

Environmental Assessment

Volume 1

Main Report

Proposed Modification to DA 376-8-2003 under
Section 75W of Part 3A of the EP&A Act 1979

Blakefield North Underground Mine Project



Bulga Coal Management Pty Ltd



GSS ENVIRONMENTAL

November 2012

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coal

Submission of Environmental Assessment

Prepared under Section 75W of the *Environmental Planning and Assessment Act 1979*

EA Prepared by:

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Development Application:

Applicant Name:	Bulga Coal Management Pty Ltd (as operator of Blakefield North Underground Mine)
Applicant Address:	744 Broke Road Singleton 2330
Land to be developed:	See Appendix 2
Proposed Development:	Modification to development consent DA 376-8-2003 to enable: • Realigned longwall layout, including expansion of the longwall extraction width up to the previously approved 400 metres; • Increased pre- and post-mining gas drainage and associated infrastructure above the longwall panels; • Construction of a gas drainage plant at the top of the Whybrow open cut highwall, including goaf vacuum plant, gas compressors, workshop, offices, hardstand areas, buried pipelines and associated infrastructure. Five goaf extraction unit flares and five pre-mining gas drainage flares (Blakefield South Underground Mine flares) are to be relocated to this proposed gas drainage plant; • Modified mine ventilation, including relocation of the two ventilation fans to the base of the open cut highwall; • Changed coal clearance infrastructure for the clearance of coal during development, by the trucking of coal through the open cut to the existing Blakefield South ROM stockpile; • The construction of a small-scale power generation plant (up to 32MW), and associated pipeline and ancillary infrastructure, to manage the increased methane production from gas drainage included within this modification proposal. This includes five new gas flares; and • Ongoing exploration activities at the Bulga Underground Operations (BUO) during the life of the Blakefield North Underground Mine.

Certificate:

We certify that we have prepared the contents of this Statement and to the best of our knowledge:

- The statement contains all available information that is relevant to the Environmental Assessment of the development to which the Statement relates; and
- The information contained in the Statement is neither false nor misleading.

Name:

**GSS Environmental
David Humphris**

**GSS Environmental
Jessica Elmes**

Signature:



Date:

21 November 2012

21 November 2012

Executive Summary

Purpose of the Assessment

The Bulga Underground Operations (BUO) is an underground coal mine located approximately 12 kilometres (km) south-west of Singleton, in the Upper Hunter Valley of New South Wales (NSW). The BUO form part of the Bulga Coal Complex (BCC), which is managed by Bulga Coal Management Pty Ltd (BCM) on behalf of Bulga Joint Venture (BJV). The BCC is composed of the BUO and the Bulga Surface Operations (BSO). Each operation is managed by a separate business unit but serviced by a common coal handling and preparation plant (CHPP) and rail loading facility.

On 23 February 2004, the NSW Department of Planning and Infrastructure (DP&I) granted development consent under Part 4 of the *Environmental Planning and Assessment Act, 1979* (EP&A Act) to the BUO pursuant to DA 376-8-2003. Consent was granted for mining in up to four seams (Whybrow, Blakefield, Glen Munro and Woodlands Hill seams). This consent has been modified on 4 occasions and represents the current operation. The BUO presently comprises the Blakefield South (BFS) Underground Mine (Blakefield seam). The Blakefield North (BFN) Underground Mine (Blakefield seam) is one of the approved but yet to be commenced underground mines.

This Environmental Assessment (EA) has been prepared to support an application by BCM, on behalf of the BUO, to further modify development consent DA 376-8-2003 under Section 75W of the EP&A Act. The proposed modification (the Project) relates to the approved BFN Underground Mine and includes the realignment of the approved longwall layout, increased gas drainage infrastructure, relocation of mine ventilation fans, changed coal clearance for development coal, the addition of a small scale power plant (up to 32 MW) and associated surface infrastructure. It is also proposed to regularise the current number of full time employees (530 personnel).

A briefing letter and a Preliminary Environmental Assessment (PEA) were provided to the DP&I on 26 September 2011 outlining the Project. DP&I subsequently responded in a letter dated 7 October 2011 stating that Director General's Requirements would not be issued as the PEA adequately identifies the likely environmental impacts associated with the Project. The DP&I also confirmed that Section 75W was the appropriate means of assessing the proposal. Following release of the DP&I's *Agricultural Impact Statement Guidelines* in March 2012, the DP&I issued supplementary DGR's on 30 April 2012 requiring the preparation of an Agricultural Impact Statement.

This EA assesses the matters relevant to the Project and seeks to demonstrate that the proposed modification has limited environmental consequences beyond those already approved in the development consent to DA 376-8-2003 (as modified). The EA concludes that the Project will not significantly change the nature of the approved development.

The Approved Development

The BUO operates under development consent DA 376-8-2003 in accordance with the *Bulga Coal Continued Underground Operations Environmental Impact Statement* dated July 2003 (2003 EIS), for mining four seams (Whybrow, Blakefield, Glen Munro and Woodlands Hill) to be accessed from the adjacent BSO open cut mine workings. This consent provided for an annual production of the continued underground operations of up to 14 Mtpa until 2031. The consent also consolidated all of the previous BUO consents (which included the consents for the Beltana No.1 Underground Mine). The BUO currently produces around 7 Mt of thermal coal annually.

The 2003 EIS identified that methane would need to be drained from the mine workings in the Blakefield, Glen Munro and Woodlands Hill seams to maintain a safe working environment, using a combination of pre and post mining gas drainage techniques. The 2003 EIS identified that methane

would be drained from the coal seams and goaves via boreholes connected to gas drainage plants on the surface. The methane would be converted to carbon dioxide by combustion (flaring) unless a beneficial use could be found for the gas. The 2003 EIS also discussed feasibility studies regarding alternative options for utilising methane liberated during the mining process.

The consent to DA 376-8-2003 has been modified on 4 occasions as summarised below.

In April 2006 the consent was modified (MOD4-1-2006) (MOD No. 1) as follows:

- A change in the location of access to the Blakefield Seam (BFS Underground Mine);
- A change in access via a decline drift, rather than conventional main roadways; and
- A change to the approved coal clearance system for the Blakefield Seam (BFS Underground Mine).

In October 2006 the consent was modified (MOD113-9-2006) (MOD No. 2) as follows:

- Increased throughput of the coal handling and preparation plant from 15Mtpa to 20Mtpa; and
- Increased peak number of daily trains from 9 to 12.

In October 2007 the consent was modified (MOD19-3-2007) (MOD No. 3) as follows:

- A change in sequence and access to mining to bring forward the mining of the Blakefield seam (BFS Underground Mine);
- Minor realignment of BFS Underground Mine longwalls (including extension of some longwall blocks) resulting in an increase in total coal mined at the BUO from 198Mt to 212Mt;
- Changed ventilation infrastructure and increase gas drainage infrastructure; and
- Changed coal clearance system.

In July 2010 the consent was modified (MOD No. 4) under Section 75W of the EP&A Act) as follows:

- Installation and operation of 8 gas-fired reciprocating engine electrical generator units (with associated infrastructure) generating up to 25 MW of gas fired power generation from the methane capture by pre and post mine drainage of the approved BFS Underground Mine as well as the future Glen Munro and Woodlands Hill seams as mining progresses.
- Construction and operation of a pilot ventilation air methane abatement system; and
- Contemporising all noise-related conditions in the consent to reflect the current NSW Government policy, including incorporation of additional controls to better mitigate and manage noise emissions.

Similar to the above modifications to the BFS Underground Mine, a review of the approved BFN Underground Mine and BSO interactions (as well as an improved understanding of the gas drainage requirements) necessitate this further modification of the consent to DA 376-8-2003.

Proposed Modification

BCM is seeking to modify Development Consent DA 376-8-2003 pursuant to Section 75W of the *Environmental Planning and Assessment Act, 1979* (EP&A Act) to allow for the following:

- Realigned longwall layout, including expansion of the longwall extraction width up to the previously approved 400 metres;
- Increased pre- and post-mining gas drainage and drilling infrastructure above the longwall panels (similar to that employed in the BFS Underground Mine);
- Construction of a gas drainage plant at the top of the BSO Whybrow open cut highwall, including goaf vacuum plant, gas compressors, workshop, offices, hardstand areas, buried pipelines and associated infrastructure. Five goaf extraction unit flares and five pre-mining gas drainage flares (already approved) are to be relocated to this proposed gas drainage plant;
- Modified mine ventilation, including the relocation of the two currently approved ventilation fans to the base of the open cut highwall within a new access slot (*Note: The new access slot is to be created as part of a separate application known as the Western Extension Modification and does not form part of this Project*);
- Changed coal clearance infrastructure for the clearance of coal during development, by the trucking of coal through the open cut to the existing BFS ROM stockpile;
- The construction of a small-scale power generation plant (up to 32MW), and associated pipeline, pipeline maintenance facility and ancillary service infrastructure (including 5 new gas flares) to manage the increased methane production from gas drainage included within this modification proposal. Two scenarios of either a 32MW (Scenario 1) or 30MW (Scenario 2) power plant were modelled.
- Ongoing exploration activities at the BUO during the life of the BFN Underground Mine.

The BUO currently employs around 530 full time employees, with employment growth occurring organically from around 300 employees in 2006 to around 530 in 2010. This need for increased manning has primarily been driven by increased gas drainage requirements and the development of additional gateway headings when the underground mine access changed from the planned highwall entry to a drift. As DA 376-8-2003 only approves 300 employees at the BUO, the Project also seeks to regularise the current number of full time employees at the BUO.

The timing of the Project is to be in accordance with BCC Life of Mine (LOM) planning process. The proposal will use the same longwall mining methods, type of equipment and infrastructure already in use by BUO. No changes are proposed to the pit-top workshop areas, the Coal Handling Preparation Plant (CHPP), coal handling techniques (other than trucking of coal during development), approved operating hours, or mining methods currently in use at the mine. No extension or reduction to the life of the current development consent or change to the approved total coal mined at the BUO is proposed. The Project would also not require any additional tailings or coarse rejects storage.

Potential Impacts

This EA, which includes technical Appendices, documents the various studies that have been undertaken to examine potential impacts that may occur as a result of the Project. The key areas addressed in the EA were identified during a risk assessment conducted by GSSE and BCM in July 2010. The key areas that have been assessed in detail are listed below. The associated technical reports are listed in brackets:

- Air Quality and Greenhouse Gas (Todoroski Air Sciences, August 2012, *Air Quality and Greenhouse Gas Assessment*);
- Noise (Global Acoustics, November 2012, *Environmental Noise Assessment*);

- Visual Impact (Terras Landscape Architects, August 2012, *Visual Impact Assessment*);
- Subsidence (MSEC, August 2011, *Subsidence Predictions and Impact Assessment*);
- Ecology (Umwelt, November 2012, *Ecological Assessment*);
- Traffic (GHD, August 2012, *Traffic Impact Assessment*);
- Aboriginal Heritage (OzArk, November 2012, *Aboriginal Heritage Assessment*);
- Agricultural Impact (GSSE, August 2012, *Agricultural Impact Statement* – includes Addendum dated November 2012).

Other issues addressed in the EA by GSSE include groundwater; surface water; soil and land capability; post mining land use and closure; socio-economic and community; and waste.

Subsidence

The overall void widths of the longwalls assessed in the 2003 EIS were 275 metres (i.e. 265 metre wide longwalls plus the first workings). However, the 2003 EIS acknowledged that “*improvements in mining technology are likely to increase this width to approximately 350-400 metres in the next 10 years*”. As a result, development consent was sought and granted for the “*extraction of longwalls over a face width of between 150 metres and 400 metres*” (2003 EIS). The modified longwall layout proposes overall void widths of approximately 410 metres (i.e. 400 metre wide longwall face width plus the first workings) as per the current development consent approval. As a result, the number of longwalls proposed to be extracted in the Blakefield Seam has reduced from twelve to seven and are referred to in the Project as Blakefield North Longwalls 1 to 7 (BNLW1 to BNLW7). As the longwalls assessed in the 2003 EIS assumed overall void widths of 275 metres, an updated Subsidence Assessment has been prepared by MSEC. The predicted mine subsidence movements resulting from the extraction of the proposed modified longwalls have been determined using the Incremental Profile Method. The subsidence prediction model has been calibrated for multi-seam mining conditions using the available empirical data and using the results from a numerical analysis. The calibrated Incremental Profile Method was previously used to predict the mine subsidence movements for BSLW1 at the BFS Underground Mine and the observed movements, to date.

The maximum predicted tilts and curvatures for some locations in proposed BNLW1 to BNLW7, based on the modified layout, are greater than those provided in the 2003 EIS. This is because the predictions provided in the 2003 EIS were based on the longwalls in the Blakefield Seam being offset from those in the Whybrow Seam, which provided flatter subsidence profiles (i.e. smaller tilts and curvatures) than the proposed modified case, which includes some locations where the Blakefield Seam chain pillars are beneath the Whybrow Seam chain pillars.

Whilst the maximum predicted additional tilts and curvatures, based on the modified layout, are greater than those provided in the 2003 EIS, the predicted outcomes are similar to those previously observed as the result of the extraction of the overlying longwalls in the Whybrow Seam at the BFS and Beltana No. 1 Underground Mines. The potential impacts resulting from the extraction of the proposed BNLW1 to BNLW7, therefore, are expected to be similar to those previously observed resulting from the Whybrow Seam longwalls.

The study area of the Subsidence Assessment has been defined, as a minimum, as the surface area enclosed by a 26.5 degree angle of draw line from the limit of proposed mining and by the predicted 20 mm subsidence contour resulting from the extraction of the proposed longwalls. The features that are located outside the study area and could be sensitive to far-field movements, have also been included in the assessment. A number of natural features and items of surface infrastructure have been identified within or immediately adjacent to the study area, including Wollombi Brook and

alluvium, drainage lines, natural vegetation, vineyards, olive groves, grazing land, public and private roads, the Broke - Fordwich Private Irrigation Distribution pipeline, 11 kV and consumer power lines, an optical fibre cable, copper telecommunications cables, fences, farm dams, houses and rural structures, archaeological sites, heritage sites and survey control marks.

The Subsidence Assessment indicates that the levels of impact on the natural features and items of surface infrastructure can be managed by the implementation of suitable management strategies. BCM has developed management strategies for the natural features and surface infrastructure which have been directly mined beneath by previously extracted Whybrow Seam longwalls at the BFS and Beltana No. 1 Underground Mines and by BSLW1 at BFS. With the implementation of these management strategies, it is expected that there would be no long term adverse impacts on the natural features and surface infrastructure resulting from the extraction of the modified longwall layout.

Air Quality

An Air Quality Assessment was undertaken by Todoroski Air Sciences and considered the potential air quality impacts associated with particulate matter (suspended dust) and deposited dust (insoluble solids). The assessment also addressed emissions of carbon monoxide (CO), nitrogen dioxide (NO₂), hydrocarbons and odour to be generated from key sources proposed in the Project including the ventilation fans, the combustion and flaring of coal seam methane and the truck haulage of development coal.

Air Quality – Construction

The construction phase would be short and relatively small scale in nature. Construction impacts can therefore be effectively controlled through the dust management measures currently applied at the BCC.

Air Quality – Operation

The Project would not change the rate of coal extraction or any surface infrastructure for receiving and processing the coal. The only changes with potential for additional air quality impacts would occur from the use of trucks to transport development coal (which would occur until a new surface conveyor can be established) and the development of a small scale power generation plant (up to 32MW) and the flaring operations. The assessment found that the predicted additional air impacts arising from the Project would be negligible at the worst impacted receptor (217s – Russell). The change in impacts is unlikely to be detectable and the predictions show that levels would be below acceptable criteria at the privately owned receptors. The predicted maximum nose-response odour level that would be caused by the proposed ventilation fans would be 0.05 OU (odour units) and is below the odour detection threshold of 1 OU (and therefore below any applicable criteria).

Greenhouse Gas

A Greenhouse Gas (GHG) Assessment was undertaken by Todoroski Air Sciences and considered the potential increase in the generation of GHG emitted to the atmosphere due to activity associated with the Project. The Project aims to capture and flare (or beneficially use) most of the additional methane emitted from the mine workings. Two scenarios of either a 32MW (Scenario 1) or 30MW (Scenario 2) power plant were modelled. The operation of the flares and power station onsite would result in a reduction of GHG emissions through the destruction of methane which would otherwise be vented to the atmosphere.

The combined Scope 1 and Scope 2 emissions generated without the proposed flares and power station would result in significant fugitive methane emissions. However, the use of the proposed flares and power station would result in an approximate 78% reduction in the approved GHG emissions for the proposal.

There would be a decrease in the Scope 2 emissions based on the difference in the amount of electricity generated by the proposed onsite power station and the amount of additional electricity required by the proposal. While the Project would require approximately an additional 2000kW of electricity usage resulting from the additional surface infrastructure proposed (as compared with the approved development) this will be off-set by the proposed power station which would generate up to 32MW of electricity. The surplus electricity generated from the power station would be fed back into the grid, resulting in a net reduction in potential GHG emissions.

In 2010, the estimated GHG emissions for Australia were 543Mt CO₂-e (DCCEE, 2011b). In comparison, the net project benefit in terms of annual average GHG emissions (Scope 1 and 2) would be a reduction of 1.35 to 1.36Mt CO₂-e. Therefore, the Project results in a net annual reduction of GHG emissions equivalent to approximately 0.25% of the Australian GHG emissions in 2010.

Noise

An Environmental Noise Assessment was undertaken by Global Acoustics Pty Ltd. This assessment considered operational noise, construction noise, low frequency noise and potential sleep disturbance impact from the Project. Additionally, cumulative noise impact with BSO and neighbouring mines was considered, including the proposed Western Extension modification to the BSO.

Noise - Operation

Two operational noise scenarios were modelled, comprising the period 2012 to 2014 and the period 2015 to 2018 to reflect the change in implementation and quantity of infrastructure over this time. Predicted noise levels for the supplementary BFN infrastructure were combined with predicted noise levels from the BCC to assess the potential impacts and compared against the BCC noise criteria.

Results indicated there would be a minor 1 dB increase to BCC noise emissions due to proposed BFN infrastructure at receptors 217m and 217s (Russell). This increase does not result in an exceedance of development consent criteria and the temporary truck haulage of development coal would primarily be responsible for this increase. Although truck haulage of development coal was included in the evening and night scenarios (for which the increase is predicted), haulage is expected to be required approximately 12 hours per day (primarily during the day period when no increase in noise is predicted).

Noise – Construction

A series of construction scenarios were considered to assess worst-case construction impact. The four most exposed gas well locations were modelled to assess worst-case impact. Predicted construction noise levels for BFN were combined with predicted levels for the remainder of the BCC, in this case BSO, BUO and BFN (as developed at that stage) to assess potential cumulative impact from the complex as a whole.

Results indicated that operational noise criteria specified in the BUO Consent would be exceeded due to gas well compound construction and drilling works. Ten receptors are predicted to receive construction noise levels greater than or equal to LAeq, 15 minute 40 dB during the day period; the highest prediction being LAeq, 15 minute 53 dB. The highest prediction for the evening and night periods is LAeq, 15 minute 39 dB. Given the relatively short duration of drilling impact, and the restriction of gas well compound civil works and vertical gas well drilling to the day period, it is considered reasonable that a construction noise criterion of LAeq, 15 minute 53 dB is allowed for the Project during the day period, and LAeq, 15 minute 39 dB be allowed for the evening and night periods. It is recommended that community consultation be undertaken prior to commencement of critical gas well drill sites, and best practice management techniques be adopted, including use of acoustic barriers, selection of quietest available plant and placement of noise sources within the drilling compound as close to acoustic barriers as possible.

Noise – Low Frequency

Low frequency noise impacts were predicted using weighting scales which predict the ear's sensitivity to tones at high noise levels. There are 31 receptors where the C-weighted total minus the A-weighted total (C minus A result) due to operational noise would be greater than or equal to 15 dB. There are nineteen (19) receptors where the C minus A result due to construction noise would be greater than or equal to 15 dB. All these receptors would traditionally draw a 5 dB low frequency noise penalty in accordance with Industrial Noise Policy (INP) guidelines. However, comparison with the desirable low frequency noise limit shows all C-weighted predictions would be less than L_{Ceq,15} minute 60 dB. On this basis, operational low frequency noise is not considered likely to cause impact.

Noise – Sleep Disturbance

Operational noise sources are not considered likely to cause sleep disturbance impact due to the relatively constant noise emission level. Exceedance of the construction noise sleep disturbance criterion of up to 6 dB is predicted at three receptors (all on the Russell property and one unoccupied). This would be due to the drilling works associated with one SIS well (SIS1), which is located relatively close to this property. For the majority of drill sites, no exceedance of the sleep disturbance criterion would result.

Noise - Cumulative

The only other significant industrial noise source in the local area is the Mount Thorley Warkworth (MTW) mine located to the north of the BCC. The results of modelling of operational noise indicate the proposed BFN infrastructure would cause an increase to BCC noise emissions at only one property (217m and 217s – Russell). The environmental assessment for the recently approved MTW Extension undertaken in 2010 predicted that the worst-case noise level from the MTW complex is L_{Aeq}, 15 minute 34 dB. The worst-case noise level predicted for the BCC for the habitable Russell residence (217s) in this assessment is L_{Aeq}, 15 minute 36 dB. When combined, these levels total L_{Aeq}, 15 minute 38 dB. As this level is less than the most stringent cumulative noise criterion (night period) of L_{Aeq}, 9 hour 40 dB, no exceedance of cumulative noise criteria is predicted at Russell due to operational noise. As there is no predicted change to BCC operational noise emissions at all other receptors, it is highly unlikely that BFN infrastructure could combine with noise emissions from MTW to cause an increase to cumulative noise levels.

Predictions for construction noise during the day period are high at some receptor locations due to the relatively close proximity of the worst-case drill sites. Mining noise during the day period is generally low level, and the likelihood of mining noise combining with construction noise to cause an increase to received levels is considered very low. Night period drilling activities in the Bulga area have the potential to combine with MTW to increase total received noise levels. At the Russell property, the predicted worst-case L_{Aeq}, 15 minute from the MTW complex is 34 dB, and from the BCC, 36 and 34 dB for the evening and night periods respectively. Predictions for SIS drilling at the Russell residence (217s) are L_{Aeq}, 15 minute 27 and 33 dB for the evening and night periods respectively. The total predicted cumulative noise at Russell is then L_{Aeq}, 15 minute 38 dB for both the evening and night periods. As this level is less than the most stringent cumulative noise criterion (night period) of L_{Aeq}, 9 hour 40 dB, no exceedance of cumulative noise criteria is predicted at the Russell property due to construction noise.

Groundwater

Comprehensive groundwater assessment of mining in the Blakefield seam for the approved BFN Underground Mine was undertaken by Mackie Environmental Research (2003) for the 2003 EIS. This identified the pre-mining groundwater quality within the hard rock aquifer associated with the coal measures as typically poor, with electrical conductivity ranging from approximately 2000 microSiemens/cm (µS/cm) to over 10,000 µS/cm. Consistent with currently approved operations, it is

unlikely that any measurable improvement in groundwater quality would be observed in the coal measures as a result of the Project. Mackie Environmental Research (2003) identified that a minor improvement in the water quality of the deeper alluvial aquifer may occur during approved mining operations due to the reduced input of saline water from the hard rock aquifer. This trend is also relevant for the proposed modified mine layout and is likely to revert back to the current groundwater flow regime as the hard rock aquifer recovers from the cessation of mining. Generally the alluvial groundwater quality is predicted to remain unaffected.

The modified longwall layout for the BFN Underground Mine has been designed to ensure that there is an adequate buffer to protect the Wollombi Brook alluvials, consistent with the currently approved longwall layout. The 40 metre buffer zone for the limit of the alluvials lies outside the 20 millimetre predicted subsidence contour. The limit of alluvium is located 145 metres south-west of the Subsidence Area, at its closest point.

There are around 35 groundwater monitoring bores within and around the Project Area and a number of registered bores within the vicinity. These are generally located within the Wollombi alluvium and are located outside of the predicted 20mm subsidence line. As these bores are located within the alluvial aquifer it is considered very unlikely that they will exhibit any loss of yield due to the lack of a predicted impact. Should the groundwater supply to these bores be affected by mining within the BFN Underground Mine area, the existing current consent requires BCC to provide an alternative water supply until such time as a more permanent supply can be re-established.

Surface Water

No significant impacts on surface water resources as a result of the proposed modification are anticipated, provided the proposed management and mitigation measures are implemented as required.

Ecology

An Ecological Assessment was undertaken by Umwelt (Australia) which identified two Endangered Ecological Communities (EECs) and one Endangered Flora Population - listed on the Threatened Species Conservation Act (TSC Act), within the Project Area. No TSC Act listed threatened flora species were identified as present or considered likely to occur within the Project Area. Assessment of the potential impacts on the two EECs and one Endangered Flora Population found that none of them would be significantly impacted by the Project. No Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act) listed threatened ecological communities (TECs) or threatened flora species were considered likely to occur within the Project Area.

A total of 13 threatened fauna species were recorded within the Project Area and comprised five birds and eight mammals (all bat species). All 13 of the threatened species are listed as Vulnerable on the TSC Act and two are also listed as Vulnerable on the EPBC Act. Potential habitat was identified for a total of 24 threatened fauna species listed on the TSC Act and/or EPBC Act. Assessment of the potential impacts on the 24 threatened fauna species listed on the TSC Act and/or EPBC Act found that none of the species would be significantly impacted by the Project.

The Project would result in the clearing of around 34 hectares of land for surface infrastructure facilities, comprising:

- Up to 5.0 hectares of Central Hunter Box – Ironbark Woodland for pre and post-mining gas wells and access tracks;
- 22 hectares of Central Hunter Box – Ironbark Grassland for pre and post-mining gas wells, the proposed pipeline maintenance facility, proposed gas drainage plant, proposed power generation plant and access tracks;

- 0.54 hectare of Central Hunter Bulloak Forest Regeneration for pre and post-mining gas wells and access tracks;
- 0.38 hectare of Central Hunter Swamp Oak Forest for pre and post-mining gas wells and access tracks;
- 0.71 hectare of Riparian Grassland for pre and post-mining gas wells and associated access tracks;
- 0.34 hectare of Exotic Grassland for pre and post-mining gas wells and associated access tracks;
- 0.42 hectare of Olive Grove for pre and post-mining gas wells and access tracks;
- 0.5 hectare of Planted Areas for pre and post-mining gas wells and access tracks;
- 2.3 hectares of Disturbed land for the proposed gas drainage plant, ventilation fans, SIS drill pads, pre and post-mining gas wells and associated access tracks; and
- 1.9 hectares of Rehabilitation land for the proposed gas drainage plant.

The proposal would also result in the subsidence of around 709 hectares of land with the main component comprising:

- 103 hectares of Central Hunter Box - Ironbark Woodland (EEC);
- 0.15 hectare of Hunter Valley Weeping Myall Woodland (EEC);
- 465 hectares of Central Hunter Box – Ironbark Grassland; and
- 141 hectares of non-threatened vegetation communities, olive groves, vineyards, planted areas, disturbed areas, etc.

Due to removal of up to 5 hectares of Central Hunter Box – Ironbark Woodland (EEC), a biodiversity offset strategy would be developed in consultation with the NSW Office of Environment and Heritage (OEH) to offset this impact.

The Project Area was not found to contain any areas of 'potential koala habitat' as defined by *State Environmental Planning Policy No. 44 – Koala Habitat Protection* (SEPP 44) and no further assessment under SEPP 44 was required.

Assessment under the EPBC Act found that the proposal was unlikely to have a significant impact on any threatened ecological communities, threatened flora, threatened fauna or migratory species.

Mitigation measures to minimise the potential impacts of the proposal on the ecological values of the Project Area would be undertaken. This primarily involves ensuring the positioning of gas drainage wells and access tracks above the longwall panels avoids woodland areas where possible.

Aboriginal and Cultural Heritage

The archaeological values of the Project Area are well documented and addressed in previous studies. The overall BCC and the Project Area have been subject to numerous archaeological investigations (Koettig 1991, Heffernan and Klaver 1997, ERM 1999/2000, Umwelt 2001, Umwelt 2003, Umwelt 2007) resulting in recordings of a profusion of archaeological sites. Of these sites, the majority comprise open sites (consisting of stone artefact scatters) and isolated finds. A total of 371

registered Aboriginal sites are mapped in the vicinity of the BCC and around 48 fall within (and up to 300m from) the Project Area boundary. However, small portions of the Project Area are located in areas that have not been assessed as part of the approval process for the BUO. An Aboriginal Heritage Assessment was therefore undertaken by OzArk Environmental and Heritage Management which specifically targeted the unassessed land within the Project Area.

No new Aboriginal sites or objects were recorded during the assessment. However, the assessment allowed a better understanding of the spatial extent of several previously recorded sites and enabled the formulation of appropriate management recommendations for the mitigation of impact to Aboriginal cultural heritage places and/or objects.

The assessment recommended that the existing practices at the BCC encapsulated in the *Aboriginal Cultural Heritage Management Plan (ACHMP)* should be continued within the subsidence area of the BFN Underground Mine. The *ACHMP* provides a management strategy which considers each site on a case by case basis. Sites that would be impacted by subsidence remedial works or other mine related surface infrastructure (access roads, additional bore holes etc.) would be managed pursuant to the *ACHMP* at the time of the then known impacts.

Land Use, Soils and Agriculture

The Project would have minimal impacts on existing land uses, soils and land capability.

An Agricultural Impact Statement was undertaken by GSS Environmental which assessed the impacts of the Project on the agricultural resources of the locality and region. The Project Area would result in the disturbance (temporary removal from agriculture) of a relatively small area of 30.3ha (4.3% of the Project Area). This comprises 11.8ha of the Strategic Agricultural Land mapped in the *Strategic Regional Land Use Plan for the Upper Hunter* which represents 2.8% of the Strategic Agricultural Land in the Project Area.

The land affected by the Project Area equals 710ha. Of this, 30.3 ha (4.3%) of the Project Area would be temporarily removed from agriculture for access roads and gas drainage. This land would be returned to agricultural production upon completion of mining and rehabilitation as agricultural land capability Class VI.

The agricultural land within the Project Area is estimated to have a potential agricultural production value of up to approximately \$234 000 per year, with approximately \$62 650 per year potentially available from private land, the remainder in mine ownership. The Project would not impact upon the agricultural production of any private property and therefore no change is expected to the production value or employment in agriculture.

Potential impacts may arise from visual/landscape impacts and subsidence. Management and mitigation strategies are proposed which should ensure these potential impacts would not have a long term impact upon the agricultural or tourist related operations in the locality. No impacts are expected to groundwater systems and minor impacts to ephemeral drainage lines in the Project Area may occur due to subsidence. These impacts would be remediated where required to ensure the natural gradient along drainage lines is retained and downstream water users are not adversely impacted upon.

Visual Amenity

A Visual Impact Assessment was undertaken by Terras Landscape Architects which assessed the surface infrastructure components of the Project. Each surface infrastructure element was treated individually by providing: a location; an appraisal of its landscape setting; a description and/or illustration of the element including disturbances created during construction; an assessment of visual impact and recommendations for amelioration if warranted.

The ventilation fans and pipeline maintenance facility would not be seen externally by the community and would be sited in a severely degraded visual environment. These elements were deemed to have no visual impact.

The proposed gas drainage plant and power plant would produce only a low visual impact on their surroundings notwithstanding having the highest visibility arising from their proximity to Broke Road. The night-time glow created by the flares would have a minor impact and would generally not be discernible from the spill lighting emanating from other existing mining structures.

The proposed SIS well/drill pads and the new powerlines were found to have a minor impact during the construction phase due to siting and scale of development involved. The installation of the gas drainage structures and associated roads and services (primarily above the longwall panels) particularly where this occurs in open pastures to the west of Charlton Road, was assessed as producing a short-term loss of visual quality to the area for a period of around 9 years. Giving consideration to the siting of elements, the use of screens and landform and the establishment of screen planting along Charlton Road would all assist in minimising this visual impact.

The Visual Impact Assessment concluded that the proposed surface infrastructure produced a low to insignificant visual impact on the local visual environment either as individual elements or as a collective group in the long term, however, there would be a short term impact caused by the installation of gas drainage infrastructure west of Charlton Road. The assessment found that practices currently being undertaken by the mining company were found to be appropriate in addressing short-term and long-term disturbances to the visual environment. In addition, the assessment recommends additional screen planting of locally occurring native species in various locations along both Charlton and Broke Roads to augment existing screen planting and screen views of the gas drainage infrastructure and the power plant.

Traffic and Transport

An assessment of traffic impacts has been undertaken by GHD. The Project would generate traffic during construction and operation of the Project. Construction traffic would be the critical activity as operational activities are infrequent and essentially require few staff to operate. The critical period for the work is likely to be 2013 when the power plant, gas plant and gas drainage are proposed to be constructed. All these components would be jointly under construction for a period of approximately 6 months.

The traffic counts undertaken as part of the assessment show that the Broke Road/Golden Highway intersection currently operates at capacity (Level of Service E). Furthermore, this intersection would fail under background growth conditions, without the proposed development, by 2012.

The results of the traffic assessment show that the intersection of Broke Road with the Golden Highway would continue to exceed capacity for the duration of the 6 months of construction works through 2013. This will require the implementation of a Construction Traffic Management Plan. Following completion of the construction of surface infrastructure, the intersection would continue to operate at existing levels.

All other intersections impacted by the proposal would continue to operate at good level of service with spare capacity.

In terms of cumulative impacts, the proposed Warkworth Expansion Project to expand adjacent Mt Thorley and Warkworth mines would impact the Broke Road/Golden Highway intersection. Impacts from this project, if it proceeds, are expected in Year 4 of that project which could be in 2015 or 2016. This timing is beyond the critical period for the BFN modification and therefore impacts would not be cumulative.

Conclusion

Bulga Coal Management Pty Ltd, on behalf of the Bulga Underground Operations, seeks to modify Development Consent DA 376-8-2003 under Section 75W of Part 3A of the EP&A Act. The modification relates to the approved but not commenced Blakefield North Underground Mine. The Project includes the realignment of the approved longwall layout, increased gas drainage infrastructure, relocation of mine ventilation fans, changed coal clearance for development coal, regularisation of current employment numbers, the addition of a small scale power plant (up to 32 MW) and associated surface infrastructure.

The technical studies conclude that adverse environmental impacts would be either negligible or very minimal, with limited environmental consequences beyond those already approved. The Project Area therefore requires few new environmental controls and existing environmental management strategies would be applied to the Project.

The Project would capture and treat (or beneficially use) most of the additional, unexpected methane emitted from the mine workings. The proposed operation of the flares and power station onsite would result in a reduction of GHG emissions through the destruction of methane, as opposed to the approved venting to the atmosphere. The use of the proposed flares and power station would have the potential to generate an approximate 78% reduction in the approved GHG emissions for the Project. The power station would generate surplus electricity that would be fed back into the grid, resulting in a net reduction in potential GHG emissions.

Assessment under the EPBC Act found that the proposal was unlikely to have a significant impact on any threatened ecological communities, threatened flora, threatened fauna or migratory species. Due to removal of up to 5 hectares of Central Hunter Box – Ironbark Woodland (EEC), a biodiversity offset strategy would be developed in consultation with the NSW Office of Environment and Heritage (OEH) to offset this impact.

The timing of the Project would be in accordance with approved Life of Mine (LOM) planning. The Project would use the same longwall mining methods, type of equipment and infrastructure already in use by BUO. No changes are proposed to the pit-top workshop areas, the Coal Handling Preparation Plant (CHPP), coal handling techniques (other than truck haulage of coal during development), approved operating hours, or mining methods currently in use at the mine. No extension or reduction to the life of the current development consent is proposed and there would be no change to the approved total coal mined at the BUO. The Project would not require any additional tailings or coarse rejects storage.

Given the minor alterations to the mining operations mentioned above, a modification of development consent pursuant to Section 75W of the EP&A Act is appropriate with respect to the Project, as it will have limited environmental consequences beyond those originally approved in DA 376-8-2003.

The Project is considered to be consistent with relevant objectives of the EP&A Act, including the principles of Ecologically Sustainable Development. The proposed modification would not change the nature of the development originally approved. On considering the balance of environment and community impacts, it is considered reasonable to conclude that the benefits of the Project outweigh the impacts.

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1.0 INTRODUCTION

1.1 Purpose of This Document

This Environmental Assessment (EA) has been prepared to support an application by Bulga Coal Management Pty Ltd (BCM), on behalf of the Bulga Underground Operations (BUO), to modify Development Consent No. 376-8-2003 under Section 75W of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The BUO presently comprises the Blakefield South (BFS) Underground Mine (Blakefield seam) and the Blakefield North (BFN) Underground Mine (Blakefield Seam). Mining of the BUO Whybrow Seam mines (South Bulga Mine and Beltana No.1 Mine) has ceased and the portals have been sealed.

The proposed modification (the Project) relates to the approved but not commenced BFN Underground Mine. The Project includes the realignment of the approved longwall layout, increased gas drainage infrastructure, relocation of mine ventilation fans, changed coal clearance for development coal, the addition of a small scale power plant (up to 32 MW) and associated surface infrastructure. The Project Application is attached as **Appendix 1**.

This EA assesses the matters relevant to the Project and seeks to demonstrate that the proposed modification has limited environmental consequences beyond those already approved in Development Consent No. DA 376-8-2003, which is attached as **Appendix 2**. The EA concludes that the Project will not change the nature of the development originally approved.

1.2 The Applicant

The BUO is an underground coal mine located approximately 12 kilometres (km) south-west of Singleton, in the Upper Hunter Valley of New South Wales (NSW). The locality of the mine and the mining lease boundary are illustrated on **Figures 1 and 2**. The BFN Underground Mine (Blakefield Seam) is an approved but yet to be commenced mine that is the subject of this EA. An overview of existing mining operations in relation to the approved BFN Underground Mine is provided in **Figure 3**.

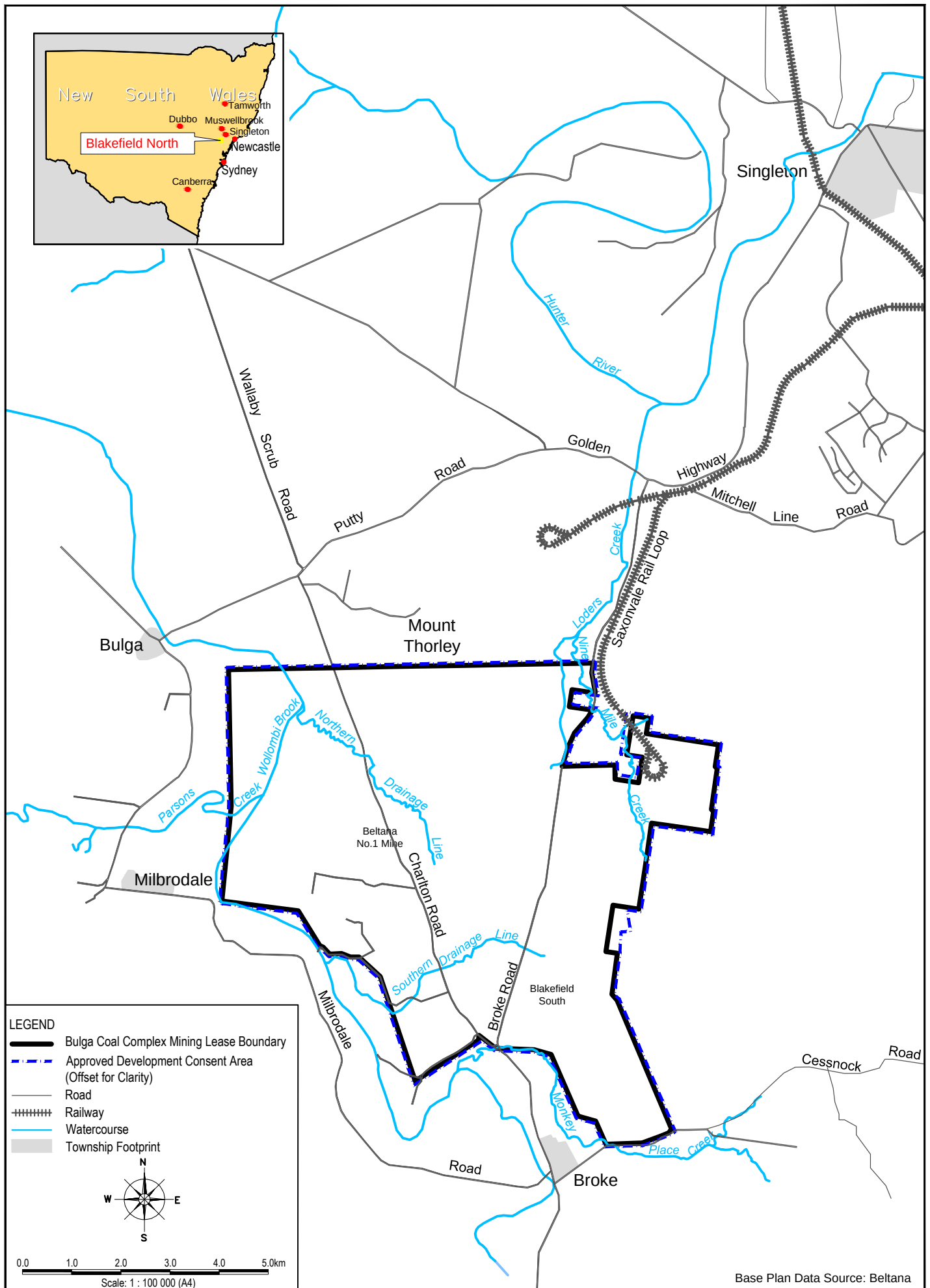
GSS Environmental (GSSE) has prepared this EA on behalf of BCM.

The BUO form part of the Bulga Coal Complex (BCC), which is managed by BCM on behalf of Bulga Joint Venture (BJV). The BCC is composed of the BUO and the Bulga Surface Operations (BSO). Each operation is managed by a separate business unit but serviced by a common coal handling and preparation plant (CHPP) and rail loading facility.

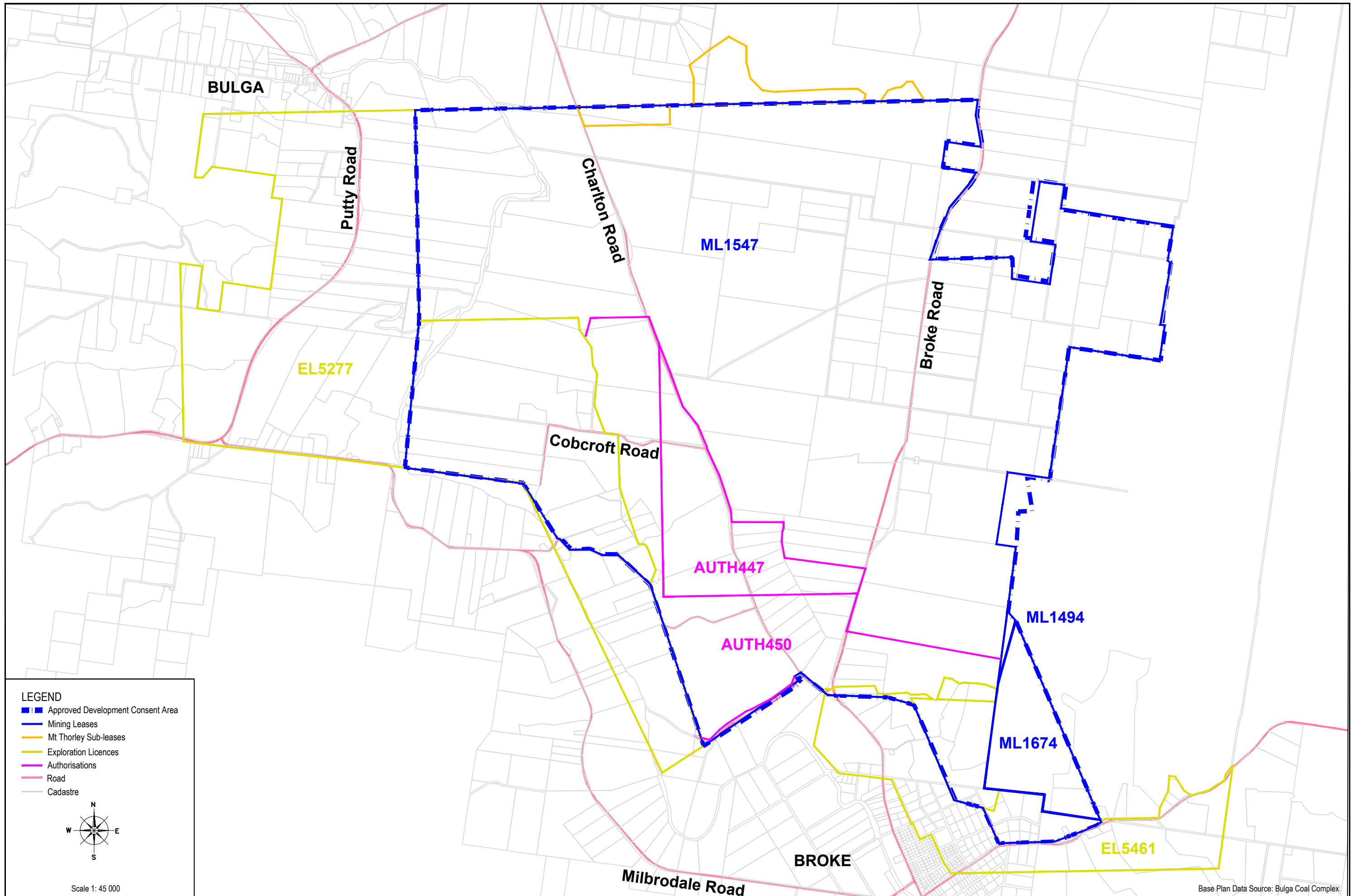
1.3 Overview of Proposed Modification

BCM is seeking to modify Development Consent DA 376-8-2003 under Section 75W of the EP&A Act to allow for the following:

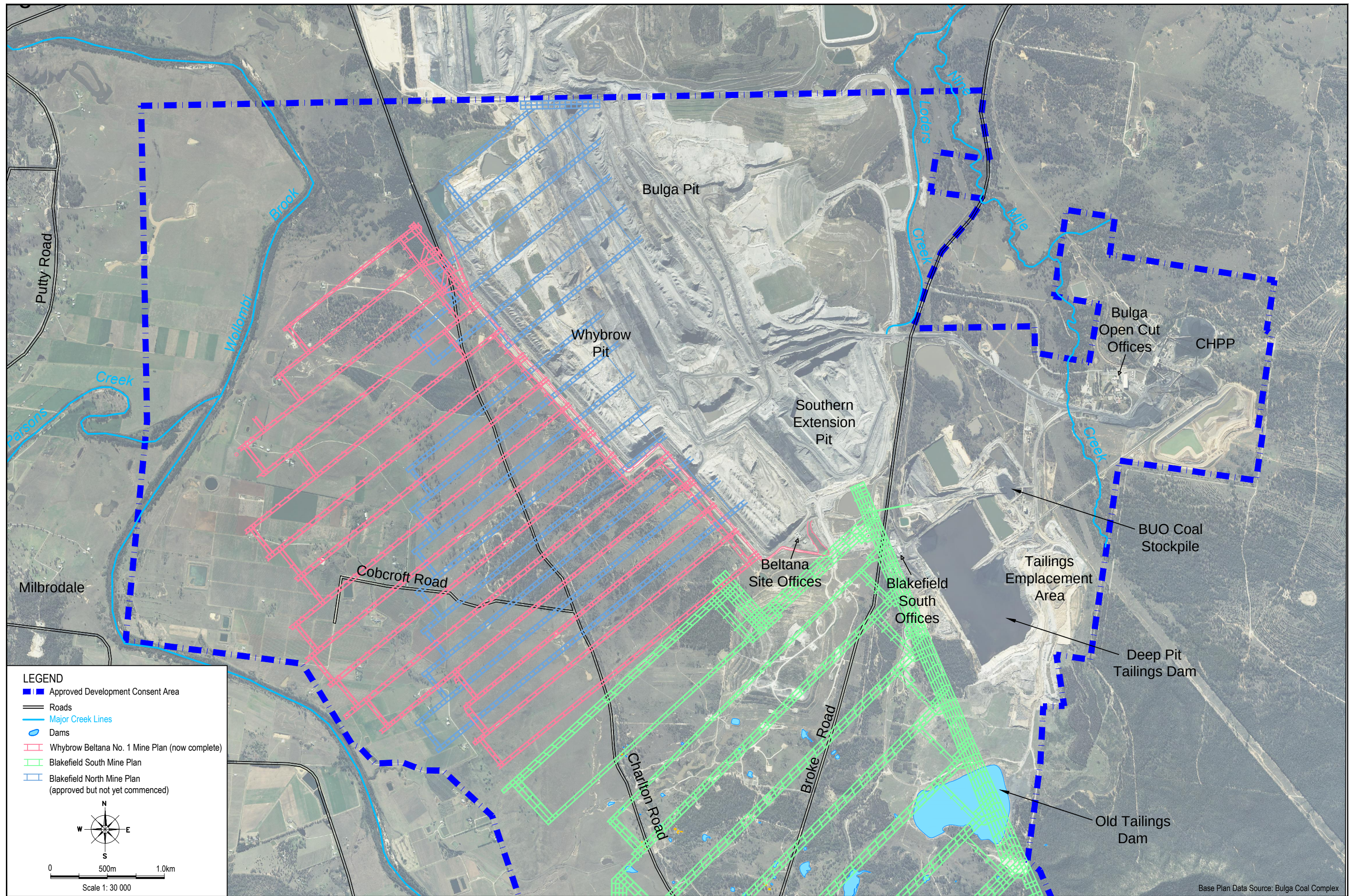
- Realigned longwall layout, including expansion of the longwall extraction width up to the previously approved 400 metres;
- Increased pre- and post-mining gas drainage infrastructure above the longwall panels (similar to that employed in the BFS Underground Mine);
- Construction of a gas drainage plant at the top of the BSO Whybrow open cut highwall, including goaf plant, gas compressors, workshop, offices, hardstand areas, buried pipelines and associated infrastructure. Five goaf extraction unit flares and five pre-mining gas drainage flares (already approved for the BFS Underground Mine) are to be relocated to this proposed gas drainage plant;



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- Modified mine ventilation, including the relocation of the two currently approved ventilation fans to the base of the open cut highwall within a new access slot (*Note: The new access slot is to be created as part of the Western Extension Modification – see **Section 1.4.2** and does not form part of this Project*);
- Changed coal clearance infrastructure for the clearance of coal during development, by the trucking of coal through the open cut to the existing BFS ROM stockpile;
- The construction of a small-scale power generation plant (up to 32MW), and associated pipeline, pipeline maintenance facility and ancillary service infrastructure, to manage the increased methane production from gas drainage included within this Project (two scenarios of either a 32MW (Scenario 1) or 30MW (Scenario 2) power plant were modelled). This includes 5 new gas flares, power lines and potentially additional switch yards and transformer; and
- Ongoing exploration activities at the BUO during the life of the BFN Underground Mine.

The BUO currently employs around 530 full time employees, with employment growth occurring organically from around 300 employees in 2006 to around 530 in 2010. This need for increased manning has primarily been driven by increased gas drainage requirements and the development of additional gateway headings when the underground mine access changed from the planned highwall entry to a drift. As DA 376-8-2003 only approves 300 employees at the BUO, the Project also seeks to regularise the current number of full time employees at the BUO.

These modifications are discussed in further detail in **Sections 3 to 8** and shown in **Figure 4**.

The timing of the Project is to be in accordance with BCC Life of Mine (LOM) planning process. The modified proposal will use the same longwall mining methods, type of equipment and infrastructure already in use by BUO. No changes are proposed to the pit-top workshop areas, the Coal Handling Preparation Plant (CHPP), coal handling techniques, approved operating hours, or mining methods currently in use at the mine. No extension or reduction to the life of the current development consent is proposed and there would be no change to the approved total coal mined at the BUO. The Project would not require any additional tailings or coarse rejects storage.

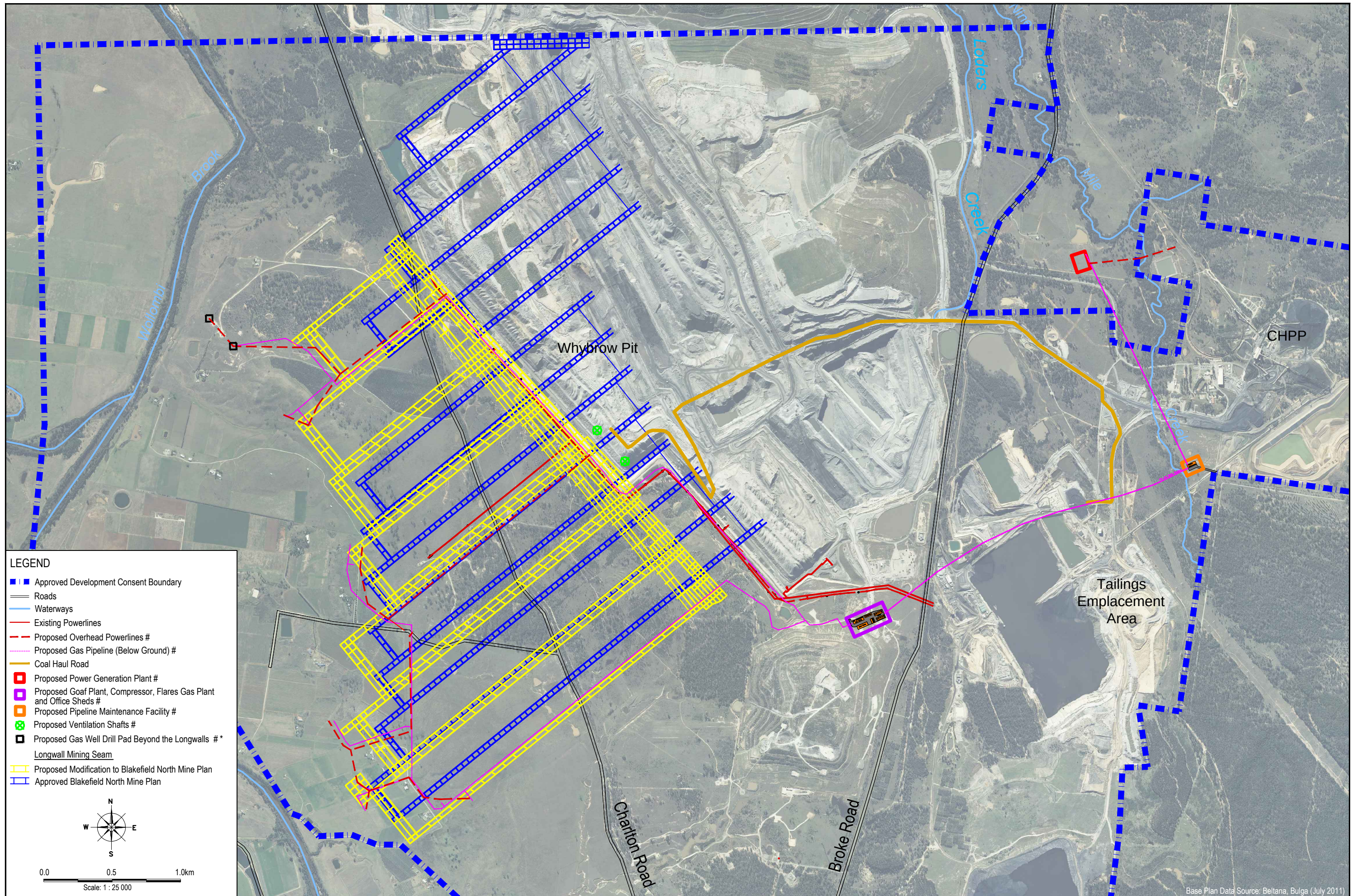
1.4 Other Projects at the Bulga Coal Complex

1.4.1 Overview

There are currently two projects being planned by the BSO which interrelate with the proposed modification to the BFN Underground Mine. These projects comprise the Bulga Coal Optimisation Project (BOP) and the Bulga Open Cut Western Extension Modification (Western Extension). Both these projects require approval under the provisions of the EP&A Act. The Bulga Open Cut Western Extension modification has recently been lodged with Department of Planning and Infrastructure (DP&I) with the BOP scheduled to be submitted later in 2012.

1.4.2 Western Extension Modification

The Western Extension modification aims to extend the existing open cut operations at the BCC and comprises a modification to the BSO development consent (DA 41-03-99). The key components of the Western Extension modification include the following:



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- To continue open cut mining in the Bulga Pit by extending the pit in a south west direction towards the existing Whybrow Pit void. Coal in the Bulga Pit will be extracted from the Redbank Creek, Wambo, Whynot, Blakefield, Glen Munro and Woodlands Hill seams. An additional 1 million tonnes (Mt) of resource will be recovered from these seams in the Bulga Pit. Extending the Bulga Pit will provide continuity of the mining and overburden emplacement process to maximise resource recovery and operating efficiency. Coal extraction will remain within the currently approved maximum rate of 12.2 million tonnes per annum (Mtpa).
- To allow additional overburden emplacement to the north of Bulga's North Blakefield Dump. Additional overburden emplacement will be undertaken on the boundary of the BSO Mining Lease and the Mt Thorley Operations Mining Lease. There is a land access agreement between BSO and Mt Thorley Operations to enable the emplacement of overburden on the Mt Thorley Operations Mining Lease.
- All activities will be undertaken on previously disturbed areas. Mining and overburden emplacement will be undertaken using a similar equipment fleet as is currently operating.

The proposed Western Extension modification is relevant to the BFN Underground Mine modification as it will include the creation of a new excavated slot in the Whybrow Pit. This slot access will provide access to the BFN Underground Mine. The Western Extension Modification was lodged with DP&I under Section 75W of the former Part 3A of the EP&A Act in July 2012.

1.4.3 Bulga Optimisation Project

The BOP aims to ensure the continuation of surface operations at the BCC until around 2035 and would enable current coal resources to be maximised largely within the existing mining footprint. The key components of the BOP include the following:

- A minimal increase in new mining areas, including deeper mining and the recovery of coal under Broke Road. There will be no increase in the approved mining capacity.
- A new noise and visual landscaped earth bund to enclose the open cut mine from the western and southern neighbours.
- Realignment of part of Charlton Road slightly further to the west of the open cut operations (but still to the east of Wollombi Brook). This is required to facilitate the proposed noise and visual bund.
- Realignment of part Broke Road to bypass the western edge of the CHPP. This is required to facilitate the recovery of coal under Broke Road.
- Relocation of the existing 330kV power lines to generally follow the new alignment of Broke Road.
- Establishment of an eastern overburden emplacement area away from residential areas to reduce the project's noise and dust impacts. This will be located to the north of the CHPP on the eastern side of the existing rail spur.
- The construction of new dams to store water to discharge to Loders Creek through the Hunter River Salinity Trading Scheme.
- The utilisation of the existing CHPP and rail spur.

The proposed BOP is relevant to the BFN modification as key surface components of the BFN Underground mine will be included in the BOP in order to consolidate surface activities primarily within one development consent. These key components are as follows:

1. The provision of a new overland conveyor for coal haulage from the BFN Underground Mine workings to the BFS Underground Mine coal stockpile. The route of this conveyor will be finalised as part of the BOP as it dependent upon the realignment of Broke Road which also forms part of the BOP.
2. The relocation of the existing pit-top facilities at the BFS Underground Mine to the top of the Whybrow Pit highwall to provide for the needs of the BFN Underground Mine. These pit-top facilities include administration buildings, the bathhouse, workshop facilities and associated car parking areas. The facilities will be relocated behind the proposed new visual/noise bund which forms part of the BOP. Until this relocation takes place, the existing pit-top facilities at the former Beltana No. 1 Underground Mine (which will be removed as part of the BOP) will be used by the BFN Underground Mine.

It is also relevant to note that the Aboriginal heritage sites BMU1 (axe grinding grooves – AHIP No. 37-6-0967) and B6 (scarred tree – AHIP No. 37-6-0428), although located within the Project Area, are already approved for removal (DA 376-8-2004). It is intended that these sites would be managed in accordance with the forthcoming BOP heritage assessment. This is because the BOP (if approved) would impact on these heritage sites prior to BFN mining. It is intended that the BOP EIS and development application will be lodged with DP&I as a State Significant Development project under Part 4 of the EP&A Act in late 2012/early 2013.

1.5 Approval Process

The NSW DP&I (formerly NSW Department of Infrastructure, Planning and Natural Resources) granted development consent under Part 4 of the EP&A Act to Bulga Underground Operations (DA 376-8-2003), which represents the current operation. As detailed in **Section 2.1.2**, this consent has been modified on 4 occasions, the most recent modification being in July 2010 pursuant to Section 75W of the EP&A Act. It is now proposed to further modify DA 376-8-2003 pursuant to the provisions of Section 75W of the EP&A Act, for the construction of additional surface infrastructure to ensure adequate ventilation and allow for gas drainage and management, including on-site power generation.

Clause 8J(8) of the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation) provides a mechanism whereby projects approved under Part 4 of the EP&A Act can be modified under Section 75W, stating that:

- (8) *A development consent in force immediately before the commencement of Part 3A of the Act may be modified under section 75W of the Act as if the consent were an approval under that Part, but only if:*
 - (a) *the consent was granted with respect to development that would be a Project to which Part 3A of the Act applies but for the operation of clause 6 (2) (a) of State Environmental Planning Policy (Major Projects) 2005, and*
 - (b) *the Minister approves of the development consent being treated as an approval for the purposes of section 75W of the Act.*

Coal mining is a class of development listed in Schedule 1 of the *State Environmental Planning Policy (SEPP) (Major Development) 2005*, and as such would be a project to which Part 3A applies. On 17 March 2009, the Director-General (as delegate of the then Minister) agreed to treat the development consent for the BUO (DA 376-8-2003) as an approval for the purposes of Section 75W of the EP&A

Act. Accordingly, the modification is sought under Section 75W, and the proposal will be subject to assessment by the Director General of the DP&I and determination by the Minister for Planning in accordance with Part 3A of the EP&A Act.

In addition to the approval under the EP&A Act, the Project may also require modifying the Environmental Protection Licence issued under the *Protection of the Environment Operations Act 1999* (POEO Act).

Further details regarding the approval process are provided in **Section 4.1**.

1.6 Project Area

The Project Area includes land within the existing DA 376-8-2003 boundary as shown in **Figure 4** and an area to the north west of the existing CHPP which extends beyond this existing boundary. The Project Area comprises the disturbance envelope required for construction and operation of the Project components, including the modified underground mining areas (and associated subsidence areas), the small-scale power generation plant, the gas drainage plant, the pipeline maintenance facility, the ventilation fans and related surface operations. The Project Area can be broken into the following distinct study areas based on the types of activities to be undertaken:

Blakefield North Underground Mine

This area includes the modified underground mining area, the subsidence area above and around the longwalls, as well as the surface infrastructure required above the realigned longwall panels. The surface infrastructure includes gas drainage infrastructure (e.g. drill pads, well heads, surface roads, buried gas pipelines, etc.) above the longwall panels and associated mining infrastructure (e.g. power lines, exploration activities, materials access, etc.). This area also includes exploration activities (predominantly the drilling of boreholes) undertaken as part of ongoing underground mining operations at the BCC in accordance with the requirements of the Mining Act.

Gas Drilling Beyond the Longwall Layout

The majority of the proposed gas wells and drilling activities will occur above the proposed longwall panels (i.e. within the modified underground mine footprint as illustrated in **Figure 4**). However, there will be some gas wells located well beyond the longwall panel footprint. This includes wells SIS1, VW1, as illustrated in **Figure 4**. New overhead power line extensions would be required to service these drill pads.

Gas Drainage Plant and Infrastructure

This area includes a new gas drainage plant at the top of the Whybrow highwall, including goaf vacuum plant, gas compressors, workshop, offices, hardstand areas, buried pipelines and associated infrastructure. Five goaf extraction unit flares and 5 pre-mining gas drainage flares (already approved for the BFS Underground Mine) are to be relocated to this proposed gas drainage plant;

Ventilation Fans

This area accommodates the two relocated ventilation fans at the base of the open cut highwall within a new access slot (*Note: The new access slot is to be created as part of the Western Extension Modification – see **Section 1.4.2** and does not form part of this Project*);

Small Scale Power Generation Plant and Infrastructure

This area comprises a small-scale, gas-fired generation plant (up to 32MW in capacity) to manage the increased methane production from the BFN underground mine. The plant is proposed to be located

near the access road to the BSO which leads off Broke Road, as shown in **Figure 4**. This area may include some land outside of the proposed power plant footprint to cater for ancillary service infrastructure (eg. power lines, transformers, switch yards, etc). This area is located on land owned by the BJV, however, is located outside of the development consent boundary and Mining Lease area (ML 1547).

Gas Pipeline and Pipeline Maintenance Facility

This area includes a gas pipeline (linking the gas drainage plant with the power plant) and a pipeline maintenance facility. The gas pipeline will either be aboveground (across mine owned disturbed land) or potentially an underground High Density Polyethylene (HDPE) pipeline. If underground, the gas pipeline will most likely be directionally drilled between the gas drainage plant (Whybrow Pit highwall) and the proposed power plant. This pipeline will break the surface to the east of Nine Mile Creek where the pipeline changes direction to the north towards the power plant. This area will comprise a pipeline maintenance pad of approximately 50m x 50m which will accommodate hardstand areas for service vehicles and gas pipeline infrastructure on the surface.

1.7 Land Ownership

The land ownership within and around the Project Area is shown in **Figure 5**. The Project is located on land in the Parishes of Wollombi, Whybrow, Vere and Broke, in the County of Northumberland and the Parish of Milbrodale, in the County of Hunter. It lies in the Singleton local government area (LGA).

The proposed Project Area is predominantly located within existing coal leases/licences (Mining Lease (ML) 1547, Exploration Licence (EL) 5277 and Authorisation Area A450 and A447) held by the BJV and operated by BCM (refer to **Figure 2**). The proposed power plant and part of the associated infrastructure (eg. above/underground gas pipeline) will be located outside of the development consent boundary and Mining Lease area and will be included in a Mining Lease application associated with the BOP.

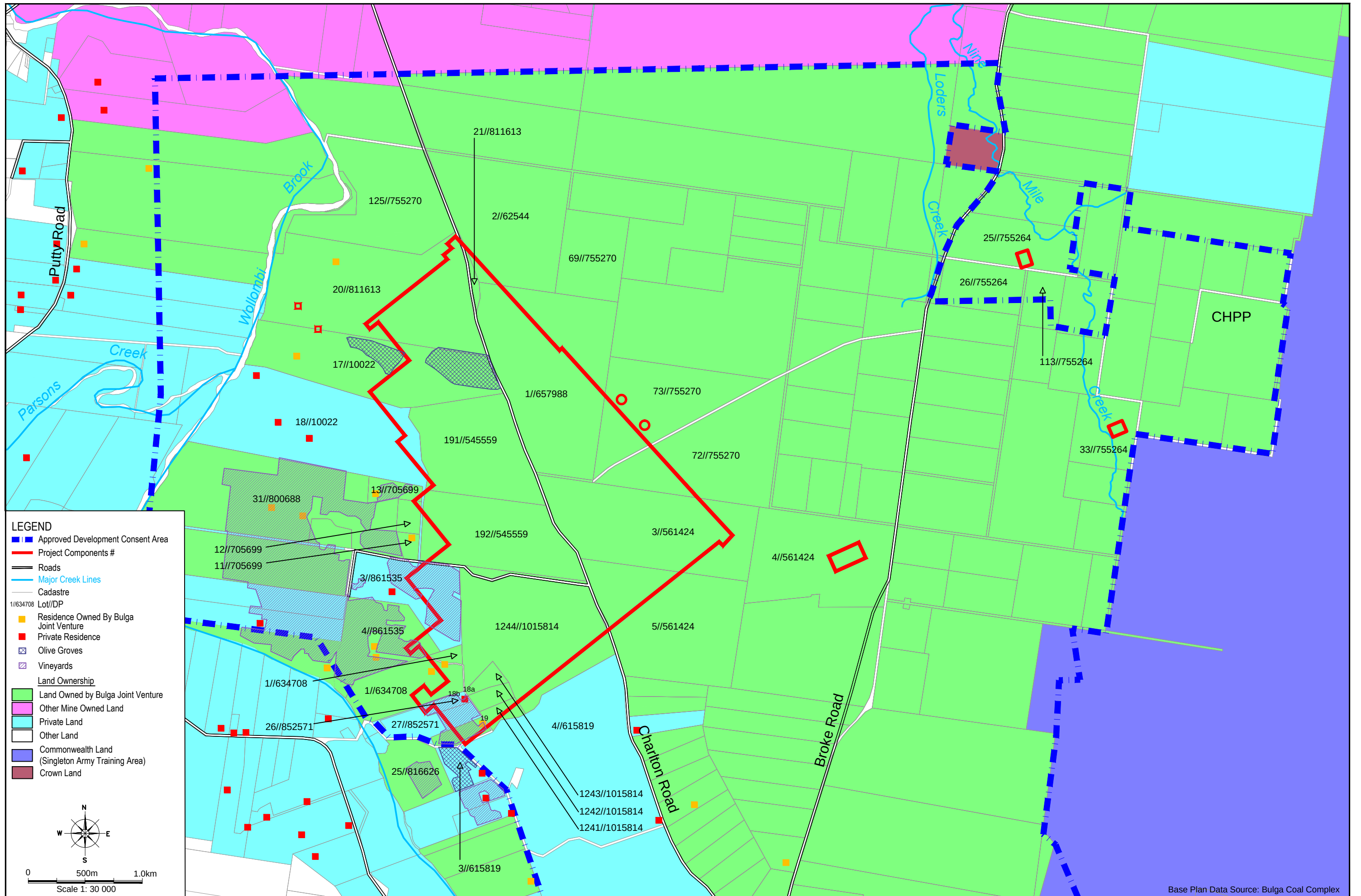
The majority of surface holdings over the area covered by this Project (including the proposed power plant land) are owned by the BJV, with the exception of some private land above the re-aligned longwall panels (refer to **Figure 5**). The Lot and Deposited Plan (DP) numbers within Project Area are included as an appendix within the development consent for the BUO (DA 376-8-2003) (see **Appendix 2**). In addition, Charlton, Cobcroft, Broke and Fordwich Roads, which traverse the mining area, are Crown roads under the jurisdiction of Singleton Council.

There are 4 private properties and 1 privately owned residential dwelling within the Project Area. The detail of consultation undertaken with owners of land subject to the proposed Project is discussed in **Section 5**.

1.8 Land Use

Mining activity in the Upper Hunter over the past 40 years has brought many changes to a once predominantly agricultural landscape. Numerous open cut and underground mining operations have been developed over this time; including coal mining activities at the BCC since 1982.

The Project Area is located within the BCC Development Consent and Mining Lease boundary (apart from the proposed location of the power plant) and is currently utilised for mining and agricultural purposes, with vegetation dominated by pasture and woodland species. The predominant land uses of the site and surrounding areas include coal mining, grazing, viticulture and rural-residential holdings, in addition to land occupied by the Department of Defence - Singleton Army Training Area (refer to **Figure 5**).



To be printed A3

All indicative locations - will be finalised pending constraints

The proposed surface infrastructure associated with the Project will predominantly be located on land already largely disturbed by the above land uses, in particular, land that has been previously cleared, grazed or subject to mining activities. No additional non-mine owned properties will be directly impacted by the Project to those previously approved as part of the current development consent.

Land Capability of the Project Area is described in further detail in **Section 6.12**. Mining activities associated with the Project are not predicted to cause any further degradation to the current land use class within the Project Area. As the modification is predominantly for the realignment of approved underground longwall panels with minor support surface infrastructure, the impact to the existing land use and vegetation within the Project Area will be limited.

1.9 Project Team

GSSE has prepared this EA on behalf of BCM. The project team included the following specialist studies by external consultants:

- Air Quality and Greenhouse Gas Emissions – Todoroski Air Sciences;
- Visual Impact – Terras Landscape Architects;
- Aboriginal and Cultural Heritage – OzArk Environmental and Heritage Management;
- Ecological Assessment – Umwelt (Australia);
- Subsidence Predictions and Impact Assessment – MSEC;
- Noise Assessment – Global Acoustics Pty Ltd;
- Traffic and Transport – GHD; and
- Agricultural Impact Assessment – GSS Environmental.

1.10 Overview of Document Structure

The purpose of this EA is to enable the consideration of the environmental impacts associated with the Project. The EA has been prepared in accordance with the requirements of the DP&I (refer to **Section 5.2.1**), the EP&A Act and the EP&A Regulations (refer to Statement of Authorship). An overview of the layout of this EA is provided below.

Section 1.0 provides the background and context for the Project, an overview of the approval process and the EA project team involved in producing the EA.

Section 2.0 describes the current approved operations at the BCC and the approved but yet to be commenced BFN Underground Mine.

Section 3.0 describes the proposed modification.

Section 4.0 describes the planning context for the proposed modification, including the applicability of Commonwealth and State legislation.

Section 5.0 describes the consultation process and the environmental and community issues identified as part of this process for detailed assessment in the EA.

Section 6.0 contains a description of the existing environmental and a comprehensive analysis and assessment of the environmental impacts of the Project.

Section 7.0 details the draft Statement of Commitments proposed to be adopted as part of the proposed modification to mitigate potential environmental and community impacts.

Section 8.0 contains the project justification and a discussion of how the proposed modification meets the principles of ecologically sustainable development.

Section 9.0 provides a list of references referred to in the EA.

2.0 DESCRIPTION OF CURRENT APPROVED OPERATIONS

2.1 Background to Approved Operations

2.1.1 Overview

As described in **Section 1.2**, the BCC comprises two existing coal mining operations being BSO and BUO. The CHPP and rail loading facility service both operations. The BUO comprise the BFS Underground Mine (Blakefield seam) and the BFN Underground Mine (Blakefield Seam) (approved but not yet commenced). Mining of the BUO Whybrow Seam mines (South Bulga Mine and Beltana No.1 Mine) has ceased and the portals have been sealed. Access to the BUO is from Broke Road.

2.1.2 Development Consent Details

The BUO operates under development consent DA 376-8-2003 (granted on 23 February 2004), in accordance with the *Bulga Coal Continued Underground Operations Environmental Impact Statement* dated July 2003 (2003 EIS), for mining four seams (Whybrow, Blakefield, Glen Munro and Woodlands Hill). This consent provided for an annual production of the continued underground operations of up to 14 Mtpa till 2031. The consent (see **Appendix 2**) also consolidated all of the previous BUO consents (which included the consents for the Beltana No.1 Underground Mine). The BUO currently produces around 7 Mt of thermal coal annually and employs about 530 people (with contractors employed on a short term basis as required).

The 2003 EIS identified that methane would need to be drained from the mine workings in the Blakefield, Glen Munro and Woodlands Hill seams to maintain a safe working environment, using a combination of pre and post mining gas drainage techniques. The 2003 EIS identified that methane would be drained from the coal seams and goaves via boreholes connected to gas drainage plants on the surface. The methane would be converted to carbon dioxide by combustion (flaring) unless a beneficial use could be found for the gas. The 2003 EIS also discussed feasibility studies regarding alternative options for utilising methane liberated during the mining process.

The consent to DA 376-8-2003 has been modified on 4 occasions as summarised below.

In April 2006 the consent was modified (MOD4-1-2006) (MOD No. 1) as follows:

- A change in the location of access to the Blakefield Seam (BFS Underground Mine);
- A change in access via a decline drift, rather than conventional main roadways; and
- A change to the approved coal clearance system for the Blakefield Seam (BFS Underground Mine).

In October 2006 the consent was modified (MOD13-9-2006) (MOD No. 2) as follows:

- Increased throughput of the coal handling and preparation plant from 15Mtpa to 20Mtpa; and
- Increased peak number of daily trains from 9 to 12.

In October 2007 the consent was modified (MOD19-3-2007) (MOD No. 3) as follows:

- A change in sequence and access to mining to bring forward the mining of the Blakefield seam (BFS Underground Mine);

- Minor realignment of BFS Underground Mine longwalls (including extension of some longwall blocks) resulting in an increase in total coal mined at the BUO from 198Mt to 212Mt;
- Changed ventilation infrastructure and increase gas drainage infrastructure; and
- Changed coal clearance system.

In July 2010 the consent was modified (MOD No. 4) under Section 75W of the EP&A Act) as follows:

- Installation and operation of 8 gas-fired reciprocating engine electrical generator units (with associated infrastructure) generating up to 25 MW of gas fired power generation from the methane capture by pre and post mine drainage of the approved BFS Underground Mine as well as the future Glen Munro and Woodlands Hill seams as mining progresses.
- Construction and operation of a pilot ventilation air methane abatement system; and
- Contemporising all noise-related conditions in the consent to reflect the current NSW Government policy, including incorporation of additional controls to better mitigate and manage noise emissions.

Similar to the above modifications to the BFS Underground Mine, a review of the approved BFN Underground Mine and BSO interactions (as well as an improved understanding of the gas drainage requirements) necessitate this further modification of the consent to DA 376-8-2003.

2.1.3 Mining Tenements

The BCC covers several mining tenements as shown in **Figure 2** and detailed in **Table 1**.

Table 1 – Summary of Mining Tenements

Lease	Details	Expiry Date
ML 1547	Bulga Coal Management Pty Ltd	4 April 2025
ML 1494	Saxonvale Coal Pty Ltd and Nippon Steel Australia Pty Ltd	20 September 2027
ML1674	Bulga Coal Management Pty Ltd	22 March 2033
AU 450	Saxonvale Coal Pty Ltd	30 December 2013
AU 447	Saxonvale Coal Pty Ltd (renewal made to DII)	1 September 2011
EL 5277	Saxonvale Coal Pty Ltd (renewal made to DII)	6 April 2010
EL 5461	Saxonvale Coal Pty Ltd and Nippon Steel Australia Pty Ltd	2 April 2013

2.1.4 Licences

Environmental Protection Licence

The BCC operates under a single Environmental Protection Licence (EPL) No.563 – reviewed annually on 29 July. Monitoring is reported to the NSW Office of Environment and Heritage (OEH) as part of the BCC EPL Annual Return.

Groundwater and Surface Water Licences

BCC holds a range of groundwater and surface water licences. This includes licences for dewatering of underground mining operations and groundwater monitoring. Water is used for coal washing, mining process, and dust suppression activities.

Dangerous Goods Licences

The BCC holds various Dangerous Goods Licences for both the surface and underground operations.

2.2 Current and Approved Mining Operations and Methods

2.2.1 Overview

Underground mining at the BUO is presently conducted using longwall mining methods (namely longwall retreat mining techniques), which are used for the primary extraction of each longwall block. **Figure 6** shows the existing and approved longwall mining area, as well as the previously mined areas.

Prior to panels of coal being extracted by longwall methods, development headings are mined to provide access to the panels. Development headings are often referred to as first workings as they are the first stage in the coal extraction process. The coal from the first workings is cut by a continuous miner. When the coal is removed, the roof is secured using roof bolts. As this process involves supported roofs there is negligible impact on the surface.

Coal in each longwall panel is removed through the use of a shearer. The shearer moves along the longwall face shearing off coal and then loading it onto a conveyor. Large steel hydraulic supports are used to maintain the roof. As the shearer progresses along the longwall and coal is extracted, the steel hydraulic supports move into the newly extracted area. The mined out area behind the steel hydraulic supports is known as the goaf. As roof supports are moved, the goaf collapses resulting in subsidence on the surface above the longwall panels. This process is continued until the longwall panel has retreated back to the main access roadways.

The BUO have continuously utilised longwall mining methods to extract approved longwalls. The current longwall extraction width at the BFS Underground Mine is 400m.

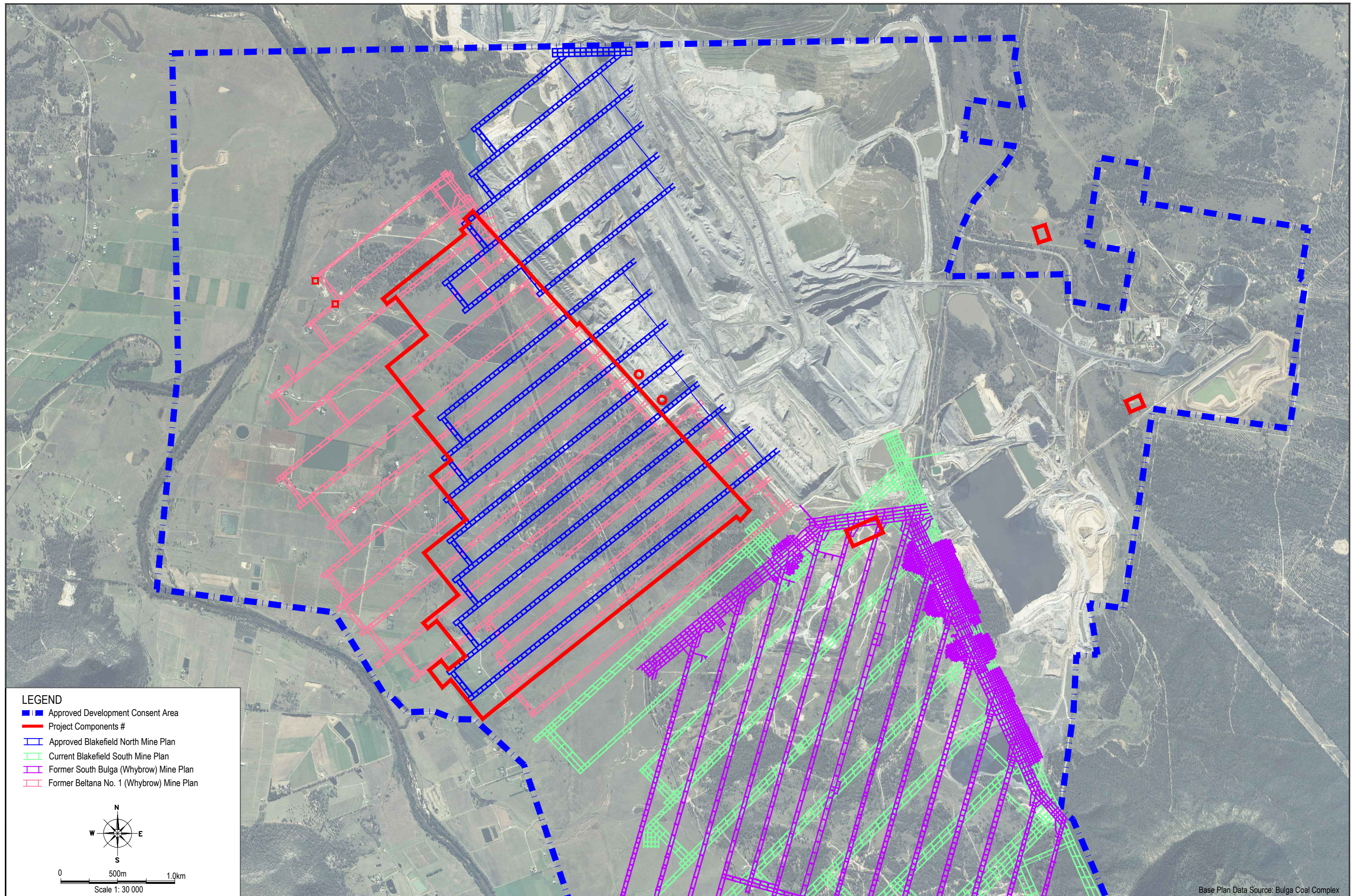
2.2.2 Beltana No. 1 Underground Mine (now complete)

The now completed Beltana No.1 Underground Mine overlies the Blakefield coal seam and consisted of fourteen longwall panels in the central and northern areas of the BCC lease area (refer **Figure 6**). Extraction of coal from the development headings commenced in July 2002 with longwall mining commencing in June 2003. Mining progressed from south to north with a production rate of up to 7 Mtpa. Run-of-mine (ROM) coal extracted from the mine was transported by a series of underground conveyors to the former South Bulga Colliery ROM coal conveyance system.

In 2011, the Beltana No.1 Mine completed mining the last longwall panel 14 in the Whybrow Seam. Beltana No.1 Mine Underground Mine used highwall or 'punch' mining (where adits were driven directly from the base of surface operations pits into the longwall development headings) in the Lower Whybrow seam. This eliminated the need for main roadways between development headings because the floor of the surface operations pit provides similar functionality to a conventional underground main roadway system. The longwall panels at Beltana No. 1 Underground Mine were approximately 265m wide.

2.2.3 Blakefield South Underground Mine (current)

The BFS Underground Mine is a current underground longwall operation that will extract around 45 Mt of ROM coal from the Blakefield Seam during the mine's life at a rate of approximately 6 Mtpa. The mine plan has been designed to give optimum recovery of the resource and maximise the use of existing infrastructure. The BFS Underground Mine commenced longwall mining in July 2010 and is currently mining Longwall panel 2 of the Blakefield seam. Access to the Blakefield seam is via a cross measure drift entry from the floor of the existing South Bulga Whybrow box cut.



With the exception of the first longwall panel which is 330m wide, the remaining eight panels are 400m wide with a maximum length of 3,800m. Longwalls 2 - 9 are scheduled for extraction between 2012 and 2017.

2.2.4 Blakefield North Underground Mine (approved)

As detailed in **Section 2.1.2**, consent was granted for mining in up to four seams (Whybrow, Blakefield, Glen Munro and Woodlands Hill seams). The BFN Underground Mine (Blakefield seam) is one of the approved underground mines that is yet to commence. The approved mine is a longwall operation that comprises twelve 265m wide longwall panels (BB1 to BB12) (refer to **Figure 6**). The conceptual mine plans in the 2003 EIS show that mining is predicted to begin between Years 2-8 (2005-2011) for longwalls 1-5 and between Years 14-21 (2017-2024) for longwalls 6-12.

2.2.5 Working Hours and Workforce

Mining operations occur 24 hours per day, 7 days per week, with maintenance activities generally undertaken during 1 to 2 shifts throughout the week.

The BUO currently employs approximately 530 full time staff, with contractors employed on a short term basis as required. Employment growth has occurred organically from around 300 employees in 2006 to around 530 in 2010. This need for increased manning has primarily been driven by increased gas drainage requirements and associated infrastructure (such as the power generation plant and pilot ventilation air methane abatement system at the BFS Underground Mine - see **Section 2.1.2**). Increased manning was also required when the change in the location of access to the Blakefield Seam was approved in 2006. This change provided access via a decline drift, rather than conventional main roadways off the highwall and resulted in the development of additional gateway headings. As DA 376-8-2003 only approves 300 employees at the BUO, the Project now seeks to regularise this current number of full time employees.

2.2.6 Mine Dewatering

During the mining operations, water is released from the underground coal seam aquifers that lie within or near the mined coal seam. This water collects in the underground mining area. Additional run off from water used in the mining process also collects in the mining area. The process whereby collected water is pumped out of the mining area is called mine dewatering.

New dewatering bores are required to extract mine water from the underground workings. This is achieved via underground sumps and a surface dewatering system. Where these are on private property, agreement is reached with the landholders. The dewatering bores are not all in operation at any time during underground mining but are progressively installed and operated for the set of longwall panels to be dewatered at any given time. Bores no longer in use are then decommissioned. As with gas bores and gas drainage plant, the location of dewatering bores is subject to mining layout and conditions. The water removed from the coal seam is reticulated into the BCC water management system.

BUO also collects water at low points in the mine workings and adjacent to the access drive and men and material drift for the BFS Underground Mine. These sumps are kept dewatered to reduce the risk of inflow to the underground mine. Water is then pumped into BCC integrated water management system. The water pumped from the mine workings is reused as operational water, for example for coal washing and dust suppression. **Section 2.8.6** further discusses water management at the BUO.

2.2.7 Mining Equipment

The equipment employed by the BUO is typical for a longwall operation and includes continuous miners, shuttle cars, a longwall unit and associated equipment.

The longwall unit, continuous miners, shuttle cars and conveyors are powered by electricity, whilst the underground mobile equipment is diesel powered. A summary of the current underground operations equipment fleet is provided in the **Table 2** below.

Table 2 – Summary of Existing Bulga Underground Mine Operations

Mining Activity	Equipment Details	Quantity
Development	Joy 15SC Shuttle Cars	2
	Stamler Breaker Feeder	5
	Joy 10sc 32BC Shuttle Cars	7
	Joy 12cm 12 Continuous Miner	7
	PJ Berriman Mk 4.5 Man Transport	6
	Juganaut Load Haul Dump	6
	Wright 120G Underground Grader	1
	992 Front End Loader	1
	777 Caterpillar Haul Truck	1
Longwall	1700 tonnes per hour (tph) conveyors	2
	DBT Electra 3000 Shearer (1990 kW Power)	1
	DBT Jumbotrack 2000 Haulage system	1
	Joy Roof supports (940 & 1150 tonne capacity), RS20 controls	1
	Joy BSL (twin 34 mm chain)	2
	PJ Berriman Mk 4.5 Transport	2
	Eimco 130 Load Haul Dump	4
	Eimco 936 Load Haul Dump	1
	Bucyrus FBL55H Loader	1
Services	Industrea - PJ Berriman Mk 4.5 Man Transport	10
	Valley Longwall International - Juganaut Load Haul Dump	15
	Wright 120G Underground Grader	1
	Valley Longwall International - SMV Drifrunner	4
	Eimco 130 Load Haul Dump	2
	Eimco 936 Load Haul Dump	1
	Industrea – PJ Beriman PowerTram	1

2.3 Mine Gas Drainage and Ventilation

2.3.1 Overview

The 2003 EIS identified that methane would need to be drained from the mine workings in the Blakefield seam to maintain a safe working environment, using a combination of pre and post gas drainage techniques. The 2003 EIS identified that methane would be drained from the coal seams and goafs via bore holes connected to gas drainage plants on the surface and would then be converted to carbon dioxide by combustion (flaring), unless a beneficial use could be found for the gas. The existing BUO approval includes both the construction of gas flares for gas drainage management as well as gas drainage infrastructure and plant being relocated during the life of the Project as required.

Currently, methane gas from underground workings is piped to a flaring facility for combustion. The flaring facility was commissioned in 2008 and expanded in May 2009. However, as detailed in **Section 2.7**, a small scale gas fired power generation plant (9MW) and pilot ventilation air methane (VAM) abatement system is currently under construction as part of the modified BFS Underground Mine approval (refer to MOD 4 in **Section 2.1.2**). Captured methane gas is proposed to be directed to the power generation plant upon completion of construction. Captured methane in excess of the power generation capacity will be flared. The use and operation of the pilot VAM abatement system will initially be trialled with diluted methane from the gas drainage. There are significant safety considerations associated with connecting the VAM abatement system to the mine ventilation system that must be overcome before being put into operation.

2.3.2 Typical Mine Gas Drainage

Pre-mining gas drainage infrastructure is constructed to extract gas prior to development workings. This involves drilling vertical wells down into the coal seam (see **Plate 1**). Methane gas flows out of the coal seam under reservoir pressure through these gas wells into the buried pipeline system. The methane gas is currently piped to an onsite flaring facility (see **Plate 2**) where it is burned and converted to carbon dioxide. The three existing pre-mining drainage flares each have a capacity of approximately 900 litres of methane per second whereas the three post-mining drainage flares each have a capacity of around 1,800L/sec. Almost all of the captured pre-drainage gas is currently flared, however a portion will in the future be directed to the new power generation plant (see **Section 2.7**). To date there are 36 pre-mining gas wells servicing the BFS Underground Mine.

Coal seam water is also abstracted from these gas drainage boreholes in preparation for underground mining. This water is reticulated into the BCC integrated water management system. Post-mining gas drainage wells are constructed to remove gas that interferes with the retreated longwall face. The goaf methane wells are drilled and installed prior to mining, however gas extraction does not occur until the methane becomes liberated in the goaf. The gas is removed under suction to prevent it entering nearby mine workings. The gas is also collected through the buried pipeline system and currently flared. In future it will be compressed to enable it to be pumped to the power generation plant. To date 34 post mining gas wells have been drilled in the BFS Underground Mine. Gas drainage during longwall extraction will be required to minimise the ingress of methane into the mine ventilation circuit for the Blakefield, Glen Munro, and Woodlands Hill seams.



Plate 1 – Existing Vertical Well above a longwall panel at the BFS Underground Mine



Plate 2 – Existing Gas Flares at the BFS Underground Mine

2.3.3 Mine Gas Drainage Improvements

Improvements in drilling technology have allowed the BUO to adopt surface-to-inseam (SIS) drilling for gas drainage, as well as conventional underground gas drainage drilling. SIS drilling comprises long horizontal holes drilled within the coal seam (see **Plate 3**). Combined with the use of vertical pre-drainage wells which intersect with the horizontal in-seam well, gas drainage is able to be undertaken from the surface, providing a safer working environment and more efficient mining. More effective pre-drainage has enabled a higher proportion of seam methane to be captured for flaring or potential beneficial use in the power plant under construction, rather than flowing into the mine ventilation circuit and subsequently venting to the atmosphere.

Three types of gas drainage techniques are employed at the BFS Underground Mine and include the following:

- SIS techniques, including large-diameter directional horizontal wells. This method involves drilling holes from a surface drill rig horizontally along the length of the longwall block, in strata which will otherwise desorb gas into the longwall goaf when de-stressed. The SIS drill pad occupies an area of around 80m x 80m during construction. The SIS boreholes are steered from the surface by directional drilling methods into the coal seam, along a pre-determined trajectory to intersect with the pre-drilled vertical wells.
- Conventional underground-inseam techniques;
- Conventional vertical pre and post-mining wells which involves drilling holes from a surface drill rig. Each vertical well drill pad generally occupies an area of around 40m x 40m during construction. This method includes:
 - vertical holes drilled from the surface;
 - approximately 250-350mm diameter;
 - typically at around 150m spacing for post mining (goaf) wells; and
 - connection to a local or remote vacuum pumping system at the surface.

As part of the gas drainage process, water is drawn from the coal seam (a discrete aquifer) to reduce the hydrostatic pressure and open coal pore spaces to allow desorption and flow of the seam gas. A system of buried pipelines is installed to convey the extracted water back into the mine raw water system and the gas to a central location where the methane is currently flared (pending completion of the BFS 9MW power plant, at which time the gas drained from the longwalls will also be directed to the new power plant).

Vertical wells for pre gas drainage are drilled ahead of mining and are generally located at the opposite end of the longwall panel to the SIS drill well with which they intersect. Vertical wells for post gas drainage (goaf wells) are drilled ahead of mining and are typically spaced approximately 150m apart along the Longwall (see **Plate 9**). Only a portion of the goaf drainage wells are operational at any one time. Once the wells become redundant the infrastructure is removed, the bore sealed and the site rehabilitated.

At present all of the gas drainage bores are located on land owned by BJV, however agreements have recently been entered into to allow gas drainage and dewatering bore wells to be constructed on privately owned land.



Plate 3 – SIS Drill Rig at BFS Underground Mine

2.3.4 Gas Well Rehabilitation

Each mining panel has its own set of gas wells which are usually in place for two to four years to extract gas during the development and mining of each mining panel. The post mining gas wells are usually in place for two to three years after mining has been completed in each panel. When the gas wells are no longer used, they are sealed with concrete in accordance with the NSW Department of Trade and Investment, Regional Infrastructure and Services (DTIRIS) guidelines. The well pads and associated access tracks are also rehabilitated through the importing of topsoil and revegetation, as demonstrated in **Plates 4, 5 and 6**.



Plate 4 - SIS well head following drilling and pad rehabilitation.



Plate 5 - SIS wellhead with screening and following rehabilitation.



Plate 6 – Vertical wellhead with screening and following rehabilitation.

2.3.5 Ventilation

Ventilation of the existing BUO currently takes place to provide fresh air to workers; dilute and control gases naturally released by the coal and rock strata; remove heat and dust and control humidity. Two sets of existing ventilation fans are located at the BUO (refer **Plate 7** in **Section 3.3.5**). The northern set of ventilation fans force air into the underground working and the southern set draws air out of the underground workings. The air extracted by the ventilation shafts is a mix of both atmospheric air and gases released from the underground exposed coal.

The 2003 EIS identified the need for a number of ventilation fans for the BFN Underground Mine located in the new underground access portals in the Whybrow and Bulga pits, with further fans to be relocated as required throughout the life of the mine. This ventilation strategy was amended by MOD No. 3 (2007) to DA 376-8-2003 (see **Section 2.1.2**) as highwall access to the Blakefield seam would not be available due to the bringing forward of mining in the seam. MOD No.3 provided for the proposed ventilation fans in the Bulga Pit to be relocated to the surface over the Blakefield South mining area.

2.4 Coal Handling, Preparation Plant and Transport

BUO Run-of-mine (ROM) coal is crushed to less than 125mm and transferred to the CHPP via conveyor and either washed or stockpiled. The washed coal is screened, rinsed, crushed and dewatered in the CHPP. The CHPP can produce two streams of product coal: semi-soft coking coal and thermal coal. These products are stacked in separate product coal stockpiles with an approximate combined capacity of 1,000,000 tonnes. Clean coal is reclaimed from the product coal stockpiles and loaded into a 1,500 tonne train loading bin. Trains are loaded from this bin at a rate of up to 3,200 tonnes per hour (tph), with trains accessing the CHPP via the existing rail loop.

The CHPP has previously modified its approval to enable the processing of up to 20 Mtpa of ROM coal, 24 hours per day, 7 days per week.

The major infrastructure associated with the CHPP and rail loading facility includes:

- Coal handling preparation plant;

- Thickener;
- Rejects hopper;
- ROM coal;
- Reclaim and feeder;
- Water management structures;
- Water treatment plant;
- Sewage treatment plant;
- Switchyard/substation; and
- Rail loader.

With regard to the BFN Underground Mine, the 2003 EIS approval included development coal being hauled to the CHPP in trucks whilst conveyors were constructed (i.e. during the development phase of the longwall panels). During these periods ROM coal would be stockpiled on the floor of the pit. The coal stockpiles would be reclaimed by front end loader and loaded into haul trucks for transfer to the CHPP along existing haul roads used by the BSO.

The BFS MOD No.3 gained approval for the relocation of an in-pit ROM coal stockpile facility from within the Bulga Pit to the eastern side of Broke Road (see **Figure 3**). This 400,000 tonne stockpile facility has been designed to service all future underground mining operations.

2.5 Coal Rejects and Tailings Management

Coarse and fine rejects are produced during the coal preparation process. Coarse rejects are currently placed in the Bulga Pit and incorporated into overburden emplacement. During wet weather a site in the Deep Pit is used. Fine rejects are thickened in the CHPP and either co-disposed with the coarse reject in the Bulga Pit (approximately 30%) or pumped to either “the Old” tailings dam or “the Deep Pit” tailings dam. The current tailings disposal facilities are projected to provide sufficient capacity for approximately 10 years.

The locations of tailings storage facilities are illustrated in **Figure 3**.

2.6 Mine Support Facilities and Site Access

The location of the existing mine infrastructure and surface facilities are illustrated on **Figure 3**. Surface facilities associated with the BUO include the following:

- Administration buildings;
- Bathhouse;
- Stores;
- Emergency helipad;
- Ventilation fans and compressors;
- Conveyors;

- Bulk fuel and oil store;
- Fire depot and pumps;
- Wash down bay;
- Substation and switchyards;
- Water supply tanks and dams;
- Water sumps;
- Workshop; and
- Bulk solcenic facilities.

As detailed in **Section 1.4.3**, the BOP provides for the relocation of the existing pit-top facilities at the BFS Underground Mine to the top of the Whybrow Pit highwall to provide for the needs of the BFN Underground Mine. The BFS pit-top facilities will be relocated behind the proposed new visual/noise bund which forms part of the BOP [*Note: Until this relocation takes place, the existing pit-top facilities being used by the BSO at the old Beltana No.1 mine (which will be removed as part of the BOP) will be shared by the BFN Underground Mine*].

Access to the BFS Underground Mine is via a cross measure decline drift entry from the floor of the existing Whybrow box cut (adjacent to the BFS surface facilities).

The 2003 EIS included entry to the BFN underground mining area via portals in the southern end-wall of the existing Bulga Pit that forms part of the BSO, using conventional main roadways.

2.7 Small Scale Power Generation

The BUO has approval for a small scale power generation facility consisting of up to eight gas fired reciprocating engine generator units (and seven gas flares) to generate up to 25MW of electricity (see **Section 2.1.2**). The power generated from this facility will be used by the BCC and when a surplus exists, put back into the power grid. A small 9MW plant, with the associated infrastructure (including five gas flares), has recently been constructed as part of the current approval and includes:

- Electrical supply lines;
- Gas monitoring and switch room;
- Control room;
- Gas treatment plants (2); and
- Gas pipeline.

2.8 Environmental Management Plans and Monitoring Programs

2.8.1 Overview

The BCC operates a comprehensive environmental management system. This includes a wide range of environmental management plans and procedures which have been developed by BCC in accordance with conditions of DA376-8-2003 (as amended), mining lease conditions, the EPL and the Xstrata Corporate Environmental Management System and Policy. This system includes water, noise

and air quality management; visual mitigation; land rehabilitation; subsidence remediation. These plans are updated on a regular basis and are backed by an environmental monitoring network including meteorological, air quality, water quality, noise and subsidence monitoring. The existing environmental management plans and systems currently utilised at the BCC will be amended, as required, to incorporate the proposed modifications and the relevant recommendations of this EA.

BCC manages an environmental monitoring system including meteorological, air quality, ground water, surface water quality, noise and subsidence monitoring. The key environmental monitoring sites are illustrated in **Figure 7**. Results from the monitoring program are reported to a wide range of NSW Government Agencies, including DTIRIS, DP&I, OEH, Singleton Council and other relevant stakeholders via the Annual Environmental Management Report (AEMR). The monitoring results and the AEMR are also published on the BCC website.

A summary of the key environmental management plans and monitoring programs is provided below.

2.8.2 Meteorological Data

The BCC undertakes meteorological monitoring through two meteorological monitoring sites. Monitoring of meteorological conditions are requirements of both the BUO and BSO development consents. The location of both meteorological stations is shown in **Figure 7**.

Continuous monitoring of rainfall, wind speed, wind direction and temperature is undertaken and downloaded to a database at BCC. Hourly averages as well as daily minima and maxima are also recorded. The monitoring results are used to assist in the environmental management of the mine and are reported in the AEMR.

Historically the BCC XCN Weather Station at the surface operations has been utilised, however ongoing technical issues and repairs were required in 2010, which resulted in a new station being established. The new station, identified as the 'Bulga Complex Weather Station', has been commissioned and tested, with reporting commencing in late 2010.

2.8.3 Air Quality

Dust emissions from the BCC are managed in accordance with the *Bulga Coal Complex Dust Management Plan* and the air quality controls set out in Schedule 4, Conditions 22 – 28A of the current development consent.

BCC operates a comprehensive air quality monitoring system. There are 30 Dust Depositional Gauges used for monitoring larger dust particles (typically >50µm) that settle out from the air over approximately one month, referred to as *depositional dust*. The Dust Deposition Gauges are sampled monthly to determine insoluble matter and ash content. There are also six High Volume Air Samplers (HVAS) which monitor Total Suspended Particulates (TSP) as well as Particulate Matter less than ten microns in diameter (PM₁₀). The location of these dust monitors are shown in **Figure 7**. The BCC also shares monitoring results with the adjacent Mount Thorley Operations. These results are collected from two Dust Deposition Gauges, two HVAS measuring TSP and two HVAS measuring PM₁₀. The results supplement the BCC air quality monitoring system.

All samples collected from HVAS are analysed by a National Association of Testing Authorities (NATA) approved laboratory. All monitoring is conducted in accordance with:

- AS 2724.3 – 1984 *Ambient Air – Particulate Matter – Determination of Total Suspended Particulates (TSP) – High Volume Sampler Gravimetric Method*; and
- AS 3580.10.1 – 2003 *Methods for Sampling and Analysis of Ambient Air – Determination of Particulate Matter – Deposited Matter – Gravimetric Method*.



Existing Environmental Monitoring Sites

FIGURE 7

Any exceedances are reported to the OEH in accordance with the conditions of the current development consent.

Dust is controlled on conveyors, transfer points, receival hoppers and the train loading bin by application of water from automatic sprays. Water carts apply mine water to haul roads throughout the site, as required. All equipment is maintained in good working order to limit the exhaust fumes, and additional dust controls are implemented during construction works.

All land surface disturbances caused by construction activities associated with new surface infrastructure, are also managed in accordance with the BCC *Sediment and Erosion Control Plan* to minimize air quality impacts.

2.8.4 Greenhouse Gas Emissions

The surface and underground operations at BCC record Greenhouse Gas (GHG) emissions utilising industry standard factors for diesel usage, explosives and fugitive emissions from stockpiles. The BUO directly measure GHG emissions from both ventilation and gas drainage. The air extracted from the ventilation shafts is a mix of both atmospheric air and gases released from the underground exposed coal. Both carbon dioxide and methane are measured in the ventilation air.

The gas drawn from the pre and post mining wells (discussed in **Section 2.3**) is nearly pure methane (CH₄), with an average gas content between 96% to 99% CH₄. At present, this methane is piped to the flaring facilities for combustion and emission as carbon dioxide, which reduces the GHG emissions. However, as detailed in **Section 2.7**, some of the methane gas will soon be used to run the 9MW gas fired power generation plant recently constructed. The pilot VAM abatement system is designed specifically to reduce GHG emissions from the mine ventilation air. There is however considerable trialling and development required before connection of the of pilot VAM abatement system to the mine ventilation system.

2.8.5 Noise Environment

Noise emissions from the BCC are managed in accordance with the *Bulga Complex Noise Management Plan*. Blast emissions are managed in accordance with the *Bulga Open Cut Blast and Vibration Management Plan*. This system is designed to comply with EPL No. 563 and the noise control conditions stipulated within the BCC development consents. Noise monitoring includes the following:

- Quarterly monitoring which includes four nights of attended monitoring with a 15 minute period of attended monitoring undertaken at each site per night;
- Monitoring of eight sites in accordance with DECCW (now OEH) *Industrial Noise Policy Guidelines* and AS 1055 *Acoustics, Description and Measurement of Environmental Noise*;
- Monitoring of atmospheric conditions;
- Additional noise monitoring triggered by complaints; and
- Real time monitoring.

Monitoring is undertaken by specialist consultants and assessed to determine compliance with statutory limits. If exceedances are identified, the incident is reported to the OEH, as required, and the BUO Environmental Coordinator is responsible for investigating the incident and implementing appropriate corrective and/or preventative actions. Noise monitoring results are reported annually in the AEMR.

Construction noise management procedures are also applied to manage potential noise impacts during construction events.

2.8.6 Water Management

Overview

In accordance with the development consent, BCC has a comprehensive *Site Water Management Plan* (SWMP) which deals with managing water supply, consumption, storage, disposal, monitoring and hydrological interception. The BUO water management is fully integrated with the BCC water management system. The SWMP objectives are to:

- Minimise the contamination of runoff from catchment areas upslope of the operations;
- Secure containment of mine water (groundwater and surface water which reports to open cut and underground mining areas), and other site water that comes into contact with areas disturbed by mining activities – including overburden emplacement areas, coal stockpiles and the coal handling and preparation plant area;
- Maximise reuse of mine water to preferentially meet on site water consumption requirements, principally for use at the CHPP and dust suppression. Water from mine dewatering, tailings decant and run off from overburden/coarse rejects disposal areas are used preferentially to Hunter River water;
- Provide secure access to make-up water to meet ongoing water supply requirements during periods when there is insufficient water available from the water management system;
- Manage sediment and erosion control impacts on surface water bodies through implementation of the BCC *Sediment and Erosion Control Plan*; and
- Manage disposal of excess water discharge to the Hunter River via the Hunter River Salinity Trading Scheme (HRSTS) in the event that an excess water inventory exists on site beyond projected requirements.

Surface Water

The SWMP outlines the methods for monitoring the quantities of water that are extracted, imported or discharged under the various licences, including extraction licences and discharge under the HRSTS.

Monitoring of surface water is undertaken at locations throughout the BCC and surrounding catchment area in accordance with the SWMP. Surface water monitoring sites are sampled on a monthly basis and include streams, creeks and dams. Water quality parameters including temperature and depth are tested onsite, whilst others including pH, electrical conductivity (EC) and total suspended solids (TSS) are undertaken by a NATA accredited laboratory. All monitoring is conducted in accordance with:

- AS 5667.4 – 1998 *Water Quality Sampling – Guidance on Sampling from Lakes, Natural and Man-made*;
- AS 5667.6 – 1998 *Water Quality Sampling – Guidance on Sampling of Rivers and Streams*; and
- The *Bulga Coal Complex Water Management Plan*.

Any exceedances are reported to the OEH and/or the NSW Office of Water (NOW) and managed in accordance with the conditions of the current development consent.

Groundwater

The SWMP includes a groundwater monitoring program and groundwater response plan. The measures outlined in this management plan have been determined in consultation with DP&I and the NOW. In addition, a *Wollombi Brook Groundwater Contingency Plan* has been approved by the DP&I. The groundwater monitoring system is designed to effectively monitor the two general types of groundwater located within the vicinity of the BCC, being the alluvial aquifers of Wollombi Brook and Monkey Creek Place and the typically saline and low yielding hard rock aquifers associated with the various coal seams.

BCC currently monitors 46 piezometers every two months for depth to water (refer to **Figure 7**). Groundwater from 35 of the piezometers is also monitored for pH and EC and twelve of the piezometers are sampled every six months and assessed for a range of analytes. The effectiveness of this monitoring network is reviewed annually and updated as required, with monitoring results also reported annually in the AEMR. All monitoring is conducted in accordance with:

- *AS 5667.11 – 1998 Water Quality Sampling – Guidance on Sampling of Ground Waters*; and
- *The Bulga Coal Complex Water Management Plan*.

Any exceedances are reported to the OEH and/or NOW and managed in accordance with the conditions of the current development consent.

Groundwater inflows to the underground operation are evaluated on a monthly basis and compared against the groundwater model predictions. If the groundwater inflows are inexplicably different to model predictions, investigations and/or corrective actions are initiated.

Water Balance

The BCC has a water balance model to assist in the management of water onsite. The water balance model is used to review performance and to undertake short term projections (12 months) of the water requirements. The water balance model is also used to predict water needs for the life of the mine. Major water transfers are monitored via a series of flow meters and water storage volumes are measured each fortnight. The water balance in 2010 for the BUO is summarised in **Table 3**.

Table 3 - Underground Operations water supply and waste water production 2010

Source	Raw water supply (ML)	Underground consumption (ML)	Incorporated into BCC dirty water system (ML)
Groundwater Seepage to Underground Operation	409	301	108
Water Re-circulated from the Goaf	226		
Hunter River	0	0	0
Captured Surface Water Run Off	113		113
Total	748	301	221

Of the 635 ML recovered from the BUO, 409 ML was calculated to be groundwater inflow. The groundwater inflow equates to approximately 1.12 ML/day which is close to the 2003 EIS groundwater model predictions of 1.1ML/day for the corresponding year 7 period.

The installation of a water filter in the BUO raw water supply system and modifications to the BFS Underground Mine raw water supply circuit, have negated the need to import water from the Hunter River. This has reduced the Hunter River water use from 190 ML during 2008 to nil during 2009 and 2010.

Potable water is supplied from the Singleton Council Broke Potable Water pipeline. Fire fighting water is supplied from the Beltana No.1 and BFS statutory fire fighting dams. A bitumen based product, Petrotac is used to mitigate dust generation on surface roads in an attempt to reduce raw water demand and road maintenance requirements.

As required by the current development consent, a detailed water balance for the BUO is reviewed annually as part of the AEMR process. The most recent review of the water balance conducted in 2010 demonstrated that the water balance reported in the 2003 EIS is consistent with the actual water movements and storage at the BCC.

2.8.7 Subsidence

All underground mining operations are required to have a Longwall Subsidence Management Plan approved by DTIRIS for secondary extraction. This is a condition of the current development consent. As detailed in **Section 6.2**, a *Mine Subsidence Predictions and Impact Assessment* has been prepared by MSEC (refer **Appendix 6**) in preparation for the Subsidence Management Plan (SMP) process. The SMP will include:

- Full details of the mining proposal including mining methods and layouts for extraction of coal in a safe and environmentally responsible manner;
- Demonstration that the proposed method of mining is efficient in terms of resource recovery and that any resources within the seams above and/or below the seam proposed to be mined are not sterilised;
- Full details of any surface and sub-surface features likely to be affected by mine subsidence including natural and man-made features (and known proposed developments) above/or below the proposed workings;
- Comprehensive assessment of subsidence effects on significant surface features;
- Pre-establishment and regular monitoring of subsidence survey locations;
- Notification of and consultation with landowners;
- Progressive repair of subsidence, including mitigation of surface cracking; and
- Comparison of monitored subsidence against modelled subsidence predictions. Should subsidence levels be outside the margins of error reported for subsidence predictions then a calibration of the model is undertaken, the subsidence predictions reviewed and landholders advised through the Private Property Subsidence Management Plan process, if impacts are greater than those identified in this EA.

In particular, specific subsidence management measures will be implemented in order to monitor and rectify potential damage to public utilities (telecommunication lines, electricity lines, public roads, underground pipelines and cables), agricultural infrastructure, watercourses, natural features, archaeological sites, heritage sites, survey marks and other surface infrastructure.

In addition to the above, the BCC have a series of existing Private Property SMP's for the various private properties located within the underground mining area. These SMP's will be updated and

implemented, as required, in accordance with the findings of this EA and in consultation with the relevant landowners.

Levels of subsidence are monitored on a regular basis (including real time survey monitoring and daily monitoring during longwall mining). Subsidence monitoring points are installed for the longwall panels (as required) and all mine subsidence is managed in accordance with the approved SMP to ensure all surface areas remain safe and serviceable. This includes the monitoring of olives and vineyards above the longwall panels before, during and after underground mining. Monitoring of remediation works at three-monthly intervals is also undertaken during the first six months after mining beneath the property and at six monthly intervals for the following year. Any monitoring and mitigation work undertaken is reported in the AEMR and reported to the Bulga Environmental Monitoring Committee on a six monthly basis.

2.8.8 Archaeology and Cultural Heritage

The archaeological values of the Project Area are well documented and addressed in a range of previous studies that have taken place at and around the BCC (refer to **Appendix 10**). Sites and relics of archaeological and heritage significance are currently managed in accordance with the *Aboriginal Cultural Heritage Management Plan* (ACHMP) and relevant permits under Section 90 of the National Parks and Wildlife Act, 1974. The ACHMP was reviewed in 2010 and updated in 2011 to develop a management plan that covers the whole BCC (surface and underground operations). This included the development of a Geographical Information System (GIS) database for all known sites and previously studied sites. This revised ACHMP has been supplied to the relevant stakeholders for comment and consultation and is in the process of being finalised for submission to the DP&I for approval.

The ACHMP is continually updated as operations at the BCC progress. The ACHMP will again be updated, in consultation with the Aboriginal community groups, to include managing the impacts resulting from the Project.

2.8.9 Flora and Fauna

Impacts on flora and fauna at the BCC are currently managed in accordance with the *Flora and Fauna Management Plan*, as required by the current development consent. The following environmental management measures that are documented in this plan are currently implemented over the life of the BCC.

- Management of remnant vegetation to provide fauna habitat;
- Restriction of vegetation clearance and minimisation of impacts on surrounding vegetation;
- Noxious weed and feral animal control;
- Strategies to minimise the loss of ecologically significant vegetation communities from the BCC;
- A clearing protocol which details methods of tree hollow and nest relocation;
- Procedures to follow if a threatened species, which has not previously been recorded on site or assessed, is encountered during construction or operation activities within the BCC;
- Provision of riparian and aquatic vegetation to provide temporary amphibian and reptile habitat during remediation of drainage lines above the underground mining areas;

- Principles for vegetation rehabilitation with endemic species, causing minimal disturbance to surrounding vegetation, and establishment of groundcover to prevent erosion;
- Establishment of the identified vegetation corridors within the BCC, as well as the management and conservation of the Warkworth Sands Woodland area; and
- Maintenance of revegetated areas until established to the satisfaction of DP&I.

Monitoring of flora and fauna at the BCC takes place in accordance with the *Flora and Fauna Management Plan* annually. This includes monitoring of revegetation, remnant vegetation, riparian habitats and changes to ecological habitats. Monitoring methods targeting threatened flora and fauna species are also described in the Plan. Flora and fauna monitoring results are reported annually in the AEMR.

The *Flora and Fauna Management Plan* will be updated to include managing the impacts on flora and fauna impacts resulting from the Project.

2.9 Visual Mitigation, Rehabilitation and Final Landform

Visual impacts of the BCC are minimised in accordance with the *Bulga Coal Complex Landscape Management Plan* and the *Bulga Complex Lighting Management Plan*. Visual mitigation is achieved through the use of bunding and tree planting along public roads and the selective placement of facilities and lighting. Personnel and materials infrastructure is placed below ground level wherever possible, to reduce the impact of light on surrounding residences and road users. New buildings and infrastructure are designed to be aesthetically pleasing in colour and to provide minimal visual impact.

Rehabilitation of the BCC is undertaken in accordance with the *Bulga Coal Complex Landscape Management Plan*. Rehabilitation consists of repairing shallow depth of cover subsidence impacts with the land being returned to pre-mining agricultural land capability of Class VI. Due to the underground nature of the operation, surface disturbance and the need for rehabilitation (particularly revegetation) is relatively minor compared to open cut mines. Areas requiring rehabilitation throughout the life of the mine currently include:

- Subsidence crack remediation;
- Landscaping relevant areas within the infrastructure site and other surface facilities;
- Rehabilitating disturbed ground around gas wells and along access tracks;
- Screening key areas of operations with vegetation and bunding; and
- Maintenance of rehabilitated areas.

Whilst the progressive rehabilitation requirements are generally minimal, BCC continues to undertake specific rehabilitation projects as mining progresses. For example, any area subject to mine induced subsidence is surveyed and monitored during coal extraction. Where substantial cracking occurs, or damage to public infrastructure occurs, BCC undertake necessary remedial works.

2.10 Waste Management

Waste management is undertaken in accordance with the regulatory requirements of the POEO Act as well as the *Bulga Coal Complex Waste Management Plan*. This includes mechanisms to:

- Comply with the conditions of the BUO and BSO development consents, the shared EPL and waste management legislation;

- Identify all types and quantities of waste generated;
- Minimise waste generation and encourage recycling of waste streams where possible;
- Undertake appropriate segregation, storage, transportation and disposal of waste generated;
- Effectively manage hydrocarbons, wastewater and sewage; and
- Provide education and training programs to site personnel and contractors regarding waste minimisation measures, waste handling and disposal.

Strategies to manage the major types of waste produced at the BCC are discussed below.

Sewage Treatment and Disposal

Sewage generated by the BUO is pumped to an extended aeration sewage treatment plant located at the BFS Underground Mine pit top facilities. The treated overflow then reports to the tailings dam.

Oil and Grease Containment and Disposal

BCC has ongoing contracts for the supply, removal and recycling of oils.

The BUO use bulk oil wherever possible to reduce the quantity of oil drums on-site. Oil for the underground is delivered in either 1,000 litre pods or 20 litre drums and stacked inside bunded areas. Empty drums are returned to the surface and removed. Waste solsenic oil is removed for disposal at a licensed facility.

Rubbish Disposal

All rubbish disposal associated with the BUO is undertaken in accordance with the *Bulga Complex Waste Management Plan*. Waste is removed by a licensed contractor and where appropriate recycled.

The main materials that are recycled include steel, paper, plastics and batteries. During 2010, 76% of waste produced by the BUO that was removed from site was recycled. This was an improvement of 8% from 2009. The BUO has implemented a recycling target of 55%, which was exceeded during every month of 2010.

2.11 Hazardous Materials Management

All hazardous and dangerous goods associated with the BUO are stored and labelled in accordance with AS1940 – 1993 – ‘*The Storage and Handling of Flammable and Combustible Liquids*’ (AS1940 – 1993) and the requirements of the Dangerous Goods Licence. An audit on the storage of hydrocarbons across the BUO was undertaken in 2010, with recommendations from this audit adopted in 2011.

A register containing Material Safety Data Sheets (MSDS) for all hazardous substances used and stored on site is maintained at Mine Support Office. Procedures for the purchase, handling, usage, storage, labelling and disposal of hazardous substances have been developed throughout the site and are communicated to employees and contractors.

Hazardous waste requires written agreements with a licensed waste transporter for the transportation of hazardous waste for disposal at a suitably licensed facility.

2.12 Spontaneous Combustion

The coal mined at BCC within the Wittingham coal measures, including the Blakefield seam, has a low to moderate propensity for spontaneous combustion, due to the low pyrite content of the coal reserve. In any event, BCC operates a *Spontaneous Combustion Management Plan* for the operation which details how the underground operation will be monitored and managed in relation to spontaneous combustion, and sets out procedures to follow in the event of an incident. In addition, as part of the currently approved SMP, BCC has committed to repairing any spontaneous combustion outbreaks that are exacerbated by cracking potentially caused by longwall mining.

2.13 Environmental Performance

The implementation of the site Environmental Management Plans and integration of Xstrata's 17 Sustainable Development Standards remains a focus for environmental management at the BCC. Review of existing documentation and updating to reflect the corporate requirements is regularly undertaken, with actions from internal and external audits being carried out as required. The environmental performance relating to the mining activities of the BUO during the 2010 reporting period is provided in the AEMR. A summary of the existing operational environmental performance in the key environmental areas is provided below.

2.13.1 Air Quality

The air quality monitoring locations are divided into those on mine owned land around the operations ('onsite locations') and offsite locations. As required by the development consent conditions, an exceedance is reported if it occurs at an offsite location. During the most recent reporting period, annual averages for all gauge locations were in compliance with the annual average criteria of $30\mu\text{g}/\text{m}^3$ and $90\mu\text{g}/\text{m}^3$ (100th percentile) for PM_{10} and TSP respectively. There were no exceedances of the long term impact assessment criteria for particulate matter or the long term land acquisition criteria for particulate matter.

Monitoring data recorded at the BCC also showed that cumulative air quality complied with the maximum 24-hour PM_{10} criteria referred to in the development consent. There was one exceedance associated with depositional dust at gauge E1. The year to date annual average at E1 was $4\text{g}/\text{m}^2/\text{month}$, which exceeded the adopted incremental dust criteria of $3.7\text{g}/\text{m}^2/\text{month}$. This gauge is located east of the BSO on federally owned defence land and there are no residential sensitive receptors at this location, or within several kilometres. The elevated levels monitored in E1 were as a result of the construction of the CHPP 3,000 ML mine water storage dam located immediately adjacent to the gauge.

2.13.2 Noise Environment

The BCC complied with noise limits applicable at all monitoring locations during the most recent reporting period, with the exception of 23 August 2010 when a $\text{LA}_{10}(15\text{ min})$ of 41 dB exceeded the relevant criterion by 1 dB, at the Russell residence (Receptor 217). According to the *Bulga Coal Surface Operations Environmental Noise Monitoring, Quarter 3 2010* (Global Acoustics), on the 23 August at the Russell residence monitoring location an exhaust, engine and fan noise continuum from the BSO was audible throughout the measurement and was primarily responsible for the LA_{eq} of 41 dB.

2.13.3 Surface Water

The implementation of the various management measures and the monitoring system have effectively resulted in the BCC having no surface water related exceedances during the 2010 reporting period. Monitoring of surface water quality during the reporting period was undertaken for a variety of parameters. Results for the BCC remained within historical ranges at all monitoring locations with the

exception of two elevated results for TSS. These results were recorded at monitoring locations LR5 and W8.

The elevated result at LR5 was taken from a shallow pool of water as a result of no surface flow at this time. Elevated TSS was most likely a direct result of concentrated pooled water. Samples taken after this spike have demonstrated that the TSS level has returned to previously observed levels.

The elevated result at W8 was recorded following levels of high rainfall in the preceding days which is likely to have flushed (normally) ponded sediments in the ephemeral stream.

During the reporting period, controlled water discharges from the BCC were undertaken in accordance with relevant assessment criteria. Criteria used to estimate whether water was able to be discharged and the volume of water able to be discharged in a single event included electrical conductivity (EC), pH and TSS. Discharges occurring under the HRSTS are licensed at three separate locations on site, being Dam 3 (Swan Lake), Fill Point 2 (Dam 9) and Dam 13. Discharges during 2010 were released exclusively from Swan Lake. The EPL for the BCC requires the discharge from the dams to be monitored during discharge events. The EPL requires that BCC monitors for pH and TSS on all discharges and stipulates criteria for pH (6.5–9.5) and TSS (120 mg/L).

There were fifteen discharge events from Dam 3 (Swan Lake) during the reporting period, with discharges occurring throughout the year (July, August, November and December). The limit of 55ML/day was not exceeded during the reporting period, with discharges remaining well below the criteria (maximum of 22.6ML/day). TSS and pH levels in all discharges were compliant with the required criteria

2.13.4 Erosion and Sediment

The implementation of the monitoring system and associated management measures implemented in accordance with the approved *SWMP* and *Sediment and Erosion Control Plan* resulted in no erosion and/or sediment control related exceedances at the BCC for the 2010 reporting period. Inspections were conducted following rainfall events. Any issues observed during these events were subsequently assigned corrective actions, including rehabilitation, stabilisation of sediment dams and hydromulching. Dams in undisturbed areas were also monitored and compared against the 50mg/L limit in the *Managing Urban Stormwater: Soils and Construction Manual* and background levels contained in the relevant Environmental Assessments.

2.13.5 Groundwater

The groundwater monitoring results recorded during the reporting period demonstrated that pH and EC were generally within the range of observed historical results at all monitoring locations. None of the impact triggers, contained in the approved BCC Environmental Monitoring Program, were reached.

Depth to water values were generally consistent with historical ranges at all monitoring locations throughout the BCC, with the exception of WBR180 (shallow coal measures). This monitoring location experienced a predicted increase in depth to water as a result of the mining of longwall 13 at Beltana No. 1 Underground Mine.

No adverse impacts on the alluvial aquifer systems have been identified to date.

2.13.6 Subsidence

Subsidence monitoring continued during the reporting period against the predicted levels for the Beltana No.1 and BFS Underground Mines. Survey data collected during 2010 on 6 lines over Beltana No.1 and 8 over BFS was supplied to MSEC to evaluate the observed subsidence and

provide expert opinion as to the accuracy of the predictions and adequacy of the management strategies in place.

The observed maximum incremental subsidence for Beltana No. 1 Longwall 13 and 14 generally showed good correlation with the predicted values. Irregular subsidence, tilt and strain was observed under shallow depths of cover and on some occasions exceeded the predicted values, however such an occurrence has been acknowledged in the BUO 2003 EIS and SMP and can be expected in shallow mining conditions.

The observed maximum incremental subsidence for BFS Longwall 1 was generally within the range of movements predicted. Observed exceedances of the predicted subsidence, tilt and strain were either isolated local occurrences or outside of the main gate edge of the longwall. Observed subsidence varied along the lengths of the monitoring lines due to the multi-seam nature of the mining, with locally increased subsidence observed adjacent to the overlying Whybrow chain pillars, and locally decreased subsidence observed above the Whybrow chain pillars.

The observed incremental subsidence for the real time monitoring lines were within the range of predicted values over the length of the monitoring line, with isolated local exceedances. The majority of subsidence development was observed after the longwall face had progressed between 30m and 110m beyond the monitoring point, or between 0.15 and 0.65 times the depth of cover.

The effective implementation of management measures and the subsidence monitoring system resulted in no subsidence related incidents or complaints during the 2010 reporting period.

2.13.7 Archaeology and Cultural Heritage

During the 2010 reporting period all activities relating to the management of archaeological and cultural heritage items at the BCC were effectively undertaken in accordance with the approved *ACHMP*. The effective implementation of the monitoring strategy and management measures outlined in the *ACHMP*, resulted in no archaeological or heritage related incidents, complaints or non compliance at the BCC during the reporting period.

The BUO completed an application for an Aboriginal Heritage Impact Permit (AHIP), in consultation with relevant Registered Aboriginal Parties. This AHIP was completed for sites that may be impacted by subsidence associated with BFS Longwalls 1 – 6. AHIP#3301 was issued by the then DECCW on 14 July 2010 and took a staged approach in determining the need for salvage of sites. Under AHIP#3301, eleven sites located in the BFS Longwall 1 - 2 area were subject to salvage in the form of surface collection. Artefacts collected were salvaged via systematic excavation, with subsequent analysis and reporting in accordance with the conditions of AHIP#3301.

2.13.8 Flora and Fauna

The management measures (including weed and pest management) and monitoring system implemented at the BCC during the most recent reporting period has effectively prevented any flora and fauna related incidents. All activities relating to the management of flora and fauna species undertaken at the BCC are done so in accordance with the approved *Flora and Fauna Management Plan*, which is continually updated to include the recommendations of the annual monitoring programs.

3.0 DESCRIPTION OF THE PROPOSED MODIFICATION

3.1 Overview

As outlined in **Section 3, Table 4** and illustrated in **Figure 4**, the proposed Project consists of the following.

- Realigned longwall layout, including expansion of the longwall extraction width up to the previously approved 400 metres;
- Increased pre and post-mining gas drainage infrastructure above the longwall panels (similar to that employed at the BFS Underground Mine);
- Construction of a gas drainage plant at the top of the BSO Whybrow open cut highwall, including goaf plant, gas compressors, workshop, offices, hardstand areas, buried pipelines and associated infrastructure. Five goaf extraction unit flares and five pre-mining gas drainage flares (already approved) are to be relocated to this proposed gas drainage plant;
- Modified mine ventilation, including the relocation of the two currently approved ventilation fans to the base of the open cut highwall within a new access slot (*Note: The new access slot is to be created as part of the Western Extension Modification – see **Section 1.4.2** and does not form part of this Project*);
- Changed coal clearance infrastructure for the clearance of development coal only, through the trucking of coal to the existing BFS ROM stockpile;
- The construction of a small-scale power generation plant (up to 32MW), and associated pipeline, pipeline maintenance facility and ancillary infrastructure, to manage the increased methane production from gas drainage included within this Project (two scenarios of either a 32MW (Scenario 1) or 30MW (Scenario 2) power plant were modelled). This includes overhead powerlines, five new gas flares and potentially transformers and switch yards; and
- Ongoing exploration activities at the BUO during the life of the BFN Underground Mine.

The BUO currently employs around 530 full time employees, with employment growth occurring organically from around 300 employees in 2006 to around 530 in 2010 (see **Section 2.2.5**). As DA 376-8-2003 only approves 300 employees at the BUO, the Project also seeks to regularise the current number of full time employees at the BUO.

These modifications are discussed in further detail in **Sections 3.2 to 3.11**. Timing of the Project is to be in accordance with approved Life of Mine (LOM) planning.

A comparison between currently approved operations and the modification proposed and detailed in this EA is presented in **Table 4**.

Table 4 – Proposed Modification to DA 376-8-2003

Approved Operations	Proposed Modifications
<u>Conceptual Mine Plan</u> Mining of the Blakefield Seam in the BFN Underground Mine in accordance with the conceptual plans in Figures 3.6 to 3.9 of the 2003 EIS. Twelve longwall panels being BB1 to BB12.	Realignment of the longwall panel layout outside of the approved footprint in certain areas. Reduction in the number of longwall panels to be extracted from twelve to seven, being BNLW1-7 (achieved through the expansion of the longwall

Approved Operations	Proposed Modifications
Longwall panel widths of up to 400m. Annual production of the continued underground operations at a maximum annual rate of 14Mtpa till 2031.	extraction width up to the previously approved 400 metres). No change to maximum annual production rate.
<u>Mine Lease and Development Consent Boundaries</u> All works approved within the Mining Lease area (ML 1547, ML1494 and ML1674) and Development Consent boundary (DA 376-8-2003).	All works within the approved Mining Lease and Development consent boundary apart from the following: • Small scale power plant and service infrastructure; and • Part of the directional drilled and buried gas pipeline leading to the power plant. The above infrastructure will be located on BCC owned land, but outside the Mining Lease and existing Development Consent boundary.
<u>Mine Access</u> Entry into the underground mining area via portals in the base of the existing Bulga Pit within the BSO.	None. (<i>Note: A new mine access slot is to be created as part of the Western Extension Modification – see Section 1.4.2 and does not form part of this Project</i>).
<u>Mining Sequence</u> Mining in accordance with the conceptual plans in Figures 3.5 to 3.9 of the 2003 EIS. The 2003 EIS identified approximately 198 Mt of recoverable coal reserves in the mining area to be mined at a maximum annual rate of 14 million tonnes of ROM coal. Conceptual mine plans in 2003 EIS show that mining in the Blakefield seam is predicted to begin between Years 2-8 (2005-2011) for longwalls 1-5 and between Years 14-21 (2017-2024) for longwalls 6-12.	Extension of some Longwall blocks and the main heading roadways outside the 2003 EIS conceptual mine plan footprint but within the development consent boundary. Mining of approved BFN Longwalls BB1-5 has already partially occurred as part of the open cut operations. The proposed modification will result in longwall mining (mainly Longwalls BB6-12 – now BNLW1-7) commencing in approximately Year 14 (2017) with completion around Year 19 (2022).
<u>Conveyor, ROM Stockpile and Associated Infrastructure</u> During the development phase of each longwall panel, development coal would be hauled to the CHPP in trucks whilst conveyors are constructed. During these periods ROM coal would be stockpiled on the floor of the pit in small stockpiles with approximate dimensions of 15m high, 30,000 tonne ROM coal capacity. ROM would be reclaimed from stockpiles by front end loader and loaded into dump trucks for transfer to the CHPP along existing haul roads used by the BSO. During longwall mining, a new in-pit conveyor, a new 150,000 tonne ROM coal stockpile in the Bulga Pit as well as an overland conveyor from the ROM stockpile to the CHPP would be provided. Coal mined in the BFN Underground Mine would be transferred via an underground conveyor and the in-pit conveyor to the new ROM coal stockpile in the Bulga pit. It would then be transported to the CHPP via the proposed overland conveyor. The BFS MOD No.3 gained approval for the relocation of an in-pit ROM coal stockpile facility from within the Bulga Pit to the east side of Broke Rd (Figure 3). This 400,000 tonne stockpile facility has been designed to service all future underground mining.	No significant change to coal clearance during the development phase. ROM coal would be stockpiled from the in-pit conveyor on the floor of the pit in small stockpiles with approximate dimensions of 15m high, 30,000 tonne ROM coal capacity. ROM would be reclaimed from stockpiles by front end loader and loaded into haul trucks for transfer to the existing Blakefield South ROM stockpile (using existing BSO haul roads), before being transported to the CHPP via the existing conveyor system. (<i>Note: Truck haulage will cease once a new overland conveyor system is established as part of the BOP (see Section 1.4.3). The BOP will provide a new overland conveyor for coal haulage from the BFN Underground Mine workings to the BFS Underground Mine coal stockpile. The route of this conveyor will be finalised as part of the BOP as it will be dependent upon the realignment of Broke Road which will be confirmed in the BOP</i>).

Approved Operations	Proposed Modifications
<u>Relocation of Ventilation Shafts</u> The 2003 EIS identified that a number of ventilation fans would be located in the new underground access adits in the Whybrow Pit and Bulga Pit and fans would be relocated throughout the life of the Project as required. This ventilation strategy was amended by MOD No. 3 (2007) to DA 376-8-2003 (see Section 2.1.2) as highwall access to the Blakefield seam would not be available due to the bringing forward of mining in the seam. MOD No.3 provided for the proposed ventilation fans in the Bulga Pit to be relocated to the BFS mining area.	Relocation of the two currently approved ventilation fans to the base of the open cut highwall. <i>[Note: These fans will be located within the new mine access slot that is to be provided as part of the Western Extension Modification (see Section 1.4.2)].</i>
<u>Provision of Gas Drainage Infrastructure</u> Pre and post mining gas drainage infrastructure (gas wells, pipelines, drill pads, power lines, access roads etc.) located above the longwall panels. One pre-drainage or in-seam borehole installed for every longwall panel. This was increased to up to 4 SIS gas wells for each longwall panel as per MOD No. 3 in 2007 for the BFS Underground Mine). The pre-drainage hole would be drilled during the development phase and be periodically relocated. Post drainage goaf-holes would be drilled for each active longwall panel with there generally being three active at any time. The exact spacing of the goaf holes would depend on the gas content of the coal seams. Flares to be constructed for gas drainage management as required. Gas drainage infrastructure and plant to be relocated during the life of the Project as required.	Increased pre and post-mining gas drainage infrastructure above the longwall panels (similar to that employed at the BFS Underground Mine). This would include SIS wells, vertical wells (both pre- and post-mining) and associated buried pipelines, drill pads, power lines and access roads. The final arrangement of pre and post mining gas drainage wells would be dependent on the progress of mine development. Between 6 and 20 gas drainage wells per longwall panel are anticipated, based on similar measures undertaken at the BFS Underground Mine (i.e. at around 150m spacing the number of goaf wells will depend upon the length of the longwall panels). Both pre and post gas drainage wells may be drilled in advance of mining. The conceptual gas drainage layout for all BFN longwalls is shown in Figure 8. Construction of a gas drainage plant at the top of the Whybrow highwall, including goaf vacuum plant, gas compressors, workshop, offices, hardstand areas, buried pipelines and associated infrastructure (<i>Note: This includes up to 5 pre-mining gas drainage flares and 5 goaf gas flares which are to be relocated from the BFS Underground Mine. These flares do not form part of this Project.</i>
<u>Power Generation</u> Methane drained from the coal seams and goafs via bore holes connected to gas drainage plants on the surface would be converted to carbon dioxide by combustion (flaring), unless a beneficial use could be found for the gas.	Construction of a small-scale gas generated power plant (up to 32MW) including a gas pipeline (potentially bored and underground), pipeline maintenance facility and associated infrastructure (including five flares, powerline infrastructure and potentially a transformer, switch yard, etc), to manage the increased methane production from gas drainage.
<u>Exploration Activities</u> Exploration activities regularly undertaken as part of ongoing underground mining operations at the BCC in accordance with the requirements of the Mining Act and relevant mining authorisations listed in Table 1. Exploration activities not explicitly referred to in the 2003 EIS.	Exploration activities to be undertaken at the BUO in accordance with the requirements of the Mining Act and the relevant mining authorisations listed in Table 1.
<u>Operational Workforce</u> Employment opportunities would be provided for up to approximately 300 personnel (including CHPP).	Regularise the current 530 full time employees at the BUO (including CHPP personnel) (see Section 2.2.5).

3.2 Changes to Mine Plan

3.2.1 Underground Mine Layout

As detailed in **Section 2.1.2**, BUO was granted development consent to mine “via underground methods” within the Whybrow, Blakefield, Glen Munro and Woodlands Hill seams for a period of approximately 27 years. The approved mine plan for the BFN Underground Mine is illustrated in **Figure 6**. Mining is via retreat longwall and continuous mining methods. The BFN Underground Mine has approval for longwall panel extraction widths of 150 to 400 metres.

The conceptual mine plans contained in the 2003 EIS show mining in the BFN Underground Mine commencing in Years 2-8 (approximately 2005 to 2011) for longwalls 1-5 and between Years 14-21 (approximately 2017 to 2024) for longwalls 6-12. The 2003 EIS approved twelve longwall panels at widths of around 265m (with approval to extract at widths of up to 400 metres). The conceptual mine plan shows all mining in the Blakefield Seam (across all underground mining areas) being completed by Year 22 (around 2025). The conceptual mine plans were identified as being possibly subject to change but subject to approval in terms of mining layout and mining sequence due to improved understanding of geology, advances in mining technology, changes as a result of the review of impacts and interactions with the BSO.

The proposed revised mine plan for the BFN Underground Mine is illustrated in **Figure 4** and includes an extension and re-orientation of some longwall blocks and main heading roadways beyond the conceptual mine plan footprint identified in the 2003 EIS, but still within the currently approved development consent boundary. The revised BFN longwall layout is located directly beneath the already mined longwalls in the overlying Whybrow Seam.

The proposed changes to the mining layout and sequence are a result of improved understanding of the geology and geotechnical regime and interactions with the BSO. The number of longwalls proposed to be extracted in the BFN Underground Mine has been reduced from twelve to seven, which are now referred to as BFN Longwalls 1 to 7 (BNLW1 to BNLW7). The reduction in the number of longwall panels results from the panel extraction widths being as per the 400m width approved in the 2003 EIS.

Mining of approved BFN Longwalls BB1-5 has already partially occurred as part of the open cut operations. The Project will result in longwall mining (mainly approved Longwalls BB6-12 – now known as BNLW 1-7) commencing in approximately Year 14 (2017) with completion around Year 19 (2022). The revised mine plan will not result in changes to the existing coal production rates for the Blakefield Seam in the BFN Underground Mine. There will be no change to the approved annual ROM coal production rate for the BUO from the maximum of 14Mtpa. There will also be no change to the approved total coal mined at the BUO.

3.2.2 Mining Method

There will be no significant changes to the mining methods detailed in **Section 2.2**. The Project will use similar longwall mining methods, type of equipment and infrastructure already in use by BUO. No changes are proposed to the Coal Handling Preparation Plant (CHPP), approved operating hours, or approved mining methods. No extension or reduction to the life of the current development consent is proposed. There will be no change to the approved total coal mined at the BUO and the Project will not require any additional tailings or coarse rejects storage.

Notwithstanding, future developments in mine working methods will be investigated and will be employed where practicable. Environmental management practices will be utilised to contain the impacts of any future revised gas drainage activities to within the impact predictions anticipated in this Project.

3.2.3 Mine Access

No change to the approved mine access is proposed as part of this Project.

A new mine access slot for the BFN Underground Mine is to be created as part of the Western Extension Modification – see **Section 1.4.2**. This does not form part of this Project.

3.2.4 Subsidence

The number of longwalls proposed to be extracted in the Blakefield Seam has reduced from twelve to seven because the mine layout has changed from 265m wide panels to 400m wide panels (which is within the approved range of widths under the consent to DA 376-8-2003). The maximum predicted tilts and curvatures, based on the modified layout, are greater than those provided in the 2003 EIS (approved under the consent DA 376-8-2003). The reason for this increase is that the original layout had the longwall panels offset from those in the overlying Whybrow Seam, which provides flatter subsidence profiles (i.e. smaller tilts and curvatures). The modified layout includes some locations where the Blakefield Seam chain pillars are beneath the Whybrow Seam chain pillars.

As detailed in the Subsidence Assessment in **Appendix 6**, the potential impacts are expected to be similar to those previously observed resulting from the extraction of the overlying longwalls in the Whybrow Seam at the BFS and Beltana No. 1 underground mines.

Should the Project be approved, BUO would prepare and seek approval for a Subsidence Management Plan from the NSW DTIRIS, which would address the subsidence impacts relating to the Project. A revised Mining Operations Plan (MOP) would also be submitted.

3.3 Mine Infrastructure and Surface Facilities

3.3.1 Introduction

The Project does not propose to significantly change the surface facilities at BUO as summarised in **Section 3.1** and illustrated in **Figure 4**. The Project would involve the construction of a small scale power plant and gas drainage plant to improve gas drainage and management, as well as the relocation of the two approved ventilation fans. The proposed changes to mine infrastructure and surface facilities are described in the sections below.

3.3.2 Product Handling and Transportation

As summarised in **Table 4**, no significant change to coal clearance during the development phase is proposed. ROM coal would still be stockpiled, from the in-pit conveyor on the floor of the pit, in stockpiles. ROM coal would then be reclaimed from stockpiles by front end loader and loaded into haul trucks for transfer to the existing BFS ROM stockpile. Existing BSO haul roads would be used to transport coal to the BFS ROM stockpile and the trucks would need to travel around 6km on these unsealed haul roads (see **Figure 4**). From this point, coal would be transported to the CHPP via the existing conveyor system.

Truck haulage would cease once a new overland conveyor system is established as part of the BOP (see **Section 1.4.3**). The BOP will provide a new overland conveyor for coal haulage from the BFN Underground Mine workings to the BFS Underground Mine coal stockpile. The route of this conveyor will be finalised as part of the BOP as it dependent upon the realignment of Broke Road which also forms part of the BOP.

3.3.3 Handling, Preparation and Stockpiles

No changes are proposed to the current coal handling, preparation or stockpile procedures to the existing operations. Development coal would be stockpiled at both the approved in-pit stockpiles and then later at the existing BFS stockpile. Following completion of the development phase as well as the BOP, coal would be stockpiled at the existing BFS stockpile.

3.3.4 Land Preparation

Additional land preparation would be required to enable the installation of drill pads for gas drainage wells, gas drainage pipelines, access tracks and power lines. The gas drainage plant on the Whybrow highwall (gas compressor, flares, goaf plant, office, and hardstand areas) would also require some land preparation of a predominantly disturbed area.

Land preparation is also required for construction of the proposed small-scale power generation plant and associated infrastructure such as access tracks, flares, power lines and pipeline maintenance facility. The site of the proposed power plant comprises cleared land previously used for grazing.

The proposed locations for this infrastructure are illustrated in **Figure 4**.

3.3.5 Ventilation and Gas Drainage

Ventilation

The 2003 EIS identifies the need for a number of ventilation fans located in the access adits within the Whybrow and Bulga Pits, with further fans to be relocated as required throughout the life of the mine. It is proposed to modify this slightly by relocating the approved location of the two approved ventilation fans to the base of the Whybrow highwall. These would be located within a future access slot opening that would be cut into the Whybrow Pit as part of the Western Extension Modification (see **Section 1.4.2**).

The two ventilation fans would be located at the base of the highwall (see **Figure 4**). These fans would be similar to those currently in use at the BFS Underground mine (refer to **Plate 7**). Each fan installation would consist of three axial or centrifugal fans in parallel with speed control (generally ventilation requirements are met by two fans, with the third fan acting as an operational spare). The downcast and upcast shafts would be approximately 6 metres in diameter and each fan would have a maximum height of around 20 metres. Each fan site pad would comprise an area of approximately 70 metres x 85 metres. Both ventilation fans would be able to be operated in both upcast and downcast modes, as required. The fan installation would have a maximum upcast and downcast volumetric flow rate capacity of around 600 m³/s.



Plate 7 – Existing upcast ventilation fan at Blakefield South Underground Mine.

Access to the fans would be from existing internal mine access roads. Power would be supplied to the ventilation fans from the existing power supply lines that currently supply the BSO operations. Some additional power lines and associated infrastructure may be required to provide power to the facilities.

All the proposed ventilation fans would be located on BJV owned property.

Gas Drainage

The 2003 EIS identified that methane gas would need to be drained from the mine workings in the Blakefield, Glen Munro and Woodlands Hill seams to maintain a safe working environment, using a combination of pre and post gas drainage techniques. The 2003 EIS identified that gas would be drained from the coal seams and goaves via bore holes connected to gas drainage plants on the surface. The methane would be converted to carbon dioxide by combustion (flaring) unless a beneficial use could be found for the gas. The 2003 EIS also discussed how the BCC were undertaking feasibility studies regarding the options for utilising methane liberated during the mining process.

As outlined in **Table 4**, the 2003 EIS discussed the need for one pre-drainage or in-seam bore and approximately three active post drainage goaf bores for each active longwall panel, with the exact spacing and location of gas drainage bores to be subject to mining layout and conditions. This was increased to up to four SIS gas wells for each longwall panel as per MOD No. 3 in 2007 for the BFS Underground Mine (see **Section 2.1.2**). The existing BUO approval also includes both the construction of gas flares for gas drainage management as well as gas drainage infrastructure and plant being relocated during the life of the Project as required.

As detailed in **Section 2.3**, improvements in drilling technology have allowed the BUO to adopt SIS drilling for mine gas, as well as conventional underground gas drainage drilling. SIS drilling, combined with the use of vertical pre-drainage wells, allows gas drainage to be undertaken from the surface, providing a safer working environment and more efficient mining. A description of the improved gas drainage provisions currently in place at the BFS Underground Mine is provided in **Section 2.3.3**. More effective gas drainage has enabled a higher proportion of seam methane to be captured for flaring and beneficial use in the power plant recently constructed, rather than flowing into the mine ventilation circuit and subsequently venting to the atmosphere.

It is proposed that gas drainage methods similar to those currently approved and used at BFS also be used at the BFN Underground Mine. The proposed gas drainage infrastructure would include the following:

- Pre-mining and post-mining gas wells with access tracks, power line infrastructure and drill pads located above the longwall panels. It is proposed that up to four horizontal SIS gas wells would be drilled outside of the chain-pillar gate roads for each longwall panel to reduce the gas content of the mining seam to levels that would allow safe and efficient mining operations. The SIS boreholes would generally be located parallel to the longwall panels and would be drilled from the surface at the eastern end of the longwall panels into the Blakefield coal seam by directional drilling methods. Vertical wells for pre gas drainage would be drilled in advance of mining and subsequently intersected with the horizontal wells and would typically be located along the western end of the longwall panels. Vertical goaf wells for post mining drainage would also be installed along the longwall panels at approximately 150 m spacing, as mining progresses (see **Plate 9**). Between 6 and 20 vertical wells per longwall panel are anticipated, based on similar arrangements at the BFS Underground Mine (depending upon the length of the longwall). The conceptual gas drainage infrastructure layout for all BFN longwalls is shown in **Figure 8**.
- Various gas well drill pads. A drill pad of approximately 80m x 80m is required for each SIS well and a drill pad of around 40 m x 40 m is required for each vertical well. These pads would include a sump for containment of drill cuttings during sinking of the well. The drill cuttings would be removed and disposed of with coal rejects in the approved emplacement area. The sump would be filled in, compacted, shaped and seeded once installation of the well is complete. Only a portion of the goaf drainage wells would be operational at any one time. Once the goaf wells become redundant the infrastructure would be removed, the bore sealed and the site rehabilitated. Additionally, to improve capture of fugitive emissions of methane from seams above and below the target mining seam, the mine may use some goaf wells to drain gas both pre and post mining. The conceptual gas drainage infrastructure layout for all BFN longwalls is shown in **Figure 8**. The ultimate location of the gas drainage infrastructure would be dependent on the effectiveness of the various configurations and potential identification of additional constraints (eg. Aboriginal heritage and ecology).
- Gas drainage plant and associated surface infrastructure at the top of the Whybrow highwall (refer to **Figure 9**). The proposed gas drainage plant would be similar to the existing goaf gas drainage plant currently under construction at the BFS Underground Mine (see **Plate 8**). The gas drainage plant would comprise gas flares, goaf gas vacuum pumps, gas compressors, office, workshop and associated hardstand areas. The infrastructure at this gas drainage plant would be used to draw and compress gas from the mine workings prior to being piped to the proposed power plant (see **Section 3.3.6** and **Figure 10**). Some gas drainage surface infrastructure from the Blakefield South workings would be relocated and used at Blakefield North. As the gas is not produced at a constant rate, excess methane would continue to be flared at the gas drainage plant to reduce GHG emissions. A total of up to 10 flares is proposed at the gas drainage plant, however, the BUO has existing approval to construct flares for gas drainage management and therefore these flares do not form part of the Project. (*Note: This includes five pre-mining gas drainage flares and five goaf gas flares which are approved and are to be relocated from the BFS Underground Mine*). Each pre-mining gas drainage flare would have a capacity of approximately 900 litres of methane per second. Each goaf gas flare would have a capacity of 1,800 litres of methane per second. Longwall goaf drainage from the BFN Underground Mine is expected to be at a rate of between 2,000L/sec and 4,000L/sec of methane (depending on coal production rates).
- 5-10 kilometres of buried gas pipeline above the longwalls to deliver gas from the proposed gas drainage wells to the proposed gas drainage plant at the top of the Whybrow highwall.
- Electrical supply lines to provide a power supply to the drilling rigs and vertical gas wells as required. Where possible existing power lines would be used. A conceptual configuration of

overhead power line infrastructure which could service the gas drainage drilling gas wells is shown in **Figures 4 and 8**. Any additional new lines would be overhead except in highly visible areas where they would be run underground.

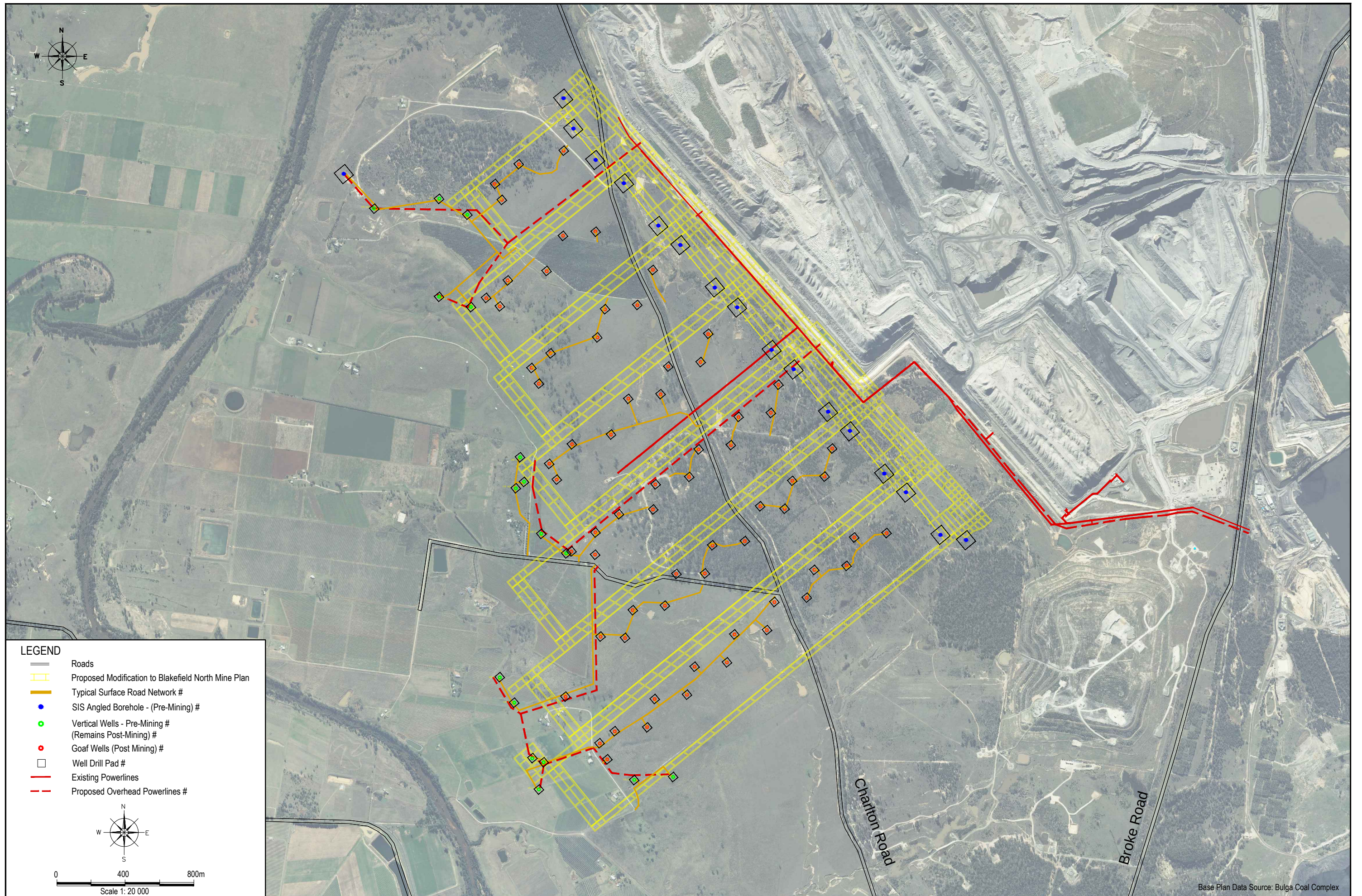
The processes and technology used for gas drainage infrastructure are constantly being improved and modified for greater efficiency and to provide improved underground mine safety. Future developments in gas drainage and capture technology and working methods will be investigated and will be employed where practicable. Environmental management practices will be utilised to contain the impacts of any future revised gas drainage activities to within the impact predictions anticipated in this Project.



Plate 8 – Goaf Gas Drainage Plant at BFS Underground Mine under construction.

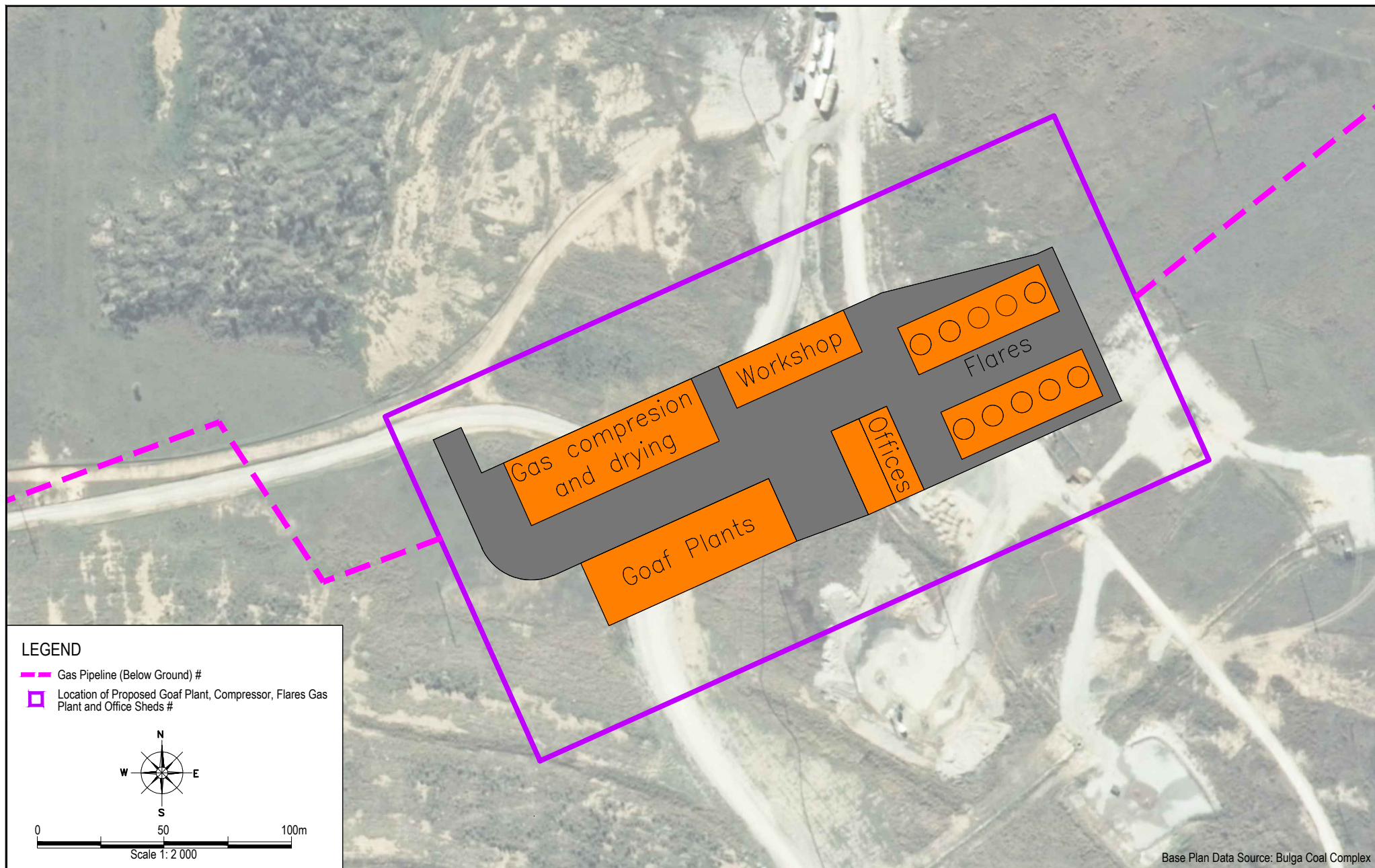


Plate 9 – Goaf Well above a longwall panel at the BFS Underground Mine.



To be printed A3

* Buried Pipelines Between Wells Not Shown
Indicative Locations will be finalised pending constraints



To be printed A4

All indicative locations will be finalised pending constraints



To be printed A4

All indicative locations and configurations - will be finalised pending constraints

The existing and approved BFS Underground Mine infrastructure would be re-located and re-used where possible at the BFN Underground Mine. All gas drainage pipelines would be buried beneath an earth bund which is spread with pasture seed mix. The BCC implements the *Pipeline Rehabilitation Procedure* to standardise the rehabilitation process. **Plate 10** shows a pipeline near Broke and Charlton Road that has been seeded and spread with hay to encourage germination and surface cover on disturbed areas. **Plate 11** shows the same location at a later date with observed successful seed germination and stabilisation of the disturbed area.



Plate 10 – Before Seed Mix Application



Plate 11 – After Seed Mix Application

The vertical drainage wells would be progressively sealed and rehabilitated, as per DTIRIS requirements, when no longer required. It is anticipated that as the mine progresses, the goaf wells would continue operating in the two previous panels, after which they would be sealed and the land

rehabilitated. The post-mining gas wells would typically be in place for two to three years after mining has been completed in each panel.

3.3.6 Small Scale Power Generation

The BFN Underground Mine would experience similarly high levels of methane as the existing BFS Underground Mine. With methane being over 21 times more potent as a GHG than carbon dioxide, it is proposed to construct a small scale gas fired power generation plant to reduce the GHG emissions associated with the underground mining operations. This would result in a net GHG benefit compared to approved operations by using the captured methane to produce electricity and offset electricity purchased from the main power grid.

The small scale power generation plant would be established on land previously cleared for agricultural purposes north west of the BCC administrative offices and CHPP (refer **Figure 10**). The site comprises around 1.25ha of land (100 metres x 125 metres) directly to the north of the main internal access road leading from Broke Road to the BCC administration building. The internal access road would provide access to the site. The power plant site is located on land owned by the BJV, however, comprises land that is located outside of the Mining Lease 1547 boundary and Development Consent DA 376-8-2003 boundary.

Gas fired reciprocating engine generator units are proposed to be installed to generate up to 32MW of power using gas drained from the pre and post mining gas drainage systems at the BFN Underground Mine. Either ten 3MW generator units (generating up to 30MW) or eight 4MW units (generating up to 32MW) would be installed in stages as the gas drainage program for the mine proceeds. The power generated from the facility would be used to power BCC with any surplus power fed back into the public power grid. *(It should be noted that only a 9 MW power generation plant has been constructed at the already approved 25MW power plant site south of the BFS ventilation shaft No. 2 – as per MOD No. 4).*

Each generator unit would be housed in a weatherproof Zincaneal enclosure which would provide for sound attenuation and security and vandal proofing of the generator and controls. Each generator unit would be approximately 24 metres in length, 4 metres wide and 12 metres high at the top of the engine exhaust stack.

The power generation system would require additional supporting infrastructure for its operation, including the following:

- Electrical supply lines and ancillary infrastructure – existing power lines would be extended to the power generation site to transmit power from the system. Supplementary transformer and switch yards may also be required.
- Gas monitoring and switch room – this would include the electrical switch room and cabling and manage the supply from the generator sets to the switchyard, and gas monitoring equipment to monitor the gas supply to the generators.
- Control room – including workshop and automatic lubrication and oil change equipment.
- Gas treatment plant – gas treatment plants would be constructed within the power generation compound which would filter and dry the gas to meet the gas engine suppliers specification and dehumidify the gas.
- Gas pipeline – a gas pipeline would link the gas drainage plant with the power plant. The gas pipeline will either be aboveground (across mine owned disturbed land) or potentially an underground High Density Polyethylene (HDPE) pipeline. If underground, the gas pipeline would either be trenched or directionally drilled between the gas drainage plant (Whybrow Pit

highwall) and the proposed power plant. Any HDPE pipeline would be between 400mm and 560mm in diameter and approximately 4.5 kilometres in length. If directionally drilled from the surface it would be maintained at a depth generally greater than 10m using established SIS drilling, survey, steering techniques and current wastewater and hydrocarbon management practices. It would break the surface to the east of Nine Mile Creek where the pipeline changes direction to the north towards the power plant. This area would comprise a pipeline maintenance pad of approximately 50 metres x 50 metres which would accommodate hardstand areas for service vehicles and gas pipeline infrastructure above the surface.

- Flares – 5 fully enclosed flares, each capable of burning up to approximately 1,800L/sec of excess methane would be installed within the power generation plant compound. The flares would be approximately 8 metres high with a diameter of around 4 metres and would be used when the generators are off-line or to flare gas beyond the capacity of the power generation units.
- Security fencing would be provided around the power generation plant site.

Longwall gas drainage from the BFN Underground Mine is expected to have peak rates of between 2,000L/sec and 4,000 L/sec (depending on coal production rates). Each power generation unit would have the capacity to utilise approximately 90L/sec of methane per MW of generating capacity. With eight operational generator units generating 32MW of power, approximately 2,880L/sec of methane would be required. Alternatively, with ten operational generator units generating 30MW of power, approximately 2,700L/sec of methane would be required.

Based on the capacity of the generator units, at 32MW of installed capacity the system would have capacity to utilise much of the gas drained from the longwall. The excess gas will be flared in the gas flares to be installed within the power generation compound. It is expected that the flares would have an availability of approximately 95% with only 5% unavailability due to maintenance, power fluctuations or other unplanned events. This would result in most of the excess gas being flared, considerably reducing the amount which would otherwise be free vented.

Minimal land preparation and clearing would be required at the proposed site, which comprises cleared former farm land. The existing internal access road would be used to provide primary access. Construction of the related vehicle access to the compound and infrastructure would be minimised and managed in accordance with existing management plans.

The power plant would operate 24 hours a day, 7 days per week.

3.3.7 Hydrocarbon Management and Materials Access Underground

The BUO maintain a number of fuel storage facilities at the BFS Underground Mine. A licensed contractor working within the waste tracking provisions of the POEO Act removes all waste hydrocarbons from site. Regular inspections are conducted and systems are maintained as required.

No change to existing arrangements for the provision of materials access to the underground workings would be required as a result of the Project. As detailed in **Section 1.4.3**, the BOP provides for the relocation of the existing pit-top facilities at the BFS Underground Mine to the top of the Whybrow Pit highwall to provide for the needs of the BFN Underground Mine. The facilities would be relocated behind the proposed new visual/noise bund which forms part of the BOP. Until this relocation takes place, the existing pit-top facilities at the former Beltana No. 1 Underground Mine (which will be removed as part of the BOP) would be used by the BFN Underground Mine.

3.3.8 Surface Access

Access to the ventilation fans and associated surface facilities for the BFN Underground Mine would be the same as the current access to the former Beltana No. 1 Underground Mine, from Broke Road. Access to the surface gas drainage infrastructure above the longwall panels would be via both existing internal tracks and Charlton Road. Access to the power plant would be via the existing access to the BSO administrative offices, off Broke Road.

3.3.9 Fuel and Oil Storage Facilities

There would be no change to the types of fuel and oil storage facilities currently used at the BUO.

3.3.10 Mine Dewatering Bores

There would be no change to the methods of mine dewatering currently used at the BUO.

3.3.11 Blasting and Explosives

There would be no change to the types of explosives in use at the BUO.

3.4 Water Management

There are no significant changes planned to the water management practices. The water abstracted during gas drainage would continue to be incorporated into the BCC water infrastructure network. A new dewatering bore would be required at the down-dip end of BFN Longwall 2, to dewater the BFN Underground Mine workings. However, this does not form part of the Project as dewatering bores are already approved for the BFN Underground Mine.

3.5 Rehabilitation and Final Landform

Rehabilitation would continue to be undertaken in accordance with the *Bulga Coal Complex Landscape Management Plan*.

3.6 Reject and Tailings Management

There would be no change to the methods of reject and tailings management currently used at the BUO, as detailed in **Section 2.5**.

3.7 Environmental Management

The Environmental Management Plans discussed above in **Section 2.8** would continue to apply to all operations at the BUO. These plans would be amended, as required, to incorporate the proposed modifications and relevant recommendations of this EA.

3.8 Monitoring Programs

Monitoring programs as detailed in **Sections 2.8** and **2.13** are reviewed on a regular basis. Where required, future amendments would be made to the monitoring programs to address specific issues related to the Project.

3.9 Construction

3.9.1 Overview

Construction of the surface facilities would be undertaken in a number of phases over the life of the operation. Construction phases would range from around 3 months for fan construction to approximately 18 months to construct and commission the small scale power plant. Construction of surface facilities, including the ventilation fans and gas drill pads, would predominantly be undertaken during daylight hours.

During construction, temporary site facilities for construction personnel including offices and car parks are likely to be required. These would be located in existing disturbed areas. Laydown areas for the assembly/fabrication of large steel structures and facilities for the maintenance and parking of construction equipment would also be required.

3.9.2 Ventilation Fans

Construction of the ventilation fans would take around 4 months with construction being undertaken during daylight hours. During construction, temporary site facilities for construction personnel, including offices, laydown areas and car parking, are likely to be required. These would be located in existing disturbed areas.

3.9.3 Gas Drainage

Construction of the vertical gas wells sites would take between 1 and 2 weeks per site. This would include the civil works required to clear and compact a pad and erect the noise barriers (used on all exposed holes). Gas drilling and well construction would then take between 2 and 4 weeks. Installation of the gas well headwork's and compound is not noise generating work that happens over the following months. Typical construction machinery and equipment would include a bulldozer for clearing, 20 tonne trucks to import and remove material, a pad foot roller for compaction, a water cart, a grader and an excavator for loading cleared/excavated material away as well as excavation of footings, steel reinforcement work and concrete pouring. All construction and drilling works would occur during daylight hours unless exceptional circumstances necessitate evening work.

Construction of the SIS drill sites would take approximately 1 month per site. This would include the civil works to clear and compact a pad and erect the noise barriers. Drilling would take place 24 hours per day over a 4 to 12 week period. Typical construction machinery and equipment would include a bulldozer for clearing, 20 tonne trucks to import and remove material, a pad foot roller for compaction, a water cart, a grader and an excavator for loading cleared/excavated material away as well as excavation of footings, steel reinforcement work and concrete pouring.

3.9.4 Gas Drainage Plant

Construction of the gas drainage plant (goaf plant, offices, sheds, compressor, etc.) on the Whybrow highwall would include the construction of a pad which would happen in a number of stages over a 2 month period. All construction works would occur during daylight hours. The civil works would typically include a bulldozer for clearing, 20 tonne trucks to import and remove material, a pad foot roller for compaction, a water cart, a grader, an excavator for loading cleared/excavated material away as well as excavation of footings, steel reinforcement work and concrete pouring. The installation of infrastructure would include transporting infrastructure in on trucks (including wide loads), craning into place and construction and commissioning by various trades people and their associated small equipment.

3.9.5 Small Scale Power Generation

Construction and commissioning of the power generation plant is the most significant construction activity and is expected to take approximately 18 months to complete. The construction would be in two stages – civil site works and infrastructure construction. The civil works, including construction of the pad, would take approximately 3 months to complete whilst the infrastructure construction and power station commissioning is expected to take approximately 15 months to complete.

Key activities during the construction program would include the following:

- Minor earthworks for the installation of the hardstand area and vehicle access;
- Trenching, installation and backfilling for the required buried services;
- Installation of overhead services (electricity) and potentially transformer and switch yards;
- Forming up of run-off drainage system and sheeting of the access road;
- Sheeting of hardstand with suitable all weather, slip and trip reduction gravel;
- Installation or construction of generators, pipelines, switchroom, control room and service workshop facilities monitoring equipment, including concrete slab footings;
- Landscape works; and
- Installation of security fencing.

Construction hours are proposed to be limited to daytime hours seven days per week.

Typical construction equipment and machinery would include:

- Excavators;
- Tipping trucks;
- Heavy haulage vehicles for generator delivery;
- Backhoe;
- Water truck;
- Roller compactor;
- Small crane;
- Poly welder unit; and
- Light vehicles.

Wide, heavy, low load vehicle movements would be required to transport the generators and related infrastructure to the site. The generators would be lifted off the low loaders with a large crane and put in place on footings. Pipework and ductwork would be lifted into place using smaller cranes.

The construction workforce will vary throughout the various construction phases and will most likely peak at 50 to 60 people per day.

3.10 Exploration Activities

Exploration activities are regularly undertaken as part of ongoing underground mining operations at the BCC in accordance with the requirements of the Mining Act and relevant mining authorisations listed in **Table 1**. However, exploration activities were not explicitly referred to in the 2003 EIS.

Exploration activities, predominantly through the drilling of boreholes, would be carried out during the life of the BFN Underground Mine at the BUO. The exploration would be used to:

- Obtain detailed coal quality information;
- Obtain detailed seam gas information;
- Obtain more detailed information on strata, geological anomalies and geotechnical data;
- Assist with refining mine design; and
- Define specific anomalies by infill, close spaced drilling as required.

BUO has developed procedures for the management of exploration activities so that they are conducted in an environmentally responsible manner and with due consideration to the community. The BUO would be responsible for the final rehabilitation of any exploration sites. Upon completion of exploration activities, any boreholes would be sealed and rehabilitated in accordance with the DTIRIS guideline EDG01 “*Environmental Management Guideline for Industry Borehole Sealing Requirements on Land: Coal Exploration*” (NSW Department of Mineral Resources 1997). Furthermore, conducted and proposed exploration activities would continue to be reported in the AEMR.

All exploration would be carried out in accordance with the requirements of the Mining Act and relevant mining authorisations as listed in **Table 1**. The exact number of exploration boreholes would be determined by the proposed activity and future mine requirements.

3.11 Proposed Program of Works

The proposed program of works for the BFN Underground Mine is planned to be as follows:

- The gas drainage infrastructure and power generation plant infrastructure will start construction in 2013 (Year 10 in the 2003 EIS).
- The power generation plant and five flares will be operational in 2013/2014 (Year 10/11). The power plant will be built early to take pre-mining gas drainage at the BFN Underground Mine. A gas compressor will be constructed at the top of the Whybrow highwall. Pre-mining gas drainage will be directed via the compressor to the new power plant. The ventilation fans will be constructed in Year 11 (2014) and commissioned in Year 11/12 (2014/15), following completion of the new slot access (to be created by the Western Extension Modification – see **Section 1.4.2**).
- Underground mining (first workings) will commence in Year 12 (2015) and will continue to throughout the life of the mine as required. Development coal (coal removed while establishing the first working) will be trucked back to the CHPP prior to the establishment of a new overland conveyor system. In Year 11/12 (2014/15), the ventilation fans will be operational; the existing BFS goaf plant will be operating east of Broke Road; and the new gas compressor will be located on the Whybrow highwall.
- By Year 14 (2017) (in preparation for longwall mining) the BFN gas drainage plant (including five goaf extraction unit flares and five pre-drainage gas flares) will be constructed adjacent to

the gas compressor on the Whybrow highwall. This will include offices and associated hardstand areas. The existing BFS goaf plant will be used until around 2017 when the BFN gas drainage plant will be available.

- Longwall mining will commence in Year 14 (2017). Coal will be transported by mine haul truck to the existing BFS stockpile until a new overland conveyor system is constructed (to be constructed as part of the BOP – see **Section 1.4.3**). It is anticipated that BFN longwall mining will continue until around Year 19 (2022).

4.0 STATUTORY REQUIREMENTS

This section describes the statutory planning instruments relevant to the BCC and the Project, and assesses their implications in relation to the required approval process.

4.1 Introduction and Background

By notice dated 2004 the then NSW Department of Infrastructure, Planning and Natural Resources granted development consent under Part 4 of the EP&A Act to DA 376-8-2003. This represents the current operation which, as detailed in **Section 2.1.2**, has been modified on 4 occasions.

BCM proposes to modify DA 376-8-2003 pursuant to the provisions of Section 75W of Part 3A of the EP&A Act. Although Part 3A was repealed on 1 October 2011, Schedule 6A of the Act provides savings provisions whereby Section 75W of Part 3A continues to apply to modifications of the Part 4 development consents referred to in clause 8J(8) of the EP&A Regulation 2000.

Clause 8J(8) of the EP&A Regulation 2000 provides a mechanism whereby Projects approved under Part 4 of the EP&A Act can be modified under Section 75W in cases where the development would have been a Part 3A Project but for the operation of clause 6(2)(a) of *State Environmental Planning Policy (Major Development) 2005* (SEPP Major Development 2005). Coal mining is a class of development listed in Schedule 1 of the SEPP Major Development 2005, and as such would be a Project to which Part 3A applies.

(Note: Although Schedule 1 of the SEPP has been repealed, Schedule 6A of the EP&A Act allows for the continuation of the provisions of this relevant section of the SEPP).

Accordingly, the Project is sought under Section 75W, and the proposal will be subject to assessment by the Director General of the DP&I and determination by the Minister for Planning in accordance with Part 3A of the EP&A Act.

In addition to the approval under the EP&A Act, the Project may also require variation of EPL 563 issued under the POEO Act.

The Project would allow for the realignment of the approved longwall layout, increased gas drainage infrastructure, relocated mine ventilation, changed clearance for development coal, and a small scale power plant.

As detailed in the Ecological Assessment in **Appendix 9**, the Project is unlikely to have any significant impact on matters of National Environmental Significance (NES) as listed in the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The proposed modifications are of minor environmental impact however an Environmental Assessment is detailed in **Section 6**.

4.2 NSW State Legislation

4.2.1 Environmental Planning and Assessment Act 1979

The EP&A Act provides a framework for environmental planning in NSW. The EP&A Act provides the basis for both the making of environmental planning instruments and the assessment of development.

Schedule 6A of the EP&A Act provides savings provisions whereby Section 75W of Part 3A continues to apply to modifications of Part 4 development consents referred to in clause 8J(8) of the EP&A

Regulation 2000 (refer to **Section 4.1**). Accordingly, the approval of the BUO pursuant to DA 376-8-2003 may be modified under Section 75W.

As confirmed by the DP&I in a letter dated 7 October 2011 (see **Appendix 4**), the Project is to be considered pursuant to Part 3A, Section 75W of the EP&A Act.

4.2.2 Local Environmental Plan

Sub-clause 7(1) of the SEPP (Mining, Petroleum Production & Extractive Industries) 2007 (SEPP Mining 2007) states that development for the purpose of mining may be carried out with development consent on land where development for the purposes of agriculture or industry may be carried out. In relation to any inconsistency between the SEPP and an LEP, sub-clause 5(3) of SEPP Mining 2007 states that if the SEPP is inconsistent with any other EPI, whether made before or after the SEPP, the SEPP prevails to the extent of the inconsistency.

The land proposed to be affected by the Project is located wholly within the Singleton Local Government Area (LGA) and is covered by the provisions of the *Singleton Local Environmental Plan 1996* (Singleton LEP). Under the provisions of the Singleton LEP, the Project Area is zoned No. 1(a) Rural. Mining is a permissible land use within this zone with development consent.

4.2.3 State and Regional Planning Policies

Pursuant to Section 75R(3) of the EP&A Act, environmental planning instruments, other than SEPP's, do not apply to a Project approved under Part 3A of the Act. However, Section 75I(2)(e) states that environmental planning instruments that would otherwise substantially govern the carrying out of the Project must be referenced by the Director General in the EA. This section therefore considers the provisions of such environmental planning instruments in relation to the Project.

SEPP (Major Development) 2005

With the repeal of Part 3A of the EP&A Act, various amendments have been made to SEPP (Major Development) 2005. Prior to these amendments, the primary aim of this SEPP was to identify development to which development assessment and approval processes under Part 3A of the EP&A Act applied. Specific types of development were listed in Schedule 1 attached to the SEPP which required assessment under Part 3A of the Act, with the Minister being the consent authority. Coal mining was defined as a major project in Schedule 1 of the SEPP.

Although Schedule 1 of the SEPP has been repealed, Schedule 6A of the EP&A Act allows for the continuation of this relevant provision of the SEPP.

SEPP (State and Regional Development) 2011

This SEPP came into effect upon the repeal of Part 3A of the EP&A Act and identifies development to which the State significant development and approval process under Part 4 of the EP&A Act apply. Coal mining is listed as State significant development in Schedule 1 of the SEPP. However, pursuant to Clause 24 of the SEPP, the transitional Part 3A provisions outlined in Schedule 6A of the EP&A Act continue to apply. As a result, the provisions of this SEPP do not apply to the Project.

SEPP (Infrastructure) 2007

Clause 104 and Schedule 3 of SEPP 2007 identifies traffic generating development that must be referred to the NSW Roads and Maritime Services (RMS). Mining is not identified in Schedule 3 of SEPP 2007. In any event, Clause 104(3) of SEPP 2007 states that the requirement to refer the application to the RMA relates to development applications and as such Schedule 3 of SEPP 2007 does not relate to Major Projects.

The then Roads and Traffic Authority (now RMS) has been consulted in regard to the Project (see **Appendix 5**). A Traffic Impact Assessment was completed as part of this EA and is discussed in **Section 6.9**.

SEPP (Mining, Petroleum Production and Extractive Industries) 2007

The aims of the SEPP are, in recognition of the importance to NSW of mining, petroleum production and extractive industries:

- a) *to provide for the proper management and development of mineral, petroleum and extractive material resources for the purpose of promoting the social and economic welfare of the state;*
- b) *to facilitate the orderly and economic use of development of the land containing mineral, petroleum and extractive material resources; and*
- c) *to establish appropriate planning controls to encourage ecologically sustainable development through the Environmental Impact Statement, and sustainable management, of development of mineral, petroleum and extractive resources.*

It is considered that the Project is consistent with the aims and objectives of the SEPP.

Although this is an assessment under Part 3A of the EP&A Act, the content of this SEPP has been considered. Part 3 of the SEPP discusses matters a consent authority must consider when assessing development applications. In particular, Clause 12 (a) states that the consent authority must consider the following:

- i. *the existing uses and approved uses of land in the vicinity of the development, and*
- ii. *whether or not the development is likely to have a significant impact on the uses that, in the opinion of the consent authority having regard to particular land use trends, are likely to be the preferred uses of land in the vicinity of the development, and*
- iii. *any ways in which the development may be incompatible with any of those existing, approved or likely preferred uses.*

As discussed in **Section 6.12**, open cut and underground coal mining Projects have been developed in the Upper Hunter Area for over 40 years. In addition to the BCC operations, a number of mines operate in the region to the north of the Site, including Mount Thorley Mine, Warkworth Mine, Wambo Mine and Hunter Valley Operations. The ongoing mining at BUO and the proposed Project is therefore consistent with land uses in the vicinity of the mine.

Again, whilst Clause 14 of the SEPP applies to Part 4 applications, it has still been considered in the preparation of this EA. Clause 14 relates to natural resource and environmental management, requiring the consent authority to consider the impacts of a development application on water resources, threatened species and biodiversity, and minimisation of GHGs. Potential impacts on water resources and threatened species have been investigated as part of the preparation of this EA, and are predicted to be negligible as discussed further in **Section 6**. In addition, the Project proposes to implement GHG abatement measures through the collection and beneficial use of gas for power generation as part of the Project.

SEPP 33 – Hazardous and Offensive Development

SEPP 33 - Hazardous and Offensive Development requires the consent authority to consider whether an industrial proposal is a potentially hazardous industry or potentially offensive industry. The aim of this SEPP is to link the permissibility of a proposal to its safety and pollution control performance. The assessment process establishes whether the proposal is potentially hazardous and if this is not the case, SEPP 33 is not applicable.

The power generation units and flares would not require any gas storage. Gas would be fed directly to the various facilities from either the gas drainage system. The DP&I (then Department of Urban Affairs and Planning) guidelines *Applying SEPP 33 – Hazardous and Offensive Development Application Guidelines* (1997) contains a risk screening procedure. Application of the guidelines assists in determining if a project represents a hazardous or offensive development. According to the guidelines methane gas is classified as Class 2.1 Flammable Gas under the Australian Dangerous Goods Code. However, the threshold quantities identified in the guidelines relate to the storage of gas and the proposed Project does not include the storage of gas on site. Gas will be supplied to the power generation plant from the mine's gas drainage system.

No hazardous substances would be required to be stored on parts of the Project Area utilised for gas drainage, gas transportation and power generation. Maintenance may require the use of minor quantities of fuels and lubricants, however, these would be used as required and stored within the existing approved areas at the BCC. Therefore SEPP 33 is not applicable to this Project.

SEPP 44 – Koala Habitat Protection

SEPP 44 applies to the Singleton Local Government Area (LGA). It requires an investigation be carried out to determine if 'core' or 'potential' Koala habitat is present and is likely to be disturbed. SEPP 44 applies to the extent that a consent authority is restricted from granting development consent from proposals on land identified as core koala habitat without the preparation of a Plan of Management.

The Ecological Assessment undertaken by Umwelt (see **Appendix 9**) found that one SEPP 44 tree species, forest red gum (*Eucalyptus tereticornis*) was recorded within the Project Area but didn't comprise 15 per cent or more of the total number of trees in the upper or lower strata of the tree component. As a result the Project Area does not provide 'potential koala habitat' and further assessment under SEPP 44 is not required. Additionally the koala was not recorded during surveys of the Project Area in 2011 or during eight years of annual fauna monitoring surveys.

SEPP 55 – Remediation of Land

State Environmental Planning Policy No. 55 – Remediation of Land (SEPP 55) provides a state-wide planning approach to the remediation of contaminated land. SEPP 55 requires consent authorities to consider contamination and remediation in zoning/rezoning proposals as well when determining development applications. Whilst SEPP 55 applies to development applications and not Part 3A major projects, the proposed Project would not pose any additional risk with regard to land contamination. The Project requires minimal additional land disturbance and predominantly comprises the location of surface infrastructure in already disturbed areas.

Hunter Regional Environmental Plan 1989 (Heritage)

The *Hunter REP 1989 (Heritage)* is now a deemed SEPP. The general aim and objective of the Hunter REP 1989 (Heritage) is to conserve the environmental heritage of the Hunter region. However, Hunter REP 1989 (Heritage) does not apply to land within the Singleton LGA and is therefore not relevant to the Project.

Upper Hunter Strategic Regional Land Use Plan

In some areas of NSW there has been growing community concern about the impact of coal mining and coal seam gas developments on agricultural land and water resources. In response, the NSW Government released the *Draft Upper Hunter Strategic Regional Land Use Plan* (NSW Government 2012) (SRLUP) for public exhibition and comment in March 2012. The final Upper Hunter SRLUP was released in September 2012.

The SRLUP is intended to provide the framework for resolving potential land use conflict issues between mining and coal seam gas proposals and strategic agricultural land within the Upper Hunter region, including the Project Area. The proposed key policy response for resolving land use conflict between mining and coal seam gas proposals and agricultural land is a gateway process. Under this process, a panel of independent experts would assess proposals involving mining or coal seam gas development on or within two kilometres of strategic agricultural land at an early stage to determine whether the proposal is considered suitable on the subject land and whether it can progress to the development application stage.

The SRLUP and the proposed gateway process (once legislated) would only apply to new State Significant development applications or modifications (under Part 4 of the EP&A Act) for mining projects located outside of existing mining lease areas. On this basis the SRLUP does not apply to the Project, which is a modification of an existing approved development under Part 3A, Section 75W of the EP&A Act. In any event, matters relating to land use impacts, agricultural suitability and soils have been dealt with in **Section 6.12**. An Agricultural Impact Statement (AIS) has been prepared by GSSE and is included in **Appendix 13**.

NSW Aquifer Interference Policy

The *NSW Aquifer Interference Policy* (AIP) is a key component of the NSW Government's Strategic Regional Land Use Policy. The AIP details how potential impacts to aquifers should be assessed by the government agencies, advisory bodies and consent authorities involved in the planning approval process. The AIP also clarifies the requirements for obtaining water licences for aquifer interference activities and defines the considerations for assessing potential impacts to key water-dependent assets.

The Water Management Act 2000 includes the concept of ensuring "no more than minimal harm" for both the granting of water access licences and approvals. The NSW Office of Water and the relevant Minister are required to ensure that when granting aquifer interference approvals, adequate arrangements are in place to ensure that no more than minimal harm will be done to any water source as a result of the proposed interference activities.

As detailed in **Section 6.10**, the proposed modified longwall layout for the BFN Underground Mine has been designed to ensure there remains an adequate buffer to protect the Wollombi Brook alluvials. This is consistent with the approved longwall layout and impacts on the alluvial groundwater quality and groundwater supply would be consistent with the currently approved operations.

4.2.4 Protection of the Environment Operations Act 1997 (POEO Act)

The POEO Act governs environmental licensing and monitoring matters. Section 43(b), 48 and 55 of the POEO Act requires that an EPL be issued prior to carrying out a scheduled activity. BUO currently holds EPL 563 for the Project Area, which will be varied as required upon approval.

4.3 Commonwealth Legislation

4.3.1 Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act)

The purpose of the EPBC Act is to ensure that actions likely to cause an impact on a matter of NES undergo a rigorous assessment and approval process. Under the EPBC Act, an action includes a project, undertaking, development or activity.

An action that “*has, will have or is likely to have a significant impact on a matter of National Environmental Significance (NES)*” may not be undertaken without prior approval from the Commonwealth Minister for the Environment, as provided under Part 9 of the EPBC Act.

The EPBC Act identifies matters of NES as:

- World Heritage properties;
- Wetlands of international significance (including Ramsar wetlands);
- Listed threatened species and ecological communities;
- Listed migratory species protected under international agreements;
- Commonwealth marine areas;
- Nuclear actions; and
- Actions prescribed by the regulations.

The Administrative Guidelines for the EPBC Act set out criteria intended to assist in determining whether an action requires approval. In particular, the Guidelines contain criteria for determining whether a proposed action is likely to have a “significant impact” on a matter of NES. These Guidelines were consulted in determining the level of impact of the proposed development.

As detailed in the Ecological Assessment in **Appendix 9**, the Project is unlikely to have any significant impact on matters of NES as listed in the EPBC Act.

4.3.2 Native Titles Act

The *Native Titles Act 1993* (Commonwealth) administers processes relating to the recognition, protection and determination of native titles dealings with native title land.

Previous searches of the National Native Title Register (for determinations) and the Register of Native Title Claims (for current claims) revealed no Native Title or active Native Title claims in existence within the Project Area. The currency of previous register searches has been renewed as part of the EA preparation and there are no Native Title or active Native Title claims within the Project Area. Additional detail relating to Indigenous Heritage is provided in **Section 6.7**.

4.4 Summary of State and Commonwealth Legislation

In addition to the requirement for approval under Part 3A of the EP&A Act, the BCC operates under a number of other pieces of legislation. A summary of the applicable Acts is included in **Table 5**.

Table 5 – Summary of Relevant NSW State Legislation

Act	Approval, Licence, Permit or Authority
<i>Environmental Planning and Assessment Act 1979</i>	This Act is administered by the DP&I. BCM was granted approval under Part 4 of the EP&A Act in 2004 for the existing BUO. BCM requires consent from the Minister of the DP&I for modifications to this approval under S75W of the EP&A Act. The EA has been prepared in accordance with the requirements of the DP&I (refer Appendix 4 and Section 5.2.1).
<i>Mining Act 1992</i>	The BCC operates under ML1547, ML 1494 and ML1674 which expire in 2025, 2027 and 2033, respectively. The proposed modification to the longwall panels will remain within the existing boundary of ML1547. The project components within the Project Area are shown in Figure 4). The proposed power plant and part of the associated infrastructure (eg. underground/aboveground pipeline) is to be located outside of the Mining Lease area will be included in a mining lease application associated with the BOP. Statutory mining documents such as the Mining Operations Plan (MOP) would be revised as necessary to incorporate the changes to mining sequences and footprint.
<i>Coal Mine Health and Safety Act 2002</i>	BCC currently holds all necessary approvals under this Act. No further approvals would be required.
<i>Mine Subsidence Compensation Act 1961</i>	This Act is administered by the Mine Subsidence Board (MSB). Approval of the MSB is required for the erection or alteration of improvements and subdivision of land within a mine subsidence district, in accordance with the Act. Approval of the MSB would be required for the construction of the power plant, gas plant and associated surface infrastructure.
<i>Protection of the Environment Operations Act 1997</i>	The Act is administered by the NSW OEH. It requires licensing for environmental protection, including waste generation and disposal, water, air, and noise pollution. The BUO operates under EPL No. 563. The EPL would need to be varied to incorporate the proposed modification.
<i>Water Act 1912</i>	This Act is administered by the NSW Office of Water. The Project Area is subject to the Hunter Unregulated and Alluvial Water Sources Sharing Plan (gazetted 1 August 2009). The Project is therefore subject to the requirements of the <i>Water Management Act 2000</i>.
<i>Water Management Act 2000</i>	The Act is administered by the NSW Office of Water and contains provisions for the licensing of water capture and use. BCC currently holds all necessary licences under the <i>Water Management Act 2000/Water Act 1912</i>. The Act also requires a controlled activity permit to be obtained for any works within 40 metres of any watercourse. Although any proposed underground gas pipeline would be located beneath Nine Mile Creek, a permit is not required for works within an area covered by a mining lease as these works are covered by approvals granted under the <i>Mining Act 1992</i>. The Project may require additional approvals and/or water licences, for groundwater and surface water extraction, where applicable. These would be obtained, as required, in accordance with the prescriptions of the Act.
<i>Fisheries Management Act 1994</i>	This Act is administered by the NSW OEH and Department of Primary Industries (DTIRIS). A permit must be obtained under the Act for any works that involve dredging or reclamation, any structure that may inhibit or obstruct the movement of fish within a waterway or cause damage or destruction on marine vegetation. The Project would not impact on fish habitat or impact on waterways. No Fisheries Management Act listed threatened aquatic flora or fauna species were recorded in the Project Area. Therefore it is anticipated that a permit would not be required under this Act.

Act	Approval, Licence, Permit or Authority
<i>Threatened Species Conservation Act 1995</i>	The Act provides protection for threatened plants and animals native to NSW (excluding fish and marine vegetation) and integrates the conservation of threatened species into development control processes under the EP&A Act. This Act is administered by the NSW OEH. Where a development is likely to have a significant effect on threatened species, the preparation of a species impact statement is required. The project components are predominantly located on land that has been previously disturbed and vegetation clearance is generally restricted to the area of the proposed power plant. The Ecological Assessment completed for the Project identified that the Project would not result in a significant impact on any threatened species, population or communities (refer to Section 6.6). A biodiversity offset strategy would be developed in consultation with the NSW OEH to offset the impacts associated with the removal of up to 5ha of Central Hunter Box – Ironbark Woodland (EEC).
<i>National Parks and Wildlife Act 1974</i>	This Act provides for the protection, preservation and management of Aboriginal relics throughout NSW, and is administered by the NSW OEH. Under this Act a Section 90 Aboriginal Heritage Impact Permit (AHIP) would be required prior to the destruction of any known Aboriginal archaeological sites. As detailed in the Aboriginal Heritage Assessment, no new Aboriginal sites or objects were recorded during the assessment. The existing practices at the BCC outlined in the ACHMP would continue to ensure sites are managed on a case by case basis.
<i>Heritage Act 1977</i>	This Act is administered by the NSW OEH. Under section 75U(1)(c) of the EP&A Act, an approval under Part 4, or an excavation permit under section 139, of the Heritage Act 1977 is not required for a project approved under Part 3A of the EP&A Act. In addition, section 75U(2) of the EP&A Act, Division 8 of Part 6 of the Heritage Act 1977 does not apply to prevent or interfere with carrying out of an approved project. In any event, the Project would not have a significant adverse impact on any known heritage sites.
<i>Crown Lands Act 1989</i>	This act provides for the administration and management of Crown land in NSW. A licence to use Crown Land would be required where use of Crown land is required for the Project.
<i>Aboriginal Land Rights Act 1983</i>	The act provides for the constitution of local, regional and State Aboriginal Land Councils and a mechanism for Land Councils to claim Crown Land. No known claims are presently in existence within the Project Area.
<i>Roads Act 1993</i>	This Act is administered by NSW Roads and Maritime Services (RMS) as well as local road authorities (generally local Councils). Under this Act, BCC must obtain the consent of the appropriate roads authority to: a. erect a structure or carry out a work in, on or over a public road; b. dig up or disturb the surface of a public road; c. remove or interfere with a structure, work or tree on a public road; d. pump water into a public road from any land adjoining the road; or e. Connect a road (whether public or private) to a classified road, Broke Road is a classified (Regional) road and Charlton Road is a local road. Singleton Council is the roads authority for Broke Road, Charlton Road and all other public roads in the area. The Golden Highway to the north of the BCC is a State road under the jurisdiction of the RMS. Additional approvals for road works are not anticipated to be required for the proposed modification. Following approval and commencement of works, BCC would undertake any required subsidence remediation works on minor local roads. The necessary approvals from Singleton Council would be obtained in this regard.

Act	Approval, Licence, Permit or Authority
Commonwealth	
<i>Environment Protection and Biodiversity Conservation Act 1999</i>	This Act is administered by the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (DSEWPC). The EPBC Act requires approval of the Commonwealth Minister for DSEWPC for any action that may have a significant impact on matters of NES. As detailed in the Ecological Assessment in Appendix 9, the proposed Project is unlikely to have any significant impact on matters of NES as listed in the EPBC Act.

5.0 CONSULTATION

5.1 Overview

BCM has undertaken consultation with local and state government authorities, Aboriginal groups, and other relevant stakeholders in preparation of this EA. A detailed stakeholder consultation log was kept during the preparation of the EA as a record of the consultation undertaken by BCM. A summary of the consultation undertaken is included in **Table 6**. The sections below further outline the consultation undertaken.

Table 6 – Stakeholder Consultation Log

Stakeholder	Method of Engagement/ Distribution	Date	Issues Raised
Department of Planning and Infrastructure	Letters, emails, meetings	Outgoing Letters dated 26/09/2011 and 19/10/2011 (Meeting on 1/09/2011)	Letter dated 7/10/2011 stating DGR's would not be issued. At meeting on 1/09/2011, DP&I requested that EA addresses subsidence impacts on existing land uses (olive farming, vineyards, tourism, cattle grazing, etc.). Supplementary DGR's issued on 30 April 2012 requesting preparation of Agricultural Impact Statement.
Department of Trade & Investment, Regional Infrastructure & Services (Resources & Energy)	Outgoing letters	26/09/2011 and 19/10/2011	No issues raised.
NSW Office of Environment and Heritage	Outgoing letters	26/09/2011 and 19/10/2011	Will comment on the EA when it is referred by DP&I.
NSW Office of Water	Outgoing letters	26/09/2011 and 19/10/2011	No issues raised.
NSW Roads and Traffic Authority (now Roads and Maritime Services)	Outgoing letters	26/09/2011 and 19/10/2011	Letter dated 21/10/2011 stating Traffic Impact Assessment should to be prepared in accordance with the RTA's Guide to Traffic Generating Developments.
Singleton Council	Outgoing letters	26/09/2011 and 19/10/2011	No issues raised.
NSW Dams Safety Committee	Outgoing letters	26/09/2011 and 19/10/2011	No issues raised.

Stakeholder	Method of Engagement/ Distribution	Date	Issues Raised
Mine Subsidence Board	Outgoing letters	26/09/2011 and 19/10/2011	Letter dated 24 October 2011 stating power/gas generation plant would require approval from MSB at the appropriate time.
Aboriginal Groups - refer to Appendix 10 for list of Aboriginal groups.	Aboriginal Consultation Log (ongoing), letters supplied within Appendix 10 .	26/10/2011 to May 2012	No issues raised.
BCC Employees	Employee Newsletter	Ongoing	No issues raised
Xstrata Coal NSW	Meetings	Ongoing	
Mt Thorley and Warkworth Mines	Meetings	Ongoing	No issues raised.
Private landholder meetings:	Meetings with around 50 private landholders	11/04/2011 to 22/04/2011	Surface disturbance Visual impact of gas drainage infrastructure Protection of alluvial aquifers
Broke Fire Brigade	Member meeting at the fire shed	13-Apr-11	Surface disturbance Visual impact of gas drainage infrastructure Protection of alluvial aquifers
Hunter Valley Protection Alliance	Member meeting at the Broke Hall: 25 members	14-Apr-11	Surface disturbance Visual impact of gas drainage infrastructure Protection of alluvial aquifers
Broke Fordwich Wine and Tourism Association	Member meeting and barbeque at the Alpaca Resort: 14 members	15-May-11	Surface disturbance Visual impact of gas drainage infrastructure Protection of alluvial aquifers
Bulga & Broke communities – open invitation	Bulga community barbeque presentation: 31 community members in attendance	18-May-11	Surface disturbance Visual impact of gas drainage infrastructure Protection of alluvial aquifers

Stakeholder	Method of Engagement/ Distribution	Date	Issues Raised
Bulga & Broke communities – open invitation	Broke community barbeque presentation: 45 community members in attendance	19-May-11	Surface disturbance Visual impact of gas drainage infrastructure Protection of alluvial aquifers
Other BCC External Stakeholders	Bulga Complex community newsletter	Twice yearly	April 2011 newsletter provided details of the BFN Underground Mine modification (see Section 5.3).
	CCC Meeting	31-Oct-11	No issues raised
	Broke Fair – BFN Underground mine modification on display	11-Sept-11	No issues raised
Bulga & Broke communities – open invitation	Broke community barbeque: 44 community members in attendance	15-Mar-12	Surface disturbance Visual impact of gas drainage infrastructure
	Bulga community barbeque: 57 community members in attendance	21-Mar-12	Protection of alluvial aquifers

5.2 Government Agency Consultation

5.2.1 NSW Department of Planning and Infrastructure

The government consultation program for this Project comprised briefing the DP&I at a meeting held on 1 September 2011. A briefing letter and a Preliminary Environmental Assessment (PEA) (September 2011) were subsequently provided to the DP&I on 26 September 2011 (letter attached as **Appendix 4**) outlining the proposed Project. DP&I subsequently responded in a letter dated 7 October 2011 stating that DGR's would not be issued as the PEA adequately identifies the likely environmental impacts associated with the Project. The DP&I also confirmed that Section 75W was the appropriate means of assessing the proposal. A copy of the letter from DP&I is contained in **Appendix 4**.

Following release of the AIS Guidelines in March 2012, the DP&I issued supplementary DGR's on 30 April 2012 (see **Appendix 4**) under section 75F(3) of the EP&A Act for the Project, requiring the preparation of an AIS, as follows:

An Agricultural Impact Statement that includes a specific focussed assessment of the impacts of the proposal on strategic agricultural land, having regard to the draft gateway criteria in the draft Upper Hunter Strategic Regional Land Use Plan.

A summary of the environmental assessment issues outlined in the PEA dated September 2011 and where these are addressed in the EA is contained in **Table 7**.

Table 7 – Environmental Assessment Issues Identified in PEA

Environmental Assessment Issue	EA Section Addressing Each Issue
Greenhouse Gas and Air Quality	Sections 6.3 and 6.4
Visual Amenity	Section 6.8
Aboriginal and Cultural Heritage	Section 6.7
Flora and Fauna	Section 6.6
Subsidence	Section 6.2
Existing Land Uses	Section 6.12
Community/Government Consultation	Section 5
Surface Water	Section 6.11
Groundwater	Section 6.10
Noise	Section 6.5
Traffic and Transport	Section 6.9
Waste Management	Section 6.15
Socio-Economic Considerations	Section 6.14
Soils and Land Capability and Agricultural Impacts	Section 6.12
Contaminated Land	Sections 3, 4.2.3 and 6.15
Hydrocarbon Management	Section 3.3.7
Sediment and Erosion Control	Sections 2.13.4 and 6.11
Rehabilitation and Life of Mine	Section 3.5

5.2.2 Other Relevant Departments and Agencies

Consultation via letters (26/09/2011 and 19/10/2011) and the submission of a PEA (September 2011) outlining the proposed Project was undertaken with the following NSW Government agencies:

- NSW Office of Water;
- NSW DTIRIS (Minerals and Energy);
- NSW Office of Environment and Heritage;
- NSW Roads and Traffic Authority (now Roads and Maritime Services);
- NSW Dams and Safety Committee; and
- NSW Mine Subsidence Board.

The same letters and PEA were also sent to Singleton Council.

An example of the letters sent and all incoming letters received are attached in **Appendix 5**.

As detailed in **Table 6**, only the Roads and Traffic Authority (now Roads and Maritime Services) and the Mine Subsidence Board provided a written response to the correspondence sent out. The NSW OEH advised via telephone that they would be responding directly to the DP&I once the EA had been lodged.

5.3 Community Consultation

Overview

The BCC played a proactive role supporting and engaging the community throughout 2011. The consultation strategy for the Project included consultation with the community and government agencies. The approaches and outcomes of the community consultation program are discussed below.

Community Consultative Committee

A combined Community Consultative Committee (CCC) operates for the BUO and BSO. The purpose of the CCC is to provide a forum for open discussion between BCC representatives, the community, the Council and other stakeholders on issues directly relating to the mine's operations and environmental performance, and to keep the community informed on these matters. The proposed modification to the BFN Underground Mine was outlined at the CCC meetings held on 3 December 2010 and 31 October 2011. The CCC meetings included representatives from the community, Singleton Council, DTIRIS and the BCC.

Newsletters, advertisements, websites

The BCC provides the community with information via its newsletter and website. The BCC website enables members of the community to access information and the latest reports, including environmental monitoring data and newsletters. The Bulga Complex community newsletter was distributed to letterboxes in Broke, Bulga, Milbrodale and Mt Thorley in April 2011. A copy of the article that appeared in the April community newsletter is shown below in **Plate 12**.

Face to face community stakeholder engagement program

The BCC undertook face to face consultation with numerous neighbours and community members throughout 2011. Community issues relating to the underground and surface operations were discussed during these consultations. The program has built strong relationships with neighbours and assists BCC with understanding key issues of concern and provides opportunity for two way feedback.

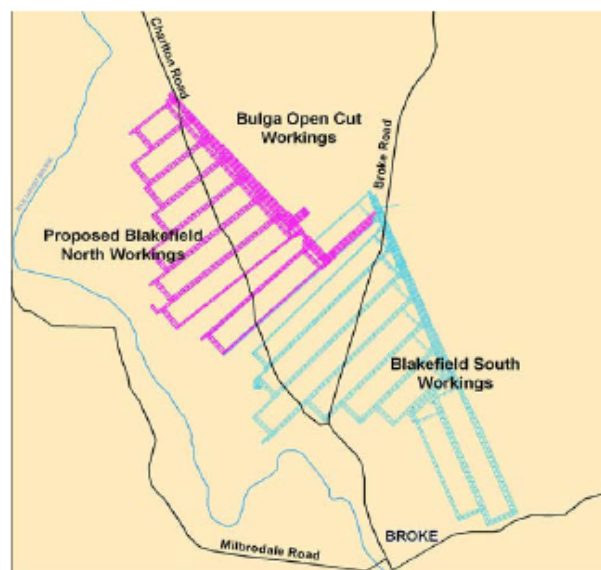
Individual meetings were held with 48 surrounding landowners. Three groups (Broke Fire Brigade, Hunter Valley Protection Alliance and Broke Fordwich Wine and Tourism Association) were consulted at meetings with their members in attendance. Each of these one-on-one meetings included a presentation outlining the proposed modification to the approved BFN Underground Mine. In general, the landowners and community members consulted understood that the proposed modifications were a function of the dynamic mining environment and improved gas drainage and utilisation methods. The main issue raised by the private landowners during the community consultation was surface disturbance and the visual impact of gas drainage infrastructure.

Ongoing consultation in regard to the Project will be incorporated into the ongoing BCC consultation program or undertaken in response to individual queries.

Blakefield North – modification to current development consent

Beltana has approval to mine the coal from four seams: Whybrow, Blakefield, Glen Munro and Woodlands Hill until 2030. Preparation is underway to mine the Blakefield seam in the north of the underground mining area (Blakefield North), scheduled to begin longwall mining in 2015. We are currently preparing an application to modify our development consent in relation to the Blakefield North operation. The main changes to the original consent that will be requested are the following:

- Entry to the underground workings will be via a drift rather than highwall access. Current pit-top facilities and coal clearance at Blakefield South will continue to be used.
- Construction of surface ventilation shafts close to the current highwall away from Charlton Road.
- Construction of gas drainage surface infrastructure comparable to that used in the Blakefield South mining area. The Blakefield coal seam contains moderate to high levels of methane. Removing the gas from the coal prior to and after mining is critical for the safety of employees working underground. Pre-drainage gas wells are required to remove the methane from the underground workings before mining commences. Post-drainage gas wells are required to remove the methane that accumulates in the collapsed area behind the longwall (the goaf). Beltana's gas drainage program is about safety for underground employees, and reducing delays in production. Beltana does not utilise hydraulic fracturing or use BTEX chemicals in its gas drainage program. The pre and post mining gas wells will not be installed through the alluvial aquifer. For more information about our gas drainage program, please read the enclosed Gas Drainage Q & A Sheet.



Proposed Blakefield North mine workings.

- Increased capacity for power generation to support our continued efforts to reduce greenhouse gas emissions. The planned location for the power generators is beside the present coal preparation plant on the north-eastern boundary of the mining lease. All power generation infrastructure will have appropriate noise attenuation and will utilise the methane recovered in the gas drainage program.

More details regarding the Blakefield North modification will be provided to the community during 2011. The request for modification will be submitted to the Department of Planning for approval.

Plate 12 – Extract from Bulga Complex Newsletter (April 2011, Issue no.3)

Community Barbeque Program

The BCC hosted two community barbeques in 2011. Thirty one residents attended the first barbeque held on 18 May at the Bulga Community Centre and a further 45 residents attended the barbeque held in Broke on 19 May. The invitation to the barbeques was letterboxed to all residents and advertised in the local Cockfighter magazine. The BUO staff presented details about the Blakefield North modification, followed by a presentation on the BSO Western Extension modification and the BOP project (see **Section 1.4**). Environment and community staff from the BSO, BUO and BOP were available throughout the evening so that residents could discuss any issues or request further consultation if required.

Broke Village Fair

The BCC has been a major sponsor of the Broke Fair for a number of years. On the day of the fair, staff from the Surface and Underground Operations held an information tent and the proposed modifications to the BFN Underground Mine were presented as part of the mine display. Community members had the opportunity to complete a Consultation and Information Request form. There were no requests for consultation or further information about the Project or proposed mining operations.

Broke Village Fair Committee

The BCC was represented at the Fair Committee meetings in 2011, to provide continued support for this popular community event.

Donations

During 2011, the BCC contributed over \$80,000 to schools, community groups and charities, including sponsorship of programs and donations to the following organizations:

- Broke Public School Speech Pathology program;
- Leukaemia Foundation – World's Greatest Shave;
- Broke Fire Brigade;
- Singleton Cancer Appeal Committee;
- Lions Club of Singleton;
- Singleton Family Support Scheme;
- Special Children's Christmas Party;
- RSL Singleton Sub Branch;
- Relay for Life, Singleton;
- Singleton Scouts;
- Molly Jane Miracle Trust;
- Milbrodale School Trash and Treasure Day;
- Singleton Disability and Respite Services;
- Maitland Art Gallery;
- Carer of the Year Awards, Singleton;
- Mount View High School;
- Broke and Milbrodale Schools – Intensive Swim School;
- Rutherford Community Centre;
- Nulkaba Public School.

5.4 Local Aboriginal Community Consultation

The consultation process with Aboriginal stakeholders was undertaken as per the *Aboriginal Cultural Heritage Consultation Requirements* (ACHCRs), Department of Environment, Climate Change and Water (DECCW 2010).

An expression of interest advertisement was placed in the Singleton Argus on the 28th of October 2011 and in the Hunter Valley News on 26 October 2011. To establish a broad base of Aboriginal people or organisations who may hold cultural knowledge relevant to the Project Area, contact details were sought from the OEH, Muswellbrook Shire Council, Singleton Council, NTSCORP, Hunter - Central Rivers Catchment Management Authority, National Native Title Tribunal, Wanaruah Local Aboriginal Land Council and the Register of Aboriginal Owners. In addition, an existing data base of Aboriginal Stakeholders associated with previous projects at BCC was sourced so that these individuals / organisations could be advised of the proposed Project and invited to register interest.

Following the first round of advertising and agency contact, Stage 1 letters were sent to over 60 identified Aboriginal groups and organisations regarding the proposed modification. At the conclusion of the Stage 1 notification phase of this process, the following 12 Aboriginal groups or organisations registered an interest (original letters, if received, are provided in **Appendix 10**).

- Cacatua Culture Consultants;
- Deslee Talbot Consultant;
- Hunter Traditional Owner Management Services;
- Hunter Valley Aboriginal Corporation;
- Kawul Cultural Services;
- Ungooroo Cultural and Community Services;
- Ungooroo Aboriginal Corporation;
- Wattaka Wonnarua Cultural Consulting Service;
- Wonn1 Consultants;
- Wonnarua People;
- Plains Clans of the Wonnarua People; and
- Yinarr Cultural Services.

ACHCR Stage 2 / 3 letters presenting information about the proposed Project and describing the proposed heritage assessment methodology were sent to all stakeholders with a request for any specific cultural information (should any be available), as well as inviting comment / input on the methodology proposed. No comments were received in relation to the proposed methods or cultural information. All correspondence was regarding survey times, dates and representative availability.

Several positions were made available for Aboriginal community representatives and a roster system was developed to allow all stakeholders to be represented during the assessment period. The fieldwork program was undertaken over two days, commencing Monday 9th January to Tuesday 10th January, 2011. The following individuals representing the listed Registered Aboriginal Parties (RAPs) were involved in the assessment:

9 January 2012

George Sampson (Cacatua Culture Consultants);

Adam Sampson (Cacatua Culture Consultants);

Rhonda Griffiths (Hunter Valley Aboriginal Corporation);
Arthur Fletcher (Wonn 1 Contracting); and
Luke Hickey (Hunter Valley Cultural Surveying).

10 January 2012

Kym Slater (Kawul Cultural Services);
Paulette Ryan (Hunter Traditional Owner Management Services);
Mitchum Neave (Deslee Talbott Consultant); and
Lisa Whalan (Yinarr Cultural Services).

Following the fieldwork programme, a draft report was prepared and sent out to all RAPs. Feedback was requested by March 30th 2012, however it was noted should an extension be required to facilitate comment, arrangements would be made. It was noted in the letter that accompanied the assessment report to the stakeholders that no response was considered to mean that the stakeholders were satisfied with the content of the report and did not wish to provide further comment. One response was received from RAPs in relation to the draft report provided. It raised no issue with the report or the accompanying test excavation methodology.

The subsequent test excavation program from 16 to 18 May 2012 included the involvement of RAPs in all aspects of the fieldwork, including decision making on the extension of excavation areas. The three day excavation was managed on a roster system, with six positions per day made available for RAPs to participate. The following individuals representing the listed RAPs were involved in the test excavation program:

16 May 2012

Danny Franks (Plains Clans of the Wonnarua People);
Steven Verey (Plains Clans of the Wonnarua People);
Annette Dunstan (Ungooroo Aboriginal Corporation);
Lisa Whalan (Yinarr Cultural Services);
Tegan McCormack (Cacatua Culture Consultants) and
Arthur Fletcher (Wonn 1 Contracting).

17 May 2012

Danny Franks (Plains Clans of the Wonnarua People);
Steven Verey (Plains Clans of the Wonnarua People);
Tegan McCormack (Cacatua Culture Consultants);
Arthur Fletcher (Wonn 1 Contracting); and
Dallas Nichols.

18 May 2012

Danny Franks (Plains Clans of the Wonnarua People);

Travis Matthews (Deslee Talbot Consultant);

Georgina Berry (Wonnarua People);

Adam Sampson (Cacatua Culture Consultants);

Rhonda Griffiths (Hunter Valley Aboriginal Corporation); and

Donna Sampson (Cacatua Culture Consultants).

Subsequent to this fieldwork, the draft report was updated to incorporate the results of the test excavation and outline the revised management recommendations for the project. A copy of this report was distributed to all RAPs for review and comments were requested by Monday 12th November, 2012. On behalf of Plains Clans of the Wonnarua People, Mr Scott Franks submitted a written response via email advising they were withholding comment due to current negotiations with BOP management.

A log of correspondence with Aboriginal community stakeholders is presented in **Appendix 10** and includes copies of the relevant letters.

6.0 ENVIRONMENTAL ASSESSMENT

6.1 Project Risk Assessment

6.1.1 Overview

A preliminary environmental Broad-Brush Risk Assessment (BBRA) for the Project was undertaken with the aim of identifying all environmental issues to be considered in the EA. A primary objective of the BBRA was to assemble the relevant stakeholders in the Project to identify the activities, aspects and possible impacts associated with the proposed activities of the Project. The risk assessment workshop was held at the BCC in July 2010. The workshop was facilitated by GSSE with key stakeholders from BSO and BUO in attendance.

For all risk assessments, where the risks were considered unacceptable, or a knowledge gap was identified in the information available, specialist consultants would be engaged to undertake further assessments and to identify potential mitigation measures that may be required. With respect to the BBRA, this process was therefore used to identify and prioritise key environmental issues which would require particular attention in the EA.

A Risk Assessment Report (including the risk register), attached as **Appendix 3**, was prepared to document the outcomes for all aspects of the Project identified throughout the BBRA process. This included previously completed reports of the related subsidence risk assessments for the proposed mining areas.

A list of the most significant environmental issues identified in the BBRA is provided below. These are the environmental issues considered to require particular attention in the EA by the risk assessment team. **Table 8** summarises the high and moderate to low risks found by the team, with the primary existing controls in place and the proposed additional controls under consideration.

6.1.2 Key Environmental Risks/Hazards Identified

Key identified activities of the Project with potential to cause a risk of environmental impact include:

- Increased surface disturbances (particularly for gas drainage and associated infrastructure);
- Increased methane gas drainage; and
- Additional/relocated infrastructure.

Based on the findings of the risk assessment workshop, and the risk/hazard evaluation undertaken for the subsequent inclusion of the small-scale power generation plant in the Project, the following issues have been identified as requiring further investigation and potentially specialist assessment. This would determine whether the proposed modifications, individually or cumulatively, have a significantly larger impact than currently approved. Issues would also need to be addressed to a level commensurate with their reduced risk or significance level. The issues include, but may not be limited to:

- | | |
|--------------------------------------|-----------------------------------|
| • Greenhouse Gas and Air Quality | • Heritage |
| • Surface Disturbance/Infrastructure | • Site Services |
| • Flora and Fauna | • Visual Amenity |
| • Surface and Groundwater | • Rehabilitation and Life of Mine |

- Traffic and Transport
- Noise and Vibration
- Land Use
- Community/Government Consultation
- Subsidence

Table 8 – Priority Risk Categories for Management and Status of Proposed Additional Controls

Risk Category	Primary Existing Controls	Proposed Additional Controls	Status / Comment
High Risks			
Air Quality and Greenhouse Gas (GHG)	• Flaring • Beneficial use of coal bed methane – incl. power generation • Pre-mine drainage • Trial VAM • Dust Management Plan • Air monitoring	• Forecast captured methane • Continual development for gas drainage techniques • Supply excess gas to new Blakefield South power generation plant and the proposed (up to 32 MW) plant. • Specialist assessment and review of emissions and potential mitigation measures.	• The proposed power generation plant reduces GHG emissions by offsetting electricity purchased from the grid. • The proposed power generation plant is not anticipated to significantly increase air quality impacts.
Visual Amenity	• Screening • Preferential location where possible; • Consultation with neighbours	• Continuous improvement in screening	• It is anticipated the gas well infrastructure can be designed to minimise visual impact. • The proposed power generation plant would not be highly visible from public or private viewpoints and consumes minimal additional land footprint. • The proposed location for the ventilation fans would not be easily seen from Charlton Rd.
Moderate – Low Risks			
Surface Infrastructure & Services	• Noise Management Plan • Rehabilitation planning • Visual screening • Traffic Management	• Improved timing of surface clearance	• It is anticipated that existing site constraints can be accommodated in proposed surface infrastructure location. • Proposed mine infrastructure lies within mine lease area, and predominantly on mine-owned land.

Risk Category	Primary Existing Controls	Proposed Additional Controls	Status / Comment
Groundwater	- Water Management Plan - Environmental monitoring	Licensing Gas wells for water extraction	- Existing environmental controls deemed adequate - Blakefield North panels further from Wollombi Brook than the previous Whybrow panels
Surface Water	- Relationship with regulators - Erosion and sediment control plan - Inspections/monitoring	- Surface water study - Additional consultation with regulators	- Existing environmental controls deemed adequate - Volume of water drawn from gas drainage is not large - Water balance included in existing Water MP, Licences to extract from BFN will be required.
Aboriginal & Cultural Heritage	- Consultation with Aboriginal Community - Archaeological Management Plan - Pre-work inspections - Relationship with regulators	Early s.90 process, as required.	- Existing heritage constraints can be accommodated in surface infrastructure location. - The bulk of artefacts have been collected for existing Whybrow mining. NPWS s90 application for the BMU1 grinding grooves will be required.
Subsidence	Various management plans associated with Whybrow and Blakefield Seam Subsidence Management Plans (SMPs)	Review SMP management plans.	- Increase in tilts and strains from stacked panels, but predicted parameters are similar to those observed from extraction of the Whybrow Seam. - Subsidence predictions and impact assessments for Blakefield Seam in the Project Area.
Flora and Fauna	Flora and Fauna Management Plan		Existing flora and fauna constraints can be accommodated in surface infrastructure location.
Life of mine & Rehabilitation	- Bulga Coal Complex landscape management Plan - Drill pad and pipeline rehabilitation procedures	Progressive rehabilitation	Life of mine and rehabilitation techniques remain valid

Risk Category	Primary Existing Controls	Proposed Additional Controls	Status / Comment
Traffic & Transport	- Permits to do work in public roadways from local council - Mine plan - Stakeholder Involvement Plan	- Vehicle/traffic Management plan for Charlton Rd - Pit Top facility analysis	Internal traffic management considered satisfactory, but any increased traffic on Charlton Rd may require consideration.
Noise	- Noise Management Plan - Environmental Monitoring Program	- Further stakeholder consultation - Specialist assessment for new ventilation system, gas compressors, power generators and well drilling. - Consideration in context of existing noise complaints for the complex.	Power generation plant noise impact is anticipated to be minimal.

The following sections of the EA discuss all of the relevant aspects of the key risk categories listed above. The structure of each of the following sections is as follows:

- Description of the existing environment, as it relates to the relevant aspect being discussed, which may be affected by the Project, both on and off the site;
- Potential impacts from the Project; and
- Mitigation measures to be adopted.

6.2 Subsidence Assessment

6.2.1 Introduction

Subsidence is the vertical and horizontal movement of the overburden and land surface as a result of the extraction of underlying coal. These movements are generally referred to as subsidence effects. The type and magnitude of the subsidence effects is dependent on a range of variables (e.g. mine geometry, topography and geology). A Subsidence Predictions and Impact Assessment (Subsidence Assessment) has been prepared by MSEC and is presented in **Appendix 6**. This assessment includes predictions of the potential subsidence effects associated with the Project and sensitivity analysis of these predictions. It includes assessment of the potential subsidence impacts on natural and man-made features associated with the Project, which are presented in **Section 6.2.2**.

It is noted that approval has already been granted for the mining of longwall panels 1 to 12 in the Blakefield seam at the BFN Underground Mine, as per the 2003 EIS and DA 376-8-2003. The Subsidence Assessment for this Project therefore updated the predictions for the proposed modifications to the approved longwall layout and compared these with the subsidence predictions previously provided in the 2003 EIS. The subsidence prediction model was also calibrated for multi-seam mining conditions to take into account the fact that the proposed modified longwall layout would take place beneath the previously extracted Whybrow seam.

The study area of the Subsidence Assessment (Subsidence Area) extends beyond the Project Area as detailed in **Section 6.2.2**. It includes the footprint of the modified layout of longwalls BNLW1-7 and also overlaps a large part of the longwalls already mined in the overlying Whybrow seam (Beltana No. 1 Underground Mine).

A full copy of the Subsidence Assessment is attached as **Appendix 6**. The following is a summary of the findings of this report. For further details, the full assessment report should be referred to. It is also important to note the difference in key technical terms used for subsidence management and potential impact assessment for natural and man-made surface features. In particular, the difference between the 20 mm subsidence contour, the concept of 'no significant impact', and the 26.5 degree angle of draw. Although all three are loosely related, they are distinctly different terms that should not be confused. These technical terms are detailed in Appendix A of the Subsidence Assessment in **Appendix 6**.

6.2.2 Existing Environment

The BFN Underground Mine proposes to extract longwalls in the Blakefield seam at the BCC. These seams lie beneath the previously extracted longwalls in the overlying Whybrow seam of the Beltana No. 1 Underground Mine. The subsidence impacts from this Project are expected to be similar to those experienced by the Beltana No. 1 Underground Mine which extracted the overlying Whybrow seam within the Subsidence Area. The subsidence impacts are also expected to be similar to those experienced by the BFS Underground Mine which extracted coal from the Blakefield seam underneath the previously mined Whybrow seam.

The Subsidence Area for the Subsidence Assessment has been defined as the surface area that is likely to be affected by the extraction of the proposed BNLW1 to BNLW7. The Subsidence Area has been calculated by combining the areas bounded by the following limits:

- A 26.5 degree angle of draw line from the extents of the proposed longwalls (i.e. the angle of inclination from the vertical of the line connecting the goaf edge of the workings), and
- The predicted limit of vertical subsidence, taken as the 20mm subsidence contour resulting from the extraction of the proposed longwalls.

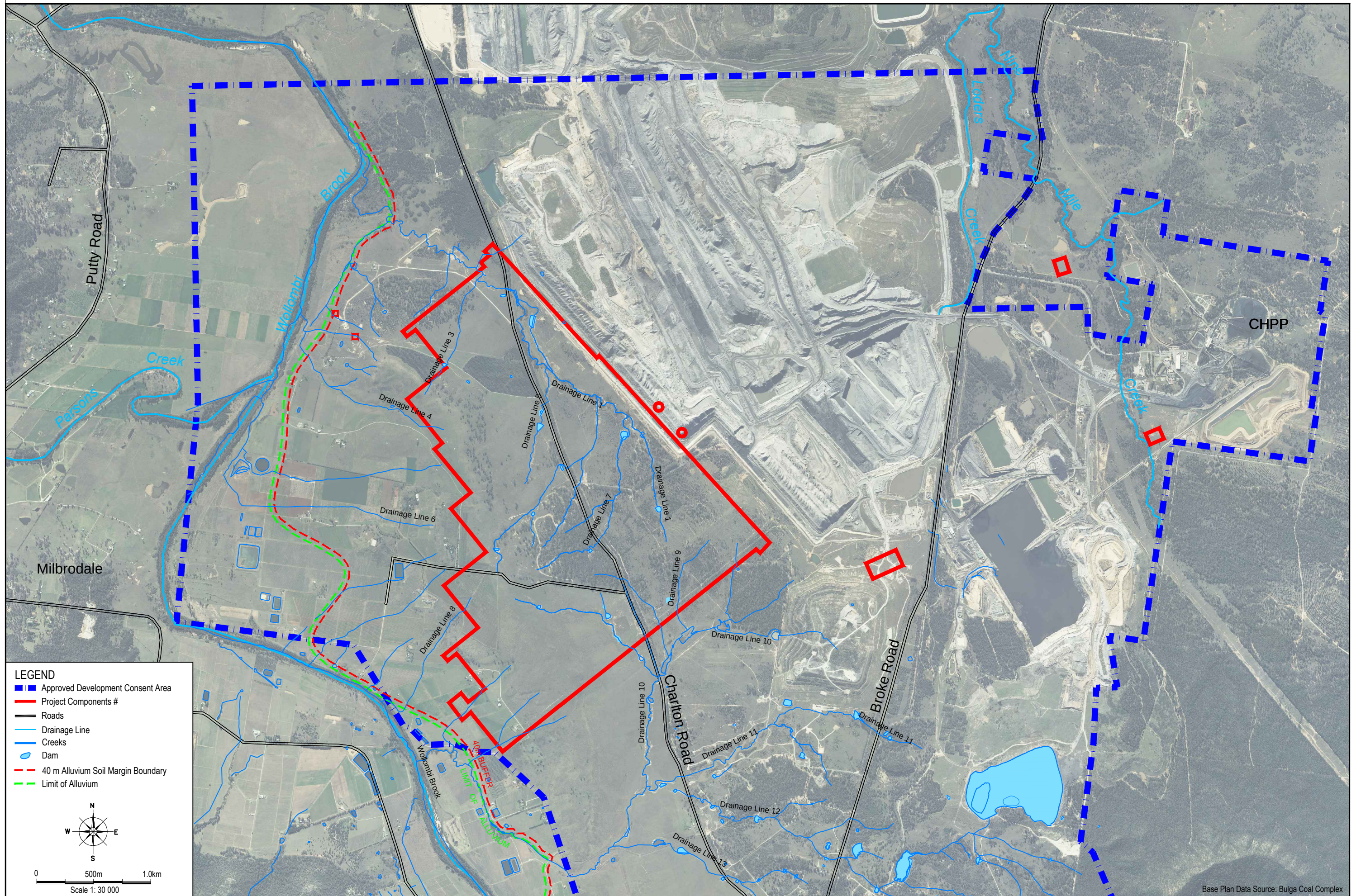
The depth of cover above the proposed longwalls ranges from a minimum of 140 metres (north eastern end) and a maximum of 320 metres (south western end). The Subsidence Area therefore has been determined with the resultant horizontal distance varying between 70m and 160m around the limits of the proposed extraction areas. The features that lie outside the Subsidence Area that are expected to experience far-field movements, or valley related movements, have also been included in the Subsidence Assessment.

Within the Subsidence Area there are only 5 privately owned properties and 1 private residence. The remaining land within the Subsidence Area is owned by the BJV. The affected existing environment has been outlined below.

Drainage Lines

The location of watercourses in the vicinity of the Subsidence Area is shown in **Figure 11**. There are no major creeks or streams within the Subsidence Area. Wollombi Brook is located outside the Subsidence Area and a minimum distance of around 700m west of BNLW1, as its closest point to the proposed longwalls. The limit of alluvium of the Wollombi Brook and the 40m buffer zone to the limit of the alluvium are shown in **Figure 11**. The limit of alluvium is located around 145m south west of the Subsidence Area, at its closest point. The predicted 20mm subsidence contour, after the extraction of the proposed BNLW1-7, is also located well outside the buffer zone to the limit of alluvium.

There are a number of ephemeral drainage lines located within the Subsidence Area (refer to **Figure 11**). The largest of these drainage lines has been labelled Drainage Line 1 and is located at the eastern ends of the proposed longwalls. Drainage Line 1 flows in a north-westerly direction and drains into Wollombi Brook approximately 1.6km north of the proposed longwalls.



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All indicative locations - will be finalised pending constraints

There are also a number of smaller drainage lines located directly above the proposed longwalls. The drainage lines in the eastern part of the Subsidence Area flow in a north-easterly direction to where they drain into Drainage Line 1. The drainage lines in the western part of the Subsidence Area flow in westerly directions to where they drain into Wollombi Brook.

Steep Slopes

The land within the Subsidence Area is undulating and there are no locations within this area that would be considered as comprising naturally steep slopes (i.e. a grade of greater than 33%).

Land Prone to Flooding and Inundation

Some land within the Subsidence Area is relatively flat and could be susceptible to inundation during major rainfall events.

Natural Vegetation

The land within the Subsidence Area primarily comprises pastoral grassland, cleared areas and some small vineyards. There are pockets of woodland, vegetation and crops. The woodland communities within the Subsidence Area generally comprise regrowth vegetation with a few mature trees. Natural vegetation is further discussed in **Section 6.6**.

Public Roads

The main public roads within the Subsidence Area are Charlton Road and Cobcroft Road, which are both located above the proposed longwalls, and Fordwich Road, which is in the south-west corner of the Subsidence Area (see **Figure 12**). Charlton and Cobcroft roads are single land sealed carriageways up to 6m wide, with table drains and grass verges. Fordwich Road, within the Subsidence Area is a single lane gravel road. All of these roads are owned and maintained by the Singleton Council.

Water Infrastructure

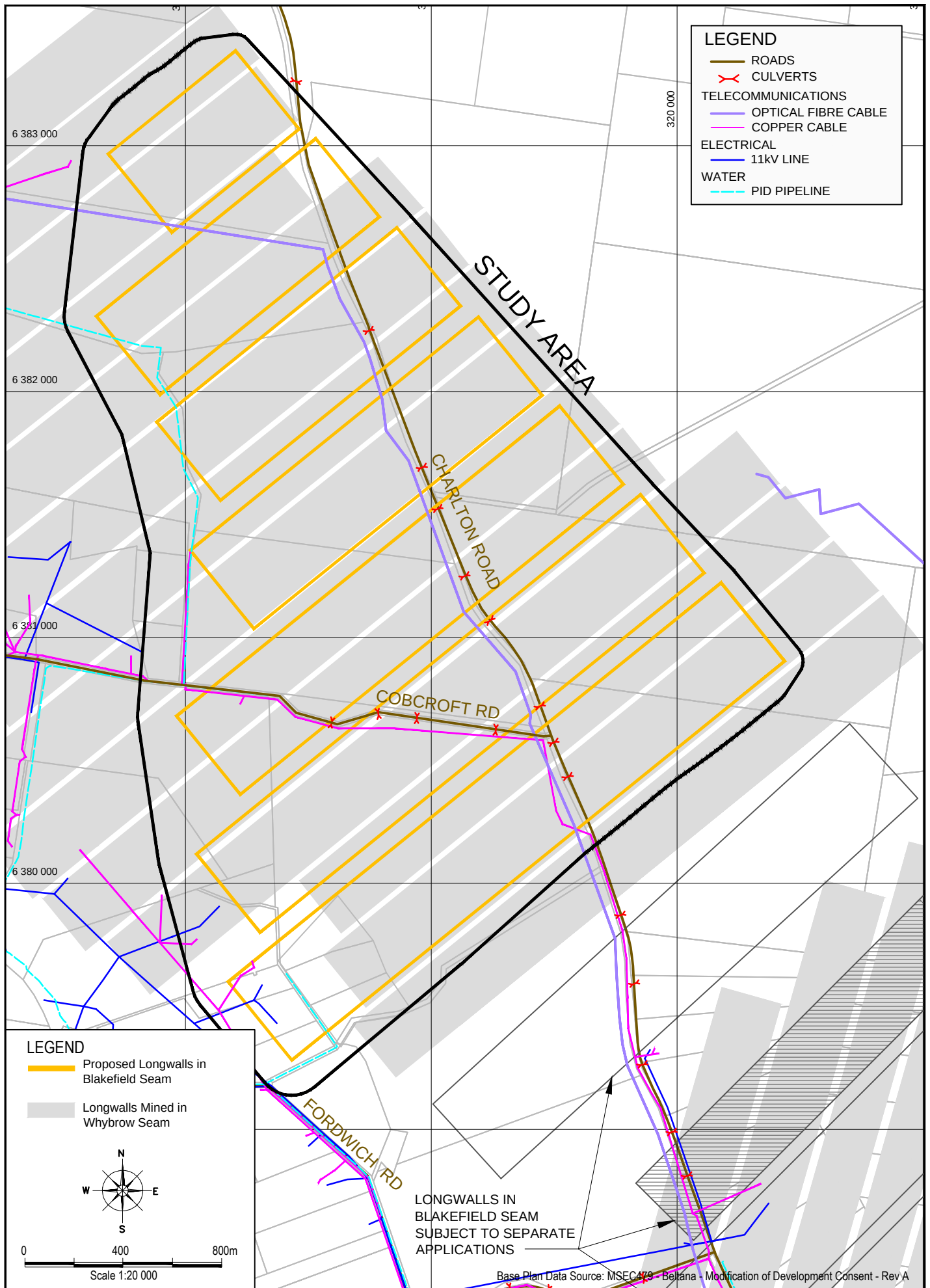
Water infrastructure within the Subsidence Area comprises the Private Irrigation Distribution (PID) pipeline which provides potable water to the rural properties along Cobcroft Road (see **Figure 12**). The pipeline comprises butt welded polyethylene pipes with diameters varying between 50mm and 160mm. The PID rising main crosses directly above the south-western ends of the proposed BNLW4 to BNLW6 and a distribution line also crossed directly above the south-western end of BNLW3.

Electrical Infrastructure

The electrical infrastructure comprises 11kV power lines and low voltage power lines in the western part of the Subsidence Area which service the rural properties along Cobcroft Road (see **Figure 12**). The power lines that service one property (identified as property 19 in the Subsidence Assessment) are located directly above the proposed BNLW1. The remaining power lines in the Subsidence Area are not located directly above the proposed longwalls.

Telecommunications Infrastructure

Telecommunications infrastructure in the Subsidence Area comprises an optical fibre cable and copper telecommunications cables which are owned by Telstra (see **Figure 12**). The optical fibre cable is direct buried and generally follows the alignment of Charlton Road within the Subsidence Area. The copper cables are also direct buried and generally follow the alignments of Cobcroft and Charlton Roads.



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FIGURE 12

Agricultural Utilisation and Viticulture

The land within the Subsidence Area has been generally cleared and has been used for light grazing and viticulture. Two privately-owned vineyards would be undermined by longwall 1 and one privately owned vineyard would be undermined by longwalls 2 and 3. The mine owned olive grove and general grazing land would be affected by the remaining undermined area.

Fences

A variety of fences are located across the Subsidence Area. These generally comprise timber fence posts and fencing wire.

Farm Dams

There are a number of farm dams in the Subsidence Area which have been constructed along the alignments of the drainage lines (refer to **Figure 11**). The farm dams are typically of earthen construction and have been established by localized cut and fill operations.

Building Structures

There are 5 private properties in the Subsidence Area and 1 privately owned dwelling. Residence 18b shown in **Figure 5** is located directly above the proposed longwall BFNW1. Residence 18b (see **Plate 13**) comprises a single storey timber framed house on brick piers, adjacent to which is a light weight metal clad shed (shown as 18a on **Figure 5**).

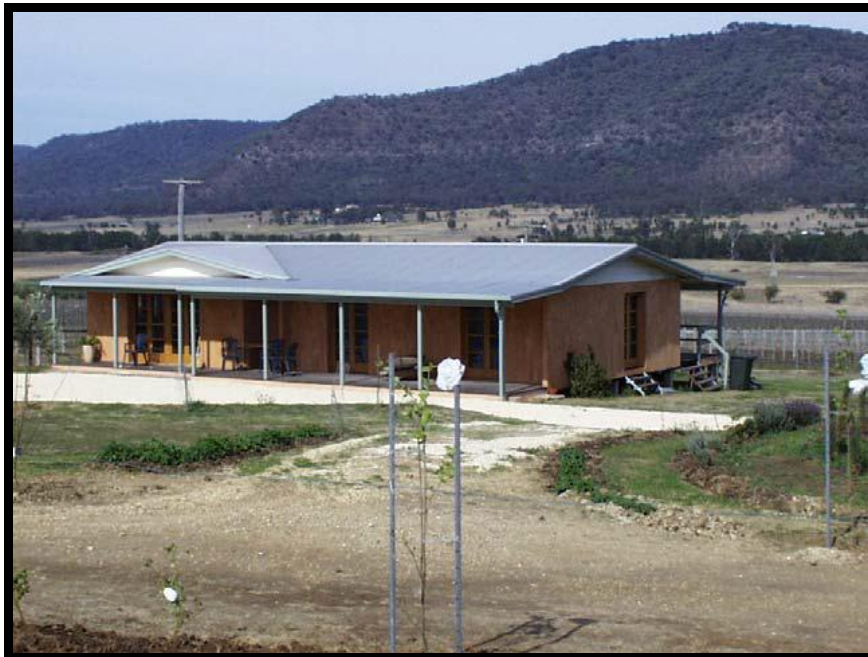
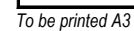


Plate 13 – House Reference 18b

Archaeological Sites

The archaeological sites within the Subsidence Area comprise the *Beltana Grinding Grooves* (BMU1), located above BNLW5 (which has approval for destruction pursuant to AHIP No. 37-6-0967) and artefact scatters and isolated finds located across the mining area (see **Figure 13**).



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FIGURE 13

Heritage Sites

There are three heritage sites within the Subsidence Area, being sites BH1 and BH2 (fence posts) and BH3 (cement, footings, bricks and artefacts) (see **Figure 14**).

Survey Control Marks

The location of survey control marks within the vicinity of the proposed longwalls is shown in Drawing No. MSEC479-09 of the Subsidence Assessment. There are six survey control marks within the Subsidence Area, with a further four in close proximity.

6.2.3 Potential Impacts

The Subsidence Assessment for the Project concluded that the maximum predicted tilts and curvatures for the proposed BNLW1 to BNLW7, based on the modified layout, would be greater than those provided in the 2003 EIS. The reason for this is that the predictions provided in the 2003 EIS were based on the longwalls in the Blakefield seam being offset from those in the Whybrow seam, which provides flatter subsidence profiles (i.e. smaller tilts and curvatures) than the proposed modified case, which includes some locations where the Blakefield seam chain pillars are beneath the Whybrow seam chain pillars. Whilst the maximum predicted additional tilts and curvatures, based on the modified layout, are greater than those approved in the 2003 EIS, the predicted parameters are similar to those previously observed as the result, of the extraction of the overlying longwalls in the Whybrow seam at the BFS and Beltana No.1 Underground Mines. The potential impacts for the proposed BNLW1-7 therefore, are expected to be similar to those previously observed resulting from the Whybrow seam longwalls.

The expected additional subsidence contours in the Subsidence Area as a result of mining the Blakefield Seam are illustrated in **Figure 15**, and described further below.

No significant impacts are anticipated as a result of subsidence on the natural features and surface infrastructure within the Subsidence Area as a result of the Project, as discussed below.

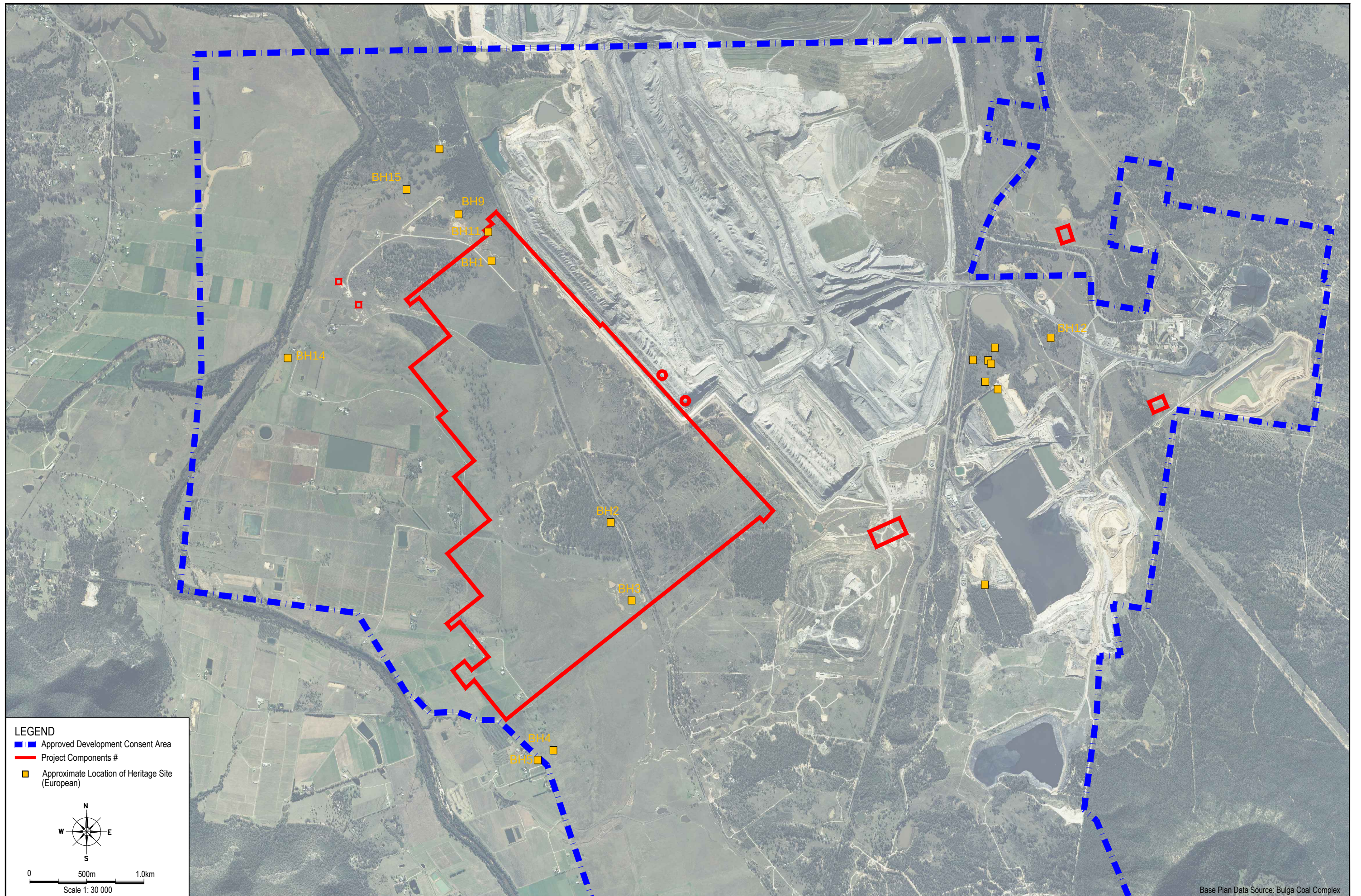
Drainage Lines

Wollombi Brook is located outside the study area being some 700m west of BN LW1 at its closest point. The proposed longwalls are therefore well outside the alluvium of Wollombi Brook and the 40m buffer zone to the limit of the alluvium. There are a number of ephemeral drainage lines in the study area, and these are expected to experience the full range of predicted subsidence movements. **Table 9** provides a comparison between the maximum predicted additional conventional subsidence parameters for the drainage lines based on the 2003 EIS and the modified longwall layout.

Table 9 – Comparison of the maximum predicted additional conventional subsidence parameters for the drainage lines based on the EIS and modified layouts

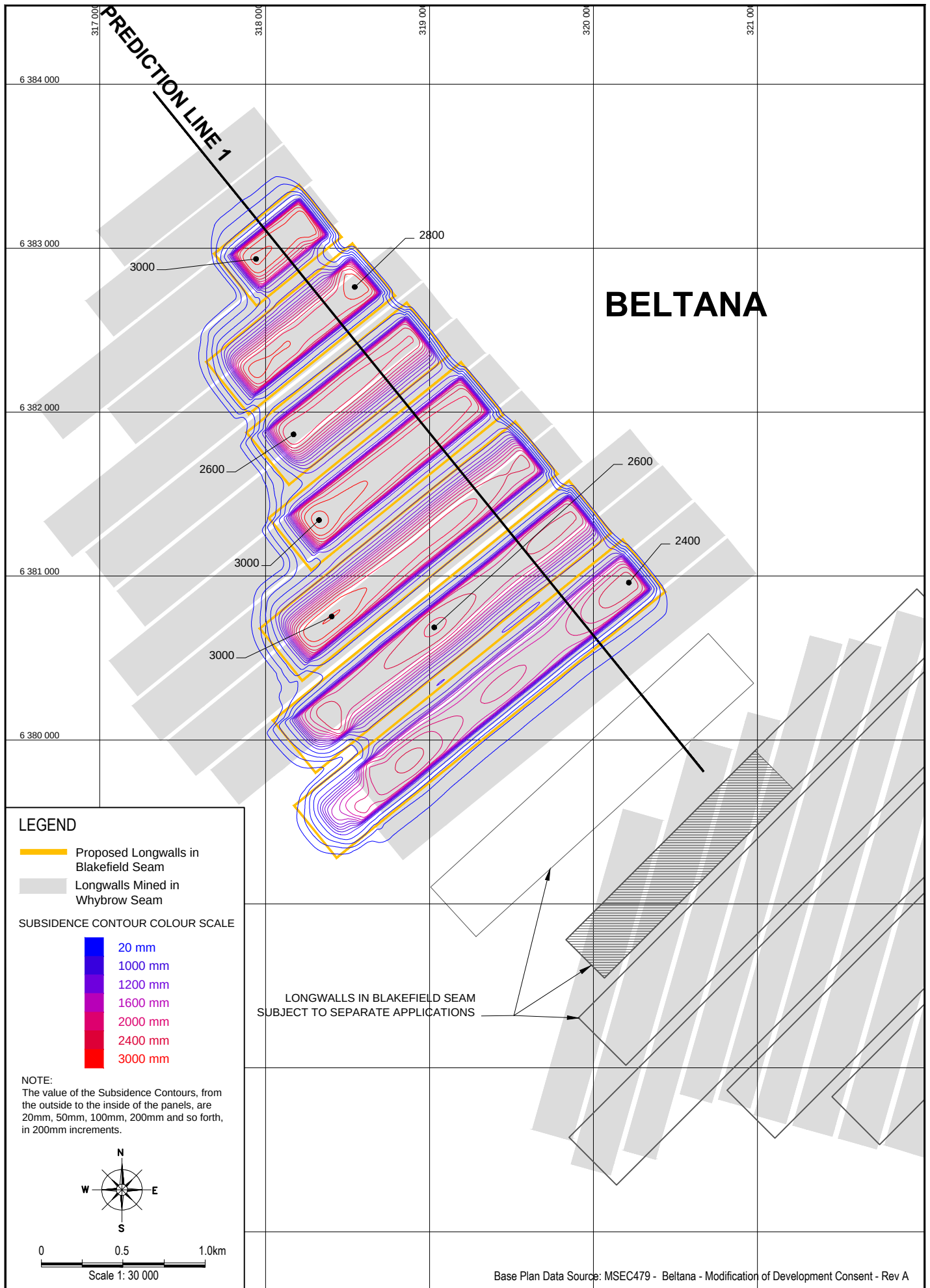
	Maximum predicted additional conventional subsidence (mm)	Maximum predicted additional conventional tilt (mm/m)	Maximum predicted additional conventional hogging curvature (km^{-1})	Maximum predicted additional conventional sagging curvature (km^{-1})
EIS Layout	3265	24	0.9*	1.1*
Modified Layout	3100	100	>5.0	5.0

Note: * denotes that predicted curvatures were not provided in the 2003 EIS, however, the curvatures based on the EIS Layout have been derived from the maximum predicted strains using the linear relationship between curvature and strain described in that report.



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All indicative locations - will be finalised pending constraints



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The predicted subsidence and tilts are likely to be of sufficient magnitude to result in changes to the surface water flows along the drainage lines. Increased ponding is predicted to develop directly above BNLW1 and BNLW7. The maximum predicted additional depth of ponding along Drainage Line 1, resulting from the extraction of the proposed longwalls in the Blakefield seam only, is around 2 metres. This increases to around 4 metres when extraction of both the Whybrow and Blakefield seams is modelled. The maximum predicted additional depth of ponding along the remaining drainage lines is around 3 metres (Blakefield seam only) and 5 metres when extraction of both (Whybrow and Blakefield) seams is modelled. Notwithstanding these modelled predictions (which are by nature conservative), the actual observed subsidence along the drainage lines following extraction of the overlying Whybrow seam was between 1.6m and 1.9m. Based on these observations, the likely maximum additional ponding along the drainage lines resulting from the proposed mining in the Blakefield Seam is likely to be between 1.5m and 2.5m (MSEC, 2012).

As described above, the drainage lines at Beltana No. 1 and BFS Underground Mines were previously undermined by the longwalls in the Whybrow seam. Although surface cracking was observed across the mining area, there were no observable surface water flow diversions in the drainage lines, resulting from the extraction of these longwalls, after the remediation of the larger surface cracks had been completed. It is not anticipated that any significant surface water diversions would result from the extraction of the proposed BNLW1 to BNLW7, after the completion of any necessary remediation of surface cracking. With the implementation of necessary management and mitigation strategies, it is expected that there would be no long term adverse impacts on the drainage lines in the Subsidence Area.

Land Prone to Flooding and Inundation

Some land within the Subsidence Area is relatively flat and could be susceptible to inundation during major rainfall events. The extraction of BNLW1-7 is likely to result in areas of increased ponding in drainage lines directly above the mined area, however, this is not expected to have any adverse long-term impacts.

Public Roads

The main public roads within the study area are Charlton Road and Cobcroft Road, which are both located above the proposed longwalls, and Fordwich Road, which is in the south-west corner of the Subsidence Area.

The predicted subsidence and tilts could be of sufficient magnitude to result in changes in the surface water drainage along the public roads. Localised troughs are expected to develop directly above each of the proposed longwalls, which could result in locally increased ponding in these locations. **Table 10** provides a comparison between the maximum predicted additional conventional subsidence parameters for the public roads based on the 2003 EIS and the modified layout.

Table 10 – Comparison of the maximum predicted additional conventional subsidence parameters for the public roads based on the EIS and modified layouts

	Maximum predicted additional conventional subsidence (mm)	Maximum predicted additional conventional tilt (mm/m)	Maximum predicted additional conventional hogging curvature (km ⁻¹)	Maximum predicted additional conventional sagging curvature (km ⁻¹)
EIS Layout	3100	33	1.3*	1.2*
Modified Layout	3000	90	>5.0	5.0

Note: * denotes that predicted curvatures were not provided in the 2003 EIS, however, the curvatures based on the EIS Layout have been derived from the maximum predicted strains in Table 5.10 of Report No. WKA135 using the linear relationship described in that report.

The predicted curvatures and the range of potential strains, for the public roads, resulting from the extraction of the proposed longwalls, are similar to those previously observed along Charlton Road resulting from the previous extraction of the longwalls in the overlying Whybrow seam. Crack widths observed along Charlton Road, due to the extraction of the Beltana No. 1 Underground Mine Longwalls 1-10 and the BSLW1 (Whybrow and Blakefield seams), typically varied between 10mm and 50mm (with a maximum crack width greater than 380mm). The compression heaving and step heights observed along the road typically varied up to 25mm. These impacts were successfully managed at Beltana No. 1 and BFS Underground Mines and it is expected that the BFN Underground Mine subsidence impacts would be able to be similarly managed.

Water Infrastructure

Water infrastructure within the Subsidence Area comprises the PID pipeline which provides irrigation water to the rural properties along Cobcroft Road. The design of the PID pipeline was approved by the Mine Subsidence Board, and can accommodate ground strains greater than 70mm/m and ground curvatures of 9m. It is therefore expected that the PID pipeline would be able to accommodate the predicted additional movements resulting from the extraction of BNLW1-7, based on the modified layout, without adverse impacts. It is possible that the lower radii of curvature, or greater ground strains could be experienced at the pipeline due to irregular subsidence movements resulting from the multi-seam conditions, however this is able to be managed by the measures outlined in **Section 6.2.4**.

Electrical Infrastructure

The electrical infrastructure comprises 11kV power lines and low voltage power lines in the western part of the Subsidence Area which service the rural properties along Fordwich and Cobcroft roads. The power lines that service one property (identified as property 18 in the Subsidence Assessment – see **Plate 13**) are located directly above the proposed BNLW1, and are expected to experience subsidence movement similar to those experienced by power lines that were directly mined beneath by the previously extracted Whybrow Seam longwalls from Beltana No. 1 and BFS Underground Mines. The impacts of subsidence from the Whybrow seam mining on power lines was managed by the temporary installation of sheaves and re-tensioning lines where necessary. The remaining power lines are not located above the proposed longwalls and are not expected to be impacted by mining BNLW1-7.

Telecommunications Infrastructure

Telecommunications infrastructure in the Subsidence Area comprises an optical fibre cable and copper telecommunications cables which are owned by Telstra. These cables are buried and generally follow the alignments of Cobcroft and Charlton Roads. Therefore the maximum predicted subsidence parameters are expected to be similar to those predicted for the public roads.

As the cables are buried they are not expected to be adversely affected by vertical subsidence or tilt. Predicted curvatures and ground strains for the cables are expected to be similar to those observed from previous extraction of longwalls in the Whybrow seam at the BFS Underground Mine. Additionally the optical fibre cable within the Subsidence Area has been duplicated with a new cable placed within flexible ducts to accommodate mine subsidence movements. It is therefore not expected that the optical fibre cable and copper telecommunications cable would be adversely affected by the extraction of the proposed longwalls.

Agricultural Utilisation and Viticulture

The land within the Subsidence Area has been generally cleared and has been used for light grazing, viticulture and the mine owned olive grove.

As part of the 2003 EIS which supported the current DA 376-8-2003 consent, a detailed Viticulture Assessment was undertaken by viticulture expert, Dr Richard Smart, in consultation with affected vignerons. This assessment looked at the potential impacts of subsidence on the vineyards and associated infrastructure (irrigation network, trellises, fencing, etc). A monitoring program of general vineyard properties of all undermined vineyards was also commenced at this time. During undermining the program included an assessment of yield (e.g. pruning weight, bud retention, yield, berry weight, sugar, acidity, pH). This monitoring program was assisted by the analysis of satellite imagery of the vineyards to identify vine vigour across all vineyards and compared against the monitoring results. The vineyards are still being monitored for soil moisture, irrigation volumes and vine health and vigour.

Subsidence previously observed at these vineyards during the previous extraction of the overlying longwalls in the Whybrow seam at Beltana No. 1 Underground Mine, resulted in only minor impacts to vineyard trellis assemblies and irrigation. No vines died as the result of subsidence impacts.

There were three claims for compensation for reduced tonnes (up to 40%) as the result of subsidence impacts. The claims were substantiated by the vignerons by comparison of tonnes from particular vineyards blocks before and after subsidence. The claims for compensation were settled with the vineyard which was the subject of the most substantial claim, following which record yields were recorded in the following season. Notwithstanding, the investigations concluded there is the potential to temporarily impact on vineyard productivity as the result of subsidence, particularly if the vineyards are undermined during the period of root growth flushes during flowering (late November early December in the Broke region) and after harvest (March/ April), and the conditions are dry. Since the first vineyard was undermined in April 2005, there have been six vintages and no observable longer term impacts.

It is anticipated that the maximum predicted subsidence parameters resulting from the extraction of the proposed BNLW1 to BNLW7, based on the modified layout, would be similar to those previously observed during the previous extraction of the overlying longwalls in the Whybrow Seam at Beltana No. 1 Underground Mine.

Fences

The fences located across the Subsidence Area are expected to experience the full range of predicted subsidence movements. The types of fences are generally flexible in construction and can usually tolerate tilts of up to 10mm/m and strains of up to 5mm/m without significant impacts.

Farm Dams

There are a number of farm dams in the Subsidence Area which have been constructed along the alignments of the drainage lines and are expected to be impacted by subsidence movements. The maximum predicted subsidence parameters resulting from the extraction of BNLW1-7 based on the modified layout are similar to those previously observed during the previous extraction of the overlying longwalls in the Whybrow seam at the Beltana No. 1 and BFS Underground Mines. The impacts of Whybrow seam subsidence on the farm dams in drainage lines did not require any remedial work.

Building Structures

There are 5 privately owned properties in the Subsidence Area and 1 privately owned dwelling (shown as 18b in **Figure 5**).

Although house 18b is directly above the proposed longwall BFNLW1, the previously extracted longwalls from the Whybrow seam did not mine directly beneath this house (i.e. single seam subsidence parameters apply). **Table 11** provides a comparison between the maximum predicted

additional conventional subsidence parameters for the affected house based on the 2003 EIS and the modified layouts.

Table 11 – Comparison of the maximum predicted additional conventional subsidence parameters for the two houses located above the proposed longwalls, based on the EIS and modified layouts

	Maximum predicted additional conventional subsidence (mm)	Maximum predicted additional conventional tilt (mm/m)	Maximum predicted additional conventional hogging curvature (km^{-1})	Maximum predicted additional conventional sagging curvature (km^{-1})
EIS Layout 18b	2370	11	NA	0.40
Modified Layout 18b	800	13	0.18	0.14

Note: * denotes that predicted curvatures were not provided in the 2003 EIS, however, the curvatures based on the EIS Layout have been derived from the maximum predicted strains in Table C.1 of Report No. WKA135 using the linear relationship described in that report.

The maximum predicted subsidence and curvatures for house 18b based on the modified layout, are less than those of the original EIS layout. The maximum tilt is similar to but slightly greater (2mm) than that predicted by the EIS layout.

It is expected that some minor serviceability impacts would occur at house 18b, however as the house is of lightweight construction, it is predicted to tolerate the predicted curvatures and strains without becoming unstable or experiencing major impacts.

Archaeological Sites

The archaeological sites within the Project Area comprise the Beltana axe grinding grooves located above BNLW5 (BMU1 – already approved for destruction pursuant to AHIP No. 37-6-0967) and artefact scatters located across the mining area. **Table 12** provides a comparison between the maximum predicted additional conventional subsidence parameters for archaeological sites based on the 2003 EIS and the modified layouts.

Table 12 – Comparison of the maximum predicted additional conventional subsidence parameters for archaeological sites based on the EIS and modified layouts

	Maximum predicted additional conventional subsidence (mm)	Maximum predicted additional conventional tilt (mm/m)	Maximum predicted additional conventional hogging curvature (km^{-1})	Maximum predicted additional conventional sagging curvature (km^{-1})
EIS Layout Grinding Grooves	3046	10	0.4*	0.4*
EIS Layout Artefact scatters	3265	24	0.9*	1.1*
Modified Layout Grinding Grooves	1825	85	4.5	4.5
Modified Layout Artefact scatters	3100	100	>5.0	>5.0

Note: * denotes that predicted curvatures were not provided in the 2003 EIS, however, the curvatures based on the EIS Layout have been derived from the maximum predicted strains using the linear relationship between curvature and strain described in that report.

The maximum predicted additional tilt and curvatures based on the modified layout are greater than the predicted by the EIS layout. The predicted parameters are similar to those observed as a result of

the extraction of the longwalls in the overlying Whybrow seam at the Beltana No. 1 and BFS Underground Mines.

It is expected that the predicted curvatures and strains at the Beltana Grinding Groove site (BMU1) are of sufficient magnitude to result in fracturing of the bedrock, and it is therefore likely that the site would be impacted if fracturing were to occur coincident with the site. In this regard it is relevant to note that approval already exists to destroy BMU1 pursuant to AHIP No. 37-6-0967 and condition 36 of DA 376-9-2003 (as amended). It is unlikely that the scattered artefacts and isolated finds would be impacted by surface cracking.

Heritage Sites

There are three heritage sites directly above the amended longwall layout, being sites BH1 and BH2 (fence posts) and BH3 (cement, footings, bricks and artefacts). These types of sites are typically not adversely affected by vertical subsidence, curvature and ground strain. **Table 13** provides a comparison between the maximum predicted additional conventional subsidence parameters for the heritage sites based on the 2003 EIS and the modified layouts.

Table 13 – Comparison of the maximum predicted additional conventional subsidence parameters for heritage sites based on the EIS and modified layouts

	Maximum predicted additional conventional subsidence (mm)	Maximum predicted additional conventional tilt (mm/m)	Maximum predicted additional conventional hogging curvature (km^{-1})	Maximum predicted additional conventional sagging curvature (km^{-1})
EIS Layout BH1	962	19	0.3*	0.3*
EIS Layout BH2	1778	18	0.3*	0.3*
EIS Layout BH3	2848	22	0.5*	0.5*
Modified Layout BH1	1300	100	>5.0	1.0
Modified Layout BH2	2375	5	1.0	1.0
Modified Layout BH3	1875	5	1.0	1.0

Note: * denotes that predicted curvatures were not provided in the 2003 EIS, however, the curvatures based on the EIS Layout have been derived from the maximum predicted strains in Table C.2 of Report No. WKA135 using the linear relationship described in that report.

The maximum predicted tilts and curvatures based on the modified layout are greater than those predicted for the EIS layout. The predicted parameters are similar to those previously observed as a result of the previous extraction of the longwalls in the overlying Whybrow seam at the BFS and Beltana No. 1 Underground Mines. The predicted tilt may be visually noticeable in the fence posts; however it is unlikely that the fence posts and other artefacts themselves would be adversely impacted by surface cracking.

Survey Control Marks

Survey control marks located directly above the proposed longwalls could experience the full range of predicted subsidence movements. On the completion of the longwalls, when the ground has stabilized, it would be necessary to re-establish any survey control marks which are required for future use.

6.2.4 Mitigation Measures

The findings of the Subsidence Assessment indicates that the levels of impact on the natural features and items of surface infrastructure can be managed by the implementation of suitable management strategies. As outlined in **Section 2.8.7**, BCC has developed subsidence management strategies for the public roads, water infrastructure, electrical infrastructure, farm dams, houses, archaeological

sites and heritage sites which have been directly mined beneath by previously extracted Whybrow seam longwalls at the BFS and Beltana No. 1 Underground Mines. With the implementation of similar and updated Subsidence Management Plans at the BFN Underground Mine it is expected that the natural features and surface infrastructure can be maintained in serviceable conditions throughout the mining period, as has been successfully undertaken at the adjacent mining operations.

A summary of the proposed mitigation measures relevant to affected natural features and surface infrastructure is provided below. These mitigation measures would be included in an updated Subsidence Management Plan:

Drainage Lines

After the completion of mining, earthworks would be required to establish the natural gradient along the drainage lines. Alternatively, if the additional ponding caused by mining was considered desirable from an ecological or agricultural use perspective the beds of the drainage lines could be reinforced to prevent scouring, and to provide additional dam walls to those which already exist along the drainage lines.

Public Roads

Public roads in the study area are of flexible construction, and can be re-graded, re-levelled, repaired and reconstructed using standard road maintenance techniques as mining proceeds. The impacts on public roads can be managed using ground and visual monitoring to the west of the road as the longwall extraction face approaches the road. BCC has developed similar management strategies for the public roads which have been undermined by previously extracted Whybrow and Blakefield seams at the Beltana No. 1 and BFS Underground Mines. This has ensured that public roads remain in safe and serviceable conditions throughout the mining period.

Water Infrastructure

If significant irregular subsidence movements impact the PID pipeline, it may be necessary to uncover the pipeline and provide a sand base so as to isolate it from the predicted curvatures and ground strains where it crosses directly above the ends of the proposed BNLW6-7. BCC has developed similar management strategies for the sections of the PID pipeline which have been undermined by previously extracted Whybrow and Blakefield seams at the Beltana No. 1 and BFS Underground Mines. This has ensured that the PID pipeline remains in a serviceable condition throughout the mining period.

Agricultural Utilisation and Viticulture

As detailed in **Section 2.8.7**, BCC already has in place monitoring and management strategies for the privately owned vineyards which have been directly mined beneath by previously extracted Whybrow Seam longwalls at the Beltana No. 1 Mine. Following approval of the Project, the existing Private Property Subsidence Management Plans and monitoring programs that relate to subsidence impacts on these land uses would be developed and updated as necessary, in conjunction with a Subsidence Management Plan for the area. This would include a continuation of the existing monitoring program for vineyards that has been established by the BCC in consultation with vignerons.

Fences

Any significant impacts on fences would be remediated by re-tensioning the fencing wire, straightening the fence posts, and if necessary, replacing some sections of fencing.

Farm Dams

Although there were no mitigation works required on farm dams in drainage lines that were undermined by previously extracted Whybrow and Blakefield seams at the Beltana No. 1 and BFS Underground Mines, BCC has developed management strategies to deal with any impacts on farm dams. This includes remediation of surface cracking and reinforcement of dam walls where required.

Building Structures

It is expected that any impacts on the impacted house would be able to be remediated by normal building maintenance techniques, to address issues such as cracking to the wall claddings and finishes, jamming of doors and windows, etc. In some cases it may be necessary to re-level the houses, based on the magnitudes of the predicted tilts.

Archaeological Sites

The 2003 EIS and approval DA 376-8-2003 recognised that the axe grinding grooves (BMU1) would be impacted by mining of the Blakefield and underlying seams. Consequently, approval was granted to destroy BMU1 pursuant to AHIP No. 37-6-0967 and condition 36 of DA 376-9-2003 (as amended). In any event, the BOP (if approved – see **Section 1.4.3**) is likely to impact on the grinding grooves prior to mining at BFN. As a result, no additional mitigation measures have been identified.

Heritage Sites

If the tilt of heritage fence posts becomes unacceptable, this would be remediated by locally adjusting the affected fence posts. Although the fence posts and isolated artefacts themselves are unlikely to be impacted by surface cracking, it may be necessary to remediate any surface cracking around these fence posts and artefacts. This would be in accordance with the developed management strategies for these heritage sites which have already been undermined by the previously extracted longwalls in the overlying Whybrow seam at Beltana No. 1 Underground Mine.

Survey Control Marks

Upon completion of longwall mining, when the ground has stabilized, it would be necessary to re-establish any survey control marks that are required for future use. This would be done in consultation with NSW Land and Property Information to ensure the survey control marks are reinstated at the appropriate time, as required.

6.3 Air Quality Assessment

6.3.1 Introduction

An Air Quality Assessment was undertaken by Todoroski Air Sciences and is attached as **Appendix 7**. The assessment considered the potential air quality impacts associated with particulate matter (suspended dust) and deposited dust (insoluble solids). The assessment also addressed emissions of carbon monoxide (CO), nitrogen dioxide (NO₂), hydrocarbons and odour generated from the ventilation fans and the combustion and flaring of coal seam methane.

The following is a summary of the findings of this report. For further details, the full assessment report should be referred to.

6.3.2 Existing Environment

The main sources of particulate matter in the wider area of the BCC include mining activities, traffic on unsealed roads, construction activities, farming and animal grazing, traffic from other local roads and

other anthropogenic sources such as domestic wood-fired heaters power generation. BCC operates a comprehensive air quality monitoring system, as detailed in **Section 2.8.3**.

Local Meteorology

As detailed in **Section 2.8.2**, continuous monitoring of rainfall, wind speed, wind direction and temperature is undertaken and downloaded to a data logger at BCC. This data logger records hourly averages as well as daily minima and maxima. Historically the BCC XCN Weather Station at the surface operations has been utilised, however, a new station (the Bulga Complex Weather Station), has been commissioned and tested, with reporting commencing in late 2010.

Site specific meteorological data was obtained from the Bulga Complex Weather Station and used in the air dispersion models for the assessment. Analysis of the windroses (annual and seasonal from data collected between 15 September 2010 and 14 September 2011) showed the most common winds on an annual basis were from the south and northwest with few winds originating from the northeast quadrant. During summer winds from the east-southeast dominate with a lesser portion of winds from the south. In autumn winds from the south were most common. During the winter months winds predominately occur from the northwest with a spread of winds from the southwest quadrant. The spring windrose had a wind distribution similar to the annual windrose with winds originating from the south, northwest and southeast. The pattern of winds was broadly typical of the seasonal wind patterns experienced in the Hunter Valley. The annual average wind speed for this data set was 4.15m/s and annual percentage of calms were 1.3%. The stability class distribution from the weather data (measuring the stability of the atmosphere) showed a high (60.4%) frequency of Class D conditions suggesting that emissions would disperse rapidly for a significant portion of time.

Long-term climatic data from the closest Bureau of Meteorology weather station at Jerrys Plains Post Office was used to characterise the local climate in the proximity of the BCC. Data collected over a 125-year period indicated that January was the hottest month with a mean maximum temperature of 31.7°C and July was the coldest month with a mean minimum temperature of 3.8°C. Rainfall data showed January was the wettest month with an average rainfall of 77.0mm over 6.4 days and August was the driest month with an average rainfall of 36.5mm over 5.2 days.

PM₁₀ and TSP

The BCC conducts PM₁₀ monitoring using five HVAS monitors. A summary of the results collected from these monitors between January 2008 and November 2011 is presented in **Table 14**. The monitored concentrations were nominally highest in the spring and summer months with the warmer weather raising the potential for drier ground elevating the windblown dust, the occurrence of bushfires and pollen levels. The data presented indicates that all monitors have recorded annual average PM₁₀ concentration levels below the OEH criteria of 30µg/m³ with the exception of the H1 monitor during 2008 and 2009.

The levels recorded at H1 were a little above the criteria with annual average PM₁₀ levels of 31 and 33 during 2008 and 2009 respectively. H1 generally records higher concentrations when compared to the other HVAS monitors as it is located adjacent to a local access road and remains frequently influenced by local dust events. This includes dust generated by a frequently trafficked road (adjacent to the sampling location) which is used by trucks for the neighbouring mushroom composting operation, as well as an adjacent train line. As a result, it would be expected to record relatively high levels that are not representative of the dust levels at sensitive receptors.

Table 14 – PM₁₀ Concentrations for HVAS Monitoring (µg/m³)

Year	Annual average					Criteria
	H1	Dawtrey	D10	Beltana**	Broke Hall	
2008	31	17	17	-	16	30
2009	33	17	16	17	17	30
2010	27	13	13	17	13	30
2011*	28	12	13	17	13	30
Year	Maximum 24-hour average					Criteria
	H1	Dawtrey	D10	Beltana**	Broke Hall	
2008	119	61	58	-	57	50
2009	101	49	50	60	48	50
2010	69	55	51	49	47	50
2011*	121	40	47	40	39	50

*Data available till November 2011

**Monitoring commenced June 2009

The maximum 24-hour average PM₁₀ concentrations at the other HVAS monitors indicate that exceedances of the NSW OEH criteria occurred in 2008, 2009 and 2010. These exceedances were due to regional events as all monitors recorded elevated levels on the exceedance days.

Ambient TSP monitoring was collected by the BCC using three HVAS monitors. The monitoring data indicates that the annual average TSP concentrations for each monitoring station were below the OEH criteria of 90µg/m³ with the exception of the Bulga HVAS monitor. During 2009 this monitor recorded an annual average TSP concentration of 92µg/m³. The Bulga HVAS monitor is situated close to the H1 HVAS monitor and typically records higher concentrations when compared to the other HVAS monitors. As detailed above, the Bulga HVAS is located adjacent to a local access road and remains frequently influenced by local dust events, rather than being representative of background levels at sensitive receptors.

Dust Deposition

The dust deposition monitoring locations are separated between those on mine owned land around the operations (onsite) and offsite locations. The onsite locations generally record levels higher than the monitors at offsite locations and are commonly used to assist with characterising the sources and areas of dust generation. These monitors should not be considered when estimating backgrounds at nearby sensitive receptors.

Table 15 shows the annual average deposition levels at each gauge from 2008 to 2010. The grey highlighted cells in **Table 15** indicate those gauges located at offsite locations. Partial results for 2011 are also shown covering the period up to October 2011. Field notes accompanying the monitoring data indicate that some of the samples were contaminated with materials such as bird droppings, insects or plant matter. This is a relatively common occurrence for this type of monitoring, and accordingly, contaminated samples were excluded from the reported annual average results.

All offsite gauges recorded an annual average insoluble deposition level at or below 4g/m²/month for 2008 to 2010 (noting that 2011 results were incomplete at the time of analysis).

Table 15 – Annual average dust deposition (g/m²/month)

ID	2008	2009	2010	2011*	Criteria
Off site dust deposition gauges					
A3	1.7	1.7	1.6	1.7	4
C5	2	2.3	1.7	1.2	4
D2	1.8	3.4	2.6	2.9	4
D6	1.4	1.9	1.7	1.2	4
D9	2.1	2.8	1.6	1.6	4
D10	0.8	1.8	1.4	1.5	4
E1	2.8	3.1	4	5.4	4
E2	2	2.6	2.5	2.1	4
E3	1.2	1.9	1.5	1.5	4
N5	1.5	1.8	1.2	0.9	4
Redibar	1.1**	1.3	0.9	0.9	4
Sharrock 1	1.4	1.7	0.9	1	4
On site dust deposition gauges					
A1	1.8	2.7	2.1	2.6	4
A2	2.7	2.9	1.9	1.8	4
B2	2.2	3.3	2.1	2	4
B3	2.2	1.9	1.5	1.6	4
C1	3.2	4.2	5.4	5.5	4
C2	4.3	7.6	10.1	7.9	4
C3	2.9	3.3	3.2	2.5	4
C4	1.3	2.4	3	2.9	4
D3	3.2	4	6.7	5.5	4
D5	1.8	2.4	2.2	2.1	4
D7	2.2	2.6	1.8	2	4
F1	1.5	2.2	2.2	3.1	4
F2	0.8	2.4	2.1	2.2	4
F3	1.9	1.8	1.2	1.5	4
L1	0.9	1.6	1.5	1.8	4
N3	2	3.3	3.5	3.9	4
N4	2.1	3.5	4.7	5.5	4
N6	2.1	2.9	2.7	1.8	4

*Data to October 2011 and not representative of annual average

*Data available from October 2008

Nitrogen Dioxide

Monitoring data from the OEH monitor at Beresfield was reviewed from 2008 to December 2011 to characterise the background levels of NO₂ concentrations. The 1-hour average NO₂ concentrations indicate that there were no exceedances of OEH 1-hour average goal of 246µg/m³ during this period and furthermore indicate that levels of NO₂ were relatively low, with a seasonal fluctuation.

Carbon Monoxide

The OEH Beresfield monitor does not record ambient concentrations of CO. Combustion activities are the cause of CO emissions and spatially there would be very little such activity in the BCC area apart from power generation, motor vehicles and wood heaters. Therefore, ambient concentrations of CO were expected to be low.

Ambient air quality goals for CO are set at higher concentration levels than NO₂ goals. Based on the NO₂ monitoring data which is low compared to the goals, and consideration of the typical mix of ambient pollutant levels, the indication is that ambient levels of CO would similarly also be well below the air quality goals.

6.3.3 Potential Impacts

Dust

Total dust emissions were estimated by analysing the dust generating activities taking place at the site for the proposed operations. Appropriate emission factors based on AP42 (USEPA 1985 and Updates) and *State Pollution Control Commission – Air Pollution from Coal Mining and Related Developments* (SPCC 1983) were applied to estimate the potential dust emissions. The assessment considered the effect of the proposed operations on the existing situation by careful consideration of the additional incremental dust impact that may be caused. This approach was applied as there would be no change proposed in the total ROM production rate from underground operation and no change proposed to the surface infrastructure associated with the storage and handling of ROM. The only proposed change is in the temporary transport by truck of development coal. Therefore only the following activities associated with the proposed mining activities would have the potential to contribute additional impacts:

- Loading ROM to trucks;
- Hauling ROM to underground ROM stockpile; and
- Unloading ROM at underground ROM stockpile.

Total annual dust emissions from these activities are presented in **Table 16**.

Table 16 – Estimated Annual TSP Emission Rate

Activity	TSP emission (kg/year)
Loading ROM	28,072
Hauling ROM to Stockpile	64,788
Unloading ROM	28,072
Total	120,932

The modelling methodology used was similar to the previous air quality assessment for the 2003 EIS (Umwelt, 2003). A version of the USEPA ISCST3 model, modified specifically for modelling dust impacts from Hunter Valley coal mines, and referred to as ISCMOD was used in predicting the dust impact. This model has been accepted for use in NSW coal mine assessments for many years. The modelling was based on the application of three particle-size categories, namely; PM_{2.5} (particles in size range 0 to 2.5 µm), PM_{2.5-10} (particles in size range 2.5 to 10 µm) and PM₁₀₋₃₀ (particles in size range 10 to 30 µm). The distribution of particles for each particle size category was derived from measurements in the SPCC (1986) study of dust from Hunter Valley coal mines and is presented in **Table 17**.

Table 17 – Estimated Annual TSP Emission Rate

Particle category	Size range	Distribution	Geometric mean diameter
Fine particulates (FP)	0 to 2.5 µm	4.68% of TSP	1
Coarse matter (CM)	2.5 to 10 µm	34.4% of TSP	5
Rest (RE)	10 to 30 µm	60.92% of TSP	17.3

Emissions from each activity were represented by a series of volume sources and were included in the ISCMOD model via an hourly varying emission file. Meteorological conditions associated with dust generation (such as wind speed) and levels of dust generating activity were considered in calculating the hourly varying emission rate for each source. As a conservative measure, the effect of rainfall in reducing dust emissions was not considered.

Analysis of the predicted incremental particulate impact levels showed minimal incremental impact at all privately owned residential receptors. **Table 18** presents the predicted incremental impact from the proposed operation at the worst impacted receptor (217s – Russell, located to the west of the Project Area). This shows that incremental impacts from the proposed operation were unlikely to cause any significant change in dust levels at any privately owned residential receptor locations.

Table 18 – Predicted Particulate Impact at Worst Impacted Receptor

Parameter	Averaging Period	Unit	Predicted Increment
PM ₁₀	24 hour	µg/m ³	0.6
PM ₁₀	Annual	µg/m ³	0.0
TSP	Annual	µg/m ³	0.1
Dust deposition	Annual	g/m ² /month	0.0

The predicted maximum level of impact at the worst impacted receptor due to the project would be approximately 1% of the criteria level for 24-hour PM₁₀, (being less than 0.033% of the annual average PM₁₀ criteria and approximately 0.1% of the TSP criteria). The predicted level of impact would be much lower at any other residential receptor location.

The predicted level of impact due to this project would not be discernible cumulatively for the following reasons:

- The dust generated would be too low. For example the Project is estimated to generate 120,933 kg of dust annually, which is 0.4% of the 27,463,479 kg of dust generated by the three nearby open cut mines (BSO, Mt Thorley and Warkworth);
- The additional dust level in the area due to the Project is below the reliable range of precision of the monitoring instruments that could be used; and
- The impacts would be within the most recent cumulative dust modelling predictions in this area. For example, the additional impact of the Project would be well below the modelling accuracy (e.g. 95% overestimation to 85% underestimation for annual average PM₁₀) in the air dispersion modelling for the Western Extension Modification (see **Section 1.4.2**). Adding the Project's maximum predicted impacts (which are less than 0.033% of the criteria) would be of no consequence in regard to compliance with criteria in this situation.

Consequently, further detailed modelling of potential cumulative dust impacts is not warranted.

Nitrogen Dioxide and Carbon Monoxide

Air emissions from the proposed small scale power generation unit (Scenario 1 being up to 32MW and Scenario 2 being up to 30MW) and all flare operations were modelled (an unlikely but conservative scenario). This included the 10 flares at the gas drainage plant on the Whybrow highwall (five pre-mining gas flares and five goaf gas flares), the five flares at the proposed power plant and the seven approved flares at the Blakefield South power plant. Flare emissions were based on the estimated stack concentration and associated exhaust flow rate. Air emissions associated with the power generation unit were estimated based on the manufacturer's specifications and the applicable Clean Air Regulations (POEO, 2005) regulatory limit for emissions from stationary reciprocating internal combustion engines operated on gaseous fuel.

The NO₂ and CO assessment was conducted following the OEH document *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (2005). AUSPLUME Version 6.0 was used in predicting the NO₂ and CO dispersion.

Analysis of the predicted NO₂ and CO impacts showed minimal incremental impact at all privately owned residential receptors. In this regard it is relevant to note that the flares account for much of the incremental impact, rather than the power plant. This would be expected given the low exit velocity and the emission rate.

Table 19 presents a comparison of predicted NO₂ and CO impacts from the Project (for both scenarios) at the worst impacted receptor. The Project would unlikely cause any exceedance of OEH criteria for NO₂ and CO. It should be noted that site specific CO monitoring was not available for this assessment. However comparison of the predicted incremental CO concentrations with the OEH criteria for CO showed that the Project contribution would be approximately 0.1% of the criteria. As it is improbable that existing background levels of CO would be more than 99.9% of the criteria levels, it is clear that any exceedance of the OEH criterion for CO at any residential receptor location is unlikely to occur.

Table 19 – Predicted NO₂ and CO Impact at Worst Impacted Receptor

Scenario 1 – 32MW Power Plant							
Parameter	Averaging Period	Unit	Receptor ID	Predicted Increment	Background	Cumulative	Criteria
CO	15 minute	mg/m ³	10	0.48	NA	NA	100
CO	1 hour	mg/m ³	10	0.36	NA	NA	30
CO	8 hour	mg/m ³	56	0.07	NA	NA	10
NO ₂	1 hour	μ g/m ³	10	107	33	140	246
NO ₂	Annual	μ g/m ³	56	1.1	8.9	10.0	62

Scenario 2 – 30MW Power Plant							
Parameter	Averaging Period	Unit	Receptor ID	Predicted Increment	Background	Cumulative	Criteria
CO	15 minute	mg/m ³	56	0.43	NA	NA	100
CO	1 hour	mg/m ³	56	0.33	NA	NA	30
CO	8 hour	mg/m ³	10	0.07	NA	NA	10
NO ₂	1 hour	μ g/m ³	56	79	33	112	246
NO ₂	Annual	μ g/m ³	10	0.74	8.9	9.64	62

Odour

Odour emissions from the proposed ventilation fans were estimated based on the measured odour data (2009 and 2010) from the existing ventilation fans at the BFS Underground Mine. This available odour data showed significant variations in the measure odour emission rate and therefore the highest rate was used in the modelling.

The odour impact assessment for the ventilation fans was conducted following the OEH document *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (2005). AUSPLUME Version 6.0 was used in predicting the odour dispersion.

The odour assessment presented a spatial distribution of predicted 99th percentile incremental nose response average odour concentration. The predicted maximum nose-response odour level that would be caused by the proposed ventilation fan operations would be 0.05 OU (odour units) and would be below the odour detection threshold of 1 OU (and below any potentially applicable criteria). Therefore, it is unlikely that the proposed operation would cause any odour nuisance at the surrounding sensitive receptor locations.

Construction

The primary emissions from the construction phase of the Project would be dust and particulate matter occurring from the following activities:

- Vegetation clearing and earthmoving during site preparation for surface activities;
- Drilling of gas drainage wells and gas drainage pad preparation works;
- Stockpiling of excavated material;
- Haulage of excavated material and movement of heavy plant and machinery within the site;
- Graders/scrapers involved in the construction of the access roads to the gas drainage infrastructure; and
- Wind erosion from exposed ground.

It is noted that the construction phase would be short and relatively small scale in nature. Construction impacts can therefore be effectively controlled through commonly applied dust management measures, as described in **Section 6.3.4**.

6.3.4 Mitigation Measures

Dust management controls already implemented at BCC, including those outlined in the BCC *Air Quality Management Plan* and the BCC *Sediment and Erosion Control Plan*, would continue to apply. These measures include the following:

- Application of dust suppression agents on heavily trafficked unsealed roads;
- Use of a water cart on all trafficable areas as required;
- Cessation of potentially dust generating activities during periods of high wind;
- Delivery and removal of materials planned and coordinated to avoid unnecessary trips;
- Dirt that has been tracked onto sealed roads would be cleaned as soon as practical;

- When conditions are excessively dusty and windy and dust can be seen leaving the work site, a water truck would be used;
- Surfaces would be dampened via the use of a water truck prior to grading/scraping;
- The clearing of vegetation and topsoil would be limited to the designated footprint required for construction; and
- All areas exposed for construction would be rehabilitated as soon as possible upon completion of works.

6.4 Greenhouse Gas Assessment

6.4.1 Introduction

A GHG Assessment was undertaken by Todoroski Air Sciences with regard to the Project. A full copy of the report is attached as **Appendix 7**. The following is a summary of the findings of this report. For further details, the full assessment report should be referred to.

Subsequent to the GHG assessment completed for the approved BFN Underground Mine (Umwelt, 2003), it was found that the methane quantities that would be generated would be much greater than previously assessed. The assessment therefore aims to estimate the potential changes in the generation of GHG emitted to the atmosphere due to the Project.

6.4.2 GHG Inventories and Emission Sources

The National Greenhouse Accounts (NGA) Factors document published by the Department of Climate Change and Energy Efficiency (DCCEE) provides calculations suitable to estimate GHG emissions from various industry sources. The NGA Factors document defines three scopes (Scope 1, 2 and 3) for different emission categories based on whether the emissions generated are from "direct" or "indirect" sources.

Scope 1 and 2 emissions encompass the direct sources from the Project (being sources within the boundary of the Project activities). Scope 1 and 2 GHG sources identified from the Project are the on-site combustion of diesel fuel necessary for hauling of development coal, emissions from the operation of the flares and power station, consumption of additional electricity for the proposed modifications and fugitive emissions of methane released through the mining process.

Scope 3 emissions occur due to the indirect sources from the Project. These emissions include those generated in the wider economy as a consequence of the Project, but which are physically produced by the activities of another organisation (e.g. the burning of coal from the BFN Underground Mine off-site). Scope 3 emissions have the potential to arise from a greater number of sources associated with the operation of Project, but as they are often difficult to quantify due to the diversity of sources. Scope 3 emissions are understood to be considered in the Scope 1 and 2 emissions from other various organisations related to the Project. In any event, the Scope 3 emissions generated from the transport and final use of the coal would predominantly not change from those assessed in previous assessments for the proposal, as the modifications do not affect these outcomes. The only exception would be minor additional emissions associated with the purchase and delivery of additional diesel temporarily, and electricity for use on-site.

The estimated quantity of additional diesel required to operate the haul trucks temporarily transporting development coal was based on the assumption that the haul trucks would consume diesel fuel at a rate of 55L per hour. With the haul trucks completing three return trips per hour and averaging 37.8km/hour, the diesel consumption would be at a rate of 145.5L/100km. Thus the calculated annual fuel requirement for this activity would be around 165,165 litres.

GHG emissions from the operation of the flares and power station were estimated from the quantities of ventilation air methane consumed by this equipment. The estimates were conservatively assumed that a direct stoichiometric reaction occurs with all the methane consumed converted to CO₂ and H₂O. These estimates are likely to be conservative and during actual operation are likely to be lower.

For Scenario 1 (32MW power plant) the estimated annual quantities of methane consumed by the flares was assumed to be 18,879 tonnes of methane per year and by the power station assumed to be 44,050 tonnes of methane per year. Excess ventilation air methane released to atmosphere had been estimated to be approximately 18,797 tonnes of methane per year.

For Scenario 2 (30MW power plant) the estimated annual quantities of methane consumed by the flares was assumed to be 21,632 tonnes of methane per year and by the power station assumed to be 41,297 tonnes of methane per year. Excess ventilation air methane released to atmosphere had been estimated to be approximately 18,797 tonnes of methane per year.

BCM has estimated that the increase in electricity usage from the Project would be approximately 2000kW. With the operation of the proposed power plant onsite any surplus electricity would be fed back into the public power grid.

6.4.3 Potential Impacts

To quantify the amount of carbon dioxide equivalent (CO₂-e) material generated from the proposed modification, emission factors obtained from the NGA Factors were applied, as summarised in **Table 20**.

Table 20 – Summary of Emission Factors

Type	Energy content factor	Emission Factor (kg CO ₂ -e/GJ)			Scope	Source
		CO ₂	CH ₄	N ₂ O		
Diesel usage	38.6 GJ/kL	69.2	0.2	0.5	1	Table 4 (DCCEE, 2011a)
	-	5.3	-	-	3	Table 38 (DCCEE, 2011a)
Electricity usage	-	0.89	-	-	2	Table 5 (DCCEE, 2011a)
	-	0.17	-	-	3	Table 39 (DCCEE, 2011a)

On the whole the operation of the flares and power station onsite would result in a reduction of GHG emissions through the destruction of methane which would otherwise be vented to the atmosphere. **Table 21** below provides a summary of the potential estimated emissions for the approved project (ie. without the operation of the proposed flares and power station).

Table 21 – Summary CO₂-e Emissions Without Flaring and Power Station (t CO₂-e)

Source	Scope 1	Scope 2	Scope 3	Scope 1+2
Electricity usage		15,593	3	15,593
Fugitive methane	1,716,246			1,716,246
Total	1,716,383	15,593	3	1,731,976

The combined Scope 1 and Scope 2 emissions generated without the proposed flares and power station would result in a significant amount of fugitive methane and consequent GHG emissions generated.

The Project would require approximately an additional 2000kW of the electricity usage through the additional surface infrastructure proposed, when compared with the approved project. The proposed power station would generate up to 32MW of electricity and the surplus electricity would be generated and fed back into the grid, resulting in a net reduction in potential GHG emissions. **Table 22** summarises the estimated annual CO₂-e emissions from the operation of the Project for both Scenario 1 (32MW power plant) and Scenario 2 (30MW power plant).

Table 22 – Summary CO₂-e Emissions For the Project (t CO₂-e)

Scenario 1 (32MW Power Plant)				
Source	Scope 1	Scope 2	Scope 3	Scope 1+2
Diesel usage	443		10	443
Electricity usage		15,593	3	15,593
Flares	51,916			51,916
Power Station	121,138			121,138
Fugitive methane	394,737			394,737
Excess electricity generated*		-212,062		-212,062
Total	568,235	-196,469	13	371,766

*Electricity generated as a result of onsite power stations, excess electricity is fed back into the grid.

Scenario 2 (30MW Power Plant)				
Source	Scope 1	Scope 2	Scope 3	Scope 1+2
Diesel usage	443		34	443
Electricity usage		15,593	3	15,593
Flares	59,488			59,488
Power Station	113,567			113,567
Fugitive methane	394,737			394,737
Excess electricity generated*		-198,808		-198,808
Total	568,235	-183,215	37	385,020

*Electricity generated as a result of onsite power stations, excess electricity is fed back into the grid.

From **Table 22** it can be seen that there would be a decrease in the Scope 2 emissions for both scenarios. This result was determined based on the difference in the amount of electricity generated by the onsite power station and the amount of electricity required by the Project.

The use of the proposed flares and power station (both scenarios) has the potential to generate an approximate 78% reduction in GHG emissions compared with the approved project. This net benefit in reducing annual GHG emissions arises mainly as fugitive methane emissions would be captured and destroyed through flaring and power generation. **Table 23** shows the net change in total CO₂-e emissions as a result of the Project.

Table 23 – Net Change in Total CO₂-e Emissions as a Result of the Project (t CO₂-e)

Source	Scope 1	Scope 2	Scope 3	Scope 1+2
Total without project	1,716,383	15,593	3	1,731,839
Total with project (Scenario 1)	568,235	-196,469	37	371,766
Total with project (Scenario 2)	568,235	-183,215	37	385,020
Net project benefit (Scenario 1)	1,148,011	212,062	-34	1,360,073
Net project benefit (Scenario 2)	1,148,011	183,215	-34	1,346,819

In 2010, the estimated GHG emissions for Australia were 543Mt CO₂-e (**DCCEE, 2011b**). In comparison, the net project benefit in terms of annual average GHG emissions (Scope 1 and 2) would

be a reduction of 1.35 to 1.36Mt CO₂-e. Therefore, the Project would result in a net annual reduction of GHG emissions equivalent to approximately 0.25% of the 2010 Australian GHG emissions.

6.4.4 Mitigation Measures

Mitigation measures already form part of the Project through the proposed flaring and on-site gas fired power generation plant. No additional mitigation measures would be required.

6.5 Noise Assessment

6.5.1 Introduction

An Environmental Noise Assessment was undertaken by Global Acoustics for the Project. The aim of the assessment was to determine the noise emissions resulting from the construction and operation of the proposed surface infrastructure in order to ensure that noise impacts, including cumulative impacts, met the previously approved noise criteria for the BCC.

Two operational noise scenarios were modelled comprising the period 2012 to 2014 (Year 9 to 11) and the period 2015 to 2018 (Year 12 to 15) to reflect the change in implementation and quantity of infrastructure over this time. For ease of reference, these periods were nominated as Year 11 and Year 15 scenarios respectively.

Predicted noise levels for the supplementary BFN Underground Mine infrastructure were combined with the predicted noise levels from the BCC to assess the potential impacts and compared against the BCC noise criteria.

A series of construction scenarios were also considered to assess the worst-case construction impact. Predicted noise levels for BFN were combined with predicted levels for the remainder of the BCC, in this case BSO, BUO and BFN (as developed at that stage) to assess the potential cumulative impact from the complex as a whole.

It is relevant to note that the predictions of the BSO in the noise assessment include the proposed BSO Western Extension Modification (see **Section 1.4.2**) due for submission to DP&I in 2012.

The following sections provide a summary of the key findings of the Environmental Noise Assessment. For further details, the full assessment report contained within **Appendix 8** should be referred to.

6.5.2 Existing Environment

The local area comprises a mix of coal mining (both open cut and underground), agriculture, viticulture, rural-residential holdings and the private residences within and around the villages of Broke and Bulga. Mining activity has occurred on the BCC site and in the adjacent local area over the past 30 years. Numerous open cut and underground mining operations have been developed over this time; including coal mining activities at the BCC since 1982.

The Project Area is predominantly located within the BCC Development Consent and Mining Lease boundary (apart from the power plant location) and is currently utilised for coal mining, grazing, viticulture and rural-residential holdings, in addition to land occupied by the Department of Defence - Singleton Army Training Area (refer to **Figure 5**).

The closest residential uses are shown in **Figure 5** as well as Figure 1 of the Environmental Noise Assessment in **Appendix 8**. All private residence locations in the area (Figure 1 of the Environmental Noise Assessment), were considered in the assessment. Broke Village is around 6 kilometres to the south of the Project Area, Bulga Village around 3 kilometres to the north west of the Project Area and

Milbrodale around 2 kilometres to the west of the Project Area. Within the Project Area, there are a number of private residences that comprise sensitive receptors located close to the proposed gas drainage and other surface infrastructure. These include receptors 160 (Dwyer), 195 (Kennedy) and 217 (Russell). At their closest point, some of these residences are located around 300 metres from proposed gas drainage drilling sites (refer to **Figure 5**). Previously, 24 hour drilling of lateral gas drainage wells for the BFS Underground Mine was undertaken within approximately 800 metres of three privately owned residences following consultation with the land owners. This work was completed without any complaints from the landowners. Similarly, vertical gas drainage wells were successfully completed (day time only drilling) within approximately 100 metres of three privately owned residences without complaint.

The only other significant industrial noise source in the local area is the Mount Thorley Warkworth Mine, located directly to the north of the BCC, so the area of possible cumulative impact is confined to the Bulga Village area and an isolated residence on Broke Road, north of the BCC. Because most these receptors are relatively distant from these noise sources, typically some kilometres, it is common for only one mine to be audible at any one time. In the case of the BCC, due to the physics of atmospheric enhancement, the majority of residences generally experience noise from only one mine at a time. That is, instances of multi-mine audibility where one mine is dominant and the other not contributing (though perhaps audible at a low level) are most common. This has been noted during the years of monitoring in the local area.

6.5.3 Potential Impacts – Operational Noise

Noise Criteria

The noise criteria outlined in the BUO development consent (DA 376-8-2003) were adopted for the assessment of operational noise. The relevant conditions are reproduced in **Appendix 8** and summarised in **Tables 24** and **25**. Condition 29 in Schedule 4 of the development consent establishes land acquisition criteria. If any noise generated by the development exceeds the criteria in **Table 24** below at any residence on privately-owned land or on more than 25% of any privately owned land, the BCC is required to acquire the land (upon receiving a written request from the landowner).

Table 24 – Land Acquisition Criteria dB(A) from DA 376-8-2003

Day/Evening/Night LAeq (15 minute)	Land
40	All privately owned land, excluding the land listed in Table 1 of the development consent (Table 1 already identifies land to be acquired).

Condition 30 in Schedule 4 of the development consent establishes noise impact assessment criteria. The BCC is required to ensure that the noise generated by development does not exceed the noise impact assessment criteria in **Table 25** at any residence on privately-owned land, or on more than 25% of any privately owned land.

Table 25 – Noise Impact Assessment Criteria dB(A) from DA 376-8-2003

Residence/Land	Day	Evening	Night	
	LAeq (15 minute)	LAeq (15 minute)	LAeq (15 minute)	LA1 (1 minute)
249	40	40	40	45
8,195	39	39	39	45
157,179,307	38	38	38	35
1,2s,154,237,239,250,252,261,262,308	37	37	37	45

Residence/Land	Day	Evening	Night	
232	37	37	36	45
97,153,163,169e,171,183,184,197,217s,217m,217n, 234,235,240,263,264,266,267,272,272,274,276,279, 280,282	36	36	36	45
33,156w,230,281	36	36	35	45
All other privately owned land, excluding the land listed for potential acquisition in Table 1.	35	35	35	45

Noise Model Parameters

Two operational noise scenarios were considered, representing operational Years 11 and 15. These scenarios are discussed in more detail below. [Note: For both scenarios modelling included: (1) The BCC (BSO and BUO) operations without the proposed BFN infrastructure; (2) The proposed BFN infrastructure only; and (3) All BCC operations and infrastructure combined with the proposed BFN infrastructure]. Comparisons were made when excluding the proposed BFN infrastructure to determine if any increase to BCC noise emissions would be likely.

Scenario 1: Year 11

By Year 11, the following infrastructure is proposed to be operational (**Figure 4** illustrates the location of the proposed infrastructure):

- One small scale power station (up to 32 MW) located approximately 1,600m northwest of the CHPP. Primary operational noise sources associated with the power station include either ten 3MW or eight 4 MW generators, and five gas flares;
- Two sets of ventilation fans located at the base of the Whybrow highwall. Access for the fans would be provided from the BSO, therefore no boring is required. Each set of fans is to consist of three centrifugal fans similar to those already in operation for BFS Underground Mine;
- Four goaf extraction units (GEU), a gas compressor and five gas flares (already approved for the BFS Underground Mine) would be relocated to the east side of Broke Road. BCC has advised that the compressor and flares would not operate simultaneously. Calculation has been undertaken for the case, being when the flares operate, as this is considered to represent the worst-case scenario;
- Haulage of development coal from the BFN Underground Mine egress to the BFS coal stockpile. Two Haulmax trucks and one Caterpillar 992 front end loader would be required, with haulage occurring approximately 12 hours per day, primarily during the day period.

Scenario 2: Year 15

The Year 15 scenario includes the proposed ventilation fans, power station and development coal haulage included in the Year 11 scenario. The goaf extraction plant, compressor and flares located east of Broke Road in the Year 11 scenario moves to the Whybrow highwall for this scenario.

Noise Results

The change in predicted levels due to the addition of proposed BFN infrastructure has been assessed. An increase to total levels above the base consent criteria of LAeq,35 dB is only possible

when predictions for BFN alone are greater than LAeq,25 dB. Thus only results for receptors which are predicted to receive LAeq,25 dB or more are presented in the assessment.

The results for Year 11 indicate there would be a minor 1 dB increase to BCC noise emissions due to the proposed BFN infrastructure at receptors 217m and 217s (Russell). However, this increase does not cause exceedance of the development consent criteria.

The results for Year 15 indicates a minor 1dB increase to BCC noise emissions at Properties 217m and 217s (Russell) due to proposed BFN infrastructure during the evening and night periods. This increase does not result in an exceedance of development consent criteria and the temporary truck haulage of development coal would primarily be responsible for this increase. Although truck haulage of development coal was included in the evening and night scenarios (for which the increase is predicted), haulage is expected to be required approximately 12 hours per day (primarily during the day period during which no increase in noise levels is predicted).

Fewer receptors are predicted to be impacted by Year 15 than Year 11 due to the goaf plant, compressor and flares moving to the Whybrow highwall from the location east of Broke Road. The new location is further from receptors and would be shielded by the south-western emplacement area.

6.5.4 Potential Impacts - Construction Noise

Noise Criteria

The NSW OEH's *Interim Construction Noise Guideline* (ICNG, July 2009) specifically relates to construction, maintenance and renewal activities. The guideline specifies standard construction hours as:

- Monday to Friday, 7.00 am to 6.00 pm;
- Saturday, 8:00 am to 1:00 pm; and
- No construction work on Sunday and public holidays.

For the construction Project proposed, a quantitative assessment is required, with comparison to relevant the relevant criteria. The criteria for work undertaken in the standard construction hours are:

- LAeq,15min equal to background plus 10 dB; and
- LAeq, 15min 75 dB (upper limit).

An LAeq criterion of background plus 5 dB is specified for work outside the standard construction hours. However, the ICNG states that this does not cover:

“noise from industrial sources (for example, factories, quarrying, mining, and including construction associated with quarrying and mining) – this is assessed under the NSW Industrial Noise Policy (EPA 2000).”

Therefore, construction noise from the Project is required to be assessed in accordance with the INP and should comply with operational noise criteria specified in the BUO development consent, as outlined in **Section 6.5.3** above.

Noise Model Parameters

Construction of the proposed small scale power station (up to 32 MW) is scheduled for Year 10, and would be complete prior to other BFN infrastructure construction. Construction of the ventilation fans

is scheduled for Year 11, and relocation of the goaf plant, compressors, flares, etc. to the Whybrow highwall is scheduled for Year 15. Construction of this infrastructure is proposed for the day period only.

Drilling of pre- and post- drainage gas wells would occur over the life of the Project. To assess worst-case drilling impacts, two vertical wells and two SIS drill site locations were assessed, representing the most exposed locations west and north of the Project Area (see Figure 2 in **Appendix 8**). Vertical well drilling is proposed to only occur during the day period. SIS drilling is proposed to occur 24 hours per day. Predicted levels for these drill sites represent worst-case impact. Other drilling locations are further from receptor locations (predominantly above the longwall panels and closer to the open cut highwall), and noise levels are expected to be less from other drill sites. Acoustic barriers with a height of 4.2 metres were modelled on three sides of drilling plant.

Based on the above construction activities and proposed timing, fourteen construction scenarios (Scenarios C1 to C14) representing construction tasks scheduled to occur during the day period, were assessed. These scenarios captured the construction of all the relevant surface infrastructure elements of the Project, including construction of the power station, ventilation fans, gas drainage infrastructure and the drilling of the SIS and vertical gas wells. The following provides a brief description of these day period scenarios:

- **Scenario C1** – Power station civil works;
- **Scenario C2** – Power station infrastructure construction;
- **Scenario C3** – Ventilation fans and civil works;
- **Scenario C4** – Ventilation fans infrastructure construction;
- **Scenario C5** – Gas drainage plant civil works;
- **Scenario C6** – Gas drainage infrastructure construction;
- **Scenario C7** – Drill site SIS1 civil works;
- **Scenario C8** – Drill site SIS1 drilling;
- **Scenario C9** – Drill site SIS2 civil works;
- **Scenario C10** – Drill site SIS2 drilling;
- **Scenario C11** – Drill site VW1 civil works;
- **Scenario C12** – Drill site VW1 drilling;
- **Scenario C13** – Drill site VW2 civil works; and
- **Scenario C14** – Drill site VW2 drilling.

The following construction activities during the evening and night periods were assessed:

- **Scenario C15** – Northern SIS drill site (SS1); and
- **Scenario C16** – SIS2 drill site.

All scenarios were combined with operational noise for the BCC, including proposed BFN infrastructure that may be operational at each stage, to obtain cumulative impact from construction activities and the operation of remainder of the complex. Plant inclusions for each scenario are included in **Table X** of the noise assessment. Plant locations are shown in **Figure 16**.

Noise Results

Day Period - Scenarios C1 to C6

Analysis of construction model results shows that noise impact from construction of the power station, gas plant and ventilation fans (scenarios C1 to C6) would be less than LAeq, 15 minute 25 dB, and would typically be inaudible. Construction of this infrastructure would not cause any increase to BCC total noise emissions.

Day Period - Scenarios C7 to C14

Analysis of gas well drilling model results shows the highest predicted construction noise results are LAeq, 15 minute 53 dB at receptor 160 (Dwyer). A further three receptors are predicted to receive levels between LAeq, 15 minute 45 dB and 49 dB, and six receptors are predicted to receive levels between LAeq, 15 minute 40 dB and 44 dB. All other receptors are predicted to receive construction noise levels less than LAeq, 15 minute 40 dB.

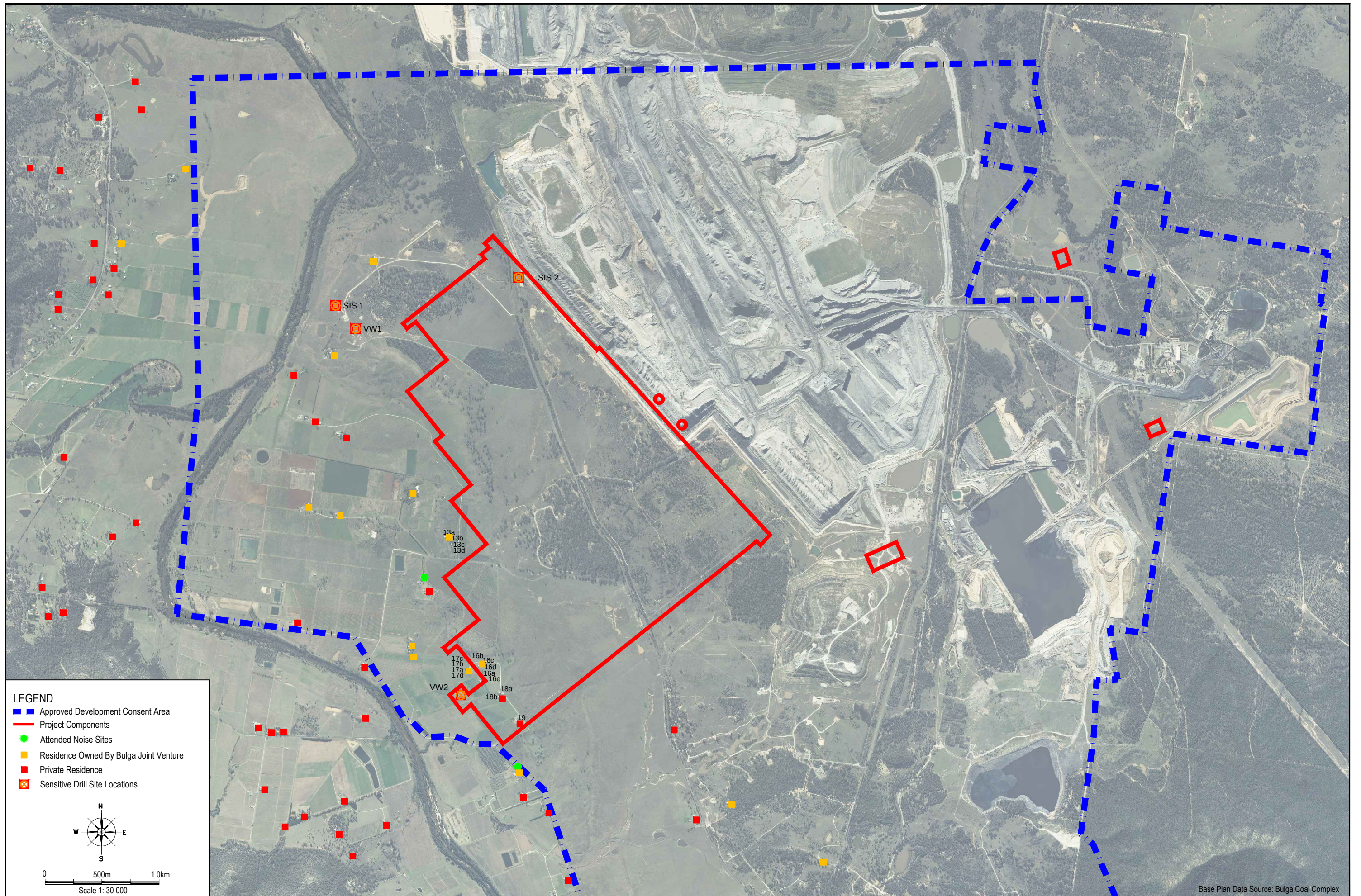
These results are primarily due to civil works associated with gas well development, which are expected to take approximately 1 month at each site. Daytime drilling predictions are less than LAeq, 15 minute 40 dB at all receptors except for 160 (Dwyer) for which a level of LAeq, 15 minute 49 dB is predicted (Note: SIS drilling generally takes from 4 to 12 weeks at each site). All results include the remainder of the BCC operating simultaneously and a 4.2m high acoustic barrier around the drilling compounds.

Evening and Night Period - Scenarios C15 to C16

SIS drilling is the only construction activity proposed for the evening and night periods. BCC have purchased an electric drill rig for construction of the SIS holes, as it is significantly quieter than traditional diesel drill rigs. The highest predicted level from SIS drilling combined with the remainder of the BCC, during evening and night periods, is LAeq, 15 minute 39 dB at receptor 232 (Medhurst). All other receptors are predicted to receive LAeq, 15 minute 38 dB or less. The greatest impact is during the evening period and results for the night period are typically 1 to 2 dB less than for the evening period. The model results show the remainder of the BCC is primarily responsible for predictions greater than LAeq, 15 minute 36 dB. Contributions to the predicted total from BFN construction noise would typically be 9 to 10 dB less than for the remainder of the BCC.

Analysis

The duration of drilling for vertical holes is 7 to 10 days, and for SIS holes 4 to 12 weeks. This represents worst-case impact from gas well drilling, and results for other drill sites should be less due to increased source to receiver distances from those modelled. Given the relatively short duration of drilling impact, and the restriction of drill compound civil works and vertical gas well drilling to the day period, the noise assessment concludes that it would be reasonable for a higher construction noise criteria to be allowed. It is recommended a construction noise criteria of LAeq, 15 minute 53 dB be allowed for the day period, and LAeq, 15 minute 39 dB be allowed for the evening and night periods. Community consultation would be undertaken prior to commencement of critical gas well drill sites, and best practice management techniques would be adopted, including use of acoustic barriers, selection of quietest available plant and placement of noise sources within the drilling compound as close to acoustic barriers as possible.



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All indicative locations - will be finalised pending constraints

6.5.5 Potential Impacts - Low Frequency Noise

Noise Criteria

Two methodologies were adopted for assessment of low frequency noise (LFN).

Firstly, evaluation of LFN was undertaken through comparison of C-weighted and A-weighted predicted total noise levels at receptors, as per INP guidelines. These weighting scales predict the ear's sensitivity to tones at high noise levels. In this method, the difference between C – weighted and A-weighted levels at receptor locations is calculated, and if the difference is greater than or equal to 15 dB, a 5 dB penalty (modifying factor) is added to predicted levels.

Secondly, evaluation of LFN was undertaken through comparison of total predicted C-weighted levels at receptor locations with an upper limit criterion. This method is in accordance with recommendations published in *A Simple Method for Low Frequency Noise Emission Assessment* by N. Broner, published in the Journal of Low Frequency Noise, Vibration and Active Control, Volume 29 Number 1 2010. This document recommends outdoor criteria for LFN assessment and **Table 26** presents the recommended criteria outlined in the document. If the total predicted C – weighted noise level at a receptor exceeds the relevant criterion, a 5 dB penalty (modifying factor) is added to predicted levels.

Table 26 – Criteria for Assessment of Low Frequency Noise

Land Use	Sensitive Receiver	Range	Criteria Leq (dBC)
Residential	Night time or plant operation	Desirable	60
	24/7	Maximum	65
	Daytime or Intermittent (1 – 2 hours)	Desirable Maximum	65 70
Commercial/Office	Night time or plant operation	Desirable	70
	24/7	Maximum	75
Industrial	Daytime or Intermittent	Desirable	75
	(1 – 2 hours)	Maximum	80

Source: *A Simple Method for Low Frequency Noise Emission Assessment* by N. Broner

Noise Results

In terms of operational LFN, all C-weighted predictions would be less than the desirable LFN limit of L_{Ceq}, 15 minute 60dB. The predicted operational LFN levels would primarily be due to the BSO.

In terms of construction LFN, all C-weighted predictions would be less than the desirable LFN limit of L_{Ceq}, 15 minute 60 dB. Receptors 154 (Rath) and 156w (Todhunter and Brook) would have C minus A results of 20 dB and 19 dB respectively, and in each case the C-weighted total is approaching the desirable LFN limit. The model results indicate these higher levels are predicted due to civil works associated with vertical gas well site preparation. The duration of this activity is relatively short, and, is restricted to the day period.

Pursuant to the above, operational and construction LFN is not considered likely to cause any significant impacts.

6.5.6 Potential Impacts - Sleep Disturbance Noise

Noise Criteria

The LA1,1 minute criterion of 45 dB, specified in the BUO development consent, was adopted for assessment of sleep disturbance at private residential locations.

Noise Model Parameters

Drilling of SIS wells is proposed for the night period, and has potential to cause sleep disturbance impact. Maximum noise emissions due to rod impact were modelled at both of the representative worst-case SIS drill site locations (SIS1 and SIS2) shown in **Figure 16**.

Noise Results

The noise assessment concludes that operational noise sources would not cause sleep disturbance impact due to the relatively constant noise emission level.

Results of the construction noise sleep disturbance model show three receptors on the same property (Russell) may receive exceedances of the L A1 1 minute 45 dB criterion of up to 6dB. It is understood that one of these receptors (217n is an unoccupied house).

6.5.7 Potential Impacts - Cumulative Noise

Noise Criteria

The cumulative noise criteria outlined in the BUO development consent (DA 376-8-2003) were adopted for the noise assessment. The relevant conditions are reproduced in **Appendix 8** and summarised in **Tables 27** and **28**.

Condition 32 in Schedule 4 of the development consent establishes cumulative noise impact assessment criteria. The BCC is required to ensure that the noise generated by development combined with the noise generated by other mines does not exceed the amenity criteria in **Table 27** below at any residence on privately-owned land, or on more than 25% of any privately owned land.

Table 27 – Cumulative Noise Impact Assessment Criteria dB(A) from DA 376-8-2003

Location	Day	Evening	Night
	LAeq (11 hour)	LAeq (4 hour)	LAeq (9 hour)
All privately owned land, excluding the land listed for potential acquisition in Table 1.	50	45	40

Condition 32A in Schedule 4 of the development consent establishes cumulative land acquisition criteria. If the cumulative noise generated by the development combined with the noise generated by other mines exceeds the amenity criteria in **Table 28** below at any residence on privately-owned land or on more than 25% of any privately owned land, the BCC is required to acquire the land (upon receiving a written request from the landowner and on an equitable basis with the relevant mines).

Table 28 – Cumulative Land Acquisition Criteria dB(A) from DA 376-8-2003

Location	Day	Evening	Night
	LAeq (11 hour)	LAeq (4 hour)	LAeq (9 hour)
All privately owned land, excluding the land listed for potential acquisition in Table 1.	53	48	43

Noise Results

The only other significant industrial noise source in the local area is the Mount Thorley Warkworth mine. This mine is north of the BCC and so the area of possible cumulative impact is confined to the Bulga Village area and an isolated residence on Broke Road, north of the BCC.

Model results for operational noise indicate the proposed BFN infrastructure would cause an increase to BCC noise emissions at only one property (217m and 217s – Russell). EMGA Mitchell McLennan (EMM) has undertaken an environmental assessment of the proposed Warkworth Extension titled *Mount Thorley Warkworth Operations – Proposed Warkworth Extension Acoustic Assessment*, (EMM April 2010) (Warkworth Extension EA). Receptor 111 in the Warkworth Extension EA represents the Russell property. The predicted worst-case noise level from the MTW complex is LAeq, 15 minute 34 dB. The worst-case noise level predicted for the BCC for the habitable Russell residence (217s) in this assessment is LAeq, 15 minute 36 dB. When combined, these levels total LAeq, 15 minute 38 dB. As this level is less than the most stringent cumulative noise criterion (night period) of LAeq, 9 hour 40 dB, no exceedance of cumulative noise criteria is predicted at Russell due to operational noise. As there is no predicted change to BCC operational noise emissions at all other receptors, it is highly unlikely that BFN infrastructure could combine with noise emissions from MTW to cause an increase to cumulative noise levels.

Predictions for construction noise during the day period are high at some receptor locations due to the relatively close proximity of the worst-case drill sites. Mining noise during the day period is generally low level, and the likelihood of mining noise combining with construction noise to cause an increase to received levels is considered very low. Night period drilling activities in the Bulga area have the potential to combine with MTW to increase total received noise levels. Excluding the Russell property, worst case night time drilling results in a maximum 1 dB increase to BCC noise at six (6) receptors. This increase is due to drilling operations at the SIS1 location and no increase to BCC emissions is predicted from the SIS2 location. The levels would be lower for the remaining SIS sites as they are further from receptors. Given that 1 dB is an imperceptible increase to BCC noise emissions, and drilling at SIS1 is temporary, cumulative noise impacts have not been considered at these six receptors. At the Russell property, the predicted worst-case LAeq, 15 minute from the MTW complex is 34 dB, and from the BCC, 36 and 34 dB for the evening and night periods respectively. Predictions for SIS drilling at the Russell residence (217s) are LAeq, 15 minute 27 and 33 dB for the evening and night periods respectively. The total predicted cumulative noise at Russell is then LAeq, 15 minute 38 dB for both the evening and night periods. As this level is less than the most stringent cumulative noise criterion (night period) of LAeq, 9 hour 40 dB, no exceedance of cumulative noise criteria is predicted at the Russell property due to construction noise.

6.5.8 Mitigation Measures

Operational noise is not considered likely to cause noise impact and therefore, no special mitigation measures would be required for the Project.

Construction noise is predicted to exceed operational noise criteria, however, it is recommended that alternate construction noise criteria be allowed due to the relatively short term duration of drilling works at exposed locations. In this regard, the following mitigation measures are proposed to minimise noise emissions from construction works:

- Drilling of vertical gas well holes would be restricted to the day period (07:00 to 18:00);
- Acoustic barriers of height 4.2m would be installed to the three most exposed sides of all drill sites;
- An electric drill rig would be utilised for the drilling of SIS holes;

- Quietest available equipment would be selected for use on drill sites;
- All equipment would be inspected and maintained on a regular basis to ensure noise attenuation components are in good working order;
- Noise sources on drill sites would be placed as close as practically possible to acoustic barriers;
- Community consultation would be undertaken prior to commencement of drilling works at exposed locations;
- A network of off-site continuous noise monitors would be utilised to identify any increased noise levels, and operations would be modified as required to restrict noise emissions to compliance levels; and
- Operations would be modified in the event of adverse weather conditions that cause an unacceptable increase in off-site noise levels.

6.6 Ecology

6.6.1 Introduction

An Ecological Assessment was undertaken by Umwelt to determine the likely impacts associated with the Project. The assessment addresses the potential impact of the Project on native flora and fauna species, threatened and migratory species, endangered populations (EPs), threatened ecological communities (TECs) and their habitats occurring in the Project Area and on adjoining lands. Vegetation communities, flora and fauna species and fauna habitat present in the Project Area have been identified and considered as part of the impact assessment.

A full copy of the report is attached as **Appendix 9**. The following is a summary of the findings of this report. For further details, the full assessment report should be referred to.

6.6.2 Existing Environment

A detailed survey methodology was designed and completed by Umwelt in order to gain a thorough understanding of the ecological features of the Project Area. The methods included a detailed literature review, including searches of all relevant ecological databases and review of a range of previous ecology reports undertaken at the BCC. Information gathered from the literature reviews and database searches was then used to design an extensive field survey program to map and survey vegetation communities, and to target threatened species, endangered populations, endangered ecological communities, or their habitats. The flora survey was based on the systematic plot-based sampling and targeted threatened flora transects, as well as non-quantitative survey to assist in the delineation of vegetation communities and refinement of vegetation mapping. Flora and vegetation surveys were conducted over a number of seasons both within and around the Project Area. Fauna surveys comprised targeted field surveys within the Project Area as well as the inclusion of surveys undertaken in adjacent or nearby identical habitat types. Fauna surveys supplemented the data already collected from three annual fauna monitoring sites (one within the Project Area and two adjacent to the Project Area) established and monitored annually since 2003. Fauna surveys were completed within and adjacent to the Project Area during autumn, winter and spring 2011.

Flora Species

A total of 118 species were recorded within the Project Area, of which 82 (69.5 per cent) were native and 36 (30.5 per cent) were introduced species. Of the total flora species recorded, two species were recorded from the Class Filicopsida (ferns) and 116 from Magnoliopsida (flowering plants) (of which

36 were from sub-class Liliidae (monocots) and 80 from sub-class Magnoliidae (dicots)). Flora species were recorded from a wide representation of plant families, 36 in total. The most speciose families in the Project Area were Poaceae (grasses) with 30 species, Asteraceae (daisies) with 19 species recorded, Fabaceae (legume and pea plants) with 11 species recorded and Chenopodiaceae (salt and drought tolerant plants) with six species recorded.

One endangered flora population, weeping myall (*Acacia pendula*) in the Hunter catchment, listed under the TSC Act, was recorded in four locations during current and previous surveys of the Project Area. The north-eastern stand contains approximately 300 to 350 mature (capable of reproduction) trees and 100 to 150 juveniles (not capable of reproduction). The north-western stand is estimated to contain between 1,500 and 1,800 juvenile trees and two dead mature trees. The south-western stand contains 12 mature trees in a paddock that is currently subject to cattle grazing and no regeneration was observed. The south-eastern is estimated to comprise between 350 and 400 mature trees and between 50 and 100 juveniles. In total, up to approximately 760 mature and 2050 juvenile *Acacia pendula* were recorded within the Project Area.

No threatened flora species were recorded in the Project Area during surveys.

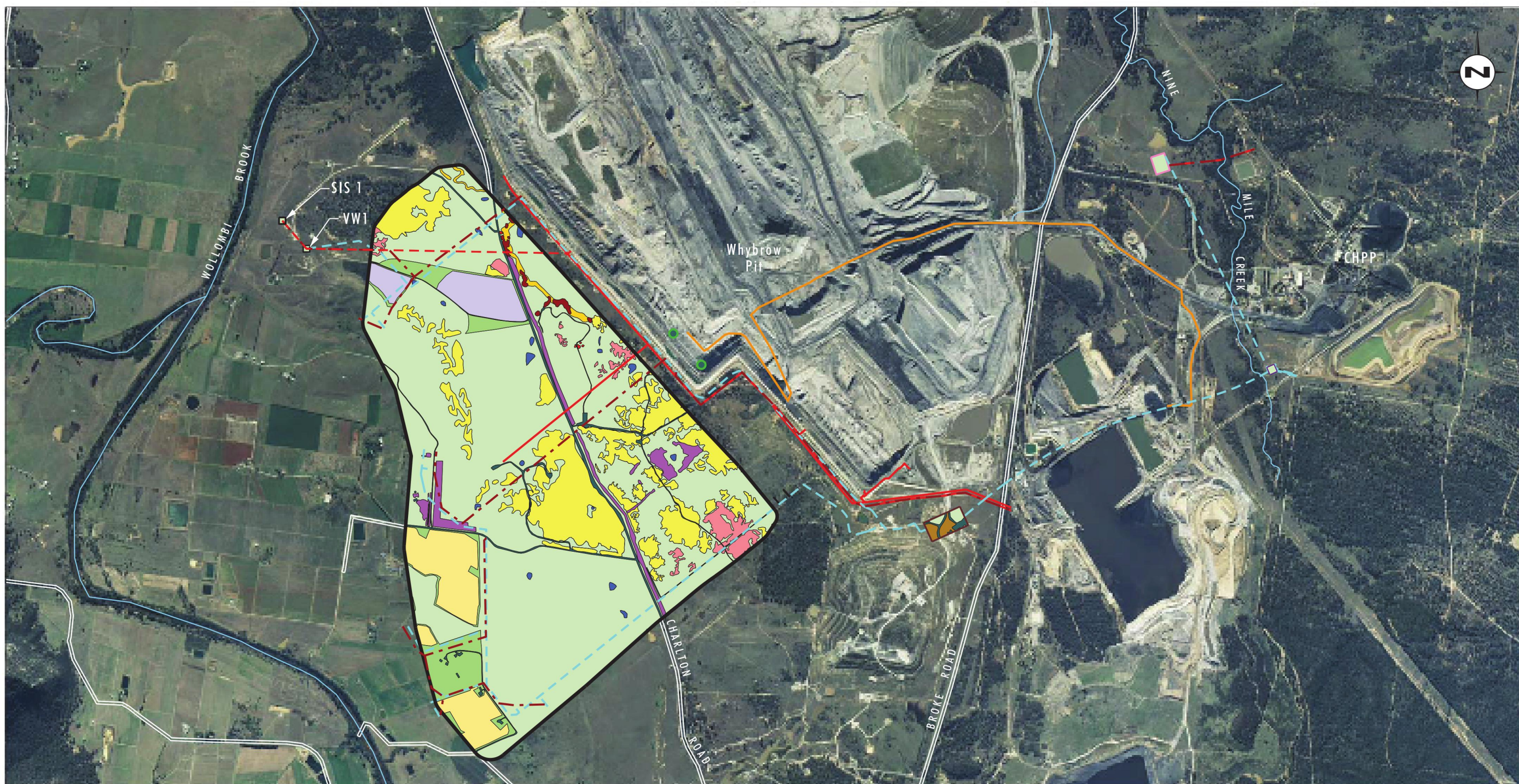
Vegetation Communities

Surveys of the Project Area identified six vegetation communities and seven types of disturbed or non-vegetated areas (**Figure 17**). **Table 29** shows the area of each vegetation community within the Project Area.

Table 29 – Vegetation Communities Identified Within the Project Area

Vegetation Community	Legal Status		Surface Infrastructure Disturbance Area (ha) ¹	Subsidence Study Area (ha)
	TSC	EPBC		
Central Hunter Box - Ironbark Woodland	EEC	-	5.0	103
Central Hunter Box - Ironbark Grassland	-	-	22	465
Central Hunter Bulloak Forest Regeneration	-	-	0.54	13
Central Hunter Swamp Oak Forest	-	-	0.38	2.1
Hunter Valley Weeping Myall Woodland	EEC	-	0	0.15
Riparian Grassland	-	-	0.71	3.5
Disturbed	-	-	2.3	14
Exotic Grassland	-	-	0.34	31
Olive Grove	-	-	0.42	21
Planted Areas	-	-	0.5	16
Rehabilitation	-	-	1.9	0
Vineyard	-	-	0	38
Waterbodies	-	-	0	2.5
Total			34.09	709.25

¹ = The "surface infrastructure disturbance area" has been calculated using the proposed gas drainage layout described in **Section 3.3.5**. The final area of woodland communities to be disturbed will likely be lower than that shown as trees and woodland areas will be avoided where possible.



Source: Infrastructure Locations - GSS Environmental

0 0.5 1 2 km

Legend

- | | | | | |
|--|--|---|--|--|
| Subsidence Study Area (SSA) | Location of Proposed Ventilation Shaft | Disturbed Grassland | Riparian Grassland | Coal Haul Road |
| Existing Powerlines | Roads | Exotic Grassland | Vineyard | |
| 66kV Powerline | Central Hunter Box - Ironbark Woodland | Hunter Valley Weeping Myall Woodland | Water body | |
| Proposed Overhead Powerlines | Central Hunter Box - Ironbark Woodland Grassland | Olive Grove | Proposed Goaf Plant, Compressor, Flares Gas Plant and Office Sheds | |
| Waterways | Central Hunter Bullock Forest Regeneration | Planted areas | Proposed Pipeline Maintenance Facility | |
| Gas Pipeline (Below Ground) | Central Hunter Swamp Oak Forest | Rehabilitation | Proposed Power Generation Plant | |

Vegetation Communities

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Base Plan Data Source: Umwelt, 2012

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All indicative locations - will be finalised pending constraints

The Central Box – Ironbark Woodland is the most widespread woodland community in the Project Area covering an area of around 103 hectares. This community is consistent with Central Hunter Grey Box - Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions, listed as an EEC under the TSC Act.

Central Hunter Box – Ironbark Grassland occurs in areas that are likely to have once supported Central Hunter Box – Ironbark Woodland, however most woody vegetation has been previously cleared for agricultural purposes. It is the most widespread vegetation in the Project Area, covering an area of approximately 465 hectares (predominantly above the proposed longwall panels). A total area of approximately 22 hectares of this vegetation also occurs in the proposed surface infrastructure disturbance areas. This vegetation is not consistent with Central Hunter Grey Box – Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions, listed as an EEC under the TSC Act, as grasslands are not specifically covered by the EEC listing. Although derived from the Central Hunter Box – Ironbark Woodland, this grassland area also now includes introduced grasses.

Hunter Valley Weeping Myall Woodland was recorded in two locations to the east of Charlton Road. The community covers an area of approximately 0.15 hectare. This community is consistent with the Hunter Valley Weeping Myall Woodland of the Sydney Basin Bioregion, listed as an EEC under the TSC Act and Weeping Myall (*Acacia pendula*) in the Hunter catchment listed as an endangered population under the TSC Act.

The remaining vegetation communities within the Project Area include disturbed areas, exotic grassland, olive groves, planted areas, vineyards, rehabilitation, and regeneration areas.

Threatened Flora Species, Endangered Populations and Threatened Ecological Communities

A detailed table of all potentially occurring threatened flora species, endangered populations and TECs is provided in Appendix 1 of the Ecological Assessment. One endangered flora population and two TECs were recorded in the Project Area during field surveys. Those threatened flora species, endangered populations and TECs that have been recorded in the Project Area, are listed in **Table 30**.

Table 30 – Threatened Flora Species, Endangered Populations & Threatened Ecological Communities Recorded in the Project Area

Scientific Name	Legal Status	Potential to Occur
Weeping myall (<i>Acacia pendula</i>) in the Hunter Catchment	EP (TSC)	Recorded
Central Hunter Grey Box – Ironbark Woodland in the Sydney Basin Bioregion	EEC (TSC)	Recorded
Hunter Valley Weeping Myall Woodland in the Sydney Basin Bioregion	EEC (TSC)	Recorded

Weeping myall (*Acacia pendula*) in the Hunter catchment (EP – TSC Act) was recorded in four locations during current and previous surveys of the Project Area (see **Figure 18**). Weeping Myall was recorded within the underground mining area and would be subject to subsidence impacts.

Central Hunter Grey Box – Ironbark Woodland in the Sydney Basin Bioregion (EEC – TSC Act) is the most widespread woodland community in the Project Area (refer to **Figure 17**). It covers an area of approximately 103 hectares within the underground mining area and would be subject to subsidence impacts.

Hunter Valley Weeping Myall Woodland in the Sydney Basin Bioregion (EEC – TSC Act) occurs in two locations within the Project Area, both occurring in the underground mining area (refer to **Figure 18**). This community covers an area of approximately 0.15 hectare.



Source: GSS Environmental, Infrastructure Locations - GSS Environmental

0 1 2 2.5 km

Legend

- | | | | |
|---|--|--|--|
| Subsidence Study Area (SSA) | Location of Proposed Ventilation Shaft | ▲ Eastern Bentwing-bat | + Little Bent-wing bat |
| — Existing Powerlines | — Roads | ■ Eastern Cave Bat | ◆ Weeping Myall (<i>Acacia Pendula</i>) in the Hunter Catchment |
| - - - 66kV Powerline | — Waterways | ◆ Grey-crowned Babbler | |
| - - - Proposed Overhead Powerlines | Proposed Goaf Plant, Compressor, Flares Gas Plant and Office Sheds | ● Speckled Warbler | |
| - - - Gas Pipeline (Below Ground) | Proposed Pipeline Maintenance Facility | + Grey-headed Flying Fox | |
| — Coal Haul Road | Proposed Power Generation Plant | ▲ Great Egret | |

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Threatened Species and Threatened Flora Population Locations

Base Plan Data Source: Umwelt, 2012

Weeping Myall Woodland (EEC - EPBC Act) is not considered to be present within the Project Area. The areas mapped as Hunter Valley Weeping Myall Woodland do not comprise Weeping Myall Woodland, as these areas do not satisfy the condition thresholds required to be considered part of the EPBC Act listed EEC. Specifically, the Hunter Valley Weeping Myall Woodland present within the Project Area covers an area of less than 0.4 hectare and to meet the Weeping Myall Woodland condition thresholds, it must cover an area of at least 0.5 hectare.

The likely level of impact on the abovementioned EECs and EPs is discussed in **Section 6.6.3** and Appendix 4 of the Ecological Assessment.

Fauna

A total of 149 fauna species were recorded during surveys of the Project Area (**Figure 18**). The 149 species comprised 115 bird, 3 reptile, 4 frog and 27 mammal species. The species list was compiled from data recorded during field surveys undertaken by Umwelt in autumn, winter and spring 2011 plus during annual fauna monitoring surveys undertaken from 2003 to 2010.

A total of 13 threatened fauna species were recorded within the Project Area and comprised five birds and eight mammals (all bat species). All 13 of the threatened species are listed as Vulnerable on the TSC Act and two are also listed as Vulnerable on the EPBC Act. Potential habitat was identified for a total of 24 threatened fauna species listed on the TSC Act and/or EPBC Act. **Table 31** provides a summary of the threatened fauna species that have either been recorded or may occur in the Project Area.

Table 31 – TECs, EPs and Threatened Species Recorded or That May Occur in the Project Area

Common Name	Scientific Name	TSC Act Status	EPBC Act Status
Little Eagle	<i>Hieraaetus morphnoides</i>	V	
Swift parrot	<i>Lathamus discolor</i>	E	E
Turquoise parrot	<i>Neophema pulchella</i>	V	
Little lorikeet	<i>Glossopsitta pusilla</i>	V	
Speckled Warbler	<i>Pyrrholaemus saggitatus</i>	V	
Scarlet robin	<i>Petroica boodang</i>	V	
Hooded Robin	<i>Melanodryas cucullata</i>	V	
Regent honeyeater	<i>Anthochaera phrygia</i>	CE	E
Grey-crowned babbler	<i>Pomatostomas temporalis temporalis</i>	V	
Varied sittella	<i>Daphoenositta chrysoptera</i>	V	
Diamond Firetail	<i>Stagonopleura guttata</i>	V	
Spotted-tailed quoll	<i>Dasyurus maculatus</i>	V	E
Brush-tailed Phascogale	<i>Phascogale tapoatafa</i>	V	
Eastern pygmy possum	<i>Cercartetus nanus</i>	V	
Squirrel glider	<i>Petaurus norfolcensis</i>	V	
Grey-headed flying-fox	<i>Pteropus poliocephalus</i>	V	V
Yellow-bellied sheath-tail bat	<i>Saccolaimus flaviventris</i>	V	
Eastern bentwing-bat	<i>Miniopterus schreibersii oceanensis</i>	V	
Eastern cave bat	<i>Vespadelus troughtoni</i>	V	
Eastern false pipistrelle	<i>Falsistrellus tasmaniensis</i>	V	
Eastern freetail-bat	<i>Mormopterus norfolkensis</i>	V	

Common Name	Scientific Name	TSC Act Status	EPBC Act Status
Greater broad-nosed bat	<i>Scoteanax rueppellii</i>	V	
Large-eared pied bat	<i>Chalinolobus dwyeri</i>	V	V
Large-footed myotis	<i>Myotis adversus</i>	V	

TSC = Threatened Species Conservation Act 1995

EPBC Act = Environment Protection and Biodiversity Conservation Act 1999

TEC = Threatened ecological community

EP = Endangered population

V = Vulnerable

E = Endangered

CE = Critically endangered

6.6.3 Potential Impacts

The potential impacts resulting from the Project would occur due to the predicted subsidence or during the construction of surface infrastructure.

The Project would also result in the subsidence of around 710 hectares of land. Much of this land comprises grassland, vineyards, olive groves and disturbed areas, however, also includes:

- 103 hectares of Central Hunter Box - Ironbark Woodland (EEC);
- 0.15 hectare of Hunter Valley Weeping Myall Woodland (EEC); and
- 465 hectares of Central Hunter Box – Ironbark Grassland.

Potential impacts resulting from subsidence include surface cracking (potentially cracks up to 450mm in width) and increased ponding along otherwise ephemeral drainage lines. The surface area has been previously undermined (Whybrow Seam) as part of the former Beltana No. 1 Underground Mine. Although surface cracking was observed across the Project Area as part of the previous mining operations, there were no observable surface water flow diversions in the drainage lines resulting from the extraction of the longwalls, once remediation of the larger surface cracks had been completed. The subsidence impacts for the modifications now proposed have been assessed as being relatively minor in terms of any potential impacts on the two EECs with none of them being significantly impacted.

The Project would result in the clearing of around 34 hectares of land for surface infrastructure facilities, comprising (approximately):

- Up to 5 hectares of Central Hunter Box – Ironbark Woodland for pre and post-mining gas wells and access tracks;
- 22 hectares of Central Hunter Box – Ironbark Grassland for pre and post-mining gas wells, the proposed pipeline maintenance facility, proposed gas drainage plant, proposed power generation plant, ancillary power plant infrastructure and access tracks;
- 0.54 hectare of Central Hunter Bulloak Forest Regeneration for pre and post-mining gas wells and access tracks;
- 0.38 hectare of Central Hunter Swamp Oak Forest for pre and post-mining gas wells and access tracks;

- 0.71 hectare of Riparian Grassland for pre and post-mining gas wells and associated access tracks;
- 0.34 hectare of Exotic Grassland for pre and post-mining gas wells and associated access tracks;
- 0.42 hectare of Olive Grove for pre and post-mining gas wells and access tracks;
- 0.5 hectare of Planted Areas for pre and post-mining gas wells and access tracks;
- 2.3 hectares of Disturbed land for the proposed gas drainage plant, ventilation fans, SIS drill pads, pre and post-mining gas wells and associated access tracks; and
- 1.9 hectares of Rehabilitation land for the proposed gas drainage plant.

All surface infrastructure has been positioned (where possible) to try and avoid woodland and forest areas. Assessment of the potential impacts on the two EECs and one Endangered Flora Population found that none of them would be significantly impacted by the Project. Assessment of the 13 threatened fauna species recorded within the Project Area (five birds and eight bat species) as well as the 24 species with potential habitat in the Project Area found that none would be significantly impacted by the Project. The Project Area was also found not to contain any areas of 'potential koala habitat' as defined by SEPP 44 and no further assessment under SEPP 44 was required.

Due to removal of up to 5 hectares of Central Hunter Box – Ironbark Woodland (EEC), a biodiversity offset strategy would be developed in consultation with the NSW OEH to offset this impact.

No EPBC Act listed TECs or threatened flora species were considered likely to occur within the Project Area. Assessment under the EPBC Act found that the Project was unlikely to have a significant impact on any threatened ecological communities, threatened flora, threatened fauna or migratory species and as such would not be referred to DSEWPC.

6.6.4 Mitigation Measures

The mitigation measures to be employed to further reduce the potential for adverse ecological impacts from the Project would include the following:

- Woodland areas and trees would be avoided wherever practicable during the positioning of gas drainage wells and access tracks (to service gas drainage wells) along the longwall panels. Where scattered trees occur in grassland areas, infrastructure and access tracks would (where possible) be positioned away from trees to avoid impacts on tree and tree hollow dependent fauna species.
- The clearing of vegetation would be undertaken in accordance with the BCC *Flora and Fauna Management Plan*.
- A biodiversity offset strategy is proposed to be developed in consultation with OEH to offset the impacts associated with the removal of up to 5ha of Central Hunter Box – Ironbark Woodland (EEC).
- Runoff/sedimentation from the proposed surface impact areas would be managed during both the construction and operation phases in accordance with the BCC *Sediment and Erosion Control Plan*.

- Weed control protocols would be implemented in accordance with the BCC *Weed and Pest Management Plan*. All weeds from areas cleared during construction would be completely removed from the construction zone and not allowed to enter adjacent habitat.
- Surface cracks caused by subsidence would be monitored and repaired according to an approved Subsidence Management Plan.
- Ponding that occurs following subsidence would be managed according to an approved Subsidence Management Plan.

6.7 Aboriginal and Cultural Heritage

6.7.1 Introduction

An Aboriginal Heritage Assessment was undertaken by OzArk Environmental and Heritage Management Pty Ltd (OzArk) for the Project. A full copy of the report is attached as **Appendix 10**. The following is a summary of the findings of this report. For further details, the full assessment report should be referred to.

6.7.2 Existing Aboriginal Heritage

The overall BCC and the Project Area have been subject to numerous archaeological investigations (Koettig 1991, Heffernan and Klaver 1997, ERM 1999/2000, Umwelt 2001, Umwelt 2003, Umwelt 2007) resulting in recordings of a profusion of archaeological sites. Of these sites, the majority comprise open sites (consisting of stone artefact scatters) and isolated finds. Also located within the BCC are the Beltana axe grinding grooves (BMU1) and scarred trees (B6). **Figure 13** illustrates the distribution of recorded Aboriginal sites within and around the Project Area. A total of 371 registered Aboriginal sites are mapped in the vicinity of the BCC and around 48 fall within (and up to 300m from) the Project Area boundary.

The 2003 EIS and approval to DA 376-8-2003 recognised that the axe grinding grooves (BMU1) and other archaeological sites would be impacted by mining of the Blakefield and underlying seams. Consequently, approval was granted to destroy various Aboriginal artefacts (and the deposits between them) pursuant to condition 36 of the consent to DA 376-9-2003. This included site BMU1 located above proposed BNLW5 (which has approval for destruction pursuant to AHIP No. 37-6-0967) as well as sites BMU12, BMU17, GIF-IF1, GIF-IF2, GIF-IF3, GIF-IF4, G2, G3, G4, G9, G11, BC01, BC03 and BC010. **Figure 13** shows the location of both the destroyed and remaining artefacts.

It is noteworthy that the distribution of artefacts within the vicinity of the BCC is likely to be a result of two factors:

- Development determined archaeological assessment areas. Those areas that have not previously been subject to development-driven assessments are less likely to exhibit registered Aboriginal sites.
- Lodgers and Nine Mile Creeks which are resource rich landscape features likely to have supported a range of flora, fauna, hydrological and stone resources during antiquity.

The majority of known sites at the BCC consist of scatters of open artefacts. Within the immediate environs of the BCC, approximately 73% of sites are described as open sites, artefact sites or artefacts scatters (open sites). Approximately 24% of registered sites are isolated artefacts ('isolated finds'). Artefact scatters with Potential Archaeological Deposit (PAD) constitute only 1%, a figure that is suggestive of the disturbed, ephemeral nature of the bulk of open sites in the region. Also represented are four restricted sites (1%), two grinding groove sites (<1%), two shelters with deposit (<1%) and one scarred tree (<1%).

In general, the recorded Aboriginal sites within the BCC area are found in close association to drainage systems and mostly consist of small scatters of silcrete and indurated mudstone artefacts. As archaeological work has progressed within the BCC area, it has become obvious that this plethora of individual recordings represented not discrete sites but evidence of a widespread and long-term occupation along the region's waterways

Figure 13 displays further information about the status of previously recorded sites within the BCC area and shows that a large number of the previously recorded sites have been salvaged in the face of various mine related activities. Of interest to this study is the artificial division of Charlton Road in the west of the BCC area where most sites to the east of Charlton Road have been salvaged while most sites to the west of Charlton Road remain valid (not salvaged). An exception to this rule is a group of sites to the west of Charlton Road in the very north of the current Project Area that has been salvaged in recent years due to flood mitigation works.

No new Aboriginal sites were recorded in the current Archaeological Assessment. This included fieldwork within Project Area with Registered Aboriginal Parties (RAPs) on 9-10 January 2012. During this fieldwork, two areas were noted that had the potential to contain subsurface archaeological deposits. These areas comprised the site of the proposed pipeline maintenance facility and the route of the proposed power line to SIS1 and VW1 (see **Figure 4**). As a result, a test excavation program was undertaken from 16 to 18 May 2012 within these areas. This recorded only two artefacts (a mudstone flake and a volcanic flake), both within area E5 (GDA Zone 56: 317614E, 6382838N) along the proposed power line route. As these sites essentially represented isolated artefacts that have already been salvaged, this area (E5) is not proposed to be recorded.

The assessment therefore confirmed a number of previously recorded sites and enabled the site boundaries of some of these sites to be extended. Due to the relative density of previously recorded Aboriginal sites within the Project Area, all artefact material recorded as part of the present assessment was seen as an extension of nearby previously recorded sites, rather than as discrete, new sites. The association of recorded sites during the assessment to previously recorded sites is summarised in **Table 32** and details of their location are provided in **Figure 13** and in **Appendix 10**.

Table 32 – Archaeological Survey Results

Site Number	Status	Notes	Survey Unit	Landform
37-6-1842	Salvaged	Outside Study Area to north. Although subject to salvage (AHIP # 2998) in 2010, a number of artefacts were recorded along the farm track where the original site was identified by Heffernan.	BFN Underground Mine	Level/slight slope
37-6-1840	Salvaged	Outside Study Area to north. Although subject to salvage (AHIP # 2998) in 2010, several artefacts were recorded along the farm track where the original site was identified by Heffernan.	BFN Underground Mine	Level/slight slope
37-6-1403	Valid	Site signposted in the field. Several artefacts noted in an area of scouring.	BFN Underground Mine	Slope
37-6-1406	Valid	Site signposted in the field. Several artefacts noted in the vicinity in an area disturbed by previous drilling activity just beyond the location for the proposed drill pad SIS1.	BFN Underground Mine	Broad, level ridge
37-6-0952	Valid	Several artefacts recorded within the area recorded by Umwelt.	BFN Underground Mine	Drainage depression
37-6-0954	Valid	Several artefacts recorded within the	BFN Underground	Moderate slope

Site Number	Status	Notes	Survey Unit	Landform
		area recorded by Umwelt.	Mine	within drainage depression
37-6-0955	Valid	Several artefacts recorded within the area recorded by Umwelt.	BFN Underground Mine	Hill top
NMC Con9	Valid	Several artefacts recorded extending NMC Con9 to NMC Con8.	Power Generation Plant	West bank of Nine Mile Creek
37-6-1969 37-6-1975	Valid	Several artefacts recorded extending these sites to the east.	Pipeline Maintenance Facility	Sloping land; 100m to Nine Mile Creek.

The key features of each portion of the Project Area subject to the assessment have been summarised below:

BFN Underground Mine

All previously recorded sites that were able to be re-visited within this part of the Project Area (i.e. those that are located on BCC land) were found to remain extant in the landscape. While artefact numbers at these sites were never large, it is nevertheless an indication that the sites remain extant and would require further management should they be impacted by the proposed works. As no new, discrete sites were recorded in this area, it is concluded that the archaeological values pertaining to the Aboriginal sites have been adequately captured in this part of the Project Area.

It is relevant to note that although site BMU1 (Beltana axe grinding grooves) is located within this part of the Project Area, it has already been approved for destruction pursuant to AHIP No. 37-6-0967 and condition 36 of the consent to DA 376-9-2003. In any event, the BOP (if approved – see **Section 1.4.3**) is likely to impact on the grinding grooves prior to mining at BFN.

Pipeline Maintenance Facility

This relatively small area could be intensively surveyed during the fieldwork and test excavation program. This revealed possible knapped glass artefacts, however, once re-examined at the time of the test excavation, the glass was assessed as not being of human manufacture. As the glass was assessed as being unmodified by humans, no Aboriginal sites are proposed to be registered at this location.

Ventilation Fans and Gas Drainage Plant

These areas have been highly disturbed by mining activities as well as having undergone archaeological management in the form of salvaging previously recorded sites (37-6-0870, 37-6-0873 and 37-6-0897). As a result, these areas were not the subject of further archaeological investigation.

Power Generation Plant

This relatively small area was also able to be intensively surveyed and although the area was grassed, active grazing of this paddock meant that a reasonable sample of the ground surface was able to be examined. Although in proximity to Nine Mile Creek and other previously recorded sites (NMC Con8 and NMC Con9), it was assessed that the proposed location of the plant and associated ancillary infrastructure is in an area that has a low likelihood of containing further, undetected Aboriginal sites or objects.

6.7.3 Potential Impacts

The potential impacts associated with the Project vary across the Project Area and can be summarised as follows:

BFN Underground Mine

For the majority of this area, the primary impact is mine subsidence. As shown in **Figure 3** the entire BFN Underground Mine area has already been undermined with the extraction of the Whybrow seam. While the effects of this subsidence are more noticeable in the east of the Project Area, there was little evidence of active subsidence to the west of Charlton Road. As shown in **Figure 13** and detailed in **Section 6.7.2**, many of the artefacts within this part of the Project Area have already been approved for destruction pursuant to condition 36 of the consent to DA 376-9-2003.

The Subsidence Assessment in **Appendix 6** examined the predicted effects of subsidence arising from the Project and concluded:

The predicted curvatures and the range of potential strains at the Beltana Grinding Groove Site (BMU1), based on the Modified Layout, are of sufficient magnitude to result in fracturing in the bedrock. It is likely, therefore, that the site would be impacted if fracturing were to occur coincident with the site.

It may be necessary to undertake preventive measures to minimise the potential for fracturing coincidence with the grinding groove site. This could include slotting the bedrock around the site, to isolate the grinding grooves from the surrounding bedrock, so as to minimise the transfer of mining induced curvature and strain.

(Note: This work has already been done under AHIP #2766 in relation to the extraction of the Whybrow seam: a mitigative program that was largely successful as the grinding grooves remain intact).

The scattered artefacts and isolated finds could potentially be affected by cracking in the surface soils as a result of mine subsidence movements. It is unlikely, however, that the scattered artefacts and isolated finds themselves would be impacted by surface cracking. It is recommended that BCM (Bulga Coal Management) seek the required approvals from the appropriate authorities, prior to the remediation of any surface cracking in the locations of these archaeological sites.

Therefore, while the predicted subsidence is in the order of 3m in some places, it is not envisaged that the stone artefacts themselves would be damaged, although the archaeological context of the artefacts could well be lost thereby greatly diminishing their scientific values. In any event, approval already exists for the destruction of many of these artefacts pursuant to condition 36 of the consent to DA 376-9-2003.

Other impacts in this area include the construction of drill pads (such as SIS1 and VW1) and an associated electricity transmission line. This would result in severe, yet localised, disturbance to the ground surface.

During the course of the Project further impacts would be likely in the form of access roads, gas drainage wells and subsidence remediation works. These works would damage the ground surface and have the possibility of directly impacting artefacts and their archaeological context, if not located appropriately.

Gas Drainage Plant, Pipeline Maintenance Facility and the Power Generation Plant

Impacts arising from these works would impact the ground surface within the construction footprint including areas designated for worker shelters, parking areas and material storage areas. While these impacts would be limited spatially to a fairly defined area, there would be severe impact to any artefacts and/or archaeological deposits that may exist within the constructional footprint.

6.7.4 Mitigation Measures

The general mitigation measures to be employed to further reduce the potential for adverse impacts on Aboriginal heritage items within the Project Area would include the following:

- The existing practices at the BCC incorporated in the *ACHMP* would be continued within the subsidence area of the BFN Underground Mine. The *ACHMP* provides a management strategy which considers each site on a case by case basis. Sites that would be impacted by subsidence remedial works or other mine related surface infrastructure (access roads, additional bore holes etc.) would be managed pursuant to the *ACHMP* at the time of the then known impacts.
- Area E5 from the test excavation program (GDA Zone 56: 317614E, 6382838N), located along the route of the proposed power line to SIS1 and VW1 gas wells, should be avoided when locating the power poles.
- The development and construction zone associated with the power generation plant and associated power lines and ancillary infrastructure would be setback a minimum of 20m from Nine Mile Creek to ensure previously recorded sites are not be adversely impacted.
- The Project works would generally remain within the impact footprint as defined by this EA. The impact footprint of each proposed works would be clearly defined in the field during construction to avoid inadvertent impact (e.g. using fencing and signposting).
- All workers during the initial ground breaking phase of construction would be informed of Aboriginal heritage sites in the vicinity and their legislative protection under the NPW Act. This induction would include instruction not to drive, excavate or store materials anywhere outside of designated areas.
- In the unlikely event that human skeletal remains are unearthed during construction, work in the vicinity would cease immediately and the police would be contacted. If the remains are deemed to be an archaeological deposit OEH would be contacted to discuss how to proceed.

The Beltana axe grinding grooves (BMU1) are already approved for destruction pursuant to AHIP No. 37-6-0967 and condition 36 of the consent to DA 376-9-2003. The BOP (if approved – see **Section 1.4.3**) is also likely to impact on the grinding grooves prior to mining at BFN. As a result, no further mitigation measure at the grinding grooves site would be required as part of the Project.

6.8 Visual Impact Assessment

6.8.1 Introduction

A Visual Impact Assessment (VIA) was prepared by Terras Landscape Architects for the Project (see **Appendix 11**). The VIA gives consideration to the various surface infrastructure elements that form part of the Project. Each Project element was treated individually with the following objectives:

- To identify and describe the existing visual/landscape environment and to evaluate its current qualities including an assessment of visual quality;
- To identify areas of impact associated with the various components that comprise the surface infrastructure;
- To determine the likely impacts the proposed surface infrastructure will have on the visual/landscape quality of the area; and

- To propose methods, where appropriate, to reduce the scenic impact of the proposed development or methods to increase the existing scenic quality should it be found that impacts are unfavourable.

It is relevant to note that the VIA does not take into consideration the BOP (see **Section 1.4.3**). Due to the proposed relocation of Broke and Charlton Roads and other associated works (such as changes in mine infrastructure within the vicinity of the power generation plant), the VIA is unlikely to be relevant should the BOP proceed. The impacts arising from the proposed BOP would require a separate visual impact assessment which would most likely result in different recommendations being made. Therefore, the recommendations of the VIA are only of relevance should the BOP not proceed or there are significant delays in obtaining approvals and/or implementation (e.g. greater than 10 years).

6.8.2 Existing Environment

The local area is typically a combination of broad alluvial flats and gently undulating rises associated with the Wollombi Brook. The alluvial flats vary in width from 1 to 5 kilometres. The lower lands are contained by steep to very steep hills of the Brokenback Ranges to the west and south with some less steep hills to the east. Both sets of hills are heavily wooded with primarily open woodland vegetation. The steepness of the hills becomes less pronounced as one moves further north.

The steepness of the adjacent slopes has restricted clearing with the main forms of development, generally related to grazing and grape-growing, being kept to the lower-lying lands. The township of Broke occurs within this area. The town is a mixture of building styles and ages laid out on large blocks with broad tree-lined streets contributing to the town having a pleasant level of visual amenity. Other small townships such as Bulga and Milbrodale also occur within the local vicinity but do not match the size of Broke.

Mining has been present on the area for a long period of time. However in the past few decades the scale and impact has increased. In particular, in locations where surface operations take place including open cut mining, the scenic quality of the area reduces. This is particularly true of the lands associated with the study area that are in the ownership of mining companies.

Tourism is also a growing activity within the area, which in part is a response to the area's prevailing landscape character and the extension of the wine growing areas of the Lower Hunter. This in turn is seeing more tourist accommodation and other related land uses being provided. This is particularly true of areas west of Wollombi Brook.

The Project Area has two distinctive landscape units mainly defined by land use than another influencing characteristic: **Wollombi Brook Landscape Unit** (western side) and **Broke Road/Blakefield Landscape Unit** (eastern side).

Wollombi Brook Landscape Unit

This unit mainly refers to the alluvial lands west of the river but it also includes the rural lands to the east with Charlton Road, being the unit's eastern boundary. This landscape unit has a moderate to high scenic quality. The key elements that contribute to the area's rating are as follows:

- The presence of strong topographic relief and landforms (steep hills, undulating hillslopes and flat alluvial plains along with the presence distinctive landforms such as rock outcrops and cliffs);
- Patterned landscapes (pastures, vineyards and native vegetation occurring over the hills and along the watercourse of the area provide a diverse and interesting mix);

- Perceived naturalness (again native vegetation and including grassy pastures which are regarded as being natural);
- Low-key development (rural structures and scattered isolated buildings that tend to be enhanced by the landscape and not dominate over it); and
- Maintained, cultural landscapes.

Broke Road/Blakefield Landscape Unit

This unit mainly refers to the land to the east of Charlton Road which has been the subject of mining activities. These areas have either been heavily mined, been used to accommodate mining infrastructure or have not received the same levels of broadscale care and management as the rural areas. This landscape unit has a low scenic rate for the following reasons:

- Naturalness rates lowly due to the dominance of development ; and
- The presence of large scale human intervention in the form of mining.

6.8.3 Potential Impacts

Power Generation Plant

The power plant and ancillary infrastructure would be readily visible to people using the access road to the CHPP. In terms of visual access from community areas, it would be possible to view sections of the plant (i.e. top sections of the five flares) for a 500 metre section of Broke Road starting at Nine Mile Creek and heading south. The most exposed location occurs where the power transmission lines cross Broke Road providing a 100m (approximate) break in the roadside vegetation. Otherwise glimpses of the plant would be afforded through small gaps in the roadside vegetation.

There is also the potential for the flares to form a glow created by burning off the methane at high temperature which may be seen at night-time when atmospheric conditions are high in particulate matter or when low clouds or other similar atmospheric conditions are present overhead.

The power generation plant, when constructed, would slightly alter the visual quality of the Broke Road/Blakefield Landscape Unit although its overall rating would not be lessened.

Pipeline Maintenance Facility

Views of the pipeline maintenance facility would only be afforded to those with access to the BCC. The proposed facility would not be seen from community areas and its siting is within an area of low visual quality due to the impacts of previous development.

Gas Drainage Plant

The gas drainage plant would be partially visible along a 600 metre section of Broke Road (refer to Figure 4.2.8 of the VIA in **Appendix 11**). This is because the existing vegetative screen is around 20 years old and has developed some gaps in its cover due to the decline of some trees. The highest visual access would be provided to motorists when travelling south to north due to the configuration of the road and location of screen planting. Views of the plant would be difficult although not impossible to motorists travelling between Mt Thorley and Broke. There would be no other community areas that have views of the plant.

As with the power generation plant, there would be the potential for the flares to form a glow created by burning off the methane which may be seen at night-time when atmospheric conditions are high in particulate matter or low clouds are present overhead.

The plant would have a low visual impact on an already degraded landscape mainly resulting from the presence of vegetative screen running parallel to Broke Road and the low visual access from community lands which limits views of the site to members of the community and others travelling along Broke Road.

Ventilation Fans

The ventilation fans would not be visible from any community areas and are located in a highly disturbed visual environment at the base of the BSO highwall. There would be no visual impact arising from the construction and installation of the ventilation fans.

SIS Wells and Drill Pads

The SIS wells and drill pads would predominantly be located at the eastern end of the longwall panels on land owned by the mine. These wells would be located near the highwall of the BSO within the Broke Road/Blakefield Landscape Unit (see **Figure 8**) which has a low scenic quality rating (mainly arising from the amount of disturbance caused by previous mining activities). Therefore, there would be no further loss of scenic quality resulting from the installation of the proposed wells.

The SIS pad beyond the longwall panels (SIS1) would be located behind a small hill and existing vegetation to the east and screened by vegetation growing along Wollombi Brook. Two mine owned and three privately owned residences occur within a 1 kilometre radius of SIS1, although only the one mine owned residence located 300m to the south-west would have a direct view. The only other community areas with visual access to this pad would be a handful of properties located with sufficient elevation to see over the creek-related vegetation in the foothills of the Brokenback Range. The closest of these residences is approximately 2.7 kilometres away. SIS1 would be located within the Wollombi Brook Landscape Unit, which has a moderate to high scenic quality rating resulting from the presence of rural lands and the avoidance of views to mining affected areas and/or activities. Once constructed, the SIS well, with some modest screening, would not present a significant visual impact. The main visual impact would occur for approximately 8 weeks during construction and rehabilitation.

Powerlines

The powerlines would have only a minor impact during and after construction. They would not appear out of character within the area and would be only briefly seen by people travelling along Charlton and Broke Road. Although the pasture land presents well as a rural landscape with little disturbance, when placed in context with the Whybrow highwall (which is located approximately 500 metres east of Charlton Road) the general locality is not of high visual quality.

Gas Drainage Wells

The proposed gas drainage wells above the longwalls would be most visible when they are located on the western side of Charlton Road (Wollombi Brook Landscape Unit), especially when sited in open pastures. The wells located on the eastern side of Charlton may still be visible, however, the visual sensitivity of this area is considerably lower and therefore changes within the landscape are less obvious and detrimental.

The visual impact of the proposed gas drainage wells would be most prominent during construction (primarily due to the presence of drilling rigs and noise attenuation barriers). However, the construction phase lasts for a limited time and has previously been managed successfully by BUO at

the BFS and Beltana No. 1 Underground Mines. This has included streamlining operations to minimise construction times, providing screening and undertaking site rehabilitation.

The visual impact of the gas wells would be temporary as they are usually in place for two to four years to extract gas during the development and mining of each mining panel. The post mining gas wells are usually in place for three to four years after mining has been completed in each panel. Following this, rehabilitation works would be progressively undertaken returning the affected areas to their pre-mined condition. Overall, the loss of visual quality related to the gas drainage wells would be around 9-10 years which includes an allowance for the rehabilitation works to take effect. However, the access tracks would be retained, where possible, to provide for future gas drainage infrastructure for the subsequent two mining seams in the same mining area until completion of mining in around 2031.

6.8.4 Mitigation Measures

Power Generation Plant

The existing roadside planting would be augmented along the eastern side of Broke Road for a distance of 500m south of where Broke Road crosses Nine Mile Creek (refer to Figure 4.2.3 of the VIS). This planting would comprise locally occurring native species of trees and tall shrubs. Where the easement occurs, plant heights would be kept to statutory limits to allow for clearances and maintenance access, however, plants growing to a height of 3 metres along the roadside within the easement would be sufficient to provide adequate screening.

It is relevant to note that the above mitigation measures would only occur should the BOP not proceed or there are significant delays in obtaining approvals and/or implementation (e.g. greater than 10 years). This is because the BOP includes the relocation of Broke and Charlton Roads and additional surface infrastructure within the vicinity of the power generation plant. The visual impacts arising from the proposed BOP would require a separate visual impact assessment with different recommendations likely to be made.

Pipeline Maintenance Facility

Mitigation measures would not be required for the proposed pipeline maintenance facility.

Gas Drainage Plant

The existing roadside planting (along the western side of Broke Road) would be augmented along a 600m stretch of this road (refer to Figure 4.2.8 of the VIA in **Appendix 11**). This planting would comprise locally occurring native species of trees and tall shrubs.

Again these mitigation measures would only occur should the BOP not proceed or there are significant delays in obtaining approvals and/or implementation (e.g. greater than 10 years). This is because the BOP includes the relocation of Broke Road and the creation of a landscaped bund that would screen the gas drainage plant. The visual impacts arising from the proposed BOP would require a separate visual impact assessment with different recommendations likely to be made.

Ventilation Fans

Mitigation measures would not be required for the proposed ventilation fans.

SIS Wells and Drill Pads

Mitigation measures for the SIS wells and drill pads above the longwall panels would include the current methods of screening at the BUO (e.g. the use of green colorbond screening and the use of

fast growing screen planting such as *Acacias*). Where possible, siting would consider making use of existing vegetation to screen the wells and the temporary roads accessing the wells would be located in a manner that does make them readily noticeable from Charlton Road with consideration given to using current landforms, existing vegetation and the avoidance of straight lengths running perpendicular to contours.

With respect to the SIS well beyond the longwall panel (SIS 1), consideration would be given to siting the well as low down as possible to take advantage of the natural screening afforded by the Wollombi Brook vegetation. The works would be well co-ordinated to minimise the time spent under construction. Rehabilitation works would seek to be consistent with the surrounding open pastures.

Powerlines

All disturbed ground arising from powerline installations, would be made good following construction. The powerline to SIS1 would be located as close to the Atulya Olive Grove as practicably possible so that the plantation can assist in providing a backdrop to the lines.

Gas Drainage Wells

To minimise the impact of the gas drainage wells within the BFN Underground Mine Area, the following mitigation measures would be implemented:

- Preference would be given, where possible, to locating gas drainage wells, powerlines and access roads in areas of low visual effect followed by medium then high visual effect.
- The siting of roads would seek to use existing landforms to provide screening when viewed from community areas.
- Natural screens (e.g. remnant native vegetation and existing landforms) would be considered when locating wells, powerlines and roads aiming to minimise views for those people travelling along Charlton Road.
- The construction times of wells would be kept to a minimum seeking to improve current procedures where possible.
- The use of temporary screens to hide equipment and provide fencing would be continued, especially close to Charlton Road.
- Where wells only require low screens, the use of mounding and other landforms to conceal the wells would be considered in preference to fencing/physical screening.
- Screen planting along Charlton Road would be undertaken with the use of *Acacias* and other fast growing native plants common to the area.

6.9 Traffic Assessment

6.9.1 Introduction

A Traffic Impact Assessment was prepared by GHD Pty Ltd (GHD) for the Project (see **Appendix 12**). The purpose of the report was to assess traffic impacts associated with the Project, specifically:

- Reviewing the existing road environment in the vicinity of the site and the traffic conditions on that road network;

- Examining the proposed traffic operations during the construction period and operation of the proposed facility, and
- Examining the traffic implications of the proposal with respect to the external road network in terms of traffic efficiency and road safety.

Information on traffic conditions was obtained from detailed traffic surveys (late 2010 and May 2011) and from published Council and RMS (Roads and Maritime Services) information. The traffic assessment was therefore undertaken at a time when the BUO had 530 full time employees.

6.9.2 Existing Environment

Broke Road

Broke Road provides access from the township of Broke in a northerly direction for approximately 15 kilometres to Putty Road/Golden Highway. It is the main link between Broke and Singleton. There is a T intersection at Charlton Road with Broke Road retaining priority. The road continues north providing access for coal mines, coal operations and minor agricultural activities. Broke Road passes under Mt Thorley (rail) Branch Line and terminates at Golden Highway/Putty Road intersection. Broke Road is operating as a collector road with annual average daily traffic (AADT) volumes of between 2,000 and 10,000.

The Project would utilise the following existing intersections on Broke Road:

- The area between Charlton Road and Broke Road (Area 2 in the Traffic Impact Assessment) will access Broke Road at the existing auxiliary right turn/left turn (AUR/AUL) intersection at the former Beltana No. 1 mine infrastructure area access. This access is currently utilised for maintenance activities.
- The area east of Broke Road (Area 3 in the Traffic Impact Assessment) will access Broke Road at the existing channelized right turn/auxiliary left turn (CHR/AUL) intersection at the BSO infrastructure area. This intersection currently provides access to the open cut mine and associated infrastructure.

More broadly, the following intersections would be utilised by the BFN modification to gain access to the site:

- The existing intersection channelised right turn/left turn intersection at Broke Road and the Golden Highway (Putty Road).
- The existing T-intersection at Broke Road and Charlton Road may be used for vehicles operating in the area to the west of Charlton Road (Area 1 in the Traffic Impact Assessment).

Charlton Road

Charlton Road connects from Broke Road to Putty Road/Golden Highway and runs directly above the proposed longwall panels. The road has unsealed shoulders, unformed drains and grassed verges. There is no centreline and there is direct property access for a number of rural lots. Charlton Road is operating as a local road with AADT volumes of less than 2,000.

Charlton road terminates at Broke Road at a stop sign controlled intersection. The existing sight distance at the intersection does not comply with the current sign posted speed limit of 100km/h, but would be compliant if the speed limit was reduced to 70km/h.

Golden Highway

The Golden Highway is a 314 kilometre route from the New England Highway, south of Singleton to Dubbo, central western NSW. It is designated State Highway 84 (SH84). In the vicinity of the Project Area, the Golden Highway comprises Mitchell Line of Road, Putty Road and the Golden Highway. The Golden Highway is operating as a sub-arterial road with AADT volumes of between 5,000 and 20,000.

6.9.3 Existing Intersection Operation

The RMS's Guide to Traffic Generating Developments describes the levels of service (LOS) for intersection performance. These are summarised in **Table 33**.

Table 33 – Performance Criteria for Intersections

LOS	Average Delay / Vehicle (secs/veh)	Give-Way and Stop Signs
A	Less than 14	Good operation
B	15 to 28	Acceptable delays and spare capacity
C	29 to 42	Satisfactory, but accident study required
D	43 to 56	Near capacity and accident study required
E	57 to 70	At capacity; requires other control mode

Broke Road / Golden Hwy

An intersection count was undertaken at the Broke Road and Golden Highway/Putty Road in May 2011 and showed the existing Broke Road and Golden Highway/Putty Road intersection was at capacity. Traffic analysis undertaken for the Warkworth Extension project, indicated that the intersection would fail within 4 years when background growth rates were considered. This is without the addition of specific developments. In addition, if historical growth rates were applied, the intersection would operate at LOS F by 2012, without any additional developments.

Bulga Coal Complex Access / Broke Road

The intersection with BCC comprises a channelised right turn, with an auxiliary left turn deceleration and a left turn acceleration lane. An intersection count was undertaken at the BCC main access road in May 2011, showing that the existing intersection is operating well, with extra capacity.

Beltana No. 1 Mine Access / Broke Road

The existing Beltana Mine intersection is operating well, with spare capacity.

Charlton Road / Broke Road

An intersection count was undertaken at the Charlton Road and Broke Road in May 2011 showing that, the intersection operates at a good LOS. The worst movement provided a LOS of B. This indicates acceptable delays and spare capacity.

Access to Charlton Road

Access from the area west of Charlton Road (Area 1 in the traffic assessment) to Charlton Road would vary depending on location of drilling activities. Given the low traffic volumes on Charlton Road and the significantly minor movements on the accesses, these have not been modelled. Management of interaction with residents and traffic on Charlton Road would be addressed in the

Contractor's Management Plans that would be approved through normal mine and statutory planning mechanisms prior to commencement of work.

Golden Highway (Mitchell Line) and Putty Road intersection

According to the proposed Warkworth Extension Project, the Putty Road/Mitchell Line (Golden Highway) intersection currently operates at LOS B.

6.9.4 Potential Impacts

The Project would generate traffic during construction and operation of the Project. Construction traffic would be the critical activity as operational activities are infrequent and essentially require few staff to operate. The critical period for the work would be through 2013 when the power plant, gas drainage and gas plant are proposed to be constructed. All these components would be jointly under construction for a period of approximately 6 months.

A summary of the intersection performance resulting from both the traffic generated by the Project and future traffic growth rates (based on historical growth rates) is shown in **Table 34** below.

Table 34 – Summary of Intersection Performance

Intersection	Critical turn	Peak	Existing LoS	Proposal LoS (2012)
Broke Rd/Golden Hwy	Right out to Golden Hwy	AM	F (2012)	F
Broke Road/Bulga	None		A	A
Broke Road/Beltana	Right out to Broke Road		B	B
Broke Road/Charlton	Right out to Broke Road		B	B
Access to Charlton Rd	None		Not modelled	Not modelled

The results of the Traffic Assessment show that the intersection of Broke Road with the Golden Highway would fail under background growth conditions (without development) by 2012. This intersection operated at capacity (LOS E) at the time of traffic counts in 2011.

The Broke Road/Golden Highway intersection would continue to operate above capacity with the increase in traffic associated with the construction of the Project, however, this would only occur in the peak construction period over of approximately 6 months. This assessment comprises a worst case scenario which assumes that all light vehicle and heavy vehicle movements associated with the construction of the Project would occur during the peak hour periods.

All other intersections impacted by the proposal would continue to operate at good level of service with spare capacity.

In terms of cumulative impacts, the proposed Warkworth Expansion Project to expand adjacent Mt Thorley and Warkworth mines would impact the Broke Road/Golden Highway intersection. Impacts from this Project, if it proceeds, are expected in Year 4 of the Mt Thorley Warkworth project which could be in 2015 or 2016. This timing is beyond the critical period for the Project and therefore impacts would not be cumulative.

6.9.5 Mitigation Measures

Mitigation measures would not be required for operational activities as the critical period of the Project comprises the overlapping of certain construction activities over around a 6 month period. Minimal traffic is generated during operations which are ongoing activities.

During construction, a Construction Traffic Management Plan would be prepared and implemented prior to construction to minimise impacts on the intersection of Broke Road and the Golden Highway.

6.10 Groundwater

6.10.1 Introduction

Comprehensive groundwater assessment of mining in the Blakefield seam for the approved BFN Underground Mine was undertaken by Mackie Environmental Research (2003) for the 2003 EIS. A key aspect of this assessment was the identification of the extent of important alluvial areas that required consideration in designing the mine layout and the extent of buffer zone from underground mining required to protect these alluvial areas. These considerations have been taken into account by BCM in designing the modified mine layout. The Project does not substantially change the extent of proposed longwall mining layout and does not seek any change to the approved maximum production rate. Mackie Environmental Research remodelled the combined impact of the BUO and BSO in 2009 and 2012 with the results being consistent with the 2003 groundwater modelling. The BCC *SWMP* includes a rigorous process of monitoring and review of groundwater inflows and water level against the 2003 EIS predictions. Additionally, as per the BCC *SWMP*, a hydrogeological review is conducted by a qualified Hydrogeologist for each successive longwall including the comparison of groundwater inflows and water levels against the EIS predictions.

Given the compliance with the 2003 EIS predictions and the *SWMP* since 2004 and the lack of a material difference between the approved and proposed mine layout, a supplementary groundwater modelling exercise has not been undertaken. The following section outlines the existing groundwater regime, potential impacts, and management measures for the Project.

6.10.2 Existing Environment

Two types of groundwater are found within the vicinity of the Project Area: the alluvial aquifer of Wollombi Brook (and to a lesser degree Monkey Place Creek) (refer to **Figure 11**) and the hard rock aquifer associated with the Wittingham and Wollombi Coal Measures. The alluvial aquifer is of variable quality, with poor quality groundwater observed in deeper zones, whilst shallower groundwater is generally fresh to brackish. The alluvial aquifer is of sufficient yield to provide an important water supply for irrigation, stock and domestic purposes. The water held in the coal measures, however, is of poor quality and low yield.

The modified BFN Underground Mine would not include mining beneath the alluvial aquifer associated with either of these creek systems. The extent of the alluvial aquifer system in the vicinity of the Project Areas has been mapped (refer to **Figure 11** and Drawing MSEC479-07 in the Subsidence Assessment) through analysis of topography, air photo interpretation, geomorphological observations, existing borehole data and targeted exploratory drilling to define the perimeter in areas close to the underground mining area. The mine plan has been developed to maintain a buffer of at least 40 metres from the edge of the alluvium to the zero subsidence limit. The limit of alluvium is located around 145 metres south-west of the Subsidence Area, at its closest point.

There are a number of water or monitoring bores within the Project Area (refer to **Figure 7**). There are, also a number of private water supply bores and wells located within the vicinity of the Project Area. These are predominantly located within the alluvial aquifer of Wollombi Brook.

6.10.3 Potential Impacts

Groundwater Quality

The pre-mining groundwater quality within the hard rock aquifer was found to be typically poor, with electrical conductivity ranging from approximately 2000 $\mu\text{S}/\text{cm}$ to over 10,000 $\mu\text{S}/\text{cm}$ (Umwelt 2003).

Consistent with currently approved operations, it is unlikely that any measurable improvement in groundwater quality would be observed in the coal measures as a result of the Project. Mackie Environmental Research (2003) identified that a minor improvement in the water quality of the deeper alluvial aquifer may occur due to the reduced input of saline water from the hard rock aquifer. This trend is also relevant for the proposed modified mine layout and is likely to revert back to the current groundwater flow regime as the hard rock aquifer recovers from the cessation of mining. Generally the alluvial groundwater quality is predicted to remain unaffected.

Groundwater Supply

The modified longwall layout for the BFN Underground Mine has been designed to ensure that there is an adequate buffer to protect the Wollombi Brook alluvials (refer to **Figure 11**), consistent with the approved longwall layout. It should also be noted that the approved and proposed BFN mine layouts are predominantly within the footprint of the Whybrow mine layout and approximately 80 metres deeper. The dewatered Whybrow goaf creates a significant hydraulic sink between the proposed Blakefield operations and the alluvial aquifer (ie. the Blakefield seam hydraulic head leaks towards the dewatered Whybrow seam). The 40 metre buffer zone for the limit of the alluvials lies outside the 20 millimetre predicted subsidence contour. The limit of alluvium is located around 145 metres south-west of the Subsidence Area, at its closest point.

There are groundwater monitoring bores within the Project Area and a number of registered bores within the vicinity (refer to **Figure 7**). The registered bores are generally located within the Wollombi alluvium and are located outside of the predicted 20mm subsidence line. As these bores are located within the alluvial aquifer it is considered very unlikely that they will exhibit any significant loss of yield due to the high recharge rate. Should the groundwater supply to these bores be affected by mining within the BFN Underground Mine area, the existing development consent (2003 EIS) requires BCC to provide an alternative water supply until such time as a more permanent supply can be re-established. BCC would provide an alternative water supply until such time as the MSB could re-establish a more permanent supply.

Groundwater in-flows from pre drainage gas wells for BFS Underground Mine have been less than 3ML per well. This groundwater make is metered and reticulated into the BCC Integrated Water Management System. These groundwater inflows do not represent an increase in overall groundwater yield to the BUO as the wells actually dewater the target coal seam thus reducing the overall yield to the working/dewatering bores.

6.10.4 Mitigation Measures

In accordance with the current development consent, BCM has a comprehensive *SWMP*, including a groundwater monitoring program, and groundwater response plan. The measures outlined in this management plan have been determined in consultation with DP&I and NOW and would apply to the BFN operations. Additionally, a *Wollombi Brook Groundwater Contingency Plan* has been approved by the DP&I as part of the BFS Subsidence Management Plan process. This would be reviewed and updated as part of the BFN Subsidence Management Plan process.

The existing BCC groundwater monitoring program would be maintained throughout the life of the Project. As detailed in **Section 2.8.6**, BCC currently monitors 46 piezometers every two months for depth to water. Groundwater from 35 of the piezometers is also monitored for pH and EC and 12 of the piezometers are sampled every 6 months and assessed for a range of analytes. The effectiveness of this monitoring network is reviewed annually and updated as required. Monitoring results would continue to be reported annually in the AEMR.

Potential groundwater impacts largely relate to the shallow alluvial aquifer systems that are used for irrigation water supply. Should the above monitoring reveal that there is a reduction in groundwater level or water quality in bore on neighbouring property as a result of mining, then BCC would

undertake the mitigation measures outlined in the *SWMP*. Such measures may include rehabilitation of the bore/well supply by deepening or replacement of supply, whichever is considered the most appropriate course of action, in consultation with the landowner.

6.11 Surface Water

6.11.1 Existing Environment

The relationship of the Project components to local surface water resources is shown in **Figure 11**. The proposed longwall mining area and gas drainage plant are located within the Wollombi Brook catchment and its tributary Monkey Place Creek. The proposed gas pipeline maintenance facility and the power plant are located within the Loders Creek catchment and its tributary Nine Mile Creek. Wollombi Brook catchment has an area of over 2,000km² and drains to the Hunter River approximately 10.5 kilometres west (upstream) of Singleton. A number of unnamed ephemeral tributaries of Wollombi Brook and Monkey Place Creek drain the surface area proposed to be undermined. The Loders Creek catchment has an area of approximately 58km² and drains to the Hunter River downstream of the confluence of the Hunter River and Wollombi Brook and approximately 6.7 kilometres southwest (upstream) of Singleton. Water quality in Wollombi Brook is generally good with low salinity and neutral pH (Umwelt 2003). Loders Creek, Nine Mile Creek, and the minor ephemeral drainages in the Project Area typically have poor quality water, which is alkaline and highly saline, except during high rainfall events (Umwelt 2003). There are a number of licensed surface water extraction points located on Wollombi Brook in the vicinity of the Project Area (**Figure 7**). These are predominantly used for irrigation, although a large proportion of the allocation is under-utilised.

The dominant topographical feature in the vicinity of the proposed longwalls is the hill located above the commencing (south-western) ends of the proposed longwalls, which rises to a level of approximately 170 metres AHD. The survey trig station known as Milbrodale is located on the top of this hill. The land to the east of the hill, above the proposed longwalls, generally falls towards the north-east, with a low point of approximately 70 metres AHD above the finishing ends of the proposed longwalls. The Whybrow Pit is located to the north-east of the proposed longwalls, at a distance of approximately 300 metres, at its closest point.

The locations of the watercourses in the vicinity of the proposed longwalls and the proposed surface infrastructure are shown in **Figure 11**. There are no major creeks or streams above the modified longwall panels. The largest watercourse in the vicinity of the proposed longwalls is the Wollombi Brook, which is located at a minimum distance of 700 metres south-west of BNLW1, at its closest point to the proposed longwalls. The brook is a perennial stream associated with a shallow aquifer, which is incised into the alluvial deposits in the bottom of a valley. The bed of the brook is approximately 5 metres below the banks on each side of the brook. The limit of alluvium for the Wollombi Brook and the 40 metre buffer zone to the limit of alluvium are shown in **Figure 11**. The limit of alluvium is located around 145 metres south-west of the Subsidence Area, at its closest point and, therefore, the proposed longwalls are located well outside the buffer zone. There are a number of ephemeral drainage lines located above the proposed longwalls, the largest being Drainage Line 1 which is located above the north-eastern ends of the proposed longwalls. Drainage Line 1 flows in a north-westerly direction to where it drains into Wollombi Brook approximately 1.6 kilometres north of the proposed longwalls. The natural gradient of Drainage Line 1 within the Project Area is around 10 mm/m (i.e. 1 %, or 1 in 10). There are also a number of smaller drainage lines located directly above the proposed longwalls. The drainage lines in the central and north-western parts of the longwall area flow in north-easterly directions to where they drain into Drainage Line 1. The drainage lines in the south-eastern part of the longwall area flow in southerly directions to where they drain into Drainage Line 10. These ephemeral drainage lines have alluvial beds with average natural gradients around 10 mm/m (i.e. 1 %, or 1 in 10). There are a number of farm dams above the longwalls which have been constructed along the alignments of the drainage lines. The farm dams are typically of earthen construction and have been established by localized cut and fill operations.

Nine Mile Creek is the closest watercourse to the proposed power plant and pipeline maintenance facility. However, this surface infrastructure would be setback well beyond the riparian zones associated with this watercourse.

6.11.2 Potential Impacts

Water Balance

A detailed water balance was developed for the BUO as part of studies completed for the 2003 EIS and is contained in **Table 35**.

Table 35 – Predicted Water Balance from the 2003 EIS

Scenario	Water Balance (ML/year)				
	Year 1 (ML)	Year 8 (ML)	Year 13 (ML)	Year 21 (ML)	Year 27 (ML)
Dry Year (10%)	-914	-228	574	675	389
Average Year (50%)	-71	477	1285	1166	879
Wet Year (90%)	819	1220	2032	1780	1493
Measure Underground Water Balance	91 (2004)	584 (2011)	N/A	N/A	N/A

As required by the current development consent, this water balance has been reviewed annually since 2004 during the AEMR process. The net underground water balance for the BUO to date has been within the water balance predictions included in the 2003 EIS as shown in **Table 35**. As there is no change to the approved production rates, the Project would not result in any substantial change to the BUO mine water balance. None of the Project components would require additional water for operation and no water discharges would occur as a result of the proposed power plant.

Subsidence Impacts

The ephemeral drainage lines are located across the longwall area and, therefore, are expected to experience the full range of predicted subsidence movements. A summary of the maximum predicted subsidence parameters resulting from the extraction of the proposed longwalls is provided in the Subsidence Assessment in **Appendix 6**. The drainage lines have shallow incisions into the surface soils and therefore it is unlikely that the drainage lines would experience any significant valley related movements resulting from the extraction of the proposed longwalls. However, the drainage lines would experience ground strains resulting from the extraction.

A comparison of the maximum predicted additional subsidence parameters for the drainage lines resulting from the extraction of BNLW1 to BNLW7, based on the modified layout (with those provided in the 2003 EIS) is provided in **Table 9** in **Section 6.2.3**. It can be seen from this table that the maximum predicted additional tilt and curvatures, based on the modified layout, would be greater than the maxima predicted based on the EIS Layout. The reason for this is that the predictions provided in the 2003 EIS were based on the longwalls in the Blakefield Seam being offset from those in the Whybrow Seam (i.e. staggered case), which provides flatter subsidence profiles (i.e. smaller tilts and curvatures) than the modified case, which includes some locations where the Blakefield Seam chain pillars are beneath the Whybrow Seam chain pillars (i.e. stacked case). Whilst the maximum predicted additional tilt and curvatures, based on the modified layout, are greater than those predicted based on the 2003 EIS layout, the predicted parameters are similar to those previously observed as the result of the previous extraction of the longwalls in the overlying Whybrow Seam at the BFS and Beltana No. 1 Underground Mines. Furthermore, the predicted total 20 mm subsidence contour, after the extraction of the proposed BNLW1 to BNLW7, is located well outside the buffer zone to the limit of alluvium.

The predicted subsidence and tilts are likely to be of sufficient magnitude to result in changes in the surface water flows along the drainage lines. The initial surface levels and predicted final surface levels, after the extraction of the longwalls in the Whybrow and Blakefield Seams, along the alignments of Drainage Line 1 and Drainage Line 5 are shown in Figures 5.1 and 5.2, respectively of the Subsidence Assessment (**Appendix 6**). It can be seen from these figures, that increased ponding is predicted to develop directly above the proposed BNLW1 to BNLW7. Increased ponding has already developed along the drainage lines, resulting from the previous extraction of the longwalls in the overlying Whybrow Seam, and the proposed longwalls are expected to increase the depths and lengths of the existing ponding. The maximum predicted additional depth of ponding along Drainage Line 1, resulting from the extraction of the proposed longwalls in the Blakefield Seam only, is around 2.0 metres. The maximum predicted additional depth of ponding along the remaining drainage lines is around 3.0 metres. The maximum predicted total depth of ponding along Drainage Line 1, resulting from the extraction of the longwalls in both the Whybrow and Blakefield Seams, is around 4.0 metres. The maximum predicted total depth of ponding along the remaining drainage lines is around 5.0 metres. Notwithstanding these modelled predictions (which are by nature conservative), the actual observed subsidence along the drainage lines following extraction of the overlying Whybrow seam was between 1.6m and 1.9m. Based on these observations, the likely maximum additional ponding along the drainage lines resulting from the proposed mining in the Blakefield Seam is likely to be between 1.5m and 2.5m (MSEC, 2012).

The drainage lines have shallow incisions into the natural surface soils and, in some locations, have farm dams constructed within their alignments. It is expected, at the magnitudes of predicted curvatures and strains, that significant fracturing and buckling would occur in the uppermost bedrock beneath the natural surface soils along the drainage lines. Surface cracking in the beds of the drainage lines would be visible at the surface where the depths of the surface soils are relatively shallow. The drainage lines are ephemeral and so water typically flows during, and for periods of time after, rain events. In times of heavy rainfall, the majority of the runoff would flow over the beds and would not be diverted into the fractured and dilated strata below. In times of low flow, however, some of the water could be diverted into the fractures and dilated strata below the natural surface soils.

The drainage lines at the BFS and Beltana No. 1 Underground Mines were previously mined beneath by the longwalls in the Whybrow Seam, where the depths of cover varied between 40 metres and 200 metres. Although surface cracking was observed across the mining area, there were no observable surface water flow diversions in the drainage lines, resulting from the extraction of these longwalls, after the remediation of the larger surface cracks had been completed. Accordingly, it is not anticipated that any significant surface water diversions would result from the extraction of the proposed BNLW1 to BNLW7, after the completion of any necessary remediation of surface cracking. With the implementation of the necessary management strategies, it is expected that there would be no long term adverse impacts on the drainage lines within the Project Area.

The farm dams in the Subsidence Area which have been constructed along the alignments of the drainage lines are expected to be impacted by subsidence movements. The maximum predicted subsidence parameters resulting from the extraction of BNLW1-7 based on the modified layout are similar to those previously observed during the previous extraction of the overlying longwalls in the Whybrow seam at the Beltana No. 1 and BFS Underground Mines.

Impacts on Downstream Users

Surface remediation activities would be undertaken periodically during the life of the Project. Such works have the potential to generate short term water quality impacts downstream. Water management measures to minimise potential water quality impacts would continue to be undertaken in accordance with the BCC SWMP and *Sediment and Erosion Control Plan*.

Stormwater drainage systems would be constructed around the compounds of the proposed surface infrastructure. These drainage systems would be designed to drain runoff from the hardstand areas into the minewater drainage system.

Construction of the proposed surface infrastructure and associated surface water runoff has the potential to impact on water quality in Wollombi Brook and Nine Mile Creek. However, implementation of the existing water management and sediment/erosion control systems at the BCC would minimise the potential for the Project to contribute to adverse water quality impacts on these creek systems.

6.11.3 Surface Water Management, Monitoring and Reporting

The BCC *SWMP* and *Sediment and Erosion Control Plan* would be applied to all operations in the Project Area. These management plans include a surface water monitoring program and surface water response plan. The existing BCC surface water monitoring program would be maintained throughout the life of the Project. Nine surface water locations are currently monitored monthly for pH, EC, TSS and depth. Monitoring results would continue to be reported annually in the AEMR.

All drainage lines to be undermined would be monitored as part of the subsidence monitoring program. Remediation of areas subject to ponding, scouring and cracking would be undertaken as required. After the completion of mining, earthworks would be required to establish the natural gradient along the drainage lines. Alternatively, if the additional ponding caused by mining was considered desirable by local farmers, the beds of the drainage lines could be reinforced to prevent scouring, and to provide additional dam walls to those which already exist along the drainage lines.

Construction of the majority of surface infrastructure would predominantly take place on land already disturbed by the BSO and BUO mining activities. Erosion and sediment control in these areas would be managed in accordance with the existing environmental management systems for the BCC. A range of mitigation measures would be implemented throughout the construction period to control surface runoff, erosion and sedimentation from the land disturbance areas. These measures would include:

- Erosion and sediment controls would be incorporated into the final site layout design plans and installed prior to construction commencing;
- All activities within the Project Area would predominantly be contained within existing or previously disturbed areas;
- Ongoing monitoring and maintenance of the erosion and sediment controls would be undertaken; and
- Disturbed areas would be rehabilitated promptly upon completion of construction.

In summary, it is considered that the cumulative impact of surface works associated with the Project would not have significant off site hydrological or water quality effects. During operation of the Project, surface drainage would be adequately managed through implementation and continual improvement of the existing water managements systems.

6.12 Land Use and Capability

6.12.1 Existing Environment

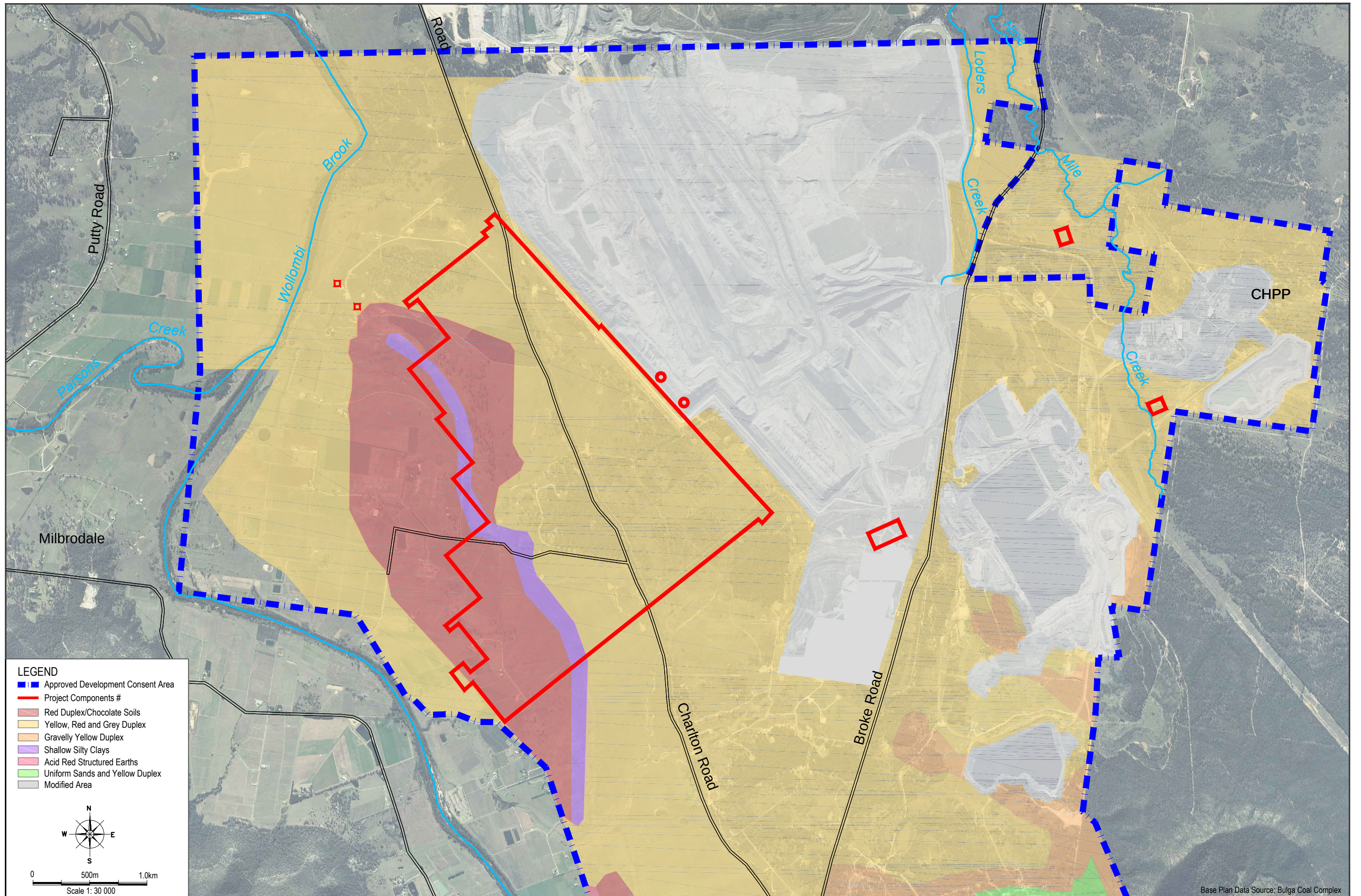
Soils

The 2003 EIS identified two soil landscapes covering the Project Area: Branxton Soil Landscape and Saxonvale Soil Landscape. The Branxton Soil Landscape covers the undulating low hills and rises, and small creek flats developed on the coal measures. It covers the majority of the Project Area. The main soils are Yellow Podzolic Soils on midslopes with Red Podzolic Soils on crests. Yellow Soloths occur on lower slopes and in drainage lines (see **Figure 19**). The Saxonvale Soil Landscape covers the Fordwich Sill ridge area located in the western portion of the Project Area. The main soils in this landscape are Chocolate Soils with minor Brown Soloths on some upper slopes. A description of the soil landscapes present in the area is shown in **Table 36**.

Table 36 – Overview of the Soil Landscapes within Project Area

Soil Landscape	Landform	General Soil Description
Branxton Soil Landscape	Undulating low hills and rises, and small creek flats developed on the coal measures.	Yellow, Red and Grey Duplex Soils <u>Hard Pedal Yellow Duplex Soils:</u> relatively shallow, highly dispersive duplex soils, which overlie sandstone and siltstone on low rises and undulating hills. Hardsetting topsoil which overlies a pedal, clayey subsoil. The pH ranges from 5.0 to 7.5 for the topsoil, with depth ranges from 8 to 25cm. Subsoils are yellowish brown to dull brown, while in areas of impeded drainage, subsoils are typically greyish yellow brown with bright brown mottles. The pH ranges from 7.0 to 9.0 and depth ranges from 48 to 230cm. <u>Hard Pedal Red Duplex Soils:</u> occur on the slopes adjacent to the Fordwich Sill and in the vicinity of the majority of the proposed surface infrastructure. The parent material is sandstone and siltstone. The soil is weakly pedal to massive, hardsetting, brownish black to greyish brown topsoil and dull reddish brown to bright reddish brown, whole coloured subsoil. Topsoil is loam to silty loam with pH ranges from 6.0 to 6.5 and depths from 8 to 10cm. Subsoil is strongly structured medium to heavy clay with a field pH of 5.5 and depth greater than 35cm. <u>Hard Pedal Grey Yellow Duplex Soils:</u> hardsetting brownish black to very dark reddish brown loam topsoil horizon, underlain by a greyish brown sandy loam horizon. Topsoil pH is 5.5 to 6.0 with depth around 20cm. Subsoil is brown to yellowish brown medium-heavy clay to sandy clay with common grey, pale and dark mottles. Subsoil pH is 7.0 to 9.0 with lower depth ranges from 160-310cm.
Saxonvale Soil Landscape	Covers the Fordwich Sill ridge area to the west of Charlton Road.	Red Duplex/Chocolate Soils Derived from in-situ weathered dolerite and basalt parent material. Topsoil (20-30cm) consists of brownish black silty clay loam to clay loam texture which is highly pedal. Topsoil pH ranges between 5.8 and 7.1. Salinity levels are low and fertility is generally high. Surface condition is friable, horizon is moderately well drained and erosion potential is low. Light to medium clay subsoil is dark reddish brown and exhibits moderate to strong structural grade, with an alkaline trend. Erodibility is relatively low. Shallow Silty Clays Occur in a narrow band associated with the Chocolate Soils on the Fordwich Sill. These clays contain rock fragments and have similar properties to the topsoil of the Chocolate Soils, except for lighter texture and shallower depth. Acid Red Structured Earths These earths consist of red and brown silty clays, which are an advanced weathered product of the Fordwich Sill. The occurrence is restricted to the south-western corner of the Project Area.

Source: Kovac and Lawrie, 1991.



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All indicative locations - will be finalised pending constraints

The erodibility of topsoils within the Project Area was assessed by Mitchell McCotter (1992) to be generally moderate, while the erodibility of subsoils was considered to be very high. Therefore prior to any surface disturbance, soil erosion and sedimentation management structures would need to be constructed.

As detailed in the AIS in **Appendix 13**, a soil sampling program was undertaken by GSSE to ground-truth the area mapped as “Strategic Agricultural Land” pursuant to the draft SRLUP (see **Section 4.2.5**). This sampling did not include a detailed assessment of the soil characteristics or attempt to revise the soil mapping present within the Project Area. The sampling program was limited to identifying the land capability and soil fertility.

Land Use

The predominant land uses of the surrounding area include coal mining (including Mt Thorley/Warkworth Mine directly to the north), grazing, military training (Singleton Army Training Area), viticulture and rural residential holdings (refer to **Figure 5**). The majority of the Project Area is currently used for mining and agricultural purposes, including olive groves owned by the BJV. The land uses within the Project Area have been described and quantified in the AIS in **Appendix 13**.

The land within the Subsidence Area has been generally cleared and has been used for light grazing and viticulture. Three privately-owned vineyards would be undermined by longwalls 1, 2 and 3. The mine owned olive grove and general grazing land would be affected by the undermined area. There are a number of farm dams in the Subsidence Area which have been constructed along the alignments of the drainage lines. There are also 5 private properties in the Subsidence Area and 1 private dwelling.

Viticulture and associated tourism are significant industries in the Hunter Valley. The vineyards of the Hunter Valley are primarily located between Broke and Pokolbin to the south and include a variety of accommodation and tourism venues. Many of these are set amongst vineyards which overlook the scenic Broken Back Range, west of Wollombi Brook. The vineyards offer a range of tourist opportunities for visitors, including vineyard tours, dining, wine tasting and sales, overnight accommodation and food and wine festivals. There are, however, no tourism venues within the Project Area.

The nearest residential area is the village of Milbrodale, which is located around two kilometres to the west of the Project Area. Broke Village is around 6 kilometres to the south of the Project Area and Bulga Village is around 3 kilometres to the north west of the Project Area. Within the Project Area, there are a number of private residences that are located close to the proposed gas drainage and other surface infrastructure. These include sensitive environmental receptors 160 (Dwyer), 195 (Kennedy) and 217 (Russell) (see **Figure 16**). At their closest point, some of these residences are located around 300 metres from proposed gas drainage drilling sites.

The nearest urban centre is Singleton, which is approximately 12 kilometres to the north east. There are no public services, including schools or churches, within one kilometre of the Project Area boundary. The nearest hospital is located around 10 kilometres away.

Land Capability

The Project Area consists of underground mining-related disturbance and infrastructure. The land overlying the Subsidence Area has been generally cleared and has been used predominantly for light grazing and viticulture. Three privately-owned vineyards would be undermined by longwalls 1, 2 and 3 and general grazing land would be affected by the remaining longwalls.

The 2003 EIS identified the pre-mining land capability of the land overlying the Project Area as predominately Class IV and V land, as per the classifications of the former NSW Soil Conservation Service (now a division within DTIRIS) (refer to **Figure 20**).

Class IV land comprises the better classes of grazing land, and whilst it can sustain cultivation for an occasional crop, it is not suitable for cultivation on a regular basis owing to limitations of slope and erosion potential. Soil conservation practices such as pasture improvement, stock control, application of fertiliser and minimal cultivation for the establishment or re-establishment of permanent pasture are necessary.

Class V land is suitable for grazing and occasional cultivation. In addition to the soil conservation practices required by Class IV land, this land requires structural soil conservation works such as absorption banks, diversion banks and contour ripping.

The land capability classes that occur within the Project Area are summarised in **Table 37**.

Table 37 – Pre-Mining Land Capability within Project Area

Land Capability	Land Use	Management	Project Area (Approx)		Disturbance Footprint (Approx)	
Class			ha	%	ha	%
IV	Grazing, occasional cultivation	Simple practices such as stock control and fertiliser application.	248.1	35	30.3	4.3
V	Grazing, occasional cultivation	Intensive soil conservation measures required, such as contour ripping and banks.	372.1	52		
VI	Grazing only	Managed to ensure ground cover is maintained.	89.8	13		
Total			710	100	30.3	4.3

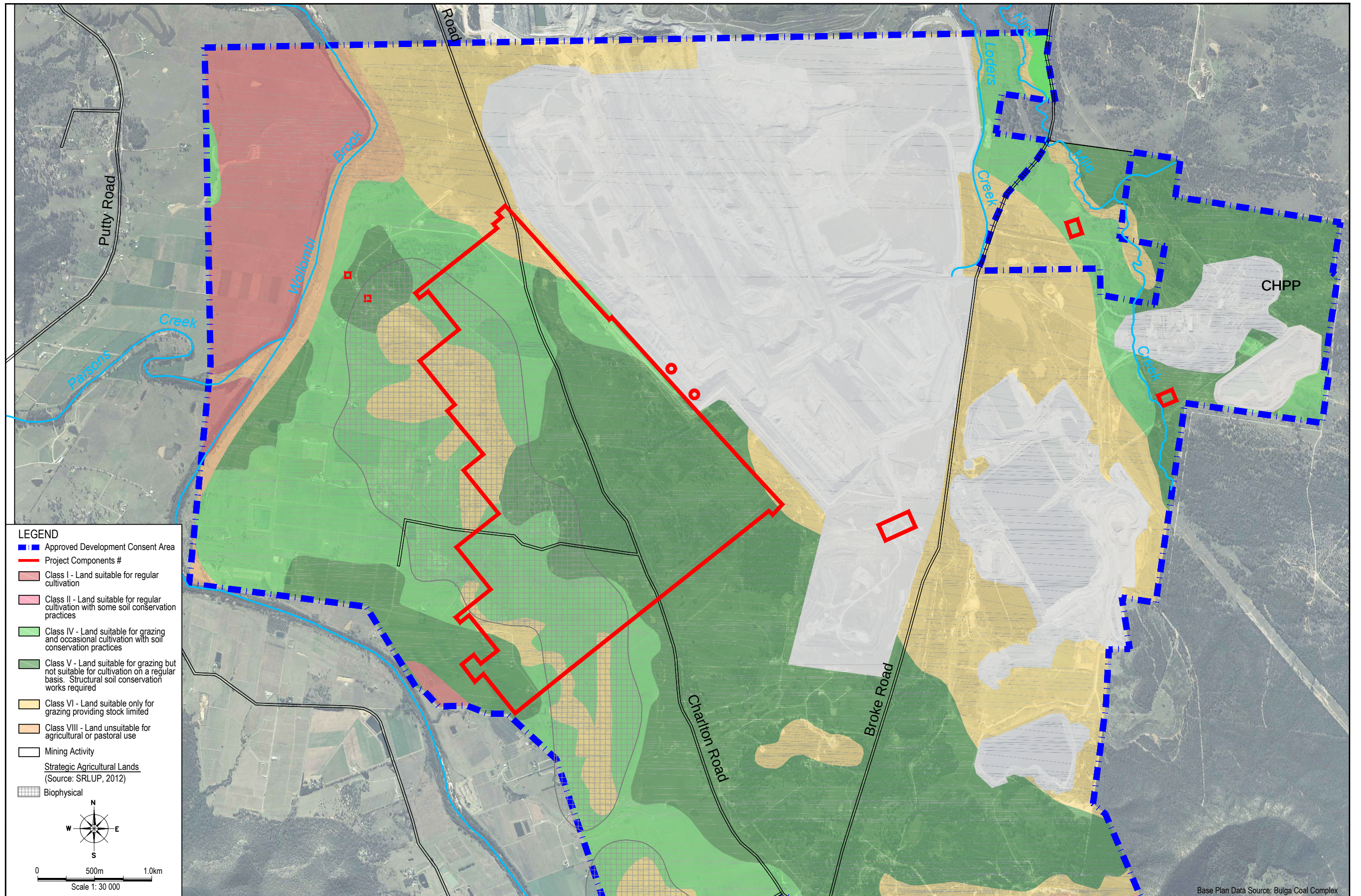
The land capability classification system identifies the majority (87%) of the Project Area as land not capable of being regularly cultivated, but suitable for grazing with occasional cultivation (Class IV & V), and 13% as suitable for grazing only (Class VI). The majority of land likely to be subject to surface works as a result of underground mining is Class V and VI. The major constraints to sustainable land use involving cultivation are soils and topography.

Agricultural Suitability

The 2003 EIS identified the agricultural suitability of the land overlying the Project Area as mapped by NSW Agriculture (now Department of Primary Industries within DTIRIS) using the four agricultural suitability classes (refer to **Figure 20**). The majority of the Project Area comprises Class 3 land, being suitable for grazing and pasture improvement. This land may be cultivated or cropped in rotation with pasture. The overall production level is moderated, with erosion hazard, soil structural breakdown and other factors limiting the capacity for cultivation. There are also small pockets of Class 4 land, being suitable for grazing only.

Table 38 outlines the pre-mining agricultural suitability classes as they apply to the Project Area.

The agricultural suitability classification system identifies approximately 80% of the Project Area as moderately productive land suited to improved pasture and to cropping with pasture rotation (Class 3). Approximately 20% is suitable for grazing based on native pastures (Class 4). There is no Class 1 or 2 land within the Project Area.



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All indicative locations - will be finalised pending constraints

Table 38 – Pre-Mining Agricultural Suitability Classes

Agricultural Suitability Class	Land Use	Management Options	Project Site		Disturbance Footprint	
			ha	%	ha	%
3	Grazing land or land well suited to pasture improvement. It may be cultivated or cropped in rotation with sown pasture.	The overall production level is moderate because of edaphic factors or environmental constraints. Erosion hazard, soil structural breakdown or other factors including climate may limit the capacity for cultivation, and soil conservation or drainage works may be required	574.8	81		
4	Land suitable for grazing but not for cultivation. Agriculture is based on native pastures or improved pastures established using minimum tillage techniques. Production may be seasonally high, but the overall production level is low as a result of major environmental constraints.	The inability for the preparation of a cultivated seedbed on these lands typifies their limitations.	135.2	19	30.3	4.3
Total			710	100	30.3	4.3

Strategic Agricultural Land

The Project Area overlays an area that the SRLUP has mapped as “Strategic Agricultural Land - Biophysical” and an area mapped as a “Viticulture Critical Industry Cluster” with the Broke-Fordwich Geographical Indicator sub-region also specifically nominated (see **Figure 20** and Figure 3 in **Appendix 13**). There is also grazing land within 2 km of the mapped Strategic Agricultural Land (SAL). The Project Area relative to the mapped SAL is summarised in **Table 39**.

As detailed in **Section 4.2.3**, the SRLUP does not apply to the Project (which is a modification of an existing approved development under Part 3A, Section 75W of the EP&A Act and within an existing mining lease area). Notwithstanding, the AIS in **Appendix 13** included an assessment of the impacts of the Project on the mapped SAL.

In total, approximately 421ha of the mapped SAL in the SRLUP would be impacted within the Project Area. This comprises 253ha of the mapped SAL – Biophysical and 421ha of the mapped SAL – Viticulture Cluster (Note: These areas overlap within the Project Area). This represents about 38% of the mapped SAL – Biophysical and 1.9% of the mapped SAL – Viticulture Cluster within the mapped SAL categories in the wider Broke-Fordwich Region (which contains approximately 22,569ha of SAL).

The Project Area would result in the disturbance (temporary removal from agriculture) of a relatively small area of 30.3ha (4.3% of Project Area) and 11.8ha of mapped SAL in the SRLUP. This in turn represents 2.8% of the SAL in the Project Area. In the wider Broke-Fordwich Region (which contains approximately 22 569ha of mapped SAL) the area impacted by disturbance associated with the Project represents 0.05% of mapped SAL.

Table 39 – Strategic Agricultural Land and Project Area

SAL	Mapped SAL (SRLUP)						
	Total Mapped SAL (Broke – Fordwich Locality)	Project Area (of mapped SAL) (Approx.)		Disturbance Footprint (of Project Area mapped SAL) (Approx.)		Disturbance Footprint (of mapped SAL Broke–Fordwich locality) (Approx.)	
		ha	%	ha	%	ha	%
Biophysical[#]	662	253	38	11.8	2.8	11.8	0.05
Viticulture Cluster[#]	22 569	421	1.9				
Sub-Total	22 569	421	1.9				
Project Area Outside of SAL	-	289	-	18.5	-	18.5	-
Total	22 569	710	-	30.3	-	30.3	-

[#]Biophysical SAL and Viticulture Cluster Overlap

Agricultural Enterprises

As detailed in the AIS in **Appendix 13**, the area of difference between the previously approved BFN Underground Mine and the proposed modification is 208ha larger on the land to the SW of the existing open-cut operations. Within the Project Area, an additional (approximate) 15ha of olive groves, 15ha of vineyards and 178ha of grazing land are now subject to under-ground mining compared to that originally approved (see Figure 4b in **Appendix 13**). The value of agriculture (potentially available) from the Project Area is estimated to be up to \$234 000 per year from **Table 40**.

Table 40 – Estimated Agricultural Value within the BCC and Project Area

Agricultural Activity BCC		Area (ha)	Gross Margins Value/ha (\$)	Total BCC Site (\$/yr)	Total Project Area ¹ (\$/yr)
Grazing	Total	4156	\$175 ²	727 300	-
	Project	665		-	116 375
Viticulture	Total	219	\$2 397 ³	524 943	-
	Project	29.4		-	70 472
Olive Production	Total	22.4	\$3 020 ⁴	67 648	-
	Project	15.6		-	47 112
Total Area		4397.4 ha		1 319 891	233 959

¹ = Project Area is from Table 1.

² = NSW DPI Beef Gross Margins 2011. (Assumed yearling production).

³ = NSW DPI, Value of Agricultural Production Data 05/06 and ABS Agricultural Commodities: Small Area Data, Australia, 2005-06 (Reissue).

⁴ = NSW DPI Gross Margins 2005 (Assumed Oil Olives – Non-Organic)

It is estimated that the agricultural potential of the entire BCC site is approximately \$1.32M per year and from Project Area estimated up to \$234 000 per year. These estimates assume that 100% of land within the BCC and/or Project Area is used for agriculture. The actual production value is likely to be less than the potential value as not all land is actively used for agriculture.

The Project Area represents about 17.7% of the potential agricultural value and approximately 16% of the land area of the BCC site. There are four privately owned properties within the Project Area. As detailed in the AIS in **Appendix 13** it is estimated that the potential agricultural production value from private land within the Project Area is approximately \$62 650 per year with the majority of that value stemming from wine grape production. The number of persons employed by these operations has not been quantified, however, as the Project would not impact upon the agricultural production of any private property there is no change expected to the current employment in agriculture.

6.12.2 Potential Impacts

Soils and Erosion

The proposal would result in ongoing disturbance and handling of soils both above the proposed underground mining areas and the areas within and around the proposed surface infrastructure locations. These works have the potential to cause erosion and result in sediment export from disturbance areas if appropriate controls are not implemented. Disturbance activities that pose a risk of accelerating natural erosion processes include vegetation clearance, track construction, plant and pipeline construction.

During the required vegetation clearance activities, the land surface may be disturbed. This mechanical disturbance of the topsoil and underlying subsoil may temporarily reduce the abilities of the soil to resist the dislodgement of particles from raindrop impact and surface water flow during rainfall events, and also more susceptible to wind erosion.

Subsidence would result in changes to the surface profile which may result in some localised impacts such as minor erosion. The remediation of subsidence impacts on drainage lines, public roads and utility infrastructure (refer to **Section 6.2.4**) may also require some soil disturbance. The management measures to be adopted during these works would be incorporated into the Subsidence Management Plan.

Land Use

The potential impacts on existing land uses within and around the Project Area with regard to air quality (**Section 6.3**), noise (**Section 6.5**), visual impacts (**Section 6.8**), traffic (**Section 6.9**) and water (**Sections 6.10 and 6.11**) have been dealt with previously in this EA. These impacts have been found to be acceptable (with mitigation measures) and therefore existing land uses would not be adversely affected by the Project. There are no tourism venues within the Project Area and the necessary subsidence repairs to local roads (particularly Charlton Road) would be progressively conducted over the life of the Project in a manner that minimises disruptions to traffic using these roads. Proposed surface infrastructure would be located predominantly in areas already disturbed by mining activities and appropriate visual screening of infrastructure and activities would occur to ensure the visual quality of the locality is not altered in any significant way.

The Yengo and Wollemi National Parks located on the western side of Wollombi Brook would not be impacted upon as a result of the Project and the environmental setting of the locality would not be altered.

Land Capability and Agriculture

As detailed in the AIS in **Appendix 13**, the Project would result in the disturbance (temporary removal from agriculture) of a relatively small area of 30.3ha (4.3% of the Project Area). This equates to 11.8ha of the mapped SAL in the SRLUP which represents 2.8% of the SAL in the Project Area. In the wider Broke-Fordwich Region (which contains approximately 22 569ha of SAL) the area impacted by disturbance associated with the Project represents 0.05% of mapped SAL.

The AIS has identified that a very small portion of agricultural resource (land and water) in the Broke-Fordwich locality would be affected by the proposed Project. The land affected by the Project Area equals around 710ha. Of this 30.3 ha (4.3%) of the Project Area would be temporarily removed from agriculture for access roads and gas drainage. However, this land would be returned to agricultural production upon completion of mining and rehabilitation as agricultural land capability Class VI.

The agricultural land within the Project Area is estimated to have a potential agricultural production value of up to approximately \$234 000 per year, with approximately \$62 650 per year potentially available from private land, the remainder in mine ownership. However not all land in the Project Area is actively used for agriculture. The Project would not impact upon the agricultural production of any private property and no change to the production value or employment in agriculture would result.

There are 3 privately owned vineyards (25.5ha of total 29.4ha within the Project Area) which would be above the proposed longwalls. These private vineyards would not be directly impacted by mining and viticulture activities would be able to continue. These areas may, however, be subject to subsidence from longwall mining, which is dealt with in **Section 6.2**.

In terms of the direct impacts from the Project, potential impacts may arise from visual/landscape impacts and subsidence. Management and mitigation strategies are proposed which should ensure these potential impacts would not have a long term impact upon the agricultural or tourist related operations in the locality. No impacts are expected to groundwater systems and minor impacts to ephemeral drainage lines in the Project Area may occur due to subsidence. Mitigation and management strategies are proposed if this occurs (see **Section 6.2.4**). Provided the drainage lines are maintained to minimise the potential for erosion and any adverse changes in slope or surface cracking are remediated by earthworks, the land capability and agricultural suitability would be unaffected by mining.

6.12.3 Mitigation Measures

Erosion and sediment control measures would be implemented within disturbed areas associated with the construction of surface infrastructure, as well as areas affected by subsidence, to prevent soil erosion from, and to trap any sediment prior to discharging from the disturbance zones. All erosion and sediment control works would generally be undertaken in accordance with the *Guidelines for Managing Urban Stormwater: Soils and Construction – Volume 2E Mines and Quarries* (the Blue Book) and with the *BCC Sediment and Erosion Control Plan*.

The erosion and sediment control measures would include, but not be limited to the following:

- Regular surface inspections of active subsidence areas and timely rectification of any surface cracking which may have the potential to cause harm to personnel safety, as per the existing mitigation measures outlined in the approved SMP and those recommended in the Subsidence Assessment (refer to **Section 6.2** and **Appendix 6**).
- Establishment of a stable vegetation cover on all disturbed areas as soon as possible following completion of construction.
- Treatment of all disturbed areas with 5-10 tonnes per hectare of gypsum to reduce the dispersibility and improve the structure of the soils and apply lime to those areas identified as slightly acidic.
- Post construction audits to be undertaken by the Environmental and Community Coordinator of rehabilitated areas.

During the construction phase, temporary erosion and sedimentation control measures would be implemented to reduce the likelihood and severity of erosion and sedimentation within and around the

construction sites. These measures may include the use of sediment fences for non-channelised flow over disturbed areas, and sand bags, rip rap etc. or any combination of those materials. Additional measures may include restricted access during wet weather or to areas under rehabilitation, reporting of erosion and sediment hazards or incidents and regular checking and maintenance of structures. Following the commissioning of surface infrastructure, there would be regular inspections of all erosion and sediment control structures.

Three privately-owned vineyards would be undermined by longwalls 1, 2 and 3. The mine owned olive grove and general grazing land would be affected by the remaining undermined area. It is predicted that the subsidence impacts would be similar to those resulting from the previous mining of the Whybrow seam. Notwithstanding, following approval of the Project, the existing private property management plans and monitoring programs that relate to subsidence impacts on these land uses would be updated as necessary, in conjunction with a Subsidence Management Plan for the area. This forms part of the existing monitoring program for vineyards that has been established by the BCC in consultation with vignerons.

Drainage lines would be maintained to minimise the potential for erosion and any adverse changes in slope or surface cracking would be remediated by earthworks (as discussed in **Section 6.2.4**). This would ensure the maintenance of water supply to ensure the land capability would be unaffected by mining.

6.13 Post Mining Land Use and Closure

Progressive rehabilitation of disturbed areas is an important aspect of the mining operations at the BCC. The objective of this rehabilitation is to restore the land to a condition that is equal or greater to that prior to disturbance. Ongoing rehabilitation of areas disturbed by operations continues throughout the life of the mine. Quarterly rehabilitation inspections and an annual rehabilitation inspection are undertaken by GSS throughout the reporting period to monitor the success of rehabilitation works. All rehabilitation works are reported within the overall context of the operations of the BCC. Rehabilitation of the undermined land within the Project Area consists of repairing shallow depth of cover subsidence impacts with the land being returned to pre-mining land capability of Class VI.

Rehabilitation activities at the BCC are completed in accordance with the BUO MOP (2007) and the BCC *Landscape Management Plan*. Where relevant, disturbed land would be returned to a capability consistent to that which existed pre-mining, and commensurate with the surrounding rehabilitated open cut mine spoil emplacement areas. The currently approved BUO MOP sets out rehabilitation planning criteria, as listed below.

- Rehabilitation and the outcomes to be consistent with the 2003 EIS which formed the basis for any approvals;
- Rehabilitation to be based on mine closure criteria and outcomes developed through stakeholder consultation;
- Compliance with the relevant regulatory requirements and that regulatory consensus is attained on the successful closure and rehabilitation of the site;
- Rehabilitated native vegetation to be integrated with undisturbed native vegetation to provide consolidated areas and wildlife corridors where possible;
- The site is rehabilitated to an agreed final land use compatible with the surrounding land fabric and land use requirements;

- The rehabilitation process addresses limitations of land capability that may arise as a consequence of mining;
- The rehabilitation is sustainable in terms of selected final land use;
- The rehabilitated site is to be stable with permanent landforms with soils, hydrology and ecosystems having maintenance needs no greater than those of the surrounding land;
- Waste substances that have the potential to affect land use or result in pollution will be secured and safely contained;
- The rehabilitated site will not present a hazard to persons, stock or native fauna;
- The site will be clean and tidy and any remaining structures (e.g. buildings) will be left in a condition that provides for the safety of the public; and
- Mine closure works are completed as quickly and cost effective as possible whilst providing that the above objectives are achieved.

Decommissioning and removal of the surface infrastructure proposed in the Project would be considered and addressed during the next revision of the BUO MOP and the BCC *Landscape Management Plan*.

6.14 Socio-Economic and Community

The Project is not anticipated to have any adverse impacts upon the social and/or economic fabric of the local area or the wider Hunter Valley, nor have any significant adverse impacts upon existing surrounding land users. As detailed in the VIA in **Appendix 11**, there will be some visual impacts associated with the introduction of new infrastructure into the Project Area (eg. gas drainage wells, overhead power lines, drill rigs, etc). These impacts would need to be mitigated as outlined in **Section 6.8.4**. There would also be some short term adverse construction noise associated with some construction activities, particularly drilling in exposed locations (see **Section 6.5**).

BCM operates under the *Bulga Coal Complex Social Involvement Plan* (SIP), which defines how the BUO will consult with the local community and other stakeholders, and includes donations/contributions the BCC makes each year to the local community (see **Section 5.3**).

Due to the nature of underground mining and surface facilities, and proposed environmental controls, the Project is expected to have a minimal impact on the amenity of the local area, consistent with currently approved operations in the BCC. The mining operation would continue to have a positive socio-economic impact on the local community as it would maintain employment for current BUO mine employees over the life of the Project and provide employment contractors during the construction phase.

The increased construction employment opportunities are not expected to have a significant impact on local infrastructure as staff would be employed locally where possible and it is considered that the existing accommodation facilities within the Singleton LGA would adequately meet demand during the construction phase. In many cases, contractors during the construction phases would be drawn from companies already working on mining projects within the Hunter Valley area.

The State and Federal government could expect economic benefits from the BUO to be maintained including revenue from rail freight, port charges, payroll tax and a number of other taxes, royalties and payments for services from statutory bodies. Local government would also continue to receive financial returns from rates and charges paid by company employees and by other people attracted to

the area as a result of the additional employment in the mining industry and the continuation of mining operations at the BUO.

In accordance with Schedule 4, condition 59 of the consent, BCM would work with the Council to investigate the minimisation of adverse socio-economic effects of a significant reduction in local employment levels and closure of the BUO at the end of its life.

6.15 Waste Management

There would be no new waste streams generated by the Project, and all waste would continue to be managed as per the regulatory requirements of the POEO Act as well as the BCC *Waste Management Plan* (refer to **Section 2.10**).

There would be no change to the approved total coal mined at the BUO and the Project would not require any additional tailings or coarse rejects storage.

As is currently the case, the cuttings from borehole drilling would be removed and disposed of with coal rejects in one of the approved emplacement areas.

7.0 DRAFT STATEMENT OF COMMITMENTS

As previously outlined, a comprehensive set of environmental management plans have been developed by the BUO in accordance with conditions of DA 376-8-2003, mining leases, the EPL and XCN standards. These plans are backed by an environmental monitoring network including meteorological, air quality, water quality, noise and subsidence monitoring. The existing environmental management plans would continue to apply to all operations at BUO, and would be amended, as required, to incorporate the proposed modifications and relevant recommendations of this EA.

Table 41 presents a compilation of the specific actions and initiatives the BUO commits to implement, in addition to those already implemented at the BCC, if the Project is approved. These commitments are designed to effectively monitor, manage and/or mitigate the potential environmental and social impacts of the Project.

For further details, refer to the relevant sub-sections above in **Section 6**.

Table 41 – Draft Statement of Commitments

Action	Timing
Mine Induced Subsidence	
A new SMP will be prepared to address the subsidence impacts relating to the Project. This SMP will be lodged with NSW DTIRIS for approval and will include the mitigation measures outlined in Section 6.2.4 .	Prior to longwall mining.
Any surface rehabilitation works that may be required will be undertaken in consultation with the relevant landowners.	As required
Any surface rehabilitation works that may be required will be undertaken with appropriate erosion and sediment control in accordance with BCC's <i>Sediment and Erosion Control Plan</i> .	As required
Aboriginal and Cultural Heritage	
Suitable barriers or signage will be established around the recorded sites to ensure their protection both during the short term construction phase of development and in the long term use of the area. If impact is unavoidable then an Aboriginal Heritage Impact Permit (that incorporates the Section 90 permit) will be sought from the OEH.	Prior to construction and any disturbance of recorded sites
The existing practices incorporated in the <i>BCC Aboriginal Cultural Heritage Management Plan</i> will continue for the BFN Underground Mine.	As required
GDA Zone 56: 317614E, 6382838N (located along the route of the proposed power line to SIS1 and VW1 gas wells) would be avoided when locating the power poles.	As required
The development and construction zone associated with the power generation plant, associated power lines and ancillary infrastructure will be setback a minimum of 20m from Nine Mile Creek to ensure previously recorded sites are not adversely impacted.	As required
The impact footprint of each component of the proposed works will be clearly defined in the field during construction to avoid inadvertent impact (eg using fencing and signposting).	Prior to construction
All workers during the initial ground disturbance phase of construction will be informed of Aboriginal heritage sites in the vicinity and their legislative protection under the NPW Act. This induction will include instruction not to drive, excavate or store materials anywhere outside of designated areas.	During site inductions
In the unlikely event that human skeletal remains are unearthed during construction, work in the vicinity will cease immediately and the police will be contacted. If the remains are deemed to be an archaeological deposit OEH will be contacted to discuss how to proceed.	As required

Action	Timing
Noise	
The noise generated by gas well drilling works will be limited to a construction noise criterion of LAeq, 15 minute 53 dB during the day period and LAeq, 15 minute 39 dB for the evening and night periods.	During gas drilling works
Drilling of vertical gas well holes will be restricted to the day period (07:00 to 18:00).	During gas drilling works
Acoustic barriers of height 4.2m will be installed to the three most exposed sides of all gas drilling sites.	During gas drilling works
An electric drill rig will be utilised for the drilling of the SIS drill hole located adjacent to Wollombi Brook.	During gas drilling works
All equipment will be inspected and maintained on a regular basis to ensure noise attenuation components are in good working order.	Ongoing
Noise sources on drill sites will be placed as close as practically possible to acoustic barriers.	During gas drilling works
Community consultation will be undertaken prior to commencement of drilling works at exposed locations.	As required.
A network of off-site continuous noise monitors will be utilised to identify any increased noise levels, and operations will be modified as required to restrict noise emissions to compliance levels.	On-going.
Operations may be modified in the event of adverse weather conditions that cause an unacceptable increase in off-site noise levels.	As required.
Air Quality (Construction Phase)	
A water cart will be used on all trafficable areas as required when conditions are excessively windy and dusty.	As required
Potentially dust generating activities will cease during periods of high wind.	As required
Surfaces will be dampened via the use of a water truck prior to grading/scraping.	Prior to construction
All areas exposed for construction will be rehabilitated as soon as possible upon completion of works.	Immediately following construction
Soil and Water Management	
Appropriate erosion and sediment controls will be implemented during the construction phase and prior to re-vegetation establishment during the operation phase. Measures will include – - Land disturbance will be minimised by clearing the smallest practical area of land ahead of construction and earthmoving activities, whilst also ensuring that the land is disturbed for the shortest possible time. - All significant upslope clean water runoff will be diverted around the disturbance areas where required via stable diversion banks. - Temporary sediment fencing will be constructed on the downstream side of all disturbance areas to treat sediment-laden runoff. - Sediment-laden runoff may be directed into a small sediment dam/sump for treatment prior to discharge into the downstream waterways if the sediment fence is deemed inadequate. Sediment dams will be designed in accordance with the guidelines laid out in <i>Guidelines for Managing Urban Stormwater: Soils and Construction – Volume 2E Mines and Quarries</i> (the Blue Book). - All disturbed areas will be re-vegetated with a suitable pasture cover crop as soon as practically possible after construction and operation is complete.	Prior to and during construction, with on-going maintenance

Action	Timing
Where there are changes to the surface profile as a result of subsidence related impacts, temporary erosion control measures will be constructed and maintained until surface impacts are remediated. Temporary erosion and sediment control features will be designed in accordance with the Blue Book, and in accordance with the approved SMP.	As required
Ecology	
Woodland areas and trees will be avoided wherever practicable during the positioning of gas drainage wells and access tracks (to service gas drainage wells) along the longwall panels. Where scattered trees occur in grassland areas, infrastructure and access tracks would (where possible) be positioned away from trees to avoid impacts on tree and tree hollow dependent fauna species.	As required
The clearing of vegetation will be undertaken in accordance with the BCC <i>Flora and Fauna Management Plan</i> .	As required
A biodiversity offset strategy will be developed in consultation with NSW OEH to offset the impacts associated with the removal of up to 5ha of Central Hunter Box – Ironbark Woodland (EEC).	Prior to clearing of Central Hunter Box – Ironbark Woodland (EEC)
Runoff/sedimentation from the proposed surface impact areas will be managed during both the construction and operation phases in accordance with the BCC <i>Sediment and Erosion Control Plan</i> .	On-going
Weed control protocols will be implemented in accordance with the BCC <i>Weed and Pest Management Plan</i> . All weeds from areas cleared during construction will be completely removed from the construction zone and not allowed to enter adjacent habitat.	Prior to and during construction
Surface cracks caused by subsidence will be monitored and repaired according to an approved Subsidence Management Plan.	As required
Ponding that occurs following subsidence will be managed according to an approved Subsidence Management Plan.	As required
Soils and Land Capability	
Erosion and sediment control measures will be implemented within disturbed areas associated with the construction of the surface infrastructure, as well as areas affected by subsidence, to prevent soil erosion from, and to trap any sediment prior to discharging from the site. All erosion and sediment control works will generally be undertaken in accordance with the Blue Book and the BCC <i>Sediment and Erosion Control Plan</i> . Measures will include: - Regular surface inspections of active subsidence areas and timely rectification of any surface cracking which may have the potential to cause harm to personnel safety. - All disturbed area will be sown with a pasture seed mix as soon as possible following completion of construction.	Prior to construction and during operation
Post construction audit will be undertaken by the Environmental and Community Coordinator of rehabilitated areas.	Post Construction
Regular inspections of all erosion and sediment control structures will take place by the Environmental and Community Coordinator.	Post construction and throughout operation
Visual	
The existing roadside planting will be augmented along the eastern side of Broke Road for a distance of 500m south of where Broke Road crosses Nine Mile Creek. This planting will comprise locally occurring native species of trees and tall shrubs. Where the easement occurs, plant heights will be kept to statutory limits to allow for clearances and maintenance access.	Post construction should the BOP not proceed.
The existing roadside planting (along the western side of Broke Road) will be augmented along a 600m stretch (refer to Figure 4.2.6 of the VIS). This planting will comprise locally occurring native species of trees and tall shrubs.	Post construction should the BOP not proceed.

Action	Timing
Current methods of screening used at BUO will be implemented for the SIS wells and drill pads, including use of green colorbond screening and fast growing screen planting such as Acacias. Where possible, SIS wells will be sited using existing vegetation and landforms to screen wells and associated works.	During and post construction.
All disturbed ground arising from powerline installation, will be made good following construction.	Post construction.
Measures to minimise the visual impact of the gas drainage wells will include: • Preference will be given, where possible, to locating gas drainage wells, powerlines and access roads in areas of low visual effect followed by medium then high visual effect. • The siting of roads will seek to use existing landforms to provide screening when viewed from community areas. • Natural screens (e.g. remnant native vegetation and existing landforms) will be considered when locating wells, powerlines and roads aiming to minimise views for those people travelling along Charlton Road. • The construction times of wells will be kept to a minimum seeking to improve current procedures where possible. • The use of screens to hide equipment and provide fencing will be continued, especially close to Charlton Road. • Where wells only require low screens, the use of mounding and other landforms to conceal the wells will be considered in preference to fencing/physical screening. • Screen planting along Charlton Road will be undertaken with the use of Acacias and other fast growing native plants common to the area.	During and post construction.
Traffic	
A Construction Traffic Management Plan will be prepared and implemented prior to construction to minimise impacts on the intersection of Broke Road and the Golden Highway.	During construction of surface infrastructure
Post Mining Land Use and Closure	
Where relevant, disturbed land will be returned to a capability consistent to that which existed pre-mining, and commensurate with the surrounding rehabilitated open cut mine spoil emplacement areas.	As required

8.0 JUSTIFICATION AND CONCLUSION

8.1 Project Justification

Since 1990 there has been a 78.2% increase in direct GHG emission from mining developments across Australia. Increased activity in the mining sector between 2000 and 2010 has resulted in a 26.9% increase in direct emissions during this time. Of the 57Mt CO₂-e direct emissions attributed to the mining industry in 2009, 53% was attributed to coal mining (Australian Government Department of Climate Change and Energy Efficiency, 2009).

One of the largest contributors to GHG emissions in the mining industry is the release of methane from the coal seams during mining. Based on the amount of warming it causes (Global Warming Potential (GWP) of 21) and the levels in the atmosphere, methane is considered the second worst GHG after carbon dioxide (BOM & CSIRO, 2009). Although carbon dioxide has a slower warming potential (GWP = 1), the volume of carbon dioxide ranks it higher than methane.

The deeper coal seams being mined at the BUO are known to contain substantial methane gas levels. In order to provide a safe working environment within the underground workings, it is necessary to drain the methane from the area to be mined. Currently this is achieved through a combination of pre and post mining drainage techniques, with the drained methane flared or vented to atmosphere.

In keeping with community and government expectation, BUO has been investigating the opportunities to reduce the GHG emissions of the operations. Beneficial use of the captured methane for power generation, with some flaring to carbon dioxide, provide significant GHG emission reduction opportunities.

The Project aims to capture and flare (or beneficially use) most of the additional methane emitted from the mine workings. The proposed operation of the flares and power station onsite would result in a reduction of GHG emissions through the destruction of methane, as opposed to the approved venting to the atmosphere. The use of the proposed flares and power station would have the potential to generate an approximate 78% reduction in the approved GHG emissions for the Project. The power station would generate surplus electricity that would be fed back into the grid, resulting in a net reduction in potential GHG emissions over the life of the Project.

There is expected to be minimal environmental degradation resulting from the Project. Continued monitoring would provide evidence to show that existing environmental criteria can be reached and that environmental impacts associated with the activities are minimised.

There would be no significant change to the character or nature of the operation at BUO in relation to the Project. The relocated ventilation surface infrastructure would be similar in configuration to existing and approved operations. The additional gas drainage infrastructure proposed is similar to that already implemented at the current BFS operations and would allow for the safe progression of mining in BFN.

The proposal would use the same longwall mining methods, type of equipment and infrastructure already in use by BUO. There would be no change to the approved total coal mined at the BUO. No changes are proposed to the CHPP, coal handling techniques, approved operating hours, or mining methods currently in use at the mine. As outlined in **Section 3**, no extension or reduction to the life of the current development consent is proposed and no additional tailings or coarse rejects storage would be required.

Potential environmental impacts have been predicted by detailed technical investigations. Recognised specialists in each relevant technical field have been selected to undertake these

investigations. Predictions have also been assisted by monitoring data collected at BCC, as well as data available from surrounding mining operations. The technical studies conclude that adverse environmental impacts would be either negligible or minimal when compared with the approved operation. BCC's history of data collection analysis and interpretation, as well as the availability of data from surrounding mining operations, has increased certainty in prediction of future impacts.

The existing BCC environmental management plans and procedures, including the Xstrata Coal Sustainable Development Standards (which successfully manage impacts on the current mine site), would be implemented for the Project. These management procedures are updated regularly.

8.2 Ecologically Sustainable Development (ESD)

8.2.1 Overview

Prior to any development taking place in NSW, a formal assessment is required to be made of the proposed development to ensure it addresses the relevant planning controls and, according to its nature and scale, confirm that it is environmentally, socially and economically sustainable. The EP&A Act provides the framework for the assessment of development proposals and allows for community participation in the decision making process that would determine future land uses.

The objects of the EP&A Act are set out in Section 5 as follows:

(a) to encourage:

(i) the proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment,

(ii) the promotion and co-ordination of the orderly and economic use and development of land,

(iii) the protection, provision and co-ordination of communication and utility services,

(iv) the provision of land for public purposes,

(v) the provision and co-ordination of community services and facilities, and

(vi) the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats, and

(vii) ecologically sustainable development, and

(viii) the provision and maintenance of affordable housing, and

(b) to promote the sharing of the responsibility for environmental planning between the different levels of government in the State, and

(c) to provide increased opportunity for public involvement and participation in environmental planning and assessment.

The Project, including the environmental management procedures and mitigation measures outlined in this EA, is considered to meet the relevant objectives of the EP&A Act. In particular:

- The Project has been designed to minimise the GHG emissions associated with the proposed BFN Underground Mine;
- The beneficial re-use of the drained gas to generate power supports the principles of ESD; and
- Siting of the Project components has been designed to minimise the impacts on the environment.

As stated above ESD is an objective of the EP&A Act and is defined under Section 6(2) of the *Protection of the Environment Administration Act 1991* as -

(2) For the purposes of subsection (1) (a), ecologically sustainable development requires the effective integration of economic and environmental considerations in decision-making processes. Ecologically sustainable development can be achieved through the implementation of the following principles and programs:

(a) the precautionary principle—namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

In the application of the precautionary principle, public and private decisions should be guided by:

(i) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and

(ii) an assessment of the risk-weighted consequences of various options,

(b) inter-generational equity—namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations,

(c) conservation of biological diversity and ecological integrity—namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration,

(d) improved valuation, pricing and incentive mechanisms—namely, that environmental factors should be included in the valuation of assets and services, such as:

(i) polluter pays—that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,

(ii) the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste,

(iii) environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.

The overall objectives of ESD are to use, conserve and enhance our natural resources. This ensures that ecological processes are maintained facilitating improved quality of the environment, now and into the future.

In order to provide sound management of the underground mining operations, BUO understand that social, economic and ecological objectives are independent. BUO also acknowledges that a well designed and run operation would avoid irreversible or costly environmental degradation through polluting activities. The Environmental Management Plans in place at BUO are designed to demonstrate environmental due diligence and to implement procedures that provide ongoing monitoring and maintenance of the operation in line with the objectives of ESD.

8.2.2 The Precautionary Principle

The precautionary principle requires that, in the absence of any other scientific information, caution should be applied when developing projects to consider environmental and social impacts.

The Project has been extensively explored and modelled for impacts related to:

- Subsidence;
- Greenhouse gas emissions;
- Air quality;
- Noise;
- Aboriginal heritage;
- Visual amenity;
- Land use and agriculture;
- Traffic; and
- Flora and fauna.

In addition, other aspects such as groundwater, surface water, waste products, socio-economic impacts, soils and land capability have also been considered.

These studies, combined with stakeholder consultation and input, have enabled BCC to understand the impacts of its operations on environmental and social factors, and therefore identify existing management controls and/or develop appropriate management and mitigation strategies to address these factors.

8.2.3 Social Equity, Inter-Generational Equity

Social equity requires that the needs of future generations are considered with respect to any activity. In regard to this, the Project and activities associated with it would not create any significant permanent impact on the natural and human environments outside of existing conditions.

As detailed in **Section 6**, the Project can be undertaken without having a significant impact on the local environment or the community. The environmental management measures discussed in **Sections 2.8** and **6** have been developed to minimise the impact of the Project on the environment and community to the greatest extent reasonably possible.

BCC undertakes ongoing monitoring with mitigation measures to provide for effective environmental management. This management is provided through planning, communications, documentation, review and feedback. These environmental management measures ensure that the health, diversity and productivity of the environment are maintained or enhanced for future generations.

8.2.4 Conservation of Biological Diversity

All environmental components, ecosystems and habitat values potentially affected by the Project are described in this EA. Potential impacts are also outlined and measures to ameliorate any negative impact are outlined in the statement of commitments (refer to **Section 7**).

The Project would not result in any significant loss of vegetation. Notwithstanding, due to the removal of up to 5 hectares of Central Hunter Box – Ironbark Woodland (EEC), a biodiversity offset strategy would be developed in consultation with the NSW OEH to offset this impact. The surface infrastructure to be installed to allow for safe longwall mining, adequate ventilation, gas drainage and power generation would predominantly be installed in areas previously disturbed by either mining or farming activities. Through a strategic mine closure planning process and by undertaking progressive rehabilitation where possible within the mining lease, all disturbed areas would be rehabilitated following cessation of mining.

8.2.5 Improved Valuation and Pricing of Environmental Resources

The principle of improved valuation and pricing refers to the need to determine proper values of services provided by the natural environment. The objective is to apply economic terms and values to the elements of the natural environment. This is a difficult task largely due to the intangible comparisons that need to be drawn in order to apply the values.

The Project optimises the valuation and pricing of the coal resources with minimal impact by:

- Providing opportunities for beneficial reuse of waste gas; and
- Minimising the amount of methane emitted to the atmosphere, thereby reducing the carbon footprint.

Given the Project is for a modification of the approved underground longwall layout and the installation of supporting infrastructure (including gas drainage and a small scale power plant) on predominantly previously disturbed land, there would be minimal disturbance of surface areas, and as such, would not significantly alter environmental resources.

If the coal in the Project area is not recovered by BCC as part of its existing operation, the likelihood of the resource being extracted in the future is considered very low due to the high costs associated with establishing a new mining operation. By recovering the coal now as part of the current approval, it allows for operational efficiencies to be realised that would otherwise make the proposition uneconomical.

BCC has a rehabilitation plan to revegetate exposed surfaces where applicable.

8.3 Conclusion

BCM, on behalf of the BUO, seeks to modify Development Consent No. DA 376-8-2003 under Section 75W of Part 3A of the EP&A Act. The Project relates to the approved but not commenced BFN Underground Mine. The Project includes the realignment of the approved longwall layout, increased gas drainage infrastructure, relocation of mine ventilation fans, changed coal clearance for development coal, the addition of a small scale power plant (up to 32 MW) and associated surface infrastructure.

The technical studies conclude that adverse environmental impacts would be either negligible or very minimal, with limited environmental consequences beyond those already approved. The Project Area therefore requires few new environmental controls and existing environmental management strategies would be applied to the Project.

The Project would capture and treat (or beneficially use) most of the additional methane emitted from the mine workings. The proposed operation of the flares and power station onsite would result in a reduction of GHG emissions through the destruction of methane and production of power from a waste product. The use of the proposed flares and power station would have the potential to generate an approximate 78% reduction in the approved GHG emissions for the proposal. The power station would generate surplus electricity that would be fed back into the grid, resulting in a net reduction in potential GHG emissions.

Assessment using the EPBC Act assessment criteria found that the proposal was unlikely to have a significant impact on any threatened ecological communities, threatened flora, threatened fauna or migratory species and therefore would not be referred to DSEWPC. Due to the removal of up to 5 hectares of Central Hunter Box – Ironbark Woodland (EEC), a biodiversity offset strategy would be developed in consultation with the NSW OEH to offset this impact.

The timing of the Project would be in accordance with approved Life of Mine planning. The Project would use the same longwall mining methods, type of equipment and infrastructure already in use by BUO. No changes are proposed to the pit top workshop areas, the CHPP, coal handling techniques, approved operating hours, or mining methods currently in use at the mine. No extension or reduction to the life of the current development consent is proposed and there would be no change to the approved total coal mined at the BUO. The Project would not require any additional tailings or coarse rejects storage.

Given the minor alterations to the mining operations mentioned above, a modification of development consent pursuant to Section 75W of the EP&A Act is appropriate as it will have limited environmental consequences beyond those originally approved in DA 376-8-2003.

The Project is considered to be consistent with relevant objectives of the EP&A Act, including the principles of Ecologically Sustainable Development. The Project would not change the nature of the development originally approved. On considering the balance of environment and community impacts, it is considered reasonable to conclude that the benefits of the Project outweigh the impacts.

9.0 ABBREVIATIONS

AADT	Annual Average Daily Traffic
ACHCRS	Aboriginal Cultural Heritage Consultation Requirements
ACHMP	Aboriginal Cultural Heritage Management Plan
AEMR	Annual Environmental Management Report
AHIP	Aboriginal Heritage Impact Permit
AIP	Aquifer Interference Policy
AIS	Agricultural Impact Statement
AUL	Auxiliary Left Turn
AUR	Auxiliary Right Turn
BBRA	Broad Brush Risk Assessment
BCC	Bulga Coal Complex
BCM	Bulga Coal Management
BFN	Blakefield North
BFS	Blakefield South
BJV	Bulga Joint Venture
BOP	Bulga Optimisation Project
BSO	Bulga Surface Operations
BUO	Bulga Underground Operations
CCC	Community Consultative Committee
CHPP	Coal Handling And Preparation Plant
CHR	Channelized Right Turn
DA	Development Application
DCCEE	Department Of Climate Change And Energy Efficiency
DECCW	Department Of Climate Change And Water
DII	Department Of Industry And Investment
DP	Deposited Plan
DP&I	Department Of Planning And Infrastructure

DSEWPC	Department Of Sustainability, Environment, Water, Population And Communities
DTIRIS	Department Of Trade And Investment, Regional Infrastructure And Services
EA	Environmental Assessment
EC	Electrical Conductivity
EEC	Endangered Ecological Community
EIS	Environmental Impact Statement
EL	Exploration Licence
EPBC Act	Environmental Protection And Biodiversity Conservation Act 1999
EPL	Environmental Protection Licence
ESD	Ecologically Sustainable Development
GEU	Goaf Extraction Units
GHG	Greenhouse Gas
GIS	Geographic Information System
GSSE	GSS Environmental
GWP	Global Warming Potential
HDPE	High Density Polyethylene
HRSTS	Hunter River Salinity Trading Scheme
HVAS	High Volume Air Samplers
INP	Industrial Noise Policy
KM	Kilometre
LEP	Local Environment Plan
LFN	Low Frequency Noise
LGA	Local Government Area
LOM	Life Of Mine
LOS	Levels Of Service
ML	Mining Lease
MOP	Mining Operations Plan
MSB	Mine Subsidence Board

MSDS	Material Safety Data Sheet
MT	Million Tonnes
MTPA	Million Tonnes Per Annum
MTW	Mount Thorley Warkworth
MW	Megawatts
NATA	National Association Of Testing Authorities
NES	National Environmental Significance
NGA	National Greenhouse Accounts
NOW	NSW Office Of Water
NSW	New South Wales
OEH	NSW Office Of Environment And Heritage
PAD	Potential Archaeological Deposit
PEA	Preliminary Environmental Assessment
PID	Private Irrigation Distribution
PM ₁₀	Particulate Matter Less Than Ten Microns In Diameter
POEO	Protection Of The Environment Operations Act 1999
RAP	Registered Aboriginal Parties
RMS	NSW Roads And Maritime Services
ROM	Run Of Mine
SAL	Strategic Agricultural Land
SEPP	State Environmental Planning Policy
SIP	Social Involvement Plan
SIS	Surface-To-Inseam
SMP	Subsidence Management Plan
SPCC	State Pollution Control Commission
SRLUP	Upper Hunter Strategic Regional Land Use Plan 2012
SWMP	Site Water Management Plan
TEC	Threatened Ecological Communities

TPH	Tonnes Per Hour
TSC Act	Threatened Species Conservation Act 1995
TSP	Total Suspended Particulate
TSS	Total Suspended Solids
VAM	Ventilation Air Methane
VIA	Visual Impact Assessment

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