boundary in Ben Bullen State Forest. Approximately 188 ha of predicted habitat (comprising 20 ha of winter habitat and 168 ha of summer habitat) also occurs in offsets proposed for the Project (see **Appendix F**).

In recognition of some minor shortfalls of direct offsets towards Broad-headed Snake, Coalpac will provide indirect offsets through monetary contributions towards research and/or the implementation of recovery actions for the species (**Section 4.13.2.2**). The University of Sydney in partnership with OEH are successfully trialling the use of artificial rock and vegetation manipulation as restoration techniques to address habitat loss and modification. Other recovery actions include site protection, monitoring key populations and bushrock removal regulation. Coalpac also propose to incorporate Broad-headed Snake habitat restoration during mine rehabilitation (**Section 4.13.20**).

4.13.5.3 Impacts to Brush-tailed Rock Wallaby

In consultation during the RTS process, OEH and SEWPaC expressed concerns on the Project's residual impacts on the Brush-tailed Rock Wallaby. No individuals were detected in the Project Boundary during the EIA despite suitable habitat being present, suggesting fox populations could be high in the area. It is likely that the species would have occurred in the Project Boundary historically.

Approximately 868 ha of predicted habitat occurs in the Project Boundary, and a total of 445 ha will be cleared, comprising 45 ha of refuge and shelter habitat and 400 ha of predicted forage and shelter habitat. The Project will remove largely potential foraging habitat for this species; however this is not expected to impose a significant impact on the species as large areas of potential habitat will be retained in the Project Boundary and exist in other adjacent areas of Ben Bullen State Forest to the east of areas of potential mining impacts. The Project is not expected to fragment habitat or isolate the species as accessible habitat will remain east of the Project Disturbance Boundary in Ben Bullen State Forest.

Approximately 153 ha of predicted habitat occurs in offsets, comprising 20 ha predicted refuge and shelter habitat and 133 ha of predicted forage and shelter habitat. Refer to the summary tables of **Appendix F** which specifically shows the quantity of habitat for the Brush-tailed Rock Wallaby to be avoided and conserved in offsets.

In recognition of some minor shortfalls of direct offsets towards Brush-tailed Rock Wallaby, Coalpac will provide indirect offsets through monetary contributions towards research on breeding biology and genetic conservation and/or implementation of recovery actions, such as predator and competitor control and captive breeding programs (**Section 4.13.2.2**).

4.13.5.4 Impacts to Squirrel Glider

OEH also expressed concerns regarding the Project's residual impacts on the Squirrel Glider. The Squirrel Glider was detected during surveys for the EIA in Tableland Gully Ribbon Gum Blackwood Applebox Forest within the Project Boundary. The tall gully forests would provide habitat within the Project Boundary. Approximately 1,589 ha of habitat occurs in the Project Boundary, and a total of 835 ha of habitat will be cleared.

The species is known in the locality (5 km radius) of proposed offsets for the Project (see Section 6.4 of the EIA). Offsets also contain suitable open forests and woodlands including gully forests. Approximately 2,349 ha of potential habitat for this species is present in the proposed properties under the Revised BOS. Recent findings are indicating that the species is not being detected in habitat considered suitable west of the Dividing Range (pers. comms. Peter Christie of OEH). Refer to the summary tables of **Appendix F**, which specifically shows the quantity of habitat for the Squirrel Glider to be avoided and conserved in Project offsets.

In recognition that suitable habitat cannot be strictly used as a surrogate for predicting habitat west of the Dividing Range, targeted searches for this species will be conducted on Biodiversity Offset Properties as part of the BOMP. In addition, nest boxes targeted to provide den sites for the species will be used in mine rehabilitation (see **Section 4.13.25.4**).

4.13.5.5 Impacts to Koala

OEH expressed concerns on the Project's residual impacts on the Koala. The Koala was not detected in the Project Boundary.

Habitat assessment indicates that some portions of the Project Boundary support primary food trees (*Eucalyptus viminalis*) and secondary food trees (*E. blakelyi, E. bridgesiana, E. dalrympleana, E. mannifera, E. melliodora and E. pacuiflora*). Approximately 224 ha of potential habitat occurs in the Project Boundary, and a total of 142 ha will be cleared, comprising 94 ha of forest and woodland containing primary food trees and 48 ha of forest and woodland containing secondary food trees.

Approximately 886 ha of potential habitat occurs in offsets, comprising 44.96 of forest and woodland containing primary food trees and 841 ha of forest and woodland containing secondary food trees. Due to time constraints the extent of forest containing Ribbon Gum (primary Koala habitat) has been mapped conservatively and is likely to be under-represented. A detailed vegetation map representing primary Koala habitat would be a focus of surveys as part of the BOMP. In addition, 672 ha of grassland will be restored back to 42 ha of forest and woodland, containing primary food trees and 630 ha of forest and woodland containing secondary food trees.

In recognition of some minor shortfalls of direct offsets towards the Koala, Coalpac will provide indirect offsets through monetary contributions towards research and/or the implementation of recovery actions, such as reducing road kills and upgrading/maintaining protective fencing (**Section 4.13.2.2**).

4.13.5.6 Impacts to Woodland Birds (including Swift Parrot and Regent Honeyeater)

OEH and SEWPaC expressed concerns on the Project's residual impacts on woodland birds. A number of woodland birds were detected in the Project Boundary, such as Varied Sittella, Brown Treecreeper, Scarlet Robin and Speckled Warbler.

In addition, a number of species that were not detected in the Project Boundary were considered to have potential to occur, such as Regent Honeyeater, Swift Parrot, Hooded Robin, Diamond Firetail, Grey-crowned Babbler, Flame Robin and Hooded Robin.

A total of 835 ha of forest and woodland habitat will be cleared in the Project Boundary. Approximately 2,302 ha of potential habitat for woodland birds are present in the properties proposed for the Revised BOS. The Revised BOS comprises approximately 78% forest and woodland of good/moderate condition (**Appendix F**) providing a forest and woodland offsets ratio of 2.8:1 of good/moderate condition. In addition, 677 ha of grasslands will also be restored as part of woodland restoration in offsets.

For the Swift Parrot and Regent Honeyeater that prefer Box Gum Woodland approximately 49 ha of Box Gum Woodland will be conserved, resulting in a 3:1 offset ratio of woodland cleared to woodland to be offset, and a 12:1 when the restoration of derived native grassland is included.

In recognition of some minor short-term shortfalls of direct offsets towards the Regent Honeyeater and Swift Parrot, Coalpac will provide indirect offsets through monetary contributions towards research and/or the implementation of recovery actions (**Section 4.13.2.2**).

4.13.5.7 Impacts to Box Gum Woodland CEEC

Further clarification was sought in a number of submissions on direct impacts on the Box Gum Woodland CEEC and indirect, cumulative and facilitative impacts on habitat critical to the survival of Box Gum Woodland. While it is questionable whether it would be possible to define and locate habitat that is critical for a widespread ecological community that is considered critically endangered (DECCW (NSW) 2010), all areas of Box Gum Woodland which meet the minimum condition criteria outlined in Appendix H of the EIA should be considered critical to the survival of this ecological community. This assumption was followed in the Project EIA.

Predicted impacts to Box Gum Woodland have been previously discussed in s.4.3, s.4.2.3 and Appendix I of the EIA, however more detail is provided below. The EIA acknowledges that the Project will remove considerable areas of Box Gum Woodland. Approximately 18.44 ha of Box Gum Woodland and Derived Native Grassland will be removed, consisting of 16.21 ha of woodland and 2.23 ha of Derived Native Grassland. Edge effects and other indirect impacts are likely to be highly localised to the areas surrounding the Project Disturbance Boundary and noise, light and dust levels are expected to reduce relatively rapidly with increasing distance from the area of direct disturbance. Weed species are not expected to penetrate deep into areas retained for vegetation as the majority of this community is located upslope of proposed open cut operations which generally eliminates potential impacts from runoff and sedimentation.

Edge effects and other indirect impacts to Box Gum Woodland are likely to be highly localised to the areas surrounding the Project Disturbance Boundary. Noise, light and dust levels are expected to reduce relatively rapidly with increasing distance from the area of direct disturbance. A preference for fertile soils, usually occurring in the lowest parts of a landscape, renders Box Gum Woodland susceptible to potential indirect impacts such as erosion, sedimentation and weed invasion. The current condition of Box Gum Woodland in the Project Boundary is good. It occurs as islands of intact vegetation with very few weeds, surrounded by intact native vegetation that also has very few weeds.

The majority of Box Gum Woodland to be retained within the Project Boundary will be buffered from disturbance by stands of intact non-listed vegetation communities. Indirect impacts are not expected to penetrate deeply into to retained areas of vegetation (including unbuffered Box Gum Woodland) with the implementation of stringent mitigation measures to be implemented for the Project, such as access restrictions, progressive rehabilitation, monitoring and managing weed levels, diversion and treatment of runoff from disturbed areas and erecting and maintaining sediment fencing around retained vegetation. These measures are also expected to reduce potential cumulative impacts during the life of the mine. Mitigation measures are outlined further below.

Box Gum Woodland located within the Project Boundary was not considered a Groundwater Dependant Ecosystem (GDE) in the Project GWIA, precluding it from potential impacts associated with groundwater loss (s.4.8 of the EIA). Modelling was undertaken for land in the Project Boundary which focused on areas most susceptible to subsidence from highwall mining operations (i.e. pagodas and escarpments). The model used was conservative and assumed a worst case scenario. It concluded that the design and management commitments made in the subsidence impact assessment will result in less than 20 mm surface subsidence for all areas impacted by highwall mining (see **Section 4.1.1**).

Highwall mining is proposed to occur under approximately 23.59 ha of the remaining areas of Box Gum Woodland that will not be directly impacted by proposed open cut operations. The Project has employed comprehensive avoidance, mitigation and compensatory measures have been developed for the Project, including a comprehensive BOS, which are outlined in Chapters 5 and 6 of the EIA and Section 8.14.4 of the EA. These include the avoidance of removing approximately two-thirds of the area of Box Gum Woodland through mine design changes and commitments to compensate Project impacts through the Revised BOS (see **Section 4.13.2**). The Revised BOS will result in the permanent conservation of over 221.7 ha of Box Gum Woodland and Derived Native Grassland. Surrounding areas of the Ben Bullen State Forest and adjacent conservation areas will also continue to provide refuge habitat. In addition, Coalpac proposes to progressively rehabilitate mined areas back to forest and woodland.

The proposed mitigation and compensation measures will result in an overall net increase in the amount of native forest, woodland and grassland. Further details of mitigation and compensatory commitments for the Project are provided in Chapters 5 and 6 of the EIA will be included in a Biodiversity Management Plan (BMP) for the Project. As noted in Section 8.14.4 of the EA, the BMP will incorporate a number of management and mitigation measures to enhance current site practice, including:

- Implementing an enhanced Land Disturbance Protocol for the Project that sets out the process for the site Environmental Manager (or delegate) to sign off on the staged clearing activities that will be required for the Project;
- Installing nest boxes in mine rehabilitation for hollow dwelling fauna, including Squirrel Glider and impacted micro-bats;
- Incorporating habitat restoration techniques in mine rehabilitation for the Broad-headed Snake;
- Limiting the disturbance of vegetation to the minimum necessary for each stage of pre-stripping in advance of mining operations;
- Limits of clearing being delineated to avoid unnecessary vegetation and habitat removal;
- Implementation of a pre-clearing Protocol for all tree clearing to minimise impacts to resident fauna, which may need to be relocated to surrounding habitat prior to disturbance;
- Scheduling the clearing of vegetation to occur at times where it is possible to optimise seed collection, where practical;
- Collecting and propagating native seed for use in rehabilitation areas and other disturbed areas;
- Translocating habitat features such as large logs (including hollows) to rehabilitation areas where safe and practically feasible;
- Trialling and developing regeneration methodologies and strategies with a particular emphasis on Threatened species and species that are part of the Box Gum Woodland CEEC;
- Progressively rehabilitating mined areas and Project biodiversity offsets (see **Section 4.13.2**). This will include the re-establishment of Threatened flora species in rehabilitated vegetation communities at similar densities to those that currently occur within the Project Boundary;
- Implementation of a BOMP to provide specifications for the restoration and management of the Biodiversity Offset Areas for the Project;

- Implementation of an annual flora and fauna monitoring program for rehabilitation and Threatened species remaining within the Project Boundary to improve the understanding of impacts and assist with rehabilitation efforts;
- Outline management strategies and undertake effective control of weeds and feral animals;
- Implement appropriate vehicle driving polices including speed restrictions and signposting of known fauna crossing locations to minimise the risk to fauna species; and
- Provide linkages and or crossing zones between isolated vegetation remnant patches, where feasible.

4.13.6 Reference to Preliminary Environmental Assessment

Submission: SIG1

Some submissions make reference to incorrect impact areas on vegetation communities and threatened species habitat outlined in the Preliminary Environmental Assessment (PEA) for the Project. Since the PEA, the mine design has been amended to avoid approximately two-thirds of the occurrence of CEEC Box Gum Woodland and direct impacts to cliff lines through setbacks, etc. These changes are clearly outlined in the EA and associated EIA prepared by Cumberland Ecology.

4.13.7 Impacts to Lyrebird

Submissions: SIG1, SIG8 – SIG9, SIG18, SIG20, SIG24, Petition

Concern was expressed in a number of submissions regarding impacts of the Project on the Lyrebird. The presence of the Superb Lyrebird was acknowledged in the fauna list provided in Appendix B of the EIA. This species was not considered individually as it is not a threatened species listed by either the TSC Act or the EPBC Act.

The Project will remove habitat for these species; however large areas of habitat will be retained in the Project Boundary and exist in other adjacent areas of Ben Bullen State Forest to the east of areas of potential mining impacts. The Project is not expected to fragment habitat or isolate the species as accessible habitat will remain east of the Project Disturbance Boundary in Ben Bullen State Forest.

The avoidance, mitigation and compensation measures proposed for listed threatened species that occupy similar habitat, particularly those that occupy the pagodas and lower forests (i.e. Broad-headed Snake and Brush-tailed Rock Wallaby) will also benefit other, non-listed species such as the Superb Lyrebird.

4.13.8 Edge Effects not Calculated

Submission: R6

One submission noted that the indirect impacts of vegetation disturbance for the Project created by edge effects were not calculated.

The impacts of edge effects were not quantified in the EIA, as these are by nature highly variable and problematic to accurately calculate. The EIA has discussed the likely impacts of edge effects and has estimated the degree of impact. Edge effects are likely to be highly localised to the areas surrounding the Project Disturbance Boundary and noise, light and dust levels are expected to reduce relatively rapidly with increasing distance from the area of direct disturbance. Edge effects are not expected to penetrate deep into retained vegetation as the majority of these communities occur on infertile soils and located upslope of operations (except Box Gum Woodland), eliminating potential impacts from runoff and sedimentation from mining areas.

All retained native vegetation including Box Gum Woodland will receive measures such as monitoring and controlling weed levels, diverting water from disturbed sites into water treatment basins, erecting and maintaining sediment fencing around vegetation will be implemented to reduce edge effects. These measures will also be prescribed in the BMP. Native species of fauna are expected to become accustomed to elevated levels of noise and light in their environment and these indirect impacts are not expected to be significant.

4.13.9 Potential Ecological Impacts to Pagodas from Highwall Mining

Submissions: R6, SIG1, SIG3 – SIG4, SIG18, Petition

As outlined in the EIA, highwall mining is a low subsidence mining method that relies upon the stability of the overlying strata to avoid subsidence. Stability and surface subsidence impacts from the highwall mining component of the Project are estimated to be less than 20 mm (Geonet 2011) and would therefore be minimal. It is widely accepted that subsidence of less than 20 mm will have negligible effect on surface vegetation. The monitoring and management of subsidence impacts for Project highwall mining operations is outlined in **Section 4.1** of this RTS and it is considered that restricting surface subsidence impacts to less than 20 mm will ensure minimal impacts to vegetation communities and habitat for individual flora and fauna species.

4.13.10 Failure to refer EPBC Act Listed Species

Submission: SIG8

Two submissions cited concerns of the failure to properly refer an EPBC Act species, the Clandulla Geebung, that was found within the Project Boundary.

The Project was referred early in recognition of a Controlled Action. At the time of referral, the Clandulla Geebung was not known in the Project Boundary.

The Project EPBC Referral (SEWPaC Reference: 2010/5776) acknowledged that other species including the Clandulla Geebung had potential to occur. Subsequently, when the species was found, detailed surveys were conducted and the population was mapped to estimate its area of occupancy and number of individuals present. Once this information was known, Coalpac held discussions with representatives of SEWPaC to inform the Department that the species was recorded in the Project Boundary and outline the likely nature of impacts under the revised mine plan for the Project.

The EIA concluded, through undertaking an Assessment of Significance, that the removal of 3.09 ha of Clandulla Geebung habitat would not impose a significant impact on the species. The EIA also concluded that the Project would provide a net gain by a combination of avoidance, mitigation and compensation. This would be achieved by staged clearing and progressive rehabilitation of disturbed habitat and avoidance of approximately 9 ha of habitat. As noted in Table 7 of the EA, the Project mine plan was also modified to avoid an area of 4.5 ha where Coalpac the Clandulla Geebung occurred, which resulted in a further reduction in the Project coal resource.

It is important to note that another 33.58 ha of habitat occurs outside the Project Boundary within Ben Bullen State Forest. The Revised BOS proposed for the Project will also conserve 86 ha of intact habitat for this species in the Hillcroft offset property. As noted in Section 8.15.4 of the EA, preliminary survey results indicate that this habitat area would contain approximately 76,676 individuals of the Clandulla Geebung.

4.13.11 Inadequate flora surveys and missed plants in the Project Boundary

Submissions: SIG1, SIG3, SIG6, SIG8 – SIG9, SIG13, Petition

Some submissions make mention of a number of flora species (including Rare or Threatened Australian Plants (ROTAP)) that were not identified during surveys of the Project Boundary during the EIA. A large survey effort has been undertaken to census the plant diversity present in the Project Boundary. The surveys span over two years and were conducted throughout different seasons (refer to s.2 of the EIA).

The Project's flora survey effort provided in Table 2.1 of the EIA has been reproduced below in **Table 17**. The survey process was aimed at increasing detection rates during known flowering periods and other active life stages of flora species that were predicted to occur on the basis of habitat assessment of the Project Boundary and desktop assessments including database searches of NSW Atlas of Wildlife and SEWPaC Protected Matters Search Tool as well as reviews of scientific literature describing threatened species habitat. While all efforts have been made to detect plant species during Project surveys, it is almost impossible to record every species. Cumberland Ecology welcomes the additional plant species provided in submissions and makes further note of the high species richness of the area.

Table 17
EIA Flora Survey Effort

Survey Technique	Dates	Effort
Vegetation Mapping	21-25 September 2009 19-23 October 2009 28 January 2010 2-3 February 2010 14-19 October 2010 12-16 September 2011 11-12 October 2011 and throughout flora survey period	Minimum 24 days, with at least two people present throughout entire survey period.
Quadrat sampling	21-25 September 2009 19-23 October 2009 28 January 2010 2-3 February 2010 14-19 October 2010 12-16 September 2011	44 quadrats
Random meanders	Throughout flora survey period during vegetation mapping, quadrat sampling and threatened species searches.	Throughout survey period
Threatened flora searches and population estimates	Surveys undertaken concurrently with vegetation community mapping, random meanders and quadrat sampling with counts and additional searches undertaken on 20 April 2011 6 and 12 May 2011 16 and 22 June 2011 12-16 September 2011	Minimum 16 days for 2 people targeted surveys and throughout survey period
	11-12 October 2011 3 - 6 November 2011	

It is important to note that none of the additional species recorded were listed under the EPBC Act or TSC Act. Some of the additional species provided in submissions are classified as ROTAP; although these have no legal status unless otherwise listed as threatened under the EPBC Act or TSC Act.

A total of 478 flora species have been recorded in the Project Boundary. These are tabulated in Appendix A of the EIA. The additional four ROTAP species, *Acacia asparagoides, Leinema lamprophyllum ssp. orbiculare, Leucochrysum graminifolium* and *Philotheca obovalis* that were recorded by other individuals and noted in submissions occur in habitats described as sandstone plateaus in heath and open forest, montane rocky heath, rocky cliff line habitat and rocky pagodas and rock shelves.

The majority of the habitats described above will not be directly impacted due to avoidance of these areas during open cut operations and will therefore be retained in the Project Boundary. Table B.2 of **Appendix F** outlines the area of habitat to be retained in the Project Boundary.

4.13.12 Re-appraisal of Targeted Threatened Flora Species

Submission: R6

Clarification has been sought through one submission from OEH for reasons why some threatened flora species apparently targeted during surveys undertaken for the Project EA (adequacy version) were seen to be removed from the list of targeted species following further surveys of the Exhibited EA.

No species have been excluded from Project surveys. Since the EA submitted to relevant regulatory agencies for adequacy review, further literature review, desktop assessment and increased survey effort was conducted for threatened flora species known to occur within the Lithgow LGA. As a result, the likelihood of occurrence of some threatened species was re-appraised, and some with potential to occur have been relegated from having "potential to occur" to "low likelihood" of occurrence. These re-classifications did not exclude them from consideration in the EIA. These re-classifications were a result of further assessments concluding a low suitability of habitat following additional surveys and habitat assessment undertaken by Cumberland Ecology (e.g. improved grasslands and heavily grazed grasslands are less suitable for species such as *Thesium australe*). Other examples include species that were found to be confined to one location up to 30 km away or only occurring in small discrete populations in the Lithgow LGA. Moreover, no additional threatened plant species were found during these additional surveys.

Even though some species were considered to have a lower likelihood of occurrence in the EA as exhibited and were consequently not specifically targeted, it is incorrect to presume that they were therefore excluded from surveys or consideration in the EIA. Any plant species found during targeted searches, random meanders, vegetation mapping or quadrat sampling for the EIA that was unidentified or shared the same genera as threatened species known to occur in the Lithgow LGA were collected for later identification by the Royal Botanic Gardens Sydney.

4.13.13 Offsets are not "like-for-like"

Submissions: R10, SIG3, SIG6, SIG8

A number of submissions raised concern that the offset properties proposed under the exhibited BOS did not represent "like for like" with those areas proposed to be disturbed for the Project.

Some of the proposed offsets, mainly Yarran View, do not contain the exact same composition of flora species, geology and topography as the area within the Project Disturbance Boundary.

Yarran View focuses on compensating for the loss of CEEC Box Gum Woodland and Derived Native Grassland due to the Project at a ratio of 12:1. The Yarran View property also provides habitat for a number of impacted threatened species recorded within the locality (5 km radius) of the property (see Chapter 6 of the EIA and **Appendix E**). In addition, the Box Gum Woodland and Derived Native Grassland provides suitable habitat for the Swift Parrot and Regent Honeyeater, which were not found in the Project Boundary.

The Hillcroft property occupies land that transitions from tablelands to western slopes, in common with the western portions of the Project Boundary. This property also contains large areas of known habitat for impacted flora as well as vegetation that can be restored to provide habitat for impacted flora species.

The remaining properties (Hillcroft, Hillview/Billabong, Hyrock Hartley and now Gulf Mountain) all contain similar vegetation types and fauna habitats to those within the Project Disturbance Boundary. Hillview/Billabong is located adjacent to the Project Boundary and shares the same vegetation communities including Capertee Rough-barked Apple – Red Gum – Yellow Box Woodland (CEEC Box Gum Woodland) and Tableland Slopes Brittle Gum – Broad-leaved Peppermint Grassy Forest.

Hyrock Hartley (and now the Gulf Mountain property as included the Revised BOS) share similar positions in the landscape (i.e. tablelands country with dry forest and woodland on slopes, rocky escarpments with heath and sheltered gullies). Although the composition of plant species is not identical, many of the tree species and understorey structure in the Project Disturbance Boundary also occur in these offset properties. More detailed surveys will be undertaken during the preparation of the BOMP (as described in Section 8.14.4 of the EA) and will likely expand upon the species richness of these areas.

The Revised BOS contain extensive areas of intact forest and woodland which provide habitat for a wide range of the threatened flora and fauna and migratory fauna species that are predicted to be impacted by the Project. The Revised BOS is therefore considered to be highly suitable for offsetting impacts to these species.

The offset properties proposed in the Revised BOS (see **Section 4.13.2**) feature over 2,353 ha of shrubland and heath, forest, woodland and swamp habitat, which are the most abundant habitat types in the Project Boundary (excluding swamp habitat) and typical of the Tablelands. Within the offset properties the forested ridgelines, slopes, gullies and permanent and ephemeral creeks support relatively mature, intact vegetation comprising a mix of species trees, understorey shrubs and grasses and abundant fallen timber and debris.

Particular habitat values that are present in offset properties or are likely to be present in proposed offset properties include:

- Ground cover, leaf litter, fallen timber and rocky outcrops and escarpments;
- Permanent and ephemeral creeks and drainage lines;
- Understorey vegetation;

- Tree hollows and dead stags; and
- Blossom-producing and feed trees.

Based upon the information derived from database analysis, site inspections and habitat assessment, the proposed offset properties are predicted to support all of the fauna species that are known or likely to occur in the Project Disturbance Boundary.

This assessment is presented in Chapter 6 of the EIA and **Appendix F**, and indicates that the offset properties provide habitat for threatened species including reptiles, small arboreal and ground-dwelling fauna microchiropteran bats and birds such as the Broad-headed Snake (*Hoplocephalus bungaroides*), Squirrel Glider (*Petaurus norfolcensis*), Spotted-tail Quoll (*Dasyurus maculatus maculatus*), Eastern False Pipistrelle (*Falsistrellus tasmaniensis*), Eastern Freetail-bat (*Mormopterus norfolkensis*), Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*), Large-eared Pied bat (*Chalinobus dwyeri*), Speckled Warbler (*Pyrrholaemus saggitatus*), Diamond Firetail (*Stagonopleura guttata*), Satin Fly Catcher (*Myiagra cyanoleuca*), Grey-crowned Babbler (*Pomatostomus temporalis temporalis*), Hooded Robin (*Melanodryas cucullata*), Scarlet Robin (*Petroica boodang*), Varied Sittella (*Daphoenositta chrysoptera*), Brown Treecreeper (*Climacteris picumnus*) and Gang Gang Cockatoo (*Callocephalon fimbriatum*). The offset properties are also able to provide foraging habitat for the Regent Honeyeater (*Anthochaera phrygia*), Swift Parrot (*Lathamus discolor*), both of which are EPBC Act listed species. The threatened flora species *Eucalyptus cannonii* and *Persoonia marginata* have also been recorded in remnant forest and woodland within the offset properties.

Several threatened species including large raptors such as the Powerful Owl (*Ninox strenua*), Barking Owl (*Ninox connivens*) and Square-tailed Kite (*Lophoictina isura*) are known to prefer nesting and roosting along permanent creek lines and sheltered gullies. As shown in **Appendix F**, some areas within the proposed offset properties are likely to provide habitat for these species.

4.13.14 Offset security Mechanism and Management

Submissions: R6, SIG4, SIG6, SIG8, SIG12, Petition

A number of concerns were raised on the long term security of the Biodiversity Offset Properties.

The offsets will be permanently conserved via a Voluntary Conservation Agreement (VCA), or other suitable arrangement to protect flora and fauna values in the long term.

4.13.15 Offset Management

The BOMP for the Project will be prepared as part of the Revised BOS to prescribe ongoing management actions for the proposed offset properties. This is a key component of the BOS to ensure that the biodiversity values of the Project's offsets can be maintained and improved.

The BOMP will explain the key management approaches and expected gains of offsets and prescribe a suite of measures that will be implemented. The document will contain a description and plan of conservation measures (long and short term), including measures to protect local biodiversity values and address specific values of significance such as the occurrence of threatened species.

The BOMP will also include details of appropriate areas for rehabilitation and conservation, details of revegetation priorities and techniques, reference sites, monitoring methodology and key performance indicators against which to measure progress, and specify appropriate periods where progress will be reviewed and the BOMP updated as required.

The key objective of the BOMP will be to improve and maintain the condition of existing vegetation and threatened species habitat so that a gain in biodiversity value can be achieved. This includes the following specific aims:

- Maintenance and improvement of the condition of existing forest and woodland within all offset properties, specifically to improve conditions for threatened flora and fauna;
- Maintenance and improvement of derived native grassland areas to promote, through management of grazing pressure, natural succession towards woodland and or open forest;
- Rehabilitation of selected areas of low diversity native grassland by replanting trees and shrubs including Capertee Stringybark to promote a more rapid regeneration towards forest or woodland; and
- Improvement of habitat connectivity across offset lands, and from offset properties to adjacent native vegetation and mine rehabilitation in order to improve wildlife movement in the long term.

The BOMP will also be designed in accordance with the latest offset management guidelines made available by OEH and SEWPaC. As such, the BOMP will include:

- A description of the threatened species and habitats within the Project offsets;
- An assessment of the general condition and extent of the offset areas and the identification of the key threats and risks;
- An assessment of the capacity of the offsite properties for natural regeneration from soil seed banks and adjacent seed sources;
- A prescription of the most appropriate measures to restore forest, woodland and riparian forest;
- A prescription of an appropriate monitoring program like that described in EIA and any adaptive management strategies;

- Details of appropriate timeframes and achievable completion criteria to allow Coalpac to effectively plan, cost, measure and monitor the progress of the management works; and
- Details of the auditing and reporting arrangements for the BOMP.

Coalpac will also engage a dedicated Biodiversity Offset Manager to fulfil the majority of the management requirements in the BOMP for both existing Compensatory Habitat Areas and the properties proposed under the Revised BOS. This will include the management and preservation of the existing vegetation and regeneration of habitat through the following activities:

- Fencing to exclude stock and restrict public access;
- Restrict public access and reduce habitat modification (i.e. bush rock removal, collection of fallen logs and hunting);
- Work with surrounding landholders to facilitate a joint approach to local land management issues (e.g. stock and feral animal controls, fencing and other boundary infrastructure);
- Restoration of habitat through seeding and plantings;
- Maintenance of tracks and trails and minimisation of erosion;
- Weed management; and
- Pest management such as foxes, goats and pigs.

Wherever practical, Coalpac will also liaise with traditional owners of the land and encourage involvement in restoration practices on a fee-for-service basis. Resources will be provided for the Biodiversity Offset Manager to be accommodated (from time to time for seasonal work programs) on properties that have existing housing, in order to facilitate the management of the property and to liaise with neighbouring landholders on a regular basis.

All restoration works will be conducted generally in accordance with any restoration and biodiversity enhancement guidelines that may be made available by DP&I and OEH.

4.13.16 Coalpac Rehabilitation Success

Submissions: R11, SIG3, SIG6, SIG8, SIG22

Several submissions convey concerns on the irreversible impacts of mining and unlikely success of rehabilitation of mined land and offsets.

The Australian mining industry is well aligned to the global pursuit of sustainable development. A commitment to leading practice sustainable development is critical for a mining company to gain and maintain its “social license to operate” in the community. The success of rehabilitation not only includes species composition, but also a multitude of ecological processes and properties.

Significant resources continue to be allocated to research and development of best practice mine rehabilitation and successful mine closure (see case studies provided below).

Effective mine rehabilitation performance in existing Invincible Colliery and Cullen Valley Mine operations further confirms that Coalpac is committed to reducing open cut mining impacts through the successful rehabilitation of ecosystem function. A recent assessment of the soil profiles within existing rehabilitation areas shows that the majority of soil has distinctive horizons consisting of an organic rich 'A' horizon above a clay rich 'B' horizon, indicating that correct soil handling procedures have been followed (EcoBiological 2012). Coalpac currently returns stripped topsoil immediately onto earth bunds or onto rehabilitated areas following re-contouring and the construction of erosion and sediment control structures (direct return technique). The presence of a Mycorrhizal fungus, the Horse Dung Fungus (*Pisolithus tinctorius)* and invertebrates (Ant species such as *Camponotus sp* and *Mymercia sp*.) was observed on several occasions in the rehabilitation assessment (EcoBiological 2012). Evidence of biological indicators naturally occurring within the more mature rehabilitation areas suggests that rehabilitation areas are re-colonising (see **Plate 15** from Ecobiological (2012)).

As outlined in the EIA and Sections 8.14 and 8.15 of the EA, the BOMP will contain details of the proposed management measures that will be implemented in the offset properties, including phased reduction of livestock management and the management of weeds to assist natural regeneration of native pastures and derived native grasslands, as well as shrub and tree planting and direct seeding of groundcover species in more modified areas. The BOMP will identify site specific issues; formulate scope of works and indicator performance criteria; prepare a series of site specific management actions, such as fencing; and prepare a set of implementation timeframes and key milestones.

As per the commitment in Section 8.24.8 of the EA, Coalpac will also develop a consolidated RLMP for the Project. This RLMP document will include provision for the monitoring of rehabilitated lands on a regular basis to ensure that rehabilitation objectives and targets are being met and that sustainable revegetation and landform sustainability is achieved in the long term. Rehabilitation monitoring will include regular inspections of rehabilitated areas to assess:

- Structural stability;
- The effectiveness of erosion and sediment control measures;
- Vegetation species development and revegetation success, including the establishment of Box Gum Woodland understorey, Capertee Stringybark individuals and fauna habitat; and
- The effectiveness of weed and pest management measures.

Maintenance works in existing and Project rehabilitation areas will be completed as required to address any issues of concern identified during monitoring reviews. Maintenance activities may include a range of management responses, including:

- Supplementary seeding of vegetated areas;
- Weed and pest control;
- The application of suitable fertiliser to selected areas;
- De-silting or repairing drainage structures and sedimentation dams; and
- The infill and regrading of any eroded areas.

Coalpac will undertake ongoing rehabilitation maintenance works as required. The results of rehabilitation and landform monitoring and the effectiveness of any maintenance activities required for the Project will be assessed against the RLMP for use in the continual refinement of rehabilitation techniques and reported against in the Annual Review.

Plate 15
Grey Fantail Nest in Existing Rehabilitation Area