Tarrawonga Coal Mine Modification

ENVIRONMENTAL ASSESSMENT

April 2010

WHITEHAVEN COAL

ResourceStrategies

TARRAWONGA COAL MINE

SECTION 75W MODIFICATION
ENVIRONMENTAL ASSESSMENT

PREPARED BY
RESOURCE STRATEGIES PTY LTD

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EXECUTIVE SUMMARY

Background

The Tarrawonga Coal Mine is located within Mining Lease (ML) 1579 approximately 15 kilometres (km) north-east of Boggabri and 42 km north-northwest of Gunnedah in New South Wales (NSW). The Mine is owned and operated by Tarrawonga Coal Pty Ltd (TCPL), which is a joint venture between Whitehaven Coal Mining Pty Ltd (Whitehaven) (70%) and Idemitsu Boggabri Coal Limited (IBC) (30%).

The Tarrawonga Coal Mine was approved by the NSW Minister for Planning in November 2005 under Part 4 of the NSW *Environmental Planning and Assessment Act, 1979* (EP&A Act). The Development Consent allows for the construction and operation of an open cut coal mine, in-pit and out-of-pit overburden placement, coal crushing and screening on-site, and transportation of the crushed coal via road to Whitehaven's Coal Handling and Preparation Plant (CHPP) on the outskirts of Gunnedah. At the CHPP the coal is crushed and screened further, washed and then loaded onto trains for dispatch and sale to customers as a low ash, thermal and/or semi-soft coking coal.

Overview of the Proposed Modification

Improved market conditions since the Tarrawonga Coal Mine was approved have made mining of higher strip ratio coal economically viable. As a result, TCPL is seeking approval under Section 75W of the EP&A Act to modify the approved Tarrawonga Coal Mine Development Consent. The proposed changes to the Tarrawonga Coal Mine are described below.

- Extension of the open cut boundary to the east by up to approximately 600 metres (m), involving additional disturbance to an area of approximately 38 hectares (ha) within ML 1579.
- Increase in the total coal production from approximately 12.4 to 16.4 million tonnes (Mt).
- Increase in the total waste rock production from approximately 88.5 to 123.3 million bank cubic metres.
- Increase in the height of the Northern Emplacement from approximately 330 to 370 m Australian Height Datum.
- Extension of the Southern Emplacement by approximately 100 to 300 m to the south, into areas previously approved for topsoil stockpiles.
- Construction and use of a new soil stockpile area, involving additional disturbance to an area of approximately 21.2 ha.
- Construction and use of two small hardstand/infrastructure areas (i.e. 1.3 ha in total).
- Adjustments to the site water management structures and water storages.
- Adjustments to the hours of operation so that coal processing hours are the same as the approved open cut mining hours.
- Approval to divert some trucks from the coal haulage route into a domestic coal 'Hub' at the Canyon Coal Mine (approval pending) where up to 450,000 t of Tarrawonga coal would be crushed and screened per annum to domestic customer specifications.
- Approval to install and use a mobile crusher at the Tarrawonga Coal Mine to enable coal crushing and screening of the 450,000 t of domestic specification coal per annum to occur at the mine site until such time as the proposed 'Hub' is approved.

The proposal does not involve changes to the mining method, maximum production rate (up to 2 Mt per annum), mine workforce, or the life of the mine (i.e. 8 to 10 years). The proposed increase in coal production of approximately 4 Mt would generate additional economic benefits to the region and additional royalties to the State of NSW.

Environmental Assessment

The environmental factors relevant to the proposed Modification were identified based on TCPL's operational experience at the Tarrawonga Coal Mine and in the Gunnedah Basin, the results of environmental studies and monitoring in the region, the findings of previous environmental impact assessments, and consultation with regulatory authorities and other stakeholders. Comprehensive studies that have been conducted to assess the potential environmental impacts of the modified Tarrawonga Coal Mine include: visual, water, noise, air quality, biodiversity, geochemistry, and Aboriginal heritage.

The Environmental Assessment (EA) that accompanies the application under Section 75W of the EP&A Act (i.e. this document) describes and assesses the potential environmental impacts that could result from the modified Tarrawonga Coal Mine. The main identified impacts and how they relate to the components of the proposed Modification are summarised below.

- The proposed Modification would result in some changes to the final landforms at mine closure (i.e. the height of the Northern Emplacement would be increased by 30 m and the Southern Emplacement would extend a further 100 to 300 m to the south). From a visual amenity impact perspective, no significant impacts on nearby privately owned residences are predicted to occur either during operations or post-closure. The overall effect of the design changes on the local and regional landscape is not considered to be significant as the final slopes of the emplacements, their integration with the natural topography, and the size and location of the final void would remain the same as the approved operation.
- Geochemical testwork conducted in 2010 has confirmed that the overburden from the area between the eastern edge of the approved open cut and the eastern boundary of ML 1579 is geochemically consistent with overburden from the current open cut, which is non-acid forming. The overburden is not likely to contain any significantly enriched or soluble elements of potential environmental concern. TCPL would continue to manage overburden disposal in accordance with existing procedures.
- The existing operational water management system would be expanded to incorporate the additional disturbance areas associated with the proposed Modification. The new surface water management infrastructure would include additional sediment basins and storage dams, mine water dams, and associated diversion bunds and channels. The new infrastructure would be sized in accordance with the design criteria outlined in the Site Water Management Plan (SWMP). Design details, operational and monitoring requirements of the expanded water management system would be documented in an updated version of the SWMP. The potential impact of the modified Tarrawonga Coal Mine on flows in local creeks was assessed as being negligible.
- The approved Tarrawonga Coal Mine intersects low to very low yielding groundwater aquifers. A recently conducted independent review of groundwater monitoring concluded that the regional groundwater level drawdown in private bores and pit dewatering was within the range predicted in the 2005 Environmental Impact Statement and had not exceeded trigger levels nominated in the approved Groundwater Contingency Plan. Due to the relatively small extension to the open cut, the proposed Modification would not result in any additional significant impacts on groundwater resources during operations or post-closure. TCPL would continue to monitor groundwater levels and quality in accordance with the Groundwater Monitoring Program, and would identify and manage impacts in accordance with the Groundwater Contingency Plan.

- Noise modelling has been conducted for the modified Tarrawonga Coal Mine. Modelling included several iterations designed to determine feasible and reasonable noise mitigation measures. The final noise modelling results included a range of noise mitigation and management measures, for example:
  - installation of a 6 m high bund on the southern side of selected portions of the haul roads (generally where the haul roads run east-west);
  - installation of a real-time noise monitor at a nearby reference location and implementation of a trigger-level management system;
  - cessation of emplacement activities on the Southern Emplacement during evening and night-time periods, where required by real-time noise monitoring triggers; and
  - modification of the fleet during the evening and night-time periods.

  During calm meteorological conditions, the predicted noise levels were predicted to comply with the relevant criteria, except for a minor (1 A-weighted decibel [dBA]) exceedance at one privately-owned receiver.

  Noise levels were also predicted under adverse meteorological conditions, including various wind speeds and directions and temperature inversions. Predicted noise levels under adverse meteorological conditions are anticipated to exceed the criteria as follows:
  - Marginal (1 to 2 dBA) exceedances at four privately-owned receivers (Noise Management Zone).
  - Moderate (3 to 5 dBA) exceedances at four privately-owned receivers (Noise Management Zone).
  - Appreciable (>5 dBA) exceedances at two privately-owned receivers (Noise Affectation Zone).

  For privately-owned receivers in the Noise Management Zone, TCPL would implement feasible and reasonable acoustical mitigation at receivers (which may include measures such as enhanced glazing, insulation and/or air-conditioning), in consultation with the relevant landowner, where noise monitoring shows noise levels which are 3 to 5 dBA above project-specific noise criteria.

  For privately-owned receivers in the Noise Affectation Zone, TCPL would implement feasible and reasonable acoustical mitigation at receivers and would negotiate agreements with landowners, where required. These negotiations have commenced with the relevant landowners.

  The potential cumulative noise impacts associated with the proposed Modification and the Boggabri Coal Mine, located to the immediate north of the Tarrawonga Coal Mine, are predicted not to exceed the relevant criteria at any privately-owned receiver.

  The blasting predictions indicate that vibration and air blast emissions would comply with the relevant human comfort and structural damage criteria at nearby privately-owned receivers. One Project-related receiver is predicted to exceed the building damage criteria for vibration.

- Air quality modelling has been conducted for the modified Tarrawonga Coal Mine. Annual average dust deposition due to the proposed Modification plus the assumed background level is predicted to not exceed the applicable criterion. Cumulative annual average particulate matter less than 10 microns in size (PM_{10}) and annual average total suspended particulate concentrations are also predicted to not exceed the relevant criteria. Predicted incremental 24-hour PM_{10} concentrations (i.e. modified Tarrawonga Coal Mine only) are not predicted to be above the relevant criterion at any privately-owned receivers. Cumulative incremental 24-hour PM_{10} concentrations (i.e. modified Tarrawonga Coal Mine plus background) are predicted to be below the relevant criteria for the majority of surrounding dwellings, but are predicted to exceed the criteria at one private residence. However, these exceedances are considered to be background-driven rather than mine-related. TCPL would continue to use on-site dust control measures to minimise impacts on air quality associated with the modified Tarrawonga Coal Mine.

- A Biobanking assessment has been prepared for this EA and has identified that the native vegetation that would be cleared by the proposed open cut extension consists of 36.8 ha of re-growth White Cypress Pine – Narrow-leaved Ironbark Shrub/Grass Open Forest of the Western Nandewar Bioregion. The area that would be disturbed by the proposed soil stockpile is derived grassland devoid of trees and has a history of grazing and cultivation. Notwithstanding, it and one of the new infrastructure areas, occupy a total of 22.3 ha and have been classified as White Box Grassy Woodland of the Nandewar and Brigalow Belt South Bioregion.

  All of the White Box Grassy Woodland meets the criteria for the NSW *Threatened Species Conservation Act, 1995* Box-Gum Woodland Endangered Ecological Community, and 0.8 ha meets the criteria for the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* Box-Gum Woodlands and Derived Grasslands Critically Endangered Ecological Community.

  The Biobanking assessment calculated the number of credits (3,051) required to account for the proposed impacts. These are available within Whitehaven's Regional Biobank Site adjacent to the Kelvin State Forest, which is located approximately 15 km to the south-east of the proposed Modification. TCPL intends to enter into a Biobanking Agreement for the proposal.

  No significant impacts on NSW or Commonwealth-listed threatened flora or fauna species are predicted to occur as a result of the proposed Modification.

  TCPL would continue to implement existing management measures to minimise the potential impacts of the modified Tarrawonga Coal Mine on flora and fauna (e.g. pre-clearance surveys, salvage and use of cleared vegetation in rehabilitation, bushfire management, weed and feral animal control).

- Mine landforms would continue to be progressively rehabilitated and undisturbed areas within and adjoining ML 1579 would be fenced and regenerated in order to improve continuity and connectivity with native vegetation remnants. The post-closure land use objectives would remain unchanged, with the exception of 61 ha of rehabilitated Northern Emplacement and in-filled open cut that was originally proposed to be returned to agricultural land. The main reasons for this change are:

  - with the proposed change to the Northern Emplacement design it is unlikely to be feasible to return the land to class 3 land capability and land suitability;
  - the originally proposed area of agricultural land was to be surrounded by native vegetation and fauna habitat areas on all sides which would make it difficult to access the area for agricultural activities; and
  - rehabilitation to native vegetation and fauna habitat would allow better integration with the native vegetation in the Leard State Forest to the north of ML 1579.

The Mining Operations Plan would be reviewed and updated, and a Mine Closure Strategy would be prepared in accordance with Condition 57 of the Development Consent to incorporate the final land use objectives, rehabilitation concepts and activities for the modified Tarrawonga Coal Mine. TCPL would continue to report on the progress of rehabilitation activities in the Annual Environmental Management Report.

- A Cultural Heritage Assessment was conducted for the proposal in accordance with relevant guidelines and in consultation with Aboriginal stakeholders. The study identified one Aboriginal cultural heritage site (an isolated find of two stone artefacts) within the proposed Modification disturbance area. This site is considered to have low Aboriginal, scientific and educational significance. TCPL would lodge application(s) for Aboriginal Heritage Impact Permit(s) under the NSW *National Parks and Wildlife Act, 1974,* as required. The existing Aboriginal Cultural Heritage Management Plan would be reviewed and revised to incorporate the findings of the Cultural Heritage Assessment.
- The modified Tarrawonga Coal Mine would not introduce new hazardous materials or change the storage or transport arrangements of hazardous materials of the approved Tarrawonga Coal Mine. Further, the proposed Modification would not change the potential impact mechanisms to the environment, the public, and public property, and their associated consequences and likelihoods, to the extent that risk levels would change from those previously assessed for the Preliminary Hazard Analysis.
- The proposed Modification would not change the maximum number of daily traffic movements to and from the approved Tarrawonga Coal Mine. However, the additional 4 Mt of coal to be hauled from the site would increase the overall number of truck movements to and from ML 1579. These additional truck movements would result in additional wear and tear along the coal haulage route. Whitehaven has entered into road maintenance agreements with the Narrabri Shire Council and the Gunnedah Shire Council in accordance with Condition 43 of Schedule 4 of the Development Consent. The scope and coverage of the existing road maintenance agreements are sufficiently broad to cover the additional wear and tear on the coal haulage route associated with the proposed Modification.
- The modified Tarrawonga Coal Mine would not change the approved life of the Tarrawonga Coal Mine (i.e. 8 to 10 years), however it would provide additional economic benefits to the region through the additional 4 Mt of coal to be mined. This additional coal would lead to additional royalty payments to the State of NSW.
- TCPL makes numerous contributions to local and regional community initiatives through financial sponsorship and in-kind support. This would continue throughout the life of the modified Tarrawonga Coal Mine.
- The mechanisms for reporting and consulting with stakeholders would remain unchanged. TCPL's procedures for receiving, investigating, responding to and reporting complaints received from the community, would also continue to operate, providing the local community with a method to register issues or complaints with respect to mining activities at the modified Tarrawonga Coal Mine.

1 INTRODUCTION

1.1 PROJECT OVERVIEW

1.1.1 Purpose of this Report

This document is an Environmental Assessment (EA) for a proposed modification to the existing Tarrawonga Coal Mine (herein referred to as the proposed Modification). The proposed Modification would involve an extension to the existing open cut to enable approximately 4 million tonnes (Mt) of additional coal to be mined. It would also require some changes to the design of the overburden emplacement areas, two additional infrastructure areas, a new soil stockpile and some new water management structures.

This EA has been prepared to accompany an application to modify the existing Tarrawonga Coal Mine Development Consent under section 75W of Part 3A of the New South Wales (NSW) *Environmental Planning and Assessment Act, 1979* (EP&A Act). This EA describes and assesses the potential environmental impacts that could result from the proposed Modification. It also describes the management measures and monitoring programmes that would be adopted during the mine life to avoid or minimise these impacts.

1.1.2 Background

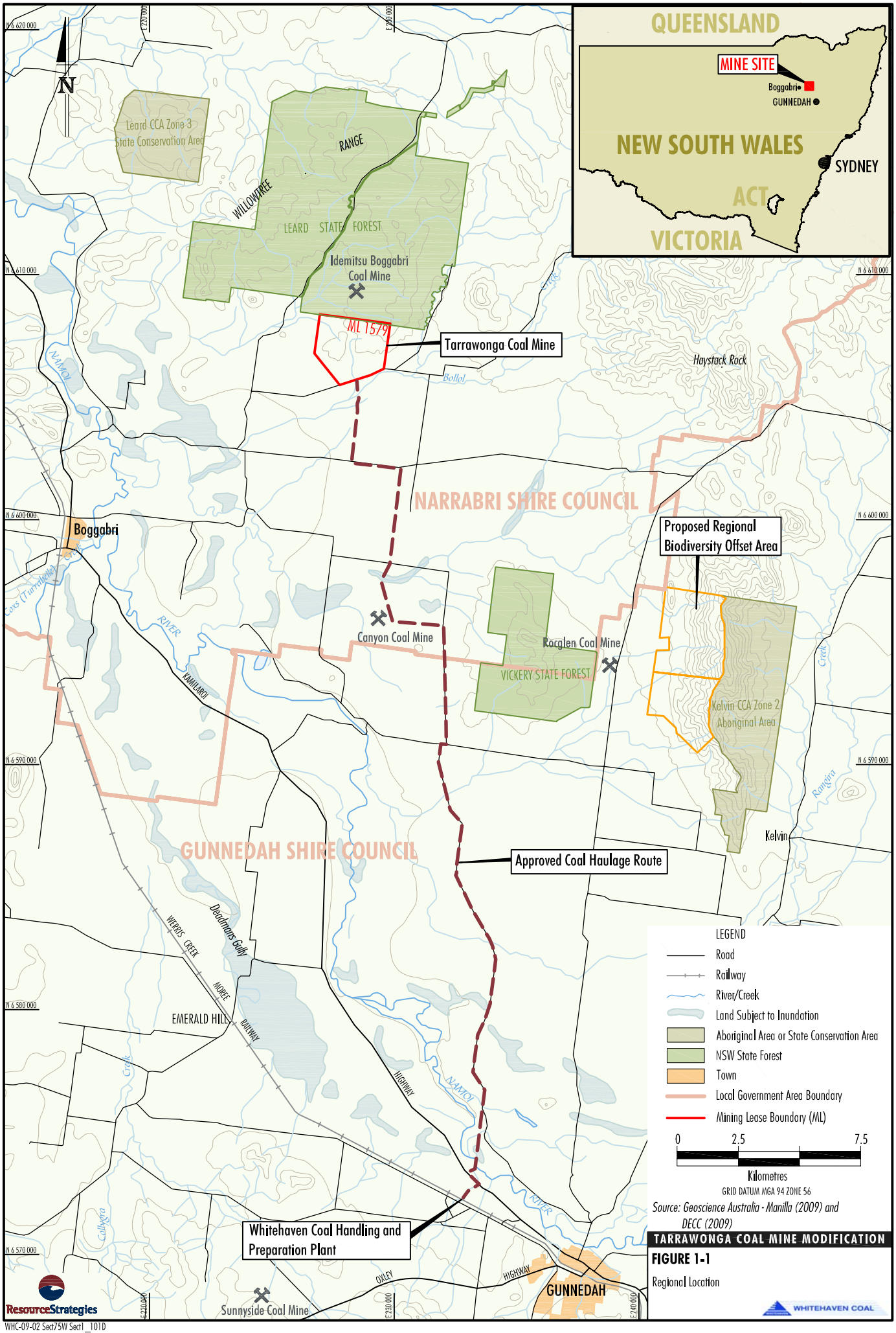
The Tarrawonga Coal Mine is owned and operated by Tarrawonga Coal Pty Ltd (TCPL), which is a joint venture between Whitehaven Coal Mining Pty Ltd (Whitehaven) (70%) and Idemitsu Boggabri Coal Limited (IBC) (30%). The Tarrawonga Coal Mine is located within Mining Lease (ML) 1579 approximately 15 kilometres (km) north-east of Boggabri and 42 km north-northwest of Gunnedah in NSW (Figure 1-1).

The approved Tarrawonga Coal Mine involves construction and operation of an open cut coal mine over an 8 to 10 year period to extract approximately 12.4 Mt of coal at a maximum rate of 2 Mt a year. Overburden generated from the open cut is placed in two adjoining out-of-pit emplacements, and as infill in the mine void. The coal is crushed and screened on-site to a nominal 50 to 150 millimetre (mm) size, and then transported via road to Whitehaven's Coal Handling and Preparation Plant (CHPP), which is located approximately 35 km to the south on the outskirts of Gunnedah (Figure 1-1). At the CHPP the coal is further crushed, screened and washed before being loaded on to trains for dispatch and sale to customers as a low ash, thermal and/or semi-soft coking coal.

The Tarrawonga Coal Mine is subject to Development Consent DA-88-4-2005, which was granted by the NSW Minister for Planning in November 2005 under Part 4 of the EP&A Act. The potential environmental impacts of the Tarrawonga Coal Mine were assessed in the 2005 East Boggabri Joint Venture Environmental Impact Statement (2005 EIS) (R.W. Corkery and Co Pty Ltd [R.W. Corkery], 2005). Figure 1-2 shows the originally proposed project layout as assessed in the 2005 EIS.

1.1.3 Project Summary

Improved market conditions since the Tarrawonga Coal Mine was approved in 2005 have made mining of higher strip ratio coal economically viable. As a result, TCPL is seeking approval to modify the approved open cut boundary to extend up to approximately 600 metres (m) further east within ML 1579 (Figure 1-3). The additional land disturbance associated with the open cut extension would be approximately 38 hectares (ha). The proposed Modification would enable TCPL to mine approximately 4 Mt of additional coal, with a corresponding increase in overburden of approximately 35 million bank cubic metres (Mbcm). The proposal does not involve changes to the mining method or maximum production rate of 2 million tonnes per annum (Mtpa).



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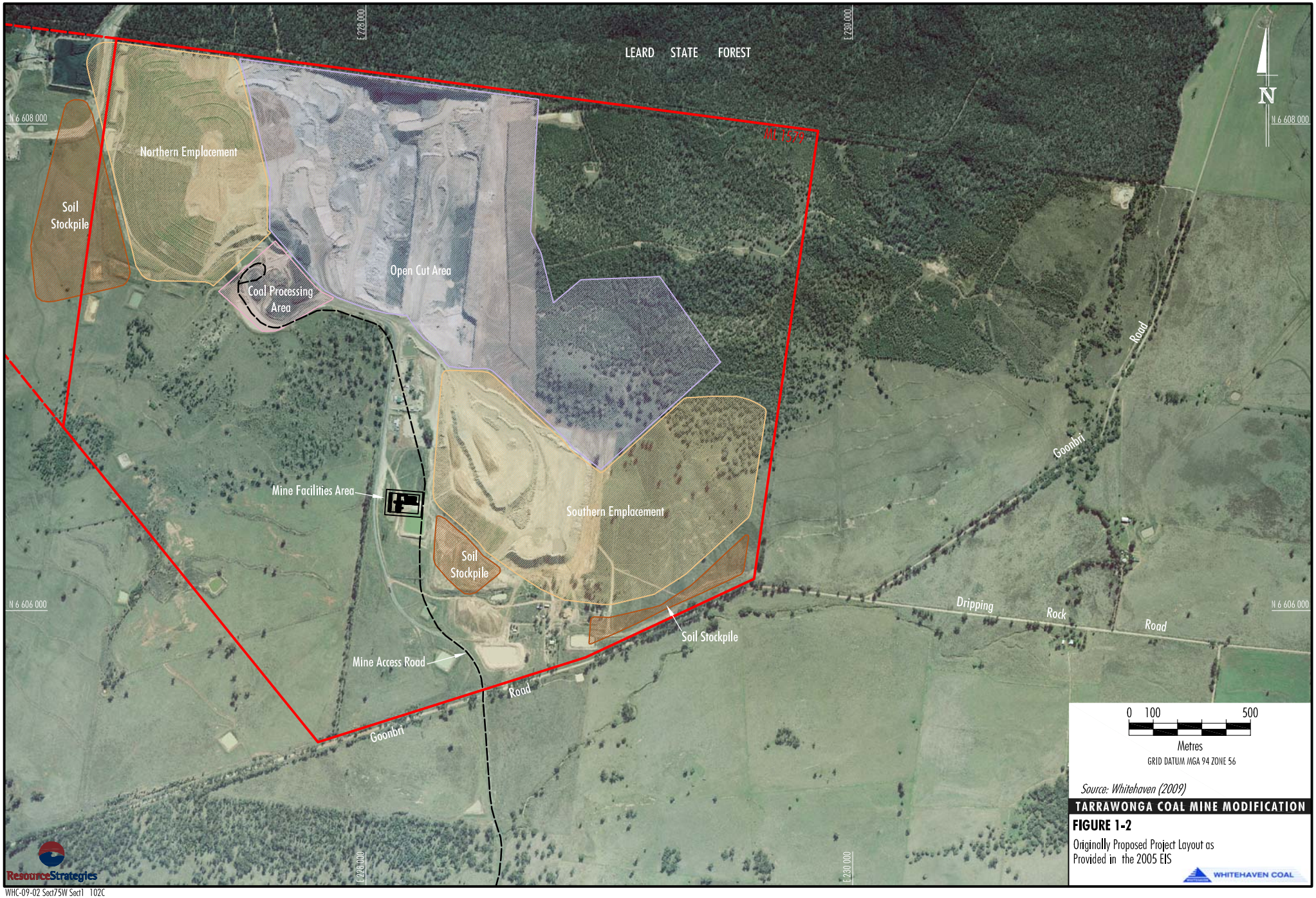

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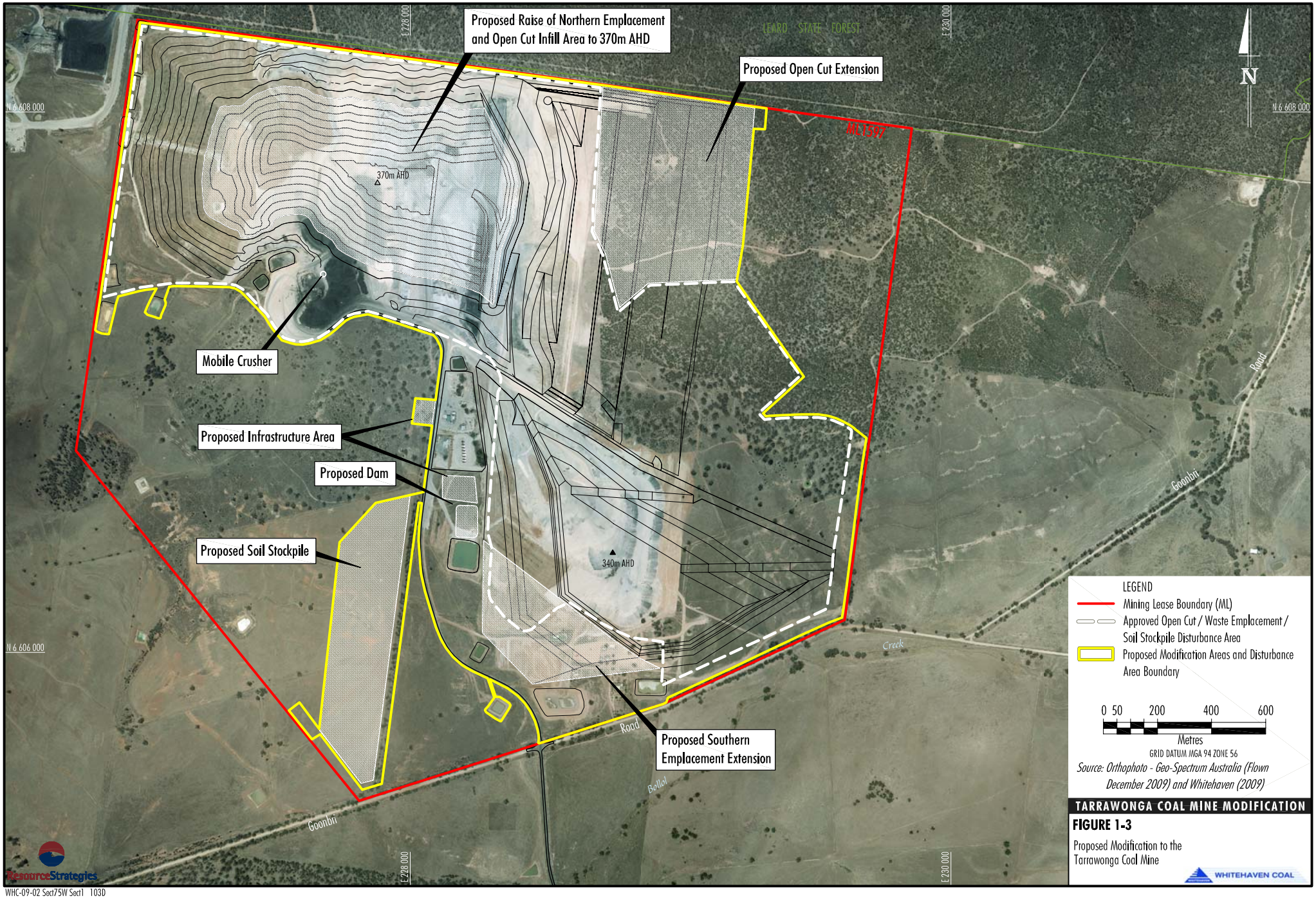

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As part of the proposal TCPL is also seeking to make some modifications to the out-of-pit overburden emplacement areas, soil stockpiles and surface water management structures, and coal processing operating hours, and install two small additional hardstand/infrastructure areas. These proposed changes are described below.

Two out-of-pit overburden emplacements are approved and are partially constructed at the Tarrawonga Coal Mine. The emplacements are located to the north-west and south of the open cut and are known as the Northern Emplacement and Southern Emplacement. They are approved to maximum heights of 330 m Australian Height Datum (AHD) and 340 m AHD respectively. The proposed Modification would involve an increase in the height of the Northern Emplacement to 370 m AHD. The maximum height of the Southern Emplacement would remain at 340 m AHD but it would be extended by approximately 100 to 300 m to the south, into areas previously approved for topsoil stockpiles (Figure 1-3).

Changes to the soil stockpile locations and surface water management structures at the Tarrawonga Coal Mine would be required due to the expanded Southern Emplacement encroaching on the existing stockpiles and water management structures. The proposed new soil stockpile would be located to the west of the main mine access road (Figure 1-3). It would be used during the mine life for the temporary stockpiling of soil materials, which would be reclaimed as required for use in the rehabilitation of the overburden dumps and open cut in-fill areas. The additional land disturbance associated with the soil stockpile would be approximately 21.2 ha. Approximately 335,000 cubic metres (m^3) of topsoil currently contained in the approved stockpiles would be relocated to the new stockpile to enable the Southern Emplacement to be expanded.

The layout of the existing surface water management structures located to the south of the Southern Emplacement would be adjusted to accommodate the expanded dump. Four additional sediment basins, a storage dam, a new mine water dam and associated diversion bunds and channels would be installed. The new structures would be designed to the same containment criteria used for the existing Tarrawonga Coal Mine.

The existing Development Consent for the Tarrawonga Coal Mine contains conditions which specify the operating hours for open cut mining and coal processing. These conditions permit TCPL to:

- carry out processing on the mine site between 7.00 am and 10.00 pm Monday to Friday, and 7.00 am and 6.00 pm Saturday, excluding public holidays;
- carry out open cut mining operations on the mine site between 7.00 am and midnight Monday to Friday, midnight and 3.30 am Tuesday to Saturday, and 7.00 am and 6.00 pm Saturdays; and
- undertake maintenance activities at any time Monday to Sunday.

As part of the proposed Modification TCPL is seeking to modify the coal processing hours so that they are the same as the open cut mining hours.

Two small new hardstand/infrastructure areas are included as part of the proposed Modification. The first area would be located to the immediate west of the existing infrastructure and administration area and would occupy an area of approximately 0.6 ha (Figure 1-3). This area would be used for the lay down of workshop spare parts. The second area would be located to the south-east of the existing administration area and would occupy an area of approximately 0.7 ha (Figure 1-3). It would be used for parking dump trucks.

Whitehaven is planning on developing a domestic coal 'Hub' at the Canyon Coal Mine, which is located approximately 10 km to the south of the Tarrawonga Coal Mine (Figure 1-1). Under the proposal, some of the coal from the Tarrawonga Coal Mine (i.e. up to 450,000 t per annum) as well as some coal from the Rocglen Coal Mine would be diverted from the approved coal haulage route which runs past the Canyon site (Figure 1-1). The coal would then be crushed and screened at the Hub to domestic customers specifications (i.e. 15 to 35 mm diameter), before being trucked down to Gunnedah via the remainder of the approved coal haulage route.

Since the 2005 EIS did not contemplate some of the Tarrawonga coal being diverted to a Hub at the Canyon Coal Mine, a modification to the Tarrawonga Development Consent is sought to enable this integration with the proposed Hub (if it is approved). The 450,000 t of diverted coal per annum would be a sub-set of the coal produced at the Tarrawonga Coal Mine (i.e. it would be part of, not in addition to, the maximum 2 Mtpa produced at the Mine). Approval for this diversion of coal to the proposed new Hub is sought as part of this modification application.

Whitehaven is currently conducting environmental assessments to support applications for development consent and other necessary approvals for the proposed Hub. While these are pending, TCPL wishes to install and use a mobile crusher at the Tarrawonga Coal Mine (Figure 1-3) to enable coal crushing and screening of the 450,000 t of domestic specification coal per annum to occur at the mine site. Approval for the use of a mobile crusher at Tarrawonga is therefore also sought as part of this modification application.

1.1.4 Project Snapshot

Table 1-1 provides a summary comparison of the approved Tarrawonga Coal Mine and the modified Tarrawonga Coal Mine.

Table 1-1
Comparison of the Approved Tarrawonga Coal Mine and the Modified Tarrawonga Coal Mine

Project Feature	Approved Tarrawonga Coal Mine	Modified Tarrawonga Coal Mine
Mine Life	8 to 10 years.	No change.*
Mining Method	Conventional open cut mining involving sequential removal of topsoil, overburden, interburden, coal extraction, progressive backfilling and rehabilitation.	No change.
Annual Coal Production Rate	Maximum 2 Mtpa.	No change.
Open Cut Operating Hours	7.00 am to 12.00 am Monday to Friday, 12.00 am to 3.30 am Tuesday to Saturday, and 7.00 am to 6.00 pm Saturdays.	No change.
Life of Mine Coal Quantity	Approximately 12.4 Mt.	Increase to approximately 16.4 Mt.
Open Cut Disturbance Area	Approximately 160 ha.	Increase to approximately 198 ha.
Life of Mine Overburden Quantity	Approximately 88.5 Mbcm.	Increase to approximately 123.3 Mbcm.
Out-of-pit Overburden Storage Areas	Northern Emplacement: maximum height: 330 m AHD. Southern Emplacement: maximum height: 340 m AHD.	370 m AHD. No change.
Blasting Hours	9.00 am to 5.00 pm, Monday to Friday.	No change.
Run-of-Mine (ROM) Coal Stockpile	Approximately 150,000 tonnes (t).	No change.

Table 1-1 (Continued)
Comparison of the Approved Tarrawonga Coal Mine and the Modified Tarrawonga Coal Mine

Project Feature	Approved Tarrawonga Coal Mine	Modified Tarrawonga Coal Mine
On-site Coal Crushing and Screening	Loaded onto conveyor via hopper and crushed to 150 mm by the primary crusher. Coal requiring further beneficiation sent to product bin and the remainder crushed to 50 mm in secondary crusher before truck loading.	Installation and use of a mobile crusher at the mine to enable the crushing and screening of up to 450,000 t of domestic coal per annum to 15 to 35 mm, until such time as Whitehaven's proposed Canyon domestic Hub is approved.
On-site Coal Crushing and Screening Operating Hours	Coal processing permitted 7.00 am to 10.00 pm Monday to Friday, and 7.00 am to 6.00 pm Saturdays, excluding public holidays.	Change to be the same as the open cut mining hours.
Product Coal Stockpile	Product coal stockpile area with a capacity of 35,000 to 50,000 t.	No change.
Water Supply	Approximately 118 megalitres (ML) per annum used for dust suppression at mine site and at the coal crushing and load-out facility. Approximately 45 ML obtained from surface inflows to pit area and 73 ML from surface inflows to sediment basins and storage dams.	No change.
Electricity Supply	On-site diesel-powered generators, consisting of a single 600 kilovolt amperes (kVA) generator, one 100k VA generator, and a system of integrated 7.5 kVA generators for lighting movable light plants.	No change.
Road Transport Requirements	Construction and use of internal haul roads and main mine access road. Use of public roads for transport of coal by truck to the Whitehaven CHPP at Gunnedah. Coal dispatch permitted between 7.00 am and 9.15 pm Monday to Friday, and 7.00 am and 5.15 pm Saturdays.	Up to 450,000 t of coal per annum to be diverted from the coal haulage route into the domestic coal Hub at the Canyon Coal Mine (if approved) for processing. Once crushed and screened to domestic customer specifications the coal would then trucked via the approved haulage route to Gunnedah.
Mine infrastructure, service facilities and soil stockpiles	Crib hut, offices, hardstand, first aid building, maintenance workshop, toilets, wash bay, and light vehicle parking area. Topsoil stockpiles located to the south of the Northern Emplacement and the Southern Emplacement.	Additional 0.6 ha and 0.7 ha areas to the west and south-east of the existing administration building. Additional 21.2 ha soil stockpile.
Workforce	67 full-time on-site personnel plus additional contract personnel employed on an as-needs-basis.	No change.

* The additional 4 Mt of coal to be accommodated by operating at the maximum approved mining rate of 2 Mtpa for longer, however the overall mine life would still not exceed the originally estimated 8 to 10 year period.

1.1.5 Land Use, Tenure and Zoning

Land use in the vicinity of the Tarrawonga Coal Mine is dominated by grazing (primarily cattle) and cereal/fodder cropping in the flatter and more fertile areas to the south, east and west. State-owned forestry (Leard State Forest) and another coal mining operation (Boggabri Coal Mine) occur to the north of the Tarrawonga Coal Mine.

TCPL holds two mining tenements in the immediate vicinity of the Tarrawonga Coal Mine (i.e. ML 1579 and Exploration Licence [EL] 5967). Figure 1-4 shows these mining tenements, plus tenements held by other companies in the areas surrounding the Tarrawonga Coal Mine. Also shown on Figure 1-4 is the approximate boundary of the currently approved Boggabri Coal Mine. The Boggabri Coal Mine is owned and operated by Boggabri Coal Pty Ltd, which is a 100% owned subsidiary of IBC. It is an independent and separate mining operation to the Tarrawonga Coal Mine, and has been in operation for approximately three years.

TCPL currently owns land within ML 1579 and EL 5967, as well as several properties surrounding the Tarrawonga Coal Mine. Relevant land ownership information for parcels of land within the immediate vicinity of the Tarrawonga Coal Mine tenements is provided on Figures 1-5a and 1-5b. Land owned by Boggabri Coal Pty Ltd is also shown on Figure 1-5a.

ML 1579 is located within the Narrabri Local Government Area (LGA) on lands designated as General Rural Zone (1a) under the *Narrabri Local Environmental Plan, 1992* (Narrabri LEP). Figure 1-1 shows the boundary between the Narrabri LGA and Gunnedah LGA to the south.

1.1.6 Proponent

The registered and principal office for Whitehaven is:

Whitehaven Coal Mining Pty Ltd
Level 9, 1 York Street
SYDNEY NSW 2000
Telephone (02) 8507 9700

The contact details for TCPL are:

Tarrawonga Coal Pty Ltd
PO Box 600
GUNNEDAH NSW 2380
Telephone (02) 6742 4337

1.2 STRUCTURE OF THIS DOCUMENT

This EA is structured as follows:

Section 1 — Provides an introduction to the proposed Modification and the purpose of this EA, describes the structure of this EA and provides a summary of the consultation undertaken.

Section 2 — Describes the approved Tarrawonga Coal Mine and the proposed Modification.

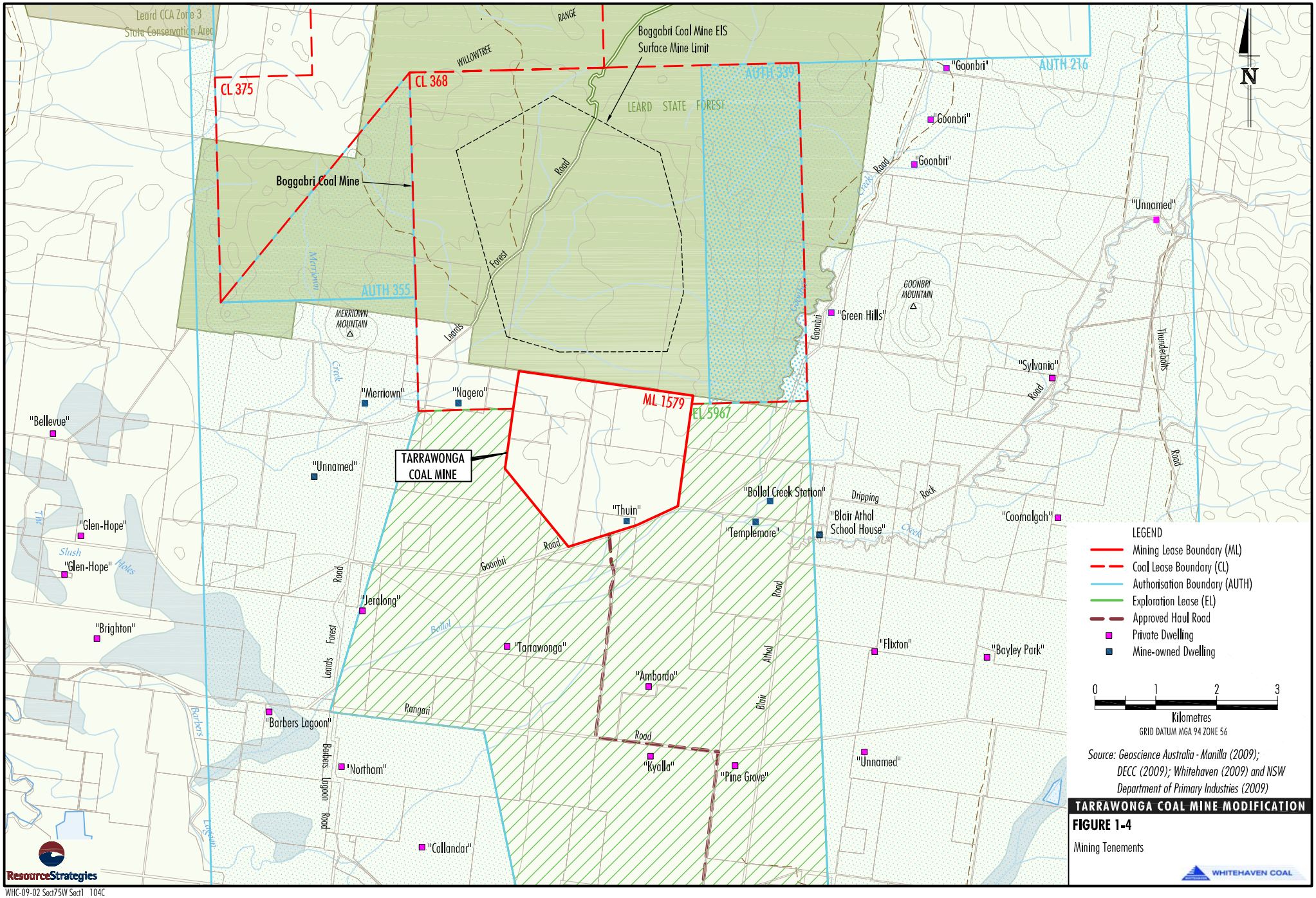
Section 3 — Outlines the relevant statutory provisions and provides a justification for the proposed Modification.

Section 4 — Details the environmental assessment for the proposed Modification including a description of the existing environment, assessment of potential impacts and a description of measures that would be implemented to avoid, minimise, mitigate, offset, manage and/or monitor the impacts.

Section 5 — Details rehabilitation objectives, proposed final mine landforms, decommissioning activities, final land use, rehabilitation procedures and rehabilitation monitoring.

Section 6 — Provides a conclusion to this EA.

Section 7 — Lists documents and reports referenced in this document.



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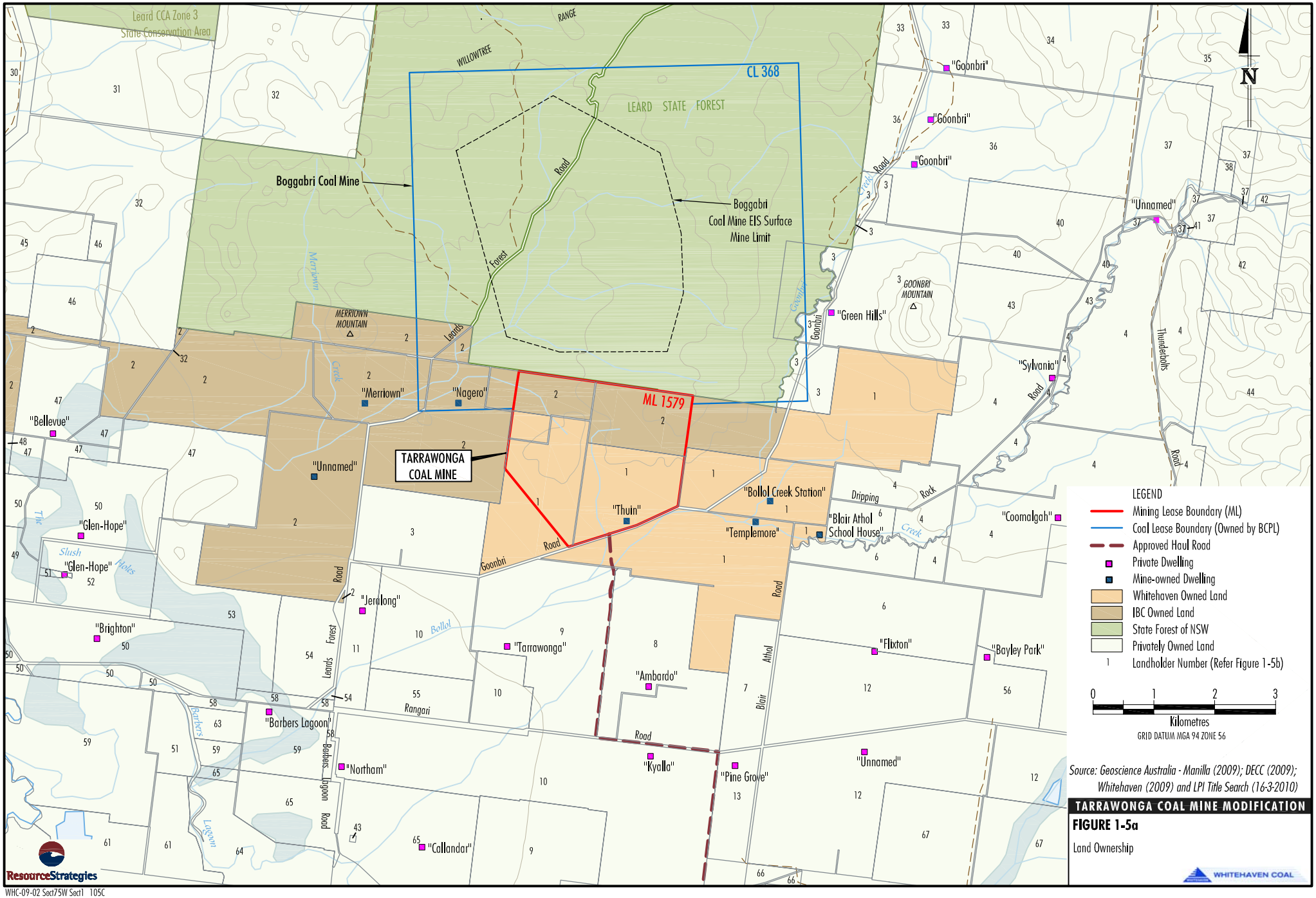

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Referenece No.	Landholder
1	Whitehaven Coal Mining Pty Limited
2	Boggabri Coal Pty Limited
3	Bradlock Pty Ltd
4	James Edward Picton, Robynne Jacqueline Picton
6	Gregory Owen Myers Johnson
7	Peter Laird, Anne Catherine Laird
8	David James Wellwood
9	Robert Peter Mcgregor, Rhonda Daphne Mcgregor
10	Robert Roy Crosby, Pamela Lake Crosby
11	Hazel May Lockwood
12	John Leslie Alker
13	Morris Alexander Bull, Carol Margaret Bull, Jacqueline Margaret Bull, Stephanie Louise Bull
30	Bresrow Pty Ltd
31	Michael John Nott, Maree Louise Nott
32	Aston Coal 2 Pty Ltd
33	Bank of New South Wales
34	Neil Francis Smith
35	Christopher Donald Baldwin, Carolyn Anne Baldwin
36	Vincent Patrick Mcauliffe, Samantha Marguerite Mcauliffe
37	Peter Andrew Devine
38	Herbert John Lynch
40	Paul Michael Mainey, Marie Isobelle Mainey
41	Jovan Milosevski, Trajanka Milosevski
42	Peter John Brien, Donna Maree Austin
43	Narrabri Shire Council
44	Philip Wallace John Pritchard, Maree Elizabeth Mcdonald-pritchard
45	Marilyn Frances Hart, Penelope Frances Rice, Timothy Thompson Hart, Sophie Louise Hart
47	Kevin Robert Druce
48	Robert William Grover, Annette Grover, Robert William Grover
49	Richard John Browning, Elaine Joy Browning
50	Russell John Heiler
51	David Victor Gillham
52	David Victor Gillham, Richard John Gillham
53	Lachlan Edward James, Katherine Emma Woodward
54	Keith Robert Pryor, Kerryn Anne Pryor
55	Bart James Crosby
56	Amy Isabel Myers Johnson, Trent Robert Hall
58	The State Of New South Wales
59	Kenneth David Gillham
60	James Michael Mckechnie, Nicole Mary Mckechnie
61	A D Watson Holdings Pty Ltd
63	Keith Lionel Grover
64	Edward Cecil Clarke, Jill Elaine Clarke
65	Robert Peter Mcgregor
66	Trent Robert Hall, Amy Isabel Myers Johnson
67	Iain Macleod Hall

Source: LPI Title Search (16-3-2010)

TARRAWONGA COAL MINE MODIFICATION

FIGURE 1-5b
Relevant Land Ownership List

ResourceStrategies

WHITEHAVEN COAL

Appendices A to F contain supporting documentation, including a number of independent specialist reports:

Appendix A	Geochemistry Assessment
Appendix B	Noise and Blasting Impact Assessment
Appendix C	Air Quality Impact Assessment
Appendix D	Surface Water Assessment
Appendix E	Cultural Heritage Assessment
Appendix F	Biodiversity Assessment

1.3 CONSULTATION

TCPL has met with and discussed the proposed Modification with the NSW Department of Planning (DoP), NSW Department of Environment, Climate Change and Water (DECCW), NSW Department of Industry and Investment – Mineral Resources (DII-MR), Narrabri Council and Gunnedah Council during the development of this EA in late 2009 and early 2010.

TCPL has also provided a briefing on the proposed Modification to the Community Consultative Committee (CCC) and has distributed a newsletter to local landholders which describes the proposal and notifies them that an environmental impact assessment is being conducted.

Consultation programmes with these regulatory authorities, the CCC, local landholders and other stakeholders will continue throughout the EA assessment process and beyond.

Aboriginal Community

Consultation with Aboriginal stakeholders during the development of this EA has been undertaken in general accordance with the *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (NSW Department of Environment and Conservation [DEC], 2005a) and *National Parks and Wildlife Act 1974: Part 6 Approvals Interim Community Consultation Requirements for Applicants* (DEC, 2004a).

In accordance with these guidelines identification of Aboriginal stakeholders was undertaken via:

- public advertisement;
- written letters of notification to the Red Chief Local Aboriginal Land Council (Red Chief LALC), Registrar of the NSW *Aboriginal Land Rights Act, 1983*, NTS Corp Limited, DECCW, NSW Native Title Tribunal, Namoi Catchment Management Authority (CMA), Narrabri Shire Council, Bigundi Biame Gunnedarr Traditional People, Min Min Aboriginal Corporation and Gunida Gunyah Aboriginal Corporation; and
- correspondence with Aboriginal stakeholders that responded to the public advertisement and/or written letters of notification.

Nine groups or individuals registered their interest in being consulted in relation to the proposed Modification.

Subsequent consultation with these groups and individuals during the preparation of this EA included:

- provision of draft Aboriginal heritage assessment methodology to the registered Aboriginal stakeholders and consideration of comments received prior to fieldwork;

- Aboriginal heritage survey and site inspection with representation from the registered Aboriginal stakeholders;
- discussions with the registered Aboriginal stakeholders regarding the cultural significance of individual Aboriginal heritage sites, the proposed Modification area and management of identified cultural heritage items;
- provision of a copy of the draft Aboriginal cultural heritage assessment report for review and comment; and
- finalisation of the Aboriginal cultural heritage assessment report including consideration of the comments received from the registered Aboriginal stakeholders.

Further detail is provided in Section 4.7 and Appendix E, including correspondence received from the registered Aboriginal stakeholders in regard to the proposed Modification.

2 PROJECT DESCRIPTION

2.1 DESCRIPTION OF THE APPROVED TARRAWONGA COAL MINE

As described in Section 1.1.2, the Tarrawonga Coal Mine was approved in November 2005 under Part 4 of the EP&A Act. Construction of the mine commenced in 2006. The approved operation involves mining over an 8 to 10 year period to extract approximately 12.4 Mt of coal at a maximum rate of 2 Mtpa.

The coal produced from the Tarrawonga Coal Mine is a high volatility coal which produces a very low sulphur semi-soft coking/thermal coal with typically less than 10% ash. Approximately 65% of the coal produced is suitable for marketing as thermal or semi-soft coking coal without the requirement for washing. The coal typically has low sulphur and phosphorous contents, and exhibits a high energy. The majority of the coal produced is exported to Asia.

The following sub-sections provide a summary overview of the main components of the approved Tarrawonga Coal Mine.

2.1.1 Coal Resource and Mining Method

Eight coal seams occur within the Tarrawonga open cut area. These are listed below in increasing depth from the surface:

- Braymont;
- Bollol Creek;
- Jeralong;
- Jeralong Lower;
- Merriown;
- Merriown Lower;
- Velyama; and
- Nagero.

The coal seams are up to approximately 4 m thick, but average 1.5 m. The total thickness of coal to be mined is approximately 20 m, with the depth below the pre-mining topography varying between 20 and 180 m. The latest Annual Environmental Management Report (AEMR), which covers the period from 1 May 2008 to 30 April 2009, reports the coal resource as being approximately 9 Mt within the current open cut. The cumulative total coal production at the end of the 2008/2009 AEMR reporting period was approximately 2.85 Mt (TCPL, 2009a).

Conventional open cut mining methods are used at the Tarrawonga Coal Mine. The mining sequence typically involves the following sequence of activities:

- separate removal of topsoil and sub-soil using an open bowl scraper;
- removal of friable overburden by scraper;
- drilling and blasting of underlying competent overburden and interburden;
- removal of overburden and interburden by bulldozers and/or excavator and dump trucks, with the overburden placed in and over the mined out areas of the open cut, or in the adjoining out-of-pit emplacements; and

- coal extraction by excavator and loading into haul trucks for transport to the ROM pad.

The Tarrawonga open cut is progressively developed in an easterly direction in approximately 60 m wide strips. In the 2008/2009 AEMR reporting period, the open cut advanced a total of approximately 250 m (TCPL, 2009a).

Two out-of-pit overburden emplacements are approved and are partially constructed at the Tarrawonga Coal Mine. The emplacements are located to the north-west and south of the open cut and are known as the Northern Emplacement and Southern Emplacement (Figure 2-1). They are approved to maximum heights of 330 m AHD and 340 m AHD, respectively.

The Tarrawonga mining fleet during the 2008/2009 AEMR reporting period is shown in Table 2-1.

Table 2-1
2008/2009 Tarrawonga Open Cut Mining Fleet

Item	No. in Operation	Function
O & K RH170 Excavator	2	Overburden excavation and loading
Hitachi EX1900 Excavator	1	Overburden/interburden/coal loading
Terex Dump Truck	7	Overburden/interburden
CAT Dump Truck 777F	3	Overburden/interburden/coal haulage
CAT Dump Truck 777D	1 (p/t)	Overburden/interburden/coal haulage
Terex SK50 Drill	1 (f/t), 1 (p/t)	Blasthole drilling
CAT D11 Dozer	2	Clearing; interburden/coal ripping/pushing; dump maintenance
CAT D10R Dozer	1	Clearing; interburden/coal ripping/pushing; dump maintenance
CAT D11R Dozer	1	Clearing; interburden/coal ripping/pushing; dump maintenance
Water Cart	2	Dust suppression
CAT 16M Grader	1	Road maintenance
CAT 637-2 Scraper	2	Soil removal and stockpiling
Service Truck	1	Machinery servicing
Cummins Genset	2	Power for site offices, workshop and coal loader
Mobile Crusher	1 (p/t)	Crushing
IT38G Loader	2	Loading
Lighting Plant	11	Lighting
CAT 980G Loader	1 (p/t)	Coal pad
CAT 988H Loader	1	Coal pad

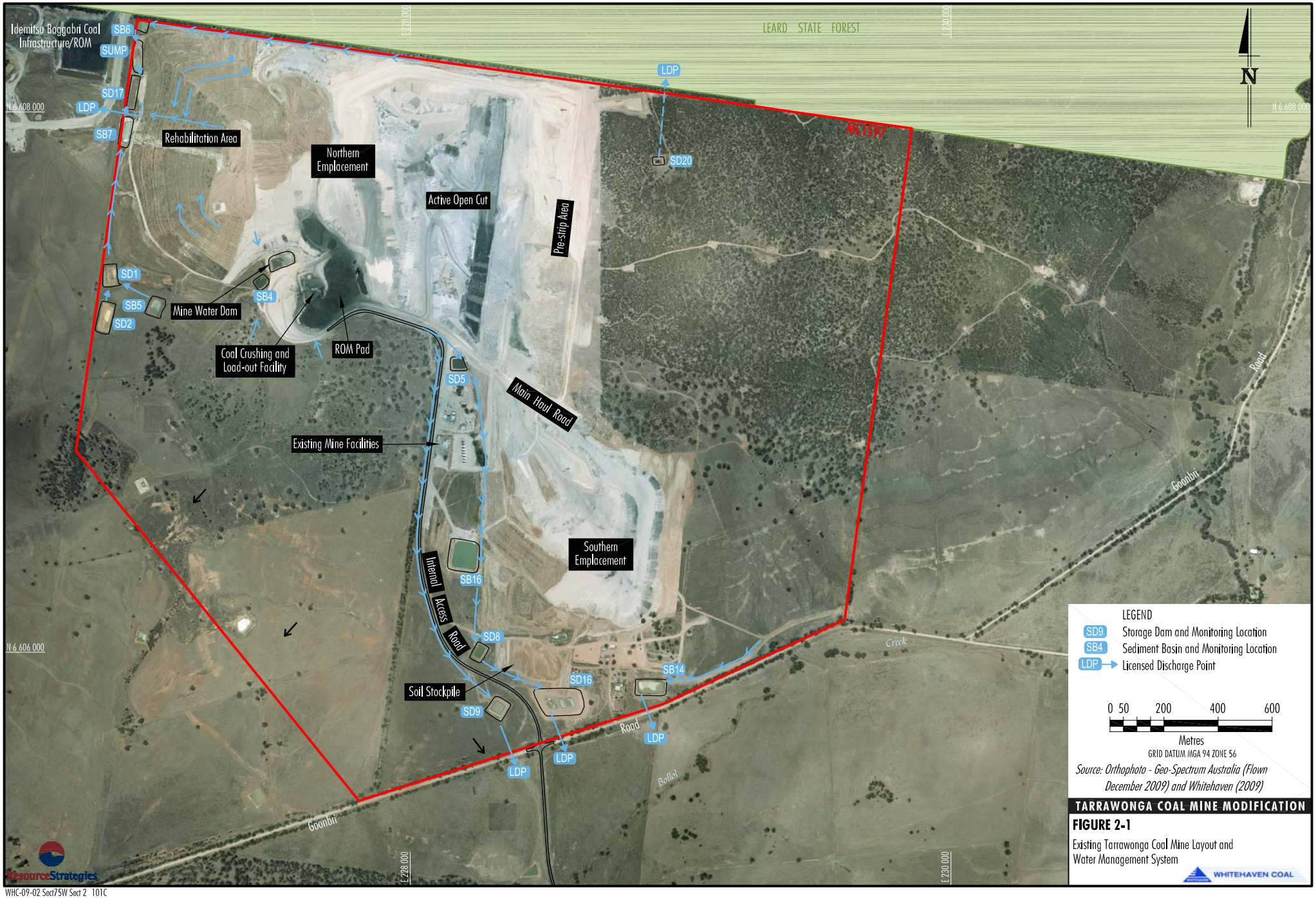
Source: TCPL (2009a).
p/t: part time; f/t: fulltime.

Open cut mining is conducted between the hours of 7.00 am and 12.00 am Monday to Friday, 12.00 am and 3.30 am Tuesday to Saturday, and between 7.00 am and 6.00 pm on Saturdays.

2.1.2 On-site Coal Crushing, Screening and Stockpiling

Coal crushing and screening is conducted on-site at the Tarrawonga Coal Mine. All other coal processing activities (e.g. coal washing) are conducted at the CHPP, which is located approximately 35 km to the south of ML 1579 on the outskirts of Gunnedah (Figure 1-1).

The coal mined from the open cut is transported directly to the ROM pad (Figure 2-1), which has a capacity of approximately 150,000 t, and is able to accommodate various stockpiles of coal including clean bypass coal and coal to be processed through the CHPP.



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At the ROM pad the coal is placed into a 40 t capacity loading hopper with a front-end loader. From here it is processed to 150 mm diameter via the primary crusher. Coal product requiring further beneficiation is sent via a conveyor under a permanent magnet to a 150 to 200 t product bin for truck loading and transport to the CHPP. The remaining coal progresses along the same circuit, through the secondary crusher to a maximum coal size of 50 mm. From here it travels to the product bin via a conveyor for despatch to Whitehaven's rail loading facility at the CHPP.

Coal processing activities at the Tarrawonga Coal Mine occur between 7.00 am and 10.00 pm Monday to Friday, and 7.00 am and 6.00 pm Saturdays, excluding public holidays.

2.1.3 Off-site Transport of Coal

Most of the off-site traffic generated by the Tarrawonga Coal Mine is associated with the road haulage of coal from ML 1579 to the CHPP, and subsequent rail transport to Newcastle and export markets. The coal haulage route between the mine and the CHPP is shown on Figure 1-1. Coal haulage on this route occurs between the hours of 7.00 am and 10.00 pm[1] Monday to Friday, and between 7.00 am and 6.00 pm[2] on Saturdays. A small proportion of transport movements to and from the Tarrawonga Coal Mine are associated with employee and supplier movements.

2.1.4 Water Management and Water Supply System

The approved Tarrawonga Coal Mine water management system is used to manage site runoff, provide erosion and sediment control, and to provide water for dust suppression and for use in the on-site coal crushing and load-out facility.

The performance objectives of the water management system are described in the Site Water Management Plan (SWMP) (TCPL, 2006a) as follows:

- to ensure sufficient quantities of water can be obtained through the capture of 'dirty' water, harvesting of 'clean' water, and extracting/harvesting groundwater to meet the requirements for dust suppression and the coal crushing, screening and load-out operations conducted on the mine site;
- to ensure the segregation of 'dirty' water from 'clean' water;
- to maximise the use of 'dirty' water for dust suppression purposes and to minimise the necessity to harvest 'clean' run-on water;
- to minimise the volume of water discharged from the mine site;
- to ensure any discharge of water from site is conducted in accordance with the requirements of Environment Protection Licence No. 12365 (the EPL);
- to minimise erosion and sedimentation from all active and rehabilitated areas of the mine site;
- to monitor the effectiveness of surface water controls and ensure all relevant surface and groundwater quality criteria are met;
- to monitor the impact on groundwater level, quality and availability;
- to minimise any impacts on the availability of surface water or groundwater to surrounding residents and landholders; and

[1] Note that the last load is dispatched from the site at 9.15 pm (in accordance with Condition 44 of the Development Consent) and arrives at the CHPP by 10.00 pm.

[2] Note that this last load is dispatched from the site at 5.15 pm (in accordance with Condition 44 of the Development Consent) and arrives at the CHPP by 6.00 pm.

- to establish a method of assessing the level of impact on groundwater supply attributable to the mine.

Diversion, collection and storage of clean water at the Tarrawonga Coal Mine is achieved using a series of diversion banks, sediment basins (SBs) and storage dams (SDs). These components have been designed to divert 'clean' water around the site or away from mine disturbed areas. 'Dirty' water is collected in sediment basins where suspended sediments are allowed to settle out of the water column. Mine water is stored in a mine water dam. Water which accumulates in these storages is either used for dust suppression or coal crushing, screening and load-out activities on-site.

The EPL specifies the conditions under which site water can be discharged to receiving creeks and treated effluent can be discharged to land. Licensed Discharge Points during wet weather are at storage dams SD20, SD17, SD16 and SD9, as well as sediment basin SB14. The EPL contains concentration limits for specific contaminants and monitoring and reporting requirements. The contaminant concentration limits are the same as those contained in the Tarrawonga Coal Mine Development Consent. Monitoring is linked to discharge events.

During times of excess water on-site, TCPL preferentially pumps water from the surface water discharge dams directly to water carts and/or pumps to storages back in the sediment basin chain with retained capacity, to reduce potential for wet weather discharge. Where this is not possible, TCPL aims to reduce sediment loads within the surface water discharge dams through flocculation to enable controlled discharge within the EPL limits from the approved discharge points (i.e. SD20, SD17, SD16, SD9, and SB14).

The main components of the existing water management system are shown on Figure 2-1 and are summarised below:

- A 'dirty' water collection drain has been constructed along the northern perimeter of ML 1597 to intercept drainage from disturbed areas in the northern part of the mine site boundary and ultimately intercept site runoff that would otherwise enter Leard State Forest. The drain conveys this water in a westerly direction to SB6 which is located in the north-western corner of ML 1597. SB6 overflows to a sump and then to SD17 which is a Licensed Discharge Point under the EPL.
- Runoff from the rehabilitated western flank of the northern out-of-pit overburden emplacement is conveyed via a series of drains and a drop structure to SB7 and SD17. SB7 overflows to SD17 which is a Licensed Discharge Point.
- A dirty water drain has been constructed on the western side of the main internal access road. The drain intercepts runoff from the road and channels it in a southerly direction to SD9 which is a Licensed Discharge Point.
- A system of 'dirty' water banks and drains at the toe of the western slopes of the Southern Emplacement are used to intercept runoff from overburden emplacement and direct it to SB16 and SD8 and ultimately to SD16, which is a Licensed Discharge Point. Runoff intercepted from the southern slopes of the Southern Emplacement is directed to SD16 or SB14 which are both Licensed Discharge Points.

Under the approved, revised SWMP (TCPL, 2006a) all drainage management structures are to be constructed prior to the commencement of surface disturbance activities in the particular area. Design of these structures is to be based on Landcom (2004).

Water for dust suppression is sourced from 'dirty' water runoff collected on-site. Any shortfall is supplemented with 'clean' water. The main source of water for dust suppression at the coal crushing and load-out facility is from the Mine Water Dam and SB4. Approximately 73 ML of water was sourced from the site water management storages during the 2008/2009 AEMR reporting period (TCPL, 2009a).

Water captured in the open cut originates from coal seam inflows (including overburden and interburden) and catchment runoff. Captured water is allowed to settle in an in-pit collection sump which has a nominal capacity of approximately 3 to 4 ML. Water which collects in the sump is pumped to the mine water dam located near the coal crusher, which is also used to supply water for dust suppression on the haul road. Approximately 45 ML of water was obtained from the open cut during the 2008/2009 AEMR reporting period (TCPL, 2009a).

Make-up water for the site can be sourced from a licensed bore if required. No water was extracted from the bore during the 2008/2009 AEMR reporting period (TCPL, 2009a).

2.1.5 Waste Management

Waste types produced at the Tarrawonga Coal Mine include the following:

- general domestic wastes from the on-site buildings and routine maintenance consumables;
- fencing materials;
- oil and grease;
- sewage;
- mine equipment and tyres; and
- potentially contaminated water from the maintenance workshop, wash-down pad and fuel storage areas.

General domestic wastes are collected on-site and placed into large storage receptacles. A contracted industrial waste collector removes the waste on a fortnightly basis. Waste hydrocarbons are stored in a bunded area at the maintenance building and are collected and disposed of by a licensed contractor approximately every three months. Sewage effluent generated at the Tarrawonga Coal Mine is managed through a Council-approved septic system, with pump outs undertaken by a licensed waste disposal contractor on an as-needs-basis.

Used mine equipment tyres are stockpiled on-site until they can be safely disposed of within the mined out areas of the open cut. Potentially contaminated run-off from the workshop, wash-down, and fuel storage areas is directed to an oil separator and containment system.

The Tarrawonga Coal Mine Development Consent also allows coal rejects from the CHPP to be back-loaded and placed in suitable long-term storage areas at the mine site. To date there has been no placement of CHPP rejects at the site.

2.1.6 Other Mine Infrastructure and Service Facilities

Other mine infrastructure and service facilities at the Tarrawonga Coal Mine include the following:

- mine administration offices;
- toilets and shower facilities;
- crib hut;
- hardstand and laydown area;
- bunded fuel bay;
- first aid building;

- maintenance workshop;
- wash bay;
- light vehicle parking facilities;
- communication, power and water reticulation infrastructure; and
- access roads.

2.1.7 Workforce

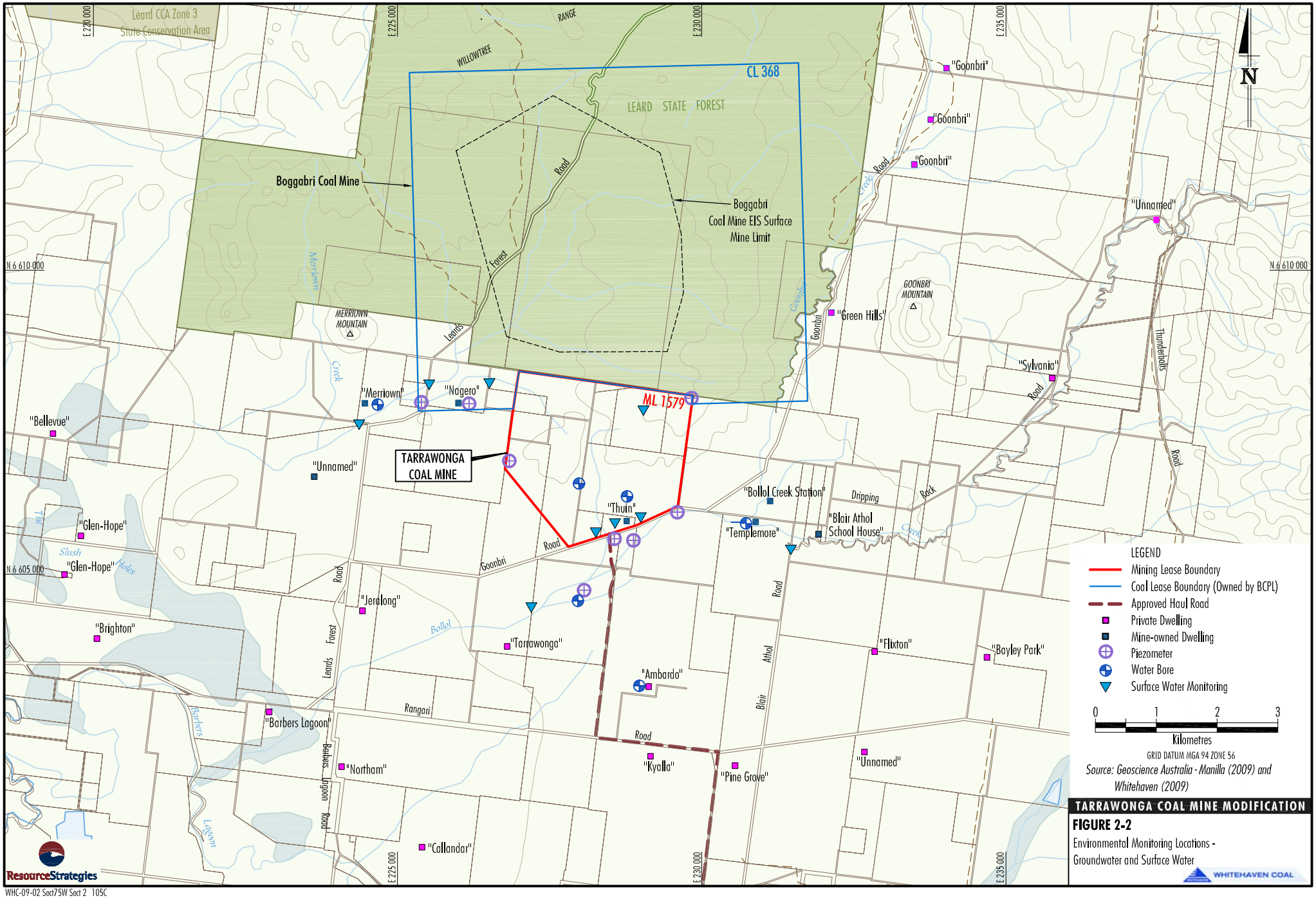
Approximately 67 full-time on-site personnel are employed at the Tarrawonga Coal Mine, with additional personnel contracted for the purpose of hauling coal from the mine site to the CHPP.

2.1.8 Environmental Management and Monitoring

The Project Manager is responsible for day-to-day on-site supervision including the implementation of all environmental management activities. Environmental management at the Tarrawonga Coal Mine has included the development and implementation of a range of environmental management plans, strategies and monitoring programmes, including:

- Environmental Management Strategy (EMS);
- Bushfire Management Plan (BMP);
- Road Noise Management Plan (RNMP);
- Archaeology and Cultural Heritage Management Plan (ACHMP);
- SWMP, which includes an Erosion and Sediment Control Plan, Surface Water Monitoring Program, Groundwater Monitoring Program and Groundwater Contingency Plan;
- Noise Management Program (NMP);
- Environmental Monitoring Program;
- Air Quality Monitoring Program (AQMP);
- Blasting Monitoring Program (BNMP); and
- Flora and Fauna Management Plan (FFMP).

A summary of the Tarrawonga Coal Mine environmental management and monitoring regime is provided in Table 2-2. Figures 2-2 and 2-3 show the locations of the existing environmental monitoring sites in the vicinity of the Tarrawonga Coal Mine.



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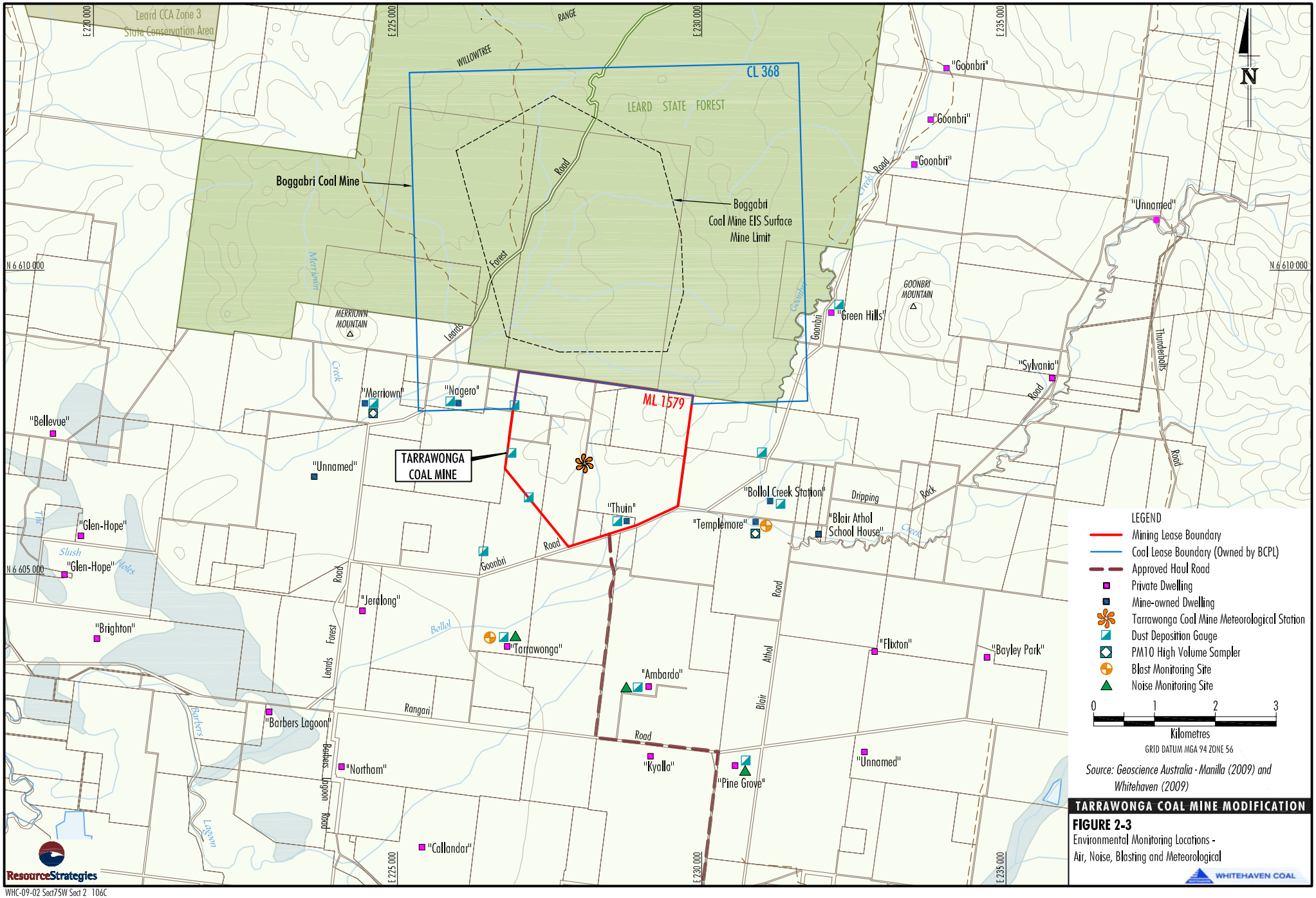

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Table 2-2
Summary of the Tarrawonga Coal Mine Environmental Management and Monitoring Regime

Environmental Aspect	Environmental Management Documentation	Environmental Monitoring
Land Resources	• BMP.	• Appointment of a Fire Officer.
Surface Water	• SWMP; • Surface Water Monitoring Program; and • Watercourse Crossing Management Plan (WCMP).	• Water quality – SD9, SD8, SB16, SD5, SB4, Mine Water Dam, SD17, SB14, BCD, BCU, NCU, NCD, MV.
Groundwater	• Groundwater Contingency Plan; and • Groundwater Monitoring Program.	• Groundwater level – MW-1, MW-2, MW-3, MW-4, MW-5, MW-6, MW-7, MW-8, GW02501, GW02129, GW044997, GW031856, GW052266, GW020432.
Air Quality	• AQMP.	• Dust deposition – EB-3, EB-4, EB-5, EB-6, EB-7, EB-8, EB-9, EB-10, EB-11, EB-12, EB-13, EB-14, EB15. • PM_{10} HVAS – "Merriown" and "Templemore".
Noise and Vibration	• RNMP; • NMP; and • BNMP.	• Attended and unattended – "Tarrawonga", "Ambardo" and "Pine Grove". • Vibration and sound overpressure – "Tarrawonga" and "Templemore".
Cultural Heritage	• ACHMP.	• Aboriginal Stakeholder representative to monitor during soil stripping and ground disturbance work.
Flora and Fauna	• FFMP.	• Rehabilitation monitoring – rehabilitation areas. • Biological monitoring – offset areas.
Visual	• EMS.	• Monitoring undertaken on a complaints basis.
Waste	• EMS.	• A waste tracking system is in place. • Waste management and minimisation are reported in the AEMR.

PM_{10} = particulate matter less than 10 microns in size.
HVAS = High Volume Air Sampler.

Three AEMRs have been produced to date in accordance Condition 3 of ML 1579, and Condition 5 of Schedule 6 of the Development Consent. The AEMRs have generally followed the format identified in the NSW Department of Primary Industries - Mineral Resources (DPI-MR) (now the DII-MR) document entitled *Guidelines to the Mining, Rehabilitation and Environmental Management Processes* Version 3 dated January 2006.

2.1.9 Rehabilitation

The rehabilitation and final land use objectives for the Tarrawonga Coal Mine are as follows.

Areas affected by mining – short-term

- Stabilise all earthworks, drainage lines and disturbed areas that are no longer required for mine-related activities.
- Reduce the visibility of mining activities from adjacent properties and the local road network.

Areas affected by mining – long-term

- Provide a low maintenance, geotechnically stable and safe landform which is commensurate with a variety of agricultural land uses and/or nature conservation.
- Blend created landforms with the surrounding land fabric.

- Revegetate the majority of the post-mining landforms with communities which emulate the existing vegetation communities or those that occurred prior to agricultural related disturbance.

Areas unaffected by mining

- Remove grazing pressure from areas of relatively intact native tree, shrub and grassland communities and thereby encourage the extension/diversification of those communities.
- Undertake plantings as a means of extending or encouraging the development of native bushland communities.

Rehabilitation is conducted progressively and has primarily focused on the western portion of the Northern Emplacement. To date approximately 30 ha of land has been rehabilitated at the site. Of this approximately 11 ha has progressed to the final rehabilitation step and can be classified as native forest/ecosystem. Approximately 7.5 ha of the Northern Emplacement is considered pasture and grasses, which have been seeded with Japanese Millet, Panic, Purple Pigeon and Rhodes grasses in the summer, and Rye corn, medics and lucerne during the winter. An additional 11 ha (approximately) is currently in the early rehabilitation stage of shaping and topsoil management.

2.1.10 Complaints Record

TCPL maintains a dedicated complaints line, with messages checked daily by the Environmental Manager. In the event of a complaint, details pertaining to the complainant, complaint and action taken are recorded on a "Complaints Form". Complaints are reported to the CCC and are documented in the AEMRs.

2.2 DESCRIPTION OF THE PROPOSED MODIFICATION

2.2.1 Additional Coal Resource and Open Cut Extension

TCPL is seeking approval to modify the approved open cut boundary to extend up to approximately 600 m further east within ML 1579. The proposed Modification would enable TCPL to mine approximately 4 Mt of additional coal, with an increase in overburden of approximately 35 Mbcm. The total amount of coal and overburden produced by the Tarrawonga Coal Mine, with the proposed Modification, would be approximately 16.4 Mt and 123.3 Mbcm, respectively.

The proposed Modification does not involve any change to the mining method or maximum production rate of 2 Mt per year. The overall life of the mine would also not be changed, and would remain at 8 to 10 years. This would be achieved by the mine operating at the maximum production rate of 2 Mt per year for longer than was originally envisaged in the 2005 EIS.

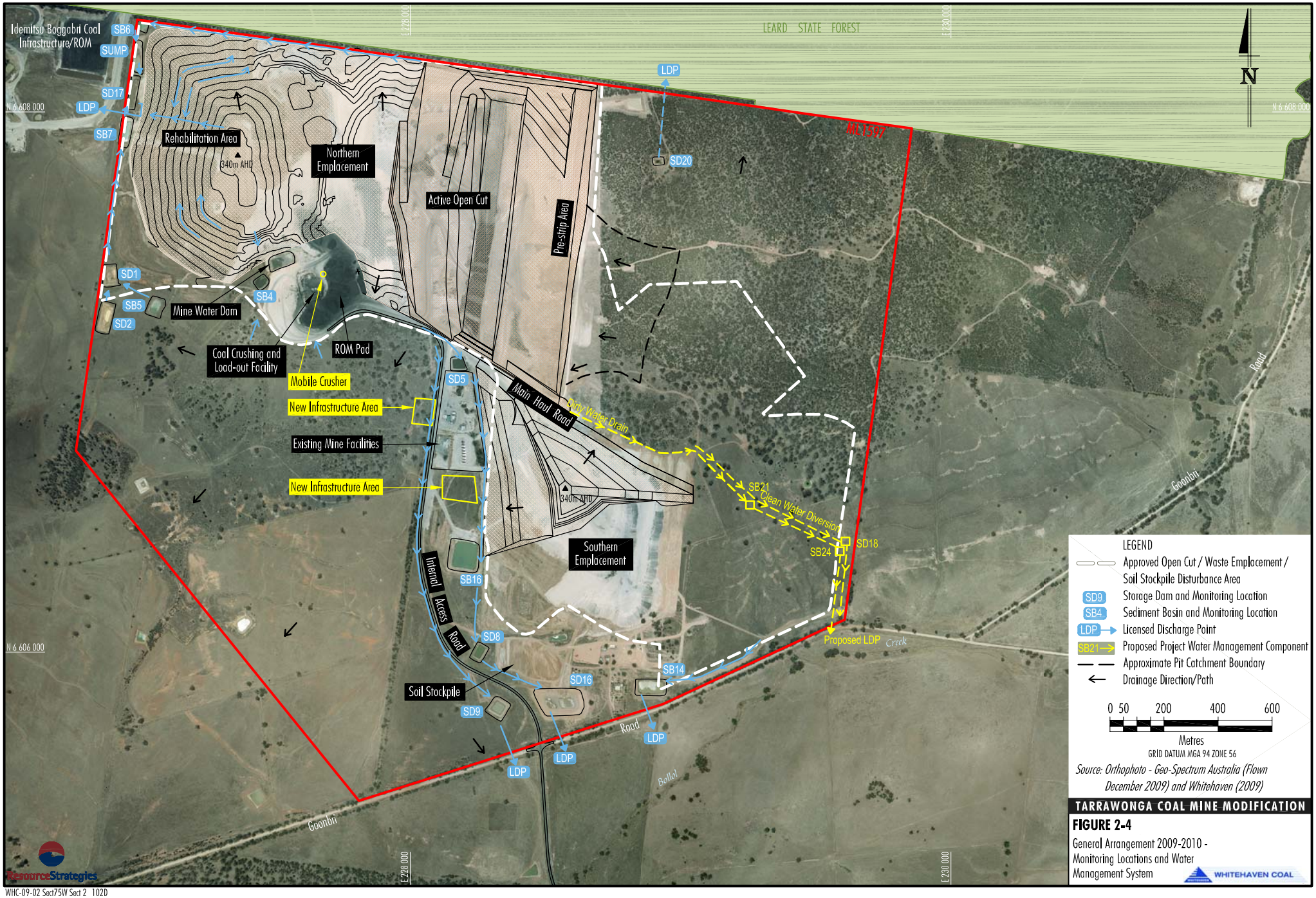
The additional land disturbance associated with the open cut extension would be approximately 38 ha.

2.2.2 Project General Arrangement

Indicative plans showing the general arrangement of the mine for the 2009/2010, 2010/2011, and 2011/2012 years are shown on Figures 2-4, 2-5 and 2-6, respectively. The general arrangement figures show the progressive development of the mine over this time.

2.2.3 Overburden Emplacements and Topsoil Management

Overburden removal from the open cut would be undertaken using the approved method of blasting, excavation, loading and transportation as summarised in Section 2.1.1.



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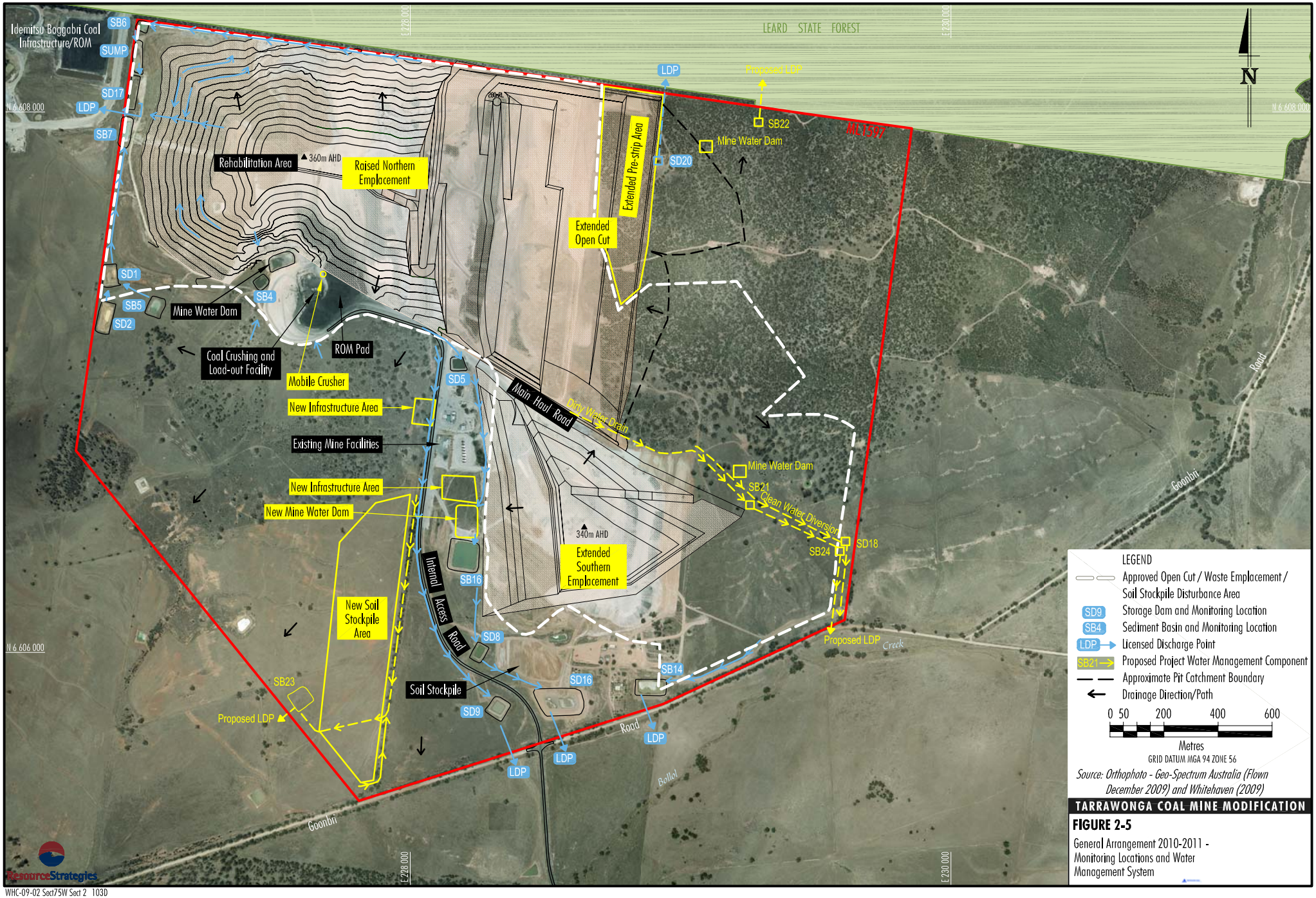

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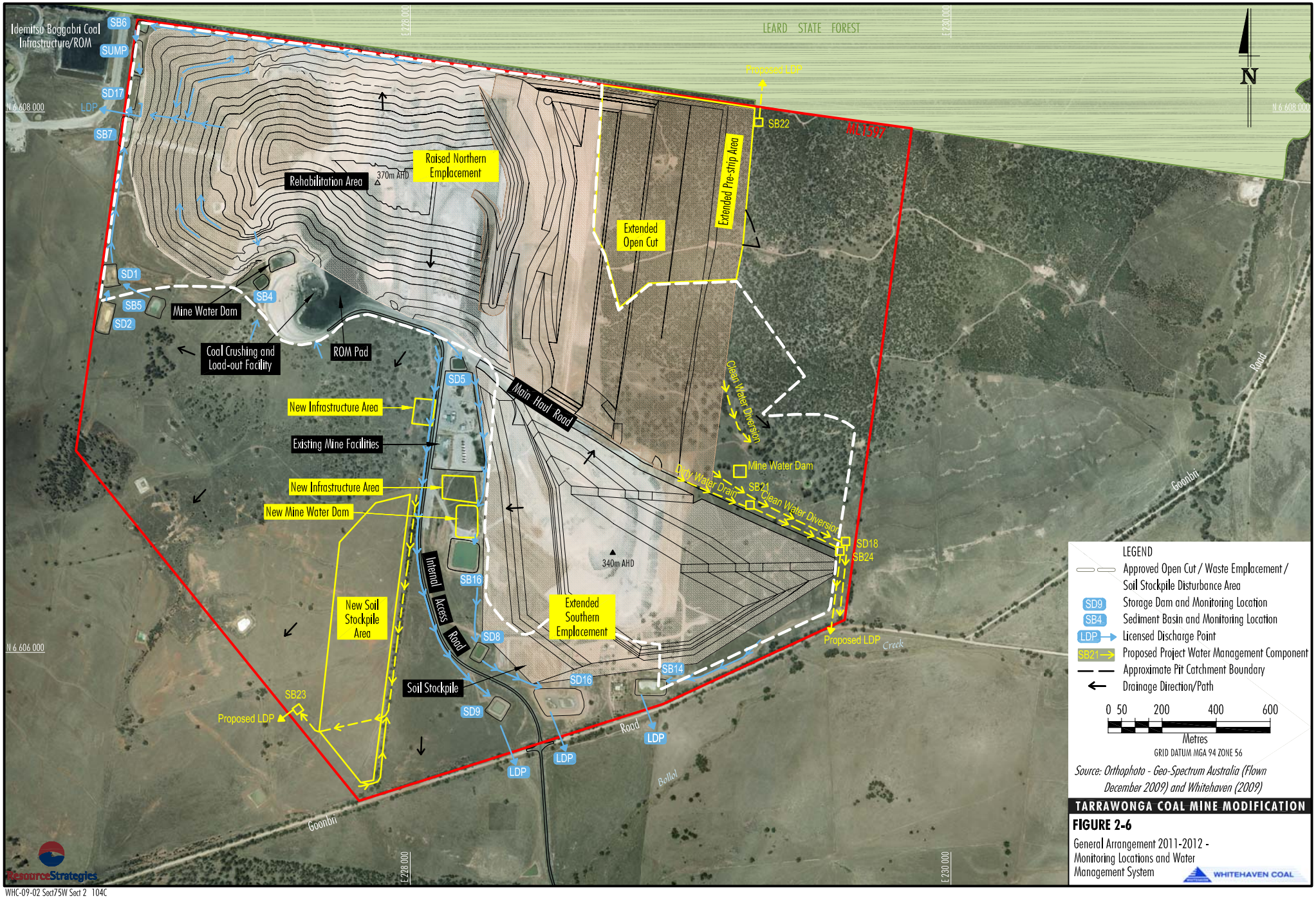

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TCPL is proposing some modifications to the out-of-pit overburden emplacement areas and soil stockpiles as part of the proposed Modification. The Northern and Southern Emplacements are currently approved to maximum heights of 330 m AHD and 340 m AHD, respectively. The proposed Modification would involve an increase in the height of the Northern Emplacement to 370 m AHD with no change to the area disturbed. The maximum height of the Southern Emplacement would remain at 340 m AHD however it would be extended by approximately 100 to 300 m to the south, into areas previously approved for topsoil stockpiles (Figures 2-4, 2-5 and 2-6).

Total overburden production over the life of the mine would increase by approximately 35 Mbcm. However, there would be no change to the maximum annual overburden production rate (i.e. up to 20 Mbcm) as a result of the proposed Modification.

Changes to the location of the soil stockpiles at the Tarrawonga Coal Mine would be required due to the expansion of the Southern Emplacement to the south. In order to allow the expansion of the Southern Emplacement, approximately 335,000 m^3 of topsoil currently contained in the approved stockpiles would be relocated to the new stockpile area. The proposed new stockpile area would be located to the west of the main mine access road. The additional land disturbance associated with the soil stockpile area would be approximately 21.2 ha.

The soil stored in the new stockpile area would be progressively reclaimed during the mine life for use in the rehabilitation of the Northern and Southern Emplacements, and other disturbed areas where necessary.

2.2.4 Mining Equipment

The list of mining equipment to be used at the modified Tarrawonga Coal Mine is provided in Table 2-3. The increase or decrease in equipment numbers, where compared with the current equipment numbers (i.e. Table 2-1), are shown in brackets.

Table 2-3
Mining Equipment for use at the Modified Tarrawonga Coal Mine

Item	Proposed No. In Operation*	Function
O & K RH170 Excavator	3 (+1)	Overburden excavation and loading
Hitachi EX1900 Excavator	1	Overburden/interburden/coal loading
Terex MT3300 Dump Truck	7	Overburden/interburden
CAT Dump Truck 777F	3	Overburden/interburden/coal haulage
CAT Dump Truck 777D	0 (-1)	Overburden/interburden/coal haulage
CAT Dump Truck 785C	4 (+4)	Overburden/interburden/coal haulage
Terex SKF Drill	1	Blasthole drilling
Cubex QXR1320 Gen V Drill	1 (+1)	Blasthole drilling
CAT D11 Dozer	0 (-2)	Clearing; interburden/coal ripping/pushing; dump maintenance
CAT D10R Dozer	1	Clearing; interburden/coal ripping/pushing; dump maintenance
CAT D11R Dozer	4 (+3)	Clearing; interburden/coal ripping/pushing; dump maintenance
Water Cart (road registered)	2 (+2)	Dust suppression
CAT 773 Water Truck	1 (-1)	Dust suppression
CAT 16M Grader	2 (+1)	Road maintenance
CAT 637-2 Scraper	4 (+2)	Soil removal and stockpiling
Service Truck	1	Machinery servicing
Cummins Genset	2	Power for site offices, workshop and coal loader
Mobile Crusher	1	Crushing

Table 2-3 (Continued)
Mining Equipment for use at the Modified Tarrawonga Coal Mine

Item	Proposed No. In Operation*	Function
IT38G Loader	2	Loading
Lighting Plant	11	Lighting
CAT 980G Loader	0 (-1)	ROM pad
CAT 988H Loader	2 (+1)	ROM pad

* Increase or decrease in current numbers (i.e. Table 2-1) are shown in brackets.

2.2.5 Additional Hardstand/Infrastructure Areas

Two small new hardstand/infrastructure areas are included as part of the proposed Modification. Figure 2-4 shows the location of these two areas.

The first area is situated immediately to the west of the existing infrastructure and administration area, and would be used for the lay down of workshop spare parts. It would occupy an area of approximately 0.6 ha. The second area would be located to the south-east of the existing administration area and would occupy an area of approximately 0.7 ha and would be used for the parking of haul trucks.

2.2.6 Coal Processing Hours

The existing Development Consent for the Tarrawonga Coal Mine contains conditions which specify the operating hours for open cut mining and coal processing. These conditions permit TCPL to:

- carry out processing on the mine site between 7.00 am and 10.00 pm Monday to Friday, and 7.00 am and 6.00 pm Saturday, excluding public holidays;
- carry out open cut mining on the mine site between 7.00 am and midnight Monday to Friday, midnight and 3.30 am Tuesday to Saturday, and 7.00 am and 6.00 pm Saturdays; and
- undertake maintenance activities at any time Monday to Sunday.

As part of the proposed Modification TCPL is seeking to modify the coal processing operating hours so that they are the same as the open cut mining hours.

2.2.7 Water Management System

The proposed Modification would require the construction of four additional sediment basins, an additional storage dam, a new mine water dam and associated diversion bunds and channels. The proposed layout of the new water management structures is shown on Figures 2-4, 2-5 and 2-6, and is summarised below.

- Expansion of the open cut would require a new diversion drain and a new sediment basin to be constructed east of the open cut (i.e. SB22).
- Expansion of the Southern Emplacement would require some realignment of the dirty water collection drains and clean water diversion drains around the new disturbance areas. The water collected in the dirty water drains would continue to be directed to the existing dams and basins including SD16 and SB14.

- Additional dirty water collection and clean water diversion drains and a new sediment basin (i.e. SB21) would be required to capture and direct runoff from and around the north-eastern portion of the expanded Southern Emplacement.
- Expansion of the Northern Emplacement eastwards as the open cut progresses would require the construction of additional contour banks and the extension of an existing dirty water collection drain along the northern edge of the ML 1597 boundary.
- The proposed new soil stockpile west of the main access road would require the creation of new dirty water collection drains and a new basin (i.e. SB23).
- Construction of sediment basin SB24 to capture overflow from SB21 to enhance storage capacity and solids settling prior to off-site licensed discharge.
- Construction of storage dam SD18 north of SB24 to capture clean water from the clean water diversion drain.
- A new mine water dam would be required to the south of the existing mine facilities and adjacent to the west side of the Southern Emplacement. The dam spillway would be directed to the existing dirty water collection drains leading to SD16. Provision would also be retained for additional mine water dams to be constructed on the north-east side of the open cut as shown in Figure 2-5.
- Construction of the proposed new hardstand/infrastructure areas would require construction of low permeability bunds and drains. These new hardstand/infrastructure areas would be for equipment parking and spare parts storage only. No equipment servicing would be undertaken in these areas with all servicing and maintenance activity continuing to occur in the existing workshop/ maintenance area.

All of the new diversion drains, sediment basins and storage dams would be constructed using the design criteria specified in the SWMP (TCPL, 2006a).

Due to the proposed expansion of the open cut and development of a new soil stockpile area, TCPL would seek approval for three new Licensed Discharge Points to be added to the EPL. These are described below:

- a new Licensed Discharge Point to be located downstream of new sediment basin SB22 to the east of the expanded open cut for any potential discharge off-site into the Nagero Creek catchment;
- a new Licensed Discharge Point to be located downstream of new sediment basin SB23 at the southwest margin of the proposed soil stockpile located to the west of the main haul road draining to Bollol Creek; and
- a new Licensed Discharge Point to be located downstream of new sediment basin SB24 for possible release off-site to the east towards Bollol Creek.

A Licensed Discharge Point from SD20 exists as part of EPL 12365. SD20 would be mined through as the open cut area advances and therefore this Licensed Discharge Point would be redundant.

Further information on the above components is provided in the Surface Water Assessment for the proposed Modification prepared by Gilbert & Associates Pty Ltd (Gilbert & Associates) (Appendix D).

2.2.8 Integration with Whitehaven's Proposed Domestic Coal Hub at the Canyon Coal Mine

Subject to it obtaining the necessary approvals, Whitehaven is planning on developing a domestic coal 'Hub' at the Canyon Coal Mine, which is located approximately 10 km to the south of the Tarrawonga Coal Mine (Figure 1-1). Under the proposal, some of the coal from the Tarrawonga Coal Mine (i.e. up to 450,000 t per annum) as well as some coal from the Rocglen Coal Mine would be diverted from the approved coal haulage route which runs past the Canyon site (Figure 1-1). The coal would then be crushed and screened to domestic customers specifications at the Hub, before being trucked down to Gunnedah via the remainder of the approved coal haulage route and then on to domestic customers. Whitehaven is currently preparing the applications and environmental assessments for obtaining development consent and other necessary approvals from the relevant regulatory authorities.

Since the original Tarrawonga proposal assessed in the 2005 EIS did not contemplate some of the Tarrawonga coal being diverted to a domestic coal Hub at the Canyon Coal Mine, a modification to the Tarrawonga Development Consent is sought to enable this integration with the proposed Hub (if it is approved). The 450,000 t of coal per annum that would be diverted to the Hub would be a sub-set of the coal produced at the Tarrawonga Coal Mine (i.e. it would be part of, not in addition to, the maximum 2 Mtpa produced at the Mine).

The Tarrawonga coal haulage trucks entering and exiting the domestic coal Hub at the Canyon Coal Mine would do so in accordance with the approved operating hours specified in the Tarrawonga Development Consent. The Canyon Coal Mine site is located within the property "Whitehaven" which is owned by Whitehaven. The section of the coal haulage route which runs past the proposed Hub is privately owned by Whitehaven.

The environmental impact assessment and approval process for the proposed Hub is underway and expected to conclude in 2010. Pending the outcome of the approval, TCPL wishes to temporarily install and use a mobile crusher at Tarrawonga to enable coal crushing and screening of the 450,000 t of domestic specification coal per annum to occur at the mine site. The proposed mobile crusher would be located on the northern side of the ROM pad (Figures 2-4 and 2-5), and would be used to crush and screen coal to approximately 15 to 35 mm diameter. The mobile crusher would be powered via the existing diesel generator at the Tarrawonga coal crushing and load-out facility. The existing loader and excavator would be used to feed coal into the mobile crusher and to load the road haulage trucks once the coal has been processed. The mobile crusher would be operated during daytime hours only.

3 PLANNING FRAMEWORK AND PROJECT JUSTIFICATION

This section outlines the statutory requirements relevant to the assessment of the proposed Modification. It also provides a discussion and justification for the proposed Modification on economic, social and environmental grounds when considered against the objects of the EP&A Act.

3.1 EXISTING TARRAWONGA COAL MINE APPROVALS

As described in Sections 1 and 2, TCPL's existing Tarrawonga Coal Mine involves open cut mining and overburden placement, on-site crushing and screening, and transport of coal to the CHPP at Gunnedah. These activities are covered by various approvals and licences, key components of which are summarised in Table 3-1 below.

Table 3-1
Existing Tarrawonga Coal Mine Tenements, Licences and Approvals

Issuing/Responsible Authority	Type of Lease, Licence, Approval	Date of Issue	Expiry	Summary
Department of Mineral Resources[1]	EL 5967	24 July 2002 Renewed 4 October 2007	23 July 2012	Approval for exploration.
Minister for Planning	Development Approval (DA) 88-4-2005	9 November 2005	9 November 2017	Approval for the construction and operation of the Tarrawonga Coal Mine.
Environment Protection Authority (EPA)[2]	EPL 12365	9 January 2006	Nil Anniversary date: 9 January Next review: 18 September 2014	Authorises the carrying out of the following activities: mining for coal; and coal works.
Department of Mineral Resources[1]	ML 1579	3 April 2006	2 April 2027	Approval of extraction of coal resources.
Department of Land and Water Conservation[3]	Water Licences 90BL253276 90BL253278 90BL253279 90BL253280 90BL254253 90BL254254 90BL254255	27 April 2006	Nil	Used for groundwater monitoring purposes.

[1] Now the DII-MR.

[2] The EPA is now incorporated within the DECCW.

[3] Now the NSW Office of Water (NOW).

3.2 ENVIRONMENTAL PLANNING AND ASSESSMENT ACT, 1979

3.2.1 Existing Development Consent

The EP&A Act and *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation) set the framework for planning and environmental assessment in NSW. Modification of the Tarrawonga Coal Mine Development Consent is sought under section 75W, which falls within Part 3A of the EP&A Act.

Section 75W of the EP&A Act states:

75W Modification of Minister's approval

(1) In this section:

Minister's approval means an approval to carry out a project under this Part, and includes an approval of a concept plan.

Modification of approval means changing the terms of a Minister's approval, including:

(a) revoking or varying a condition of the approval or imposing an additional condition of the approval, and

(b) changing the terms of any determination made by the Minister under Division 3 in connection with the approval.

(2) The proponent may request the Minister to modify the Minister's approval for a project. The Minister's approval for a modification is not required if the project as modified will be consistent with the existing approval under this Part.

(3) The request for the Minister's approval is to be lodged with the Director-General. The Director-General may notify the proponent of environmental assessment requirements with respect to the proposed modification that the proponent must comply with before the matter will be considered by the Minister.

(4) The Minister may modify the approval (with or without conditions) or disapprove of the modification.

…

Accordingly, an approval granted by the Minister under Part 3A of the EP&A Act to carry out a project may be modified under section 75W.

In addition, clause 8J(8) of the EP&A Regulation provides that certain development consents granted under Part 4 of the EP&A Act may also be modified under section 75W of the EP&A Act. Clause 8J(8) of the EP&A Regulation relevantly states:

8J Transitional Provisions

(8) For the purposes only of modification, the following development consents are taken to be approvals under Part 3A of the Act and section 75W of the Act applies to any modification of such a consent:

…

(c) a development consent granted by the Minister under Division 4 of Part 4 of the Act (relating to State significant development) before 1 August 2005 or under clause 89 of Schedule 6 to the Act,…

The development consent, if so modified, does not become an approval under Part 3A of the Act.

The existing Tarrawonga Coal Mine Development Consent was granted on 9 November 2005 by the NSW Minister for Planning. Schedule 1 to the Development Consent relevantly provides:

State Significant Development: *The proposal is classified as State significant development, under section 76A(7) of the Environmental Planning and Assessment Act 1979, ….*

Clause 89 of Schedule 6 to the EP&A Act relevantly provides:

89 State significant development matters

(1) If a development application for State significant development is pending on the commencement of Part 3A of this Act, the application is to be determined (unless withdrawn by the applicant) as if the amendments made to this Act by Schedule 1 to the 2005 Amending Act had not been made.

(2) A reference in any Act or instrument to State significant development within the meaning of this Act is taken to be a reference to a project to which Part 3A of this Act applies.

The application for the Development Consent, which was for State significant development, was pending on the commencement of Part 3A of the EP&A Act (being 1 August 2005). Accordingly, the Development Consent falls within paragraph (c) of clause 8J(8) of the EP&A Regulation.

Accordingly, by operation of clause 8J(8) of the EP&A Regulation, the existing Tarrawonga Coal Mine Development Consent is taken to be an approval under Part 3A of the EP&A Act for the purposes of the proposed Modification, and section 75W of the Act applies to the proposed Modification.

3.3 OTHER APPLICABLE PLANNING INSTRUMENTS AND STATUTORY APPROVALS

3.3.1 Other Planning Instruments

ML 1579 is located in the Narrabri LGA (Figure 1-1) and is wholly within lands zoned 1(a) (General Rural) under the Narrabri LEP.

Clause 10 of the Narrabri LEP relevantly provides:

(1) The Council shall not consent to an application to carry out development on land within Zone No 1 (a) or 1 (c) unless it has taken into consideration, if relevant, the effect of the carrying out of that development on:

(a) the present use of the land, the potential use of the land for the purposes of agriculture and the potential of that land for sustained agricultural production,

(b) vegetation, timber production, land capability (including soil resources and soil stability) and water resources (including the quality and stability of water courses and ground water storage and riparian rights),

(c) the future recovery of know or prospective areas of valuable deposits of minerals, coal, petroleum, sand, gravel or other extractive materials,

(d) the protection of areas of significance for nature conservation or of high scenic or recreational value, and places and buildings of archaeological or heritage significance, including Aboriginal relics and places,

(e) the cost of providing, extending and maintaining public amenities and services to the land, and

(f) future expansion of settlements in the locality.

(2) As well as the matters referred to in subclause (1), the Council shall take into consideration the relationship of the development to development on adjoining land and on other land in the locality, including the effects of potential aerial spray drift.

…

Under clause 9 of the Narrabri LEP mining is permissible on lands zoned 1(a) with development consent.

Zone Objectives

Pursuant to the Table to clause 9 of the Narrabri LEP, the objectives for land zoned 1(a) (General Rural) under the LEP are to promote the proper management and use of resources by:

(a) protecting, enhancing and conserving:

(i) agricultural land in a manner which sustains its efficient and effective agricultural production potential,

(ii) soil stability by controlling and locating development in accordance with soil capability,

(iii) forests of existing and potential commercial value for timber production,

(iv) valuable deposits of minerals, coal, petroleum and extractive materials by controlling the location of development for other purposes in order to ensure the efficient extraction of those deposits,

(v) trees and other vegetation in environmentally sensitive areas where the conservation of the vegetation is significant to scenic amenity or natural wildlife habitat or is likely to control land degradation,

(vi) water resources for use in the public interest,

(vii) areas of significance for nature conservation, including areas with rare plants, wetlands and significant habitats, and

(viii) places and buildings of archaeological or heritage significance, including the protection of Aboriginal relics and places,

(b) preventing the unjustified development of agricultural land for purposes other than agriculture,

(c) preventing residential development of prime crop and pasture land, except where it is ancillary to agriculture or another use permissible in the zone,

(d) facilitating farm adjustments,

(e) ensuring that any allotment created for an intensive agricultural pursuit is potentially capable of sustaining a range of such purposes or other agricultural purposes,

(f) minimising the cost to the community of:

(i) fragmented and isolated development of rural land, and

(ii) providing, extending and maintaining public amenities and services.

The proposed Modification of the Tarrawonga Coal Mine is considered to be generally consistent with these objectives in that it comprises a relatively minor alteration to an approved coal mine that would extract coal and involves relatively short-term surface developments.

3.3.2 State Environmental Polices

The following SEPPs (further to the Major Developments SEPP discussed in Section 3.2.1) may also be relevant to the proposed Modification.

State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries), 2007

The SEPP (Mining, Petroleum Production and Extractive Industries), 2007 (Mining SEPP), which commenced on 16 February 2007, regularises the various environmental planning instruments that previously controlled mining activities.

Clause 5(3) of the Mining SEPP gives it primacy where there is an inconsistency between the provisions of the Mining SEPP and the provisions of any other environmental planning instrument (except the Major Development SEPP, *State Environmental Planning Policy No. 14 [Coastal Wetlands]* and *State Environmental Planning Policy No. 26 [Littoral Rainforest]*).

- ***Clause 2***

Clause 2 sets out the aims of the Mining SEPP as follows:

(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, and

(b) to facilitate the orderly and economic use and development of land containing mineral, petroleum and extractive material resources, and

(c) to establish appropriate planning controls to encourage ecologically sustainable development through the environmental assessment, and sustainable management, of development of mineral, petroleum and extractive material resources.

- ***Clause 12***

Clause 12 of the Mining SEPP requires that, before determining an application for consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must:

(a) consider:

(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 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, and

(b) evaluate and compare the respective public benefits of the development and the land uses referred to in paragraph (a) (i) and (ii), and

(c) evaluate any measures proposed by the applicant to avoid or minimise any incompatibility, as referred to in paragraph (a) (iii).

Land use in the vicinity of the Tarrawonga Coal Mine is dominated by grazing (primarily cattle) and cereal/fodder cropping in the flatter and more fertile areas to the south, east and west. State-owned forestry (Leard State Forest) and another coal mining operation (Boggabri Coal Mine) occur to the north of the Tarrawonga Coal Mine. The land in the immediate vicinity of the proposed Modification is the Tarrawonga Coal Mine itself. Accordingly the proposed Modification would be generally consistent with the preferred use of the land in the vicinity of the development.

Noise and air quality impact assessments have been conducted for the modified Tarrawonga Coal Mine and these assessments indicate that it would not result in significant additional impacts on adjoining land uses near the approved mine (Sections 4.4 and 4.5, respectively).

As described in Section 4, the modified Tarrawonga Coal Mine would not have a significant impact on regional water resources or users (Sections 4.9 and 4.10), or biodiversity values (Section 4.11), and is not incompatible with the existing land uses within the vicinity of the approved Tarrawonga Coal Mine (Section 4.2). As described in Section 4.14, the modified Tarrawonga Coal Mine would result in continued employment and business opportunities in the Narrabri LGA and adjoining Gunnedah LGA.

TCPL would, where practicable, continue to implement environmental management measures to avoid or minimise incompatibility with existing and future land uses in the vicinity of the mine.

- ***Clause 14***

Clause 14(1) of the Mining SEPP requires that, before granting consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider whether or not the consent should be issued subject to conditions aimed at ensuring that the development is undertaken in an environmentally responsible manner, including conditions to ensure the following:

(a) that impacts on significant water resources, including surface and groundwater resources, are avoided, or are minimised to the greatest extent practicable,

(b) that impacts on threatened species and biodiversity, are avoided, or are minimised to the greatest extent practicable,

(c) that greenhouse gas emissions are minimised to the greatest extent practicable.

In addition, clause 14(2) requires that, without limiting clause 14(1), in determining a development application for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider an assessment of the greenhouse gas emissions (including downstream emissions) of the development, and must do so having regard to any applicable State or national policies, programmes or guidelines concerning greenhouse gas emissions.

The potential impacts of the modified Tarrawonga Coal Mine on surface water and groundwater resources are discussed in Sections 4.9 and 4.10, respectively, including measures to minimise potential impacts. The potential impacts of the modified Tarrawonga Coal Mine on threatened species and biodiversity are discussed in Section 4.11, including measures to minimise potential impacts.

The greenhouse gas emissions assessment for the modified Tarrawonga Coal Mine is provided in Section 4.6, including greenhouse gas abatement measures.

- ***Clause 15***

Clause 15 of the Mining SEPP requires that:

(1) Before granting consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider the efficiency or otherwise of the development in terms of resource recovery.

(2) Before granting consent for the development, the consent authority must consider whether or not the consent should be issued subject to conditions aimed at optimising the efficiency of resource recovery and the reuse or recycling of material.

(3) The consent authority may refuse to grant consent to development if it is not satisfied that the development will be carried out in such a way as to optimise the efficiency of recovery of minerals, petroleum or extractive materials and to minimise the creation of waste in association with the extraction, recovery or processing of minerals, petroleum or extractive materials.

A review of potential coal production indicated that the changes associated with the proposed Modification would ultimately result in more efficient coal recovery. The new infrastructure areas would integrate with the approved infrastructure components and facilities, to minimise the required total surface disturbance area.

- ***Clause 16***

Clause 16 (1) of the Mining SEPP requires that, before granting consent for development for the purposes of mining or extractive industry that involves the transport of materials, the consent authority must consider whether or not the consent should be issued subject to conditions that do any one or more of the following:

(a) require that some or all of the transport of materials in connection with the development is not to be by public road,

(b) limit or preclude truck movements, in connection with the development, that occur on roads in residential areas or on roads near to schools,

(c) require the preparation and implementation, in relation to the development, of a code of conduct relating to the transport of materials on public roads.

The proposed Modification would not change the maximum number of daily traffic movements to and from the approved Tarrawonga Coal Mine. However, the additional 4 Mt of coal to be hauled from the site would increase the overall number of truck movements to and from ML 1579. These additional truck movements would result in additional wear and tear along the coal haulage route.

Whitehaven has entered in to road maintenance agreements with the Narrabri Shire Council and the Gunnedah Shire Council in accordance with Condition 43 of Schedule 4 of the Development Consent. The scope and coverage of the existing road maintenance agreements are sufficiently broad to cover the additional wear and tear on the coal haulage route associated with the proposed Modification.

Clause 16 (2) of the Mining SEPP requires that, if the consent authority considers that the development involves the transport of materials on a public road, the consent authority must, within seven days after receiving the development application, provide a copy of the application to each roads authority for the road, and the NSW Roads and Traffic Authority (RTA) (if the RTA is not a roads authority for the road).

In addition, Clause 16 (3) of the Mining SEPP requires that the consent authority:

(a) must not determine the application until it has taken into consideration any submissions that it receives in response from any roads authority or the Roads and Traffic Authority within 21 days after they were provided with a copy of the application,

…

TCPL will continue to consult with the RTA as and when required in regard to traffic and road transport.

State Environmental Planning Policy No. 33 - Hazardous and Offensive Development

Clause 13 of SEPP No. 33 - Hazardous and Offensive Development (SEPP 33) requires the consent authority, in considering a Development Application for a potentially hazardous or a potentially offensive industry, to take into account:

(c) in the case of development for the purpose of a potentially hazardous industry—a preliminary hazard analysis prepared by or on behalf of the applicant, and

(d) any feasible alternatives to the carrying out of the development and the reasons for choosing the development the subject of the application (including any feasible alternatives for the location of the development and the reasons for choosing the location the subject of the application)…

The Tarrawonga Coal Mine operates in accordance with the environmental management plans and management procedures required by the existing Development Consent. These plans and procedures have been developed to minimise the environmental risks associated with operation of the mine.

The proposed Modification does not significantly alter the consequences or likelihood of a hazardous event occurring at the Tarrawonga Coal Mine, as the operational activities on-site would be generally unchanged.

State Environmental Planning Policy No. 44 (Koala Habitat Protection)

SEPP No. 44 (Koala Habitat Protection) (SEPP 44) requires the consent authority for any Development Application in certain LGAs (including the Narrabri LGA) to consider whether land subject to a Development Application is *potential Koala habitat* or *core Koala habitat*.

Surveys targeting Koala's were undertaken by Eco Logical Australia Pty Ltd (Eco Logical) as part of the biodiversity assessment of the proposed Modification (Appendix F). The surveys included spotlighting, playback of male calls and targeted scat searches. The Koala was not recorded during the surveys. Based on these findings the provisions of SEPP 44 are not applicable to the proposed Modification.

State Environmental Planning Policy No. 55 (Remediation of Land)

SEPP No. 55 (Remediation of Land) (SEPP 55) aims to provide a State-wide planning approach to the remediation of contaminated land. Under SEPP 55, planning authorities are required to consider the potential for contamination to adversely affect the suitability of the site for its proposed use.

A consent authority must consider the following under clause 7(1):

(a) whether the land is contaminated, and

(b) if the land is contaminated, it is satisfied that the land is suitable in its contaminated state (or will be suitable, after remediation) for the purpose for which the development is proposed to be carried out, and

(c) if the land requires remediation to be made suitable for the purpose for which the development is proposed to be carried out, it is satisfied that the land will be remediated before the land is used for that purpose.

Further under clause 7(2), before determining an application for consent to carry out development that would involve a change of use of land, the consent authority must consider a report specifying the findings of a preliminary investigation of the land concerned carried out in accordance with the contaminated land planning guidelines.

The proposed Modification areas are located within the existing ML 1579. As a result no change of use is proposed and no preliminary land contamination investigation is required.

3.3.3 Other Statutory Approvals

Environment Protection and Biodiversity Conservation Act, 1999

The objective of the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) is to provide for the protection of those aspects of the environment that are of *national environmental significance.* Proposals that are likely to have a significant impact on a matter of environmental significance are defined as a *controlled action* under the EPBC Act. Proposals that are, or may be, a controlled action are required to be referred to the Commonwealth Minister for the Environment, Water, Heritage and the Arts for determination as to whether or not the proposed action is a controlled action.

Based on the biodiversity assessment presented in Section 4.11 and Appendix F, which include assessment of potential impacts on matters of national environmental significance currently identified under the EPBC Act, no matters of national environmental significance are likely to be significantly impacted by the modified Tarrawonga Coal Mine. The proposed Modification has therefore not been referred to the Commonwealth Minister for a controlled action determination under the EPBC Act.

Other Approvals

Additional approvals that may be required as a result of the proposed Modification include:

- a variation to EPL 12365 from the DECCW;
- an amendment to the existing Mining Operations Plan (MOP) from the DII-MR;
- an Aboriginal Heritage Impact Permit (AHIP) under section 87 of the *National Parks and Wildlife Act, 1974* to salvage any Aboriginal objects associated with the Aboriginal cultural heritage site NAS02 (Section 4.7.3); and
- an AHIP under section 90 of the *National Parks and Wildlife Act, 1974* for Aboriginal objects that may be unknowingly destroyed, defaced or damaged within the proposed Modification area (Section 4.7.3).

3.4 PROJECT JUSTIFICATION

A justification of the proposed Modification on economic, social and environmental grounds, including consideration of alternatives and consideration of the consistency of the Project with the objects of the EP&A Act is provided below.

3.4.1 Consideration of Project Alternatives

The proposed extension to the approved Tarrawonga Coal Mine open cut would generate approximately 4 Mt of additional coal. The extension is located immediately adjacent to the existing open cut, and could be mined using the same conventional mining methods and generally the same mining fleet.

Mining of this coal by underground mining methods has been evaluated by TCPL but is considered to be unviable due to the high up-front establishment costs to convert from an open cut to underground mine, and the fact that the deposit is made up of eight relatively thin coal seams (Section 2.1.1) which are generally not suitable for underground mining at the proposed 2 Mtpa rate.

The additional overburden that would be generated by the proposed Modification would be placed on the two existing emplacements, and used to in-fill the open cut. The height of the Northern Emplacement would be increased from 330 to 370 m AHD and the Southern Emplacement would be extended by approximately 100 to 300 m to the south (Section 2.2.3). Alternatives to this component of the proposal were considered by TCPL as part of the project design and included development of new overburden emplacement to the south west of the open cut, and raising the heights of both emplacements. These alternatives were discounted for the proposed Modification on economic grounds (i.e. haul distance to a new emplacement) and amenity grounds (additional noise, visual and air quality impacts associated with raising the Southern Emplacement above its currently approved maximum height).

As an alternative to the proposed additional topsoil stockpile, TCPL evaluated the potential for placing topsoil in two new stockpiles rather than just one. The second stockpile was discounted in order to restrict land disturbance areas to one location.

The proposed new hardstand/infrastructure areas are located in close proximity to the existing mine infrastructure areas (Section 2.2.5), as is the proposed new mine water dam (Section 2.2.7). Alternative locations for these facilities were considered on the cleared agricultural land in the vicinity of the proposed new soil stockpile (i.e. to the west of the internal access road), however these locations were discounted due to the distance from the existing infrastructure areas.

3.4.2 Ecologically Sustainable Development Considerations

The concept of sustainable development came to prominence at the World Commission on Environment and Development (1987), in the report entitled *Our Common Future*, which defined sustainable development as:

> *Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.*

For the purposes of this EA, the relevant definition of ecologically sustainable development (ESD) is that in section 6(2) of the *Protection of the Environment Administration Act, 1991*, which is the definition adopted by the EP&A Act. This definition provides as follows:

> *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.*

Project design, planning and assessment have been carried out applying the principles of ESD, through:

- incorporation of environmental considerations and the results of the impact assessments in decision-making processes;

- adoption of high standards for environmental and occupational health and safety performance;
- assessment of potential greenhouse gas emissions associated with the modified Tarrawonga Coal Mine; and
- optimisation of the economic benefits to the community arising from the modified Tarrawonga Coal Mine.

Assessment of potential long-term impacts of the modified Tarrawonga Coal Mine was carried out during the preparation of this EA on visual aspects, surface water, biodiversity, air quality (including greenhouse gas emissions) and noise. The design of the proposed Modification, and proposed mitigation measures to minimise environmental impacts, takes into account biophysical considerations, including the principles of ESD as defined in section 6(2) of the *Protection of the Environment Administration Act, 1991*.

3.4.3 Consideration of the Project Against the Objects of the EP&A Act

Section 5 of the EP&A Act describes the objects of the EP&A Act 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 proposed Modification is considered to be generally consistent with the objects of the EP&A Act, because it:

- incorporates measures for the management and conservation of natural resources including water and natural areas, development of the State's coal resources, and control measures to minimise potential amenity impacts associated with surface activities in the vicinity of ML 1579 (Section 4);
- includes the economic use and development of land, while maintaining key existing land uses including agricultural uses on surrounding Whitehaven and privately-owned land;
- would support the ongoing provision of community services and facilities through royalties, tax revenue and contributions;
- incorporates a range of measures for the protection of the environment, including the protection of biodiversity values (Section 4.11);
- incorporates relevant ESD considerations (Section 3.4.2);

- is a Major Project that would be determined by the Minister for Planning (Section 3.2), however feedback and consultation with Local Government agencies has been undertaken where relevant (Section 1.3); and
- involves public consultation though the EA consultation programme (Section 1.3), which would be ongoing following the public exhibition of the EA document and DoP assessment of the proposed Modification in accordance with the requirements of the EP&A Act.

4 ENVIRONMENTAL ASSESSMENT

The following section presents the environmental assessment for the proposed Modification. It includes a description of the existing environment (including the existing Tarrawonga Coal Mine, where relevant); an assessment of the potential impacts of the proposed Modification; and a description of environmental mitigation measures, management and monitoring that would be implemented. This section provides an environmental assessment of the following:

- climate;
- land resources;
- visual character;
- noise and blasting;
- air quality and greenhouse gas generation;
- Aboriginal heritage;
- European heritage;
- water;
- biodiversity;
- hazard and risk;
- road transport; and
- social and economic aspects.

4.1 CLIMATE

Regional Bureau of Meteorology (BoM) meteorological data are available from the Gunnedah Pool Station (BoM Station No. 055023), the Gunnedah Soil Conservation Research Station (BoM Station No. 055024), and the Boggabri Station (BoM Station No. 055268).

Meteorological conditions are currently monitored at the Tarrawonga Coal Mine at an on-site meteorological station within ML 1579 (Figure 2-3).

A summary of the regional meteorological data (BoM, 2010) and data from the on-site weather station is provided in Table 4-1 and is discussed in the following sections.

Temperature

Table 4-1 indicates that regional temperatures are warmest from December to February and coolest from June to August. Average daily maximum temperatures peak in January (34.0 degrees Celsius [°C], 31.9°C and 34.8°C for Gunnedah Pool, Gunnedah Research Station, and the Tarrawonga on-site Station, respectively), while average daily minimum temperatures are lowest in July (3.0°C, 4.7°C and 0.8°C for Gunnedah Pool, Gunnedah Research Station and the Tarrawonga on-site Station, respectively) (Table 4-1).

Table 4-1
Historical Meteorological Data Summary

Month	Average Relative Humidity (%)				Average Air Temperature (°C)						Average Rainfall (mm)				Mean Monthly Pan Evaporation (mm)
	Gunnedah Pool Station[1]		Gunnedah Research Station[2]	Tarrawonga On-site Station[3]	Gunnedah Pool Station[1]		Gunnedah Research Station[2]		Tarrawonga On-site Station[3]		Gunnedah Pool Station[1]	Gunnedah Research Station[2]	Tarrawonga On-site Station[3]	Boggabri Station[4]	Gunnedah Research Station[2]
	9 am	3 am	9 am	Average	Max.	Min.	Max.	Min.	Max.	Min.					
January	60	43	56	53	34.0	18.3	31.9	18.8	34.8	18.7	71.3	85.5	59.9	108.5	238.7
February	65	45	61	53	32.9	18.1	31.1	18.6	33.4	16.9	66.6	73.0	95.8	66.2	190.4
March	64	44	59	53	30.7	15.8	29.1	16.6	31.7	13.2	47.9	41.2	17.3	44.6	186
April	67	46	61	57	26.4	11.4	25.1	12.8	26.5	9.3	37.7	39.6	21.7	40.0	132
May	73	51	70	63	21.3	7.1	20.3	8.7	26.1	11.8	42.5	44.8	26.4	58.4	83.7
June	78	55	76	80	17.6	4.3	16.8	6.1	18.9	3.2	43.9	39.5	76.6	43.0	57
July	77	53	75	70	16.9	3.0	16.1	4.7	18.6	0.8	42.2	42.4	20.3	49.4	58.9
August	71	48	68	58	18.9	4.1	17.9	5.8	19.3	2.3	41.3	35.3	33.5	35.7	86.8
September	65	43	61	57	22.8	6.9	21.4	8.5	26.0	7.0	39.8	39.6	38.7	40.5	120
October	61	43	56	48	26.7	10.7	25.1	12.1	30.1	10.1	55.2	59.3	33.4	59.2	164.3
November	59	40	54	54	30.3	14.1	28.3	15.0	30.6	13.6	60.9	68.0	73.9	65.6	201
December	58	40	52	55	33.0	16.8	31.1	17.5	32.5	15.3	68.6	68.5	81.4	66.5	241.8
Annual Average	**67**	**46**	**62**	**58**	**26.0**	**10.9**	**24.5**	**12.1**	**27.4**	**10.2**	**-**	**-**	**-**	**-**	**-**
Average Annual Total	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**618.3**	**637.5**	**582.3**	**691.2**	**1,752**

[1] For the period December 1876 to March 2010.

[2] For the period January 1948 to March 2010.

[3] For the period August 2006 to April 2009.

[4] For the period September 1966 to January 2010.

Relative Humidity

Relative humidity records at all sites indicate a seasonal variance with higher humidity in winter and lower humidity in summer (Table 4-1). Average monthly morning (9.00 am) relative humidity records for the Gunnedah Pool and Gunnedah Research Station were lowest in December (58% and 52%, respectively) and highest in June (78% and 76%, respectively) (Table 4-1). The average monthly relative humidity at the Tarrawonga on-site Station was lowest in October (48%), and highest in June (80%) (Table 4-1). Average monthly afternoon (3.00 pm) relative humidity records ranged from 40% to 55% at the Gunnedah Pool (Table 4-1).

Wind Speed and Direction

Annual wind behaviour experienced at the Tarrawonga Coal Mine was evaluated by Heggies Pty Ltd (Heggies) (2010) as part of the air quality assessment of the proposed Modification (Appendix C). Hourly-average wind speed and direction for 2007 were derived from the 15-minute average dataset from the on-site meteorological station. The evaluation used the United States Environmental Protection Agency (2000) approach for calculating scalar wind speed and direction. Windroses for the mine site are provided in Appendix C and show occurrences of winds from all quadrants.

The wind data shows that during the period, winds experienced at the Tarrawonga Coal Mine were predominately light to moderate (between 1.5 metres per second [m/s] and 8 m/s) from the north-west quadrant (approximately 30% combined) and light to fresh (between 1.5 m/s and 10.5 m/s) from the south-east quadrant (approximately 30% combined) (Appendix C). Calm wind conditions (wind speed less than 0.5 m/s) were observed to occur 14.2% of the time (Appendix C).

The seasonal windroses indicate that (Appendix C):

- In spring, light to moderate winds are experienced from the north-west quadrant (approximately 36% combined) and light to fresh winds from the south-east quadrant (approximately 28% combined).
- In summer, light to fresh winds are experienced predominantly from the east to south-east (approximately 30% combined).
- In autumn, light to fresh winds are experienced predominantly from the east-southeast to south-southwest (approximately 40% combined).
- In winter, light to moderate winds are experienced predominantly from the west to north-northwest (approximately 46% combined).

Rainfall

The average annual rainfall for the Gunnedah Pool, Gunnedah Research Station and Boggabri Stations are 618.3 mm, 637.5 mm, and 691.2 mm, respectively (Table 4-1). The average annual rainfall recorded at the Tarrawonga on-site Station is 582.3 mm (Table 4-1).

The months with the highest monthly average rainfalls at the Gunnedah Pool, Gunnedah Research Station and Boggabri Stations are January (71.3 mm, 85.5 mm and 108.5 mm (Table 4-1). At the Tarrawonga on-site Station the highest monthly average rainfall occurs in February (95.8 mm) (Table 4-1). The months with the lowest monthly average rainfalls at the Gunnedah Pool, Gunnedah Research Station, Tarrawonga on-site and Boggabri Stations are April (37.7 mm), August (35.3 mm), March (17.3 mm) and August (35.7 mm), respectively (Table 4-1).

The Tarrawonga on-site Station typically records lower monthly rainfall averages than the regional locations, however the period of records for the Tarrawonga on-site Station is significantly shorter and has coincided with a period where drought has been a feature of the climate .

Evaporation

Total mean annual evaporation based on Gunnedah Research Station records was 1,752.0 mm per year (Table 4-1). December (241.8 mm) had the highest monthly rates of evaporation while June (57.0 mm) had the lowest monthly rates (Table 4-1). Table 4-1 demonstrates that while average monthly rainfall was not particularly seasonal, evaporation was markedly different between summer and winter.

4.2 LAND RESOURCES

4.2.1 Existing Environment

The following provides a description of land resources including land use, landforms and topography, soils, land capability and suitability, geology and geochemistry within ML 1579 and surrounds.

Land Use

Land use in the vicinity of the Tarrawonga Coal Mine is dominated by grazing (primarily cattle) and cereal/fodder cropping in the flatter and more fertile areas to the south, east and west. State-owned forestry (Leard State Forest) and another coal mining operation (Boggabri Coal Mine) occur to the north of the Tarrawonga Coal Mine.

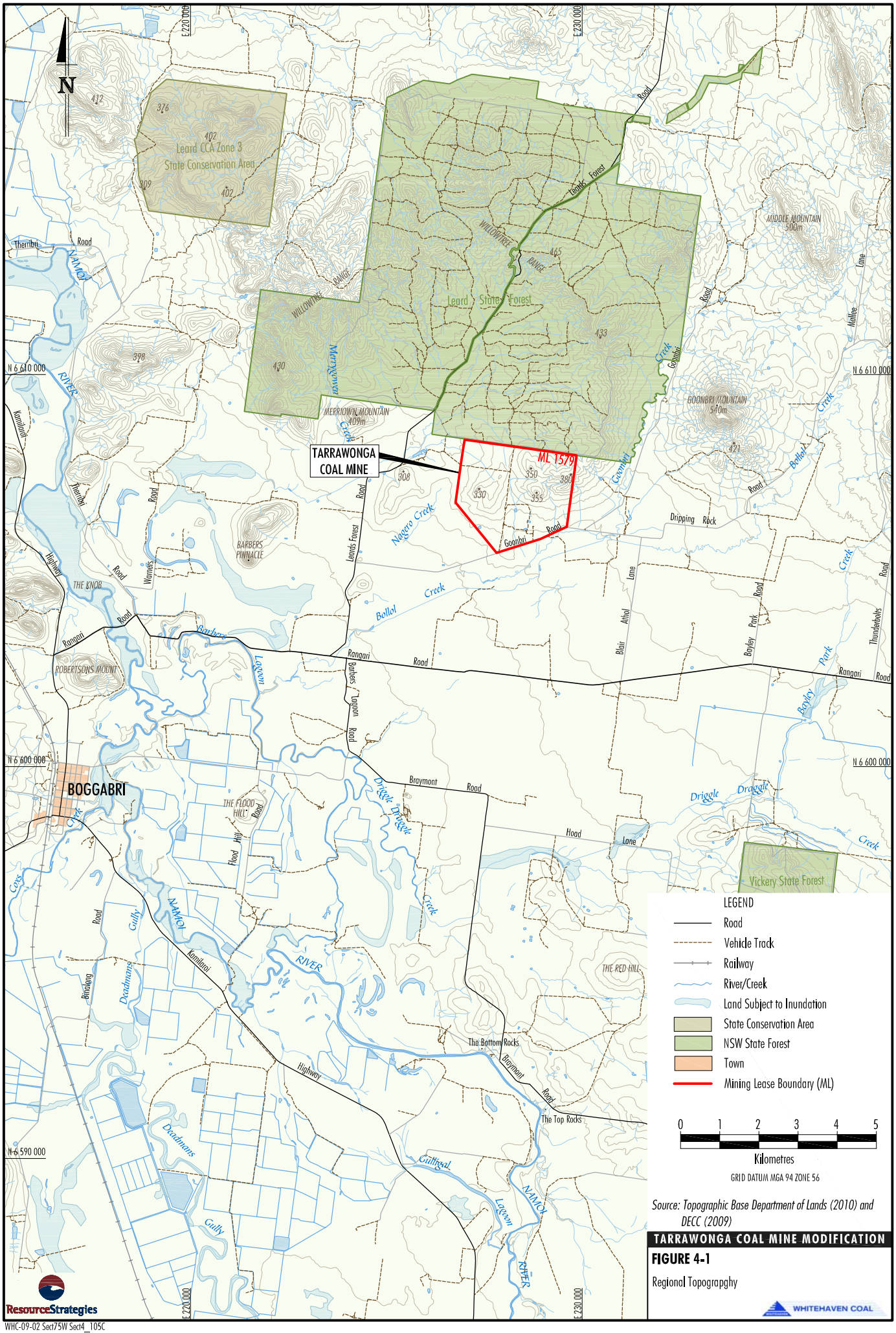
Landforms and Topography

The Tarrawonga Coal Mine is situated in the foothills of the Willowtree Range some 12 km east of the Namoi River (Figure 4-1). The main local drainages are Nagero Creek and Bollol Creek which drain west to the Namoi River. Areas of higher elevation in the region include peaks on the Willow Tree Range approximately 7 km to the north (465 m AHD), and Goonbri Mountain approximately 4 km to the north-east (540 m AHD) (Figure 4-1).

The topography of ML 1579 comprises a series of rolling hills which vary in elevation from about 300 to 360 m AHD. The fringing floodplains of Bollol Creek just to the south of ML 1579 vary from approximately 260 to 280 m AHD.

ML 1579 is bounded by the Leard State Forest to the north and is surrounded by low lying flood plains of Bollol Creek (a tributary of the Namoi River) to the south (Figure 4-1). Nagero Creek drains the southern slopes of the Willowtree Range including the north-western portions of ML 1579. In their lower floodplain areas Bollol and Nagero Creeks comprise poorly defined channels and a series of depressions. These areas become wide, shallow, slow moving waterways during and following significant rainfall runoff events.

The existing mine landforms of the Tarrawonga Coal Mine have modified the topography within ML 1579. The Northern Emplacement rises to an approximate height of 340 m AHD in the north-western corner of ML 1579, while the base of the open cut is currently at approximately 255 m AHD. The Southern Emplacement near the centre of ML 1579 rises to a current elevation of approximately 320 m AHD. The site of the proposed soil stockpile currently ranges in elevation from 270 m AHD at the southern edge of the ML 1579, rising steadily in a northerly direction to approximately 295 m AHD. The proposed extension of the open cut would incorporate an existing ridgeline with a height of approximately 355 m AHD (Figure 4-1).



Source: Topographic Base Department of Lands (2010) and DECC (2009)

TARRAWONGA COAL MINE MODIFICATION

FIGURE 4-1

Regional Topograpghy

ResourceStrategies

WHITEHAVEN COAL

WHC-09-02 Sect75W Sect4_105C

Soils, Land Capability and Agricultural Suitability

An assessment of soils, land capability and agricultural suitability of ML 1579 was conducted by Geoff Cunningham Natural Resource Consultants Pty Ltd (GCNRC) (2005a) as part of the 2005 EIS.

Soils that occur within ML 1579 and the adjoining Leard State Forest are considered by GCNRC (2005a) to have developed from two main parent materials; weathered sandy conglomerates, and weathered Boggabri Volcanics and sedimentary outcrops. GCNRC (2005a) identified four soil mapping units through a programme of soil mapping and test pit excavations within ML 1579 and the northern section of the coal haulage route to the CHPP (Table 4-2).

Table 4-2
Summary of Soil Mapping Units within ML 1579 and the Northern Section of the Coal Haulage Route

Soil Mapping Unit	General	Topsoil	Subsoil
1a Sandy Soils	*Soil Depth*: 40 to 250 centimetres (cm) *Surface*: Loose to firm or hard setting *Stones*: Surface gravel common, gravel common through subsoil *Overlies*: Coarse textured profile below 100 cm or bedrock	*Horizons*: A1 and bleached A2 horizon *Texture*: Clayey sand, sandy clay loam, sandy loam or silty clay loam *pH*: 5.0 to 6.5 *Colour*: Shades of grey, brown and pink	*Horizons*: Up to four B horizons *Texture*: Clayey sand, loamy sand, sandy clay loam, sandy loam *pH*: 5.5 to 10.0 *Colour*: Shades of grey, yellow, pink and brown
1b Duplex Soils	*Soil Depth*: 250+ cm *Surface*: Soft, firm, hard setting or self-mulching *Stones*: Surface gravel and sometimes larger stones present *Overlies*: Continuation of profile but finer textured beginning generally shallower than 100 cm	*Horizons*: A1 (occasionally two A1 layers) with a bleached A2 horizon sometimes present *Texture*: Sandy loam or sandy clay loam, sometimes fine sandy clay loam to light clays or silty clay loam *pH*: 5.0 to 6.5 *Colour*: Shades of brown, grey and some pink	*Horizons*: Up to six B horizons *Texture*: Light to medium clay, often sandy or gritty, clayey sandy light medium or medium to heavy clay, sandy loam, sandy clay loam or sandy clay *pH*: 5.5 to 10.0 *Colour*: Generally shades of white, brown and grey
2 Clay Soils	*Soil Depth*: 92 to 50 cm *Surface*: Self-mulching and cracked, sometimes firm or hard setting *Stones*: Surface gravel and stone and commonly though profile, occasionally absent *Overlies*: Bedrock or gritty material	*Horizons*: Single A horizon *Texture*: Medium clay, sometimes sandy or gritty light clay, silty clay or medium to heavy clay *pH*: 5.5 to 8.0 *Colour*: Shades of brown or grey	*Horizons*: Up to six B horizons *Texture*: Medium to heavy clay, sometimes sandy or gritty with sandy clay gritty light clay *pH*: 5.5 to 10.0 *Colour*: Shades of brown or grey

Table 4-2 (Continued)
Summary of Soil Mapping Units within ML 1579 and the Northern Section of the Coal Haulage Route

Soil Mapping Unit	General	Topsoil	Subsoil
3 Clay Soils	*Soil Depth*: 250 cm *Surface*: Soft or self-mulching/ cracked *Stones*: Surface stone usually absent, gravel usually absent through profile *Overlies*: Material similar to lowest subsoil horizon	*Horizons*: Single A horizon *Texture*: Light clay to medium clay *pH*: 6.5 to 7.0 *Colour*: Shades of brown and dark grey	*Horizons*: Three B horizons, sometimes four *Texture*: Medium or medium to heavy clay *pH*: 8.0 to 10.0 *Colour*: Shades of brown or dark grey

Source: 2005 EIS (R.W. Corkery, 2005).

The proposed new infrastructure areas, open cut extension, and Southern Emplacement extension areas would be located within soil mapping units 1a and 1b. The proposed soil stockpile would be located within areas mapped as soil mapping unit 3. Clay soils (i.e. soil mapping unit 2) would not be disturbed by the proposed Modification.

A land capability and agricultural suitability assessment of ML 1579 was conducted as part of the 2005 EIS. The assessment identified the lands within the lease as being capability class II, III, VI or VII. Table 4-3 summarises the characteristics of each of these classes.

Table 4-3
Summary Description of Land Capability Classes within ML 1579

Land Capability Class	Description
Class II	*Land suitable for regular cultivation provided soil conservation practices such as strip cropping, conservation tillage and adequate crop rotations are used.*
Class III	*Land suitable for regular cultivation provided structural soil conservation works such as diversion banks together with soil conservation as in Class II are used.*
Class VI	*Land not capable of being cultivated but suitable for grazing; and application of soil conservation practices including limitation of stock, broadcasting of seed and fertiliser, prevention of fire and destruction of vermin.*
Class VII	*Land best protected by green timber.*

Source: 2005 EIS (R.W. Corkery, 2005).

The proposed open cut extension would be located in areas mapped as land capability classes VI and VII. The proposed Southern Emplacement extension, new soil stockpile and new infrastructure areas would be located in areas mapped as land capability class III.

The 2005 EIS identified two agricultural suitability classes as occurring within ML 1579 (i.e. classes 3 and 5). Table 4-4 summarises the characteristics of these two classes.

Table 4-4
Summary Description of Agricultural Suitability Classes within ML 1579

Agricultural Land Suitability Class	Description
Class 3	*Grazing land or land well suited to pasture improvement that may be cultivated and cropped in rotation with pasture. Erosion hazard or soil structural breakdown limit the frequency of ground disturbance, and conservation works may be required.*
Class 5	*Land unsuitable for agriculture or at best suited only to light grazing. Agricultural production is very low or zero due to severe constraints which preclude improvement.*

Source: 2005 EIS (R.W. Corkery, 2005).

The proposed open cut extension would be located in areas mapped as agricultural suitability class 5. The proposed Southern Emplacement extension, new soil stockpile and new infrastructure areas would be located in areas mapped as agricultural suitability class 3.

Geology

The Tarrawonga Coal Mine is located in the Gunnedah Basin, which contains sedimentary rocks, including coal measures, of the Permian-Triassic age. The 2005 EIS describes the Gunnedah Basin as forming the central part of the Permo-Triassic Sydney-Gunnedah-Bowen Basin system which extends along the eastern margin of Australia. A north-south-trending ridge of Early Permian volcanic rocks, known as the Boggabri Ridge, divides the Gunnedah Basin into the Maules Creek sub-basin to the east, and the Mullaley sub-basin on the western side of the Ridge.

ML 1579 is situated on the western side of the Maules Creek sub-basin. Below the Maules Creek Formation are the Goonbri and Leard Formations, which are basal units of the Gunnedah Basin sedimentary sequence and unconformably overlie the Boggabri Volcanics.

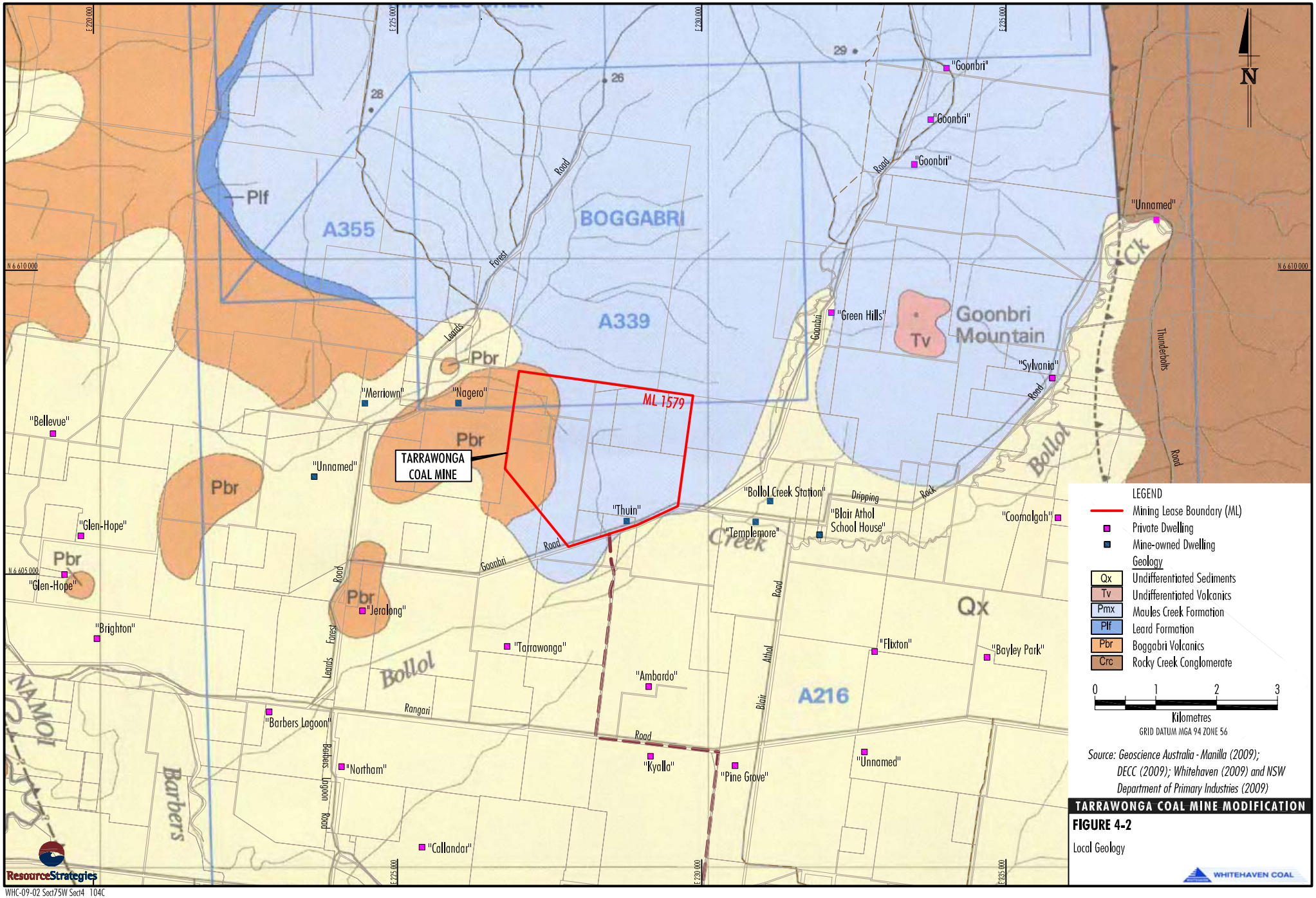
The Boggabri Volcanics and the Goonbri and Leard Formations are described in the 2005 EIS as dipping gently to the east for a short distance before dropping away steeply. As the dip steepens, the thickness of the overlying Maules Creek Formation increases from approximately 200 m below ML 1579, to in excess of 400 m at the eastern edge of EL 5967 (Figure 1-4). The cumulative thickness of coal is developed in coal seams of the Maules Creek Formation, which sub-crop near the Boggabri Ridge in the western portion of ML 1579.

Figure 4-2 is a plan showing the local geology in the vicinity of ML 1579.

As described in Section 2.1.1, eight coal seams are currently mined within the Tarrawonga open cut (i.e. the Braymont, Bollol Creek, Jeralong, Jeralong Lower, Merriown, Merriown Lower, Velyama, and Nagero seams). The seams range in thickness up to 4 m, but typically average 1.5 m. The seams generally strike in a north south direction and dip to the east. Overburden and interburden rock types are typically conglomerates, sandstones, siltstones and carbonaceous mudstones.

The 2005 EIS describes a 40 m thick conglomerate layer at the base of the currently mined seams, which separates them from additional deeper seams (i.e. the Northam, Therribri, Flixton and Tarrawonga seams). Mining of these deeper seams is not currently economically viable, but advances in underground technology and improved market conditions may allow open cut or underground mining in the future.

Figure 4-3 is a cross-section showing the main geological units and coal seams at Tarrawonga.



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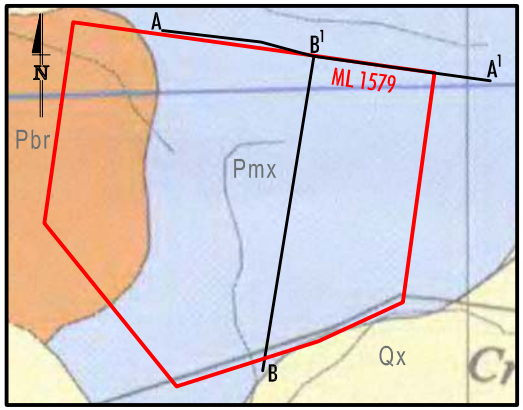

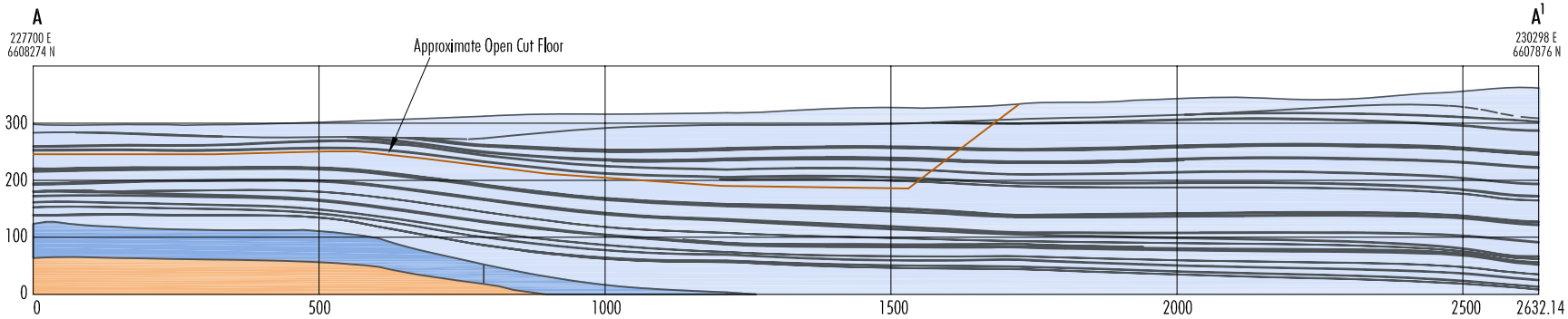

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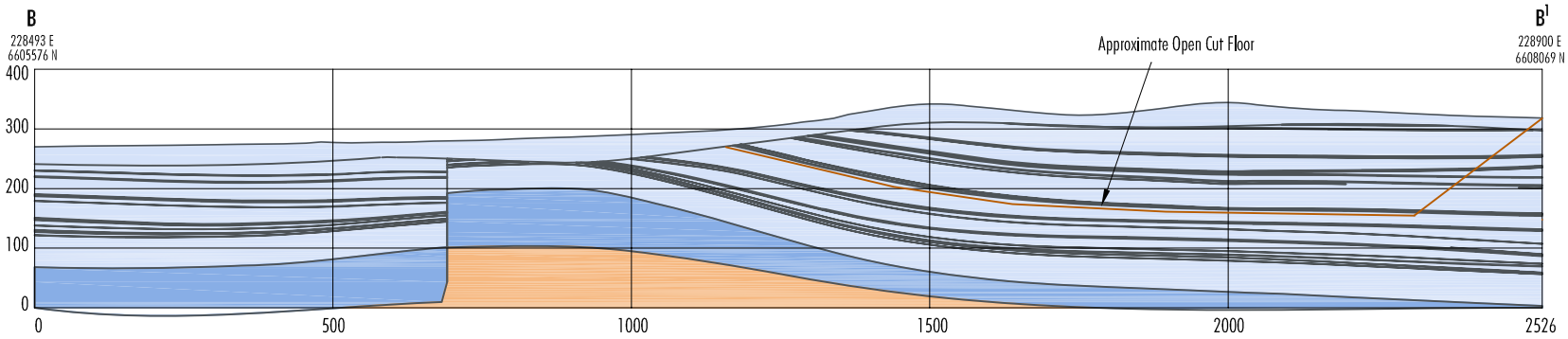

SECTION B -B1

LEGEND

Mining Lease Boundary (ML)

Geology

Pmx Maules Creek Formation

Plf Leard Formation

Pbr Boggabri Volcanics

0 50 100 300

Metres

GRID DATUM MGA 94 ZONE 56

Source: Whitehaven (2009); NSW Department of Primary Industries (2009)and Pratt (1996)

TARRAWONGA COAL MINE MODIFICATION

FIGURE 4-3

Local Geology - Typical Cross-sections

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WHITEHAVEN COAL

WHC-09-02 Sect75W Sect4_106B

Geochemistry

Previous geochemical characterisation of overburden from the Tarrawonga Coal Mine was carried out by URS Australia Pty Ltd in May 2005 as part of the 2005 EIS. For this programme five sample composites were tested from a drill-hole located within the proposed open cut area.

The results of the 2005 testwork showed that the materials had relatively low percentage sulfur (%S) contents (0.04 to 0.31 %S) and a range in acid neutralising capacities (ANC) from 8 to 64 kilograms of sulphuric acid per tonne of material (i.e. kg H_2SO_4/t). The corresponding net acid producing potential values were all negative indicating an excess in acid neutralisation over acid potential. The net acid generation (NAG) test results derived NAG pH values all greater than pH 4 (NAG pH range 6.2 to 9.0) and based on these results the materials represented by the samples tested were all classified as being non-acid forming (NAF). The 2005 EIS geochemical testwork also indentified only a low potential for soluble salt generation indicating a low salinity risk. The sodicity ratings of the overburden materials were not determined at the time.

A geochemistry assessment for the proposed Modification has been undertaken by Geo-Environmental Management Pty Ltd (GEM) (2010). A summary of the findings of the assessment is provided below, with further detail provided in Appendix A.

The geochemical tests were conducted on 29 overburden samples from drillhole TA31C, including pH and Electrical Conductivity (EC), acid forming characteristics, a sodicity assessment, and element enrichment and solubility testwork. The depth intervals selected by GEM for sampling were based on the lithology and proximity to the coal seams using the stratigraphic log for the drill-hole provided by TCPL.

The results showed that overburden material is likely to be slightly to moderately alkaline. The $EC_{(1:2)}$ values range from 0.139 to 0.575 deciSiemens per metre (dS/m) indicating that the overburden materials are expected to be generally non-saline (GEM, 2010). The unweathered carbonaceous mudstone and siltstone recorded moderate sodic exchangeable sodium percent (ESP) values, while all of the other fresh and weathered lithologies generally recorded non-sodic ESP values.

Multi-element analyses were conducted on eight samples (two conglomerate, two sandstone, one siltstone and two carbonaceous mudstone) based on stratigraphic location, lithology and geochemical characteristics. The results exhibited only minor enrichment of Arsenic (As) in all samples, and of Antimony (Sb) and Selenium (Se) in some of the samples compared to the average crustal abundance. The high ANC sandstone sample also exhibited significant enrichment of Barium compared to the average crustal abundance, and higher concentrations of Calcium, Iron, Magnesium and Manganese compared to the other samples.

The results indicate that overburden from the area between the eastern edge of the approved open cut and the eastern boundary of ML 1579 is geochemically consistent with overburden from the current open cut in that it is expected to be relatively barren (non-reactive) with a consistently low sulfur content and a moderately low ANC. Based on this, no changes to the current overburden management practices are considered to be necessary (GEM, 2010). However, the sodicity assessment performed by GEM on a limited number of samples, indicated that some of the overburden materials, including the carbonaceous mudstone and siltstone, have the potential to be moderately sodic. Materials that are sodic have a tendency to be highly dispersive and therefore can cause problems with stability and erosion if left exposed on the outer dump surfaces (GEM, 2010).

The results of the multi-element scans indicated that the overburden is not likely to contain any significantly enriched elements of potential environmental concern, and also indicated no significantly soluble elements of environmental concern (GEM, 2010). However, the scans did identify relatively minor enrichments of As, Sb and Se in the solids and relatively high solubility of As, Molybdenum (Mo) and Se. As a result of this finding, TCPL would include analysis of these elements in the site water quality monitoring programme (every three months) in order to confirm that the release of these elements from the stockpiled overburden does not adversely impact the water quality of the receiving environment.

TCPL would also further investigate the distribution of sodic materials throughout the overburden sequence in order to minimise the potential for sodic materials to be left exposed on the final dump surfaces.

4.2.2 Potential Impacts

The proposed Modification to the Tarrawonga Coal Mine has the potential to alter:

- land use, land capability and agricultural suitability;
- landforms and topography;
- soils; and
- geochemistry.

These potential impacts are described in the following sub-sections. Measures to mitigate and manage potential impacts are provided in Section 4.2.3.

Land Use, Land Capability and Agricultural Suitability

The proposed open cut extension would disturb an additional 38 ha and is located in an area which is almost entirely covered with re-growth Narrow-leaf Ironbark and White Cypress Pine. This vegetation continues north into Leard State Forest. The proposed open cut disturbance area has low capability/suitability and is not currently used for agricultural purposes (e.g. cattle grazing or cropping) and as a result, the potential impact of this component of the proposal is the loss of native woodland re-growth vegetation, which would otherwise continue to mature and connect with an existing State Forest area.

The proposed extension to the Southern Emplacement and the new hardstand/infrastructure areas are located in close proximity to active mine areas. Prior to the commencement of the mine these areas were used for agricultural purposes and have been classified as having relatively good capability/suitability. These areas have, however, been fenced since the commencement of the mine and are not used agriculturally due to mine safety requirements.

The proposed Modification would not materially affect the land use in these areas (i.e. agricultural activities in these areas would continue to be excluded for the life of the mine, but could potentially resume after rehabilitation and closure, subject to agreement on the post-closure land use).

The proposed new soil stockpile area is located in a cleared area that is owned by Whitehaven (the "Thuin" property – Figure 1-5a) and is currently used for cattle grazing. This area occupies approximately 21.2 ha and is classified as having relatively good land capability and agricultural suitability (i.e. class III and class 3, respectively). It has been used for cropping in the past decade (e.g. it was sown to cereal and lucerne circa 2006), and it is likely it had been cropped numerous times before that.

The proposed use of this area for soil stockpiling would represent a temporary change in land use for the duration of the mine life (i.e. once the soil is removed from the stockpile for use in mine rehabilitation, the area could revert to agricultural use, subject to agreement on the post-closure land use).

Landforms and Topography

The main changes to the existing topography that would result from the proposed Modification are:

- the height of the Northern Emplacement would be increased to 370 m AHD (Section 2.2.3);
- the Southern Emplacement would be extended 100 to 300 m to the south, but its maximum approved height would not change (Section 2.2.3);
- some minor landform alterations associated with the new hardstand/infrastructure areas such as minor cut and fill earthworks (Section 2.2.5); and
- other minor landform changes associated with construction of internal access roads (e.g. to the new soil stockpile) and construction of the new water management components (Section 2.2.7).

The proposed changes to the overburden emplacements and new soil stockpile would increase the impacts of the mine on visual amenity, in particular the increase in height of the Northern Emplacement. However, the Northern Emplacement is located furthest away from potentially sensitive receptors, and the relative scale and type of change is low to moderate in the context of the approved landforms of the Tarrawonga Coal Mine. An assessment of the proposed changes on visual amenity, including visual simulations of the proposed emplacements, is contained in Section 4.3.

Soils

Potential impacts of the proposed Modification on soils relate primarily to:

- loss of soil resources within the proposed open cut and Southern Emplacement extension areas;
- alteration of soil structure beneath hardstand/infrastructure areas and access roads;
- soil contamination;
- increased erosion and sedimentation due to increased exposure of soils during clearing; and
- alteration of the physical and chemical properties of the soil during soil stripping and stockpiling (e.g. structure, fertility, microbial activity).

Geochemistry

As discussed in Section 4.2.1 and Appendix A, the overburden from the area between the eastern edge of the approved open cut and the eastern boundary of ML 1579 is geochemically consistent with overburden from the current open cut and is expected to be relatively barren (non-reactive) with a consistently low sulfur content and a moderately low ANC (GEM, 2010).

Potential impacts on water resources associated with the identified minor enrichments of As, Sb and Se in the solids and relatively high solubility of As, Mo and Se are discussed in Sections 4.9 and 4.10.

4.2.3 Mitigation Measures and Management

Land Use, Land Capability and Agricultural Suitability

The land ownership within and surrounding ML 1579 is shown on Figures 1-5a and 1-5b. Whitehaven and IBC-owned lands not required for the Tarrawonga Coal Mine would continue to be managed as rural enterprises during the life of the mine (i.e. cattle grazing and occasional cropping).

The proposed new soil stockpile would require fencing-off of approximately 21.2 ha of the Whitehaven-owned "Thuin" property in order to exclude stock. The soil stored in this area would be removed and used for rehabilitation prior to mine closure, and the area would be rehabilitated to its pre-mine land use (or as otherwise agreed with the relevant statutory authorities).

Rehabilitation activities would be undertaken in consultation with the relevant statutory authorities, the MOP and the Mine Closure Strategy. Condition 57 of Schedule 4 of the Development Consent requires the Mine Closure Strategy to be prepared at least three years prior to the cessation of mining.

Landforms and Topography

The existing and proposed infrastructure and mine landforms have been designed and located to integrate with existing topography and drainage features. This has been achieved by:

- placing the additional overburden generated by the mine in the existing emplacements and as in-fill rather than constructing a new stand-alone emplacement;
- locating the new hardstand/infrastructure areas adjacent to the existing infrastructure;
- locating the new soil stockpile in a cleared agricultural area as close as possible to the existing open cut and waste emplacements; and
- maximising the use of the existing Tarrawonga Coal Mine infrastructure, services, amenities, and water management infrastructure, where practicable.

Progressive rehabilitation would continue to be undertaken to further integrate constructed landforms with the surrounding landscape. Rehabilitation and landscape management strategies are detailed in Section 5.

Soils

A number of soil resource management strategies are currently implemented at the Tarrawonga Coal Mine, including:

- duplex and sandy topsoils are stripped to a depth of at least 0.15 m and are stockpiled for retrieval for later use in site rehabilitation;
- the height of topsoil stockpiles is generally restricted to 2 m, and where practicable, are maintained as windrows in preference to larger structures;
- the maximum sub-soil stockpile height is generally restricted to 3 m;
- stockpiles that are retained for over three months are seeded with a non-persistent cover crop to reduce erosion potential and assist in the maintenance of the biological viability of the soil;
- clay soils are stripped and mixed with interburden and placed within the overburden emplacement as these soil types are saline and/or sodic and are generally not suitable for use in rehabilitation;
- an inventory of soil resources present on the site, both in stockpiles and awaiting stripping, is maintained and regularly reconciled with rehabilitation requirements;

- water management structures are used to divert surface water flow away from soil stockpile areas, thereby reducing the potential for erosion;
- silt fences or similar are installed downslope of stockpiles and other disturbance areas where required, until stable vegetation cover is established; and
- contour banks and rock-lined waterways are installed on final mine landforms following soil application.

Mitigation measures used at the Tarrawonga Coal Mine to prevent or reduce the potential for contamination of land from spills/leaks of hazardous materials include the following:

- maintenance of mobile equipment and fixed plant in accordance with the manufacturer's recommended maintenance schedule;
- operator and driver training and licensing for their job descriptions;
- construction of all civil engineering structures in accordance with applicable codes, guidelines and Australian Standards;
- all contractors employed by TCPL are required to operate in accordance with the relevant Australian Standards, NSW Legislation and TCPL's prescribed operating procedures; and
- storage and usage procedures for potentially hazardous materials (i.e. fuels and lubricants) are developed in accordance with Australian Standards and relevant legislation.

Geochemistry

Overburden generated by the proposed Modification would be placed in the Northern and Southern Emplacements and used for open cut in-fill consistent with the Tarrawonga Coal Mine MOP.

4.3 VISUAL CHARACTER

This sub-section presents an assessment of the potential visual impacts of the proposed Modification. It reviews the existing visual character of the Tarrawonga Coal Mine and surrounds, and qualitatively assesses potential visual impacts using methodology developed by the United States Department of Agriculture – Forestry Service (1974). Visual simulations are also provided from key privately-owned residences surrounding ML 1579.

4.3.1 Existing Environment

As described in Section 4.2.1, the topography of ML 1579 comprises a series of rolling hills which vary in elevation from approximately 300 to 360 m AHD. The fringing floodplains of Bollol Creek just to the south of ML 1579 have elevations between approximately 260 and 280 m AHD.

The existing mine landforms at the site have modified the topography within ML 1579. The Northern Emplacement rises to an approximate height of 340 m AHD in the north-western corner of ML 1579, while the base of the open cut is currently at approximately 255 m AHD. The Southern Emplacement near the centre of ML 1579 rises to a current elevation of approximately 320 m AHD. The site of the proposed soil stockpile currently ranges in elevation from 270 m AHD at the southern edge of ML 1579, rising steadily in a northerly direction to approximately 295 m AHD. The proposed extension of the open cut would incorporate an existing ridgeline with a height of approximately 350 m AHD.

Night-lighting is emitted from the following sources at the Tarrawonga Coal Mine:

- overhead lighting at the coal crushing and load-out facility and the administration areas;
- mobile lighting plants (floodlights) used on the Northern and Southern Emplacements and the open cut; and
- mobile vehicle-mounted lights (e.g. haul trucks, loaders, coal trucks, and other heavy and light vehicles in various locations within ML 1579).

The following measures are currently used at the Tarrawonga Coal Mine to minimise potential impacts on visual amenity:

- the area pre-stripped ahead of the advancing open cut is limited to the practical minimum (i.e. approximately 60 m wide) in order to minimise the area of disturbance open at any one time;
- the mine is designed so that the completed sections of the Northern Emplacement and in-filled open cut areas are able to be progressively rehabilitated behind the advancing open cut;
- the shape and final batter slopes of the Northern and Southern Emplacements are designed to be similar to, and integrate with the naturally occurring slopes and ridgelines in the local area; and
- haul roads and mobile night-lights are oriented to minimise potential night-lighting impacts on local residences.

4.3.2 Potential Impacts

The level of visual modification caused by a proposed development can be measured as an expression of the visual interaction, or the level of contrast between the development and the existing visual environment. The level of visual change generally decreases as the distance from the development to viewpoint locations increases.

Visual sensitivity is a measure of how critically a modification to the existing landscape is viewed from nearby areas, and is a function of both land use and duration of exposure (i.e. individuals generally view changes to the visual setting of their residence more critically than changes to the visual setting of the broader setting in which they travel or work). The visual impact resulting from the combination of visual modification and viewer sensitivity is shown in Table 4-5.

Table 4-5
Visual Impact Matrix

Visual Modification \ Viewer Sensitivity	H	M	L
H	H	H	M
M	H	M	L
L	M	L	L
VL	L	VL	VL

VL = Very Low

L = Low

M = Moderate

H = High

For the purposes of the visual assessment, land use areas in the vicinity of the Tarrawonga Coal Mine were characterised in terms of low, moderate or high visual sensitivity, as follows:

- Low to moderate visual sensitivity – local roads (e.g. Goonbri Road, Blair Athol Road, Leards Forest Road).
- High visual sensitivity – rural dwellings and natural/recreation areas (e.g. Leard State Forest).

The extent to which the viewer may have become accustomed to the existing approved Tarrawonga Coal Mine was also considered.

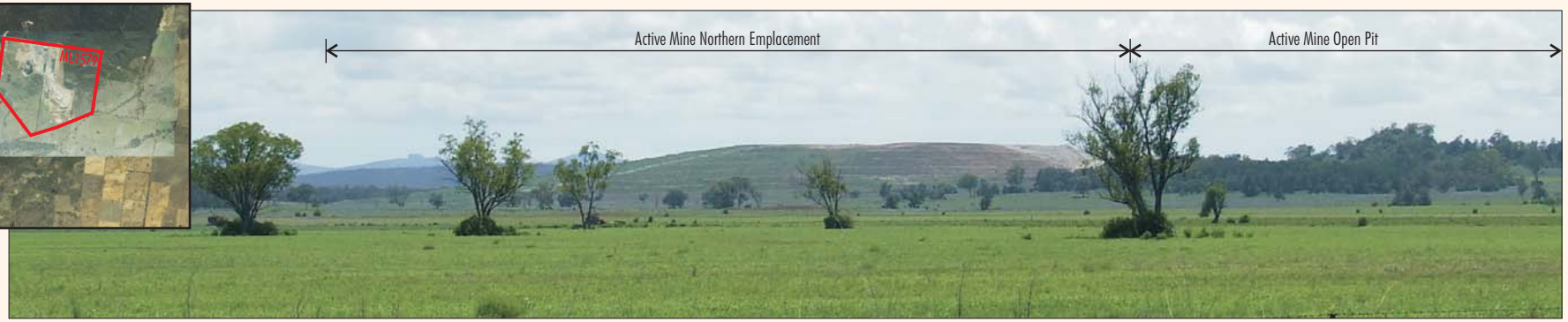
As described in Section 4.2.2, the main changes to the existing topography and visual character that would result from the proposed Modification are:

- the height of the Northern Emplacement would be increased to 370 m AHD;
- the Southern Emplacement would be extended 100 to 300 m to the south;
- some minor landform alterations associated with the new hardstand/infrastructure areas such as minor cut and fill earthworks; and
- other minor landform changes associated with construction of internal access roads and construction of the new water management components.

Assessment of the potential visual impacts focused on areas and privately-owned residences to the south, west and east of the mine. Potential visual impacts were determined in accordance with the matrix presented in Table 4-5.

Figures 4-4, 4-5 and 4-6 provide visual simulations from the vicinity of the “Jeralong”, “Tarrawonga”, and “Blair Athol School House” residences, respectively. It should be noted that each of these residences have numerous trees and shrubs within the ‘house paddock’ surrounding them, which restrict views of the mine to occasional glimpses. The photographs used in the simulations were all taken at the edge of the house paddock closest to the mine and therefore do not take into account screening provided by these trees and shrubs in the foreground. Notwithstanding, the visual simulations were prepared to conservatively show the existing views in the vicinity of these residences as well as simulations of the proposed Modification during 2011/2012 (Figure 2-6), when the proposed landforms would be at their maximum heights. Post-mining simulations were also developed to illustrate the conceptual landform following completion of mining and rehabilitation activities.

The “Jeralong” residence is located approximately 3.5 km from the south-west boundary of ML 1579 (Figure 1-5a). Existing views of the mine site from the “Jeralong” residence are obscured by a ridge which is located between the house and Goonbri Road. On the northern side of the ridge, adjacent to Goonbri Road, the view towards the mine site is of the partially rehabilitated Northern Emplacement (Figure 4-4). The ROM pad cannot be seen due to the presence of a vegetated knoll in the right side of the middle ground (Figure 4-4). The potential visual impact at “Jeralong” would remain generally the same as the existing level of visual impact. The simulation on Figure 4-4 shows that whilst the Northern Emplacement would increase in area and in height by approximately 30 m in the latter years of the proposed Modification, this increase would be offset by progressive rehabilitation and therefore the level of visual impact would be low to moderate. The simulated post-mining landform in Figure 4-4 would be completely rehabilitated and as a result would reduce the level of visual impact even further. As identified above, the views of the Tarrawonga Coal Mine from the “Jeralong” residence site are currently obscured by a ridgeline, with the simulation on Figure 4-4 providing the view from Goonbri Road where it runs along the northern boundary of the “Jeralong” property.



Existing View

Final Mining Year Simulation

Post-Mining Simulation

TARRAWONGA COAL MINE MODIFICATION

FIGURE 4-4

Existing View and Visual Simulations - "Jeralong" Property Boundary

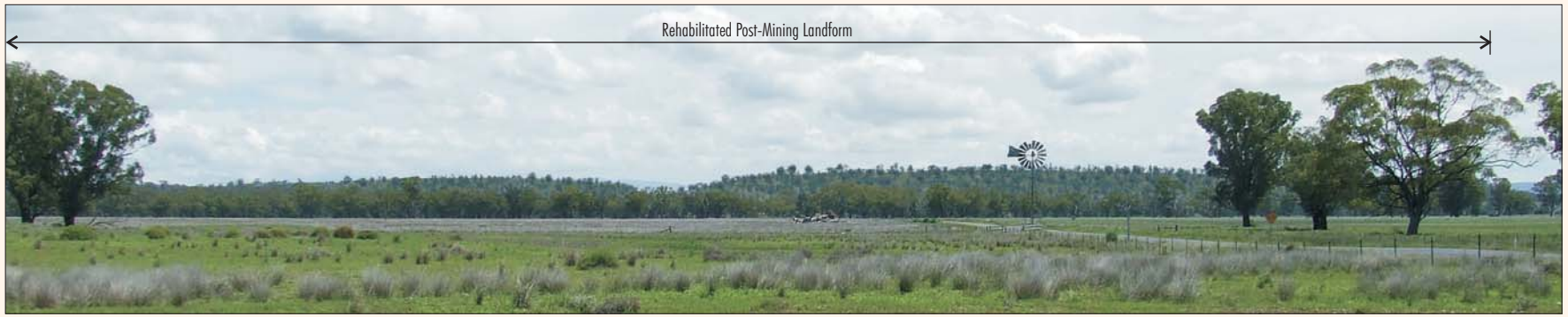
ResourceStrategies

WHITEHAVEN COAL

WHC-09-02 Sect75W Sect 4_001B

Existing View

Final Mining Year Simulation



Post-Mining Simulation

TARRAWONGA COAL MINE MODIFICATION

FIGURE 4-5

Existing View and Visual Simulations - "Tarrawonga" Property Entrance

ResourceStrategies

WHITEHAVEN COAL

WHC-09-02 Sect75W Sect 4_002B

Existing View

Final Mining Year Simulation

Post-Mining Simulation

TARRAWONGA COAL MINE MODIFICATION

FIGURE 4-6

Existing View and Visual Simulations -
"Blair Athol School House"
Property Entrance

ResourceStrategies

WHITEHAVEN COAL

WHC-09-02 Sect75W Sect 4_003B

The "Tarrawonga" residence is located approximately 3 km from the southern boundary of ML 1579 (Figure 1-5a). The existing view shows in the background a small section of the top of the elevated Southern Emplacement, which is partially visible through vegetation in the middle ground (Figure 4-5). The potential visual impact at "Tarrawonga" would occur during the latter years of the proposed Modification, when the heights of the modified landforms increase beyond their currently-approved (Northern Emplacement) or existing (Southern Emplacement) elevations. Figure 4-5 shows that following progressive and final rehabilitation, the level of visual impact would be low to moderate. Further, only the upper halves of the modified emplacements would be visible as the lower halves would be obstructed from view by vegetation in the area between ML 1579 and the "Tarrawonga" residence.

The "Blair Athol School House" is located approximately 2.4 km from the eastern edge of ML 1579 (Figure 1-5a). Whilst the "Blair Athol School House" is a project-related property, views from this location would be representative (conservatively) of views from other properties further to the east of the mine. The existing view shows the eastern side of the upper sections of the Southern Emplacement, the majority of which is obscured by a barrier of trees in the middle ground (Figure 4-6). The potential visual impact of the proposed Modification at the "Blair Athol School House" would occur during the latter years of the modified Tarrawonga Coal Mine, when the heights of the landforms would be at their greatest. The simulation on Figure 4-6 shows that following progressive and final rehabilitation, the level of visual impact would be low to moderate. A substantial proportion of the Southern Emplacement would be visible from the "Blair Athol School House", however this level of visual impact would have occurred in any case (i.e. without the proposed Modification). Only the very top of the Northern Emplacement would be visible in the background to the north-west.

Night-Lighting

The proposed Modification would result in marginally more night-lighting impacts primarily due to the proposed increase in the mining fleet (Table 2-3), and the increase in height of the Northern Emplacement. These changes would, however, only result in a low to moderate increase in night-time visual amenity impacts, due to the continued implementation of management measures such as the use of directional lighting, and design of roads and work areas to minimise light spill.

4.3.3 Mitigation Measures and Management

Potential visual impacts are currently managed through the use of progressive rehabilitation, mine planning, and night-lighting management, which would continue to be implemented for the proposed Modification.

Progressive Rehabilitation

Progressive rehabilitation would be undertaken throughout the life of the Tarrawonga Coal Mine. Rehabilitation of the Northern Emplacement, open cut in-fill area, Southern Emplacement, and other mine infrastructure areas (e.g. coal crushing and load-out facility, workshops, etc.) would include revegetation with pasturelands and woodlands, and would particularly focus on the rehabilitation of the outer batters of the overburden emplacements. Further details of proposed rehabilitation activities are provided in Section 5.

Soil stockpiles and other disturbance areas such as cut and fill batters on access roads or infrastructure areas, would be stabilised and sown with cover crops, where appropriate.

Mine Planning

TCPL would continue to design the overburden emplacements, open cut and other mine landforms so that the main haul roads and work areas would be oriented in a way which minimises potential amenity impacts (e.g. visual, noise and air quality) on nearby privately-owned owned residences.

Night-Lighting

TCPL would seek to minimise light emissions from the Tarrawonga Coal Mine by carefully selecting the sites where lights would be placed, and by using shrouds and reflectors whilst ensuring that operational safety is not compromised. Measures that would be employed to mitigate potential impacts from night-lighting would include one or more of the following, where practicable:

- restriction of night-lighting to the minimum required for operations and safety requirements;
- use of directional lighting;
- use of light shrouds and reflectors to limit light spill; and
- planting of trees or use of other screening measures at nearby dwellings to help reduce potential night-time lighting impacts.

4.4 NOISE AND BLASTING

A Noise and Blasting Assessment for the modified Tarrawonga Coal Mine was undertaken by Wilkinson Murray (Sydney) Pty Ltd (Wilkinson Murray) (2010) and included an evaluation of the on-site operational noise and blasting impacts (Appendix B).

The Noise and Blasting Impact Assessment was conducted in accordance with the NSW *Industrial Noise Policy* (INP) (EPA, 2000).

4.4.1 Existing Environment

Noise and Blasting Management and Monitoring Regime

On-site Operational Noise

Noise management at the Tarrawonga Coal Mine is undertaken in accordance with the NMP which incorporates a Noise Management Protocol and Noise Monitoring Program (TCPL, 2008a). The NMP includes the following:

- details of noise mitigation measures;
- management of community involvement, including handling of complaints; and
- details of the noise monitoring and reporting regimes.

Noise monitoring is conducted on a quarterly basis at the locations shown on Figure 2-3. Details of the specific mitigation measures contained in the NMP are provided in Appendix B.

Off-site Road Haulage

In accordance with Conditions 6 and 7 of Schedule 3 of the Development Consent, the management of off-site road noise is separated between private sections of the approved haul road (Condition 6) and public sections of the approved haul road (Condition 7). Management of noise from off-site transport of product coal is undertaken in accordance with the RNMP (TCPL, 2006b).

Mitigation measures outlined in the RNMP are provided below:

- *Strict adherence to the approved hours of operation for coal dispatch by road as stipulated in Development Consent Condition 4(43):*
  - *(a) 7.00 am to 9.15 pm Monday to Friday;*
  - *(b) 7.00 am to 5.15 pm Saturday; and*
  - *(c) at no time on public holidays.*
- *Maintenance of the mine access road and internal road network to minimise noise generation from loaded and unloaded trucks.*
- *All product transportation trucks will be maintained in good condition to ensure both body and truck engine noise are within acceptable limits. Quiet technology trucks, e.g. trucks with air-bag suspensions and aluminium bodies which minimise the noise from un-laden trucks in particular, will be used where available. Any new trucks purchased will incorporate high horse power engines which require fewer gear changes, lower operating revs and hence, less noise than older trucks.*
- *The coal transportation contractor will provide certification to East Boggabri Coal Pty Ltd (EBC) that coal trucks comply with the noise requirements of ADR 28/01 (road-registered trucks) prior to commencement of off-site coal transportation.*
- *All trucks transporting coal from the mine site will have signs on both driver and passenger doors advising that they are transporting East Boggabri Coal and a truck identification number.*
- *Driver education. Prior to the commencement of coal transportation, EBC, in conjunction with the coal transport contractor, will undertake an education program for all drivers reinforcing:*
  - *the necessity to comply with all commitments in the Transport Code of Conduct, a copy of which will be supplied to all drivers;*
  - *the need for courteous and safe driving and compliance with EBC's commitments with respect to hours of operation and school buses; and*
  - *the locations of residences and the need for drivers to drive in a manner which minimise compression/exhaust braking and engine revving adjacent to residences, including driving in accordance with noise reduction signs.*

  All relief drivers will also be required to attend a competency-based induction prior to commencing to transport product coal from the mine site to ensure that they are fully aware of the noise limitations and expected driver behaviour.
- *Road noise monitoring as described in Section 5.*
- *All drivers will be encouraged to report any evidence of road pavement deterioration which could impact upon noise generation by trucks to their contracting mine (ie EBC or Whitehaven Coal Mining Pty Ltd (WCM) management). EBC and WCM will then jointly assess the additional noise impacts from the road deterioration and, if necessary, undertake or arrange for any works required to achieve compliance with the road noise criteria. The required works will be undertaken by, or to the satisfaction of, the relevant local Council.*

It is relevant to note that TCPL has noise agreements relating to haulage of product coal with three privately-owned receivers ("Pine Grove", "Ambardo" and "Kyalla") which are located proximal to a private section of the approved haul road (Appendix B).

Given that no changes are proposed to the road haulage operation at the Tarrawonga Coal Mine as part of the proposed Modification, associated noise impacts are not further discussed.

Blasting Management

Blast and vibration management would continue to be conducted at the Tarrawonga Coal Mine in accordance with the BNMP (TCPL, 2008b). The BNMP contains:

- details of blasting monitoring undertaken at the Tarrawonga Coal Mine;
- blasting procedures designed to minimise off-site air blast and vibration emissions;
- details of how nearby receivers are notified of blast events;
- flyrock management measures; and
- complaints handling procedures.

Compliance and Complaints

Noise monitoring and monitoring of blasting events has been conducted at the Tarrawonga Coal Mine since 2006. The noise monitoring results were reviewed by Wilkinson Murray (2010), and the results are summarised in Table 4-6.

Table 4-6
Noise and Blasting Monitoring Compliance Summary

Year	Blasting	Noise
2006/2007	Compliance with criteria.	Compliance with criteria.
2007/2008	Compliance with criteria (exceedances within the allowable 5%).	• July 2007 – exceedances of criteria due to road haulage operations recorded at Pine Grove and Ambardo. • September 2007 – exceedances of criteria due to road haulage operations recorded at Pine Grove and Ambardo. • January 2008 – exceedances of criteria due to road haulage operations recorded at Pine Grove and Ambardo.
2008/2009	Compliance with criteria.	• June 2008 – exceedances of criteria due to road haulage operations recorded at Pine Grove, Tarrawonga and Ambardo. • September 2008 – exceedances of criteria due to road haulage operations recorded at Ambardo. • March 2009 – exceedances of criteria due to road haulage operations recorded at Pine Grove and Ambardo.
2009 to March 2010	Compliance with criteria.	• June 2009 – exceedances of criteria due to road haulage operations recorded at Pine Grove, Ambardo and Kyalla. • September 2009 – exceedances recorded at Pine Grove, Ambardo and Tarrawonga. At Pine Grove the exceedance was due to emissions from trucks travelling on the private section of the haul road. At Ambardo the total measured noise was a result of emissions from the open cut operations and trucks travelling on the private section of the haul road. At Tarrawonga the mine noise was due to emissions from the open cut operations. • September 2009 – exceedances of criteria due to open cut operations recorded at Blair Athol School House (now owned by TCPL). • December 2009 – exceedance of criteria due to road haulage operations recorded at Pine Grove. TCPL currently has an agreement in place with the owner of Pine Grove in respect to elevated noise levels from haul trucks and, therefore, under this agreement the measured noise level is not considered an exceedance of the noise criterion.

Source: After TCPL (2007a, 2008c, 2009a, 2009b) and Spectrum Acoustics (2009a, 2009b, 2009c, 2009d, 2009e, 2009f).

The complaints summary provided in the AEMRs for 2006/2007, 2007/2008 and 2008/2009 and the complaints register were reviewed. An overview of findings is provided in Table 4-7.

Table 4-7
Complaints Summary 2006 to 2010

Date Received	Details	TCPL Response
28/07/2006	Blasting vibration and potential for damage to house	TCPL discussed with complainant and conducted ongoing monitoring for future blasts. Complaint later withdrawn following further blasts and no impact on the house was noted.
5/07/2007	Blast event resulted in windows rattling at house	TCPL advised the complainant that Blast controls tightened to exclude blasting where wind speed >6 m/s from the north-west. Blasting to take place around midday, where practicable.
9/07/2007	General complaint received in relation to noise and blasting	TCPL advised the complainant that monitoring indicates compliance with the relevant criteria.
20/08/2007	General complaint received in relation to noise and blasting	TCPL advised the complainant that monitoring indicates compliance with the relevant criteria.
23/04/2008	Blast event resulted in windows shaking at house	TCPL advised the complainant that monitoring indicates compliance with the relevant criteria.
8/10/2009	General complaint received in relation to noise	TCPL reviewed the data, which indicated the prevailing wind on that day was away from the receiver. Suspected source of the noise was the Boggabri Coal Mine, which is closer to the receiver than the Tarrawonga Coal Mine.

Source: After TCPL (2007a, 2008c, 2009a, 2009b) and Spectrum Acoustics (2009a, 2009b, 2009c, 2009d, 2009e, 2009f).

Table 4-7 indicates that noise complaints are received relatively infrequently. TCPL also received other complaints on occasions in relation to road haulage and operating timeframes. Following each complaint, TCPL advised the road haulage contractors of the complaints and undertook steps to address those issues with the complainants.

Noise Measurement and Description

The assessed noise levels presented in Appendix B and summarised in this section are expressed in A-weighted decibels (dBA). The logarithmic dBA scale simulates the response of the human ear, which is more sensitive to mid to high frequency sounds and relatively less sensitive to lower frequency sounds.

The equivalent continuous noise level (L_{Aeq}) refers to the steady sound level, which is equal in energy to the fluctuating levels recorded over the sampling period.

Blasting Measurement and Description

Overpressure (or airblast) is reported in linear decibels (dBL) and is the measurable effect of a blast on air pressure, including generated energy that is below the limit of human hearing. Ground vibration is the measurable movement of the ground surface caused by a blast and is measured in millimetres per second (mm/s) as Peak Vector Sum (PVS) vibration velocity.

Discernible blast emission effects can be divided into the three categories listed below.

1. Occupants of a building can be inconvenienced or disturbed (i.e. temporary amenity effects).
2. Contents of a building can be affected.
3. Integrity of a building structure can be affected.

Background Noise Levels

Given that the construction of the Tarrawonga Coal Mine commenced in 2006 and operations are ongoing, in accordance with the INP it is considered appropriate by Wilkinson Murray (2010) to refer to background noise surveys conducted prior to the establishment of the Tarrawonga Coal Mine.

Review of background noise levels presented in the noise impact assessment which accompanied the 2005 EIS (Spectrum Acoustics, 2005) indicated that the background noise for the locality is 30 dBA during daytime, evening and night-time periods (Appendix B).

4.4.2 Potential Impacts

Operational Noise

Noise Criteria

The INP assessment procedure for industrial noise sources has two components (EPA, 2000):

- controlling potential intrusive noise impacts in the short-term for residences; and
- maintaining noise level amenity for particular land uses, for residences and other land users.

The INP prescribes detailed calculation routines for establishing project-specific $L_{Aeq(15minute)}$ intrusive criteria and $L_{Aeq(period)}$ amenity criteria. The INP project-specific intrusive and amenity assessment criteria for the modified Tarrawonga Coal Mine are presented in Table 4-8.

Table 4-8
INP Project-specific Intrusive and Recommended Acceptable Amenity Assessment Criteria (dBA)

Receiver	Land Use	Intrusive $L_{Aeq(15minute)}$[1]			Amenity $L_{Aeq(period)}$[1]		
		Day	Evening	Night	Day	Evening	Night
All residential receivers	Rural Residential	35	35	35	50	45	40

Source: Appendix B.

[1] Daytime – 7.00 am to 6.00 pm; evening – 6.00 pm to 10.00 pm; and night-time – 10.00 pm to 7.00 am.

In those cases where the INP project-specific assessment criteria are exceeded, it does not automatically follow that all people exposed to the noise would find the noise noticeable or unacceptable. In subjective terms, exceedances of the INP project-specific assessment criteria can be generally described as:

- negligible noise level exceedance (less than 1 dBA) (not noticeable by all people);
- marginal noise level exceedance (between 1 and 2 dBA) (not noticeable by most people);
- moderate noise level exceedance (between 3 and 5 dBA) (not noticeable by some people but may be noticeable by others); and
- appreciable noise level exceedance (greater than 5 dBA) (noticeable by most people).

For the purposes of assessing potential noise impacts, exceedances can be separated into a Noise Management Zone (i.e. 1 to 5 dBA above the criteria) and a Noise Affectation Zone (i.e. greater than 5 dBA above the criteria). In view of the above, Table 4-9 presents the methodology for assessing noise levels which may exceed the INP project-specific noise assessment criteria.

Table 4-9
Project Noise Impact Assessment Methodology

Assessment Criteria	Project-Specific Criteria	Noise Management Zone		Noise Affectation Zone
		Marginal	Moderate	
Intrusive $L_{Aeq(15\ minute)}$	35 dBA	1 to 2 dBA above project-specific criteria	3 to 5 dBA above project-specific criteria	> 5 dBA above project-specific criteria
Amenity $L_{Aeq(period)}$	50, 45 and 40 dBA for daytime, evening and night-time periods, respectively			

Source: Appendix B.

Noise Modelling

Methodology

Noise modelling was conducted by Wilkinson Murray using the Environmental Noise Model and noise levels were predicted for both calm and adverse meteorological conditions.

In terms of the adverse meteorological conditions modelled, Wilkinson Murray calculated noise levels at nearby receivers under a varied set of existing meteorological conditions, using meteorological data obtained from the Tarrawonga Coal Mine meteorological station for 2007. Measured statistical occurrences of these meteorological conditions were then applied to the noise results, and a 10^{th} percentile exceedance noise level calculated (i.e. the level that is exceeded 10% of the time), which was then compared with relevant criteria.

Assessment of Feasible and Reasonable Noise Mitigation Measures

The modelled scenario presented in Appendix B is the result of several iterative noise modelling investigations designed to determine feasible and reasonable noise mitigation measures. Where feasible and reasonable, operations have been modified to reduce potential noise emissions from the modified Tarrawonga Coal Mine. The iterative steps undertaken are described below:

1. Preliminary noise modelling of scenarios representative of the maximum noise emissions from the proposed Modification to identify the potential for noise exceedances.
2. Evaluation of various combinations of noise management and mitigation measures to assess their relative effectiveness.
3. Review of the effectiveness of these measures and assessment of their feasibility by TCPL.
4. Adoption by TCPL of a range of noise management and mitigation measures to appreciably reduce noise emissions associated with the proposed Modification, including (Appendix B):
   - installation of a 6 m high bund on the southern side of selected portions of the haul roads (generally where the haul roads run east-west);
   - installation of a real-time noise monitor at a nearby reference location and implementation of a trigger-level management system;
   - cessation of waste emplacement activities on the southern waste rock emplacement during evening and night-time periods, where required by real-time noise monitoring triggers (Section 4.4.3);
   - modified alignment of haul routes (in particular, relocating the haul route from the open cut floor to the Northern Emplacement to its northern face);

- orientation of the ROM coal stockpiles to screen the on-site crusher and the mobile crusher; and
- modification of the fleet during the evening and night-time periods.

Predicted Noise Emissions

The results of acoustic modelling conducted by Wilkinson Murray (2010) for the modified Tarrawonga Coal Mine are described in Appendix B and are summarised below.

Calm Meteorological Conditions

- The 35 dBA $L_{Aeq,15min}$ criterion would be met for all privately-owned receivers, except for "Ambardo", which is predicted to experience a marginal (1 dBA) exceedance.

Tenth Percentile Adverse Meteorological Conditions

- In most instances, operational noise at nearby receivers would be highest during night-time periods (due mainly to the prevalence of night-time temperature inversions).
- Two privately-owned receivers ("Tarrawonga" and "Ambardo") are predicted to exceed the criteria by greater than 5 dBA during evening and night periods for the modified Tarrawonga Coal Mine under adverse meteorological conditions.
- Noise levels at four privately-owned receivers ("Kyalla", "Pine Grove", "Flixton" and "Green Hills") are predicted to exceed the criteria by between 3 and 5 dBA for the modified Tarrawonga Coal Mine under adverse meteorological conditions.
- Noise levels at four privately-owned receivers ("Jeralong", "Barbers Lagoon", "Northam" and "Unnamed-b") are predicted to marginally exceed the criteria by between 1 and 2 dBA for the modified Tarrawonga Coal Mine under adverse meteorological conditions.

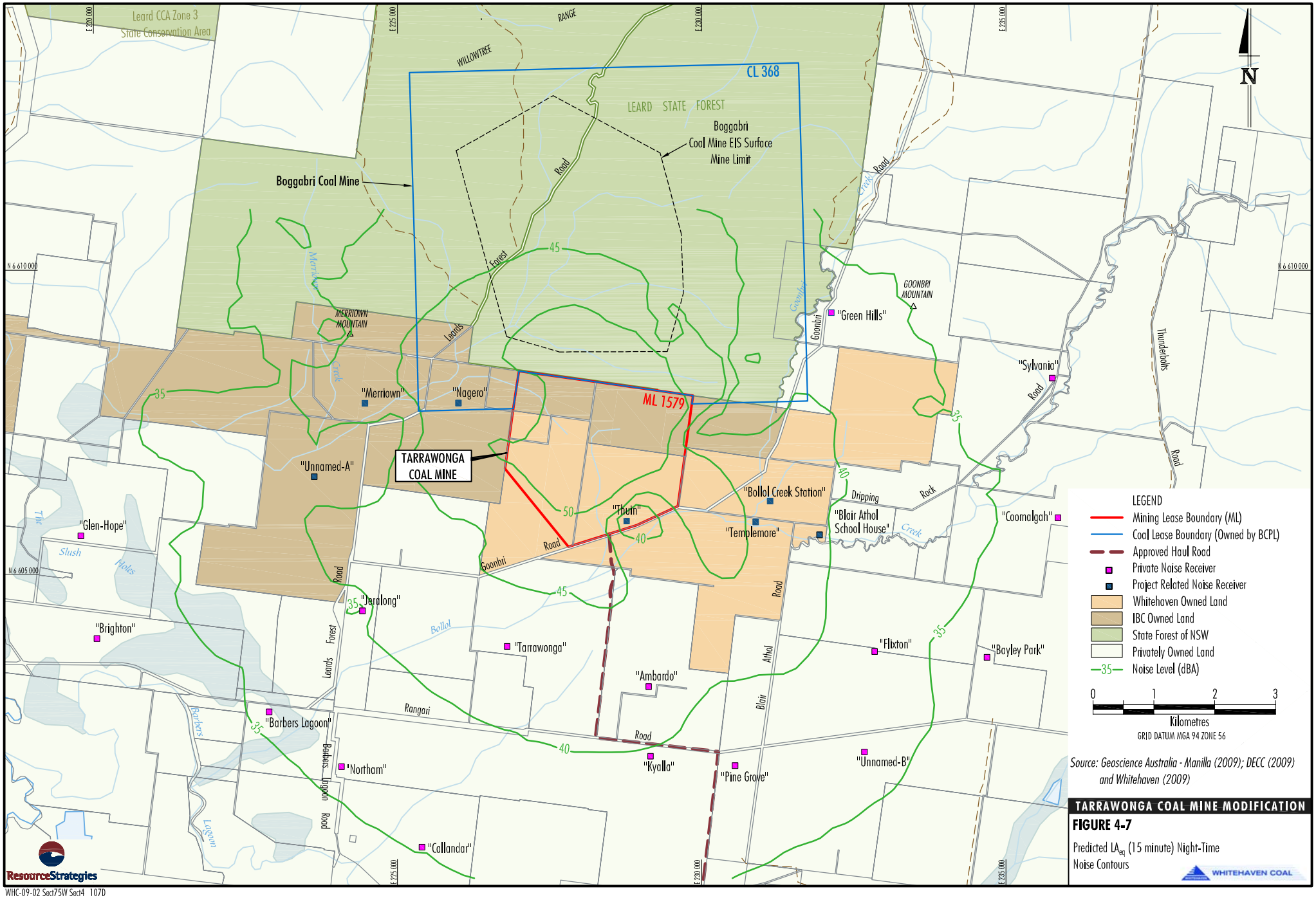
A summary of potential exceedances under adverse meteorological conditions is provided in Table 4-10 below.

Table 4-10
Summary of Potential Exceedances under Adverse Meteorological Conditions

Noise Management Zone		Noise Affection Zone
1 to 2 dBA Exceedance	**3 to 5 dBA Exceedance**	**> 5 dBA Exceedance**
Jeralong	Kyalla	Tarrawonga
Barbers Lagoon	Pine Grove	Ambardo
Northam	Flixton	
Unnamed-b	Green Hills	

Source: Appendix B.

Night-time $L_{Aeq(15minute)}$ noise contours during adverse meteorological conditions are presented on Figure 4-7. The development of noise contours involves interpolation and in some cases the contours on Figure 4-7 will vary from the point-source calculations presented in Appendix B.



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Cumulative Noise Emissions

Appendix B presents an assessment of the potential cumulative impacts associated with the modified Tarrawonga Coal Mine and the Boggabri Coal Mine, located to the immediate north of the Tarrawonga Coal Mine (Figure 1-4). The methodology used in Appendix B involved adding the highest predictions from the noise model for the modified Tarrawonga Coal Mine to the highest predictions for a recent modification to the Boggabri Coal Mine, and comparing the result with the relevant amenity criteria.

Wilkinson Murray (2010) noted that this methodology is highly conservative as it assumes that worst-case noise emissions from both operations coincide for every receiver. In addition, the assessment uses noise levels calculated over a 15 minute period (i.e. $L_{Aeq(15minute)}$) for the Boggabri Coal Mine and compares the results against the amenity criteria which is averaged over the relevant period (i.e. $L_{Aeq(period)}$). This is conservative because the $L_{Aeq(15minute)}$ noise levels are generally approximately 2 to 3 dBA higher than the corresponding $L_{Aeq(period)}$ noise level (Appendix B).

Notwithstanding the conservative methodology, Wilkinson Murray (2010) concluded that predicted cumulative noise levels would not exceed the day, evening or night-time amenity criteria at any prviately-owned receiver (Appendix B).

Blasting

Blasting Criteria

Ground vibration and airblast levels which cause human discomfort are generally lower than the recommended structural damage limits. Therefore, compliance with the lowest applicable human comfort criteria generally ensures that the potential to cause structural damage to buildings is minimal.

The DECCW currently adopts the Australian and New Zealand Environment Conservation Council (ANZECC) (1990) *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* for assessing potential annoyance from blast emissions during daytime hours, as follows:

- the recommended maximum level for airblast is 115 dBL;
- the level of 115 dBL may be exceeded on up to 5% of the total number of blasts over a period of 12 months. The level should not exceed 120 dBL at any time;
- the recommended maximum for ground vibration is 5 mm/s, PVS vibration velocity; and
- the PVS level of 5 mm/s may be exceeded on up to 5% of the total number of blasts over a period of 12 months. The level should not exceed 10 mm/s at any time.

Australian Standard (AS) 2187:2006 *Part 2 Explosives - Storage and Use - Part 2: Use of Explosives* provides guidance in assessing blast-induced ground (and structural) vibration and airblast effects on buildings and their occupants. In relation to building damage airblast criteria, AS 2187 recommends a maximum airblast of 133 decibels (dB) (peak linear [pkLinear]). In accordance with AS 2187, Appendix B adopts 10 mm/s as the building damage vibration criterion.

Blasting Predictions

Blasting predictions are presented in Appendix B based on empirical blasting measurements undertaken at an open cut coal mine in NSW.

The blasting predictions presented in Appendix B indicate that vibration and air blast emissions would comply with the relevant human comfort and structural damage criteria at nearby privately-owned receivers.

One project-related receiver ("Thuin") is predicted to exceed the building damage criteria for vibration. Management of blasting at "Thuin" is discussed in Section 4.4.3 below.

4.4.3 Mitigation Measures, Management and Monitoring

Noise Mitigation Measures

The privately-owned receivers where noise emissions are predicted to exceed the project-specific criteria can be divided into a Noise Management Zone and a Noise Affectation Zone (Table 4-10). Proposed management procedures for receivers in these zones are described below.

Noise Management Zone

Depending on the degree of exceedance of the project-specific criteria, potential noise impacts in the Noise Management Zone could range from marginal to moderate (in terms of the perceived noise level increase). In addition to the noise mitigation measures included in the predictive modelling, noise management procedures would include:

- noise monitoring on-site and within the community;
- prompt response to any community issues of concern and complaints;
- refinement of on-site noise mitigation measures and operating procedures where practicable; and
- implementation of feasible and reasonable acoustical mitigation at receivers (which may include measures such as enhanced glazing, insulation and/or air-conditioning), in consultation with the relevant landowner, where noise monitoring shows noise levels which are 3 to 5 dBA above project-specific noise criteria.

Noise Affectation Zone

Exposure to noise levels greater than 5 dBA above project-specific criteria may be considered unacceptable by some landowners. Management procedures for the Noise Affectation Zone would include:

- discussions with relevant landowners to assess concerns and define responses;
- implementation of feasible and reasonable acoustical mitigation at receivers (which may include measures such as enhanced glazing, insulation and/or air-conditioning), in consultation with the relevant landowner, where noise monitoring shows noise levels from the mine which are greater than 5 dBA above project-specific noise criteria; and
- negotiated agreements with landowners where required.

TCPL has commenced the relevant landholder consultation with relevant landholders in the affectation zone and the management zone and is currently in discussions with the owners of "Ambardo" in relation to potential acquisition or landholder noise agreement. TCPL currently has an agreement with "Ambardo" in relation to road haulage noise. In addition, the "Tarrawonga" receiver is currently rented and resided in by a TCPL employee who has indicated that noise associated with the proposed modification is not likely to cause concern. TCPL would continue to consult with the owner and with the occupier of "Ambardo" regarding potential noise impacts.

A continuous noise monitor would be installed at a nearby reference location to assist with noise management and enable real-time noise controls to be implemented. The existing NMP would be revised to reflect the use of the continuous noise monitor as part of the noise management regime. The revised NMP would include details of a noise level 'triggers' that would result in operational noise controls being invoked, including the cessation of waste emplacement activities on the southern waste rock emplacement during evening and night-time periods.

The existing NMP would be revised to include the mitigation measures for the proposed Modification. In addition, the NMP includes a number of general noise mitigation measures that would continue to be implemented for the modified Tarrawonga Coal Mine:

- Contractors, including all personnel and sub-contractors, would undergo environmental training on noise control and awareness. This training would take place before the commencement of work by any contractor, or sub-contractor, whose work is likely to create loud noise.
- The Sound Power Levels of mobile mining equipment would be periodically tested in accordance with ISO 6395:1988 *Acoustics - Measurement of exterior noise emitted by earth-moving machinery - Dynamic test conditions*.
- Site equipment selection would include consideration of sound power levels and equipment would be maintained in good order.
- The contractors would be required to pay due attention to adverse weather conditions and make modifications to the work programme, where necessary.
- All complaints would be registered and responded to in accordance with the complaints procedures in the Environmental Management System.
- Monitoring of emitted noise levels would be undertaken during mining operations to verify compliance with noise criteria and to assess the need, if any, for additional noise attenuation measures.

Blasting Mitigation Measures

Blasting would either be managed in a way that ensures that the relevant structural damage criteria are satisfied at the project-related "Thuin" receiver, or the dwelling would be vacated (i.e. the dwelling would be vacant until such time as blasting activities are sufficiently remote to ensure compliance with the structural damage criteria). Should TCPL decide to vacate "Thuin", the dwelling would remain unoccupied until a structural inspection is undertaken and indicates that the building is structurally sound and fit for occupation.

Should the "Thuin" receiver continue to be occupied throughout the life of the modified Tarrawonga Coal Mine, the existing Blast Monitoring Programme would be revised to include specific measures that would be invoked to reduce blasting emissions to below the building damage criteria (e.g. reducing the MIC in the southern portion of the open cut).

4.5 AIR QUALITY

An Air Quality Impact Assessment was undertaken by Heggies (2010) and is attached as Appendix C. The assessment was conducted in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (DEC, 2005b).

4.5.1 Existing Environment

Air Quality Management Regime

Air quality management at the Tarrawonga Coal Mine is described in the AQMP (TCPL, 2009c). Current air quality mitigation and management measures employed at the Tarrawonga Coal Mine are provided below (TCPL, 2009a):

- Use of trunks, branches and litter from clearing for mine site rehabilitation (no materials are burnt).
- Limiting groundcover removal in advance of mining consistent with operational requirements. Under normal operational circumstances, a maximum of 60 m is prepared in advance of mining.
- Groundcover removal as part of the topsoil removal activities, rather than prior to topsoil removal.
- Where practicable, limiting soil stripping activities to periods when there is sufficient soil moisture to prevent significant dust lift-off and avoiding periods of high winds.
- Soil stripping using open bowl scrapers, thereby eliminating the dust generated from elevated scrapers.
- Application of water to exposed surfaces, with emphasis on those areas subject to frequent vehicle or equipment movements which may cause dust generation and subsequent dispersion.
- Use of water injection on drilling rigs.
- Use of imported aggregates for blast hole stemming.
- Water application at the on-site crusher and on the conveyor discharge point to the coal bin.
- Cessation of coal processing activities during periods of concurrent high winds and temperatures which cause coal dust dispersal, independent of water applications.
- ROM coal pad watering.
- Progressive shaping and rehabilitation of areas once they are no longer required for mining purposes.
- Speed limit restrictions on all vehicles and equipment on the mine site.
- Equipment exhaust positioning to avoid exhausts impinging on the ground and causing dust lift-off.
- Use of covers on all product coal trucks. Toll is the principal contractor engaged in the haulage of coal from the Tarrawonga Coal Mine to the CHPP. All Toll vehicles and those operated by its contractors are fitted with roll-over tarpaulins.

Air quality-related complaints were reviewed by Heggies (2010). Examination of the AEMR for 2006/2007, 2007/2008 and 2008/2009 (TCPL, 2007a, 2008c, 2009a) indicated that six complaints pertaining to air quality issues have been received between May 2006 and April 2009.

Of the six complaints received between May 2006 and April 2009, five were received from a residence that was subsequently purchased by TCPL. No complaints regarding air quality were received by TCPL during the 2008/2009 reporting period.

Air Quality Criteria

Dust Deposition

The DECCW amenity criteria for dust deposition seeks to limit the maximum increase in the mean annual rate of dust deposition from a new development to 2 grams per square metre per month (g/m^2/month) and total dust deposition (i.e. including background air quality) to 4 g/m^2/month (Appendix C).

Concentrations of Suspended Particulate Matter

Exposure to suspended particulate matter can lead to health and amenity impacts. The likely risk of these impacts depends on a range of factors including the size, chemical make-up and concentration of the particulate matter and the general health of the person (NSW Health and NSW Minerals Council, 2006).

Such particles (referred to as total suspended particles [TSP]) are typically less than 50 micrometres (μm) in size and can be as small as 0.1 μm. Fine particles less than 10 μm are referred to as PM_{10}. Suspended particulate matter criteria, standards and goals used in the assessment include (Appendix C):

- The DECCW 24-hour PM_{10} assessment criterion of 50 micrograms per cubic metre ($\mu g/m^3$) (for concentrations due to the modified Tarrawonga Coal Mine alone).
- The DECCW annual assessment criterion for PM_{10} of 30 $\mu g/m^3$ as a concentration that should be met within the region (concentrations due to the modified Tarrawonga Coal Mine plus background air quality).
- The National Health and Medical Research Council's (NHMRC's) annual goal for TSP of 90 $\mu g/m^3$ (concentrations due to the modified Tarrawonga Coal Mine plus background air quality).

Details of the air quality criteria for concentrations of suspended particulate matter are provided in Table 4-11.

Table 4-11
Air Quality Assessment Criteria for Suspended Particulate Matter Concentrations

Pollutant	Criterion/Goal	Agency
TSP Matter	90 $\mu g/m^3$ (annual mean)	NHMRC
PM_{10}	50 $\mu g/m^3$ (24-hour average – maximum)*	DECCW assessment criterion
	30 $\mu g/m^3$ (annual mean)	DECCW assessment criterion

Source: After Appendix C.

* modified Tarrawonga Coal Mine only emissions.

In addition to the above, Appendix C also presents an assessment of 24-hour maximum PM_{10} emissions from the modified Tarrawonga Coal Mine and other sources.

Air Quality Monitoring Results

Dust Deposition

Ambient dust deposition levels have historically been measured by TCPL at thirteen separate locations surrounding the Tarrawonga Coal Mine since 2005, with twelve locations currently active. Additionally, IBC currently maintains four locations in the local region.

Annual averages for available data are presented in Table 4-12 below.

Table 4-12
Annual Average Dust Deposition Rates (g/m^2/month)

Monitoring Location	Description	Annual Average Dust Deposition Levels (g/m^2/month)			
		2006	2007	2008	2009[1]
EB-3	TCPL-owned	1.7	2.6	4.2[2]	N/A
EB-4	TCPL-owned	1.4	1.4	2.0	2.9
EB-5	TCPL-owned	2.0	2.2	2.3	4.8
EB-6	Ambardo	1.2	1.0	1.3	2.4
EB-7	IBC-owned	1.2	1.1	1.2	2.4
EB-8	TCPL-owned	1.1	1.1	2.5	11.3
EB-9	Pine Grove	0.9	1.2	1.0	2.2
EB-10	Tarrawonga	1.4	1.0	2.9	3.3
EB-11	TCPL-owned	N/A	1.4	1.4	3.5
EB-12	Pine Grove	N/A	1.0	1.7	3.5
EB-13	TCPL-owned	N/A	4.4	12.9	6.8
EB-14	TCPL-owned	N/A	N/A	2.7	3.6
EB-15	TCPL-owned	N/A	N/A	2.7	7.2

Source: Appendix C.

[1] Data are available to December 2009.

[2] Site decommissioned in June 2008.

N/A: No data available.

As shown in Table 4-12, the recorded annual average dust deposition levels vary across all monitoring sites, with elevated levels recorded at locations closer to the Tarrawonga Coal Mine site boundary. It is noted that, with the exception of EB-13, dust deposition levels in 2009 are the highest throughout. It is likely that this attributable to the occurrence of significant regional-scale dust storm events in September 2009 (Appendix C).

Dust deposition levels at the three dust deposition monitoring locations situated at privately-owned properties ("Ambardo", "Pine Grove" and "Tarrawonga") are below the relevant air quality goal of 4 g/m^2/month for each monitoring year (Table 4-12). Dust gauges on TCPL-owned land are located, in some situations, in close proximity to active mining areas and are considered to provide diagnostic data only.

Taking into account the large number and geographical spread of dust deposition monitoring undertaken around the Tarrawonga Coal Mine; given the distance of the "Pine Grove" monitoring location (Figure 2-3) from mining operations, it is likely that this location best provides a measure of ambient dust deposition levels with minimal influence of local mining operations (1.2 g/m^2/month [annual average]) (Appendix C).

Concentrations of Suspended Particulate Matter

PM_{10} concentrations (24-hour average, 1-in-6 day cycle) are measured by HVAS at two locations surrounding the Tarrawonga Coal Mine. The HVAS locations are situated at the "Merriown" property (Figure 2-3) to the west and the "Templemore" property (Figure 2-3) to the east.

All measured concentrations at both HVAS locations between December 2006 and October 2009 were below the DECCW 24-hour average criterion of 50 µg/m^{3,} with the exception of three 24-hour periods (two in the "Merriown" dataset [15 April 2007 and 30 June 2009] and one in the "Templemore" dataset [27 September 2009]). The exact cause of these exceedances is not readily known, however Heggies (2010) review of the NSW DECCW 2007 Annual National Environment Protection Measures Report indicated that elevated concentrations were experienced at regional NSW monitoring locations on 15 April 2007, while one "Templemore" exceedance occurred during the September 2009 regional dust storm event. The average PM_{10} concentrations of the "Templemore" and "Merriown" HVAS datasets are 15.5 µg/m^3 and 15.1 µg/m^3 respectively (Appendix C).

TSP concentrations can be inferred from the PM_{10} monitoring data, by assuming that 40% of the TSP is PM_{10}. This relationship was obtained from data collected from co-located TSP and PM_{10} monitors that were operated for periods of time in the Hunter Valley (NSW Minerals Council, 2000).

Based on inferred concentrations, it has been assumed that the annual average TSP background concentration is 30.5 µg/m^3 which is well below the DECCW assessment criterion of 90 µg/m^3 (Appendix C).

4.5.2 Potential Impacts

Modelling Scenario

Appendix C predicts the air quality emissions likely to be generated by the modified Tarrawonga Coal Mine and the predicted impact of these emissions in combination with existing background air quality in the vicinity of the Tarrawonga Coal Mine. Dispersion modelling was undertaken by Heggies (2010) in accordance with the DEC (2005b).

A representative worst-case modelling scenario was developed by Heggies (2010) and TCPL for the purposes of developing dispersion model predictions.

Dust Deposition

Modified Tarrawonga Coal Mine only incremental increases in annual average dust deposition were not predicted to exceed the applicable 2 g/m^2/month DECCW amenity criterion at any receiver (Appendix C).

Annual average dust deposition due to the modified Tarrawonga Coal Mine plus the assumed background level (1.2 g/m^2/month) was also not predicted to exceed the applicable 4 g/m^2/month DECCW amenity criterion at any receiver (Appendix C).

Suspended Particulates

Annual Average PM_{10}

Predicted annual average PM_{10} (modified Tarrawonga Coal Mine plus background) concentrations were not predicted to exceed the 30 µg/m^3 DECCW assessment criterion at any receiver (Appendix C).

24-Hour PM_{10}

Modified Tarrawonga Coal Mine only predicted 24-hour PM_{10} concentrations modelled were not predicted to be above the 50 µg/m^3 DECCW assessment criterion at any privately-owned receivers (Appendix C).

Annual Average TSP

Annual average TSP (modified Tarrawonga Coal Mine plus background) concentrations modelled were not predicted to be above the DECCW assessment criterion of 90 µg/m^3 at any receiver (Appendix C).

Air Quality Contours

Contours showing the predicted modified Tarrawonga Coal Mine-only maximum 24-hour average PM_{10} emissions, annual average PM_{10}, annual average TSP and annual average dust deposition are provided on Figure 4-8.

Road Transport Emissions

An assessment of the potential air quality implications associated with the haulage of ROM coal from the Tarrawonga Coal Mine to the CHPP is provided in the air quality impact assessment for the 2005 EIS (Richard Heggie Associates, 2005). Given that the maximum number of daily product coal truck movements would not change as a result if the proposed Modification, the conclusions in Richard Heggie Associates (2005) would remain unchanged (Appendix C).

4.5.3 Mitigation Measures, Management and Monitoring

As discussed in Section 4.5.1, TCPL currently employs air quality mitigation and management measures at the Tarrawonga Coal Mine which are considered by Heggies (2010) to be generally best practice. These measures are described in the AQMP and the *Annual Environmental Management Report for the Tarrawonga Coal Mine May 2008 – April 2009* (TCPL, 2009a).

4.6 GREENHOUSE GAS GENERATION

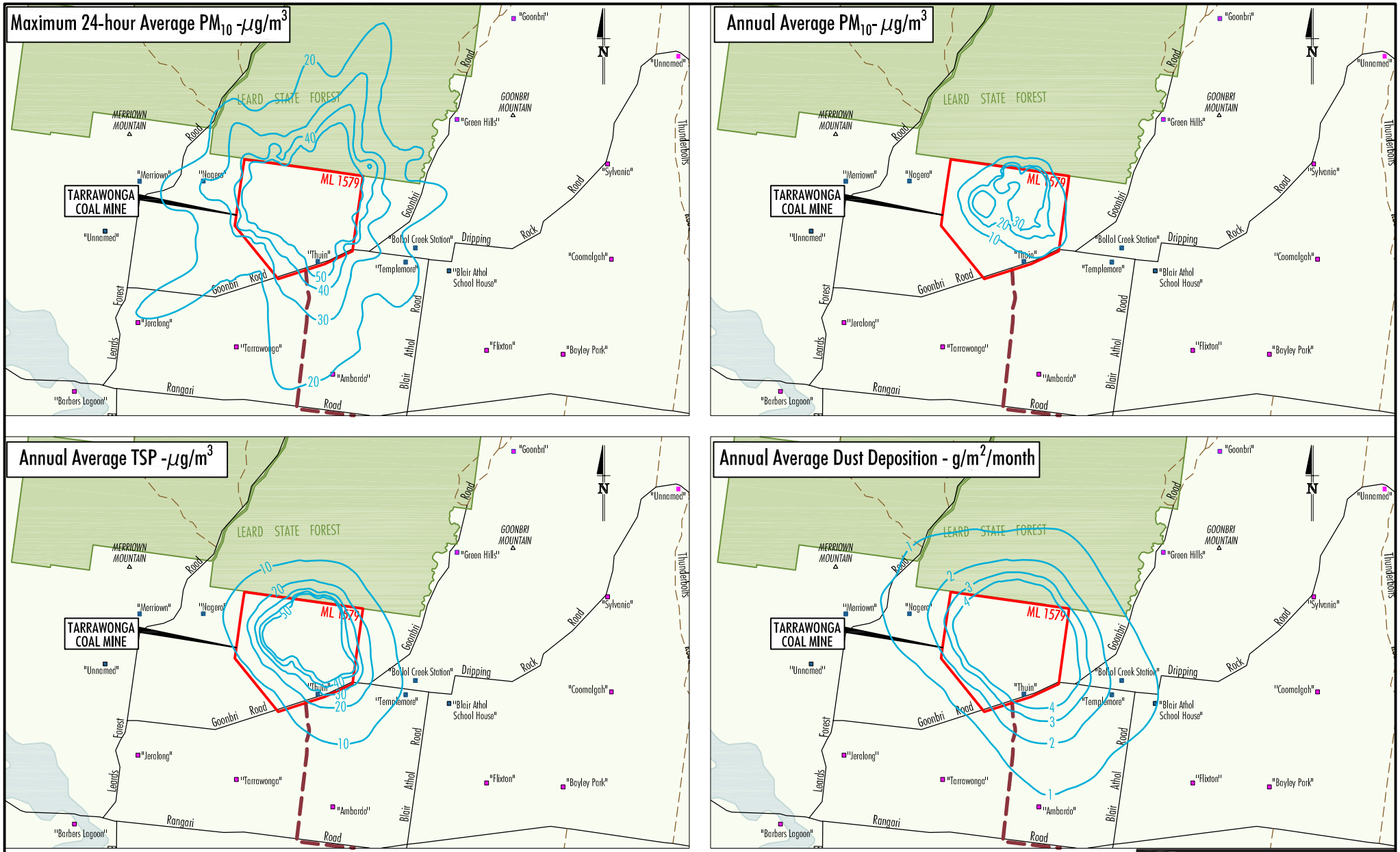
4.6.1 Modified Tarrawonga Coal Mine Greenhouse Gas Emissions

Greenhouse gas emissions associated with the proposed Modification have been assessed in Appendix C in accordance with relevant National Greenhouse Accounts factors (Commonwealth Department of Climate Change [DCC], 2009). The greenhouse gas emissions associated with the modified Tarrawonga Coal Mine have been assessed in terms of direct (Scope 1) emission potential, indirect (Scope 2) emission potential and significant upstream/downstream (Scope 3) emission potential (Appendix C).

Direct emissions include diesel usage and the liberation of methane associated with mining of the coal seam, whilst indirect emissions are associated with the transportation and end-use of coal.

The total direct (Scope 1) emissions from the modified Tarrawonga Coal Mine are estimated to be approximately 0.14 million tones of carbon dioxide-equivalent (Mt CO_2-e) emissions per annum. The total indirect emissions (Scope 3) are estimated to be 5.1 Mt CO_2-e per annum (Appendix C).

A comparison of the predicted direct (Scope 1) emissions against Australia's 2007 net emissions of 597 Mt CO_2-e demonstrates that the modified Tarrawonga Coal Mine would represent approximately 0.02% of the total annual Australian emissions (DCC, 2008). A comparison of the predicted Scope 1 emissions against NSW emissions in 2007 (162.7 Mt CO_2-e) demonstrates that the modified Tarrawonga Coal Mine would represent approximately 0.08% of NSW emissions (DCC, 2007).



TARRAWONGA COAL MINE MODIFICATION

FIGURE 4-8

Predicted Air Quality Emissions from the Modified Tarrawonga Coal Mine

WHITEHAVEN COAL

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4.6.2 Mitigation Measures, Management and Monitoring

TCPL has investigated opportunities for greenhouse reduction at the Tarrawonga Coal Mine. To date, these investigations have focussed on the reduction of diesel use. Measures employed to reduce diesel use have included (TCPL, 2009a):

- regular maintenance of the mining fleet;
- minimising the gradient and length of loaded haul runs for the operating dump trucks;
- use of Terex dump trucks (electric drive), which have proven to burn less diesel fuel as compared to the standard mechanical drive fleet;
- use of B-Doubles for the product coal haulage fleet with the prime mover's specifically engineered for low emissions; and
- product coal haulage fleet are limited to a speed of 93 kilometres per hour, which has been determined to be the optimum operating speed in terms of operational and fuel efficiency.

In addition, TCPL is a member of the Federal Government's Greenhouse Challenge Plus Program. Greenhouse gas mitigation measures would continue to be investigated and reported through the AEMR.

4.7 ABORIGINAL HERITAGE

A Cultural Heritage Assessment was prepared for the proposed Modification by Landskape Natural and Cultural Heritage Management Pty Ltd (Landskape) (Appendix E). It was undertaken in accordance with the *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (DEC, 2005a) and the *Interim Community Consultation Requirements for Applicants* (*Interim Requirements*) (DEC, 2004b) and in consideration of the *Aboriginal Cultural Heritage Draft Community Consultation Requirements for Proponents Part 6 National Parks and Wildlife Act, 1974* (NSW Department of Environment and Climate Change [DECC], 2009a).

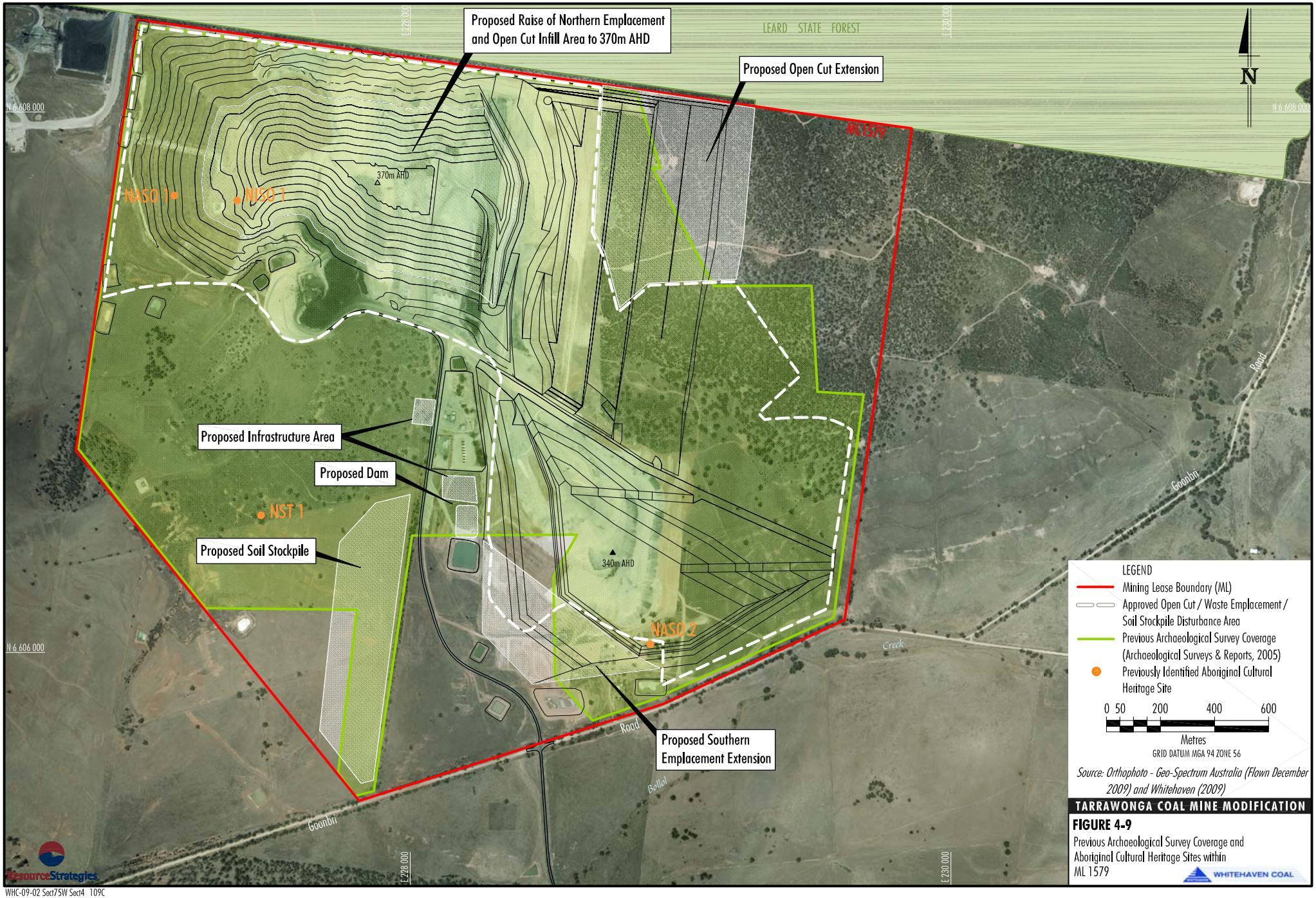
A description of Aboriginal heritage in the vicinity of the Tarrawonga Coal Mine is provided in Section 4.7.1. Section 4.7.2 describes the potential impacts of the proposed Modification on Aboriginal heritage and Section 4.7.3 outlines mitigation, management and monitoring measures.

4.7.1 Existing Environment

Previous Archaeological Investigations

The most recent archaeological investigation of the Tarrawonga Coal Mine area was undertaken by Archaeological Surveys & Reports Pty Ltd (ASR) as part of the 2005 EIS. ASR (2005) estimated that they archaeologically surveyed approximately 473 ha within ML 1579, including most of the disturbance areas of the proposed Modification (Figure 4-9).

A total of four Aboriginal heritage sites were identified within ML 1579 by ASR (Table 4-13 and Figure 4-10). A further four sites were identified along the proposed access route to the mine (i.e. GGOS1, GGOS2, GGOS3 and GGOS4).



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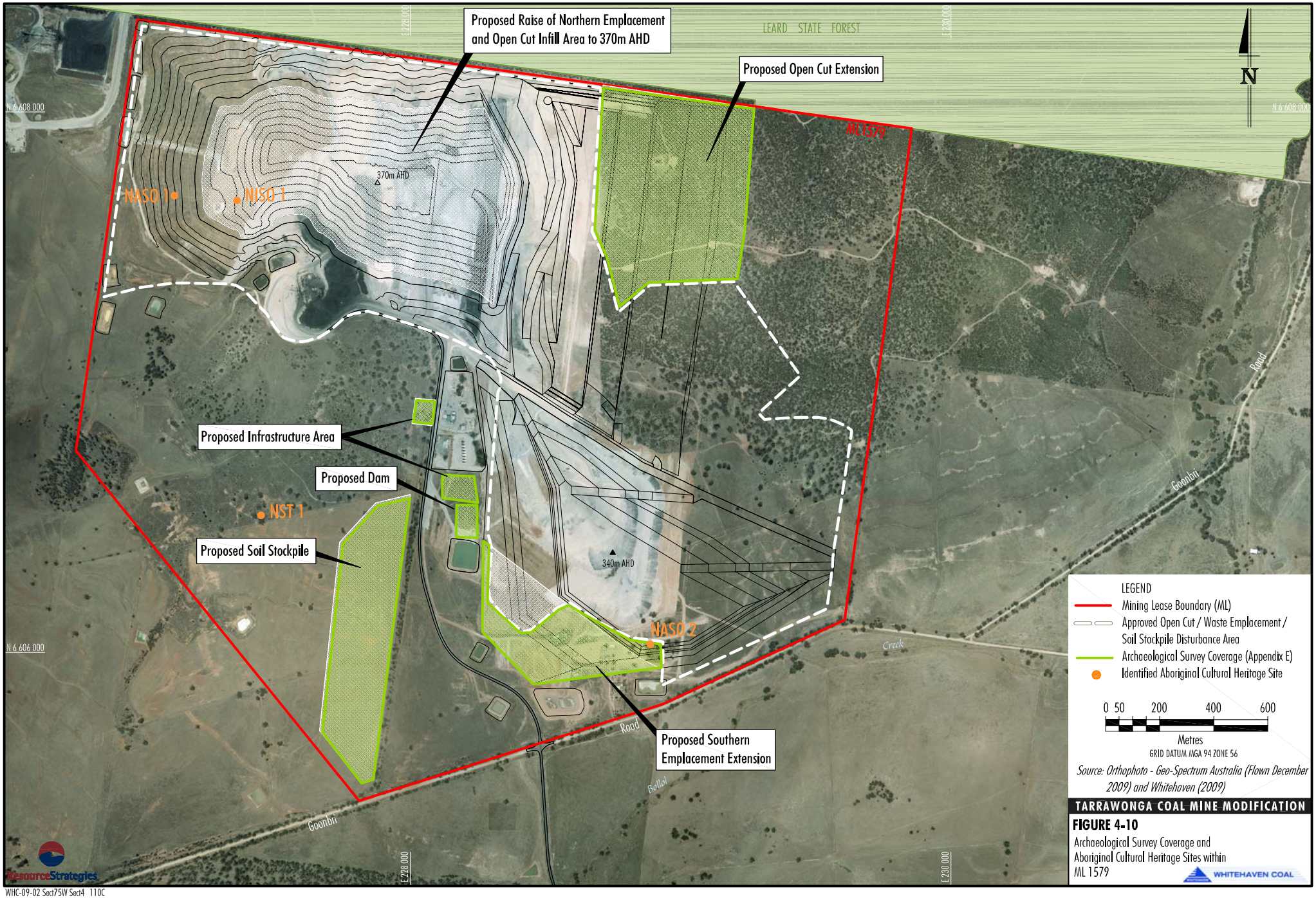

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Table 4-13
Known Aboriginal Heritage Sites within ML 1579

Site Type	Site
Isolated Artefact	NAS01, NIS01, NAS02
Tree (possibly been scarred by Aborigines)	NST1
Artefact scatters along the access route to the mine	GGOS1, GGOS2, GGOS3 and GGOS4

Representatives from the Red Chief LALC and Bigundi Biame Gunnedarr Traditional People are contracted to inspect all construction areas at the Tarrawonga Coal Mine prior to disturbance and perform the role of monitors during construction works in accordance with the ACHMP (TCPL, 2005a).

To date, Red Chief LALC and Bigundi Biame Gunnedarr Traditional People representatives have not identified any additional Aboriginal heritage items since commencement of the Tarrawonga Coal Mine (TCPL, 2007a, 2008c, 2009a) (Appendix E).

In addition to the archaeological investigations described above, a number of investigations have been undertaken in the wider region and a summary of these is presented in Appendix E.

Cultural Heritage Assessment

Assessment Programme

The Landskape (2010) Cultural Heritage Assessment used the findings of the previous assessments plus the results of the Aboriginal heritage survey and site inspection conducted by an archaeologist and representatives of the Aboriginal community in January 2010. The aim of the Aboriginal heritage survey and site inspections was to conduct additional site-specific survey in the proposed Modification disturbance areas and to provide the contemporary Aboriginal community the opportunity to inspect the areas in order to provide more informed comment on cultural significance and heritage management and mitigation recommendations. The area surveyed during January 2010 is shown on Figure 4-10.

Table 4-14 summarises the main stages of the Aboriginal heritage consultation/survey programme undertaken as part of the proposed Modification.

Table 4-14
Summary of Proposed Modification Aboriginal Heritage Consultation/Survey Programme

Date	Consultation/Survey Conducted
November 2009	Public advertisement and registration of interested stakeholders.
November 2009	Identification of local Aboriginal stakeholders with an interest in being consulted in regard to Aboriginal heritage at the Tarrawonga Coal Mine.
27 November 2009	Provision of a proposed methodology for undertaking the Cultural Heritage Assessment to registered stakeholders.
November/December 2009	Feedback from the registered stakeholders in regard to the proposed methodology. Consideration of all comments received on the proposed methodology.
December/January 2009	Invitation to registered stakeholders to attend the Aboriginal cultural heritage survey and site inspection.
13 to 15 January 2010	Presentation of information regarding the proposed Modification.
13 to 15 January 2010	Aboriginal cultural heritage survey and site inspection. Cultural significance of the area and Aboriginal heritage sites discussed with the Aboriginal participants.
5 February 2010	Draft Cultural Heritage Assessment report issued to the registered stakeholders for review, including survey results, archaeological and cultural significance assessment (based on feedback received during consultation and fieldwork), potential impacts and proposed management and mitigation measures.

Table 4-14 (Continued)
Summary of Proposed Modification Aboriginal Heritage Consultation/Survey Programme

Date	Consultation/Survey Conducted
February 2010	Further consultation with the registered stakeholders to discuss the draft Cultural Heritage Assessment.
February/March 2010	Written feedback and advice received from registered stakeholders.
March 2010	Comments received from registered stakeholders on the draft Cultural Heritage Assessment (in relation to cultural heritage) were considered and/or addressed in the Cultural Heritage Assessment.

Source: Landskape (2010) (Appendix E).

The eight stakeholders who registered an interest in being consulted in relation to the Cultural Heritage Assessment process were:

- Bigundi Biame Gunnedarr Traditional People;
- Gunidah Gunyah Aboriginal Corporation;
- Min Min Aboriginal Corporation;
- Bullen Bullen Consultants;
- Cacatua Culture Consultants;
- Minnga Consultants;
- Aboriginal Native Title Consultants; and
- Red Chief LALC.

Archaeological Findings

One Aboriginal heritage site (NAS02) has been previously recorded within the proposed Modification area. The Aboriginal heritage survey and site inspection conducted in January 2010 did not identify any additional items or places of Aboriginal heritage significance.

The locations of known Aboriginal heritage sites within ML 1579 are shown on Figure 4-10.

Archaeological and Cultural Heritage Values

As part of the Cultural Heritage Assessment, the existing information (e.g. photos, site plans, previous archaeological reports) was reviewed for the known Aboriginal heritage site (NAS02) within the proposed Modification area. A discussion of the archaeological assessment of the site is provided in Appendix E, with a summary provided in Table 4-15.

Table 4-15
Summary of Aboriginal Archaeological Site NAS02 Assessment of Significance

Site	Scientific Significance				Aboriginal Significance	Educational Significance
	Integrity	Structure	Contents	Rarity		
NAS02	Low	Low	Low	Low	Low (indicative)	Low

Source: Landskape (2010) (Appendix E)

4.7.2 Potential Impacts

Potential Direct Impacts

Aboriginal heritage sites located within the proposed Modification area and surrounds may be potentially subject to direct disturbance.

One Aboriginal cultural heritage site (NAS02) is located within the proposed Modification disturbance area and therefore would be subject to direct disturbance associated with mining activities. This site was an isolated find of two stone artefacts (with only one of the artefacts re-identified during the survey).

Potential Indirect Impacts

One Aboriginal heritage site (NST1) has been identified outside the modified Tarrawonga Coal Mine disturbance area but within ML 1579.

This site could be indirectly impacted by the modified Tarrawonga Coal Mine in the absence of relevant mitigation measures. Potential indirect impacts to archaeological sites could include the following:

- deposition of dust generated by mining;
- accidental disturbance by peripheral activities; and
- inappropriate visitation including the unauthorized removal of Aboriginal objects.

4.7.3 Mitigation Measures and Management

The mitigation measures, and management and monitoring programmes detailed below have been developed in consultation with the registered stakeholders (Appendix E).

The existing ACHMP (TCPL, 2005a) describes measures that are currently employed at the Tarrawonga Coal Mine to minimise the potential impacts of surface disturbance activities on Aboriginal heritage. These measures include:

- TCPL providing guidance on Aboriginal cultural heritage matters to mining employees and contractors who, as a consequence of their roles at site, have the potential to disturb ground, as part of the induction programme;
- monitoring of topsoil stripping and ground disturbance activities;
- use of land disturbance management protocols to be implemented in the event of identification of new Aboriginal heritage finds; and
- use of reporting and communication protocols.

The ACHMP would be reviewed and revised to incorporate the findings of the Cultural Heritage Assessment of the proposed Modification (Landskape, 2010). In particular, the revised ACHMP would include management measures for Aboriginal cultural heritage site (NAS02). These measures may include, but are not necessarily restricted to:

- application for an AHIP under section 87 of the *National Parks and Wildlife Act, 1974* to salvage any Aboriginal objects associated with the site;
- engagement of an archaeologist and representatives of the Aboriginal community to record, collect, curate and store Aboriginal objects in the “Keeping Place”; and

- replacement of Aboriginal objects from the site within rehabilitated areas in consultation with the Aboriginal community and the DECCW.

Site NST1 (a tree, potentially scarred by Aboriginal people) would continue to be protected within a fenced and sign-posted enclosure to reduce the risk of accidental damage, in accordance with the ACHMP.

Other general control measures relevant to the management of Aboriginal heritage that would be implemented at the Tarrawonga Coal Mine are listed below:

- Ongoing consultation with the Aboriginal community over the life of the modified Tarrawonga Coal Mine, including appropriate Aboriginal representation during archaeological fieldwork (e.g. collection of artefacts prior to construction).
- Consideration of reasonable requests from Aboriginal community members to access identified Aboriginal sites located on TCPL-owned land, subject to Occupational Health and Safety requirements.
- Application for an AHIP under section 90 of the *National Parks and Wildlife Act, 1974* for Aboriginal objects that may be unknowingly destroyed, defaced or damaged within the proposed Modification area.
- Management of any new sites which may be identified during the development of the modified Tarrawonga Coal Mine in accordance with the conditions the approved AHIP for the site.
- Registration of any new sites which may be identified during the development of the modified Tarrawonga Coal Mine with the DECCW in consultation with registered Aboriginal stakeholders.
- Maintenance of a record of known Aboriginal heritage sites, including their status and location.
- Cessation of all work in a particular work area if human skeletal remains are discovered during the course of the mining activities. In the unlikely event that an Aboriginal burial site is encountered, appropriate management measures would be developed with the involvement of the Aboriginal community.

4.8 EUROPEAN HERITAGE

The Cultural Heritage Assessment prepared by Landskape (Appendix E), includes a description of the historical cultural heritage context of the Gunnedah Basin and identifies the historical cultural heritage in the local area. The Assessment included a review of the NSW State Heritage Inventory (which contains items listed by the Heritage Council under the *Heritage Act*) and the Narrabri LEP (which also lists historical heritage sites within the Narrabri Shire).

The historical heritage site closest to the study area previously registered on the NSW Heritage database is Gunnedah Railway Station (State Heritage Inventory Database Number 5012046). This structure is located on the Werris Creek-Moree Railway in Railway Avenue, Gunnedah, approximately 42 km south-east of the study area (Appendix E).

The proposed Modification would not impact any known sites of historical heritage significance.

4.9 SURFACE WATER

A Surface Water Assessment of the proposed Modification was undertaken by Gilbert & Associates and is provided in Appendix D. The study scope included:

- characterisation of baseline hydrological conditions;

- review of the existing surface water management system;
- identification of potential impacts and measures to minimise them; and
- discussion of proposed changes to the surface water management system.

The following sub-sections provide a summary of the findings of the Surface Water Assessment, including a description of the existing local and regional surface water resources (Section 4.9.1), a discussion of the potential impacts of the modified Tarrawonga Coal Mine (Section 4.9.2), and a description of the mitigation measures and monitoring programme that would be implemented to minimise potential impacts (Section 4.9.3).

4.9.1 Existing Environment

Catchments and Topography

As described in Section 4.2.1, the Tarrawonga Coal Mine is situated in the foothills of the Willowtree Range approximately 12 km east of the Namoi River (Figure 4-1). The Namoi River is a major inland river system and has an estimated mean annual flow of approximately 527,000 ML at the Turrawan gauging station (GS419023) which is located downstream of the confluence with Nagero Creek (Gilbert & Associates, 2010). Further downstream, the Namoi River flows north and west in the Barwon-Darling River system west of Walgett. The Namoi River at Boggabri, just upstream of the confluence of Barbers Lagoon and Nagero Creek, has a total catchment area of approximately 23,000 square kilometres (km^2) (Appendix D).

Local Creek Catchments and Hydrology

The main local drainages in the vicinity of ML 1579 are Nagero Creek, Bollol Creek and Goonbri Creek. These creeks drain west to the Namoi River (Figure 4-1). The surface water quality and flow regimes in the vicinity of ML 1579 are influenced by the existing mine and historical clearing for grazing on native and improved pastures and other agricultural activities in the surrounding rural lands.

The Nagero Creek catchment rises along the southern margin of the Willowtree Range in the Leard State Forest north of ML 1579. A small portion of the creek catchment originates in the north western corner of ML 1579 and has been diverted from its original flow path to be captured within site water storages and sediment dams for on-site usage and to prevent sediment laden runoff entering the creek. Nagero Creek in the vicinity of the mine is ephemeral and only flows during or after prolonged rainfall events or periods of frequent rainfall. Discharges from the Tarrawonga Coal Mine to Nagero Creek are infrequent (Gilbert & Associates, 2010).

The headwaters of Bollol Creek rise in timbered hilly terrain approximately 20 km east of the Tarrawonga Coal Mine. More than half of the southern portion of ML 1579 is within the Bollol Creek catchment. Bollol Creek is also ephemeral, flowing for short periods during and following prolonged rainfall events.

Goonbri Creek, which is a tributary of Bollol Creek, rises on the eastern slopes of the Willowtree Range and drains a minor portion of the eastern part of ML 1579. Similar to the other creeks in the vicinity of the Tarrawonga Coal Mine, Goonbri Creek is an ephemeral creek and only flows during and following prolonged rainfall events (Gilbert & Associates, 2010).

Existing Water Management System

A description of the existing water management and water supply system is provided in the SWMP, with a summary presented in Section 2.1.4.

A review of the existing Tarrawonga Coal Mine surface water and erosion control structures was conducted in July 2009 by the Department of Lands' Soil Conservation Service. The assessment calculated the ability of the existing system of sediment basins and storage dams to capture runoff resulting from a five day, 90th percentile rainfall event. As part of the assessment, the site was divided into two predominant site catchments, western and eastern. The review concluded that the western and eastern catchments both have sufficient storage capacity if managed efficiently (Appendix D).

Surface Water Quality

Figure 2-2 shows the existing regional and local surface water monitoring locations at the Tarrawonga Coal Mine. Figure 2-4 shows the existing sediment basins and water storage dams at the site. The site sediment basins and storage dams are sampled at quarterly intervals or during significant rainfall events. Sampling of Bollol Creek and Nagero Creek at upstream and downstream locations is undertaken when the creeks are flowing, and when it is feasible and safe to obtain samples.

The Gilbert & Associates (2010) evaluation of the available water quality data indicated that there has been no consistent or obvious difference between water quality at sites upstream and downstream of the mine area (Appendix D). The pH has been near neutral and EC has been low at all sites (Appendix D). Total suspended solids have been variable with maximum recorded both at upstream and downstream sites exceeding the 100 percent limits set for discharge from site storages (Appendix D). Oil and grease concentrations have been at or near the analytical detection limits.

Flooding

The potential for large scale regional flooding affecting the Tarrawonga Coal Mine is considered to be low, given that the Namoi River is located approximately 12 km away, and that the lowest natural low point on the site (i.e. approximately at 275 to 280 m AHD) is some 40 m higher in elevation than the River. No significant flood events have occurred at the mine since the commencement of operations.

4.9.2 Potential Impacts

The following sub-sections describe the potential operational and post-mining impacts of the modified Tarrawonga Coal Mine on surface water flow regimes and surface water quality.

Surface Water Flow Regimes

Potential impacts on the flow regime of local creeks may occur due to changes in runoff and flows in contributing catchments.

The containment of site runoff in storage dams, sediment basins, the open cut, and the use of water on-site for operational purposes would likely reduce the volume of water leaving ML 1579 over time (Appendix D).

The potential impact of the proposed Modification on flows in local creeks was assessed by Gilbert & Associates (2010) as part of the Surface Water Assessment. The reduction in the catchment area of Nagero Creek was estimated to 0.3 km^2 or 0.4% of the total catchment area of the creek. The reduction in the catchment area of Bollol Creek was estimated to be 0.2 km^2, which represents less than 0.2% of the total creek catchment. There would be virtually no change to the Goonbri Creek catchment (Appendix D). The overall effect of these catchment area reductions on creek flows and creek morphology is considered by Gilbert & Associates (2010) to be negligible.

Surface Water Quality

Potential impacts of the modified Tarrawonga Coal Mine on surface water quality include the reduction in surface water quality due to uncontrolled runoff from disturbed areas and/or release of contaminants and acid mine drainage.

Runoff and Contaminants

Potential impacts of the modified Tarrawonga Coal Mine on the water quality of Bollol and Nagero Creeks could result from elevated suspended solids contained in runoff or discharge from disturbed areas (pre-stripping, during open cut mining, and post-mining prior to rehabilitation) and leakage or spillage of hydrocarbons from infrastructure areas. Erosion, sediment and land contamination controls that would be applied to the modified Tarrawonga Coal Mine are described in Section 4.9.3. TCPL would operate the site in accordance with the requirements of the EPL.

Acid Mine Drainage

As discussed in Section 4.2.1 and Appendix A, the overburden from the area between the eastern edge of the approved open cut and the eastern boundary of ML 1579 is geochemically consistent with overburden from the current open cut and is expected to be NAF (GEM, 2010). The results of the multi-element scans indicated that the overburden is not likely to contain any significantly enriched elements of potential environmental concern, and also indicated no significantly soluble elements of environmental concern (GEM, 2010).

The geochemistry testwork did however identify relatively minor enrichments of As, Sb and Se in the solids and relatively high solubility of As, Mo and Se. As described in Section 4.2.1, and a result of this finding, TCPL would include analysis of these elements in the site water quality monitoring programme (every three months) in order to confirm that the release of these elements from the stockpiled overburden does not adversely impact the water quality of the receiving environment.

Post-Mining Surface Water Impacts

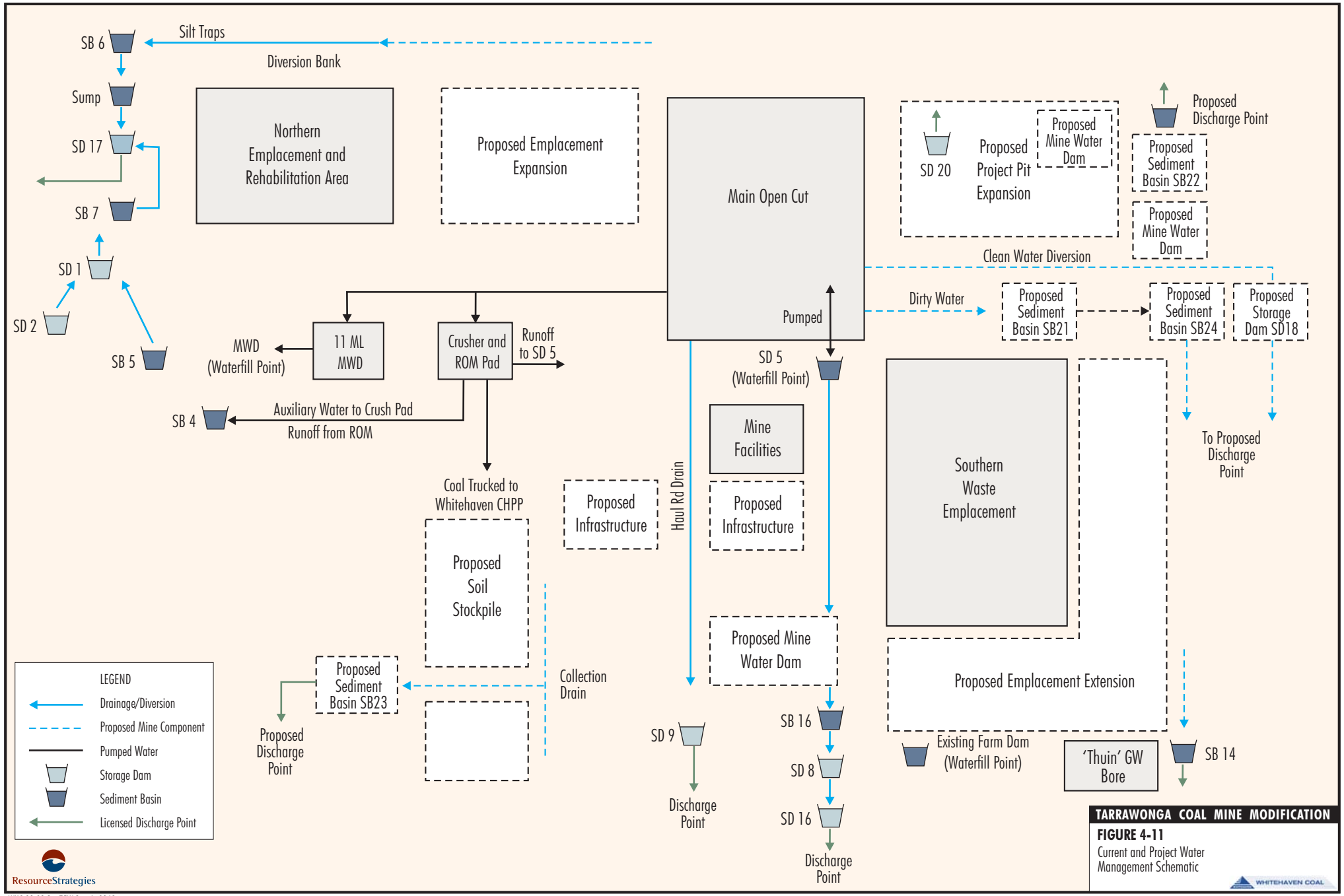
Following completion of mining and rehabilitation, drainage from the majority of the modified Tarrawonga Coal Mine area would be directed to tributaries of Nagero Creek and Bollol Creek (Appendix D). The catchment of the final void is estimated to be comparable to that for the approved Tarrawonga Coal Mine (Appendix D). The long-term catchment area reduction is likewise expected to have a negligible effect on flows in the two creeks (Appendix D).

4.9.3 Mitigation Measures, Management and Monitoring

Operational Water Management

The existing operational water management system would be expanded to incorporate the additional disturbance areas associated with the proposed Modification. The new surface water management infrastructure would include additional sediment basins and storage dams, mine water dams, and associated diversion bunds and channels. The new infrastructure would be sized in accordance with the design criteria outlined in the SWMP. Design details, operational and monitoring requirements of the expanded water management system would be documented in an updated version of the SWMP which would be developed in consultation with DECCW and submitted to DoP for approval.

Figure 4-11 provides a schematic of the current and proposed water management system.



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The proposed layout of the new water management structures are shown on Figures 2-4, 2-5 and 2-6, and a summary description is provided in Section 2.2.7. A more detailed description is contained in Appendix D.

The updated SWMP would include details of the proposed new sediment basins (i.e. SB21, SB22, SB23 and SB24). These basins would be monitored as per the current SWMP and would be sampled at quarterly intervals and, where practicable, following significant rainfall events.

A new mine water dam would be required adjacent to the west side of the Southern Emplacement (Figure 2-6). As the mine continues to develop, additional mine water dams may be constructed near SB21 and SB22.

As described in Section 2.2.7, due to the proposed expansion of the open cut and development of a new soil stockpile area, TCPL would seek approval for three new Licensed Discharge Points to be added to the EPL. These are described below:

- a new Licensed Discharge Point to be located downstream of new sediment basin SB22 to the east of the expanded open cut for any potential discharge off-site into the Nagero Creek catchment;
- a new Licensed Discharge Point to be located downstream of new sediment basin SB23 at the southwest margin of the proposed soil stockpile located to the west of the main haul road draining to Bollol Creek; and
- a new Licensed Discharge Point to be located downstream of new sediment basin SB24 for possible release off-site to the east towards Bollol Creek.

A Licensed Discharge Point from SD20 exists as part of the EPL. However, this storage dam would be mined through as the open cut area advances and therefore this Licensed Discharge Point would become obsolete.

Proposed new Licensed Discharge Points downstream of SB22, SB23 and SB24 would be monitored when controlled discharge occurs or within 24 hours of a spill where it is feasible and safe to do so.

Water collected in sediment basins and storage dams would continue to be used to satisfy mine water requirements (Section 2.1.4). Water that is surplus to mine requirements would be tested to measure compliance against the requirements of EPL 12365 prior to release from a Licensed Discharge Point (if required to avoid uncontrolled discharge). TCPL would seek to avoid discharge from the site where practicable, however, storm events may result in uncontrolled discharge from site, upon which sampling of discharge waters would be undertaken. Application of flocculants such as gypsum may be undertaken to reduce suspended solids concentration to below the limits prescribed in the EPL.

No change to the off-site creek water quality monitoring locations are considered necessary as a result of the proposed Modification (Gilbert & Associates, 2010). However, As, Sb, Se and Mo would be included as parameters in the surface water monitoring programme as per the recommendation by GEM (2010).

New and existing erosion and sediment control structures at the Tarrawonga Coal Mine would be inspected by mine personnel on a regular basis and following rainfall events greater than 25 mm in a 24 hour period to assess integrity, identify signs of potential erosion and determine retained capacity. All sediment basins would be cleaned of accumulated sediment material once their capacity has been reduced by 20%.

Erosion and sediment control structures would continue to be progressively installed as rehabilitation progresses. Contour banks on the final landform would be used where appropriate to direct surface water flows to sediment basins which would act as detention basins, reducing peak flow rates in discharge off-site. Drop structures on steeper slopes would be rock-lined in a similar fashion to the existing drop structure on the Northern Emplacement (Appendix D).

Post-Closure Water Management

The final landform at completion of the mine life is described in the 2005 EIS as being comprised of a predominantly backfilled and rehabilitated open cut area, re-profiled out-of-pit waste emplacements, and a re-profiled coal processing area. The Northern and Southern Emplacements are described as being rehabilitated to create gently sloping hills predominantly with slopes of 10^{o} or shallower (none would exceed 18^{o}) and to an elevation consistent with the surrounding landscape.

The final slopes within the open cut void are described as being at approximately 10^{o} and would be formed through a combination of highwall blasting, bulldozer pushing and backfilling. The base of the final void was estimated to be at approximately 265 m AHD, which would be approximately 50 m below the rim of the final void (R.W. Corkery, 2005).

The 2005 EIS contains a commitment that the final landform would be constructed in a manner such that only water falling on the upper surface of the rehabilitated waste emplacements would be directed to the final void. The modified Tarrawonga Coal Mine would maintain this commitment.

The 2005 EIS predicted that groundwater levels in the final open cut void would re-establish at pre-mine levels (i.e. approximately 270 m AHD) and that a small, shallow water body (i.e. approximately 5 m deep) would establish within the final void after a period of approximately 25 years. Final void water quality was predicted to be mildly brackish (R.W. Corkery, 2005).

As part of the modified Tarrawonga Coal Mine, the open cut void would be located approximately in the same location, with the Northern Emplacement expanded to the east and the Southern Emplacement expanded to the south and east. The final void would have a somewhat greater surface area to that envisaged in the 2005 EIS. However, Gilbert & Associates (2010) consider that the final void water balance and water quality would be similar to what was predicted in the 2005 EIS. Notwithstanding, TCPL would prepare a Mine Closure Strategy for the modified Tarrawonga Coal Mine in accordance with Condition 57 of Schedule 4 of the Development Consent.

TCPL is considering the feasibility of further expanding the mine to the east of ML 1597, which, it is anticipated, would require approval under Part 3A of the EP&A Act. Should such an expansion be considered feasible, the mine closure concepts for the site would require a more substantial review and revision which would be conducted as part of the environmental impact assessment and approvals process.

4.10 GROUNDWATER

The following sub-sections provide a description of existing groundwater resources in the mine area and surrounds, including existing effects of the approved Tarrawonga Coal Mine (Section 4.10.1), a discussion of the potential impacts of the proposed Modification (Section 4.10.2), and a description of the mitigation measures and monitoring programme that would be implemented to minimise potential impacts (Section 4.10.3).

4.10.1 Existing Environment

2005 Hydrogeological Assessment

A Groundwater Assessment was undertaken for the approved Tarrawonga Coal Mine by RCA Australia Pty Ltd (RCA) and was included in the 2005 EIS. The study scope included:

- characterisation of baseline hydrogeological conditions;
- assessment of potential sources of groundwater pollution;
- assessment of potential impacts on groundwater resources (including groundwater level, yields, quality, availability and potential cumulative impacts associated with the Boggabri Coal Mine); and
- proposed mitigation measures, management and monitoring.

The key findings of the assessment, where relevant to the proposed Modification, are discussed further below.

Hydrogeological Regime

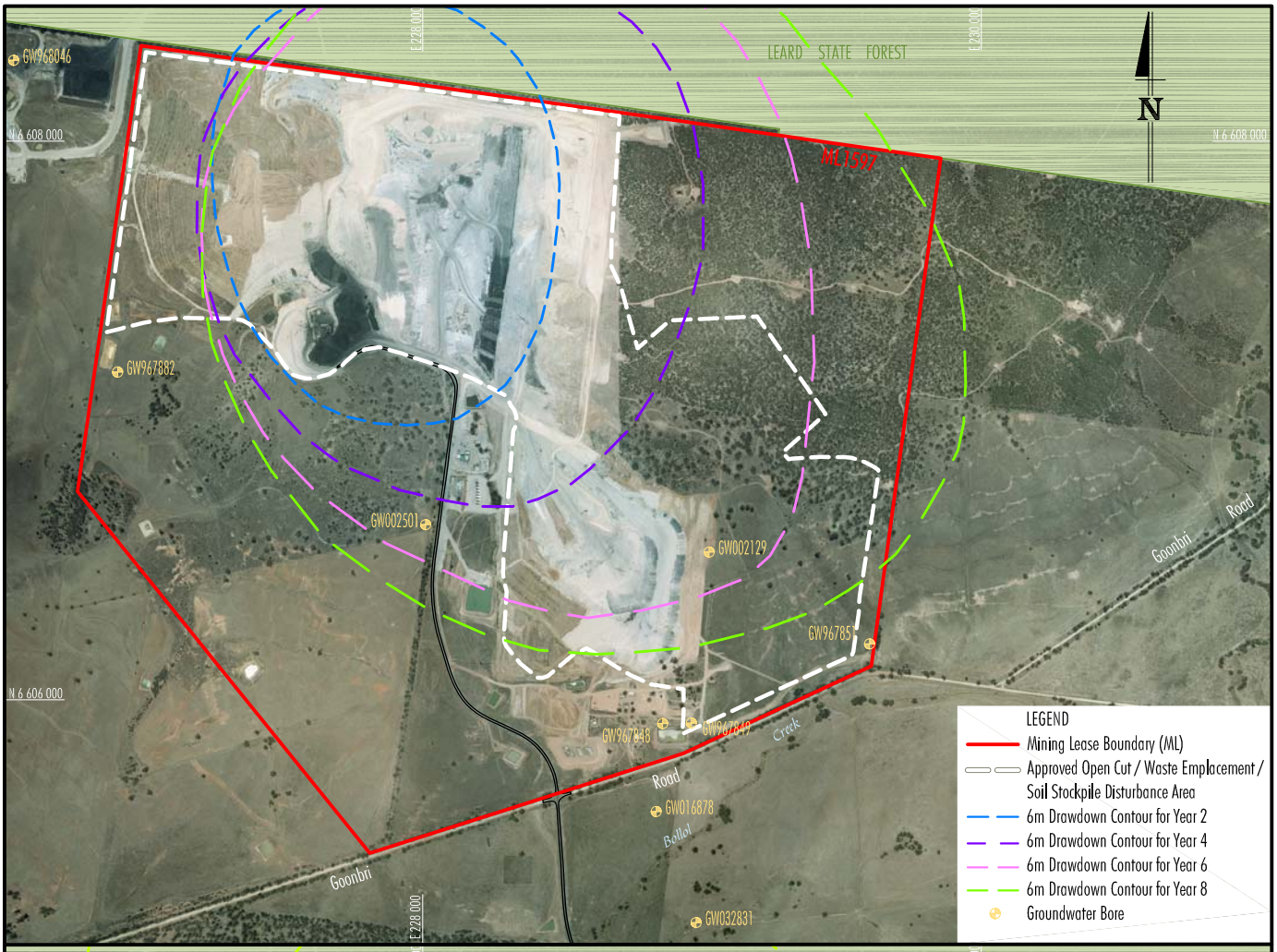
The Hydrogeological Assessment (RCA, 2005) identified groundwater resources within the vicinity of the Tarrawonga Coal Mine as occurring within the following three geological formations:

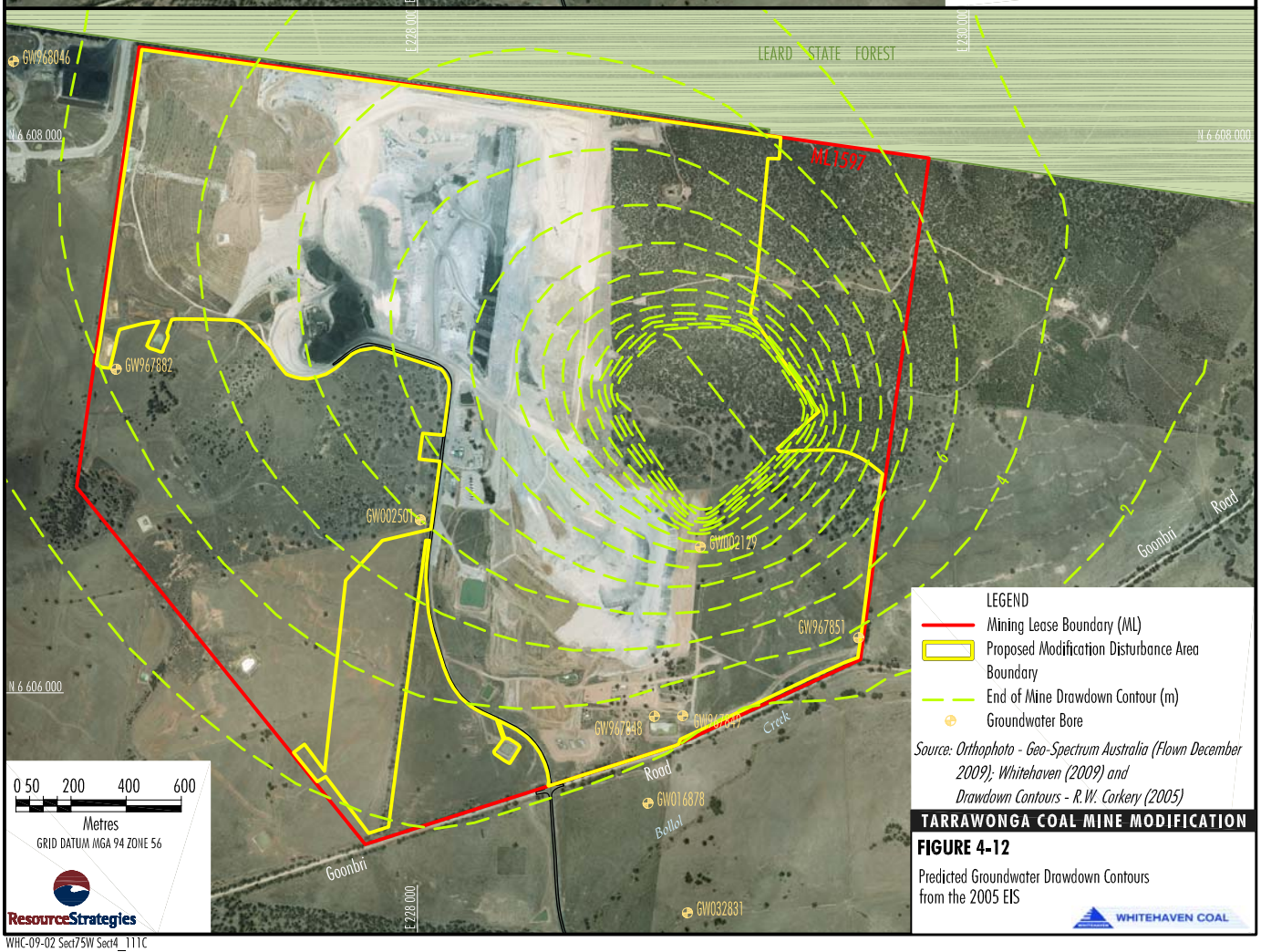
- Permian coal measures of the Maules Creek Formation, which comprises aquifers in coal seams and interburden rocks with standing water levels typically 10 to 80 m below natural ground level with a saturated thickness of 20 to 60 m (with the groundwater partially confined and under pressure in the coal seams with the interburden rocks acting as semi-confining layers or aquitards);
- early Permian Boggabri Volcanics, where flow occurs along fractures in the bedrock; and
- Quaternary alluvial sediments, approximately 1 to 1.5 km to the south of the ML 1579 particularly within and adjacent to Bollol Creek and to the northwest along Nagero Creek, with groundwater typically ranging from 5 to 10 m below ground level.

Groundwater Inflows to the Open Pit

Groundwater modelling conducted for the 2005 EIS estimated that inflows rates in the open cut would peak at approximately 700 m^3 per day in Year 6 of operations, but would remain below the calculated daily evaporative rate (RCA, 2005). Figure 4-12 shows the predicted 6 m drawdown contours in mine years 2, 4, 6 and 8 from the 2005 EIS. Figure 4-12 also shows the predicted groundwater drawdown contours at the end of the mine life when the final open cut void has been completed and is located in the eastern portion of ML 1579. As described in Section 4.9.3, under the proposed Modification the final open cut void would be approximately in the same location and would be mined to the same depth (i.e. approximately 265 m AHD).

TCPL's operational experience since the mine commenced operations in 2006 has confirmed the predicted low to very low groundwater inflows, and the Tarrawonga Coal Mine is regarded as a "dry mine". The annual volumes of water collected via in-pit sumps since May 2006 are shown in Table 4-16. These volumes include groundwater inflows, rainfall and surface flows from within the open cut.





Source: Orthophoto - Geo-Spectrum Australia (Flown December 2009); Whitehaven (2009) and Drawdown Contours - R.W. Corkery (2005)

TARRAWONGA COAL MINE MODIFICATION

FIGURE 4-12

Predicted Groundwater Drawdown Contours from the 2005 EIS

WHITEHAVEN COAL

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Table 4-16
Water Collected in the Open Cut via In-Pit Sumps

Period	Annual Total (ML)*
May 06 to April 07	28
May 07 to April 08	32
May 08 to April 09	45

Source: Adapted from TCPL (2007a, 2008c, 2009a).

* Includes rainfall.

Groundwater Level Drawdown

The 2005 EIS included an assessment of potential effects of drawdown from mine dewatering on groundwater users outside ML 1579. The modelling results indicated that for all non-mine-related bores 1,100 m or more from the open cut, the decline in saturated thickness would be less than 10% (R.W. Corkery, 2005).

The approved groundwater monitoring programme for the approved Tarrawonga Coal Mine is described in the SWMP (TCPL, 2006a). The existing local and regional groundwater monitoring bores are identified on Figure 2-2.

Standing water levels (i.e. depth to the groundwater from the surface) are recorded at monitoring bores up to 10 km from the open cut and are reported annually in the AEMRs. A summary of these results is provided in Table 4-17.

Table 4-17
Observed Groundwater Levels in Monitoring Bores

Monitoring Bore	Property	Approximate Distance from Open Cut (km)	Groundwater Levels – June 2006 to January 2009*	
			Minimum (m)**	Maximum (m)**
MW-1	Thuin	2.6	7.50	9.22
MW-2	Thuin	2.6	3.60	4.68
MW-3	Nagero	2.3	13.30	15.90
MW-4	Tarrawonga	2.9	9.30	10.01
MW-5	Templemore	1.9	3.40	4.56
MW-6	Merriown	2.3	9.00	10.03
MW-7	Mine Site	1.5	74.30	87.70
MW-8	Mine Site	1.5	13.60	14.60
GW002501	Mine Site	1.0	27.90	28.63
GW002129	Mine Site	1.5	22.53	26.75
GW044997	Templemore	3.1	6.40	7.26
GW031856	Ambardo	4.3	16.40	19.74
GW052266	Tarrawonga	2.9	6.29	9.37
GW020432	Merriown	3.9	21.10	21.10

Source: TCPL (2007a, 2008c, 2009a).

* Some bores were not operational for the entire period from June 2006 to January 2009.

** Metres from the surface.

The variations in standing water levels are generally considered to be typical of natural effects (e.g. seasonal fluctuations) and a response to rainfall trends and farming activity (TCPL, 2007a; 2008c; 2009a).

Groundwater drawdown contingency measures have been developed for implementation when there is a reduction in saturated thickness of more than 15%. These contingency measures are described in the Groundwater Contingency Plan (TCPL, 2006c), which has been prepared in accordance with Condition 31 of Schedule 4 of the Development Consent. In the event that routine monitoring indicates that a trigger has been reached or is being approached, TCPL will initiate the following process (TCPL, 2006c):

- a hydrogeologist will be commissioned to review the data;
- the outcomes of that review, including any recommendations, will be subject to discussion and agreement with the NOW hydrogeologists;
- should the saturated thickness trigger level be achieved in any bore, TCPL will notify the affected landowner(s) and, if TCPL's and NOW's hydrogeologists are of the opinion that the reduction is a consequence of mining, appropriate mitigation measures will be implemented; and
- an independent authority may also be used where a dispute arises as to the cause of the change, given that groundwater changes can be affected by non-mining related factors.

In 2009 TCPL commissioned an independent review of groundwater monitoring and observable trends in the three year period since the Development Consent was issued. The independent review was conducted in accordance with the Groundwater Contingency Plan and Condition 32 of Schedule 4 of the Development Consent. The report was completed by GeoTerra Pty Ltd (GeoTerra), whose appointment was approved by the Director-General of Planning.

GeoTerra (2009) found that, in general, groundwater levels in the vicinity of the mine had risen since the end of the long-term drought around mid to late 2007. GeoTerra (2009) did however, identify a trend of localised Permian aquifer depressurisation in TCPL's monitoring bore MW7, which is located in the north-east corner of ML 1579 (Figure 2-2). Outside ML 1579, lowered groundwater levels were identified in the Quaternary alluvial aquifer in the vicinity of Bollol Creek (i.e. MW4 on the "Tarrawonga" property, and GW44997 on the "Templemore" property), and the alluvial aquifer in the vicinity of Nagero Creek (i.e. MW8 on the eastern boundary of the "Nagero" property). The percentage reduction in groundwater levels in MW4, GW44997 and MW8 were all less than the 15% trigger level, and were calculated by GeoTerra (2009) as being 5.2%, 3% and 7.4% respectively.

The GeoTerra (2009) review concluded that the regional groundwater level drawdowns in private bores and pit dewatering were within the range predicted in the 2005 EIS and did not require any additional investigations.

Groundwater Quality

The 2005 EIS included an assessment of potential effects of the mine on groundwater quality. The RCA (2005) groundwater assessment, and URS Australia Pty Ltd (2005) geochemistry assessment (Section 4.2.1) predicted that the potential for any acid or salt contamination of groundwater would be low.

The groundwater monitoring programme for the approved Tarrawonga Coal Mine includes monitoring of groundwater quality parameters including: EC; pH; heavy metals; major cations and anions; and total petroleum hydrocarbons. Groundwater quality monitoring results are provided in the AEMRs, with the details of the monitoring programme provided in the SWMP. Groundwater quality monitoring results reported in the 2008/2009 AEMR indicated that:

- groundwater in most bores is generally neutral in pH to mildly alkaline;
- groundwater in all bores can be described as fresh to brackish;

- total petroleum hydrocarbon concentrations have reduced across most monitoring sites; and
- concentrations of heavy metals remained relatively consistent at all sites, with the exception of MW-1.

The contingency measures for groundwater quality are described in the Groundwater Contingency Plan (TCPL, 2006c). The benchmarks and trigger levels for changes in groundwater chemistry are presented in Table 4-18.

Table 4-18
Groundwater Quality Benchmarks and Trigger Levels

Measure	Benchmark*	Trigger Level
EC	Established baseline +/- natural fluctuation	15% increase
pH	Established baseline +/- natural fluctuation	15% increase or decrease
Lead	0	0.1 mg/L*

Source: TCPL (2006c).

* Based on criteria for livestock watering in ANZECC (2000).

mg/L = milligrams per litre.

In the event that routine monitoring indicates that a trigger has been reached or is being approached, TCPL will initiate the following process (TCPL, 2006c):

- a hydrogeologist will be commissioned to review the data;
- the outcomes of that review, including any recommendations, will be subject to discussion and agreement with the NOW hydrogeologists;
- a trigger of pH or EC would initially lead to an increase in the analytes monitored and/or frequency of sampling to confirm the magnitude and extent of the change in groundwater chemistry and verify the change is a consequence of mining; and
- an independent authority may also be used where a dispute arises as to the cause of the change, given that groundwater changes can be affected by non-mining related factors.

The independent review by GeoTerra (2009) also assessed groundwater quality. The review found somewhat elevated salinity (i.e. above the 15% trigger) in monitoring bores MW1, MW5 and GW44997 which are located on the "Templemore" property. Elevated lead (i.e. above 0.01 mg/L) was also recorded in monitoring bore MW1, and one pH reading in October 2008 at GW52266 (on the "Tarrawonga" property) exceeded the trigger of 8.5. The independent review concluded that no further investigation was required, other than continued monitoring to assess trends.

4.10.2 Potential Impacts

Groundwater Inflows to the Open Pit

The proposed Modification would not change the depth of the open cut or the strata to be mined. The proposed open cut extension by approximately 600 m to the east would result in a corresponding extension of the groundwater drawdown effect to the east, however no privately-owned bores are located in this area and therefore no additional groundwater users would be affected by the proposal.

The final void would be in the same location as described in the 2005 EIS and would have the same depth and approximately the same shape. As a result, the post-closure affects of the modified Tarrawonga Coal Mine on groundwater resources would remain unchanged (i.e formation of a small, brackish, shallow water body some 5 m deep after approximately 25 years).

Predicted changes to the natural groundwater chemistry described in the 2005 EIS would not alter significantly as a result of the proposed Modification.

As described in Section 4.2.1, the results of the multi-element scans undertaken by GEM (2010) indicated that the overburden is not likely to contain any significantly enriched elements of potential environmental concern, and also indicated no significantly soluble elements of environmental concern. However, the scans did identify relatively minor enrichments of As, Sb and Se in the solids and relatively high solubility of As, Mo and Se. As a result of this finding, TCPL would include analysis of these elements in the groundwater quality monitoring programme (every three months) in order to confirm that the release of these elements from the stockpiled overburden does not adversely impact the water quality of the receiving environment.

4.10.3 Mitigation Measures, Management and Monitoring

As discussed in Section 4.10.1, TCPL currently monitors groundwater levels and quality in accordance with the groundwater monitoring programme described in the SWMP.

The groundwater monitoring programme would be updated to include monitoring of Sb, Mo and Se.

The Groundwater Contingency Plan would be continued for the modified Tarrawonga Coal Mine.

4.11 BIODIVERSITY

Biobanking Scheme Background and Application

The NSW *Biodiversity Banking and Offset Scheme* (Biobanking Scheme) was established under Part 7A of the NSW *Threatened Species Conservation Act, 1995* (TSC Act) in 2008. The Biobanking Scheme is based on a market of 'biodiversity credits' in which a computer based programme (i.e. the Biobanking Credit Calculator [DECCW, 2009a]) is used to calculate the number and type of 'biodiversity credits' needed to be obtain from the market in order to offset biodiversity impacts. 'Biodiversity credits' are generated by landowners who commit to enhance and protect biodiversity values on their land through a biobanking agreement. Further information on the Biobanking Scheme can be found on the DECCW (2010a) website.

A biobanking assessment for the proposed Modification was prepared by Eco Logical and is presented in Appendix F. As part of the biobanking assessment, Eco Logical also considered the relevant objectives and key thresholds in the *Draft Guidelines for Threatened Species Assessment* (DEC and NSW Department of Primary Industries [DPI], 2005).

This section provides a description of the existing environment (Section 4.11.1), an overview of potential impacts on biodiversity (Section 4.11.2), impact avoidance and mitigation measures relevant to biodiversity (Section 4.11.3) and offset measures (Section 4.11.4).

4.11.1 Existing Environment

Regional and Local Setting

The proposed Modification area is within the Brigalow Belt South Bioregion as defined in the *Interim Biogeographic Regionalisation of Australia* (IBRA) (Commonwealth Department of the Environment, Water, Heritage and the Arts [DEWHA], 2010a). It is also located in the Liverpool Plains (Part B) CMA sub-region of the Namoi CMA planning region (DECCW, 2010b).

The existing Tarrawonga Coal Mine is located in an agricultural landscape with more intact areas of woodland occurring in state forests, including Leard State Forest directly north of ML 1579 and Vickery State Forest approximately 10 km to the south-east (Figure 4-1). Leard State Forest is zoned for the purposes of forestry, recreation and mineral extraction. The Boggabri Coal Mine is the closest operating mine to the Tarrawonga Coal Mine and is located in Leard State Forest (Figure 1-4). The majority of Leard State Forest comprises woodland vegetation, including grassy woodlands, shrubby forests and woodlands on skeletal soils, riparian woodlands and grasslands (Boggabri Coal, 2009).

Flora and Fauna Surveys

GCNRC (2005b) and Country Wide Ecological Services (2005) undertook detailed baseline flora and fauna surveys within ML 1579 as part of the 2005 EIS. The surveys involved flora quadrat sampling and vegetation mapping (GCNRC, 2005b), as well as, various fauna survey techniques (e.g. pitfall traps, avifauna census, Elliott trapping, hair tubes, Anabat recorders, spotlighting and targeted searches) (Country Wide Ecological Services, 2005). These baseline surveys provided information on the biodiversity within ML 1579, and a means to assess the potential biodiversity impacts from the Tarrawonga Coal Mine.

In addition to the baseline surveys, annual flora and fauna monitoring has occurred within ML 1579 since 2007 and 2008, respectively (TCPL, 2009a; Country Wide Ecological Services, 2009; GCNRC, 2009). The aim of the monitoring is to observe the change in biodiversity as rehabilitation proceeds at the Tarrawonga Coal Mine. The results of the monitoring are reported by TCPL in the AEMR.

For the biobanking assessment, Eco Logical (2010) conducted vegetation type mapping, collected habitat data (e.g. estimates of percentage cover for grasses) and conducted targeted surveys for select threatened species in accordance with the Biobanking Scheme (DECCW, 2010a).

Flora

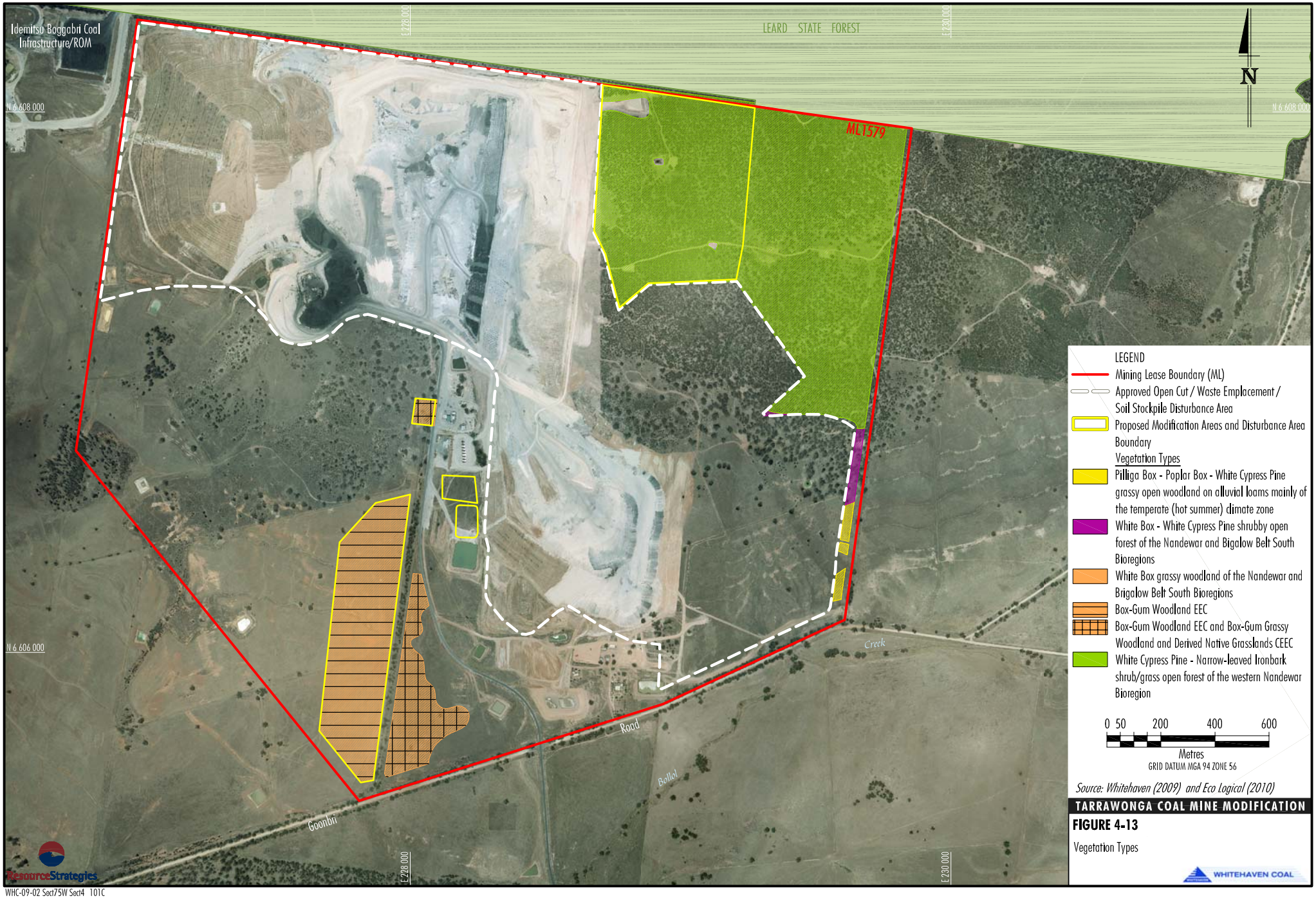
The land within ML 1579 (outside of the existing/approved mine area) is undulating and predominantly cleared due to a history of grazing and cultivation (GCNRC, 2005b). The largest area of existing woodland within ML 1579 occurs in the north-east corner of the site and mainly consists of regrowth Narrow-leaf Ironbark and White Cypress Pine (GCNRC, 2005b). This vegetation continues north into Leard State Forest.

Comparatively more sparse open woodland occurs in the south-western corner of ML 1579, comprising of various combinations of White Box, Blakely's Red Gum and to a lesser extent, Narrow-leaf Ironbark (GCNRC, 2005b).

Eco Logical (2010) mapped the following vegetation types (DECCW, 2010a) within the proposed Modification area as shown on Figure 4-13:

- White Cypress Pine – Narrow-leaved Ironbark Shrub/Grass Open Forest of the Western Nandewar Bioregion; and
- White Box Grassy Woodland of the Nandewar and Brigalow Belt South Bioregions.

Approximately 20.1 ha of land within the proposed Modification area is cleared land as defined by DECCW (2009a) (Appendix F).



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The following noxious weeds listed under the *Noxious Weeds Act, 1993* for the Narrabri Shire were recorded within ML 1579 by GCNRC (2005b): African Boxthorn (*Lycium ferocissimum*); Galvanised Burr (*Sclerolaena birchii*); Bathurst Burr (*Xanthium spinosum*); Noogoora Burr (*Xanthium occidentals*); and Prickly Pears (*Opuntia* and *Cylindropuntia* spp.). These noxious weeds are controlled in accordance with the Tarrawonga Coal Mine FFMP (GCNRC and Countrywide Ecological Services, 2007).

Fauna

Broad fauna habitat types within ML 1579 were identified by Country Wide Ecological Services (2005) and include open woodland/forest habitats, regenerating Cypress Pine and cultivated paddocks and a small area of Belah woodland and farm dams.

The fauna which use these habitat types has been documented by Country Wide Ecological Services during the baseline fauna surveys (Country Wide Ecological Services, 2005) and TCPL's fauna monitoring programme (Country Wide Ecological Services, 2009). The fauna species are represented by amphibians, reptiles, woodland birds and ground dwelling mammals and bats.

Introduced pest species recorded within ML 1579 are the House Mouse, European Rabbit, European Red Fox, Feral Cat, Feral Pig and Brown Hare (Country Wide Ecological Services, 2005, 2009). These introduced pests are controlled in accordance with the FFMP (GCNRC and Country Wide Ecological Services, 2007).

Threatened Species

Eco Logical (2010) identified threatened species within or near the proposed Modification area by undertaking a review of relevant literature and databases (DECCW, 2009a; NSW Government, 2009; Country Wide Ecological Services, 2005; GCNRC, 2005b), in addition to targeted surveys for particular threatened species as required by the Biobanking Credit Calculator (Appendix F).

No threatened flora listed under the TSC Act or EPBC Act have been recorded within or near the proposed Modification area (Eco Logical, 2010; GCNRC, 2005b, 2009). Similarly, no threatened species listed under the NSW *Fisheries Management Act, 1994* have been recorded within or near the proposed Modification area (Appendix F), primarily due to the absence of appropriate habitat.

Table 4-19 provides a list of threatened fauna species with records within ML 1579 and therefore some potential to be affected by the proposed Modification. All of the species in Table 4-19 are listed as vulnerable under the TSC Act. No threatened fauna listed under the EPBC Act have been recorded in the proposed Modification area.

Table 4-19
Threatened Fauna Species Recorded within ML 1579

Scientific Name	Common Name
Birds	
Calyptorhynchus lathami	Glossy Black Cockatoo
Neophema pulchella	Turquoise Parrot
Climacteris picmnus victoriae	Brown Treecreeper (*Eastern Sub-species*)
Pyrrholaemus saggitatus	Speckled Warbler
Melanodryas cucullata	Hooded Robin
Pomatstomus temporalis temporalis	Grey-crowned Babbler (*Eastern Sub-species*)
Mammals	
Chalinolobus picatus	Little Pied Bat
Saccolaimus flaviventris	Yellow-bellied Sheath-tail Bat

Source: Country Wide Ecological Services (2005, 2009); Eco Logical (2010) (Appendix F).

The co-ordinates of the records of threatened fauna species listed in Table 4-19 were not reported by Country Wide Ecological Services (2005, 2009) or Eco Logical (2010) so the species locations can not be shown on a figure. However, the recorded occurrences of the threatened fauna species are discussed below.

Glossy Black-cockatoo

The Glossy Black-cockatoo was recorded by Country Wide Ecological Services (2005) feeding on Belah (*Casuarina cristata*) within ML 1579. During the survey, Country Wide Ecological Services (2005) did not note any nesting resources for this species (i.e. large hollows in trees). While not specifically targeted by Eco Logical (2010), Eco Logical did not record this species during the recent avifauna survey. This species has not been recorded in Leard State Forest (NSW Government, 2010).

Turquoise Parrot

A small flock of Turquoise Parrot was previously observed within ML 1579 by Country Wide Ecological Services (2005). Eco Logical (2010) also recorded the Turquoise Parrot within the proposed Modification area in December 2009, which indicates that a local population of Turquoise Parrot uses habitat within ML 1579. The Turquoise Parrot has also been recorded in Leard State Forest (NSW Government, 2010).

Brown Treecreeper (Eastern Sub-species)

The Brown Treecreeper (Eastern Sub-species) was previously recorded by Country Wide Ecological Services (2005) within ML 1579 and has been recorded in Leard State Forest (NSW Government, 2010). The species was also recorded by Eco Logical (2010) within the proposed Modification area in December 2009.

Speckled Warbler

Although not previously recorded within ML 1579 (after Country Wide Ecological Services, 2005, 2009), Eco Logical (2010) recorded the Speckled Warbler in December 2009, during targeted avifauna survey for another threatened species. The Speckled Warbler has been recorded in Leard State Forest (NSW Government, 2010).

Hooded Robin

A single Hooded Robin was recorded within ML 1579 by Country Wide Ecological Services (2005) in White Cypress Pine regrowth. An immature female Hooded Robin was recorded during fauna monitoring in 2009 by Country Wide Ecological Services (2009). While not specifically targeted, Eco Logical (2010) did not record this species during the recent avifauna survey. This species has not been recorded in Leard State Forest (NSW Government, 2010).

Grey-crowned Babbler (Eastern Sub-species)

The Grey-crowned Babbler (Eastern Sub-species) was recorded within ML 1579 on two occasions by Country Wide Ecological Services (2005, 2009). Country Wide Ecological Services (2009) recorded a family of 16 Grey-crowned Babblers and inferred that the species was persisting despite the mining activities.

In addition to the above, the Grey-crowned Babbler (Eastern Sub-species) has also been recorded in Leard State Forest (NSW Government, 2010). While not specifically targeted, Eco Logical (2010) did not record this species during the recent avifauna survey.

Little Pied Bat

Acoustic calls of the Little Pied Bat were recorded within ML 1579 on two occasions by Country Wide Ecological Services (2005, 2009). While not specifically targeted, Eco Logical (2010) did not record this species during the recent spotlighting. This species has not been recorded in Leard State Forest (NSW Government, 2010).

Yellow-bellied Sheath-tail Bat

Acoustic calls of the Yellow-bellied Sheath-tail Bat were recorded within ML 1579 on two occasions by Country Wide Ecological Services (2005, 2009). While not specifically targeted, Eco Logical (2010) did not record this species during the recent spotlighting. This species has not been recorded in Leard State Forest (NSW Government, 2010).

Other Threatened Fauna Species

Five threatened fauna species additional to those listed in Table 4-19, have been recorded in Leard State Forest or nearby, namely the Black-chinned Honeyeater (*Melithreptus gularis gularis*), Diamond Firetail (*Stagonopleura guttata*), Masked Owl (*Tyto novaehollandiae*), Greater Long-eared Bat (*Nyctophilus timoriensis*) and Grey Falcon (*Falco hypoleucos*) (Country Wide Ecological Services, 2005). Eco Logical (2010) considered that these species could potentially use habitat in the proposed Modification area (Appendix F).

The Grey Falcon was observed by Country Wide Ecological Services (2005) in habitat immediately adjacent to ML 1579. While not recorded using habitat within ML 1579, Eco Logical (2010) considered that the species could potentially use habitat in the proposed Modification area. This species was not included in the Biobanking Calculation as it has not been sighted in the proposed Modification area (Appendix F).

A SEPP 44 assessment of potential Koala habitat is provided in Section 3.3.2.

Threatened Ecological Communities

The White Box-Yellow Box-Blakely's Red Gum Woodland Endangered Ecological Community (Box-Gum Woodland EEC) and White Box–Yellow Box–Blakely's Red Gum Grassy Woodland and Derived Native Grassland Critically Endangered Ecological Community (Box-Gum Grassy Woodlands and Derived Native Grasslands CEEC) are threatened ecological communities listed under the TSC Act and EPBC Act, respectively.

Different approaches to the conservation of Box-Gum Woodlands have been adopted by the State and Commonwealth Governments. The NSW approach under the TSC Act is to regard all Box-Gum Woodland remnants, even highly disturbed ones that would respond to 'assisted natural regeneration' 'under appropriate management' (NSW National Parks and Wildlife Service [NPWS], 2002), as belonging to the listed Box-Gum Woodland EEC. On the other hand, the Commonwealth Box-Gum Grassy Woodlands and Derived Native Grasslands CEEC definition under the EPBC Act includes only higher quality Box-Gum Woodland remnants that have groundcovers rich in native perennial herbaceous species (Threatened Species Scientific Committee, 2006a, 2006b).

Eco Logical (2010) report that all of the Box-Gum Woodlands in the proposed Modification area meet the criteria for the Box-Gum Woodland EEC under the TSC Act (i.e. 22.3 ha), and a portion of this (i.e. 0.8 ha) meets the criteria for the Box-Gum Grassy Woodlands and Derived Native Grasslands CEEC under the EPBC Act (Figure 4-13).

Migratory Species

Table 4-20 presents the migratory species listed under the EPBC Act that have been recorded within ML 1579.

Table 4-20
Migratory Species Recorded within ML 1579

Scientific Name	Common Name
Apus pacificus	Fork-tailed Swift
Charadrius hiaticula	Ringed Plover

Source: Country Wide Ecological Services (2005, 2009); Eco Logical (2010).

There is very limited habitat for migratory birds within ML 1579.

Critical Habitat

No critical habitat occurs within the vicinity of the proposed Modification area as designated by the Register of Critical Habitat held by the Commonwealth Minister for the Environment, Water, Heritage and the Arts (DEWHA, 2010b), Register of Critical Habitat held by the Director-General of the DECC (DECCW, 2010c), the Register of Critical Habitat held by the Director General of the DII-Fisheries (DII-Fisheries, 2010) or the Narrabri LEP. Therefore, the proposed Modification would not affect any critical habitat.

4.11.2 Potential Impacts

Potential impacts from the modified Tarrawonga Coal Mine on biodiversity are assessed below.

Direct Impacts - Vegetation/Habitat Clearance

The Biobanking Credit Calculator (DECCW, 2009a) was used by Eco Logical (2010) to calculate the direct impacts of the modification on biodiversity. This incorporates the following key threatening processes listed under the TSC Act: clearing of native vegetation, removal of dead wood and dead trees and bush rock removal.

Table 4-21 provides the quantities of each vegetation type (DECCW, 2010a) which would be removed as part of the proposed Modification (Appendix F) (Figure 4-13).

Table 4-21
Vegetation Types within the Proposed Modification Area

Vegetation Types	Disturbance Area (ha)
White Cypress Pine – Narrow-leaved Ironbark Shrub/Grass Open Forest of the Western Nandewar Bioregion	36.84
White Box Grassy Woodland of the Nandewar and Brigalow Belt South Bioregions	22.3
Total	59.14

Source: Eco Logical (2010) (Appendix F).

The occurrence of Box-Gum Woodland EEC in the proposed soil stockpile area is devoid of trees and characterised by derived grassland. It is located in a paddock which has a history of grazing and cultivation (cereal and lucerne [GCNRC, 2005b]). Although the paddock continues to be grazed, the groundcover is dominated by native flora species (> 50%) (Appendix F). Eco Logical (2010) report that the Box-Gum Woodland EEC comprised of a moderate abundance of introduced flora species and there is a low diversity of native ground cover species (other than grasses) with those largely represented by grazing tolerant flora species. Similar derived grasslands which were former White Box Woodland are relatively common in the landscape due to widespread agricultural land use.

Topsoil and sub-soil stripped from the mine area would be stockpiled in the proposed soil stockpile area. The stockpile area would be a temporary structure as the soil would be progressively reclaimed and used to rehabilitate the mine.

The occurrence of Box-Gum Grassy Woodlands and Derived Native Grasslands CEEC in the proposed infrastructure area is characterised by advanced regrowth White Box (*Eucalyptus albens*) with some old growth trees, and a patchy mid-storey of regrowth White Cypress Pine (*Callitris glaucophylla*) and other shrubs, which have regrown since the relaxation of grazing pressures (Appendix F).

Indirect Impacts

The Biobanking Credit Calculator (DECCW, 2009a) does not calculate the credits required for indirect impacts. The Biobanking Operational Manual (DECC, 2009b) requires the Biobank Assessor to *estimate the number of credits required to offset the impacts resulting from indirect impacts off-site following the implementation of all cost effective on-site measures to minimise these impacts'*

Eco Logical (2010) identified and assesses relevant negative indirect impacts that the proposed Modification is likely to have on the biodiversity values of areas adjacent to the planned disturbance areas. Eco Logical (2010) identified increased run-off, and additional light and noise as the likely indirect impacts of the proposed Modification, although considered that these indirect impacts are likely to be minimal given the measures used by TCPL at the Tarrawonga Coal Mine to reduce impacts (Section 4.11.3). The type and number of credits prescribed by Eco Logical (2010) is described in Section 4.11.4.

Additional indirect impacts which may be relevant relate to the following key threatening processes listed under the TSC Act: invasion of native plant communities by exotic perennial grasses, predation by feral cats, predation by the European Red Fox and competition and grazing by the feral European Rabbit. These indirect impacts are managed at the Tarrawonga Coal Mine in accordance with the FFMP (Section 4.11.3).

Human-caused climate change is also a relevant key threatening process listed under the TSC Act and is discussed further in Section 4.6.

4.11.3 Measures to Avoid or Mitigate Impacts

TCPL currently implements the following environmental management plans relevant to the management of biodiversity at the Tarrawonga Coal Mine:

- FFMP;
- BMP;
- RNMP;
- SWMP;
- BNMP; and
- AQMP.

These management plans provide measures to avoid and mitigate potential impacts of the Tarrawonga Coal Mine on flora and fauna as described below. The management plans would be reviewed and revised to incorporate the modified Tarrawonga Coal Mine.

Vegetation Clearance and Pre-clearance Fauna Surveys

The extent of clearing would be minimised and consistent with the operational requirements. The FFMP provides procedures for vegetation clearance and pre-clearance fauna surveys. The pre-clearance surveys are required to be conducted by a suitably qualified and experienced fauna expert (GCNRC and Country Wide Ecological Services, 2007). The FFMP includes management measures for specific threatened species (e.g. relocation of bat roosts).

The FFMP also provides measures for the salvage and re-use of cleared vegetation, including, the collection and propagation of native seed, incorporation of groundcover into topsoil when it is stripped, use of clearing debris on the rehabilitated landform and salvage of hollow tree trunks and branches.

In accordance with the existing Development Consent, the implementation of the measures contained in the FFMP is to be reviewed annually.

Rehabilitation and Revegetation of Disturbance Areas

The rehabilitation and revegetation of mine disturbance areas is described in Section 4.11.4, as rehabilitation is included in the approved offset strategy for the Tarrawonga Coal Mine.

Flora and Fauna Monitoring Programme

The FFMP describes a flora and fauna monitoring programme for the rehabilitated mine areas.

Flora quadrats on the rehabilitated mine landform are surveyed annually, and have been surveyed in April-May 2007, May 2008 and March 2009 (TCPL, 2009a; GCNRC, 2009). The 2008/2009 AEMR describes how the results on the rehabilitation monitoring plots vary due to the short monitoring period but nonetheless remain positive (TCPL, 2009a).

Fauna monitoring within ML 1579 was undertaken in March 2008 (TCPL, 2008c) and February 2009 (TCPL, 2009a; Country Wide Ecological Services, 2009). Monitoring is showing an increase in local fauna density, richness and diversity within ML 1579 which may be attributed to an increase in habitat complexity (e.g. additional habitat provided by water storages dams and logs/branches from tree clearance) and an improvement in patch quality from de-stocking in the approved offset area (Section 4.11.4) (Country Wide Ecological Services, 2009).

Bushfire Management

A BMP has been prepared for the Tarrawonga Coal Mine in consultation with the Boggabri No.1 and Nandewar Rural Fire Brigades and Narrabri Shire Council (TCPL, 2006d). The BMP provides bushfire controls (including fire equipment and locations), emergency response (community/mine personnel), emergency telephone numbers and bushfire training requirements.

Noise Controls and Monitoring

The RNMP incorporates a road noise monitoring programme. Measures to reduce noise from the Tarrawonga Coal Mine include truck noise minimisation and driver education/ training.

The BNMP provides for the management of blasting which is also further described in Section 4.4.3.

Dust Controls and Monitoring

Dust controls and air quality monitoring at the Tarrawonga Coal Mine is described within the AQMP. As described in Section 4.5, dust controls include minimising the clearing of vegetation ahead of construction, progressive rehabilitation, and where necessary, spraying low moisture coal with water prior to excavation to raise the moisture content.

Site Water Management

The SWMP provides a description of water management at the Tarrawonga Coal Mine including a description of surface water management structures, the predicted site water balance, an erosion and sediment control plan, a surface water monitoring programme and a groundwater monitoring programme. As described in Section 4.9.3, the SWMP would be reviewed and revised to incorporate the proposed Modification.

Weed Management

Noxious weeds previously recorded within ML 1579 are listed in Section 4.11.1. Environmental and noxious weeds management at the Tarrawonga Coal Mine is conducted in accordance with the FFMP. Weed management measures include twice yearly inspections of revegetation areas (GCNRC and Country Wide Ecological Services, 2007).

Feral Animal Control

Feral animals previously recorded within ML 1579 are listed in Section 4.11.1. Feral animal control measures are provided in the FFMP. Measures include participation with local landholders and the Rural Lands Protection Broad in control programmes, trapping and/or baiting of animal pests (e.g. European Rabbits and European Red Foxes) (GCNRC and Country Wide Ecological Services, 2007).

4.11.4 Offsets

This sub-section describes the outcome of the biobanking assessment (Appendix F) as well as planned rehabilitation and a proposed modification to the Tarrawonga Coal Mine approved offset area.

Biobanking Assessment Outcome – Credit Requirement

There are two types of credits under the Biobanking Scheme, namely, 'ecosystem credits' and 'species credits'. 'Ecosystem credits' are *the class of biodiversity credits created or required for the impact on general biodiversity values and some threatened species; that is, for biodiversity values except threatened species or populations that require species credits* and 'species credits' are *the class of biodiversity credits created or required for the impact on threatened species that cannot be reliably predicted to use an area of land based on habitat surrogates* (DECCW, 2009a).

The biobanking assessment (Appendix F) for the proposed Modification indicated that a total of 3,051 'ecosystem credits' are required. No 'species credits' are required for the proposed Modification (Appendix F) since the DECCW (2009b) *Threatened Species Profile Database* indicates that the threatened species recorded in the proposed Modification area (Table 4-19) can be predicted to use an offset area based on habitat (i.e. the threatened species are not required to be found in the offset area and they are assumed to be present).

As the Tarrawonga Coal Mine will be rehabilitated and revegetated (refer to discussion below), the 'deferred credit' provision of the BioBanking Scheme is applicable, whereby a portion of the credits are required to be retired prior to development and the remaining portion is held by the Minister for the Environment until rehabilitation of the mine site is completed. Using the 'deferred credit' provision, 2,216 ecosystem credits would need to be retired and 835 ecosystem credits would be held by the Minister for the Environment pending rehabilitation of the mine site.

The profile of the credits required to be retired (as prescribed in the biobanking assessment [Appendix F]) is presented in Table 4-22.

Table 4-22
Profiles of Credits Required

Number of Credits Required	CMA Sub-regions in which the Offset is able to be Located	Vegetation Types able to be used as an Offset	Minimum % Surrounding Vegetation	Minimum Patch Size (ha)
1,001	Namoi CMA Region, Liverpool Plains (Part A) or Liverpool Plains (Part B) Subregions.	White Cypress Pine – Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion (NA228).	10	25
612	Namoi CMA Region, Liverpool Plains (Part A) or Liverpool Plains (Part B) Subregions.	White Cypress Pine – Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion (NA228).	10	100
603	• Central West CMA Region, Pilliga Subregion; or • Namoi CMA Region, Liverpool Plains (Part A) or Liverpool Plains (Part B) Subregions.	• White Box Grassy Woodland of the Nandewar and Brigalow Belt South Bioregions (CW 215); or • White Box Grassy Woodland of the Nandewar and Brigalow Belt South Bioregions (NA226).	10	100

Source: Eco Logical (2010) (Appendix F).

The correct number of credits required to meet the credit requirement are available within the proposed Whitehaven Regional Biobank Site (proposed Regional Biodiversity Offset area) (Figure 1-1) for which an application to register the property as a Biobank Site was made in March 2010.

The CMA sub-region boundary splits the proposed Whitehaven Regional Biobank Site into the Peel sub-region and the Liverpool Plains (Part B) sub-region. While there are sufficient credits in the Liverpool Plains (Part B) component of the proposed Whitehaven Regional Biobank Site, TCPL wants the option to use the credits in the Peel sub-region portion. Eco Logical (2010) consider that the required credits should be able to be retired using equivalent credits from the Liverpool Plains (Part B) and/or the Peel sub-regions for reasons such as there no physical boundaries limiting species movement between the CMA sub-regional boundaries in the proposed Whitehaven Regional Biobank Site. Further justification is provided in Appendix F.

Under section 75JA of the EP&A Act, the NSW Minister for Planning *may approve a project subject to a condition that requires the proponent to acquire and retire (in accordance with Part 7A of the Threatened Species Conservation Act 1995) biodiversity credits of a number and class (if any) specified by the Minister in the approval.*

The occurrence of Box-Gum Woodland EEC and Box-Gum Grassy Woodlands and Derived Native Grasslands CEEC in the proposed Modification area (22.3 ha) results in a 'red flag' under the Biobanking Scheme (Appendix F). However, as the proposed Modification would be assessed under Part 3A of the EP&A Act, the term 'red flag' does not apply to the proposed Modification.

Proposed Modification to the Approved Offset Strategy

Conditions 33 and 34 under Schedule 4 of the existing Development Consent require the provision of a biodiversity offset strategy for the approved Tarrawonga Coal Mine. The approved offset strategy was described in the 2005 EIS and is shown on Figure 4-14 (reproduced from the 2005 EIS). The approved offset strategy aims to provide linkages between post-mining landforms, existing remnant patches and Leard State Forest, thereby improving the habitat opportunities for local fauna which would be impacted by the Tarrawonga Coal Mine.

There are two components to the approved offset strategy (Table 4-23):

- rehabilitation and revegetation of post-mining landforms; and
- enhancement of adjoining offset areas (including existing woodland/forest and derived grasslands).

A modified offset strategy is proposed as part of the modified Tarrawonga Coal Mine. The two components to the offset strategy are summarised in Table 4-23 and are described below.

N

REFERENCE
- Project Site Boundary
- Open Cut Area
- Mine Access Road (to Remain)
- Existing Agricultural Land
- Proposed Agricultural Land
- Existing Native Vegetation
- Proposed Native Vegetation
- Stock Exclusion / Offset Area
- Existing Contour (Interval = 10m)(m AHD)
- Final Landform Contour (Interval = 10m)(m AHD)

0 50 200 400 600
Metres
GRID DATUM MGA 94 ZONE 56

Source: R.W. Corkery & CO. Pty Limited (2005)

TARRAWONGA COAL MINE MODIFICATION

FIGURE 4-14

Approved Final Land Use and Biodiversity Offsets

ResourceStrategies

WHITEHAVEN COAL

WHC-09-02 Sect75W Sect4_102C

Table 4-23
Approved and Modified Offset Strategy

Component		Approved Offset Strategy[1] (as shown on Figure 4-14)	Modified Offset Strategy (as shown on Figure 4-15)
1. Rehabilitation of Disturbed Areas with Local Native Flora Species		269 ha	435 ha
2. Offset area	Conservation of Existing Vegetation	141 ha (including 30 ha of White Box-Blakely's Red Gum-White Cypress community and 2 ha of Belah community)	110 ha (including 30 ha of White Box-Blakely's Red Gum-White Cypress community and 2 ha of Belah community)
	Stock Exclusion Zone	132 ha	132 ha
Total		542 ha	677 ha

[1] Development Consent Condition 33.

Rehabilitation

As described in Section 5, rehabilitation and revegetation of post-mining landforms is conducted progressively at the Tarrawonga Coal Mine. The post-mining landforms are revegetated with tube stock and seeds of the tree, shrub and grass species of the vegetation communities which are disturbed.

As part of the approved offset strategy, the final land use of the rehabilitated landforms was described in the 2005 EIS as comprising approximately 269 ha of land for conservation purposes (Table 4-23) and approximately 61 ha planned for agriculture. As part of the modified offset strategy (Table 4-23), it is proposed that the post-mining landforms (approximately 327 ha) are rehabilitated with woodland vegetation (Figure 4-15) and that the final land use is for conservation purposes. The aim of this change is to increase the continuity and integrity of the rehabilitated vegetation (Figures 4-14 and 4-15).

The rehabilitation and revegetation of mine disturbance areas is discussed further in Section 5.

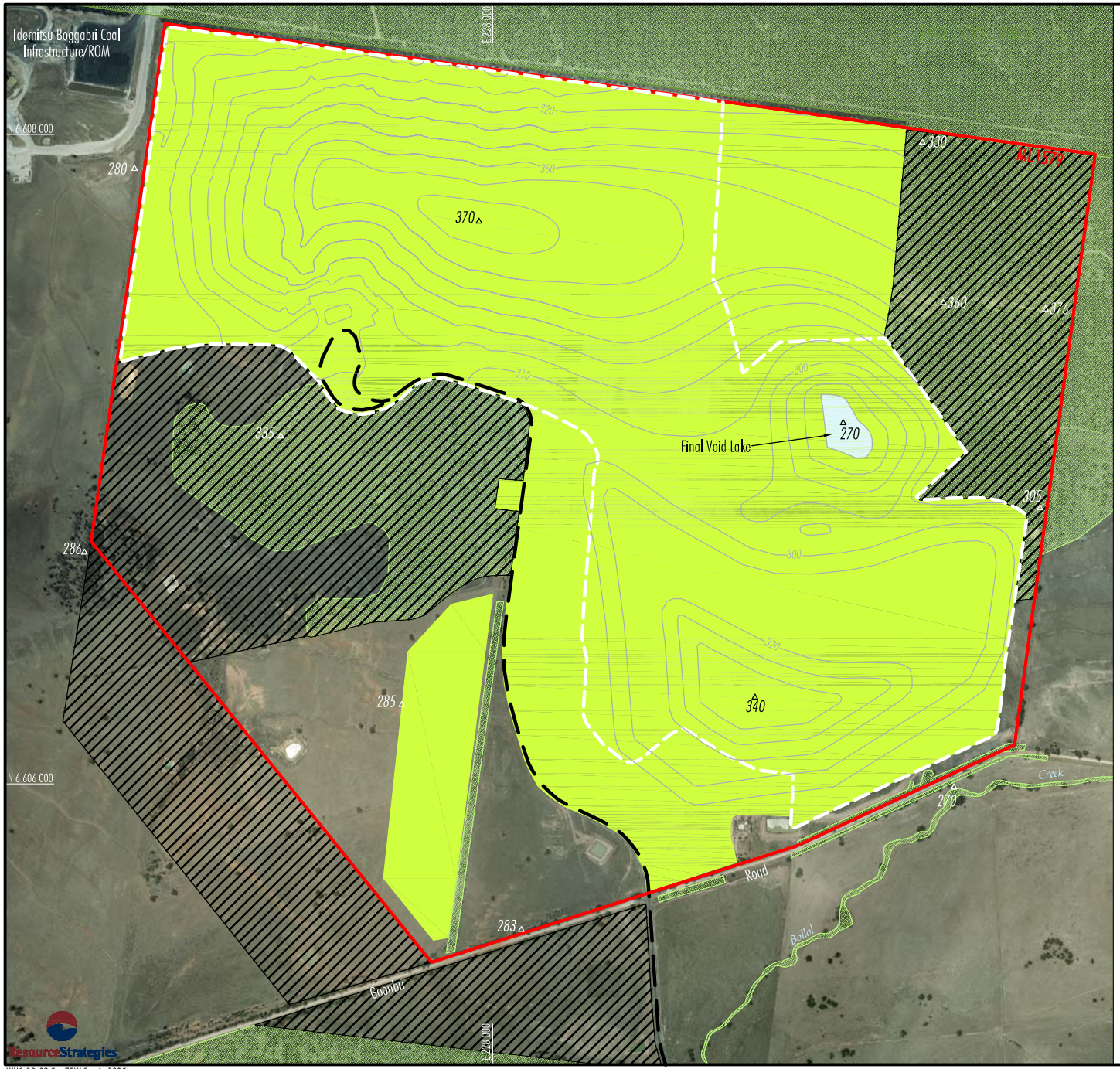
Offset Area

The approved biodiversity offset strategy includes stock exclusion/offset areas (132 ha) in addition to areas of existing vegetation (141 ha) (these two areas combined are herein referred to as the approved offset area) (Figure 4-15).

Grazing has been excluded from the approved offset area to encourage natural regeneration. Personnel access to the approved offset area has also been restricted (GCNRC and Country Wide Ecological Services, 2007).

The FFMP describes a flora monitoring programme for the offset area (referred to as the destocked former agricultural land in the plan). Eight flora monitoring quadrats were established in the offset area in April-May 2007 and re-surveyed in May 2008 and March 2009 (TCPL, 2009a; GCNRC, 2009). The results of the monitoring are reported in the AEMR.

A modification to the existing offset area is proposed as part of the modified Tarrawonga Coal Mine (Figures 4-14 and 4-15). The same quantities of land required in the offset area would also be in the modified offset area, which the exception of the vegetation to be cleared as part of the proposed Modification. As shown in Table 4-23, the modified offset area would result in a reduction in the area of existing vegetation to be conserved within ML 1579 (i.e. by approximately 38 ha). However, the biobanking assessment (Appendix F) assessed the number of credits required to address clearance of this vegetation (refer above), and these credits would be obtained as part of the proposed Modification.



N

LEGEND

- Mining Lease Boundary (ML)
- Mine Access Road
- Approved Open Cut / Waste Emplacement / Soil Stockpile Disturbance Area
- Existing Agricultural Land
- Existing Native Vegetation
- Proposed Native Vegetation (Rehabilitation)
- Proposed Offset Area
- 340 Spot Height in Metres AHD

0 50 200 400 600

Metres

GRID DATUM MGA 94 ZONE 56

Source: Orthophoto - Geo-Spectrum Australia (Flown December 2009) and Whitehaven (2009)

TARRAWONGA COAL MINE MODIFICATION

FIGURE 4-15

Proposed Final Land Use and Biodiversity Offsets

WHITEHAVEN COAL

WHC-09-02 Sect75W Sect4_103C

The key benefits of the modified offset area are listed below:

- It contains existing vegetation communities (including Narrow-leaf Iron Bark-White Cypress Pine, White Box- Blakely's Red Gum – White Cypress Pine, Belah Woodland, Narrow-leaf Iron Bark-White Cypress Pine – Wattle) (GCNRC, 2005b).
- It contains threatened Box-Gum Woodland EEC (GCNRC, 2005b).
- It contains known habitat for threatened species which are directly impacted by the Tarrawonga Coal Mine (including Glossy Black Cockatoo, Turquoise Parrot, Brown Treecreeper [Eastern Sub-species], Speckled Warbler, Hooded Robin, Grey-crowned Babbler [Eastern Sub-species], Little Pied Bat, Yellow-bellied Sheath-tail Bat).
- It provides for the conservation and enhancement of habitats in a similar landscape position to those which would be disturbed.
- It provides the opportunity to enhance existing vegetation by removal of grazing and managing for conservation purposes.
- It provides the opportunity to improve linkages between post-mining landforms, existing remnant patches and Leard State Forest.

The conservation of the modified offset area would be secured in perpetuity (e.g. through rezoning the land under the Narrabri LEP, or covenant on title) within 12 months of approval of the proposed Modification. Should TCPL wish to change the location of the offset area, an alternative offset area would be provided to the satisfaction of the Minister for Planning.

The FFMP would be reviewed and revised to incorporate the modified offset area, and would detail measures including:

- providing appropriate fencing to exclude grazing;
- selective revegetation in derived grasslands by appropriate plantings or seeding using local seed sources;
- soil erosion management;
- managing weeds and pests;
- signage of the proposed offset area;
- restricting vehicular and people access; and
- monitoring, auditing and reporting the performance of the offset.

Habitat features (e.g. large hollows and some suitable logs) would continue to be salvaged during vegetation clearance activities and relocated to rehabilitation areas and the offset area.

4.12 HAZARD AND RISK

4.12.1 Existing Measures

Preliminary Hazard Analysis

A Preliminary Hazard Analysis (PHA) conducted as part of the 2005 EIS analysed the potential risks associated with the storage and use of diesel fuel and ammonium nitrate fuel oil (ANFO). The PHA included a number of risk reduction measures that have been incorporated into the design of the Tarrawonga Coal Mine, as follows (R.W. Corkery, 2005):

Diesel Fuel

- *Up to 110,000 L of diesel would be stored within the mine facilities and coal processing areas.*
- *The diesel would be stored in two 50,000 L tanks and one 10,000 L tank, each bunded to contain 110% of the tank volume.*

ANFO

- *Nitro-pril bags, diesel and detonators, when stored on the Project Site, would all be stored separately either in designated magazines or the previously noted diesel storage areas.*
- *Storage of these materials (Nitro-pril and detonators) would generally be sufficient for the upcoming blast event only.*
- *Restricted access and separate storage removes the risk of accidental detonation.*
- *Only authorised personnel such as the nominated blasting contractor, blasting engineer and mine management would have access to these materials and storage areas.*

The PHA concluded that the storage and use of diesel and ANFO represent an insignificant risk (R.W. Corkery, 2005).

No hazardous events or incidents have occurred at the Tarrawonga Coal Mine since the commencement of operations that have changed the conclusion presented in the PHA (TCPL, 2007a, 2008c, 2009a).

Explosives Management

No explosive materials are retained within ML 1579. Orica Mining Services has a storage facility located between the Tarrawonga and Canyon mine sites to remove the requirement for on-site storage (TCPL, 2009a).

Material Safety Data Sheets

Materials Safety Data Sheets are retained on-site for all hazardous materials, independent of the quantity. Additionally, all contractors are required to supply Materials Safety Data Sheets for any hazardous goods they may bring onto the site (TCPL, 2009a).

Bushfire Management Plan

Management measures relevant to bushfire hazards at the mine are detailed in the BMP (TCPL, 2006d).

The BMP includes management measures relevant to:

- mobile equipment and mine operations;
- fixed plant and buildings;
- fuel and oil management;
- mine site protocols;
- fire fighting equipment; and
- training.

Emergency Management Procedure

Emergency management procedures (including actions/instructions and responsible persons) for potential emergency situations that could occur at the Tarrawonga Coal Mine have been documented in the Emergency Management Procedure (TCPL, 2008d).

Health and Safety Management Plan

A Health and Safety Management Plan (TCPL, 2007b) has been developed for the approved Tarrawonga Coal Mine and generally follows the intent of Australian Standard/New Zealand Standard (AS/NZ) *AS/NZS 4804 - Occupational health and safety management systems – General*. The Health and Safety Management Plan includes measures relevant to:

- health and safety policy;
- risk management;
- training and competence; and
- information control, system measurement and evaluation.

Incident Management Standard

TCPL has developed an Incident Management Standard (TCPL, 2009d) as a systematic approach for the investigation of incidents, to identify the necessary control measures to prevent a recurrence and to outline the process and accountabilities for incident investigation and action planning. The Incident Management Standard is applicable to events that cause, or have the potential to cause:

- injury to people;
- damage to equipment or plant;
- damage to the environment;
- reputational damage; or
- a major disruption in productivity.

4.12.2 Hazard Identification and Risk Assessment

The proposed Modification would not introduce new hazardous materials or change the storage or transport arrangements of hazardous materials (i.e. diesel fuel and ANFO) of the approved Tarrawonga Coal Mine.

Further, the proposed Modification would not change the potential impact mechanisms to the environment, private and public property, and their associated consequences and likelihoods, to the extent that risk levels would change from those previously assessed for the PHA.

4.12.3 Hazard Prevention and Mitigation Measures

The hazard prevention and mitigation measures described in Section 4.12.1 would continue to be implemented for the modified Tarrawonga Coal Mine.

4.13 TRANSPORT

4.13.1 Existing Environment

The approved Tarrawonga Coal Mine is located approximately 15 km northeast of Boggabri, and is situated adjacent to Goonbri Road and between Maules Creek Road and Blair Athol Lane. Goonbri Road and the other local roads adjacent to the ML 1579 are unsealed and provide a link between local properties and Boggabri to the south-west and Gunnedah to the south.

The 2005 EIS assessed the coal haulage route to be used for the movement of coal between the mine site and the CHPP (Figure 1-1), as well as the return of coal rejects for disposal within ML 1579 (Section 2.1.5). The transport route was constructed in 2006 in accordance with the Transport Route Construction Management Plan (TCPL, 2005b) and the WCMP (TCPL, 2005c).

The transport route includes:

- northern section – comprising a 2 km section of an existing public road (Manilla Road) and approximately 8.8 km of private roads constructed on freehold land owned by both TCPL and local landholders; and
- southern section – comprising the private mine access road within the Canyon Coal Mine and public roads which form the existing route used for coal transportation between the Canyon Coal Mine and the CHPP and rail-loading facility.

As described in the EMS (TCPL, 2005d), the transportation of coal from the mine site is integrated with the overall delivery of coal from Whitehaven's mines supplying coal to the CHPP and coal loading facility. Coarse reject material is approved to be back-loaded from the CHPP to ML 1579 via the transport route. As described in Section 2.1.3, coal haulage on this route is permitted between the hours of 7.00 am to 10.00 pm[3] Monday to Friday, and between 7.00 am to 6.00 pm[4] Saturdays.

4.13.2 Potential Impacts

The proposed Modification would not change the maximum number of daily traffic movements to and from the approved Tarrawonga Coal Mine (i.e. the 2005 EIS assessed traffic associated with a 2 Mtpa production rate). However, the additional 4 Mt of coal to be hauled from the site would increase the overall number of truck movements to and from ML 1579. These additional truck movements would result in additional wear and tear along the coal haulage route.

4.13.3 Mitigation Measures, Management and Monitoring

As described in Section 4.13.1, the transport route was constructed in 2006 in accordance with the Transport Route Construction Management Plan.

Whitehaven has entered in to road maintenance agreements with the Narrabri Shire Council and the Gunnedah Shire Council in accordance with Condition 43 of Schedule 4 of the Development Consent.

[3] Note that the last load is dispatched from the site at 9.15 pm (in accordance with Condition 44 of the Development Consent) and arrives at the CHPP by 10.00 pm.

[4] Note that this last load is dispatched from the site at 5.15 pm (in accordance with Condition 44 of the Development Consent) and arrives at the CHPP by 6.00 pm.

The agreement with Gunnedah Shire Council covers the maintenance of roads used by Whitehaven in association with the Tarrawonga Coal Mine, as well as other Whitehaven mines and facilities in the region (e.g. the Whitehaven CHPP, Canyon Coal Mine and Rocglen Coal Mine). Under the agreement Whitehaven is required to pay 95% of road maintenance costs incurred by the Gunnedah Shire Council for Hoad Lane and Blue Vale Road. Annual road maintenance requirements are determined following an inspection in February/March by at least the Works Engineer of the Council and the relevant Whitehaven coal mine Operations Managers. The inspections are used to jointly monitor the condition of the roads and to develop a financial plan for both short-term and long-term works including the location and scope of minor heavy patching, bitumen re-seals, and minor pavement rehabilitation.

The road maintenance agreement with the Narrabri Shire Council Agreement covers the section of the coal haulage route within the Narrabri Shire. It requires the road and intersections to be maintained in good condition at all times at Whitehaven's cost. Under the conditions of the agreement joint inspections are to be carried out every four months to determine maintenance requirements.

The scope and coverage of the existing road maintenance agreements are sufficiently broad to cover the additional wear and tear on the coal haulage route associated with the proposed Modification.

4.14 SOCIAL AND ECONOMIC ASPECTS

As described in Section 1.1.3, the proposed Modification would not change the approved life of the Tarrawonga Coal Mine. The modified Tarrawonga Coal Mine would continue to provide economic and employment benefits to the region. The Tarrawonga Coal Mine currently employs some 65 to 70 operational personnel plus additional contract personnel employed on an as-needs-basis (TCPL, 2009a). This level of employment would continue for the life of the modified Tarrawonga Coal Mine. Approximately 50% of employees are sourced from the local Boggabri/Gunnedah area, with the remainder residing in nearby Narrabri, Manilla and Curlewis. Employees would continue to be sourced from these areas for the modified Tarrawonga Coal Mine.

The operation of the Tarrawonga Coal Mine would continue to result in the collection of royalties and taxes by the State of NSW and the Commonwealth Government.

TCPL continues to make numerous financial sponsorship and in-kind support to the local community. Approximately $45,000 was donated to the community during 2008/2009 AEMR reporting period (TCPL, 2008c).

TCPL also continues to work with the local Aboriginal community regarding Aboriginal cultural heritage matters at the Tarrawonga Coal Mine (Section 4.7).

A CCC was formed prior to the commencement of operations at the mine, in accordance with Condition 8 of the Development Consent. The CCC comprises representatives of Gunnedah and Narrabri Shire Councils, the local community and TCPL. The CCC meets on a regular basis (i.e. four times per year). Community consultation would continue to be provided in accordance with the Tarrawonga Coal Mine CCC.

The procedure for receiving, investigating, responding to and reporting complaints received from the community, would continue to operate, providing the local community with a method to register issues or complaints with respect to TCPL mining activities.

5 REHABILITATION

This section summarises the approach to rehabilitation and mine closure for the modified Tarrawonga Coal Mine. It describes how the mine would be progressively rehabilitated and integrated into the landscape, and the measures which would be put in place for the long-term protection and management of the site following the cessation of mining.

In accordance with the *Mining Act, 1992*, rehabilitation would be subject to agreement and approval from the relevant regulatory authorities. The rehabilitation concepts presented below are therefore provisional to allow for the consideration of the results of current and proposed investigations, as well as consultation with regulatory authorities and other stakeholders.

The results of rehabilitation investigations and proposed rehabilitation concepts for the Tarrawonga Coal Mine are currently documented in the 2008/2009 AEMR and MOP. Condition 57 of Schedule 4 of the Development Consent requires a Mine Closure Strategy to be prepared at least three years prior to the cessation of mining. This strategy has not yet been prepared.

If the proposed Modification is approved, the MOP would be reviewed and updated, and a Mine Closure Strategy would be prepared to incorporate the rehabilitation concepts and activities for the modified Tarrawonga Coal Mine. TCPL would continue to report on the progress of rehabilitation activities in the AEMR.

5.1 REHABILITATION OBJECTIVES

As described in Section 2.1.9, the rehabilitation and final land use objectives for the existing Tarrawonga Coal Mine, as described in the 2005 EIS, 2008/2009 AEMR, and MOP, are as follows.

Areas affected by mining – short-term

- Stabilise all earthworks, drainage lines and disturbed areas that are no longer required for mine-related activities.
- Reduce the visibility of mining activities from adjacent properties and the local road network.

Areas affected by mining – long-term

- Provide a low maintenance, geotechnically stable and safe landform which is commensurate with a variety of agricultural land uses and/or nature conservation.
- Blend created landforms with the surrounding land fabric.
- Revegetate the majority of the post-mining landform to communities which emulate the existing vegetative communities or those that occurred prior to agricultural related disturbance.

Areas unaffected by mining

- Remove grazing pressure from areas of relatively intact native tree, shrub and grassland communities and thereby encourage the extension/diversification of those communities.
- Undertake plantings as a means of extending or encouraging the development of native bushland communities.

TCPL would aim to provide a rehabilitation outcome that balances the alternative land uses that exist in the region by establishing a combination of agricultural land and native woodland on ML 1579. Woodland areas would be created to contribute to the local and regional habitat corridors. Agricultural land would be retained in the southern portion of lease in the areas adjacent to the proposed new soil stockpile (Figure 4-15).

Rehabilitation works at the end of the mine life would be minimised by constructing the final outer slopes of waste emplacements during their development, and by progressively rehabilitating mine landforms and other disturbance areas throughout the mine life as they become available.

5.2 FINAL LANDFORM

At the completion of mining, the key final landforms/features at the modified Tarrawonga Coal Mine would include the following:

- Northern Emplacement, Southern Emplacement and in-filled open cut;
- mine infrastructure areas (e.g. coal crushing and load-out facility, ROM pad, administration areas, workshops, etc.); and
- water storage dams and sediment basins.

Northern and Southern Emplacements

As for the approved Tarrawonga Coal Mine, the Northern and Southern Emplacements would be rehabilitated to create gently sloping hills in the final landform. These landforms would be constructed predominantly with slopes of 10 degrees (^{o}) or shallower (none would exceed 18°) and to an elevation consistent with the surrounding landscape.

The original final landform concept for the Northern Emplacement described in the 2005 EIS was for it to form a northern extension of the existing low hill located to the immediate southwest of the coal crushing and load-out facility. The proposed Modification would involve some adjustments to this concept in order to accommodate the additional overburden to be generated by the open cut extension.

The modified Northern Emplacement would be designed to gently slope up from the natural ground surface on the western edge of ML 1579 to a rounded peak of 370 m AHD (Figure 4-15). From here it would gently slope down towards the east, where it would merge with the in-filled open cut and ultimately the undisturbed natural topography at around 330 to 360 m AHD near the eastern edge of ML 1579. The overall effect of this design change on the local and regional landscape is not considered to be significant, as the final slopes of the emplacement would remain the same as described in the 2005 EIS, it would still be shaped to integrate with the natural topography, and the maximum height of the emplacement would still be comparable to naturally occurring hills in the local area. From a visual amenity impact perspective, no significant impacts on privately-owned residences are predicted to occur either during operations or post-closure (Section 4.3).

The 2005 EIS described the Southern Emplacement as effectively replacing a portion of an existing hill removed through mining activities, albeit the new hill would be about 500 m further to the south. The modified Southern Emplacement would not significantly alter this final landform concept other than the new hill would be an additional 100 to 300 m south. The other key characteristics of the final landform design would remain unchanged (i.e. it would still have approximately the same overall shape, the final slopes would be 10^{o} or shallower, the maximum height of the emplacement would be 340 m AHD, and the landform would be integrated with the natural topography).

Final Open Cut Void

The 2005 EIS described the final landform concept for the open cut void as involving pushing back the residual slopes to a grade of approximately 10^{o} through a combination of highwall blasting, dozer pushing and backfilling. The base of the final void would be up to 50 m below the rim of the final void (approximately 265 m AHD) and would be located in the south-east corner of the open cut area. As described in Section 4.9.3, the groundwater assessment conducted for the 2005 EIS predicted that a small, shallow, mildly brackish water body (i.e. approximately 5 m deep) would establish within the final void at approximately 270 m AHD approximately 25 years after mine closure.

The modified open cut would be in-filled and re-shaped in a manner such that the final void would remain in the same location described in the 2005 EIS. It would also have a similar catchment area and depth (i.e. base of approximately 265 m AHD). As a result, the predictions for a shallow lake to form in the void some 25 years after closure remain unchanged. Figures 4-14 and 4-15 show the final landform and offset concepts from the 2005 EIS and the modified Tarrawonga Coal Mine respectively.

Notwithstanding the above, and as described in Section 4.9.3, it should be noted that TCPL is considering the feasibility of further expanding the mine to the east of ML 1597. Subject to TCPL deciding to proceed with this further expansion (and it obtaining the necessary operating approvals), the mine closure concepts for the site would require a more substantial review and revision which would be conducted as part of the environmental impact assessment and approvals process.

5.3 DECOMMISSIONING ACTIVITIES

All infrastructure and facilities would be decommissioned and removed from the site following the cessation of mining, unless otherwise agreed with the regulatory authorities. A summary description of the main items to be decommissioned is provided below.

Coal Crushing and Load-out Facility and ROM Pad

The coal crushing and load-out facility would be dismantled and removed following the cessation of mining. Any residual coal on the ROM Pad would be removed to the CHPP or buried within the open-cut infill area. The site would then be re-profiled to integrate with the southern batter of the Northern Emplacement and adjoining natural topography. The area would then be contour ripped, topsoiled and revegetated.

Administration, Infrastructure and Workshop Areas

Buildings, equipment and service infrastructure within the administration, infrastructure and workshop areas would be dismantled and removed. The footprint areas would then be tested for land contamination in accordance with the applicable statutory requirements. Smaller areas of contaminated soil would be treated on-site by contour ripping, spreading and allowed to naturally remediate. Larger areas of contaminated soils would be removed for proper disposal in accordance with the requirements of the relevant regulatory authority. All disturbance areas would then be contour ripped, topsoiled and revegetated.

Access Roads and Tracks

The majority of internal access roads and tracks on ML 1579 would be ripped and revegetated if they are not required for monitoring and maintenance purposes following the cessation of mining activities. TCPL (as the landowner of "Thuin") currently intends to retain the main internal access road within ML 1579 following the completion of mining activities. However, should a decision be made for it to be rehabilitated in part or full, the following activities would be undertaken:

- the road would be closed and a lockable gate installed to prevent access from Goonbri Road;
- the bitumen seal would be ripped and disposed of in the open cut in-fill area;
- compacted sub-base and base-coarse material would be ripped or excavated and disposed of in the open-cut infill area; and
- topsoil would be spread and seeded with pasture species or native tree and shrub species, depending on the land use designated for that section of the road.

The private sections of the coal haulage route between ML 1579 and the CHPP that traverse the "Tarrawonga", "Kyalla", "Bungalow" and "Whitehaven" properties would be retained as access roads between those properties and the public road network.

Water Management Infrastructure

Some of the water storage dams may be retained for future use, subject to consultation with the relevant stakeholders and approval by the regulatory authorities. Sediment dams would remain pending long-term acceptable water quality and may be kept as stock watering points if suitable.

5.4 FINAL LAND USE

The 2005 EIS described the proposed final land use for the site as being a combination of:

- mine landforms and disturbance areas rehabilitated to native vegetation and fauna habitat;
- mine landforms and disturbance areas rehabilitated to enable the re-introduction of cropping and/or cattle grazing;
- an open cut final void waterbody;
- undisturbed areas within ML 1579 that would be fenced to allow the natural re-generation of native vegetation; and
- undisturbed areas within ML 1579 that would continue to be used for cropping and/or cattle grazing.

The proposed land uses for ML 1579 described above would remain unchanged, with the exception of the 61 ha of rehabilitated mine landforms that was proposed to be returned to agricultural land. The proposed area of rehabilitated agricultural land described in the 2005 EIS was situated in a re-contoured shallow valley in the western portion of the in-filled open cut (Figure 4-14). It was proposed in order to counter the loss (through development of the mine) of an area of land with class 3 land capability and land suitability.

TCPL is proposing to change the final land use of this area to native vegetation and fauna habitat for the reasons listed below:

- The proposed modification to the design of the Northern Emplacement and in-filled open cut would mean that the area in question would no longer be a shallow valley, and would instead be a rounded east-west trending hill (Section 5.2). As a result, it is unlikely to be feasible to return the land to class 3 land capability and land suitability.
- The originally proposed area to be returned to agricultural land was to be surrounded by native vegetation and fauna habitat areas on all sides. This would make it difficult to access the area for agricultural activities (i.e. stock and cropping equipment would have to be moved through several hundred metres of the adjoining native vegetation and fauna habitat areas).
- Rehabilitation of this area to native vegetation and fauna habitat would allow better integration with the native vegetation in the Leard State Forest to the north of ML 1579.

5.5 GENERAL REHABILITATION PROCEDURES

Rehabilitation activities at the Tarrawonga Coal Mine would aim to minimise potential environmental impacts and would be conducted using the general procedures summarised below. Rehabilitation would be undertaken during daylight hours where practicable, and watering of roads would be undertaken where required.

5.5.1 Vegetation Clearing

Progressive clearance of vegetation would be undertaken ahead of the advancing mining operation. A vegetation clearance protocol has been developed to minimise the impact of vegetation clearance on flora and fauna for the existing Tarrawonga Coal Mine and is documented in the FFMP.

The FFMP describes the measures to be used to salvage and re-use cleared vegetation, including, the collection and propagation of native seed, incorporation of groundcover into topsoil when it is stripped, use of clearing debris on the rehabilitated landform and salvage of hollow tree trunks and branches.

5.5.2 Soil Management

Soil stripping would be undertaken progressively and stockpiling procedures would aim to minimise degradation prior to it being used for progressive rehabilitation. The soil resource management strategies used at the Tarrawonga Coal Mine are described in Section 4.2.3.

5.5.3 Overburden Placement and Shaping

Overburden would be placed and re-shaped as necessary to create slopes generally 10^{o} or shallower (none would exceed 18°). Wherever practicable, TCPL would design the waste emplacements and conduct the re-shaping so that large rocks or dispersive materials were not placed on the surface of the final landforms. Coarse rejects from the CHPP would be covered with at least 2 m of overburden.

5.5.4 Drainage Installation

Contour banks would be progressively installed on rehabilitated mine landforms. As described in the 2005 EIS, the heights and cross-sectional areas of the individual banks would be determined on the basis of individual sub-catchment areas, but would typically be less than 0.7 m and 3 m^2, respectively.

Flumes would be constructed on the slopes of the final landforms as necessary to assist in controlling the flow of water off the slopes.

5.5.5 Revegetation

Areas to be revegetated with native vegetation and fauna habitat would initially be stabilized with a non-persistent cover crop. Suitable native plant species for revegetation of mine landforms and disturbance areas would be determined in consultation with the regulatory authorities and landholders.

Species would be selected on a site by site basis depending on nearby remnant vegetation associations, soil types, aspect and site conditions. Drought tolerance would also be a consideration in species selection.

Species selection for revegetation would also be based on re-vegetation lists in the 2005 EIS, FFMP, species recorded within the ML 1579 and surrounds (Appendix F) and results from the rehabilitation monitoring.

In consultation with regulatory authorities and landholders, additional species may be included over time as rehabilitation progresses and the results of ongoing rehabilitation trials become available.

5.6 REHABILITATION MONITORING

Monitoring of rehabilitation activities at the Tarrawonga Coal Mine is currently undertaken through the implementation of monitoring programmes outlined in the MOP and AEMR.

The parameters to be monitored during rehabilitation would be determined in consultation with DII-MR and documented in the MOP. Ongoing monitoring and maintenance of rehabilitation would be conducted to assess:

- progression of rehabilitated land ; and
- effectiveness of rehabilitation techniques used (i.e. evidence of erosion/sedimentation, success of initial grass cover establishment, success of tree and shrub plantings, adequacy of drainage controls, general stability of the rehabilitation site).

The meteorological station would be maintained to provide data on climatic conditions such as temperature and rainfall.

The results and performance of rehabilitation would be reported in the AEMR.

6 CONCLUSION

The modified Tarrawonga Coal Mine would involve the following changes to the approved operation:

- extension of the open cut boundary to the east by up to approximately 600 m, involving additional disturbance to an area of approximately 38 ha within ML 1579;
- increase in the total coal production from approximately 12.4 to 16.4 Mt;
- increase in the total waste rock production from approximately 88.5 to 123.3 Mbcm;
- increase in the height of the Northern Emplacement from approximately 330 to 370 m AHD;
- extension of the Southern Emplacement by approximately 100 to 300 m to the south, into areas previously approved for topsoil stockpiles;
- construction and use of a new soil stockpile area, involving additional disturbance to an area of approximately 21.2 ha;
- construction and use of two small hardstand/infrastructure areas (i.e. 1.3 ha in total);
- adjustments to the site water management structures and water storages;
- adjustments to the hours of operation so that coal processing hours are the same as the approved open cut mining hours;
- approval to divert some trucks from the coal haulage route into a domestic coal 'Hub' at the Canyon Coal Mine (approval pending) where up to 450,000 t of Tarrawonga coal would be crushed and screened per annum to domestic customer specifications; and
- approval to install and use a use a mobile crusher at the Tarrawonga Coal Mine to enable coal crushing and screening of the 450,000 t of domestic specification coal per annum to occur at the mine site until such time as the proposed 'Hub' is approved.

The proposal would not involve any changes to the mining method, maximum production rate (up to 2 Mtpa), mine workforce, or the life of the mine (i.e. 8 to 10 years).

This EA has been prepared to accompany an application to modify the existing Development Consent under Section 75W of the EP&A Act. This EA describes and assesses the potential environmental impacts that could result from the modified Tarrawonga Coal Mine. It also describes the management measures and monitoring programmes that would be adopted during the mine life to avoid or minimise these impacts. Project design, planning and assessment have been carried out applying the principles of ESD, through:

- incorporation of environmental considerations and the results of the impact assessments in decision-making processes;
- adoption of high standards for environmental and occupational health and safety performance;
- assessment of potential greenhouse gas emissions associated with the modified Tarrawonga Coal Mine; and
- optimisation of the economic benefits to the community arising from the modified Tarrawonga Coal Mine.

Assessment of potential long-term impacts of the modified Tarrawonga Coal Mine was carried out during the preparation of this EA on visual aspects, surface water, biodiversity, air quality (including greenhouse gas emissions), noise, geochemistry and Aboriginal heritage. The proposed Modification is considered to be generally consistent with the objects of the EP&A Act, because it:

- incorporates measures for the management and conservation of natural resources including water and natural areas, development of the State's coal resources, and control measures to minimise potential amenity impacts associated with surface activities in the vicinity of ML 1579;
- includes the economic use and development of land, while maintaining key existing land uses including agricultural uses on surrounding Whitehaven and privately-owned land;
- would support the ongoing provision of community services and facilities through royalties, tax revenue and contributions;
- incorporates a range of measures for the protection of the environment, including the protection of biodiversity values;
- incorporates relevant ESD considerations; and
- involves public consultation though the EA consultation programme, which would be ongoing following the public exhibition of the EA document and DoP assessment of the proposed Modification in accordance with the requirements of the EP&A Act.

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