

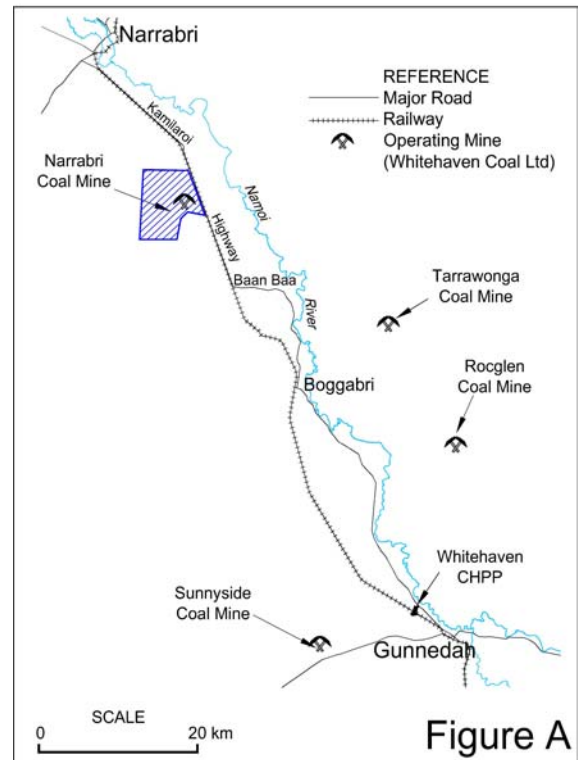
Executive Summary

INTRODUCTION

This *Environmental Assessment* has been prepared by R.W. Corkery & Co. Pty. Limited to accompany an application for project approval by Narrabri Coal Operations Pty Ltd (“the Proponent”) to increase production at its Narrabri Coal Mine (“Stage 1”) through the introduction of longwall mining (the “Longwall Project”). The Longwall Project would require some additions and alterations to surface infrastructure, however, all surface and underground operations would remain within the boundary of Mining Lease (ML) 1609, which is referred to as the “Mine Site” throughout this document.

As illustrated in **Figure A**, the Mine Site is located on the western side of the Kamilaroi Highway, approximately 30km south-southeast of Narrabri and 10km north-northwest of Baan Baa. The Mine Site covers an area of approximately 5 210ha, the majority of which is located on freehold agricultural land. A small section of the Mine Site is located within the Pilliga East and Jacks Creek State Forests. Within the Mine Site, the Proponent has purchased 3 825ha of land within which all direct surface disturbing activities would be undertaken.

The Longwall Project is classified as a Major Project in accordance with the *State Environmental Planning Policy (Major Development) 2005* and, consequently, the Minister for Planning is the approval authority. As a Major Project, it will be assessed under Part 3A of the *Environmental Planning and Assessment Act 1979* and an *Environmental Assessment* is required to be submitted to support the application for project approval.



The *Environmental Assessment* provides information covering all proposed activities of the Longwall Project, together with the approved Stage 1 activities, as the Narrabri Coal Mine is planned to be operated as a single coordinated project in accordance with a consolidated project approval. This document would provide the basis for a project approval for the operational life of the Narrabri Coal Mine.

This summary presents an overview of the Longwall Project, its design and operational safeguards and the predicted associated impacts on the surrounding environment.

THE PROPONENT

The Proponent for the Narrabri Coal Mine – Stage 2 Longwall Project is Narrabri Coal Operations Pty Ltd, a joint venture between Narrabri Coal Pty Ltd (77.5%), Upper Horn Investments (Australia) Pty Ltd (7.5%),



J-Power (7.5%), Daewoo (5%) and Kores (2.5%). Narrabri Coal Pty Ltd is a 100% subsidiary company of Whitehaven Coal Limited (WCL), a publicly listed Company with several mining interests in the Gunnedah-Narrabri region of NSW.

The directors of Narrabri Coal Operations Pty Ltd have considerable coal mining experience in the Gunnedah Basin, particularly since 1999 when WCL became actively involved in coal mining. WCL currently owns the Canyon Mine (recently closed) and Rocglen Coal Mine (north of Gunnedah), the Whitehaven Coal Handling and Preparation Plant at Gunnedah and the former Gunnedah Colliery. Through subsidiary companies, WCL also operates the Sunnyside Coal Mine (west of Gunnedah) and Werris Creek Coal Mine (south of Werris Creek). As part of a joint venture with Idemitsu Boggabri Coal Pty Ltd, WCL also operates the Tarrawonga Coal Mine (east of Boggabri).

The Longwall Project forms an integral part of WCL's strategy to supply export markets with low ash, high energy coal from the Gunnedah Basin.

PLANNING CONTEXT

The Longwall Project would be developed and operated in accordance with a number of State and regional planning instruments, namely:

- State Environmental Planning Policy (Major Development) 2005.
- State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007
- State Environmental Planning Policies 33 and 44; and
- Orana Regional Environmental Plan (REP) No. 1 – Siding Spring.

The Longwall Project is a permissible land use on the Mine Site under the *Narrabri Local Environmental Plan 1992*.

PROGRESSION FROM STAGE 1 TO THE LONGWALL PROJECT

Project Approval (PA) 05_0102 for the Narrabri Coal Mine (Stage 1) was granted by the Minister for Planning on 13 November 2007 and permits the mining and rail transportation of up to 2.5 million tonnes per year of run-of-mine (ROM) coal for a period of 21 years. Following the receipt of PA 05_0102, ML 1609 was issued in January 2008 and site works on the Pit Top Area commenced in April 2008.

Since commencing Stage 1, continued geological exploration and a range of related technical studies have been completed to evaluate the feasibility of converting the Stage 1 continuous miner operation to a longwall mining operation. The Proponent's intent to pursue this evaluation was outlined in the *Environmental Assessment* for Stage 1 where it was noted that the required studies would be completed over a period of 2 to 3 years.

The accelerated progression of Stage 2 has been proposed as the required technical studies (in the fields of ground stability, gas drainage and ventilation, spontaneous combustion potential, subsidence and hydrogeology) have all been completed well in advance of the schedule identified in the Stage 1 *Environmental Assessment*. This is largely attributable to the delayed commencement of Stage 1 (initial application for project approval was lodged in November 2005 and an initial *Environmental Assessment* submitted in July 2006), allowing many of these studies to be initiated prior to the commencement of Stage 1 in April 2008.

Based on the completion of these studies, the Proponent has obtained a sufficient level of confidence in the local geology, ground stability, gas content, spontaneous combustion potential, and subsidence potential to enable the completion of mine planning for the proposed Longwall Project.



Also contributing to the accelerated progression to the Longwall Project is the fact that hydrogeological detail that was to be obtained following the commencement of Stage 1, and originally considered to be essential in the design of the longwall mining operation, is now thought to be of only limited value (as it would only provide information on hydrogeological conditions and in-flows under conditions where no significant subsidence occurs). In light of this, and the fact that the groundwater model for the mine has been substantially upgraded and calibrated against considerably more local groundwater monitoring and hydraulic testing data, it is considered unnecessary to wait until 2 years of data from Stage 1 mine in-flows is available to initiate the design of the longwall mining operation.

MINE PLANNING CONSIDERATIONS

At the outset, it was recognised the coal resource within the Mine Site may be suitable for extraction by longwall mining methods, however, given the absence of any local experience with longwall mining operations, the Proponent favoured a staged approach by first commencing with a continuous miner operation to ensure a safe and economic mining venture eventuated. Mine planning needed to consider economic, geological, geotechnical and environmental issues, all of which contribute to a successful mine design.

Economic Considerations

Although the Mine Site is approximately 380km from Port Newcastle and the cost of rail freight would be significantly higher than that from mines in the Hunter Valley, a number of economic considerations offset this disadvantage.

- The low ash and low sulphur quality of in-situ coal would maximise the yield and ensures that there would be a ready market for the coal.

- ML 1609 is located in close proximity to the North Western Branch Railway Line with a connecting rail loop already constructed.
- The Proponent has an existing rail allocation on the appropriate rail lines, ensuring that the coal produced is able to be transported to Port Newcastle for export.

Geological Considerations

Geological exploration results have identified that the coal resource included a sufficiently large area which appeared to be free of major structural disturbance and accordingly these areas would support a high production longwall mining operation. The longwall panels have been defined to correspond with areas where the coal seam thickness is at least 4m or greater.

The geological data enabled the definition of the eastern-most and shallowest section of the Hoskissons Coal Seam. This data then assisted with defining the location of the Pit Bottom Area and longwall panels.

Geotechnical Considerations

A range of geotechnical studies were conducted to assist in the design and planning of the Longwall Project. The critical geotechnical parameter influencing the design and development of the longwall mining operations, as opposed to the approved Stage 1 continuous miner operations, was the predicted subsidence and possible impacts of this subsidence both underground and at the surface.

Environmental Considerations

The primary environmental considerations focussed on the additional surface disturbance that would result from the proposed longwall mining operation, subsidence-related impacts at the surface and potential impacts on local ground and surface water resources. The following subsections provide a summary of the main environmental issues considered in the design of the Longwall Project.



Ecology: In order to install the proposed ventilation and gas drainage system for the Longwall Project, access roads, power lines and drill sites would be constructed. The Proponent has committed to locating these activities in a manner that would minimise disturbance to the remnant vegetation and undertaking regular reassessment of the ecological value of the areas to be disturbed and proposed management practices to minimise any impacts.

Aboriginal Heritage: Field surveys conducted over the Mine Site have identified that many low density artefact scatters are present, generally in close proximity to ephemeral water courses that traverse the Mine Site. Following close consultation with the representatives of the local Aboriginal community, the Proponent has prepared a draft Statement of Commitments in relation to managing the Aboriginal cultural heritage on the Mine Site. This would involve avoiding those sites deemed to be of greatest cultural and/or scientific significance and preferentially avoiding all other sites. If, however, it is not practicable to avoid Aboriginal sites, all archaeological material would be salvaged and transferred to an appropriate ‘keeping place’.

Water Resources: Beyond the initial years of the longwall mining, the quantity of groundwater likely to flow into the underground workings is likely to be greater than that required for operational requirements and, due to its saline nature, would require storage and segregation from natural surface water drainage on the Mine Site. The Proponent has therefore incorporated a Water Conditioning Plant and additional ponds to store brine by-product generated by the water conditioning process.

The Proponent has also developed (in consultation with a specialist hydrological consultant) a strategy for dewatering the underground mine, treating the saline groundwater and storing and disposing of the fresh water product and concentrated brine by-product of the water conditioning process.

Noise: Monitoring of the Stage 1 construction noise levels identified that inversion conditions during winter mornings may be much stronger than were originally anticipated as part of the Stage 1 assessment. These inversion conditions have resulted in elevated noise levels being experienced at some residences surrounding the Pit Top Area. These local conditions have been incorporated into a revised noise modelling study for the Longwall Project with some restrictions proposed on construction activities within the Pit Top Area to enable compliance with noise criteria nominated in accordance with the Industrial Noise Policy (INP).

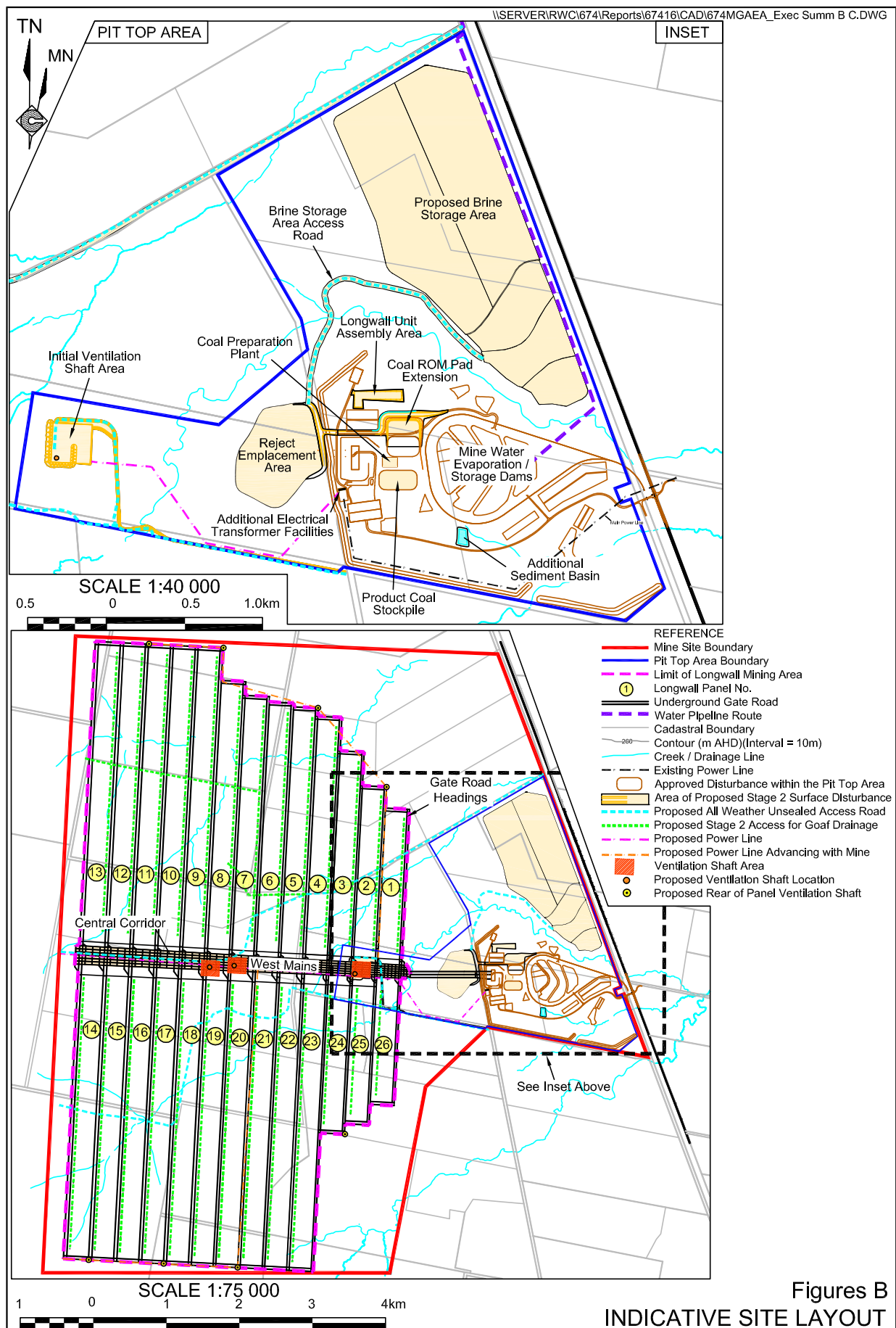
PROJECT DESCRIPTION

Figure B displays the principal surface and underground components of the proposed Longwall Project, differentiating between those activities or infrastructure already approved for the Stage 1 operations and those proposed for the Longwall Project. The following subsections provide an outline of the proposed Longwall Project operations.

Longwall Mining

Longwall mining would involve the sequential development of sets of heading gate roads approximately 305m apart oriented north-south from the main mine headings (“West Mains”) and developed for the full distance to the northern and southern boundaries of ML 1609 (up to 4.1km) (**Figure B**).





Once each set of dual roadways is fully developed, the longwall equipment would be installed and the coal recovered as the longwall unit retreats back towards the West Mains between the two sets of roadways. All coal would be conveyed back to the Pit Bottom Area for transfer to the surface via the approved conveyor drift.

The longwall unit would recover 4.2m of coal from the base of the Hoskissons Coal Seam (leaving up to 5.2m of lesser quality coal in-situ), retreating at a rate of approximately 15m per day. At this rate, each longwall panel would take approximately 1 year to complete. Based on the proposed mining schedule, there could be up to three longwall panels being prepared (gate road development) or mined (longwall unit retreat) at any one time.

Mine Ventilation and Gas Drainage

The Hoskissons Coal Seam has a measured gas content that ranges from 3.5m³/t to 7.5m³/t. The composition of this gas is predicted to vary considerably, however, for planning purposes and subject to further data becoming available, it is assumed to be an average of 90% carbon dioxide and 10% methane. The porous coarse grained sandstone floor of the Hoskissons Coal Seam would also be a source of gas within the underground workings.

Pre-drainage of the coal seam would be undertaken to reduce gas content to less than 5.0m³/t for the management of outbursts and rib emission prior to the development of each longwall panel. Pre-drainage would be initially undertaken using Surface to In-Seam (SIS) drilling from the surface. The Proponent is confident that once gate road development progresses ahead of longwall mining operations, pre-drainage of the gas would revert to conventional underground in-seam drilling (which would significantly reduce the area of surface disturbance attributable to the Longwall Project).

As the three mine drifts, dual gate road headings and longwall panels are developed, the mine ventilation system would be progressively upgraded to prevent gas build-up within the underground workings, thereby providing for safe working conditions and minimising the risk of outburst or spontaneous combustion.

As the longwall unit retreats, and the upper 5.2m of the seam collapses, the gas accumulating in the collapsed goaf would also be drained. Goaf gas drainage would be completed either by re-using the SIS system, or by the development of additional bores from surface into the collapsed panel. In both cases, the gas would be drawn out the goaf by the installation and operation of a mobile vacuum plant at the top of each bore.

Mine Dewatering and Management

As groundwater seeps into the underground workings, it would be diverted to underground sumps from where it would be pumped to the surface into a dam within the rail loop (**Figure B Inset**). A proportion of this 'raw' groundwater, which is expected to have a Total Dissolved Solids (TDS) concentration of up to 8 000mg/L, would be used (without further treatment) within the Pit Top Area for activities such as coal washing and dust suppression.

Fresh water (TDS≤500mg/L) would also be required for use underground, ie. for dust suppression and equipment cooling. In order to improve the quality of the water collected during mining operations, a water conditioning plant (incorporating both ultra-filtration and reverse osmosis processes) would be operated. The raw groundwater would be pumped from the initial storage dam to the water conditioning plant, with the treated water ("raffinate") discharged to Dams B1, C and D. The 'brine' by-product, which is expected to have a salinity approximating that of seawater (25 000mg/L), would be pumped to Dams A2, A3 and B2 for initial storage.



Following the completion of groundwater modelling for the Longwall Project, it became evident that the volume of groundwater in-flow is expected to gradually increase to a level whereby the volume to be dewatered and treated may far exceed operational requirements. Furthermore, no beneficial use for the excess raw groundwater has been identified. As a consequence, all dewatered groundwater not required for Pit Top Area and underground activities would be processed through the Water Conditioning Plant. It is proposed to discharge the excess raffinate to the Namoi River via a pipeline to be laid largely within Narrabri Shire Council road easements. The additional brine, would be pumped to and stored within a series of lined ponds, progressively constructed within the “Brine Storage Area” to the north of Kurrajong Creek Tributary 2 (**Figure B Inset**).

At the completion of underground mining, the stored brine would be pumped back into the goaf areas and remaining gate roads of the completed longwall panels. The Proponent is also investigating the potential to progressively pump the brine into the completed goaf areas of the mine.

If required, water to supplement that captured within the Pit Top Area during the initial years of the Longwall Project would be sourced through licence allocations from the Namoi River or Namoi Alluvium and pumped to the Mine Site via the pipeline described above.

Coal Transfer to Surface and Processing

Transportation of the mined coal to the ROM coal stockpile would continue to be via the conveyor drift from the Pit Bottom Area to the box cut within the Pit Top Area. From the box cut excavation, the ROM coal would be transported to the ROM coal stockpile area by conveyor from where it would be conveyed to the Coal Preparation Plant (CPP).

Coal Processing and Reject Management

ROM coal would be drawn from the ROM coal stockpiles via one of two reclaim valves and tunnels from where it would be fed to a rotary breaker for size reduction. The broken coal would then be transferred to a dry screen with the <16mm coal transferred directly to the product coal stockpile area and the remainder transferred to the CPP where the coal would be washed and coarse and fine reject material removed. The washed coal would be transferred to the product coal stockpile area where it would ultimately be loaded into rail wagons for transport from the Mine Site.

The coal preparation process would remove up to 5% of the total ROM feed as reject material. The reject would comprise predominantly rock from the floor of the workings, about 90% of which would be coarse reject. The remaining reject material would be fine and ultra-fine reject which would be dewatered to produce a filter cake. The coarse, fine and ultrafine reject would be stockpiled within a reject pile from where the consolidated reject would be transferred to the Reject Emplacement Area (**Figure B Inset**). The proposed maximum footprint of the Reject Emplacement Area is approximately 25ha, however, it would be constructed progressively as a series of elongated (north-south oriented) cells from east to west. The emplacement would be constructed against the slope of the ridge, rising to a maximum of 15m above the natural surface level. The propensity of the reject to produce leachate which has deleterious impacts, eg. high salinity, high acidity or elevated contaminant levels, would be regularly tested. If deleterious impacts are predicted, the floor of the Reject Emplacement Area would be constructed to be effectively impermeable (<1x10⁻⁹m/sec).



Transportation

Product coal would be drawn from the product coal stockpiles via three reclaim valves and tunnels and conveyed to the train load-out bin. The loading of product coal would be fully automated with batches drawn from the stockpiles and loaded into rail wagons on the rail loop.

Rehabilitation

Rehabilitation of the Mine Site would involve five distinct areas.

Pit Top Area infrastructure.

All surface infrastructure, with the exception of the mine access road and rail infrastructure, would be decommissioned and removed from the Mine Site. Disturbed parts of the Pit Top Area would be backfilled, where appropriate, eg. box cut and water storage dams (after dam lining and saline material is removed), profiled, covered with available topsoil and revegetated with either pasture grass species or native tree, shrub and grass species (depending on final landform and land use requirements).

Reject Emplacement Area.

As the permanent 14° batters of each cell of the Reject Emplacement Area are formed, they would be progressively capped with subsoil and topsoil. On completion of each cell to the nominated 15m height, the upper surface would be profiled to create a series of transverse (ie. east-west) drainage swales and re-spread with topsoil. The completed surfaces of the Reject Emplacement Area would be revegetated with a sterile, fast growing cover crop to stabilise the landform, with pasture species ultimately sown to enable a return to agriculture over this area once mining is completed.

Water and brine storage ponds.

Following dewatering of the ponds, the HDPE liner of each pond would be removed and transported to a waste disposal facility. The salinity level of the compacted clay floor beneath the liner would be analysed to confirm that no contamination has occurred. If required, appropriate remedial measures would be undertaken to remove the saline contamination. The ponds would then be backfilled, profiled, re-topsoiled and revegetated with pasture species to create a landform comparable with the surrounding topography.

Ventilation and gas drainage infrastructure.

The ventilation and gas drainage infrastructure would be rehabilitated in much the same fashion as the Pit Top Area. When facilities are no longer required, they would be progressively rehabilitated given the area required for the construction and installation of the bores required for ventilation and gas drainage greatly exceeds the area required to manage and maintain these operations.

Surface cracking caused by subsidence.

The disturbance resultant from any surface cracking caused by subsidence would be progressively rehabilitated. For smaller width cracking, the surface would simply be ripped to allow the cracks to be filled in. In some instances, the surface cracking may be too wide to be effectively in-filled by surface ripping and in these instances, material excavated from within the footprint of the reject emplacement area would be used to in-fill the cracks prior to ripping and revegetation.

Mine Life and Hours of Operation

The life of the Longwall Project is estimated to be up to 30 years. Operating 7 days per week, the proposed hours of operation would be as follows.



Activity	Hours
Surface Facilities Construction	
Vegetation clearing / soil removal	7:00am to 10:00pm
Surface infrastructure construction	7:00am to 10:00pm
Reject Emplacement Area development	7:00am to 10:00pm
Raw materials / supply delivery	7:00am to 10:00pm
Ventilation shaft construction	24 hours
Gas drainage bore construction	24 hours

Activity	Hours
Mining Operations	
Pit Bottom Area development	24 hours
Underground mining	24 hours
Gas drainage	24 hours
Ventilation fan operation	24 hours
Crushing, screening, washing and stockpiling	24 hours
Rail loading and transportation	24 hours
Surface maintenance	24 hours
CPP reject disposal	24 hours
Raw materials / supply delivery	7:00am to 10:00pm

Employment

Based upon the operation of three continuous miners in conjunction with the longwall unit, the Proponent estimates that the Longwall Project would provide employment for 211 persons, comprising 186 mine workers and 25 management and technical staff.

ISSUE IDENTIFICATION AND PRIORITISATION

In order to undertake a comprehensive *Environmental Assessment* of the Longwall Project, appropriate emphasis needs to be placed on those issues likely to be of greatest significance to the local environment, neighbouring landowners and the wider community. These issues (and their potential impacts) were identified through a program of community and government consultation, preliminary environmental studies and literature review.

This was followed by an analysis of the risk posed by each potential impact in order to prioritise the assessment of the identified environmental issues within the *Environmental Assessment*.

Consultation

Consultation with the local community involved:

- individual discussions with the landowners / residents of properties surrounding the Pit Top Area;
- mine open days; and
- a community consultation day (convened at Baan Baa community hall).

The Proponent and its consultants also regularly consulted with various government agencies and authorities throughout the planning phase of the Longwall Project.

Issue Prioritisation

Considering the environmental issues raised throughout the consultation process, a review of the project design and local environmental features was undertaken to identify risk sources and potential environmental impacts for each environmental issue. An analysis of risk for each potential environmental impact was then completed with a risk rating assigned to each impact based on likelihood and consequence of occurrence, ie. in the absence of any mitigation measures. Through a review of the allocated risk ratings and the frequency with which each issue was identified, the relative priority of each issue was determined, with this priority used to provide an order of assessment and depth of coverage within the *Environmental Assessment*.

Based on the issues identified and the risk ratings allocated to the potential environmental impacts of these, the following order of priority of environmental issues has been determined.



1. Subsidence
2. Groundwater
3. Surface Water/Flooding and Drainage
4. Flora and Fauna
5. Aboriginal Heritage
6. Noise and Vibration
7. Air Quality
8. Soils and Land Capability
9. Traffic and Transport
10. Visual Amenity
11. Socio-economic Setting

ENVIRONMENTAL SAFEGUARDS AND IMPACTS

The components and features of the existing environment on and around the Mine Site have been studied in detail and the Longwall Project designed to avoid or minimise impacts on that environment. A brief overview of the main components of the surrounding environment, the proposed safeguards and the assessed level of impact are set out below.

Subsidence

The Longwall Project is effectively a ‘greenfields’ operation, ie. a mining area where no local prior knowledge of ground response to underground mining exists. As a consequence, it has been necessary to make predictions using proven empirical modelling techniques developed in other coalfields with similar geological conditions. This approach has been used to produce total and differential subsidence predictions across the Mine Site.

In order to account for these uncertainties in model parameters and subsidence development, modelling predictions considered the following three cases all of which relate to the ability of a thick volcanic rock unit (the Garrawilla Volcanics) to span or subside into the mined coal seam.

- Case 1: Non-spanning Garrawilla Volcanics and maximum chain pillar subsidence.
- Case 2: Spanning Garrawilla Volcanics (where thick enough) and maximum chain pillar subsidence.
- Case 3: Non-spanning Garrawilla Volcanics and minimum chain pillar subsidence.

Maximum panel and chain pillar subsidence predictions for the three cases were based on ‘Credible Worst Case’ values derived from the empirical model.

The subsidence modelling predicts the maximum tensile and compressive strains are expected to range from 2mm/m to 19mm/m. Impacts are likely to include surface cracking (from 20mm to 190mm wide), surface gradient increases or decreases by up to 6% (3°) along creeks; and potential ponding depths of 0.5 to 1.5m above several of the longwalls and creeks. These impacts could also result in the development or acceleration of erosion, especially within the watercourses that traverse the Mining Area.

Direct hydraulic connection to the surface, due to sub-surface fracturing above the panels, is considered unlikely to occur as cover depths exceed 150m. However, subsurface aquifers within 110m to 180m above the longwall panels may be affected by direct hydraulic connection to the workings leading to increases in vertical permeability. It is also possible that indirect or discontinuous sub-surface fracturing could interact with surface cracks where cover depths are <215m leading to losses from dams and creek flows. It is noted that this is considered unlikely as this behaviour usually only occurs where shallow surface rock is present and not where deep soil profiles exist (as on the Mine Site).



The various Proponent-owned dwellings and farm infrastructure both on the Proponent's and surrounding land above the Mining Area and within the angle of draw are likely to be significantly damaged as a result of the predicted mine subsidence. No impact is expected on structures outside of the angle of draw, including the North Western Branch Railway Line and Kamilaroi Highway.

The Proponent has proposed a range of management and mitigation measures to ensure that the surface and sub-surface related subsidence impacts do not result in unacceptable impacts upon surface hydrology, groundwater hydrogeology, local flora and fauna, soils and local infrastructure. In particular, potential cracking zones and all watercourses and other areas susceptible to ponding and/or erosion would be regularly inspected and remedial works undertaken as necessary. Individual Property Subsidence Management Plans would be prepared for each non-project related potentially affected property.

The Proponent has committed to a comprehensive subsidence monitoring program to measure tilt and strain at relevant locations over the life of the Longwall Project. Based on the results of monitoring, the management of subsidence related impacts may require further subsidence control, ie. mine planning changes, or mitigation techniques to be applied. The extent of mining layout adjustment would be determined following discussion with relevant stakeholders and government agencies.

Groundwater

The Triassic, Jurassic and Quaternary sequences within the Mine Site contain differentiated aquifers which have been defined as the following groundwater management areas (GWMA's).

- (i) The Upper Namoi GWMA which is contained in the unconsolidated sediments of the Namoi River and its tributaries.
- (ii) Intake Beds of the Great Artesian Basin GWMA which is defined by the easterly extent of the Surat Basin sequence which includes the following formations.
 - Pilliga Sandstone
 - Purlawaugh Formation
 - Garrawilla Volcanics
- (iii) Gunnedah Basin GWMA which is comprised of the Permo-Triassic Gunnedah Basin sequence and includes the following formations.
 - Napperby Formation (Mid Triassic)
 - Digby Formation (Early Triassic)
 - Black Jack Group (Late Permian) which includes the Hoskissons Coal Seam

Aquaterra Consulting Pty Ltd developed and ran a groundwater model to predict the impact of the Longwall Project on mine in-flows, local groundwater levels (drawdown), base flows to the Namoi River, groundwater dependent ecosystems and the three GWMA's more generally.

Values for the initial input parameters of the model were generated through a review of a previous groundwater study for the Narrabri Coal Mine, historic literature and mapping available for the region and local area, as well as additional on-site testing conducted since the approval of the Stage 1 Narrabri Coal Mine. The groundwater model was then calibrated by means of a historic match to the observed groundwater levels during the period November 2007 to August 2008. This calibrated groundwater model, became the 'base case' model for predictions of impact on local and regional groundwater resources.



Sensitivity analyses of the base case groundwater model determined that the model was not highly sensitive to changes in hydraulic conductivity. Despite the apparent lack of model sensitivity, and to account for variation in the in-situ hydraulic properties of the hydrogeological units above the proposed underground mine, the input parameters of the base case model were altered to account for the following.

1. Continuous fracturing extending into the Garrawilla Volcanics.
2. Higher and lower vertical hydraulic conductivities of the hydrogeological units within the fracture zone.
3. Reducing vertical hydraulic conductivities within the fracture zone to model the settling and/or redistribution of fines within the affected strata.

The groundwater model predicts that groundwater would initially inflow at a moderate rate of 0.21ML/day (78ML/year), steadily increase to a peak rate of 3.89ML/day (1419ML/year) in about Year 13 before declining as water is allowed to remain in the goaf areas of completed longwall panels in areas down dip of the active mining. The ‘uncertainty analysis’ suggests that the predicted in-flow may increase by up to 37% if the elevated hydraulic conductivities are observed within the fracture zone. This rate of inflow is between 150% and 250% of that predicted for the Stage 1 Narrabri Coal Mine and the Proponent has developed a strategy for managing this volume of water at surface.

Significant drawdown of groundwater levels is predicted to be restricted to the hydrogeological units within the Gunnedah Basin GWMA. The potential for impact on the small number of bores screening the aquifers of the Gunnedah Basin GWMA has to a large degree been mitigated by the Proponent’s acquisition of properties within the anticipated zone of impact. However, in

the event that drawdown related to the Longwall Project is determined to impact on the yield of a non-project related bore, the Proponent has committed to mitigating these impacts (or compensating the bore holder). Importantly, no impact on the volume of groundwater held within the Intake Beds of the Great Artesian Basin, or Upper Namoi Alluvium GWMA is predicted.

The impact of brine re-injection on groundwater recovery and water quality was also modelled. The results of the analysis determined that re-injection over a period of approximately 2 years post-mining would ensure that groundwater levels do not rise above the Napperby Formation, ie. into the geological units and better quality water. Additionally, the modelling confirmed that the saline water would not disperse from the re-injection point such that it could impact on the quality of the surrounding groundwater.

The Longwall Project is not predicted to have any measurable impact on the groundwater base flow discharges to Namoi River, Maules Creek or Jacks Creek nor groundwater dependent ecosystems of the region.

Surface Water

The Mine Site is located in the Namoi River catchment and within the catchments of two of its tributaries, namely Kurrajong Creek, and Pine Creek. Both creeks are ephemeral, generally flowing for short periods after significant rainfall events or protracted wet periods. The Namoi River flows in a northwesterly direction approximately 3km to 5km to the east of the eastern boundary of the Mine Site.

The surface water flows on and around the Mine Site provide a very minor contribution to the overall flows within the Namoi River catchment. This water is important to local landowners for stock watering and/or crop irrigation purposes, with any changes in



water availability potentially detrimental to the existing land uses. The surface water flows are also important to the ecological health of the Namoi River, ie. the fauna and flora which rely on good quality water. Acknowledging the potential impacts of the Longwall Project on the Namoi River catchment, the management targets for surface and groundwater ecosystems of the Catchment Action Plan for the Namoi River have been considered in the design of Mine Site water management controls and safeguards.

The surface water management controls and safeguards for the Longwall Project build on those already implemented as part of the Stage 1 Narrabri Coal Mine and account for the increased volume of saline groundwater predicted to be dewatered from the underground mine. All structures and operating controls have been designed based on recommendations provided by the Proponent's hydrological consultant and the following principles.

- The diversion of clean water away from disturbed areas.
- The capture and treatment of potentially contaminated water prior to inclusion in the Mine Site water supply.
- The capture, settlement and discharge of sediment-laden water to ensure any discharge meets the relevant water quality guidelines.
- The temporary storage and treatment (filtration and desalination) of groundwater pumped from the underground workings.
- The storage of the concentrated brine by-product of water treatment and eventual re-injection into the completed underground workings (at the completion of the Longwall Project).
- The storage, re-use and/or discharge to the Namoi River of the freshwater raffinate produced by the water treatment.

- The prevention of erosion and sedimentation through the maintenance of vegetation cover within natural and constructed drainage lines.

Based on rainfall data collected over a period of 105 years, the predicted mine in-flow rates and the proposed operational water requirements of the Longwall Project, a water balance was prepared accounting for dry, median and wet years. The water balance indicated that the nominated dirty water and contaminated water structures would operate efficiently for the life of the Longwall Project and that sufficient capacity was provided by the proposed brine storage ponds to account for the upper level groundwater in-flow predictions. The water balance did, however, illustrate that during the initial years of the Longwall Project, supplementary water supply may be required.

Based on the proposed water management controls and structures, the Longwall Project would be unlikely to have a significant impact on either the quantity or quality of water available to downstream landholders and the local environment. In fact, the discharge of good quality water into the Namoi River beyond about Year 7 of the mine life could be seen as having a positive impact on the local catchment (especially during periods of low flow in the river). Notwithstanding this, the Proponent has committed to offsetting any additional salt load to the Namoi River resulting from the proposed discharge. The nature and design of this offset strategy is still to be finalised, however no discharge of water will occur until the offset strategy is in place. In addition, the Proponent would implement a comprehensive monitoring program of water levels and quality within the Pit Top Area storages and natural drainage features of the Project Site.

Flora and Fauna

A total of seven vegetation communities were identified within the Mine Site and along the route of the water pipeline to the



Namoi River, six of which are native vegetation communities (see **Figure C**). Of these, the following three Endangered Ecological Communities (EEC) have been identified as occurring as a component of one or more of these identified communities.

- *Brigalow within the Brigalow Belt South, Nandewar and Darling Riverine Plains Bioregions* occurs in marginal form over scattered parts of Community 1.
- Community 2 may be classified as the *Inland Grey Box Woodland in the Riverina, NSW Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions*.
- *Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW Southwestern Slopes Bioregions* (Community 6).

No threatened or rare flora species were detected within the Mine Site. However, one species, *Bertya opposens*, was assessed as having a high likelihood of occurring, a second species, *Cadellia pentastylis*, was assessed as having a moderate likelihood of occurring and a third species, *Lepidium aschersonii*, a low to moderate likelihood of occurring.

Sixteen threatened fauna species were recorded during field surveys of the Mine Site with potentially suitable habitat present for a further 20 threatened or migratory species that were not identified during field surveys.

Based on the proposed mine design, the Proponent estimates that up to approximately 210ha of native vegetation (Communities 1 to 4) could be disturbed (see **Figure C**).

Community	Area of Disturbance (ha)			
	1	2	3	4
Ventilation Fan Sites	13.0	1.0	0	0
Pre-drainage Sites	88.6	11.2	0.6	1.0
Goaf Gas Drainage Sites	62.0	8.0	3.0	1.0
Internal Access Roads, Power Lines and Service Corridors	15.3	2.7	0.5	0.2
Pit Top Area	0	1.9	0	0.5
Total	178.9	24.8	4.1	2.7

The Proponent proposes to offset the removal of native vegetation through the protection in perpetuity of a Biodiversity Offset Strategy. The design of the Biodiversity Offset Strategy is still to be finalised, however, the Proponent has nominated two parcels of land, namely Lots 64 and 65, DP757114, in the northwestern section of the Mine Site for inclusion as part of the Strategy. The following table identifies the area of each vegetation community that would be disturbed and preserved.

Comm-unity.	Total Area	Disturbed	Conserved	Offset Ratio
1	2058	178.9	465.7	2.6:1
2	318	24.8	78.7	3.2:1
3	98	4.1	2.9	0.7:1
4	20	2.7	0	--
Total	2494	210.5	547.3	2.6:1

The Proponent has committed to finalising the Biodiversity Offset Strategy within 3 years of receiving project approval or prior to commencement of surface disturbance above LW4, whichever occurs sooner.

Other operational safeguards to be implemented by the Proponent to minimise impacts on flora and fauna would include:

- undertaking pre-clearing surveys for threatened fauna in areas of native vegetation;
- relocating and re-erecting, where practicable, to avoid any net loss of hollow resources.
- regular programs would be conducted to control noxious weeds and feral animals.



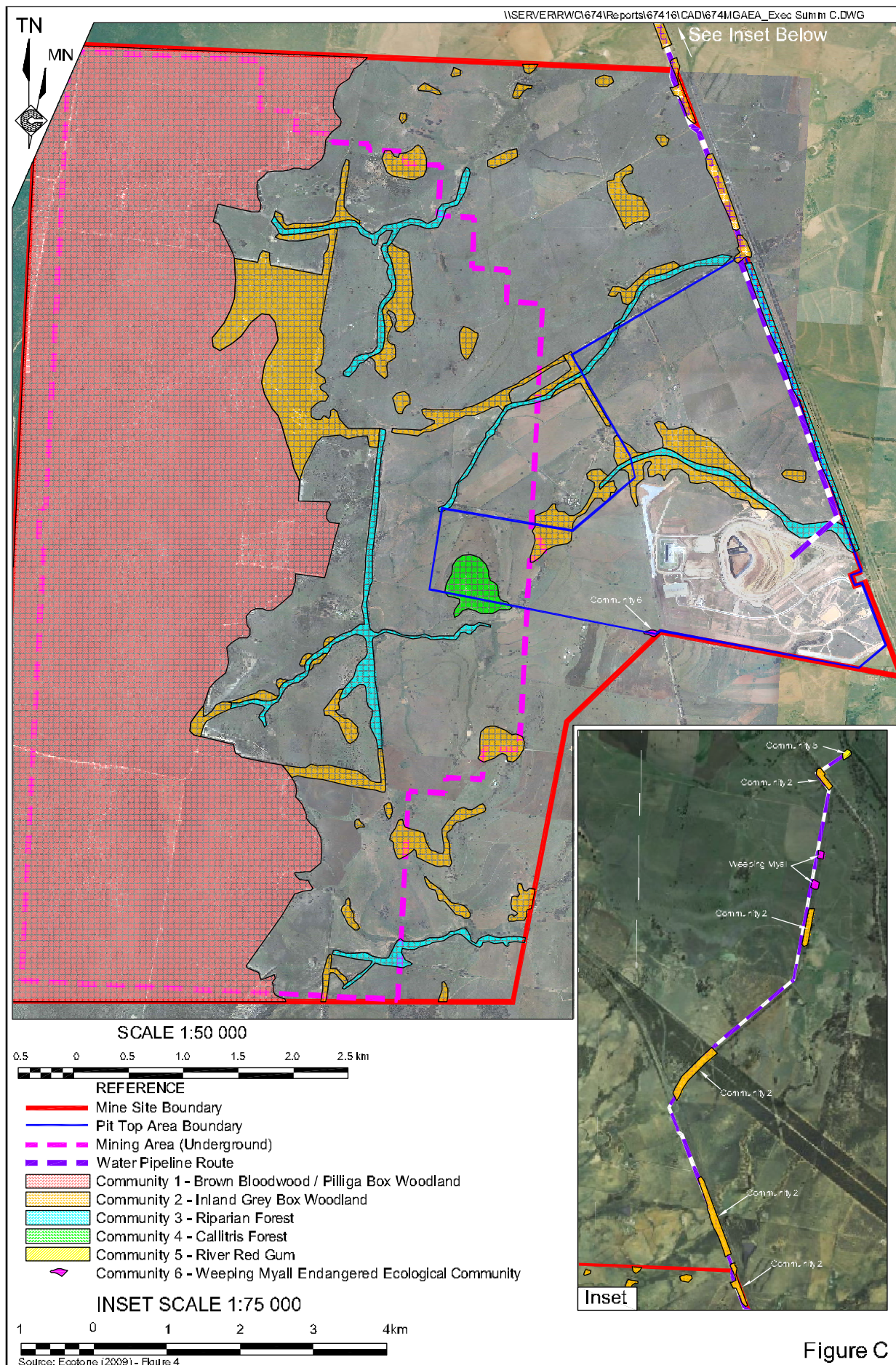


Figure C



Taking into account the proposed biodiversity offset strategy and the other operational safeguards, an assessment of the impacts of the Longwall Project on the identified or potentially occurring threatened species found there would be no significant impact on:

- threatened flora or fauna species;
- key threatening processes;
- Koala habitat;
- riparian vegetation and vegetation;
- groundwater dependent ecosystems; and
- the ecology of the Namoi River.

Aboriginal Heritage

The Longwall Project has the potential to impact on Aboriginal sites, both as a result of surface disturbing activities (within the Pit Top Area, along the proposed water pipeline route and associated with the progressive development of mine ventilation and gas drainage infrastructure) and mine subsidence. Following consultation with registered Aboriginal community stakeholders, the Proponent commissioned four separate field surveys to identify the type and distribution of Aboriginal sites.

Panels 1 to 7 Survey. A detailed survey of the proposed disturbance areas of the Mining Area above longwall panels LW1 to LW7 was undertaken. A total of 43 sites were recorded, with all but one recorded within 50m of a creek or drainage line. Four of the 43 sites have been identified as being of higher cultural or scientific significance, with the Proponent committed to locating gas drainage activities to avoid these four sites.

Brine Storage Area Survey. A detailed survey of the proposed area nominated for the construction of brine storage ponds resulted in the identification of nine

Aboriginal sites. All nine sites are low density artefact scatters or isolated artefacts and are not considered to be of high cultural or scientific significance.

Water Pipeline Route Survey. A detailed survey of the route of the proposed water pipeline between the Mine Site and the Namoi River did not identify any Aboriginal sites.

Panels 8 to 26 Survey. A reconnaissance survey of those locations and environmental features of the Mining Area above longwall panels LW8 to LW26 considered as having higher potential for Aboriginal site occurrence and identification was undertaken. This survey was undertaken, not for the purpose of recording every site, but to provide a firmer basis upon which to assess the cumulative impact of disturbing or salvaging sites within the Panels LW1 to LW7 Survey. A total of 69 sites were identified, the majority of which were low density artefact scatters of limited scientific significance.

Following the completion of the field surveys, the Proponent developed a draft Statement of Commitments in relation to managing Aboriginal heritage on the Mine Site. In summary, the Proponent has committed to avoiding disturbance to those sites identified as being of elevated scientific or cultural significance. The Proponent has also made the commitment to avoid, where practicable, all other identified sites unless mine ventilation or gas drainage requirements make this impractical for mine safety reasons. In the event that a site cannot be avoided, the Proponent would provide for the salvage of all artefacts and storage of these in accordance with the recommendations of the Aboriginal community. Further detailed surveys will subsequently be undertaken over the remaining Mining Area (LW8 to LW26) after which the same Aboriginal heritage management strategy (as presented in the draft Statement of Commitments)



would be adhered to. The two registered Aboriginal stakeholders have been presented with the draft Statement of Commitments. Both Aboriginal Stakeholders have provided written confirmation of their satisfaction with these.

On the basis that site salvage would be the last resort of the Proponent, and that the salvage operations would be undertaken as agreed to with the Aboriginal community, the impact of the Longwall Project on Aboriginal cultural heritage would be minimised. Based on the relatively low proportion of sites likely to require salvage, and the maintenance of the those sites of higher cultural and scientific significance, it has been concluded that the sites remaining after salvage would be representative of the type, number and content of sites throughout the wider region, ie. the cumulative impact of the Longwall Project would not be significant.

Finally, it has also been determined that the type of sites identified within the Mine Site are unlikely to be affected by mine subsidence, which is only likely to displace artefacts vertically and not have any significant impact on the natural processes affecting horizontal displacement of the artefacts.

Noise

The sources of noise around the Mine Site are typical of a rural environment with contributions from farming activities, insect noise, livestock, wind through vegetation and vehicles on local roads. Stage 1 operations are also audible at a number of residences on and adjacent to the Mine Site.

The criteria for noise generated by the project have been established as:

- an $L_{Aeq(15min)}$ of 5dB(A) above the assumed 30dB(A) background level for mine operations;
- an L_{Amax} of 15dB(A) above the assumed background level for night-time sleep disturbance;

- an $L_{Aeq(1hr)}$ of 60dB(A) and 55dB(A) for daytime and evening road traffic noise respectively; and
- a maximum $L_{Aeq(24hr)}$ of 60dB(A) and L_{Amax} of 85dB(A) for rail traffic.

The Longwall Project would generate noise levels over and above those currently experienced throughout the existing environment around the Mine Site. These noise levels, assuming the implementation of the Proponent's operational commitments, would generally comply within the DECCW nominated criteria for all construction and operational activities. Through the implementation of the nominated noise controls, exceedances of noise criteria would be limited to between (1dB(A) and 5dB(A)) at all but one residence ("Kurrajong") as operations occur over LW24 to LW26 (Scenario 3) beyond about Year 20.

The predicted exceedances would only occur under noise enhancing conditions (inversion or southeast winds) and would be limited temporarily to the period associated with either surface activities above LW1 to LW3 ("Bow Hills", "Naroo", and "Greylands"). As all reasonable and feasible noise mitigation measures are to be implemented, the predicted exceedances would be limited to noise enhancing meteorological conditions only, and then for a limited period of operations. The impact of these moderate exceedances is considered acceptable.

No exceedances of sleep disturbance or road and rail traffic noise criteria were predicted.

The Proponent would monitor noise levels at several of the potentially most affected surrounding residences and maintain dialogue with these residents to ensure that the impacts of noise generated by the project are minimised.



Air Quality

The air quality assessment concluded that the adoption of air quality control measures including the dust suppression, progressive rehabilitation and minimisation of clearing in advance of operational activities would ensure any minor increases to annual average PM₁₀, and dust deposition would satisfy environmental and health criteria. Incremental increases in 24-hour maximum PM₁₀ concentration are considered unlikely to result in exceedances of the relevant environmental and health criterion. Additionally, based on previous research, the predicted dust levels would not have any significant impact on either local livestock or pasture.

Emissions of nitrogen dioxide and sulphur dioxide would also be well within the air quality goals. In addition, all greenhouse gas emissions arising from the on-site and off-site activities and from the use of the coal would account for 0.06% of the total baseline Australian emissions.

Soils and Land Capability

A variety of soil types were identified across the Mine Site. Based upon field observations and a review of the physical and chemical data, soil-related constraints for the Longwall Project were identified. In most cases, the soils were identified as ‘not limiting’, however, some of the soil types, particularly those derived from the Purlawaugh Formation, may be moderately to highly dispersive, erodible and saline, and careful management would be required where subsidence results in cracking, slope increases or occurs within drainage lines.

All soils would be handled as little as possible by ensuring the area to be stripped and the area of stockpiling are clearly identified. All topsoil would be stripped and re-used in site rehabilitation, with the stripping and use of subsoil in rehabilitation or other works restricted to those soils identified as amenable for this purpose.

Topsoil stockpiles would not exceed 2m in height, while the subsoil stockpiles would not exceed 3m in height.

A review of Land Capability mapping and field survey indicated that the sections of the Mine Site that have been cleared and farmed in the past may be classified as Class III land. The land along the major drainage lines may be classified as Class IV and the remaining land associated with rocky ridges and sandy soils Class VII. The Longwall Project would do little to alter this land capability classification.

A review of the soils located within the proposed footprint of the Reject Emplacement Area, Brine Storage Areas and water pipeline route determined that with the implementation of appropriate controls, these soils would not constrain development.

Transportation Aspects

The Mine Site is accessed via a purpose built intersection between the Mine Access Road and the Kamilaroi Highway (SH 29). Pavement conditions of the Kamilaroi Highway are considered good at the intersection and both north and south of the intersection. The Mine Access Road has been constructed as a two lane, sealed road of 8m pavement width with 1m wide unsealed shoulders and intersects with Kurrajong Creek Road, where it makes a right hand bend to the south on the western side of the railway line crossing. A Stop sign has been erected for northbound traffic on Kurrajong Creek Road to emphasise this traffic priority.

The Longwall Project would not generate a significant increase in heavy vehicle traffic and therefore the current arrangement is considered adequate. Adherence to all other operational safeguards and controls would ensure that the Longwall Project does not have a significant impact on traffic volumes, flows and safety levels for road and rail transport.



Notwithstanding this assessment, the Proponent has committed to providing equitable contribution and support to any future study of accumulative impacts associated with increasing rail movements on the North Western Branch and Main North Railway Lines initiated by Australian Rail Track Corporation or a NSW Government Agency.

Visibility

The Pit Top Area is located in an area visible from adjoining properties and sections of the local road network. The remaining areas of proposed disturbance within the Mine Site are generally located a significant distance from surrounding properties and are often well shielded by vegetation and/or topography.

The Longwall Project would incorporate the following visual controls to limit the visual intrusiveness of the various site components.

- A 3m high perimeter bund around sections of the Pit Top Area.
- Any disturbed areas not required for long term operations would be revegetated.
- The load-out bin and site buildings would be painted in a green / grey hue.
- A high standard of housekeeping would be adopted.

The changes to the landscape and the new activities within the Mine Site may be noticeable to local residents. However, the controls adopted would limit the impact(s) of those changes.

Socio-economic Setting

A socio-economic assessment for the project was undertaken in two phases.

Phase 1 involved an analysis of previous social and economic assessments in the region in order to obtain a general

understanding of the local setting, social issues of greatest concern and community views/opinions on mining.

Phase 2 involved more detailed qualitative research of those social issues identified to be of greatest significance to local stakeholders, namely:

- housing;
- education;
- industry diversification;
- employment opportunities; and
- community services and facilities.

Based on the identification of these key themes, the qualitative research component of the assessment focussed on:

- (i) consideration of the existing services, facilities and opportunities within the Narrabri and Gunnedah Local Government Areas; and
- (ii) consultation with various professionals working in the key areas.

In light of the range of available services in Narrabri and Gunnedah LGAs, combined with the positive attitude of the local Councils, the region currently has, or would quickly develop, capacity in the four key areas of education/training, housing capacity, infrastructure and economic development to meet the demands of a growing population of mine workers and related trades, even with the cumulative demand of other mines in the region.

The positive socio-economic impacts such as increased employment, development and services, improved employment diversity, training and community vibrancy and implementation of the Proponent's proactive management measures would offset any negative impacts related to temporary loss of agricultural productivity and social amenity. This positive assessment is confirmed by key stakeholders in the area who favourably anticipate development of the Longwall Project.



PROJECT EVALUATION AND JUSTIFICATION

The Narrabri Coal Longwall Project has been evaluated and justified principally through consideration of its potential impacts on the environment and potential benefits to the local and wider community.

An evaluation of the Longwall Project has been undertaken by firstly reassessing the risks posed to the local environment by project-related activities following the implementation of all operational controls, safeguards and/or mitigation measures, and secondly through consideration of the principles of ecologically sustainable development. This evaluation has found that, with the implementation of the proposed operational controls, safeguards and/or mitigation measures, the residual risk posed by each possible environmental incident or impact was reduced from its original level and with limited exception classified as either moderate or low, and therefore acceptable. Further, the design of the Longwall Project has addressed each of the sustainable development principles, and on balance, it is concluded that the Longwall Project achieves a sustainable outcome for the local and wider environment.

The Longwall Project and associated activities have been assessed in terms of a wide range of biophysical, social and economic issues. Potential residual impacts can be justified in terms of the positive economic and social benefits to Narrabri, the local government areas of Narrabri and Gunnedah, surrounding districts, NSW and Australia, the market opportunities for export quality coal and the principles of ecologically sustainable development.

CONCLUSION

The Longwall Project has, to the extent feasible, been designed to address all issues raised by the local community and all levels of government as well as the principles of ecologically sustainable development. The project provides for the mining, production, sale and despatch of a high quality coal product which would be significant in generating further employment opportunities and maintaining stimulus to the local economies of Narrabri and surrounding communities. The post-mining landform would also provide for the substantial re-establishment of agricultural land.

In light of the conclusions included throughout the *Environmental Assessment*, it is assessed that the proposed Longwall Project could be constructed and operated in a manner that would satisfy all relevant statutory goals and criteria, environmental objectives and reasonable community expectations.

The *Environmental Assessment* supported by the range of specialist consultant studies has established that if the Longwall Project proceeds, it would:

- (i) contribute to satisfying the demand for export quality coal;
- (ii) satisfy sustainable development principles;
- (iii) have a minimal and manageable impact on the biophysical environment;
- (iv) address the perceived social impacts; and
- (v) contribute to the continued economic activity of Narrabri, Narrabri Shire and surrounding districts.

