

**MANDALONG MINE
MODIFICATION TO DEVELOPMENT CONSENT**

ENVIRONMENTAL ASSESSMENT

Prepared by:

HANSEN BAILEY
6 / 127-129 John Street
SINGLETON NSW 2330

September 2008

for:

CENTENNIAL MANDALONG PTY LTD
PO BOX 1000
TORONTO NSW 2283

ENVIRONMENTAL ASSESSMENT STATEMENT

Submission of Environmental Assessment

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

Environmental Assessment

Prepared by

Name:

James Bailey

Qualifications:

B. Natural Resources, MBA

Address:

Hansen Bailey
PO Box 473
SINGLETON NSW 2330

In Respect Of:

Mandalong Mine Modification to Development Consent

Applicant Name:

Centennial Mandalong Pty Ltd

Applicant Address:

PO Box 1000
TORONTO NSW 2283

Land to be Developed:

Refer **Appendix 4** of DA 97/800.

Proposed Development:

Modification to Development Consent 97/800 as described in
Section 3.0 of the Environmental Assessment.

Environmental Assessment:

An Environmental Assessment for the Modification is attached.

Certification:

I certify that I have prepared the contents of this Environmental Assessment and to the best of my knowledge:

- It is in accordance with Sections 75E and 75F of the *Environmental Planning and Assessment Act 1979*;
- It contains all available information that is relevant to the environmental assessment of the activity to which the statement relates; and
- The information contained in the statement is neither false nor misleading.

Signature:



Name:

James Bailey - Director

Date:

September 2008

EXECUTIVE SUMMARY

INTRODUCTION

This Environmental Assessment supports an Application for modification to Mandalong Mine's development consent under Section 75W of the *Environmental Planning and Assessment Act 1979* to be lodged with Department of Planning for determination by the Minister for Planning.

BACKGROUND

Mandalong Mine is an underground coal mine located to the west of the township of Morisset in the Lake Macquarie area and generally consists of the Mandalong Mine Access Site, the Mandalong Mine Services Site (formerly Cooranbong Colliery) and the Delta Entry Site. Centennial Mandalong Pty Ltd, a fully owned subsidiary of Centennial Coal Company Ltd has owned and operated Mandalong Mine since 2002.

Mandalong Mine was granted development consent DA 97/800 in 1998 for the extension to underground mining activities at the existing Cooranbong Colliery and development of the Mandalong Mine Access Site and facilities.

Development Consent 97/800 is supported by the Cooranbong Colliery Environmental Impact Statement (Umwelt, 1997). The Minister for Planning has granted three modifications to DA 97/800 since 1998.

Since 2005, Centennial Mandalong has extracted coal from the West Wallarah Seam at up to 4 million tonnes per annum utilising the longwall mining method.

Approvals are held to process and transport up to 8 million tonnes per annum of run of mine coal, up to 4 million tonnes per annum via each of the Mandalong Mine Services Site and Delta Entry Site. Mandalong Mine operates up to 24 hours per day, 7 days per week with up to 220 direct workers employed at the Mandalong Mine Access Site, and approximately 10 additional employees at the Mandalong Services Site.

Mandalong Mine operates an Environmental Management System, which includes various management plans, programs, work procedures and a monitoring program to manage and mitigate its environmental and community impacts.

THE MODIFICATION

Table 1 provides a summary of the Modification as sought.

Table 1
The Modification Summary

Key Feature	Description
Modification Name	Mandalong Mine Modification to Development Consent DA 97/800 (MOD4)
Proponent	Centennial Mandalong Pty Ltd
Local Government Area	Lake Macquarie City Council
Application Area	The existing Mandalong Mine DA Boundary as shown in Figure 1 .
Modification Components	• The construction and operation of gas engines generating 12 megawatts of electricity fuelled by waste coal methane gas extracted from the existing methane drainage plant; • An increase in the rate of run of mine coal extraction from the currently approved 4 million tonnes per annum to 6 million tonnes per annum and an associated increase from the direct approved 230 to approximately 305 full time equivalent employees; • The relocation of an approved, but not yet constructed ballast borehole; and • Updating subsidence conditions to ensure consistency with the Department of Primary Industries (Mineral Resources) Subsidence Management Plan process.

The Department of Planning initially issued Director-General's Environmental Assessment Requirements for a modification to DA 97/800 on 4 July 2007. Department of Planning re-issued the Director-General's Environmental Assessment Requirements for this Modification on 14 April 2008. This Environmental Assessment has been prepared to ensure that this Modification is consistent with the objectives as specified in Section 5 of the *Environmental Planning & Assessment Act 1979* in relation to the principles of ecologically sustainable development.

This Environmental Assessment supports the application for modification and fulfils the requirements of the revised Environmental Assessment Requirements, assessing environmental and social impacts and economic and social benefits. This Environmental Assessment enables the Minister for Planning to determine this Modification to development consent as sought.

STAKEHOLDER CONSULTATION

Centennial Mandalong developed and undertook a stakeholder consultation program for this Modification which identified 184 stakeholders, including 150 near neighbours. Meetings were held with the Department of Planning and letters were sent to regulators describing methodologies of relevant studies and requesting further feedback consistent with the Environmental Assessment Requirements. Three presentations were made during the preparation of the Environmental Assessment to the Mandalong Mine Community Consultative Committee.

Key identified issues of concern, which have been assessed in this Environmental Assessment include: revised timing of subsidence impacts on sensitive surface features, noise and air quality impacts from the gas engines, and hazard potential from the operation of the gas engines.

IMPACTS, MANAGEMENT & MITIGATION

Introduction

A risk assessment was undertaken to identify environmental and social issues in relation to the four components of this Modification. The higher risk issues identified (in the absence of any control measures) included: air quality, greenhouse and hazard potential at the gas engines and ballast borehole; and air quality and greenhouse in relation to the increased rate of production and stakeholder consultation. Several medium and low risk issues were identified.

The level of assessment undertaken for each issue reflected this assessment of risk, in consideration of the Environmental Assessment Requirements and the issues raised during the stakeholder consultation process.

A summary of the findings of the key environmental assessments is provided below.

Noise

The noise assessment examined the existing and approved Mandalong Mine in conjunction with this Modification in accordance with the Department of Environment & Climate Change's *Industrial Noise Policy*. This assessment has developed updated noise criteria and involved the reassessment of existing noise levels.

Background noise monitoring was undertaken at four representative locations surrounding the Access Site, Mandalong Services Site and the proposed ballast borehole location with adopted background noise levels determined in consideration of the contribution of insects and the F3 freeway which is the dominant noise source at all locations. Sound power levels of existing equipment were confirmed via monitoring. Predicted noise levels from mining operations were determined for private residences surrounding the Mandalong Mine.

The noise levels from Mandalong Mine's operations at private receivers under prevailing weather conditions (i.e. worst-case) were predicted to remain within adopted noise criteria at all residences.

Sleep disturbance criteria were established with the assessment concluding that the expected noise impacts are well within the normal range of noise levels that occur at each residence and are unlikely to disturb a resident's sleep.

Traffic noise from trucks accessing the ballast borehole site are also predicted to remain within the relevant criteria. Traffic noise from employee movements were assessed in the *Cooranbong Colliery Life Extension Environmental Impact Statement* with traffic movements generated from this Modification predicted to remain within currently adopted noise criteria levels at all residences. Additionally, no increase in ground vibration levels above present levels has been predicted.

Noise control measures will be implemented to enclose the gas engines within a suitably designed acoustic attenuation structure to provide the necessary level of noise control. Regular noise monitoring will continue to be undertaken in accordance with a revised Noise Management Plan to incorporate relevant components of this Modification.

Subsidence

Longwall panel mining has been conducted at Mandalong Mine since 2005 with five panels extracted to date. The design of longwall panels and subsidence impacts have remained within predictions in the *Cooranbong Colliery Life Extension Environmental Impact Statement* and the approved Subsidence Management Plans. Coal extraction at Mandalong Mine commenced in accordance with the *Cooranbong Colliery Life Extension Environmental Impact Statement*. In accordance with the Environmental Assessment Requirements, a revised mine plan, including predicted subsidence, has been presented in this Environmental Assessment.

Results of monitoring to date have indicated that subsidence impacts are predicted to remain within levels in the *Cooranbong Colliery Life Extension Environmental Impact Statement* with no private structures predicted to exceed the criteria of 'safe, serviceable and repairable'.

Centennial Mandalong also seeks a modification to the existing development consent to update selected conditions relating to subsidence impacts, landowner notification, compensation and reporting requirements to enable consistency with the Department of Primary Industries – Mineral Resources' Subsidence Management Plan guidelines. With the adoption of Subsidence Management Plan Guidelines and meeting the conditions of mining leases, Mandalong Mine's regulatory requirements will be consistent with other underground mining operations in NSW.

Soil & Water

There is some potential for the generation of soil erosion and sedimentation during the construction of the ballast borehole and gas engines sites. The approved Erosion and Sediment Control Plan will be revised as required to ensure that issues associated with water and soils are adequately managed.

A revised water balance has been completed for the operation of Mandalong Mine for coal extraction up to 6 million tonnes per annum. The volume of water managed through the system at the Access Site and the Delta Entry Site will remain unchanged if coal production rate increases. The sources of, and demands for water managed through the Mandalong Services Site will remain substantially unchanged however the volume of water in this system will increase. Specifically, the demand for externally supplied potable water and the volume of excess underground water will increase.

The estimated total annual water surplus which will be generated at the Mandalong Services Site (including this Modification) is estimated to be 618 megalitres. This corresponds to an average daily discharge volume of 1.7 megalitres per day, which is less than Mandalong Mine's licensed discharge limit of 5 megalitres per day at Licensed Discharge Point 001 under its Environment Protection Licence 365.

The existing site water management system will continue to be implemented in accordance with the approved Water Management Plan.

Aboriginal Heritage

A desktop study, field survey and review of existing literature was undertaken to determine the presence of any known Aboriginal cultural heritage in the vicinity of the gas engines and ballast borehole sites. Eight recorded sites were identified within 10 km of Mandalong Mine.

The Aboriginal Community was consulted in accordance with the *Department of Environment and Climate Change Interim Community Consultation Requirements for Applicants* (DEC, 2004). A field survey of the gas engines and ballast borehole area was undertaken over two days with members from two local Aboriginal community groups in attendance.

The Aboriginal archaeology and cultural heritage assessment did not locate any artefacts of Aboriginal origin or identify areas as potential archaeological deposits within the ballast borehole or gas engines survey areas and it is highly unlikely that this Modification will impact upon any undetected sites that might retain archaeological integrity. No cultural heritage significance was identified in the area.

A draft of the assessment was provided to the Darkinjung Local Aboriginal Land Council, Awabakal Descendants Traditional Owners Aboriginal Corporation and Awabakal Traditional Owners Aboriginal Corporation for review and comment. Additional comments from the Aboriginal community were incorporated into the final assessment.

Non-Aboriginal Heritage

A desktop study and review of existing literature was undertaken to determine the presence of any known Non-Aboriginal heritage in the vicinity of the gas engines and ballast borehole sites. Two sites were identified within 10 km of the proposed site. No non-Aboriginal heritage sites exist in the vicinity of the gas engines and ballast borehole sites.

Flora & Fauna

A desktop study, field survey and review of existing literature was undertaken to determine the presence of any threatened flora or fauna in the vicinity of the gas engines and ballast borehole sites.

A single species of conservation significance was recorded during field surveys, namely the Cattle Egret listed as a Migratory/Marine species under the *Environment Protection & Biodiversity Conservation Act 1999*. The Cattle Egret was found foraging near a pond within the ballast borehole survey area. The ballast borehole survey area is not predicted to remove or substantially modify the existing habitat in this area for this species and consequently, an Assessment of Significance is not required.

There is no Koala habitat present in the ballast borehole or gas engines survey areas.

This Modification will result in the clearance of approximately 5 ha of disturbed grassland (4 ha and 1 ha to be cleared for the development of the ballast borehole and gas engines survey areas, respectively). This small amount of clearing of the dominant grassland communities located within each of the survey areas is not anticipated to adversely affect any existing vegetation communities as they are already highly disturbed and dominated by exotic grasses and weed species.

While these grassland communities may still be used as foraging areas for generalist species, the continuous grazing by cattle, combined with the relatively low species diversity present suggests that the areas surveyed do not provide optimal roosting and foraging habitat for the majority of the threatened species that have the potential to occur in the region.

Therefore, this Modification will not result in significant impacts on any listed species or communities and as such, an Assessment of Significance under the *Environment Protection & Biodiversity Conservation Act 1999* and *Threatened Species Conservation Act 1995* is not warranted.

The existing approved Flora & Fauna Management Plan will be revised as necessary to incorporate relevant aspects of this Modification including further weed control and the protection of the small pond adjacent the ballast borehole site.

Air Quality

An assessment of air quality impacts was undertaken to determine emissions from the operation of the gas engines, greenhouse gas impacts in relation to the gas engines and the increase in coal extraction and dust impacts from the construction of the other minor components of this Modification.

A worst-case scenario of six units with a 2 megawatt capacity each has been modelled for the gas engines, however any configuration generating 12 megawatts of power (including a staged construction) is anticipated to generate fewer emissions than modelled in this Environmental Assessment.

Modelling results show that all private receivers in the vicinity of the gas engines are predicted to experience contaminant concentrations below the relevant assessment criteria. The assessment predicted that the gas engines would make a very small contribution to total nitrogen dioxide emissions in the regional air shed and similarly, would have very little effect on ozone formation in the area.

The gas engine exhaust stacks will be designed and built to at least 10 m in height to minimise any adverse air quality impacts on neighbouring landowners and ensure the necessary emission dispersion.

Some dust emissions are anticipated to occur when the ballast borehole is constructed and the site works for the gas engines are undertaken.

Both of these construction works will be of limited duration (approximately two months) and can be managed using standard dust control management techniques.

Preliminary Hazard Analysis

A preliminary hazards analysis was undertaken in accordance with the requirements of *State Environmental Planning Policy No. 33 – Hazardous and Offensive Development* for the proposed gas engines. This assessment was requested through the Environmental Assessment Requirements due to the potentially hazardous nature of the gas engines for surrounding lands and the nearby F3 Freeway.

The preliminary hazards analysis demonstrated that there are no high level risks identified for off-site impacts and therefore, the current management measures in place at Mandalong have been found to adequately protect local land users. The Modification is considered to be '*not hazardous*' and a qualitative study was deemed to be sufficient according to *Multi-Level Risk Assessment*.

A number of safeguards were identified in the assessment that shall be implemented at Mandalong in order to manage any potential for off-site impacts associated with the proposed gas engines.

Traffic & Transport

An assessment of car parking facilities and the existing Type C Intersection to the Mandalong Access Site was undertaken which confirmed that both adequate car parking and intersection capacity exists for the proposed increased employees.

Traffic movements associated with construction and operation of the ballast borehole were assessed with the current level of service on Mandalong Road determined as Level A. Traffic counts were undertaken on Mandalong Road in April 2008 to assist. Up to ten gravel deliveries per week have been assumed which have been predicted to contribute to an increase above existing traffic levels of 0.5% per day.

All design and construction works will be undertaken in accordance with the relevant engineering design standards and in consultation with Lake Macquarie City Council. A section 138 approval under the *Roads Acts 1948* will be sought.

All other traffic movements associated with this Modification will not exceed those assessed in the *Cooranbong Colliery Life Extension Environmental Impact Statement* and as such have not been further assessed in this Environmental Assessment.

Greenhouse

The greenhouse gas assessment determined additional 0.681 million tonnes carbon dioxide equivalent emissions to the atmosphere as a result of the extraction of the additional 2 million tonnes per annum of coal.

Additionally, the assessment determined that the burning of methane in the gas engines will deliver a saving in greenhouse gas emissions of up to 0.136 million tonnes of carbon dioxide equivalent compared with the current case where methane is released unburnt to the atmosphere. Total greenhouse gas emissions will not change over the life of Mandalong Mine with extraction occurring within the same defined resource and same period as that previously approved.

Economics

Economic benefits as a result of this Modification are estimated as follows:

- Additional payments of approximately \$8.3 million to full time equivalent contractors;
- Approximately \$4.3 million in Government Royalties and taxes;
- Approximately \$400,000 in contributions to the Australian Coal Association Coal 21 levy; and
- An increase in approximately \$200,000 in contributions payable to the Australian Coal Association Research Program.

Visual & Lighting

A visual and lighting assessment was undertaken in relation to residences and road users in the vicinity of the gas engines and ballast borehole sites. Some receivers along Gimberts Road to the east may have potential views towards the gas engine site.

Views from other locations surrounding this Modification (i.e. private residences to the north west or south) are unlikely to receive views towards the proposed infrastructure.

It was determined that due to the lack of vegetation surrounding the proposed ballast borehole location, some residents are likely to have views of this infrastructure.

The approved Landscaping and Revegetation Plan will be revised to incorporate the various components of this Modification to ensure that visual impacts to the neighbouring residences are appropriately managed. Additionally, residences 82 and 115 will be consulted with in regard to any visual screening required to be implemented between the ballast borehole and their property in order to reduce visual impacts on these receivers.

The materials used for the construction of the gas engines and the ballast borehole will incorporate natural tones to blend in with the surrounding environment with no reflective materials used.

Consideration of the location of neighbours with views surrounding the gas engines site and road users will be undertaken to ensure that any lighting requirements for this Modification will be directed away from these receivers to minimise any adverse effects.

CONCLUSION

A reduction in greenhouse gas emissions from Mandalong Mine of 0.136 million tonnes per annum have been predicted as a direct result of the construction and operation of the proposed 12 megawatt gas engines which will provide electricity to the NSW power grid.

This Modification represents a continuation of the intended land use utilising the existing resource, facilities and transport methods to allow Mandalong Mine to continue to meet both domestic and international energy demands.

The proposed gas engines are within the footprint of the currently approved Mandalong Mine and the ballast borehole is proposed immediately above the approved footprint of the underground workings. The increase in production as sought will be extracted from the same mining footprint and will utilise the same mining methods and equipment as currently approved.

Significant economic benefits to the Lake Macquarie area, regional economy and the state of NSW have been identified as a result of the proposed increased production workforce.

The suitability of the site for the purpose of mining, processing and transporting coal (and all associated activities) has previously been assessed and approved by regulatory authorities. This Modification as sought will allow the continuation of Mandalong Mine in its currently approved capacity, whilst allowing for improvements in efficiency and for the business to take advantage of export opportunities.

All environmental impacts have been reviewed in the Environmental Assessment on a worst-case scenario, assuming maximum extraction of 6 million tonnes per annum is achieved.

Despite the application of a stringent, contemporary environmental assessment, this Environmental Assessment has not identified any significant environmental impacts associated with this Modification. Appropriate management measures have been identified and included in the Mandalong Mine statement of commitments to ensure that the minor environmental and social impacts associated with this Modification are mitigated.

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1.0 BACKGROUND

1.1 INTRODUCTION

Mandalong underground coal mine (Mandalong Mine) is located to the west of the township of Morisset in the City of Lake Macquarie, NSW, approximately 130 km north of Sydney. Mandalong Mine consists of the following operational areas as shown on **Figure 1**:

- Mandalong Mine Access Site (Access Site): including the Mandalong Mine underground workings and associated surface infrastructure near Morisset (and the old Cooranbong workings for ventilation and access);
- Mandalong Mine Services Site (Services Site): which includes the underground workings and coal handling and surface infrastructure of the Cooranbong Entry Site (formerly Cooranbong Colliery surface facilities) near Dora Creek; and
- The Delta Entry Site: which encompasses an entry and coal delivery system at the Vales Point Rail Unloader Facility near Wyee.

Mandalong Mine was granted development consent (DA 97/800) in 1998 for the extension to underground mining activities at the existing Cooranbong Colliery, the establishment of a mine access site, the upgrade of the coal preparation and transport systems and the establishment of a rejects emplacement area. Three minor modifications have been granted by the Minister for Planning to DA 97/800 since 1998. Further detail on Mandalong Mine's approvals is provided in **Section 2.0**.

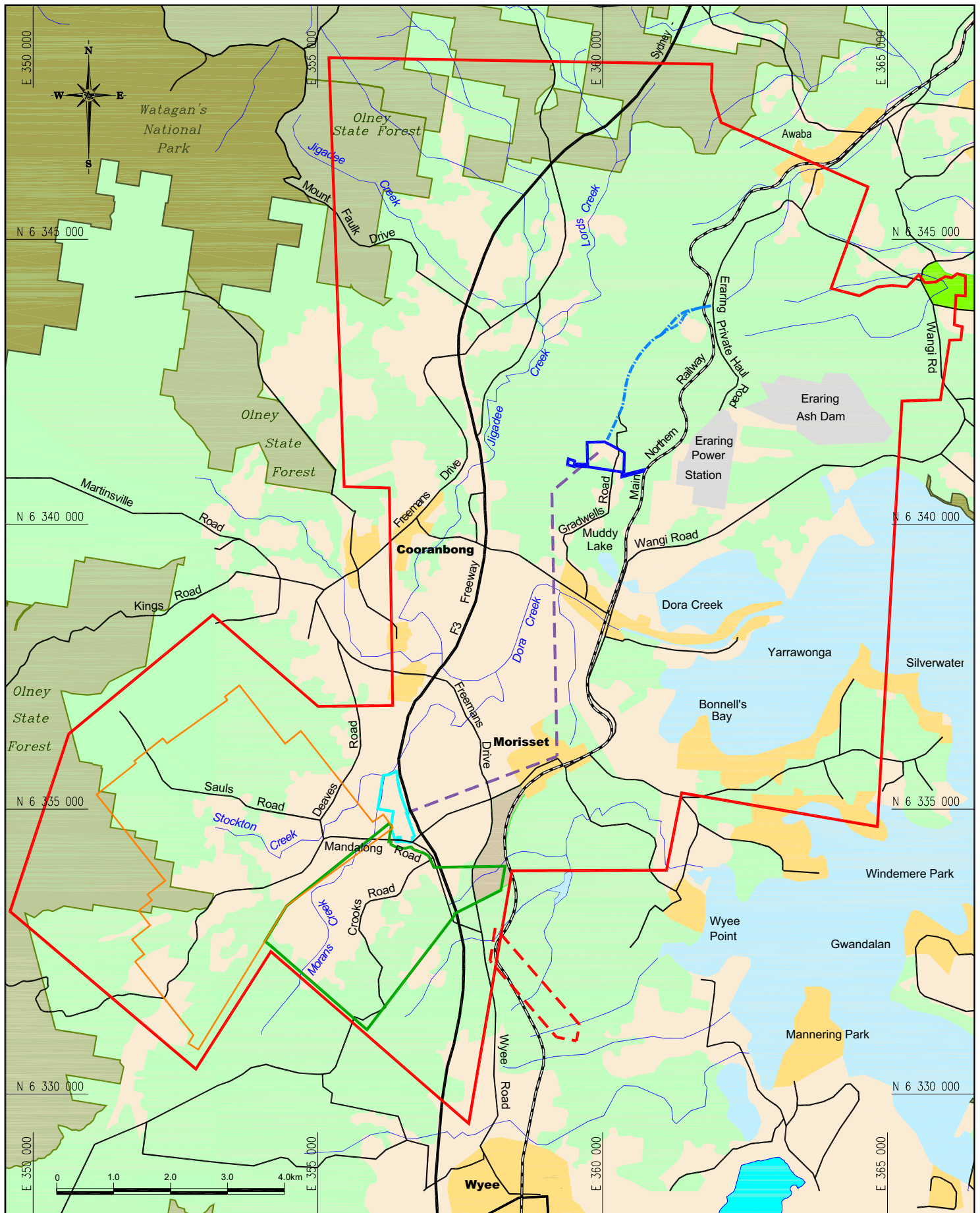
Centennial Mandalong Pty Ltd (Centennial Mandalong) is a fully owned subsidiary of Centennial Coal Company Limited (Centennial) which has owned Mandalong Mine since 2002. Longwall mining has been conducted at Mandalong Mine since 2005.

1.2 DOCUMENT PURPOSE

This Environmental Assessment supports an Application for modification to DA 97/800 under Section 75W of the *Environmental Planning and Assessment Act 1979* to be lodged with the Department of Planning for determination by the Minister for Planning to permit the following:

- Construction and operation of methane gas fired engines with a generating capacity of up to 12 Megawatts;
- Increase coal extraction to 6 Million tonnes per annum (Mtpa) Run of Mine and Full-Time Equivalent (FTE) employees to approximately 305;
- Relocation of an approved but not yet constructed ballast borehole; and
- Update Conditions of Consent to ensure consistency with the Department of Primary Industries – Mineral Resources' Subsidence Management Plan Process.

The Department of Planning issued the Director-General Environmental Assessment Requirements for this Modification on 4 July 2007. These were reissued on 14 April 2008 to incorporate a revised project description for some additional minor elements to that originally proposed. This Environmental Assessment fulfils the requirements of the revised Environmental Assessment Requirements and assesses environmental impacts and socio-economic benefits of this Modification as sought.



- DA Boundary
- Delta Entry Site DA Boundary
- Services Site
- Mandalong Private Haul Road (Not Constructed)
- Mine Access Site
- Underground Coal Conveyor
- Mining Area 1 (LW)
- Mining Area 2 (Bord and Pillar)
- Roads
- Lake
- Forest
- Park
- Forest Reserve
- National Reserve
- Residential



Centennial Coal
Mandalong

Source: EIS (1997), DA 97/800
Co-ordinate System: MGA Zone 56

MANDALONG MINE

Regional Locality

Cad File: 028230.dwg

Date: 17.06.08

Drawn: CS

Figure
1

1.3 DOCUMENT STRUCTURE

Section 2.0 provides relevant information on the environment surrounding Mandalong Mine, describes operations at the existing Mandalong Mine, and provides details on the relevant approvals and Environmental Management System utilised to manage the operation. **Section 3.0** provides a detailed description of the components of this Modification. **Section 4.0** details the regulatory framework relevant to this Modification.

Section 5.0 provides information on the stakeholder consultation process undertaken for this Modification and the issues raised during this process. Specifically, this section lists the Environmental Assessment Requirements and identifies where these issues are addressed in this Environmental Assessment.

Section 6.0 lists the environmental risk assessment undertaken to identify and prioritise the issues associated with this Modification. An assessment of relevant environmental and social issues and required management and mitigation measures for this Modification are presented in **Section 7.0**.

Section 8.0 presents the Statement of Commitments for this Modification. A detailed conclusion identifying key environmental impacts, benefits and suitability of the site in relation to this Modification is presented in **Section 9.0**.

A list of abbreviations used throughout this Environmental Assessment is presented in **Section 10.0** whilst the documents referred to in this Environmental Assessment are referenced in **Section 11.0**. This Environmental Assessment has been prepared by the environmental consultancy firm Hansen Bailey Pty Ltd (Hansen Bailey) with a full list of the Environmental Assessment study team shown in **Section 12.0**.

2.0 EXISTING ENVIRONMENT

This section of the Environmental Assessment provides a detailed description of the existing and approved operations / facilities at Mandalong Mine, including all statutory approvals that apply and a discussion of any relevant inter-relationship between other existing or approved mining operations in the region relevant to this Modification.

2.1 NATURAL ENVIRONMENT

2.1.1 Topography

Mandalong Mine is located in the Mandalong Valley, west of the township of Morisset in the City of Lake Macquarie, NSW. Diverse landforms are present within the Mining Leases held by Centennial Mandalong, including the broad, flat floodplains of the Stockton Creek and Morans Creek catchments, undulating hills and rugged ridgelines associated with the surrounding Watagan Mountain range.

The exposed sedimentary rocks of the uppermost three formations of the Narrabeen Group typify the surface geology of the Mandalong Valley. These are the Terrigal Formation, Patonga Claystone and Tuggerah Formation (Umwelt, 1997).

The land use is predominantly associated with low intensity agricultural operations on small rural and rural-residential holdings. Other land use in the region include some high intensity agricultural operations, power generation facilities, a range of small-scale industrial enterprises and the major transport corridor of the F3 Freeway.

2.1.2 Climate

The Bureau of Meteorology (BoM) monitoring station at Norah Head provides indicative climatic data (i.e. long-term data) relevant to this Modification. The implications of the climatic patterns of the region have been considered for the relevant assessments undertaken for this Modification, in conjunction with the on-site Mandalong meteorological station and data collected at Awaba, for noise and air quality assessments, respectively.

Temperature

Summer months in the region are the warmest, with February reaching an average daily high temperature of 25.8°C (see **Table 2**). July is on average, the coolest month, with a mean daily high temperature of 17.2°C. Humidity levels exhibit variability and seasonal flux throughout the year. Mean morning (9 am) humidity levels range from 64% in August and October to 78% in February. Mean afternoon (3 pm) humidity levels range from 56% in August to 72% in February. Winter months are generally drier than the rest of the year.

Table 2
Meteorological Data Summary

Month	Mean Daily Temperature (°C)		Mean Rainfall (mm)	Mean Rain days	Mean Relative Humidity (%)	
	Min	Max			9am	3pm
January	19.4	25.5	74.0	12.3	76	70
February	19.9	25.8	105.4	11.5	78	72
March	18.7	24.6	107.2	12.9	77	69
April	15.8	22.9	122.8	12.6	70	65
May	13.2	20.1	163.5	14.5	72	64
June	10.8	18.0	130.8	12.8	71	62

Month	Mean Daily Temperature (°C)		Mean Rainfall (mm)	Mean Rain days	Mean Relative Humidity (%)	
	Min	Max			9am	3pm
July	9.7	17.2	94.6	10.4	69	58
August	10.7	18.9	79.2	9.2	64	56
September	12.8	20.8	68.0	12.5	65	60
October	14.8	22.6	53.7	10.0	64	63
November	16.5	23.3	84.9	13.0	72	67
December	18.4	24.8	64.9	10.5	72	67
Annual Mean	15.1	22.0	1149.9	142.2	71	65

Norah Head Meteorological Station 061366

Source: BoM, 2008

Rainfall

Rainfall in the region typically peaks in autumn and declines during spring. The annual average rainfall for Norah Head is 1149 mm, occurring over approximately 142 rain days per year. Mean monthly rainfall ranges from 53.7 mm per month in October to up to 163.5 mm per month during May.

Wind Speed & Direction

Representative data for wind speed and direction for Mandalong Mine was collected from the Awaba meteorological station (located approximately 6 km north of the Mine Access Site) during a monitoring period between September 2005 and September 2006 where data recovery was 100%.

This data indicates that annually, winds are predominantly from the south west, with a smaller portion of the stronger winds blowing from the south east. In summer, the winds from the south east quadrant are more predominant than in other periods of the year. During the winter months, this trend is not evident, with little to no winds blowing from the south east. Some winds blow from the north east quadrant, but the dominant wind is from the south west. The wind speeds recorded were calm (less than or equal to 0.5 m/s) for 32.3% of the time. A discussion of this monitoring program is included in **Section 7.3**.

Consideration and analysis of wind speed and direction characteristics has been included as relevant in the Noise and Air Quality Impact Assessments (see **Sections 7.2** and **Section 7.3**).

Temperature Inversions

Temperature inversions occur when relatively dense, cool air is trapped below an air mass which is warmer and lighter.

Typically, such inversions tend to occur in the cooler months, during the night and early morning periods. Under temperature inversion conditions, the diffusion of noise, gases and dust particulates is inhibited and can increase their concentrations and effects at ground level. While air temperature and wind data collected for Mandalong Mine implies that temperature inversions do not substantially occur in this area, these effects have been considered for the Air Quality and Noise Impact Assessments.

2.2 MANDALONG MINE

Mandalong Mine is operated generally in accordance with the development consent and the supporting *Cooranbong Colliery Life Extension Environmental Impact Statement* (Cooranbong EIS) (Umwelt, 1997) which provides approval for (at least) the following activities:

- Longwall and bord and pillar mining with a coal extraction rate of approximately 4 Mtpa Run of Mine coal from two mining areas within Mining Lease Application 88 (now Mining Leases 1443 and 1543);

- Development and construction of the Mine Access Site west of the Morisset interchange on the F3 Freeway. This 40 ha site consists of the underground development, a ballast borehole shaft (not constructed), an upcast shaft and surface facilities including infrastructure for administration, water treatment, a bathhouse, a compressor facility, services workshop and car parking for up to 200 vehicles;
- 24 hour per day operation, 7 days per week for up to 220 direct employees at the Access Site and 10 additional direct employees at the Services Site (formerly Cooranbong Colliery);
- Development of the infrastructure at the pre-existing Cooranbong Entry Site including two 100,000 tonne (t) coal stockpile area and for a Coal Handling and Preparation Plant to process Run of Mine coal produced at Mandalong Mine (not yet constructed);
- Transport of product coal via an overland conveyor to Eraring Power Station at a rate of 1.5 Mtpa from the Cooranbong Entry Site; and
- Construction of a sealed 3.4 km road as an extension to an existing Private Haul Road running between Newstan Colliery and Eraring Power Station (not yet constructed). This road extension shall be used to transport 1.5 – 2.0 Mtpa of product coal processed at the Mine Services Site to the existing Private Haul Road for export from the Newstan Rail Loading Facility.

An additional 4 Mtpa of Run of Mine coal may be transported via the Delta Coal Unloader to Vales Point Power Station under a separate planning approval DA 35-2-2004.

Further detail on specific operations at the Mandalong Mine is provided below.

2.2.1 Mining

Mandalong Mine is an underground operation with approval to extract up to 4 Mtpa of coal from an approximate total reserve of 65 Million tonnes (Mt) from the West Wallarah and Great Northern Coal Seams with approval to utilise both longwall and bord and pillar mining methods within the two separate mining areas (Umwelt, 1997).

Longwall mining has been undertaken at Mandalong Mine supported by main heading roadways. These operations have occurred within Area 1 (see **Figure 1**) and consist of a series of longwall blocks up to 160 m (but may be developed up to 250 m) in void width and are designed in order to limit surface subsidence impacts.

Mining height is limited to approximately 3.2 m in development roadways and in a range up to 4.8 m for longwall panels where seam thickness permits. Mining is constrained to the south by a split in the West Wallarah Seam that significantly reduces seam thickness to less than 2.0 m and to the north west by a thinning of the seam and a rapid increase in seam ash.

A methane gas drainage plant has operated at the Access Site since October 2005 as a component of the ventilation system for the underground operations.

The methane gas drainage plant is located adjacent the mine fan and operates continuously, draining methane from the underground workings. The gas **drainage** is drilled into the longwall panel in advance of the operation (Centennial Mandalong, 2004).

A ballast borehole is described at a designated location in the Cooranbong EIS but has not yet been constructed. Ballast is required to be delivered to the underground for roadways and is currently transported via an Eimco which delivers a bucket load at a time via the main drift.

2.2.2 Coal Handling & Preparation

The handling and preparation of Run of Mine coal is undertaken at one of two locations, either at the Services Site Coal Handling Plant or the Delta Entry Site (illustrated in **Figure 2**) and described briefly below.

Mandalong Services Site Coal Handling Plant

Coal processed at the Coal Handling Plant is conveyed underground by 1,200 mm conveyor belts to a 2,000 tonne capacity Run of Mine bin or is stockpiled at either one of three Run of Mine stockpiles.

The Coal Handling Plant processes up to 700 t of coal per hour and coal is stockpiled and back fed via front end loader into the reclaim hopper as needed.

Coal from the Run of Mine Bin or reclaim hopper is discharged via a feeder onto a conveyor belt where a magnet removes any iron prior to the coal being discharged into a rotary breaker. This breaker processes coal down to a size of less than 200 mm in diameter. Large fragments of stone are separated in the breaker module before being discharged into a separate 50 t stone bin. From the breaker, coal is conveyed into a 400 tonne capacity storage bin where it is then fed via feeders through a crushing and screening plant. The crushing process reduces the size of the coal to less than 31 mm and once this has occurred, the product is then conveyed to a 2000 t product bin that Eraring Power Station may draw from as required (Centennial Mandalong, 2007b).

Further to this, the Cooranbong EIS describes upgrades to the existing Coal Handling Plant to incorporate additional washing and processing of coal. Specifically, the Coal Handling Plant may be upgraded to a Coal Handling and Preparation Plant to size Run of Mine coal to less than 32 mm in diameter in a two-stage sizing process, with washing of Run of Mine coal undertaken in a modular coal wash plant.

Two coal processing modules, with a combined capacity of 600 tonnes per hour, may be installed for the Coal Handling and Preparation Plant.

Indicatively, each of these modules will consist of:

- Dense Medium Cyclones (DMC) and associated screens;
- Spirals and dewatering screens;
- De-sliming screens and cyclones;
- DMC floats and spirals product dewatering centrifuge;
- DMC sinks and spirals rejects dewatering centrifuge; and
- Tailings thickener.

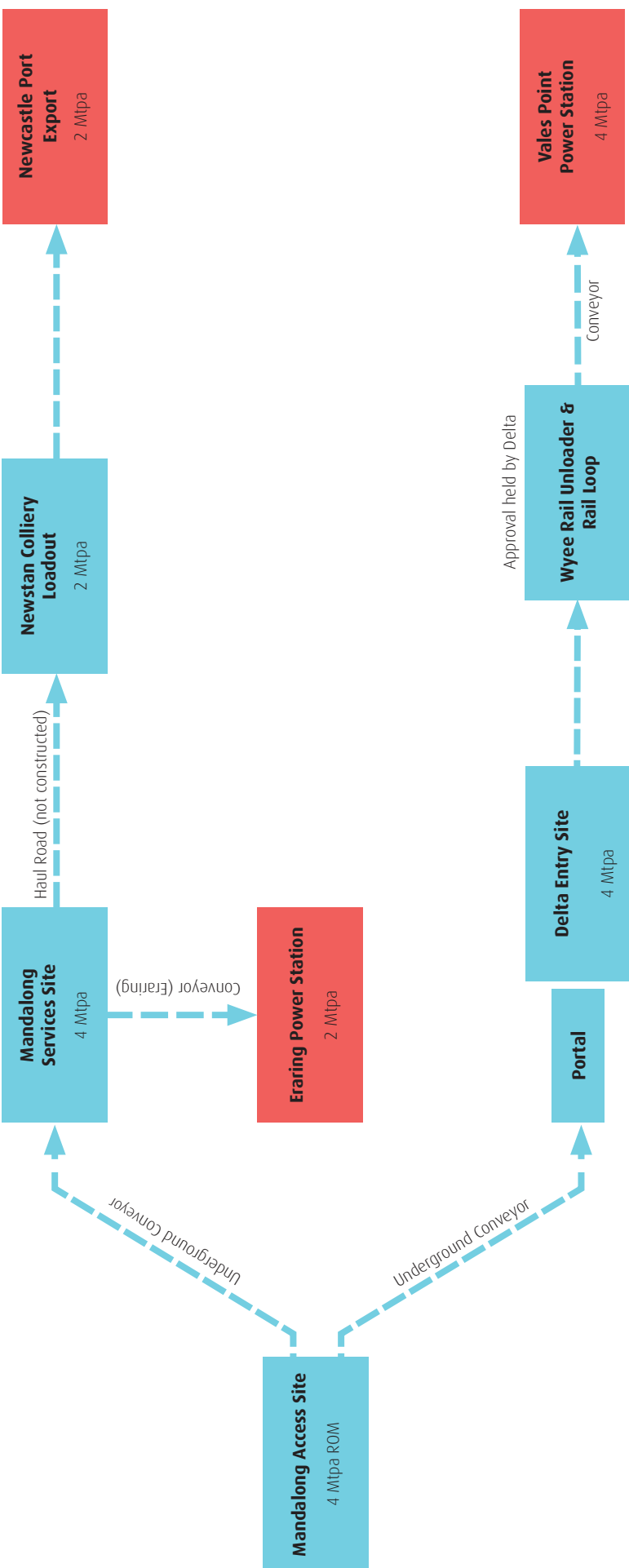
Two stockpiles with an approximate total capacity of 100,000 t are also included in the Cooranbong EIS to store the product coal processed by the Coal Handling and Preparation Plant.

Delta Entry Site

The Mandalong Coal Delivery System has the capacity to deliver 1,600 t per hour (tph) of coal by underground conveyor from Mandalong Mine to the Delta Entry Site where it reaches the surface through the decline tunnel at the Wyee Rail Unloader site. This facility is approved to deliver up to 4 Mtpa of coal, although due to contractual constraints, Centennial Mandalong provides less than 2 Mtpa of coal to the Vales Point Power Station.

Coal from the underground conveyor is fed via the surface portal to the Wyee Coal Handling Plant where coal is directed to the two secondary coal sizing units that crush coal to less than 50 mm diameter.

Additionally, the Delta Link Project Statement of Environmental Effects describes the construction and operation of a 5,000 t run of mine coal stockpile, with a bulldozer or front end loader used for coal reclamation (Umwelt, 2004). A conveyor constructed from the sizing units then moves the processed coal to the bin at Wyee Coal Unloader.



2.2.3 Coal Transport

Current approvals permit coal that is extracted from the underground workings of Mandalong Mine to be distributed to either the Services Site Coal Handling and Preparation Plant or the Delta Entry Site for use at the Eraring and Vales Point Power Stations, respectively. A schematic outlining the transportation of coal to these facilities is provided in **Figure 2**.

Following processing at the Coal Handling Plant, coal is transported to Eraring Power Station via an overland conveyor with a maximum capacity of 800 tonnes per hour (tph).

Transport to Vales Point Power Station occurs via the Mandalong Coal Delivery System, a clearance system which carries coal from the workings of Mandalong Mine to the Delta Entry Site along a 4.5 km underground conveyor located within the Wallarah Coal Seam. Coal is conveyed to the Delta Entry site through the Delta decline tunnel and upon reaching the surface, feeds into crushing units to be sized. Once processed, coal is fed onto the Wyee overland conveyor and transported to the Vales Point Power Station (Centennial Mandalong, 2007b).

Additionally, upon the construction of the approved Mandalong internal private haul road (as shown on **Figure 1**) up to 2 Mtpa of coal from Mandalong Mine may be delivered to the Newstan Loadout facility for transport via rail to the Port of Newcastle for export.

2.2.4 Equipment & Manning

Operations are approved to be conducted up to 24 hours per day, 7 days per week with a maximum of 220 direct employees at the Access Site, with the Cooranbong EIS assessing the impact of up to 140 direct employees on site at any one time.

Additional contractors work at the Services Site with FTE employees on a three-shift system per day currently utilised. Additional employees operate the Services Site.

Mining is currently conducted with an indicative fleet of four continuous miners, one Joy longwall miner, several shuttle cars, auxiliary fans and a Joy Shearer, conveyors, diesel man transporters, load haul dump machines and crushers. Other support activities are undertaken using hired machinery or with the use of specialised contractors supplying their own equipment relevant to an underground coal mining operation (Centennial Mandalong, 2004).

2.3 LAND OWNERSHIP

Table 3 lists property ownership adjacent to the Environmental Assessment Boundary of Mandalong Mine. **Table 3** should be read in conjunction with **Figure 3** and **Figure 4** which illustrate land ownership, indicating if a receiver (residence) is located on the property.

The land surrounding the Services Site is predominantly owned by the Crown to the north and the Eraring Power Station to the east. Some private residences are located to the south of the Services Site on small rural holdings.

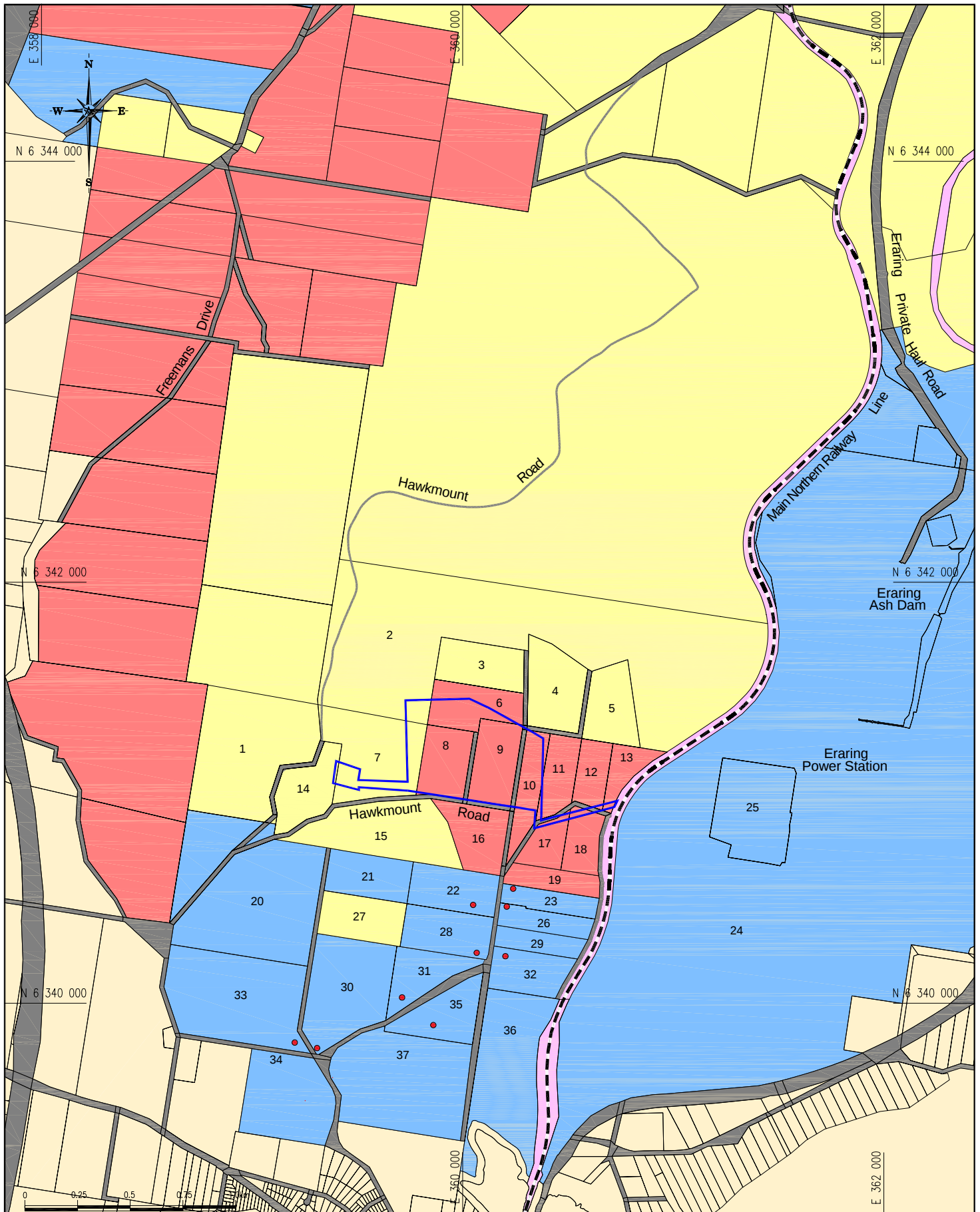
The majority of land near the Access Site is held by Centennial Coal or in private freehold. The land to the east of the Access Site across the F3 Freeway is held by a range of small industrial enterprises.

Table 3
Land Ownership

ID	Landholder	ID	Landholder	ID	Landholder
1	Crown Land	46	GM & SF Stoddart	92	Centennial Coal
2	Crown Land	47	MH Griffin & SJ Ball	93	Centennial Coal
3	Crown Land	48	C Deaves	94	Centennial Coal
4	Crown Land	49	Dawson	95	Centennial Coal

ID	Landholder	ID	Landholder	ID	Landholder
5	Crown Land	50	Deaves	96	Centennial Coal
6	Crown Land	51	CT & RJ Piper, B Johnson	97	Kildey
7	Crown Land	52	Roads & Traffic Authority	98	Centennial Mandalong
8	Centennial Coal	53	Martin	99	LJ Lee, AL Ferris & MG Kildey
8	Centennial Coal	54	C Deaves	100	LJ Lee, AL Ferris & MG Kildey
9	Centennial Coal	55	JYJ Pty Ltd (C Deaves)	101	Gomfertz & Balfour-Paul
10	Centennial Coal	56	Centennial Coal	102	Centennial Coal
11	Centennial Coal	57	Smith	103	Birt
12	Centennial Coal	58	Martin	104	Centennial Coal
13	Centennial Coal	59	Arthur	105	Centennial Coal
14	Centennial Coal	60	C Deaves	106	Centennial Coal
15	Crown Land	61	C Deaves	107	Barker
16	Centennial Coal	62	Patience	108	Attard
17	Centennial Coal	63	Red Lea Chickens Holdings	109	Menzies
18	Centennial Coal	64	Andrews & Boyton	110	Maxwell
19	Centennial Coal	65	Centennial Coal	111	Hartley & Wandel
20	Moncrieff Properties Pty Ltd	66	Case	112	Hughan
21	Wynmox Pty Limited	67	Palmer	113	Ednie
22	Wynmox Pty Limited	68	Red Lea Chickens Holdings	114	Wheeler
23	RP Vanderblom & JE Russell	69	Centennial Coal	115	Sommers & Vinski
24	Transgrid	70	Magill	116	Attard
25	Eraring Energy	71	Centennial Coal	117	Alexander
26	KM & ML Dennis	72	Mullard	118	Denmark
27	Crown Land	73	Magill	119	Aurtherson
28	HC Zaska	74	Jones	120	Lake Macquarie City Council
29	NL & GL Atkins	75	Munro	121	Lake Macquarie City Council
30	Moncrieff Properties	76	Waldon	122	Centennial Coal
31	A & M Hendrickx	77	KYH & ESY Young	123	Hall
32	SM & RR Fuller	78	Centennial Coal	124	Sutherland
33	The House of Slate & Stone	79	Centennial Coal	125	Crook
34	Moncrieff Enterprises	80	Centennial Coal	126	Crook
35	RJ Clout	81	Centennial Coal	127	Lake Macquarie City Council
36	JP Quinn	82	Ferris	128	Taylor
37	AB & PJ Bennett	83	Centennial Coal	129	Computer Source Australia
38	U Diccio	84	Centennial Coal	130	Lain & King
39	The State of NSW	85	Mclean	131	Thomas
40	Buchanan	86	Enright	132	Schmidt
41	Australian Conference Association	87	Jones	133	Bukowski
42	DF King	88	Stoddart	134	Hendry & Evers
43	JA Fenech	89	Mclean	135	Harland
44	PJ & AJ Howard, SG Pendergast, MW Bennett	90	Centennial Coal	136	Moore
45	Gibson	91	Pitt	137	Jupp & Cash

Source: Centennial Mandalong (2008)



- Mandalong Services Site
- Residences
- Centennial Coal
- Crown Land
- Freehold Land
- Unknown
- NSW State Railway
- Roads



Co-ordinate System MGA Zone 56

MANDALONG MINE

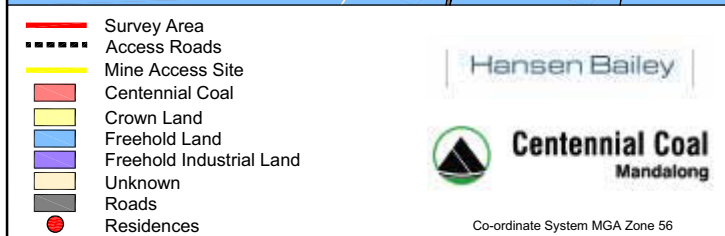
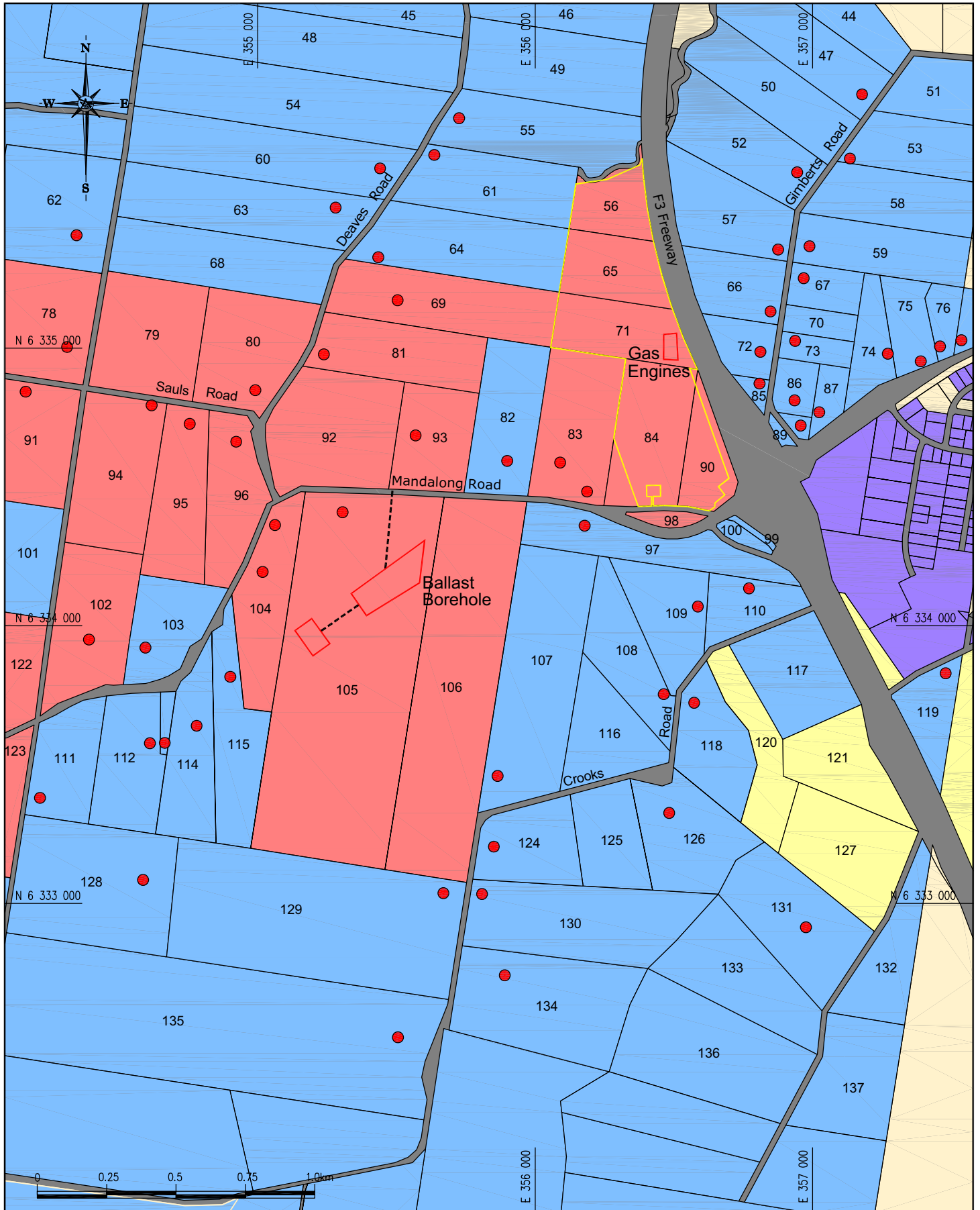
Services Site Surrounding Land Ownership

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Figure
3



2.4 EXISTING STATUTORY APPROVALS

Table 4 lists current licences, leases and approvals under which Mandalong Mine currently operates. A detailed discussion on legislation relevant to this Modification and the ongoing operation of Mandalong Mine is provided in **Section 4.0**.

2.5 ENVIRONMENTAL MANAGEMENT SYSTEM

Environmental management at Mandalong Mine is regulated by the licences, leases and approvals as shown in **Table 4**. Additionally, Mandalong Mine's Environmental Management System provides a framework under which environmental issues are managed onsite.

The major components of the Environmental Management System include:

- Centennial Coal's Environmental Policy;
- Various management plans and other management documents;
- Mandalong Mine's Environmental Monitoring Program; and
- The Environmental Management Strategy.

Various reporting elements are also used to track progress on the objectives of the Environmental Management System. Key elements of the Environmental Management System are further discussed in the following sections.

2.5.1 Environmental Management

The Environmental Management System has been developed and implemented to ensure the effective management of environmental issues and compliance with regulatory requirements while providing a means for continued improvement in the environmental performance of Mandalong Mine.

The Environmental Management System incorporates a number of environmental management plans that are designed to assist in meeting community and regulatory expectations which are shown in **Table 5** and **Table 6**.

Mandalong Mine also relies on other additional Department of Primary Industries regulatory required documents including a Subsidence Management Plan and a Mining Operations Plan. These documents provide a framework for the planning of mining operations while considering potential environmental issues and their management onsite.

The Environmental Management System also contains a series of Environmental Work Procedures which provide details of operational and maintenance activities as well as required environmental inspections and monitoring. Both employees and contractors at Mandalong Mine are required to adhere to the relevant environmental procedures.

Table 4
Licences & Approvals

Title	Description	Issuing Authority	Expiry Date
DA 97/800	Development Consent for Mandalong Mine (14/10/1998)	Department of Urban Affairs & Planning	14/10/2019
DA 35/2/2004	Development Consent for the construction and use of the Mandalong Coal Delivery System (Delta Link Project) (2004)	Department of Planning	04/07/2021
Mining Lease 1443	Mandalong Mine primary Mining Lease, title to surface land	Department of Primary Industries	01/03/2020

Title	Description	Issuing Authority	Expiry Date
Consolidated Coal Lease 762	Title to surface land	Department of Primary Industries	13/10/2022
Consolidated Coal Lease 746	Title to surface land	Department of Primary Industries	31/12/2008
Mining Purposes Lease 191	Mining lease	Department of Primary Industries	24/02/2023
Mining Purposes Lease 329	Mining lease	Department of Primary Industries	04/08/2015
Mining Lease 1431	Mining Lease, title to surface land	Department of Primary Industries	27/05/2019
Mining Lease 1543	Mining Lease	Department of Primary Industries	25/11/2024
Mining Lease 1553	Mining Lease	Department of Primary Industries	07/09/2025
Exploration Lease 6317	Exploration Lease	Department of Primary Industries	08/08/2009
Exploration Lease 4443	Exploration Lease	Department of Primary Industries	23/10/2012
Exploration Lease 4968	Exploration Lease	Department of Primary Industries	31/07/2012
Exploration Lease 4969	Exploration Lease	Department of Primary Industries	31/07/2023
Exploration Lease 5892	Exploration Lease	Department of Primary Industries	31/07/2012
Authorisation Lease 404	Exploration Lease	Department of Primary Industries	31/07/2012
Mining Operations Plan	Summary of Mining Activities – Mandalong	Department of Primary Industries	24/12/2011
Subsidence Management Plans	Application for Longwall 1 & Longwall 2 (February 2004)	Department of Primary Industries	N/A
	Application for Longwall 3, Longwall 4 & Longwall 5 (November 2005)	Department of Primary Industries	N/A
	Application for Longwall 6 & Longwall 7 (August 2007)	Department of Primary Industries	01/02/2014
	Application for Longwall 8 & 9 (March 2008)	Department of Primary Industries	01/07/2015
Environmental Protection Licence 365	Surface Operations, Monitoring and Discharge	Department of Environment and Climate Change	Perpetual

Table 5
Development Consent Required Management Plans & Programs

Title	Consent Condition	Consent Timing	Regulator
Environmental Management Strategy	Schedule 2, Conditions 7 - 8	Prior to the preparation of the first Mining Operation Plan	Consultation with Mandalong Mine CCC, to the satisfaction of Department of Planning
Landowner Communication and Consultation Plan *	Schedule 2, Condition 13 (i)	Within one month of the 2001 modification of DA 97/800	Plan to be approved by Department of Planning and made available for public inspection
Property Subsidence Management Plan *	Schedule 2, Condition 13 (ii) - 17	Must address each property title to be affected by the effects of subsidence from a longwall panel or groups of longwall panels, or other area of secondary workings	Consultation as relevant with the Mine Subsidence Board, Lake Macquarie City Council, Department of Water and Energy, to the satisfaction of Department of Primary Industries

Title	Consent Condition	Consent Timing	Regulator
Longwall Subsidence Management Plans*	Schedule 2, Conditions 18 - 19	Prior to an approval for secondary workings	To the satisfaction of Department of Primary Industries
Land Management Plan	Schedule 2, Condition 42	Within three months of the date of consent	Consultation with NSW Agriculture and the Department of Water and Energy and made available to the Mandalong CCC
Noise Management Plan	Schedule 2, Condition 45	Prior to the commencement of construction of surface facilities	Consultation with Department of Environment and Climate Change, to the satisfaction of Department of Planning
Air Quality Management Plan	Schedule 2, Conditions 50 - 51	Prior to the commencement of surface construction	Consultation with Department of Environment and Climate Change, to the satisfaction of Department of Planning
Water Management Plan	Schedule 2, Conditions 50 - 51	Prior to the commencement of surface construction	Consultation with Department of Environment and Climate Change and Department of Water and Energy, to the satisfaction of Department of Planning
Erosion and Sediment Control Plan	Schedule 2, Conditions 61- 63	Prior to the commencement of relevant site works	To the satisfaction of Department of Water and Energy and submitted to the Department of Environment and Climate Change
Flora and Fauna Management Plan	Schedule 2, Conditions 70 - 72	None	Consultation with Department of Water and Energy, Department of Environment and Climate Change and Lake Macquarie City Council, and to the satisfaction of Department of Planning
Wetland Management Plan	Schedule 2, Condition 74	Prior to any mining activity that may change the hydrological regime of each individual wetland	Consultation with Department of Environment and Climate Change and affected landholders to the satisfaction of Lake Macquarie City Council
Waste Management Plan	Schedule 2, Condition 77	Prior to the commencement of construction of surface facilities	Consultation with Department of Environment and Climate Change to the satisfaction of Department of Planning
Conservation Plan	Schedule 2, Condition 81	Prior to the commencement of secondary workings in the area for part of the "convict road" historic heritage item	To the satisfaction of Department of Planning
Energy Savings Action Plan	N/A	N/A	N/A

* Not required following granting of this Modification.

Table 6
Subsidence Management Plan Longwalls 8-10 Requirements

Title	Purpose	Scope	Timing	Authority
Subsidence Management Plan	To monitor the effects of longwall extraction so as to prevent adverse impacts on surface improvements and natural features	The plan applies to surface improvements, natural features and the environment which may be effected by extraction of longwall panels	Approval required prior to longwall development and extraction	Department of Primary Industries - Mineral Resources
Public Safety Management Plan	To ensure public safety in any surface areas that may be affected by subsidence above longwall operations	The plan applies to the risk to public safety based on a risk assessment for each parcel of public and private land assessing the risk of subsidence impact on surface features and public infrastructure	Approval required prior to longwall extraction	Department of Primary Industries - Mineral Resources – as required by Subsidence Management Plan conditions in ML 1143 and under consent N92/00275 condition No. 18 requiring (Longwall Subsidence Management Plan)
Underground Mining Environmental Management Plan	To monitor the effects of longwall extraction on surface and groundwater, erosion and flora and fauna so as prevent and mitigate adverse impacts on these natural features	The plan applies to water management, control of erosion and resultant sedimentation and management of flora and fauna affected by the extraction of longwall panels at Mandalong Mine	Approval required by prior to longwall extraction	Department of Primary Industries - Mineral Resources (as required by Subsidence Management Plan conditions of ML1445) and Department of NSW Planning (as required by condition 61, 68 & 70)
Powerline Management Plan	To manage the risk associated with surface subsidence caused by the mining of Longwall Panels at Mandalong Mine	The plan applies to the management of the risk associated with subsidence from longwall mining on powerline infrastructure within the longwall mining area	Approval required prior to longwall extraction	Department of Primary Industries - Mineral Resources (as required by Subsidence Management Plan condition in ML1443)
Telstra Management Plan	To manage the risks associated with surface subsidence caused by mining of longwall panels at Mandalong	The plan applies to the risks to the Telstra network	Chief inspector DPI prior to impact from Longwall extraction	Department of Primary Industries - Mineral Resources (as required by Subsidence Management Plan)

Title	Purpose	Scope	Timing	Authority
Public Roads Management Plan	To manage the risks associated with surface subsidence caused by mining of longwall panels at Mandalong Mine on public roads	The plan applies to the management of the risks associated with subsidence from longwall mining on public roads (both sealed and unsealed) in the mining area	Approval required prior to longwall extraction	Department of Primary Industries - Mineral Resources (as required by Subsidence Management Plan condition in ML1443)

Source: Centennial Coal (2008)

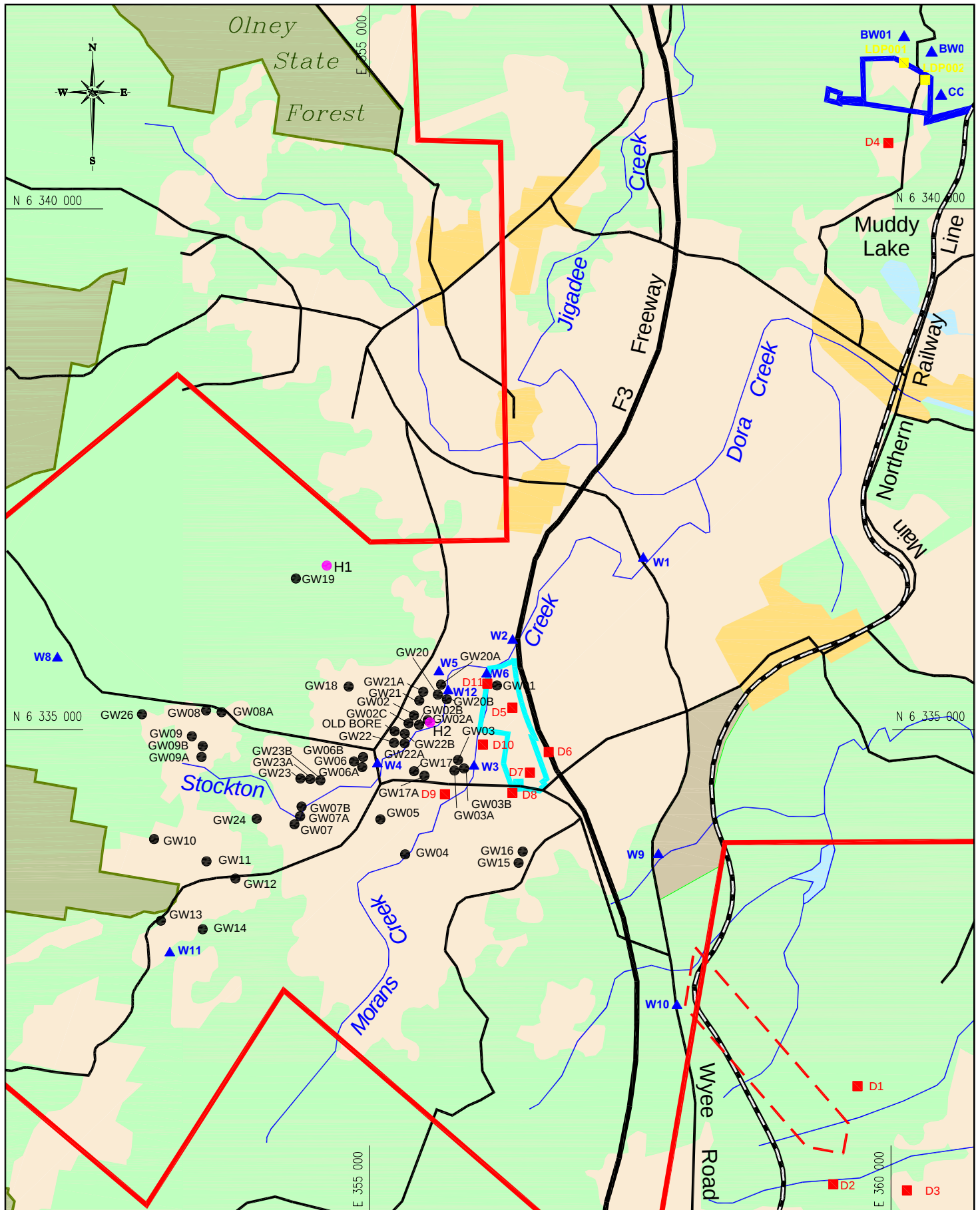
2.5.2 Environmental Monitoring

Mandalong Mine currently undertakes a comprehensive Environmental Monitoring Program in accordance with regulatory requirements. The Environmental Monitoring Program ensures that Mandalong Mine meets regulatory requirements and enables the identification and management of potential environmental risks associated with its activities.

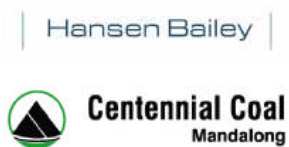
The environmental monitoring requirements are contained within the relevant management plans and current monitoring locations are shown in **Figure 5**.

Environmental monitoring is undertaken for the following:

- Meteorology;
- Air Quality (including greenhouse gas emissions);
- Noise;
- Blasting (as required);
- Flora & Fauna;
- Surface Water;
- Groundwater;
- Subsidence;
- The "Convict Road" heritage site (Non-Aboriginal Heritage Site H2 on **Figure 5**); and
- Vibration (undertaken by the Mine Subsidence Board).



- DA Boundary
- - - Delta Entry Site DA Boundary
- Services Site
- Mine Access Site
- ▲ Water Monitoring Points
- Air Quality Monitoring Points
- Groundwater Monitoring Points
- Licensed Water Discharge Points
- Non-Aboriginal Heritage Sites



Source Centennial (2008)
Co-ordinate System MGA Zone 56

MANDALONG MINE

Environmental Monitoring Locations

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Figure
5

3.0 MODIFICATION DESCRIPTION

This section of the Environmental Assessment provides a description of the various components of this Modification, including the need, alternatives considered, plans for any new building works and plans for revised mining operations (incorporating this Modification).

3.1 COMPONENTS

Centennial Mandalong seeks to modify DA 97/800 to provide further flexibilities and improved efficiencies at the Mandalong Mine. Specifically, this Modification comprises of the following components:

- The construction and operation of gas engines fuelled by waste coal mine methane gas extracted by the existing drainage plant;
- An increase of the rate of Run of Mine coal extraction from the currently approved 4 Mtpa to 6 Mtpa and an associated increase from the approved 230 direct employees to approximately 305 Full Time Equivalent employees;
- The relocation of an approved, but not yet constructed ballast borehole; and
- Updating relevant conditions of development consent to ensure consistency with the Department of Primary Industries Subsidence Management Plan process.

Figure 6 shows the general location of the various components of this Modification which are described in the following sections.

3.1.1 Gas Engines

Centennial Mandalong proposes to construct and operate multiple gas engines with an expected capacity of up to 12 Megawatts to generate electricity. The purpose of these gas engines is to generate electricity from coal seam methane, currently a waste by-product of the mining operation.

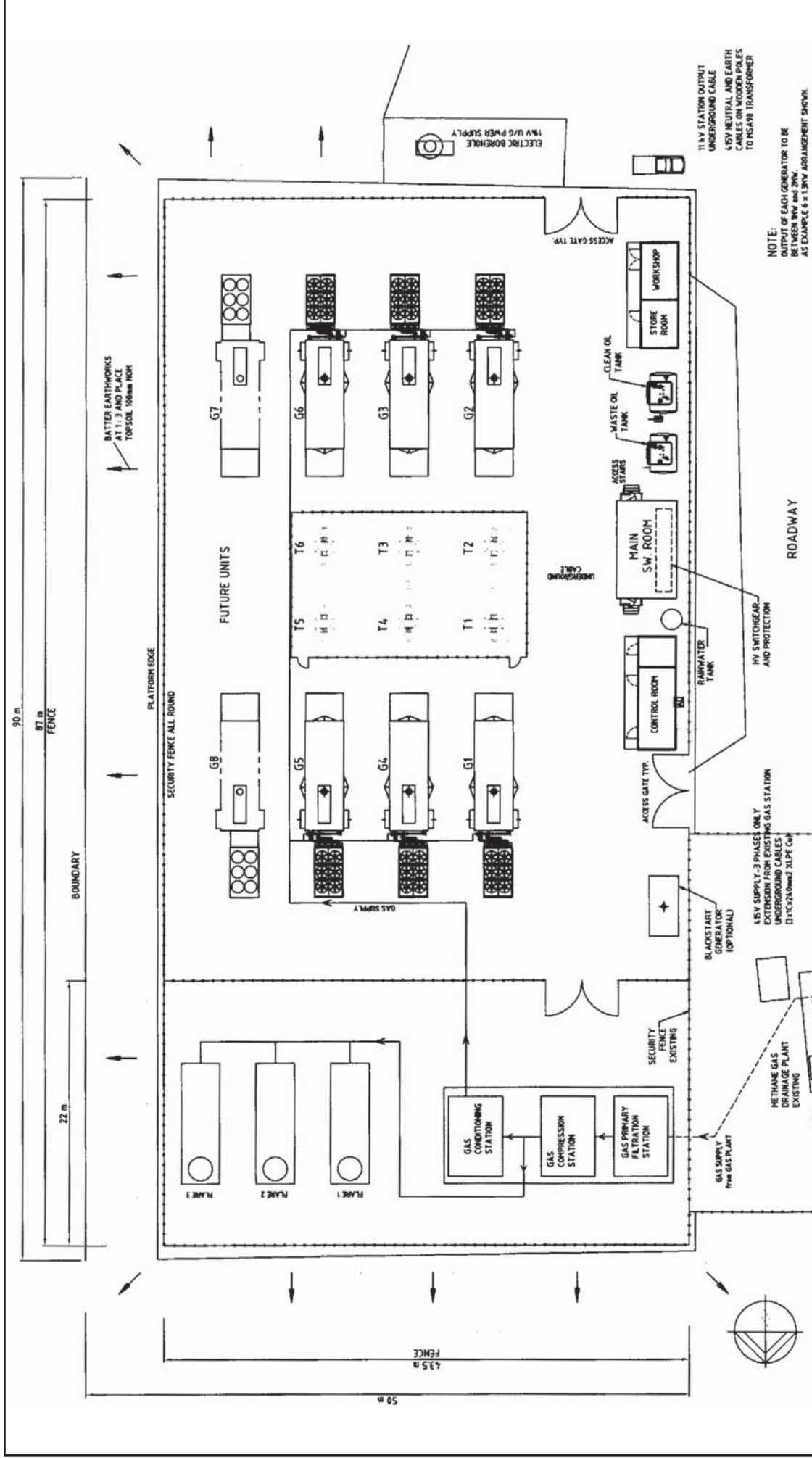
This initiative will complement the existing greenhouse abatement activities undertaken at Mandalong Mine and reduce emissions by up to 25%.

Power from the gas engines will be fed into the mine high voltage substation, providing additional capacity to the NSW power grid. The gas engines will be operated in conjunction with the currently approved gas flares and be fuelled by waste coal methane gas which is extracted from the underground workings by an existing methane drainage plant.

The gas engines will be located on the Mandalong Mine Access Site, adjacent to the existing methane drainage plant and the approved, but not yet constructed gas flares (see **Figure 6**). A majority of this area has previously been cleared of all vegetation and a level gravel pad has been formed to accommodate the methane drainage plant and associated infrastructure. The establishment of the proposed gas engines will require an extension of this area by approximately 30 m to the east.

The design and configuration of the gas engines has not yet been fully finalised, due to ongoing commercial discussions with Australia Gas Light Company (AGL), the preferred supplier. General design specifications for the project will be provided by AGL for the establishment and operation of these facilities and will include consideration of the environmental impacts (including air quality and noise) of the gas engines. Gas engines are typically configured to the size of a shipping container, enabling construction to take place offsite, and the engines can be relocated with relative ease.

It is likely that the establishment of the gas engines will occur in a staged fashion, depending on the successful delivery of the gas extracted from the underground workings during the initial commissioning stage of the gas engines. The final design of the gas engines will be determined following a detailed feasibility study undertaken by AGL on the long-term methane flow rates from Mandalong Mine.



MANDALONG MINE

Conceptual Gas Engines Layout

Figure
6

Date: 11.08.08

Filename: MC006 - (766) AGL Gas Engine Figure - 0808.indd

Hansen Bailey



Source: AGL (2008)

For the purposes of this Environmental Assessment, alternative configurations of gas engines with a total generating capacity of 12 Megawatts as worst-case scenarios have been assessed. These configurations include: one gas engine with a 12 Megawatt capacity; six gas engines with 2 Megawatts capacity; or two gas engines with a capacity of 6 Megawatts each.

The design of the gas engines will be similar to those used at other methane gas electricity generating facilities. Each gas engine and associated generator will be enclosed within a building which will be appropriately fabricated to mitigate the potential for noise impacts on any neighbouring receivers. The buildings and at least 10 m high exhaust stack will be fitted with an automatic fire suppression system to ensure safety requirements are met.

All pipe work for the units will be designed in accordance with the relevant Australian Standards and to satisfy the outcomes of a failure modes risk assessment. Typical controls, such as slam shut valves, non-return valves and flame arrestors will be installed to eliminate the risk of explosion. Earth leakage protection along with sensors will be installed to regulate temperature and pressure in the pipelines and the gas engines. The operation of the gas engines and associated infrastructure will be managed from one central, fully automated and computerised control room.

A gas monitoring system will regulate the flow of gas in either the gas engines or gas flares, typical of those currently utilised in the free venting of gas from underground mining operations. Prior to combustion through the gas engines, infrastructure will be installed to facilitate the removal of moisture from the gas, filter particulates, pressurise the gas, and cool the gas prior to storing in an intermediate storage vessel.

Access to the gas engines will be via the existing gravel road which leads to the methane drainage plant. The gas engine buildings will be enclosed within security fencing to ensure access is controlled to allow authorised personnel only.

Additionally, the existing security monitoring program for the Mandalong Mine will be updated to incorporate the security of this facility.

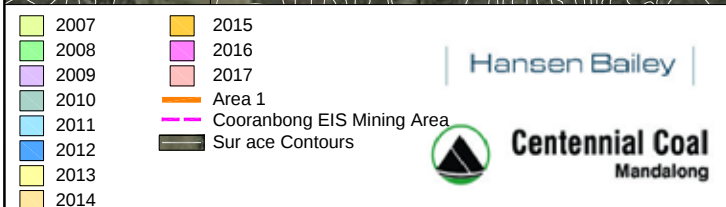
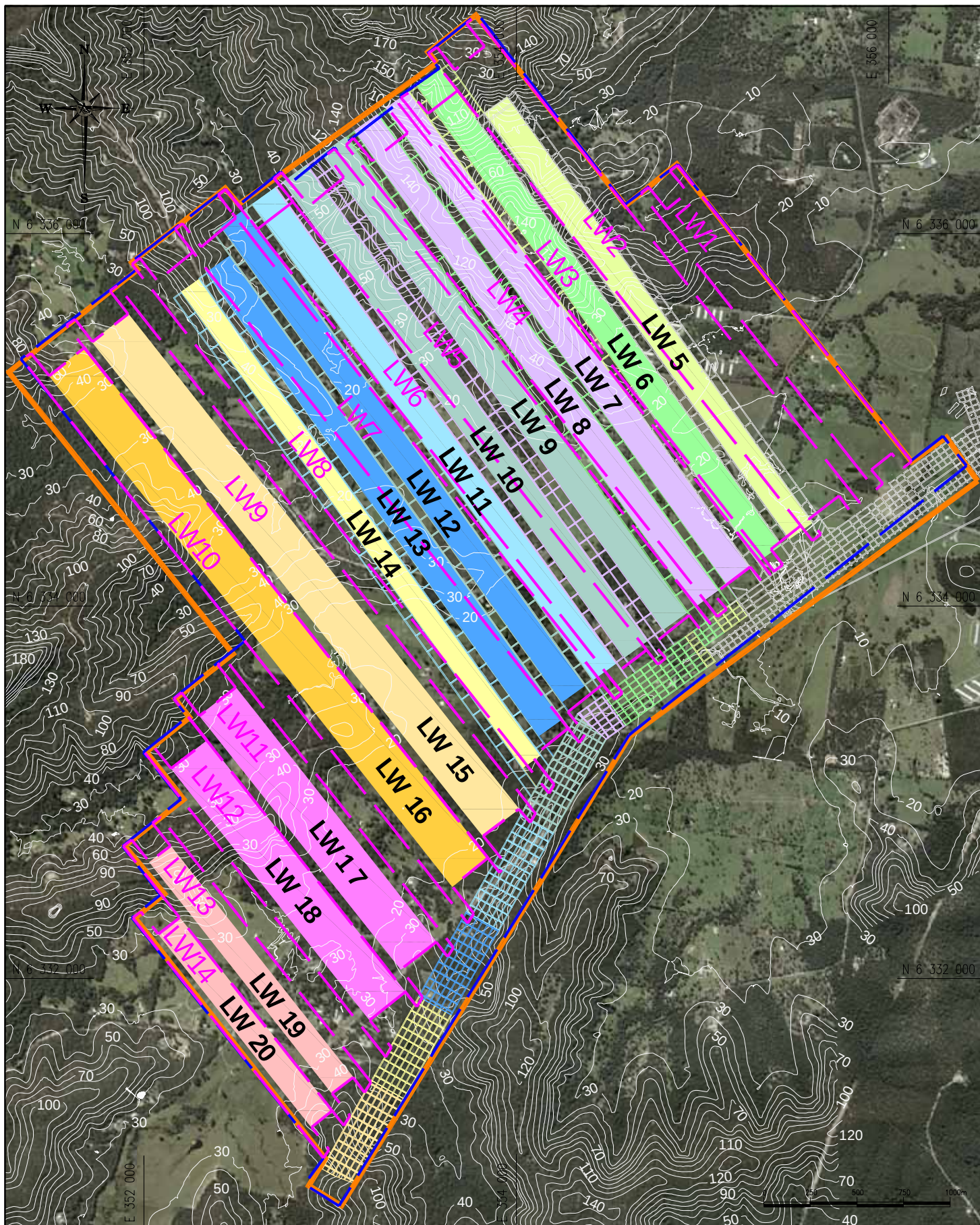
The establishment of the gas engines will be undertaken during day-time hours (7:00 am to 6:00 pm) Monday to Saturday only and will involve earthworks for the extension of the existing gravel pad and construction of the associated structures. Construction of the gas engines will occur off site with these being transported to site and commissioned. The establishment, including construction activities and commissioning works, is expected to take approximately six months from award of contract. The gas management system, including the existing approved methane drainage plant and gas flares will be operated 24 hours per day, 7 days per week.

3.1.2 Coal Extraction Rate

Due to improved operational efficiencies, increased knowledge of the geology within the mining area and other technological advances being realised since the commencement of mining, Centennial Mandalong is seeking an increase in Run of Mine coal extraction from 4 Mtpa to 6 Mtpa. Gaining this flexibility will not require an increase in the approved underground mining area (for either Area 1 or Area 2) as shown on **Figure 1** and approved in the Cooranbong EIS.

An indicative mine plan schedule to 2017 which shows the currently proposed design for longwall panels in Area 1 is provided in **Figure 7**. **Figure 8** conceptually shows the surface features known to exist above the approved mine plan. These figures provide an indicative timing at which these features may be subsided if the currently employed, narrower (up to 160 m) than approved longwall panels (up to 250 m) are extracted at Mandalong Mine.

The mine plan has been revised to reflect the delay in the commencement of coal extraction from that proposed in the Cooranbong EIS and the proposed increase in coal extraction to 6 Mtpa. To date, no mining has occurred in Area 2 as described in the Cooranbong EIS, with the exception of the underground workings associated with the construction of the Delta Link Project.



Co-ordinate System MGA Zone 56

MANDALONG MINE

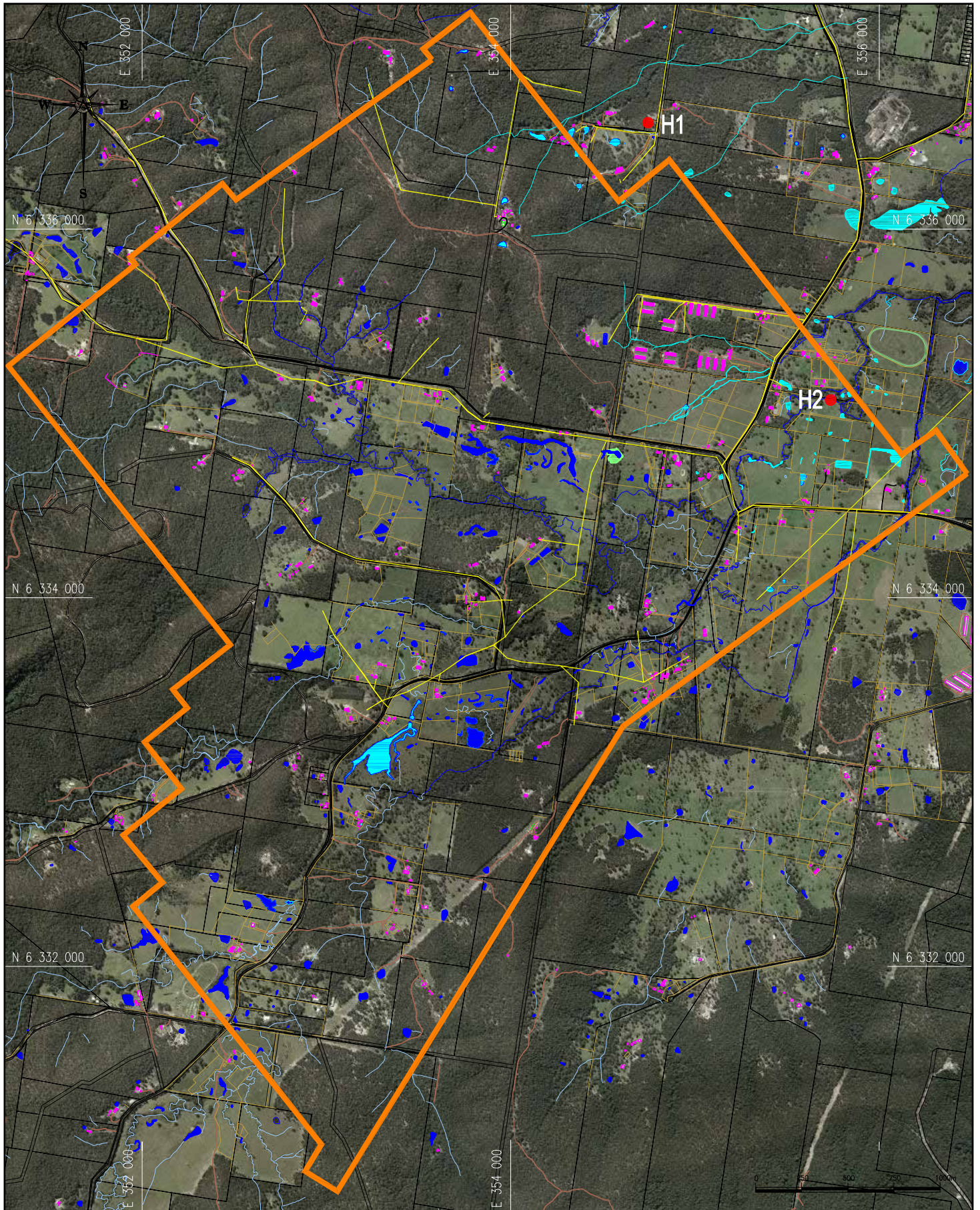
Indicative LW Mine Plan

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Figure
7



— Area 1 — Roads — Tracks — Fences ● Dams — Creeks — Urban Features ■ Buildings — Water courses — Gullies	— Energy ● Wetlands ● Non-Aboriginal Heritage Sites	Hansen Bailey Centennial Coal Mandalong Co-ordinate System MGA Zone 56
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MANDALONG MINE		
Indicative Surface Features & Structures		
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		Figure 8

The Cooranbong EIS envisaged all coal extracted from underground operations would be handled and dispatched from the coal handling facilities of the former Cooranbong Colliery (now Services Site). The Cooranbong EIS considered the relevant environmental impacts of processing and transporting up to 4 Mtpa of Run of Mine coal from this facility.

In addition, Centennial Mandalong was granted DA 35-2-2004 for the construction and operation of the Delta Link Project in 2004 incorporating the Delta decline tunnel. Additionally, Delta Electricity was issued DA 25012004 by LMCC on June 15 2004 for the construction and operation of coal handling infrastructure at the Delta rail unloader site (Delta Site). This also allows the transport up to 4 Mtpa of Run of Mine coal to the Delta Site from Mandalong Mine, additional to that processed at the Services Site.

Some additional employees will be required at site to facilitate the additional tonnages to that proposed in the Cooranbong EIS of approximately 305 full time equivalent personnel.

In seeking this increase in tonnage, Mandalong Mine will not exceed processing of the 4 Mtpa at the Services Site and will not exceed 4 Mtpa throughput at the Delta site. As such, it is considered that the surface environmental impacts associated with the handling, processing and transport of the additional coal extracted from Mandalong Mine have been assessed and approved.

3.1.3 Approved Ballast Borehole Relocation

This Modification includes the relocation of an approved, but not constructed, ballast borehole to service the underground mining operations.

The Cooranbong EIS described the need for ballast delivery to the underground workings which was to be located on the Access Site. The operational needs of Mandalong Mine are now such that it is more efficient and practical to deliver ballast to the underground workings from an alternative location.

The ballast borehole is proposed to be located further down the main headings and over the existing and future operations, generally within the survey area shown on **Figure 4**. An enlarged survey area was developed to accommodate the best placement of the ballast borehole which is to be situated approximately 1 km to the south west of the Access Site.

The ballast borehole survey area is located in the Mandalong Valley on land that has previously been cleared and has few trees remaining. The land is currently utilised for low-intensity grazing. The ephemeral Morans Creek flows close to the north eastern corner of the survey area however will not be disturbed by this component of this Modification.

The ballast borehole will be comprised of a steel lined borehole approximately 350 mm in diameter fitted with a small loading hopper to facilitate the transport of ballast to the underground workings in the West Wallarah Coal Seam, consistent with that described in the Cooranbong EIS. A smaller diameter borehole will also be constructed adjacent to the ballast borehole to accommodate communication lines (phone/radio) to assist in the safe operation of the ballast borehole. Other infrastructure associated with the ballast borehole will include:

- An access road turning off the Mandalong Road to the ballast borehole, which will be constructed generally over existing tracks in the area;
- A gravel pad large enough to accommodate the safe manoeuvring of a 10 t gravel truck and dog trailer;
- A small ballast stockpile with a capacity of approximately 300 t;
- Security fencing around the site of the ballast borehole and associated equipment; and
- Various landscaping: including vegetated earthen bunds to mitigate any potential visual and noise impacts.

The construction of the ballast borehole and associated infrastructure is anticipated to take up to two months and will be conducted seven days a week during day time hours only (i.e. 7:00 am to 6:00 pm).

Construction will require the drilling of the two boreholes down to the West Wallarah Coal Seam and the installation of steel casing and other associated infrastructure. Drilling of the borehole will be undertaken utilising a rotary percussive drill which is likely to be powered by twin 900 cubic feet per minute compressors. A sump will be constructed to facilitate the reticulation of water to the drill during the drilling process which will be filled in with soil and rehabilitated once drilling is completed. Approximately 160 m of 350 mm steel casing will then be inserted into the ballast borehole utilising a crane and various other pieces of support equipment. A small metal hopper with a lockable lid will secure this casing. Associated water utilised for the drilling process will be retained in a closed system and removed from the site and disposed of by a licensed waste contractor.

Delivery of gravel for the construction of the Access Road and pad will be undertaken utilising 10 t gravel trucks towing 8 t dog trailers from local quarries. An average of 10 deliveries of ballast per week will be required to the borehole and will be undertaken five days a week during daytime hours only (7:00 am to 6:00 pm). The delivery of ballast to the underground workings will be undertaken utilising a front end loader at the borehole site to load ballast from the stockpile into the hopper.

3.1.4 Review of Subsidence Management Conditions of Development Consent

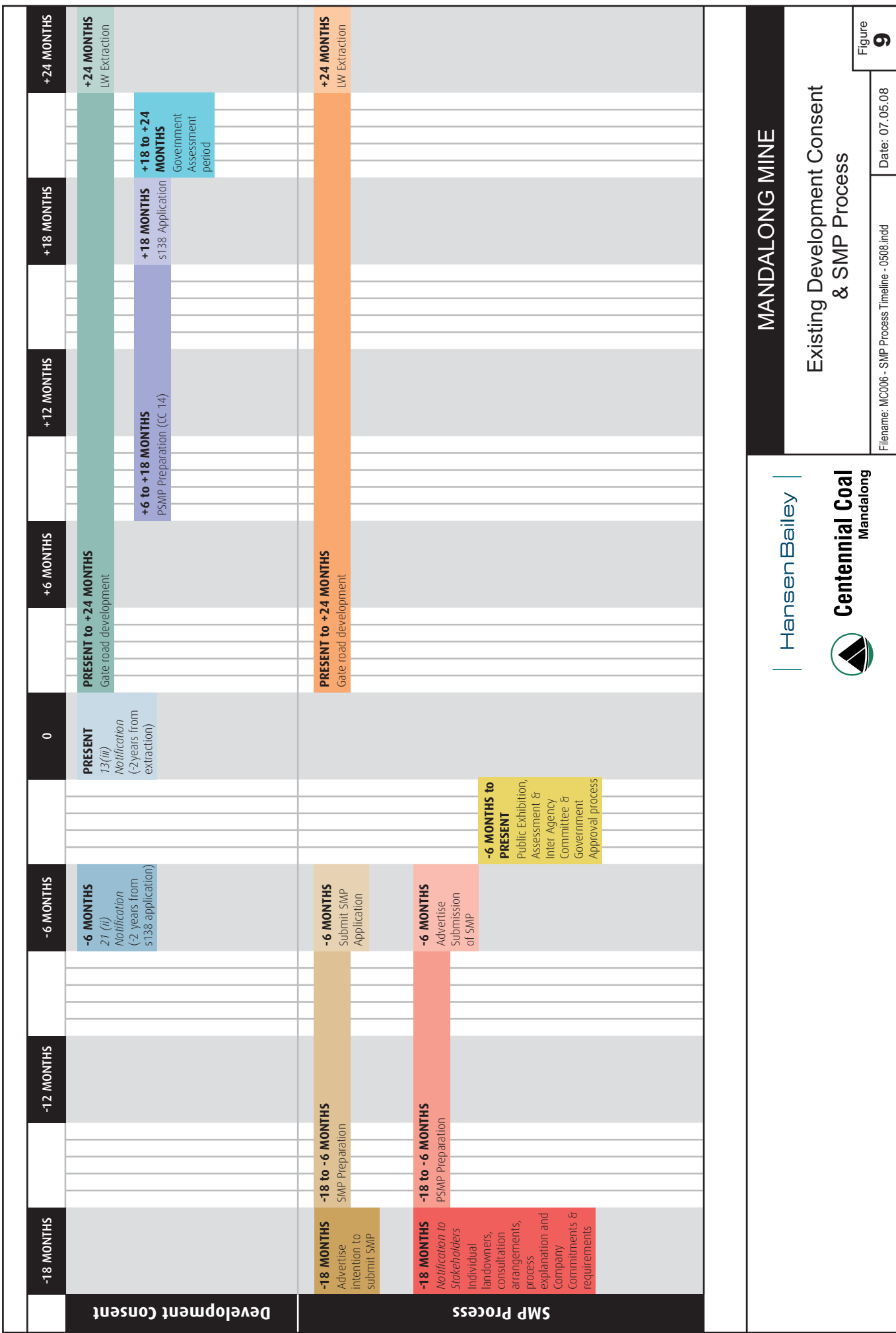
Centennial Mandalong seeks to update specific conditions of DA 97/800 relevant to subsidence impacts and related stakeholder notifications (see **Appendix A**) to ensure consistency with the Department of Primary Industries Subsidence Management Plan Process which applies to all NSW underground coal mining operations.

Centennial Mandalong's development consent includes conditions requiring the preparation of Property Subsidence Management Plans and a Longwall Subsidence Management Plan. The preparation of these instruments were previously triggered under the process required by Section 138 of the *Coal Mines Regulation Act 1982* (CMR Act) with which the conditions of development consent were drafted in accordance with. The Department of Primary Industries Subsidence Management Plan Process was introduced in 2004 following the repeal of Section 138 of the CMR Act. The introduction of the Subsidence Management Plan process created an inconsistency between the requirements of the consent conditions in regard to the timing for the preparation of the subsidence management instruments and consultation with the landowners that may potentially be affected by mining subsidence.

Figure 9 illustrates the different requirements for each of the conditions of development consent and Department of Primary Industries Subsidence Management Plan Process which is examined further below.

Under the process outlined in the development consent, landowners that may potentially be affected by underground mining subsidence are to be notified between 18 and 24 months prior to the commencement of underground operations (including development). However, gateroad development could commence within this time. The application for the Section 138 approval and Property Subsidence Management Plans would then commence, leading to Longwall panel extraction up to 24 months from the original notification of affected landowners.

The proposed Modification will require public notification via a public advertisement and personal notifications to near neighbours and other regulators.



The Subsidence Management Plan is prepared in parallel with the Property Subsidence Management Plan's which must be developed in consultation with landowners and infrastructure owners prior to the submission of the Subsidence Management Plan. A public exhibition process then follows which provides more detailed notification to the affected landowners with all approvals required prior to any underground development or extraction taking place.

Mandalong Mine has been operating under both the Subsidence Management Plan process and adhering to conditions of development consent to date. This Modification seeks to modify development consent conditions to allow Mandalong Mine to follow the same Subsidence Management Plan process consistent with all other underground coal mining operations in NSW.

3.2 BENEFITS OF THIS MODIFICATION

A number of alternatives were considered during the planning and development stages of this Modification. The principles of Ecologically Sustainable Development (ESD) have been considered during both the planning phase of this Modification and throughout the preparation of this Environmental Assessment.

In 2006, Centennial Mandalong was granted a modification to its development consent to allow the construction and operation of gas flares to reduce greenhouse gas emissions by burning the methane extracted from underground workings in a methane drainage plant. Since this time, Centennial Mandalong has worked closely with AGL to investigate further feasible options to reduce greenhouse gas emissions from Mandalong Mine. The proposed construction and operation of the gas engines has been identified as a preferred option and will not only minimise greenhouse gas emissions by burning the waste coal mine methane extracted, but will also generate electricity for use in the NSW power grid.

If this Modification were not approved, the methane gas extracted from the drainage plant would either be released into the atmosphere or burnt by utilising the approved gas flares without generating electricity for use in the NSW power grid. As such, the construction of the gas engines is expected to result in a considerable reduction in the quantity of greenhouse gas emissions from the site and benefit the wider community through 'green' generation of electricity.

Mine planning has identified that with the current progression of underground operations at Mandalong Mine it would be more efficient and practical to deliver ballast to the underground operations from a point that is located above the current and future mining activities. A survey area for the proposed ballast borehole was developed in order to accommodate various alternative locations for the borehole to consider both the engineering practicalities as well as the potential environmental impacts of the construction of this infrastructure. The principles of intergenerational equity and ecological diversity and integrity has been considered in the development of this component of this Modification by aiming to reduce adverse impacts to the natural environment. Approval for the relocation of this borehole at a location above the existing and approved mining operations will further improve the efficiency at Mandalong Mine and allow Centennial Mandalong to ensure the future of Mandalong Mine.

With improved operational efficiencies and knowledge of the mining area, this Modification will provide Mandalong Mine with the flexibility to extract coal at a maximum rate of 6 Mtpa in the highly competitive market, whilst utilising the currently approved infrastructure and equipment fleet. The proposed increase in the coal extraction rate will further improve Centennial Mandalong's competitiveness in both the export and domestic markets.

Centennial Mandalong has approval to handle, process and transport up to 8 Mtpa of product coal to the export and domestic markets. An extraction rate of up to 8 Mtpa was considered during the planning stage of this Modification.

However, at this point in time it was considered that 6 Mtpa is the most practical alternative to reduce potential impacts to the neighbouring community, and ensure the longevity of the operation whilst meeting Mandalong Mine's future commercial interests.

The variations to the conditions of development consent related to subsidence management are required to ensure that Mandalong Mine is operating consistently with the requirements of Department of Primary Industries (as the key regulator of mining subsidence in NSW) and all other underground mining operations in NSW. If this Modification was not approved, Mandalong Mine would continue to operate under the often conflicting requirements of the development consent and Department of Primary Industries Subsidence Management Plan processes, thus duplicating notifications to landowners and infrastructure owners. These variations will ensure that the management processes for Mandalong Mine are consistent with the expectations placed upon all other underground coal mining operations in NSW. If this Modification were not approved, Mandalong Mine would be required to continue to satisfy the requirements of both the development consent and Department of Primary Industries processes.

4.0 REGULATORY FRAMEWORK

This section of the Environmental Assessment provides a description of the regulatory framework under which Mandalong Mine operates. It discusses the ability of the Minister to modify DA 97/800 under Section 75W of the *Environmental Planning and Assessment Act 1979*, describes the approvals process, stipulates the consistency with the objectives of the *Environmental Planning and Assessment Act 1979* and requirements for licences and approvals as a result of this Modification.

4.1 ENVIRONMENTAL PLANNING & ASSESSMENT ACT 1979

4.1.1 Existing Development Consent

Mandalong Mine was granted DA 97/800 under Part 4 of the *Environmental Planning and Assessment Act 1979* for the "Extension to Underground Coal Mining Activities for Cooranbong Colliery, establishment of Mine Access Site, modification to Coal Preparation and Transportation System and establishment of a Coarse Reject Emplacement Area" on 14 October 1998. DA 97/800 is supported by the *Cooranbong Colliery Life Extension Project Environmental Impact Statement*".

Three minor modifications to DA 97/800 have been granted and include:

- MOD 1 – in 2001 some minor modifications related to the preparation of Property Subsidence Management Plans, longwall Subsidence Management Plan and notification of landowner requirements. These modifications were sought to clarify the timing of the consultation with property owners potentially affected by subsidence, and to formalise the arrangements for preparing plans that describe the specific impacts on each property referred to in the conditions of DA 97/800;
- MOD 2 – in 2005 a modification was granted to allow for the construction and operation of a methane gas drainage plant and the transportation of 1,000 t of coal from the mine by road to local power stations, supported by the *Mandalong Mine Methane Drainage Plant and Coal Haulage Statement of Environmental Effects* (SKM, 2004). The gas drainage plant was approved for construction within the Access Site to support the existing mine ventilation system and facilitate the controlled extraction of methane from the underground mine workings. The approval for the transportation of coal by road to Awaba Colliery was required to utilise the coal extracted during the development of the decline tunnel from the Mine Access Site to the underground workings; and
- MOD 3 – in 2006 a modification was granted to allow for the installation and operation of up to six enclosed methane gas flare units to burn methane generated by the methane drainage plant approved in 2005. The supporting document is the *Statement of Environmental Effects for Mandalong Mine Installation and Operation of Enclosed Methane Gas Flare Units* (Umwelt, 2006).

Development Consent DA 35-2-2004 was issued to Centennial Mandalong by the Minister for Planning in 2004 and provided approval for the Delta Coal Delivery System. This approval, supported by the Delta Link Project Statement of Environmental Effects (Umwelt, 2004) entailed the development of:

- A tunnel created by a coal drivage in the Wallarah Seam;
- A tunnel from the coal drivage to the surface at the Wyee Rail Loader site at which there will be a box cut/portal and a coal conveyor; and
- Consent to deliver, via conveyor, up to 4 Mtpa of coal from the working at Mandalong Mine.

Approval for the Delta Coal Delivery System was granted to Delta Electricity and approved under DA 2501/2004 by Lake Macquarie City Council. This provided approval for the development of coal handling facilities at the Vales Point Power Station rail unloader site.

The Wyee Coal Handling Plant is managed by Delta Electricity under a separate, appropriate planning approval.

4.1.2 Modification Under Section 75W

Section 75W of the *Environmental Planning and Assessment Act 1979* provides for the modification of planning approvals issued under Part 3A of the Act as follows:

- “(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.”*

DA 97/800 was originally granted under Part 4 of the *Environmental Planning and Assessment Act 1979* prior to the commencement of Part 3A of the Act.

Clause 8J(8) of the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation) allows, in certain circumstances, for a Development Consent which was in force immediately before the commencement of Part 3A of the *Environmental Planning and Assessment Act 1979*, to be modified under Section 75W of the *Environmental Planning and Assessment Act 1979*. Clause 8J(8) of the EP&A Regulation states that:

“A development consent in force immediately before the commencement of Part 3A of the Act may be modified under section 75W of the Act as if the consent were an approval under that Part, but only if:

- (a) *the consent was granted with respect to development that would be a project to which Part 3A of the Act applies but for the operation of clause 6(2)(a) of State Environmental Planning Policy (Major Projects) 2005, and*
- (b) *the Minister approves of the development consent being treated as an approval for the purposes of section 75W of the Act.*

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

Mandalong Mine would, but for the operation of clause 6(2)(a) of the *State Environmental Planning Policy (Major Projects) 2005* (Major Projects (State Environmental Planning Policy)) be a Major Project as it is “development for the purpose of mining that: (a) is coal ... mining” as provided in item 5(1)(a) of Schedule 1 to the Major Projects State Environmental Planning Policy, thus satisfying clause 8J(8)(a) of the EP&A Regulation.

On 14 June 2007, the Minister for Planning approved the DA 97/800 as “*being treated as an approval for the purposes of section 75W*” of the *Environmental Planning and Assessment Act 1979*, thus satisfying clause 8J(8)(b) of the EP&A Regulation.

Accordingly, the Minister for Planning may modify DA 97/800 granted under Part 4 by action “... *under section 75W of the Act as if the consent were an approval under that Part*”.

4.1.3 Modification Under 75W & Principles of ESD

Due to the above, the determination of this Modification must follow the process as specified under Section 75W of Part 3A of the *Environmental Planning and Assessment Act 1979* where the application must be considered as a ‘Project Application’. This requires that all procedural aspects of Part 3A in respect of a Project Application apply to this Modification application.

The Minister for Planning has confirmed his requirement for an ‘Environmental Assessment’ and as such Division 2 of Part 3A of the *Environmental Planning and Assessment Act 1979* applies. In this regard, on 4 July 2007, a delegate of the Director-General issued Environmental Assessment Requirements under Section 75W(3) of the *Environmental Planning and Assessment Act 1979* for this Modification application. Revised Environmental Assessment Requirements were issued on 14 April 2008 to incorporate a revised project description incorporating further minor elements to that originally proposed (see **Appendix B**). The Environmental Assessment Requirements are addressed throughout this Environmental Assessment with a checklist referencing where each item is addressed provided in **Section 5.0**.

This Environmental Assessment has been prepared to ensure that this Modification is consistent with the objectives as specified in Section 5 of the *Environmental Planning and Assessment Act 1979* with further detail provided in **Section 6.0**, **Section 7.0** and **Section 9.0**.

This Environmental Assessment provides (at least): consideration of the management, development and conservation of resources to promote social and economic welfare of the community; the orderly and economic use of the land; and the protection of the environment.

Public involvement and participation with this Modification has been encouraged throughout the preparation of this Environmental Assessment, with a summary of the stakeholder consultation process undertaken provided in **Section 5.0**.

4.1.4 Exemptions Due to Part 3A

Section 75U of the *Environmental Planning and Assessment Act 1979* provides that certain authorisations normally required under various statutes are not required for “an approved project” and that the provisions of any Act that prohibit an activity without such an authority do not apply to “an approved project”.

No new approvals under legislation exempted by Sections 75U are required for this Modification.

4.2 RELEVANT PLANNING INSTRUMENTS

Under Section 75J(3) of the *Environmental Planning and Assessment Act 1979*, the Minister for Planning “*may (but is not required to) take into account the provisions of the environmental planning instrument that would not (because of Section 75R) apply to the project, if approved*”. Further, this Modification sought under this application is not prohibited by reason of clause 8O of the EP&A Regulation.

The following sections provide a review of the environmental planning instruments that are relevant to this Modification.

4.2.1 Hunter Regional Environmental Plan 1989

The *Hunter Regional Environmental Plan 1989* (HREP) applies to the land relevant to this Modification and provides objectives to ensure balanced development within the Hunter Region.

Part 6 (Natural Resources), clause 39 of the HREP states *"the objectives of this plan in relation to planning strategies in relation to mineral resources and extractive materials are to (a) "manage the coal and other resources and extractive materials of the region in a co-ordinated manner so as to ensure that adverse impacts on the environment and the population likely to be affected are minimised".*

This Modification sought will assist in the orderly extraction of the already identified underground coal resource at Mandalong Mine in an environmentally sensitive manner hence meeting the objectives of the HREP.

4.2.2 Lake Macquarie Local Environmental Plan 2004

This Modification is located on land described within the *Lake Macquarie Local Environmental Plan 2004* (Lake Macquarie LEP) as Zone 9 (Natural Resources) and Zone 1(1) (Rural (Production)). Development 'for the purpose of mining' is a permissible use in Zone 1(1) and Zone 9 under the Lake Macquarie LEP. Further, all components of this Modification are within the area assessed in the Cooranbong EIS for which DA 97/800 has been granted.

This Modification sought will meet the objectives of the Lake Macquarie LEP.

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

The objectives of *State Environmental Planning Policy (Mining)* are:

- (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".*

The land upon which the various components of this Modification are proposed is land zoned as Zone 1(1) and Zone 9 under the Lake Macquarie LEP. In accordance with clause 7 of State Environmental Planning Policy (Mining), the carrying out of development for the purpose of mining is a use permissible with development consent.

This Modification sought will meet the objectives of State Environmental Planning Policy (Mining).

4.3 OTHER RELEVANT LEGISLATION

4.3.1 Environmental Protection Biodiversity Conservation Act 1999

The Commonwealth's *Environmental Protection and Biodiversity Conservation Act 1999* provides a mechanism for national environment protection and biodiversity conservation for 'Matters of National Environmental Significance' which includes:

- Listed species and communities (e.g. listed threatened species and ecological communities and migratory species);
- Protected areas (e.g. World heritage properties, RAMSAR wetlands of international significance, conservation zones); and
- National, Commonwealth and Indigenous Heritage.

Actions that are likely to have a significant impact on a Matter of National Environmental Significance require approval under the *Environmental Protection and Biodiversity Conservation Act 1999*. No significant impacts on Matters of National Environmental Significance were identified in relation to this Modification and hence a referral is not required. Further detail is provided in **Section 7.5**.

4.3.2 Mining Act 1992

The mining of coal in NSW is controlled by the *Mining Act 1992* (Mining Act), administered by the Minister for the Department of Primary Industries. Section 5 of the Mining Act requires a relevant lease be granted before conducting any mining and Section 65(2) of the Mining Act requires that there be “*appropriate development consent*” as a prerequisite to the granting of a Mining Lease.

Mandalong holds the relevant mining authorisations set out in **Section 2.4**.

Mandalong Mine’s Mining Operations Plan will be updated to incorporate relevant components of this Modification as sought. Centennial Mandalong will continue to develop Subsidence Management Plans in accordance with conditions of its Mining Leases and with the Department of Primary Industries’ guidelines.

4.3.3 Roads Act 1993

The *Roads Act 1993* (Roads Act) provides for the dedication of classified and unclassified roads and confers certain functions to the Lake Macquarie City Council in relation to the management of roads. Under Section 138 of the Roads Act, consent from the Lake Macquarie City Council is required to erect a structure or carry out work in, on or over a public road.

Section 75V of the *Environmental Planning and Assessment Act 1979* provides “*an authorisation of the following kind cannot be refused if it is necessary for carrying out of an approved project and is to be substantially consistent with the approval under this part...*”. The authorisations referenced include an approval under Section 138 of the Roads Act.

An approval under Section 138 of the Roads Act will be sought from Lake Macquarie City Council prior to the construction of the intersection at Mandalong Road and the ballast borehole entry.

4.3.4 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* provides for the licensing of pollution by the Department of Environment and Climate Change which administers the *Protection of the Environment Operations Act 1997*.

Mandalong Mine holds Environmental Protection Licence 365 in respect to its currently approved operations and would seek a variation under the *Protection of the Environment Operations Act 1997* to incorporate the increase in coal extraction above 5 Mtpa and emissions from the proposed gas engines, as required.

5.0 STAKEHOLDER CONSULTATION

Centennial Mandalong developed and implemented a stakeholder consultation program for this Modification. The program is discussed further below and comprised:

- The identification of stakeholders;
- Scoping of issues; and
- The development of relevant responses to the identified concerns to ensure that these issues were addressed as part of the Environmental Assessment process.

5.1 STAKEHOLDER IDENTIFICATION

A comprehensive list of 184 stakeholders was developed based on previous stakeholder consultation programs undertaken by Centennial Mandalong and the Mandalong Mine “Community Information” database.

The identification process found approximately 150 individual neighbours within the vicinity of Mandalong Mine likely to have an interest in this Modification. Additionally, regulatory agencies and other stakeholders were identified as parties who may have an interest in this Modification. Identified stakeholders, the method of consultation employed and any issues raised are described in **Table 7**.

5.2 ISSUE SCOPING

The identification of specific issues relevant to this Modification is integral to the preparation of this Environmental Assessment.

Meetings with relevant regulators and the distribution of newsletters on this Modification aid in ensuring ongoing two-way continuous communication and the dissemination of factual information.

The objectives of the issue scoping phase of the consultation program were to:

- Explain and provide ongoing information on this Modification;
- Continue open, two-way communication with stakeholders;
- Identify stakeholder issues and concerns in relation to this Modification; and
- Identify potential strategies to address the issues raised.

Specific communication methods were designed for different stakeholders relevant to this Modification to ensure a comprehensive list of issues was formulated.

Consultation was generally conducted through the distribution of Newsletters to all known stakeholders who may have an interest in this Modification and one-on-one meetings or written correspondence with the relevant regulators. **Table 8** lists the timing and extent of stakeholder consultation undertaken in relation to this Modification. In addition to the consultation activities provided, presentations have been made to the Mandalong Mine CCC over the course of the Stakeholder Consultation Program.

All relevant stakeholders were informed of this Modification via the local press and radio, Centennial Coal website, newsletter distribution and through the Mandalong Mine Community Consultative Committee. A Newsletter (see **Appendix B**) was distributed to near neighbours and other relevant stakeholders in late January 2008 to provide detail on the approvals sought under this Modification. Relevant contact details were also provided in this newsletter to assist stakeholders seeking any further information on this Modification.

5.3 ISSUE RESPONSE

The objective of this stage of the consultation program was to pro-actively respond to all issues raised (as shown in **Table 7**) and to work with stakeholders to develop appropriate strategies to manage impacts associated with this Modification.

Where possible, any issues identified during the consultation program were addressed with stakeholders. All issues raised have been incorporated in this Environmental Assessment.

5.3.1 Environmental Assessment Requirements

This Environmental Assessment has been compiled in accordance with the Director-General's revised Environmental Assessment Requirements which are reproduced in full in **Appendix B**. **Table 9** lists the requirements and where each is addressed in this Environmental Assessment.

5.3.2 Key Messages

Throughout the stakeholder consultation process key messages were developed and provided to external stakeholders and are summarised below in **Table 10**.

5.3.3 Aboriginal Community Consultation

The requirements of the *Department of Environment and Climate Change Interim Community Consultation Requirements for Applicants* (DEC, 2004a) and the *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (DECC Guidelines) (DEC, 2005a) have been applied to this Modification. This ensures an appropriate level of stakeholder consultation in relation to Aboriginal archaeology and Cultural Heritage. Further detail in relation to consultation with the Aboriginal community is provided in **Section 7.6**.

Table 7
Identified Project Stakeholders & Issues Raised

Stakeholder	Method of Communication	Issues
Department of Planning	Meetings & Presentation, Newsletter	Revised timing of mining operations, gas engines hazardous assessment, and mitigation measures.
Department of Primary Industries	Letter & Newsletter	No response received as at 20 August 2008.
Mandalong Community Consultative Committee (CCC)	Presentations & Newsletter	Noise associated with gas engines and Subsidence Management Plan conditions modification.
Lake Macquarie City Council	Letter & Newsletter, attendee at CCC	No response received as at 20 August 2008.
Mine Subsidence Board	Letter & Newsletter	No response received as at 20 August 2008.
Department of Water and Energy	Letter & Newsletter	No response received as at 20 August 2008.
Department of Environment and Climate Change	Letter & Newsletter	No response received as at 20 August 2008.
Relevant State & Federal MPs	Presentation, Newsletter	No response received as at 20 August 2008.
Individual Neighbours	Newsletter	No response received as at 20 August 2008.
Relevant Neighbouring mines & industry	Newsletter	No response received as at 20 August 2008.
Non-Government Organisations	Newsletter (if requested)	No response received as at 20 August 2008.

Table 8
Stakeholder Consultation Timeline

Date	Activity
June 2007	Meeting with Department of Planning to present project and request Director Generals Requirements.
22 May 2007	Correspondence by email to Department of Planning on 22 May 2007 outlining the details as proposed in this Modification.
4 July 2007	Minister for Planning approved DA 97/800 to be treated as an approval for the purposes of Section 75W of the <i>Environmental Planning and Assessment Act 1979</i> and issued Environmental Assessment Requirements for this Modification.
22 November 2007	CCC Presentation.
23 January 2008	Meeting with Department of Planning to present revised project and request revised Environmental Assessment Requirements.
24 January 2008	Letter sent to Lake Macquarie City Council providing information on this Modification and contact details should they require any further information in relation to this Modification.
29 January 2008	Letters sent to Department of Environment and Climate Change, Department of Primary Industries, Department of water and Energy, Mine Subsidence Board providing information on this Modification and requesting input into Environmental Assessment. Provided contact details should they require any further information.
29 January 2008	'Mandalong Mailbox' Newsletter sent to 184 neighbours, regulators & other interested persons. Newsletter provided an update on Mandalong Mine operations and community projects. The newsletter also presented a discussion on this Modification and summarised the components of the project that would be assessed in this Environmental Assessment.
29 January 2008	Letter sent to Department of Planning requesting revised Environmental Assessment Requirements for this Modification.
30 January 2008	'Mandalong Mailbox' Newsletter made available on Centennial Coal website.
13 February 2008	Revised Environmental Assessment Requirements received from Department of Planning
8 January 2008	CCC Presentation (Lake Macquarie City Council representative in attendance).
28 February 2008	CCC Presentation (Update on the Modification).
28 March 2008	Letter sent to Department of Planning requesting the removal of Private Haul Road component from this Modification and revised Environmental Assessment Requirements sought.
14 April 2008	Department of Planning issued revised Environmental Assessment Requirements for the Environmental Assessment.
30 June 2008	CCC presentation (Update Modification with results of draft Environmental Assessment presented).

Table 9
Environmental Assessment Requirements

Issue	Description	EA Section
General Requirements	The Environmental Assessment must include:	
	an executive summary;	Page ii
	a detailed description of the existing and approved operations / facilities on site, including all statutory approvals that apply to these operations;	2.0
	- a detailed description of the proposed modification, including the: - need for the proposal;	3.0
	alternatives considered;	3.0
	plans for any new building works; and	3.1

Issue	Description	EA Section
	○ revised mining operations (incorporating the proposal); • consideration of the proposal against any relevant statutory provisions, including whether the project is consistent with the objects of the <i>Environmental Planning and Assessment Act 1979</i>; • a general overview of the environmental impacts of the proposal, identifying the key issues for further assessment; • a detailed assessment of the key issues specified below, and any other significant issues identified in the general overview of environmental impacts of the proposal (see above), which includes: ○ a description of the existing environment; and ○ an assessment of the potential impacts of the revised mining operations (incorporating the proposal); ○ a description of the measures that would be implemented to avoid, minimise, mitigate, offset, manage and/or monitor the impacts of the revised mining operations; • a Statement of Commitments, outlining the proposed environmental management, mitigation and monitoring measures; • a conclusion justifying the proposal, taking into consideration the potential costs and benefits of the proposal and the suitability of the site; and • a signed statement from the author of the Environmental Assessment report certifying that the information contained in the report is neither false nor misleading.	3.1 4.0 6.0 7.0 2.0 7.0 7.0 1.0 9.0 Page i
Key Issues	• Noise; • Subsidence – including: ○ opportunities to rationalise the regulation of subsidence-related impacts under the existing conditions of consent and Department of Primary Industries' Subsidence Management Plan process; ○ updated framework predictions of subsidence and subsidence impacts based on monitoring undertaken to date; and ○ maps indicating the revised timing or onset of mining subsidence impacts in relation to surface features and structures; • Soil and Water – including a revised water balance; • Aboriginal Cultural Heritage – in respect of any additional areas of ground disturbance; • Flora and Fauna – in respect of any additional areas of ground disturbance;	7.2 7.1 7.1.1 7.1.5 Figure 7 & Figure 8 7.4 7.6 7.5
	• Air Quality – including assessment of air quality impacts from the planned operation of methane fuelled gas engines and any planned increased coal processing, stockpiling capacity or ground disturbance; • Hazards – including a Preliminary Hazard Analysis demonstrating that the cumulative offsite risk from all credible incidents on the site will not exceed the risk criteria in the Department's Hazardous Industry Planning Advisory Paper No.4, <i>Risk Criteria for Land Use Safety Planning</i>; • Transport – assess traffic impacts from any increased employment or mine deliveries; • Greenhouse Gas; and • Social and Economic.	7.3 7.10 7.9 7.3 7.11

Issue	Description	EA Section
References	The Environmental Assessment should take into account relevant State and Commonwealth Government technical and policy guidelines. While not exhaustive, the attached list identifies some of the potentially relevant guidelines.	5.0
Consultation	During the preparation of the Environmental Assessment, you should consult with the relevant local, State or Commonwealth Government authorities, service providers, community groups or affected landowners. The consultation process and the issues raised must be described in the Environmental Assessment. In particular you should consult with: • Department of Environment and Climate Change; • Department of Water and Energy; • Department of Primary Industries; • Lake Macquarie City Council; • Mine Subsidence Board; • Mandalong Mine CCC; and • Landowners and occupiers likely to be affected by the proposed modification. The consultation process and the issues raised must be described in the Environmental Assessment.	5.0 5.0 5.0 5.0 5.0 5.0 5.0

Table 10
Key Messages Summary

MANDALONG MINE KEY MESSAGES
EXISTING OPERATIONS • Mandalong Mine is a modern underground longwall mining operation located in the Lake Macquarie area near Morisset. The Mine is situated approximately 130 km north of Sydney supplying coal to domestic and export markets. Mandalong Mine generally comprises: ○ Underground longwall panels and development units with supporting surface infrastructure, near Morisset; ○ Underground workings and surface infrastructure at the Cooranbong Entry Site (formerly Cooranbong Colliery), near Dora Creek; and ○ The Delta Entry Site which encompasses an entry and coal delivery system at the Vales Point Rail Unloading Facility, near Wyee. • Mandalong Mine operates under Development Consent DA 97/800 which was approved in 1998. The supporting document for DA 97/800 is the <i>Cooranbong Colliery Life Extension Project Environmental Impact Statement</i>. • Minor modifications to DA 97/800 in 2001, 2005 and 2006 related to changes to administrative conditions of consent, construction of a gas drainage plant, transport of coal to local power stations and installation of methane gas flare units. THIS MODIFICATION • Mandalong Mine intends to submit an application for modification to DA 97/800 under section 75W of the <i>Environmental Planning & Assessment Act 1979</i> which will be supported by the Mandalong Mine Modifications to Development Consent Environmental Assessment.

MANDALONG MINE KEY MESSAGES	
- Mandalong Mine is seeking to modify aspects of site operations to gain efficiency in its operations. Centennial will be seeking approval from the NSW Government, after consultation with relevant regulators and the local community. The proposed Modifications include: - Construction and operation of gas engines fuelled by coal mine methane gas; - An increase the rate of Run of Mine production from the currently approved 4 Million tonnes per annum to 6 Million tonnes per annum; - Relocation of the approved ballast borehole; and - Update conditions in line with the current Subsidence Management Plan process.	
Public notifications required under the new Department of Primary Industries – Mineral Resources Subsidence Management Plan process are contrary to current consent conditions. As such, Centennial intends to modify its development consent to ensure notifications are consistent with current Department of Primary Industries – Mineral Resources policy. This will result in notifications to potentially affected residences in relation to subsidence impacts being made prior to any gate road development being undertaken and will result in additional notification time than currently required to be provided.	
No coal haulage will be undertaken on public roads.	
The proposed modifications to surface facilities will be undertaken on land being either crown land or owned by Centennial.	
- Centennial is working to assess and develop power generation at Mandalong Mine. The installation will comprise multiple gas engines, with an expected generation capacity of up to 12 Megawatts. The gas engines will be fuelled by coal methane from an existing gas drainage plant. - The Mine is investigating the viability of power generation under the NSW Greenhouse Gas Abatement Scheme, a voluntary program for large energy users to reduce greenhouse emissions and generate abatement credits.	
Centennial is committed to open, two-way communication with all interested parties in relation to the Modification. To this end, regular Newsletters will be distributed to interested stakeholders.	
Centennial is committed to meeting the principles of ecologically sustainable development and participates in research and development programs to develop, implement, monitor and report projects that will assist the company in meeting its commitments.	

5.4 ONGOING CONSULTATION

Centennial Mandalong has an established stakeholder consultation program, which will continue to be implemented throughout the operation of Mandalong Mine. This will include periodic consultation with neighbouring landholders, representatives of key local and state regulatory authorities, industry bodies and the Aboriginal community.

External communications may include:

- The Mandalong CCC;
- External Reporting (e.g. Annual Environmental Management Report (AEMR));
- 24 hour public inquiry and complaints line;

- Open days and community sponsored events;
- Centennial Coal's website;
- Regulatory planning processes; and
- Inspections by regulators.

Internal communications with Centennial Mandalong and Centennial Coal staff occur through verbal communication sessions, toolbox talks, OH&S Committee notice boards, intranet and via e-mail.

6.0 RISK ASSESSMENT

The primary purpose of the Environmental Risk Assessment process was to identify, prioritise and focus the required environmental assessments for this Modification. The key risks identified for each component of this Modification were analysed in accordance with the risk matrix in **Appendix C** determined through input from stakeholders and the Environmental Assessment Requirements. Each risk was based on their probability of occurrence and potential consequences in the absence of mitigation and management measures. Each potential environmental issue was ranked as either being high, medium or a low potential risk to the environment.

Issues were identified through the Environmental Risk Assessment process for each component of this Modification (described in detail in **Section 3.0**). The findings from the Environmental Risk Assessment process are provided in detail in **Appendix C** and summarised in **Table 11**.

The findings from the Environmental Risk Assessment indicated some issues associated with this Modification potentially posed a high environmental risk in the absence of mitigation or management measures, whilst the majority of identified issues were rated as medium to low risk.

The Environmental Risk Assessment provided a general overview of the potential environmental impacts of the proposal, identifying key issues for the further assessment of impacts.

Table 11
Potential Environmental & Social Impact Risk Rankings

Project Component	High Risk	Medium Risk	Low Risk
Gas Engines and Ballast Borehole	Air Quality & Greenhouse, Hazard Potential	Flora & Fauna, Surface & Groundwater, Noise, Visual & Lighting, Traffic & Transport, Aboriginal Cultural Heritage and Non-Aboriginal Archaeology	Rehabilitation
Subsidence Management Plan Conditions			Stakeholder Consultation
Increased Annual Coal Extraction Rate	Air Quality & Greenhouse	Surface & Groundwater	Economics, Vibration & Waste Management

7.0 IMPACTS, MANAGEMENT & MITIGATION

This section of the Environmental Assessment provides a detailed assessment of the environmental issues associated with this Modification as detailed in the Environmental Risk Assessment process as described in **Section 6.0**. The potential environmental impacts of this Modification, as identified throughout the planning and consultation process have been assessed as part of this Environmental Assessment.

The findings of the relevant environmental assessments undertaken for each component of this Modification and a description of the measures that would be implemented to manage and mitigate impacts are presented below.

7.1 SUBSIDENCE

7.1.1 The Department of Primary Industries Subsidence Management Plan Process

In 2004, the NSW Department of Primary Industries introduced the Subsidence Management Plan approval process for all underground coal mining operations in NSW (DPI, 2003a and 2003b). For those operations that already held a mining lease, a new condition was appended to these leases under powers available through Section 239(2) of the *Mining Act 1992*.

As a requirement of the mining lease, all underground coal mines must lodge a Subsidence Management Plan Application for approval with the Department of Primary Industries – Mineral Resources prior to the commencement of any works with the potential for mining induced subsidence. This SMP Application must include:

- A full description of the area proposed to be impacted by mining activity;

- An outline of existing mine workings within the application area, the proposed mine plan and a schedule of proposed mine development for the period to be covered by the Subsidence Management Plan;
- Predictions of the expected extent of subsidence;
- A full assessment of the potential environmental, land use and other impacts;
- An assessment of the economic and social benefits and impacts of the proposed mine development;
- Relevant extracts of associated development consents, licences, and policies of other agencies;
- A description of subsidence projections and actual impacts associated with any previous activities;
- Proposals to minimise impacts of surface subsidence, particularly in areas of environmental, heritage or archaeological sensitivity, or important built surface features;
- Proposals for ground and surface water management;
- Proposals for rehabilitation of subsidence impacts;
- Results of consultation with affected landowners, State and local agencies, and the general community; and
- Details of proposals for ongoing community consultation.

Once a Subsidence Management Plan Application is lodged, it must be advertised and placed on public exhibition for a minimum of 30 days whereby submissions may be made to the Applicant.

The Subsidence Management Plan Application is assessed by an interagency committee comprising senior representatives from Department of Primary Industries – Mineral Resources, the Department of Environment and Climate Change, the Department of Planning and the Mine Subsidence Board. Representatives from other agencies (such as the Sydney Catchment Authority, Dam Safety Committee, Roads and Traffic Authority and Heritage Office) are also involved where appropriate.

The interagency committee considers the application and where approval is granted, develops conditions of approval. The Subsidence Management Plan Application is approved by the Director-General of the Department of Primary Industries. Subsidence Management Plan approvals are restricted to a maximum approval period of seven years and are subject to annual review.

This modification includes an assessment of the proposed amendments to conditions of development consent to ensure consistency with the Department of Primary Industries' Subsidence Management Plan approval process described above (DPI, 2003a and 2003b). This assessment includes an updated framework for predictions of subsidence and subsidence impacts based on monitoring undertaken to date. It also provides a revision of the timing of onset of mining subsidence impacts in relation to surface features and structures compared to that provided in the Cooranbong EIS (see **Figure 7** and **Figure 8**).

7.1.2 Subsidence Related Consent Conditions

Prior to the introduction of the Department of Primary Industries – Mineral Resources Subsidence Management Plan Process, conditions were applied to Mandalong's development consent stipulating requirements in relation to subsidence impacts, landowner notification, landowner compensation and reporting.

The subsidence management process that Mandalong Mine follows for each longwall panel under its conditions of development consent is similar to that required by the Department of Primary Industries – Mineral Resources Subsidence Management Plan Process, in that Mandalong Mine's development consent requires (under Schedule 2):

- The development of Property Subsidence Management Plans in consultation with affected landowners (condition 13(ii), condition 13(iv), condition 14(i), condition 15(i) to (x));
- Notification to landholders (at least two years prior to extraction by Longwall mining) (condition 13(iii), condition 21, condition 22);
- Each Property Subsidence Management Plan is to include:
 - Updated geological data based on current knowledge (condition 14(ii));
 - Revised mine plan based on current geological knowledge (condition 14(iii));
 - Revised subsidence predictions taking into account results of subsidence monitoring undertaken (condition 14(iv));
 - Structural inspection of each structure including structural integrity of all building in their entirety (condition 14(v));
 - Surveyed drainage channels within and adjacent to relevant properties (condition 14(vi));
 - An assessment of current agricultural utilisation, improvements and suitability (condition 14(vii));
 - A review of the current land use for business purposes, including business and improvement value (condition 14(viii));

- Inspections carried out by an independent and technically qualified person in consultation with relevant landowners (condition 14(xi));
- Revised surface water modelling taking into account changes to mine planning or subsidence predictions and identification of areas that may require further mitigation works to minimise impacts (condition 14(x), condition 14(xi));
- A review of potential changes to the flood hazard category and evacuation requirements (condition 14(xii));
- Adherence to the Flood Policy Objectives within the NSW 'Floodplain Management Manual' (condition 14(xiii)) ; and
- Improvements to agricultural productivity where surface remedial works can be used to improve such productivity (condition 14(xiv)).
- The identification of dwellings likely to be subject to damage beyond safe, serviceable and repairable criteria as a result of the development (condition 15(iii));
- The identification of structures likely to be subject to significant damage as a result of the development (condition 15(iv));
- The identification of agricultural or other business values likely to be affected by the development (condition 15(v));
- On site meetings with relevant landowners to review draft Property Subsidence Management Plan in conjunction with the Mine Subsidence Board where dwellings are predicted to be beyond the safe, serviceable and repairable criteria (condition 15(vi));
- An investigation into feasible mitigation measures that can be implemented to reduce subsidence impacts, in consultation with the Mine Subsidence Board, and to landowner satisfaction (condition 15(viii));
- An investigation into other options such as compensation, acquisition, temporary relocation, and identification of areas of likely compensable loss in consultation with affected landowners (condition 15(viii), condition 15(ix) and condition 15(x));
- The implementation of Property Subsidence Management Plans (condition 16);
- Payment of reasonable costs for landowners to obtain legal and other advice on Property Subsidence Management Plans (condition 17);
- The preparation and implementation of Longwall Subsidence Management Plans and ensure each Longwall Subsidence Management Plan includes each relevant Property Subsidence Management Plan (condition 18, condition 19);
- Subsidence monitoring to be undertaken in consultation with Department of Water and Energy (former DLWC) and the Department of Primary Industries – Mineral Resources (former DMR) (condition 20);
- Acquisition and compensation where significant structural damage to dwellings is or is likely to be beyond the safe, serviceable and repairable criteria, or where a dwelling has or would have a subsided floor level below the design predicted post mining flood level or where a landowner suffers a loss of agricultural productivity or other adverse impact (condition 27, condition 28, condition 29).

These conditions, combined with the Department of Primary Industries – Mineral Resources Subsidence Management Plan Process, have resulted in the development of a complex process for meeting both development consent and subsidence approval requirements.

Mandalong are seeking to modify the above conditions of its development consent to provide a more consistent approach to subsidence management between the Department of Planning development approval and the Department of Primary Industries - Mineral Resources' Subsidence Management Plan Process. Mandalong is not seeking to modify any other condition related to subsidence or subsidence management within its consent.

Section 3.1.4 and **Appendix A** provide a description of conditions proposed to be amended as part of this Modification in relation to subsidence impacts, landowner notification, compensation and reporting requirements.

The proposed modifications to conditions of development consent are consistent with the current Department of Primary Industries - Mineral Resources Subsidence Management Plan Process and enable flexibility should this process vary with time. Adopting these proposed conditions will ensure that the Subsidence Management requirements are consistent with other underground coal mining operations in NSW. **Appendix A** confirms where these conditions are incorporated in the Department of Primary Industries' Subsidence Management Plan Process.

7.1.3 Existing Environment

The approved mine plan as presented in the Cooranbong EIS utilises a 250 m wide panel design with a maximum predicted subsidence of 2.91 m. Key conditions of the development consent require landowner agreement if the mine forecasts subsidence impacts to dwellings beyond a safe, serviceable and repairable condition, impacts on use of land or creates a flood hazard.

These conditions of development consent have influenced Centennial's decision to establish a more conservative design in order to ensure that a balance existed between the sustained viability of the operation and the interest of stakeholders.

In 2003, Centennial decided to adopt a layout that utilised relatively narrow longwall widths as well as the presence of a massive conglomerate beam in the overlying strata to ensure reduced levels of subsidence.

Seedsman Geotechnics uses an analytical engineering approach to model subsidence using the Voussoir Beam theory. This theory examines the behaviour of the overlying rock strata above the coal seam. In particular, the conglomerate forms a beam which spans across the extracted longwall panel and bends rather than breaking, resulting in reduced levels of subsidence. This approach requires that subsidence and stability be considered as two components; the sag that develops above the extracted longwall panels; and the subsidence that develops above the remaining pillars adjacent to each longwall panel.

Mining commenced in January 2005 with Longwall panel 1 and has successfully continued through the extraction of Longwalls 2, 3 and 4 with a void width of 125 m. Longwalls 5 and 6 have since been extracted with an increased void width of 160 m. Subsidence Management Plan approval has been granted to extract Longwall 7 and the subsequent Longwalls 8 to 10 at the same width.

7.1.4 Previous Subsidence Predictions & Observed Impacts

Given the degree of uncertainty around the potential effects of geological features in the area, the approved mine plan as presented in the Cooranbong EIS utilised a number of Longwall panel widths, to a maximum 250 m wide panel design. Vertical subsidence was predicted in the Cooranbong EIS to be between 1.5 m (125 m panel) and 2.91 m (250 m panel). Mandalong commenced extraction of Longwall 1 at a reduced Longwall width (125 m).

Initial subsidence predictions did not fully take into account the extent to which unknown geological features may impact subsidence locally. With actual subsidence experienced within that which was predicted, an increased Longwall width (160 m) was introduced. Revised subsidence predictions, approved under Subsidence Management Plan Approval for Longwall 3 to 5 indicated that with a 160 m void width, subsidence effects could be managed within the approved development consent footprint (**Table 12**).

Mining commenced in Longwall 1 in January 2005. Longwall 1 and Longwall 2 were completed in August 2005 and March 2006 respectively. Extraction of Longwall 3 commenced in April 2006 and was completed in September 2006. Longwall 4 commenced extraction in October 2006 and was completed in April 2007. Longwall 5 commenced in June 2007 and was completed in December 2007. Longwall 6 completed extraction in September 2008, with Longwall 7 scheduled to commence extraction in October 2008.

Initial subsidence impacts were predicted in the Cooranbong EIS and are listed in **Table 12** and **Table 13**. With the introduction of the Department of Primary Industries – Mineral Resources Subsidence Management Plan Process, and through the Longwall 3 to 5 Subsidence Management Plan Approval, predictions were revised for Longwalls 5 through to 10 based on a panel width of 160 m.

7.1.5 Updated Framework Predictions and Potential Impacts of Subsidence

One of the core elements of the Department of Primary Industries – Mineral Resources Subsidence Management Plan Process is undertaking a risk assessment to determine and predict subsidence impacts from mining. Mandalong recently obtained approval from the Department of Primary Industries – Mineral Resources for extraction of Longwall 8 to 10. A component of this Subsidence Management Plan Application was the risk assessment. This risk assessment determined the management and mitigation strategies were consistent with consent

conditions and Subsidence Management Plan requirements for Longwalls 8 to 10.

The risk assessment involved a structured methodology to assess the risk of subsidence to properties, natural features and infrastructure.

This risk assessment assessed whether:

- Dwellings or associated structures are likely to be exposed to subsidence levels which are likely to cause subsidence impacts beyond Safe, Serviceable & Repairable;
- Significant natural features are likely to be influenced beyond acceptable levels of subsidence;
- Dwellings are subject to a change in Flood Hazard Category; and
- Public infrastructure or significant man made improvements are influenced beyond the tolerance of the structure and therefore resulting in a loss of service (e.g. telephone).

Within the Subsidence Management Plan Application for Longwalls 8 to 10, Mandalong revised its subsidence predictions based on a panel width of 160 m, known surface impacts and previous subsidence monitoring results (see **Table 12** and **Table 13**). Revised predictions for Longwalls 6 to 10 are included in **Table 12**.

Subsidence predictions have not been revised for subsequent Longwall panels. Instead, these will maintain a maximum subsidence envelope of 250 m wide panels, and 2.91 m vertical subsidence in accordance with the existing development consent (**Figure 7**). Any change to the mine plan beyond Longwall 10, will include a detailed review of subsidence predictions as an integral part of future Subsidence Management Plan Applications through the Department of Primary Industries – Mineral Resources Subsidence Management Plan Process.

7.1.6 Impact Assessment

Subsidence monitoring is conducted as per the subsidence monitoring program approved by the Department of Primary Industries Principal Subsidence Engineer under the conditions of the Subsidence Management Plan Approval. This monitoring program currently requires the reporting of subsidence levels in the subsidence affectation zone at Mandalong Mine on a four monthly basis to a range of stakeholders.

Subsidence monitoring results for extraction to date are included in **Table 12**. The actual impacts of this subsidence compared against the predicted impacts are included in **Table 13**.

Measured subsidence associated with the fault zone is consistent for Longwall 1 to Longwall 3, being up to 1.2 m. However, significantly less subsidence has occurred above Longwall 4, and to date, there is no evidence of increased subsidence associated with the fault zone on Longwall 5.

Monitoring at all residences indicate impacts are within predictions and are well below Safe, Serviceable & Repairable criteria. Visual inspections of the surface areas above the Longwall are undertaken in accordance with the Department of Primary Industries approved Subsidence Monitoring Program. These visual inspections examine features such as damage to dwellings/improvements/infrastructure and also any surface deformations (including cracking).

Consultation with private landowners and utility providers involves regular contact to identify if subsidence effects on property features or services have occurred. The subsidence monitoring and consultation with landowners completed to date has identified the subsidence impacts in **Table 13**.

With ongoing monitoring and review of subsidence impacts it is clear that geological features have a localised impact on subsidence. For example, subsidence monitoring over Longwall 5 has recorded a maximum vertical subsidence of 0.82 m over an isolated zone associated within the steep in-seam roll.

Mandalong has recognised these effects through the Department of Primary Industries – Mineral Resources Subsidence Management Plan Process and has developed a number of management plans to take the effect of geological structures into account. These include:

- Property Subsidence Management Plans;
- Infrastructure Management Plans for roads, power lines, communication cables;
- Public Safety Management Plans; and
- Environmental Management Strategy and supporting management plans.

Table 13 describes the predicted impacts within the development consent and subsequent Subsidence Management Plan applications. The actual observed impacts associated with Longwall extraction at Mandalong are within those predicted under both government processes.

The existing Mandalong development consent and its associated development footprint approved a series of parallel Longwall panels with design width of up to 250 m and, as predicted in the Cooranbong EIS, the maximum vertical subsidence levels are 2.91 m. In the absence of revised predictions through the Department of Primary Industries – Mineral Resources Subsidence Management Plan Process, these maximum predicted levels of subsidence shall be utilised. Where it can be demonstrated through the Department of Primary Industries – Mineral Resources Subsidence Management Plan Process, in consultation with relevant stakeholders, and where Safe, Serviceable and Repairable criteria can be maintained, Mandalong will operate within the maximum approved footprint under its existing development consent.

The current subsidence predictions up to Longwall 10 have been approved by the Department of Primary Industries – Mineral Resources through both the Subsidence Management Plan Longwall 6 and Longwall 7 and the Subsidence Management Plan for Longwalls 8 to 10. A Subsidence Management Plan

Application for Longwalls 11 to 14 is currently being developed with longwall panel width of 160 m. A digital copy of the Longwall 8, 9 and 10 Subsidence Management Plan Application is attached to this document.

Longwall panels beyond Longwall 14 are subject to ongoing exploration and mine planning. Longwall panel width is yet to be determined with options being evaluated ranging between the current 160m wide and

250 m wide longwalls approved in the development consent. The evaluation will consider costing and lead time for acquiring additional mining equipment for increased longwall panel width, geology as well as subsidence impact assessment against the Subsidence Management Plan process and the existing requirements of the development consent.

Table 12
EIS Predicted, Actual and Approved Subsidence *

Current Mine Plan	Cooranbong EIS Longwall	EIS Prediction (m)	Actual Subsidence (m)	Actual Subsidence As Affected by Geological Feature (m)	Approved Subsidence (m) **
1	1	1.50	0.41	0.87	-
2	1	1.50	0.55	1.36	-
3	1	1.50	0.53	1.22	-
4	1	1.50	0.40	0.67	-
5	2	2.91	0.73	1.01	-
6	3	2.91	0.82*	0.68*	1.20
7	4	2.91	-	-	1.60
8	4	2.91	-	-	1.40
9	5	2.91	-	-	1.20
10	5	2.91	-	-	1.20

* Approved by Department of Primary Industries – Mineral Resources following lodgement of Subsidence Management Plan Applications for Longwalls 7 and 8 to 10

** As at September 2008.

Table 13
Mandalong Predicted & Observed Subsidence Impacts

EIS Predicted Impact	SMP Predicted Impact	Observed Impact
Strains on 10% of dwellings beyond SSR (MSB Damage Category 4 and 5) Tilts on 37% of dwellings beyond SSR (MSB Damage Category C and D)	No dwellings or associated structures beyond safe, serviceable and repairable. The subsidence predictions resulted in an interpreted level of safe, serviceable and repairable as: Tilts <7mm/m Strains <5mm/m.	No dwellings or associated structures beyond safe, serviceable, repairable for Longwall 1-6. Minor effects on dwelling above previous Longwall 1-3 including minor cracks to brick, tiles, concrete floors and grade changes to a constructed drain. Minor effects on Longwall 4-6 include surface cracking on a private property road and concrete slab.
Eleven dwellings to have less freeboard and three to have flood levels below the 1 in 100 year ARI water level as a result of subsidence.	No change to Flood Hazard Category on dwellings and access in consideration of 1 in 1 and 1 in 100 year rainfall events.	Actual subsidence levels in floodplain has not changed the flood hazard category to dwellings or access to date.
Modelling indicates that surface ponding will increase as a result of mining unless drainage mitigation works undertaken.	Some minor ponding as a result of elevated subsidence in localised fault zone areas on the floodplain with mitigation works to be undertaken as required.	Fault zone areas on Centennial owned and one private property experienced minor ponding. Drainage works on Centennial Coal property have been installed to make area free-draining. Minor ponding on Longwall 4 to be remediated.

EIS Predicted Impact	SMP Predicted Impact	Observed Impact
Mitigation works and repair will be required for public infrastructure including transmission towers/lines, communication networks and roads.	No public infrastructure or significant improvement influenced beyond the tolerance of the structure or loss of service.	Subsided section of Deaves Road, fibre optic and power cables not influenced beyond subsidence tolerance. No loss of services or damage. Minor repairs required to Mandalong Road.
Unlikely that mining will result in vertical drainage of the surface alluvial aquifer. Some tension cracking of the upper soil layer and underlying rock layers allow temporary passage of water from layer to layer.	No adverse impacts on alluvium groundwater levels or quality as a result of mining induced subsidence.	Alluvium groundwater levels trending with cumulative rainfall deficit. No indication of changes following mining above Longwall 1-5.
Potential for creek bed realignment and restriction of drainage paths requiring creek bed lowering and construction of additional surface drains.	Minimal changes to creek channel flows or alignment.	Minimal changes to creek channel flows, no mining induced erosion or bed/bank realignment.
Some tension cracking of the upper soil layer and underlying rock layers allow temporary passage of water from layer to layer.	Surface cracking not expected on alluvium and some minor cracking in rock head areas.	Minor soil cracking on higher areas above Longwall 5 and on some exposed rock head areas.
Hydrologic modelling indicated that changes to wetlands habitat from drying out, change in shape or extent, while additional areas may become wetland habitat from inundation.	No net loss of flora and fauna habitat, some minor soil changes with localised changes to vegetation types.	No changes to vegetation types caused by changes to soil condition. No observed changes in flora and fauna habitat.

7.1.7 Management & Mitigation

As described above, subsidence impacts at Mandalong will be managed through the Department of Primary Industries – Mineral Resources Subsidence Management Plan Process within the approved development footprint in the existing Mandalong Mine development consent. Future subsidence applications will be undertaken using the most up to date and relevant information available and will include requirements outlined in the relevant Department of Primary Industries' guidelines. Mitigation measures, should actual impacts fall outside predictions, will continue to be implemented in accordance with an approved Subsidence Management Plan.

Modifying the current conditions of Mandalong's development consent, as proposed, will provide greater clarity to stakeholders on the role of the

Department of Planning and Department of Primary Industries in the management of subsidence at the Mandalong Mine.

Process Improvement

Subsidence monitoring during the extraction of Longwalls 1 to 6 have indicated that the mine design is sensitive to geological features including faulting and steep seam rolls. The location of geological features is determined through surface exploration, underground drilling and mapping. Known geological features are incorporated in the subsidence modelling and prediction with their potential impacts managed through the management plan process.

With these influences and the above mitigation in mind, the key elements of subsidence management process include:

- Continual comprehensive subsidence monitoring programs approved by the Department of Primary Industries – Mineral Resources Principal Subsidence Engineer;
- Continual review and calibration of subsidence modelling;
- Structured decision making through Department of Primary Industries – Mineral Resources Subsidence Management Plan Process and Trigger Action Response Plans to manage impacts of predicted and anomalous subsidence on surface improvements and natural features;
- Refinement of existing community consultation; and
- An “Independent Panel” to monitor subsidence management performance and assist stakeholders in assessing and understanding subsidence information.

7.2 NOISE

A Noise Impact Assessment for this Modification has been completed by Bridges Acoustics and is presented in **Appendix D** with a summary presented below.

7.2.1 Background

The Noise Impact Assessment included a consideration of mining noise, gas engine noise, vibration impacts and road and rail traffic noise for the entire Mandalong Mine (incorporating the approved operation and this Modification). The assessment is summarised below and has been prepared in accordance with:

- The *NSW Industrial Noise Policy* (INP) (EPA, 2000);
- The *Environmental Noise Control Manual* (ENCM) (EPA 1985); and
- The *Environmental Criteria for Road Traffic Noise* (ECRTN) (EPA, 1999).

Previous noise impact assessments at Mandalong (including that in the Cooranbong EIS) were completed prior to the introduction of current noise assessment policies, such as the INP. This assessment therefore assesses the existing Mandalong Mine in conjunction with this Modification in accordance with the INP.

This assessment has developed updated noise criteria and involved the reassessment of existing noise levels consistent with current guidelines and policies.

Table 3 lists landownership in the vicinity of Mandalong Mine whilst **Figure 3** and **Figure 4** illustrate Receivers surrounding Mandalong and allocates each property an individual identification number, highlighting if a residence is situated on that property. Both should be read in conjunction with this section.

7.2.2 Methodology

Background Noise Levels

An investigation into existing environmental noise levels was undertaken to determine appropriate noise criteria for this assessment according to procedures recommended in the INP. Noise surveys were conducted to measure existing background and ambient noise levels using a combination of long term unattended noise monitoring and short term operator-attended noise measurements at the following four locations as shown on **Figure 10 to Figure 12**:

- M1 – Representative of residences 64, 103, 112, 114 and 115 near the proposed ballast borehole;
- M2 – Representative of residences 82, 97, 107 to 110, 124 and 126 west of the Access Site;
- M3 – Representative of residences 57, 66, 72, 85 and 86 east of the Access Site; and
- M4 – Representative of residences 22, 23, 26, 28 and 32 near the Services Site.

Further discussion of the measured background level at each location is provided below.

M1 and M3

During the attended noise surveys at M1 and M3, it was observed that background noise levels in this area were dominated by a combination of F3 Freeway traffic, frogs and insects. The measured background noise level at M1 and M3 therefore includes a combination of traffic and insect noise.

To ensure long term background noise levels are not overstated, 3 dBA has been subtracted from the measured night background level to remove any influence from insects.

M2

Observations and measurements at monitoring location M2 indicate the F3 Freeway is a major source of background noise during all time periods, whilst insect noise was often dominant during the night.

An analysis of the measured background noise levels was completed, assuming noise levels measured in the frequency bands above 2000 Hertz (Hz) were almost entirely due to insects. If high frequency insect noise is excluded and only the frequency range 50 Hz – 2000 Hz is considered at M2, then the measured background noise level reduces to 37 $L_{A90,15min}$. A conservative night background level of 37 $L_{A90,15min}$ is therefore adopted at M2 to ensure long term levels are not overestimated.

M4

Observations and measurements at monitoring location M4 indicate traffic on the F3 Freeway and Wangi Road, insects, Eraring Power Station and the Services Site are all audible at times.

Insect noise tends to increase and become dominant during the evening and night at this location.

Similar to M2, an analysis of the measured background noise levels found that noise levels measured in the frequency bands above 2000 Hz was almost entirely due to insects. Therefore, if high frequency insect noise is excluded and only the frequency range 50Hz – 2000Hz is considered, then the measured background noise level reduces to 34.4 $L_{A90,15min}$. A background noise level of 34 $L_{A90,15min}$ is therefore adopted at M4 which excludes all insect and mining noise. As it is reasonable to assume some insect noise would occur in all seasons, the adopted background level is considered very conservative.

Adopted Background Noise Levels

Based on the analysis and discussion presented above for each noise monitoring location. **Table 14** summarises the adopted background noise levels. Entries shown in **bold font** have been reduced below the actual measured background levels, primarily to remove the influence of insect noise and existing mining noise.

Table 14
Adopted Background & Ambient Noise Levels

Monitoring Location	Background ($L_{A90,15min}$)			Ambient ($L_{Aeq,15min}$)		
	Day	Evening	Night	Day	Evening	Night
M1 - Ballast Borehole	39.9	43.2	35.8	50.2	49.8	47.4
M2 - West of Mine Access Site	49.0	48.8	37.0	64.4	62.0	58.8
M3 - East of Mine Access Site	55.6	50.6	42.9	64.4	58.0	56.9
M4 - Services Site	41.6	41.6	34.0	55.6	55.8	54.0

Assessment Criteria

Mining Noise

In accordance with the INP, intrusive criteria are set 5 dBA above the background noise level for each time period. Intrusive noise criteria listed in **Table 15** should be considered as being the levels above which some noise impact may be noticed by receivers. Louder noise levels at a receiver do not necessarily imply the noise is unacceptable at that location.

Amenity limits as recommended in the INP have been applied to this assessment. All receivers, with the exception of those near M3, are considered to be in the 'rural' amenity category outlined in the INP. Monitoring location M3 is significantly affected by F3 Freeway noise during all time periods, so it is reasonable to consider high traffic noise amenity criteria at this location.

Table 15 shows the intrusive and amenity criteria applied to each receiver area. Amenity criteria are based on the high traffic category for M3 and on the rural category for all other receivers.

The lowest of the intrusive or amenity criteria are normally adopted as the limiting criteria for each receiver.

Sleep Disturbance

Disturbance to sleep can occur when a short, sharp noise that is clearly audible over the background noise level occurs. Sleep disturbance criteria are sourced from the State Pollution Control Commission (now Department of Environment and Climate Change) ENCM which recommends an $L_{A1,1min}$ limit of 15 decibels above the background noise level during the hours of 10:00 pm to 7:00 am, or to 8:00 am on Sundays and public holidays. Sleep disturbance criteria based on the adopted night background levels are listed in **Table 16**.

Table 15
Adopted Mining Noise Criteria at Residences

Receiver Area	Intrusive Criteria ($L_{Aeq,15min}$)			Amenity Criteria ($L_{Aeq,period}$)		
	Day	Evening	Night	Day	Evening	Night
M1 – Near Ballast Borehole	45	48	41	50	45	40
M2 – West of Mine	54	54	42	50	45	40
M3 – East of Mine	60	56	48	54	48	47
M4 – Near Mine Services Site	47	47	39	50	45	40

Table 16
Adopted Sleep Disturbance Criteria

Residential Areas *	Sleep Disturbance Criteria ($L_{A1,1min}$)
M2 – West of Mine	52
M3 – East of Mine	58
M4 – Near Services Site	49

* M1 - Borehole site not included due to operation during daytime only.

Weather Conditions

Data from Centennial Mandalong's weather station, for the period January 2002 to July 2007 was analysed to determine appropriate weather parameters for use in this assessment. The analysis indicated that a wide range of wind directions occur at Mandalong, with south west to westerly winds reasonably common during the day and evening in autumn and winter. East to south easterly winds were dominant during summer evenings. An analysis of temperature inversions concluded an occurrence in this area for up to 23% of the time and therefore are not required to be assessed, as the INP only requires inversions to be assessed when they occur for over 30% of the time. The prevailing weather conditions used in this assessment are shown in **Table 17**.

Plant Sound Power Levels

Sound Power Levels (SPL) were confirmed for all existing items of **stationary** plant in April 2008 via field measurements by Bridges Acoustics. A combined sound power level of 102 dBA from all **gas** engines, except standby units, when measured according to AS1217 or equivalent standard will be met to meet modelled predictions as presented in this Environmental Assessment.

For modelled equipment locations, please refer to **Appendix D**.

Table 17
Prevailing Weather Conditions

Period	Conditions
Day (7:00 am – 6:00 pm)	No wind; 20° C air temperature; 70% relative humidity; and -2.0° C/100 m lapse representing a warm sunny day.
Evening (6:00 pm – 10:00 pm)	3 m/s winds from the east; 15° C air temperature; 70% relative humidity; and No vertical temperature gradient.
Night (10:00 pm – 7:00 am)	No wind; 10° C air temperature; 80% relative humidity; and No vertical temperature gradient.

7.2.3 Impact Assessment

Mining Noise Levels

Environmental noise levels produced by this Modification have been calculated using the Renzo Tonin & Associates' Technology's Environmental Noise Model (ENM) software. ENM is a general purpose noise modelling package that combines terrain and noise source information with other input parameters such as weather conditions to predict noise levels at specific receiver locations or as contours over a specified receiver area.

Predicted noise levels include proposed noise mitigation measures discussed further in **Section 7.2.4** and represent worst-case operation of Mandalong Mine with all equipment operating under noise enhancing weather conditions.

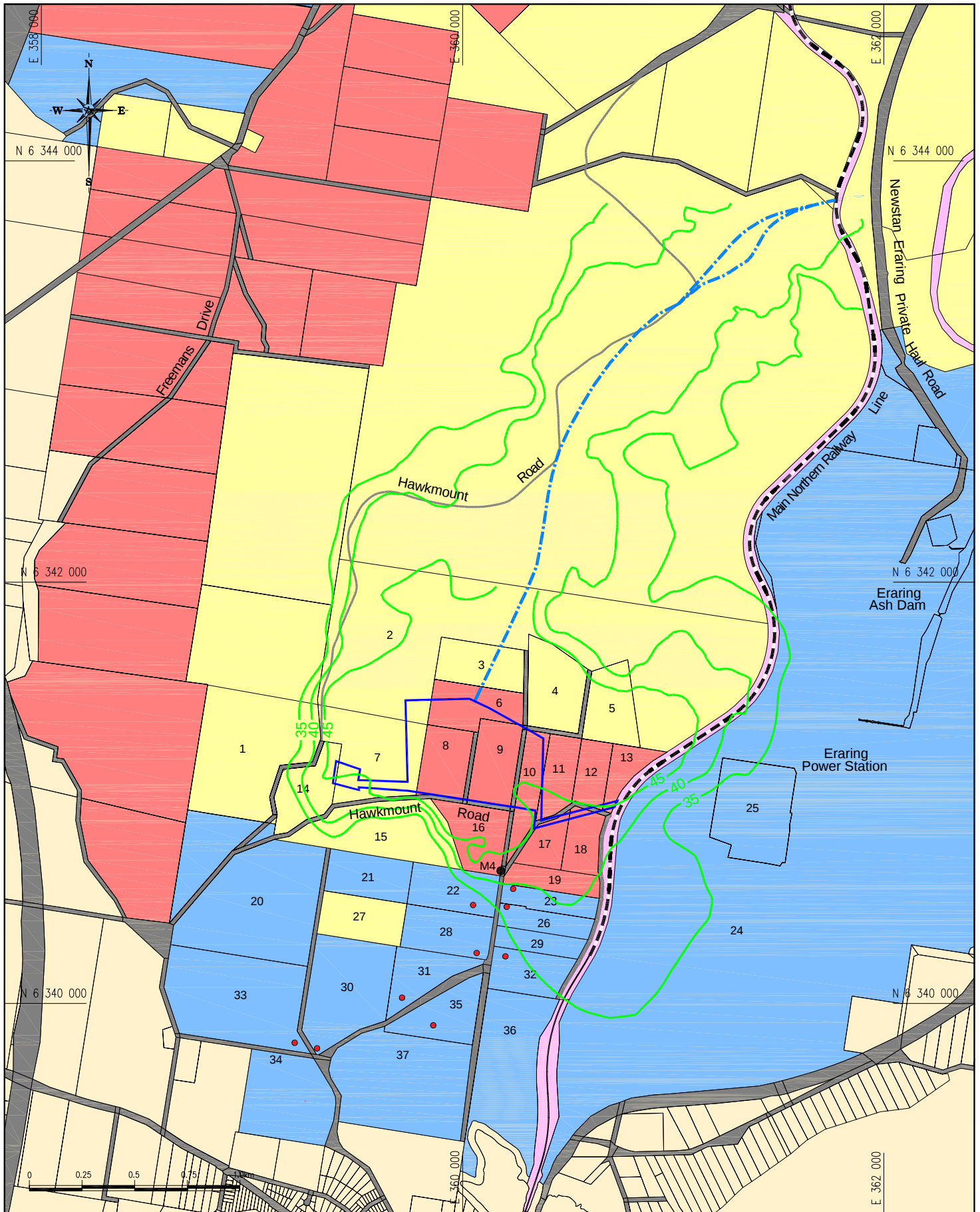
While this situation may occur occasionally, noise levels will generally be lower than the predicted levels for much of the time.

A summary of the predicted received noise levels at private receivers under prevailing weather conditions (i.e. worst-case) is shown in **Table 18** (all other receivers are predicted to receive 25 dBA or less in all time periods). **Table 18** shows that predicted noise levels are to be within adopted noise criteria at all residences. **Figure 10**, **Figure 11** and **Figure 12** illustrate selected predicted noise levels as noise contours for this Modification under prevailing weather conditions during the day, evening and night at selected locations.

Table 18
Summary of Predicted Noise Levels at Receivers

Receiver	Received Level ($L_{Aeq,15min}$) by Time Period				Noise Criteria	
	Day	Evening	Night	Gas Engines *	Intrusive ($L_{Aeq,15min}$) D/E/N	Amenity ($L_{Aeq,period}$) D/E/N
22	29	31	31	-	47/47/39	50/45/40
23	36	39	39	-		
26	33	36	36	-		
28	27	29	29	-		
32	30	33	33	-		
57	29	27	31	27	60/56/48	54/48/47
66	35	32	36	34		
72	37	34	39	37		
85	37	34	38	36		
86	34	31	36	32		
89	34	31	36	31	54/54/42	50/45/40
82	29	35	30	< 25		
97	34	39	35	30		
109	33	33	34	25		
110	34	32	36	25		

* Received noise levels from only two sources (the gas engines and flares) operating during the night.



- Noise Contours (dBA)
- - - Approved Haul Road
- Services Site
- Centennial Coal
- Crown Land
- Freehold Land
- Unknown
- NSW State Railway
- Roads
- M4
- Noise Monitoring Location
- Residences



Source Bridges (2008)
Co-ordinate System MGA Zone 56

MANDALONG MINE

Services Site Noise Contours Evening & Night

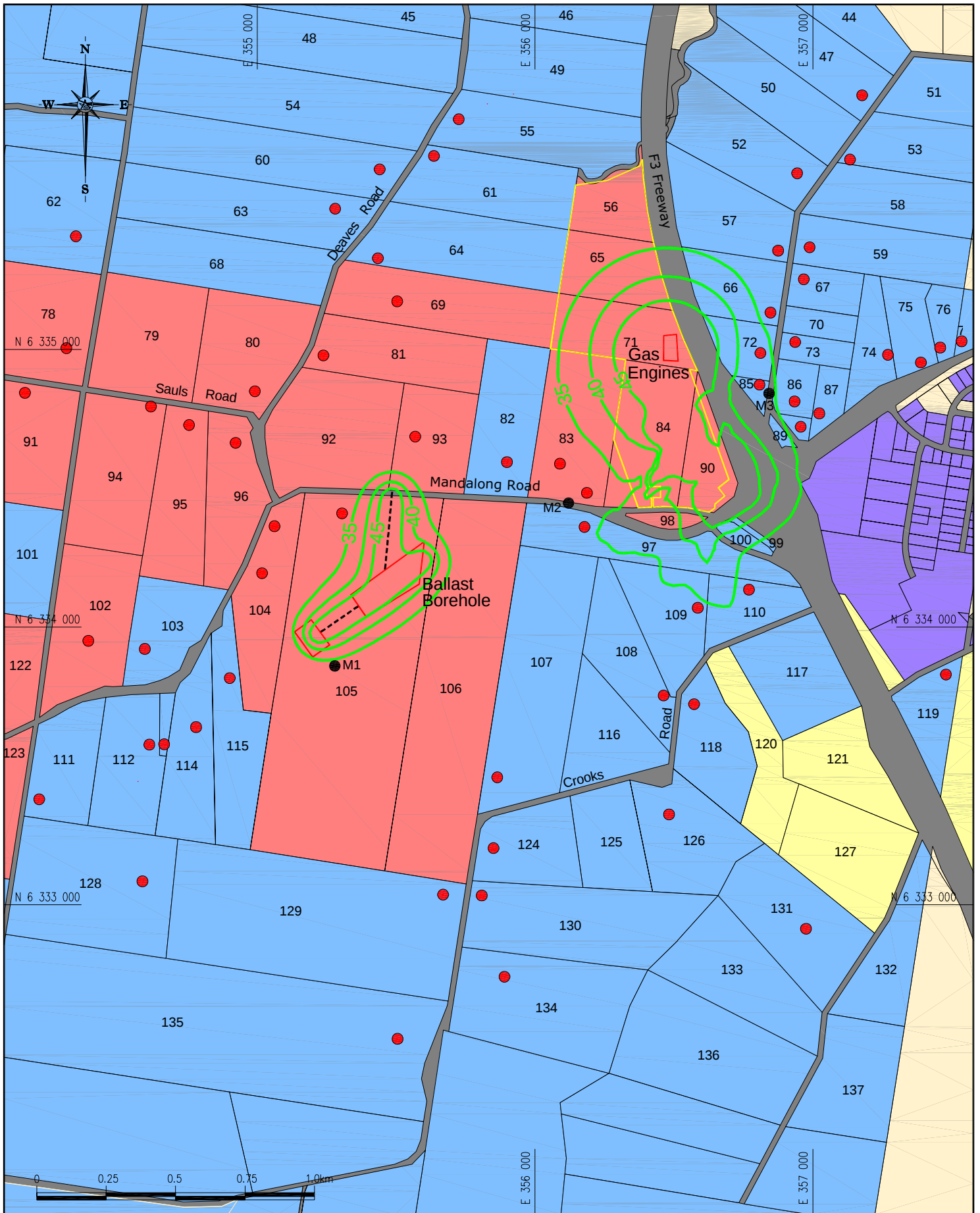
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Figure

10



Noise Contours (dBA)
 Survey Area
 Access Roads Survey Area
 Access Site
 Centennial Coal
 Crown Land
 Freehold Land
 Freehold Industrial Land
 Unknown
 Roads
 Residences
 Noise Monitoring Locations

Hansen Bailey

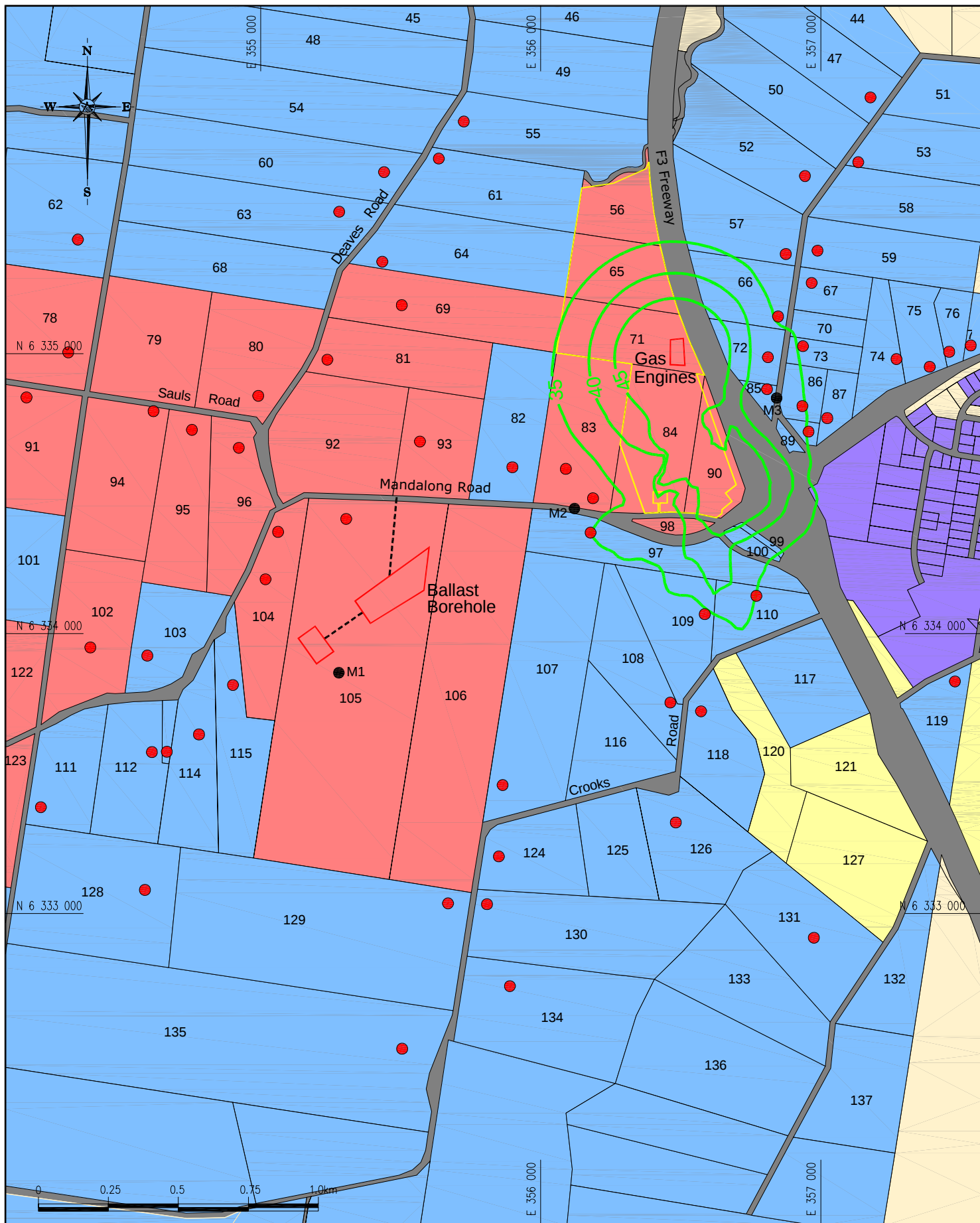
Source Bridges (2008)
 Co-ordinate System MGA Zone 56

MANDALONG MINE

Access Site Noise Contours Day

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Figure
11



Hansen Bailey

Centennial Coal
Mandalong

Source Bridges (2008)
Co-ordinate System MGA Zone 56

MANDALONG MINE

Access Site Noise Contours Night

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Figure
12

Sleep Disturbance

Mine site sources having the potential to disturb sleep include Eimco bucket impacts, reverse alarms, vehicle horns and the operation of the Coal Handling and Preparation Plant. These sources currently have the potential to occur on the mine site and the situation is not expected to change as a result of this Modification.

The approved coal truck movements at the Services Site (that have not yet commenced) also have the potential to cause impact noise to nearest residences. An analysis of impact noise from coal falling into a truck body found that worst-case noise impacts may approach the sleep disturbance criterion while normal operation of the site is unlikely to cause maximum noise levels to approach the criterion.

The assessment found the expected noise impacts are well within the normal range of noise levels that occur at each residence and are unlikely to disturb a resident's sleep. However, notwithstanding the low probability of disturbance to residents as a result of occasional impact events, Centennial Mandalong will continue to manage site operations to minimise the occurrence of such events.

Road Traffic Noise

The *Cooranbong Life of Mine Environmental Impact Statement* predicted traffic noise levels associated with Mandalong Mine. The proposed 305 full time equivalent personnel would generate less than 600 vehicle movements per day to and from the Access Site and would therefore not exceed the previously assumed limit of 100 one way vehicle movements associated with shift changes. As traffic flows associated with the Mandalong Mine Access Site would not increase over approved levels, a detailed assessment of traffic noise from additional vehicle movements to the Access Site is not warranted.

The proposed ballast borehole is the only component of this Modification which has the potential to increase traffic noise levels from public roads, apart from some short term increases in traffic flows during the initial construction phase.

Worst-case truck movements are expected to result in received noise levels of 43 and 41 $L_{Aeq,1hr}$ compared to a criterion of 55 $L_{Aeq,1hr}$ for local roads recommended by the ECRTN. The proposed truck movements to and from the ballast borehole site are unlikely to reach or exceed relevant traffic noise criteria at any receiver.

Ground Vibration

This Modification does not include any changes to mining methods or equipment, with the proposed increase in annual production being achieved via increased efficiency and equipment utilisation rather than additional or larger equipment. This Modification is therefore unlikely to increase ground vibration levels above pre-existing levels.

7.2.4 Mitigation & Management

Centennial Mandalong will implement noise control measures on the proposed gas engines by enclosing the engines within a suitably designed structure. This strategy will typically utilise appropriately designed building facade and engine cooling systems to provide the necessary level of noise control.

Centennial Mandalong will continue to actively monitor noise levels as a result of their operations, particularly focusing on any night impacts which may create sleep disturbance.

A combined sound power level of 102 dBA from all engines, except standby units, when measured according to AS1217 (or equivalent) will be utilised for design purposes to meet modelled predictions as presented in this Environmental Assessment.

Centennial Mandalong will also revise the existing Noise Management Plan for this Modification to the satisfaction of the Department of Planning. The current noise monitoring program will continue to be relied upon to ensure the predicted noise impacts and criteria are achieved.

7.3 AIR QUALITY & GREENHOUSE

An air quality and greenhouse gas impact assessment for the various components of this Modification has been undertaken by Holmes Air Sciences and is provided in full in **Appendix E**. A summary of the assessment is provided below.

7.3.1 Background

The air quality and greenhouse gas impact assessment provides a consideration of the following aspects associated with this Modification:

- Air quality impacts in relation to emissions from the operation of the gas engines;
- Greenhouse gas impacts in relation to the gas engines and the increase in rate of coal extraction; and
- Dust impacts from the construction of the other minor components of this Modification.

The assessment was prepared following the procedures outlined in the Department of Environment and Climate Change's *"Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW"* (DEC, 2005) and the Environmental Assessment Requirements.

7.3.2 Methodology

Gas Engines

Emissions due to the operation of the gas engines (namely Carbon Dioxide, Nitrogen Oxide and Sulphur Dioxide) were predicted using AUSPLUME (Version 6.0) model software.

The modelling undertaken utilised local meteorological data (see **Appendix E**) and assumed nitrous oxide and other emission characteristics for each power generating unit from a previous study for a proposed landfill gas power station at Marsden Park, prepared by Holmes Air Sciences in 2004. The modelling accounted for gas engine exhaust stack emissions and identified concentrations of pollutants emitted from the stacks at ground-level receptors.

The model considered two cases of gas engine design configuration, including:

- Case 1 - six by 2 Megawatt engines; and
- Case 2 - two by 6 Megawatts engines.

For the purposes of modelling, and to cover the worst-case scenario, it has been assumed that the cluster of gas engines will be comprised of six units (i.e. Case 1). Each unit would consist of a five metre high "shipping container" type structure housing combustion engines and associated generator. At least a 10 m high exhaust stack would be associated with each unit to dispose of combustion gases. The gas engines have been assumed to be in operation for up to 24 hours per day.

Greenhouse Gas

This assessment was prepared in accordance with the Australian Greenhouse Office *"AGO Factors and Methods Workbook"* (AGO, 2006) and the Environmental Assessment Requirements.

Two key aspects associated with greenhouse gas impacts have been assessed for this Modification:

- The greenhouse gas emissions associated with the proposed accelerated mining rate; and
- The greenhouse gas emissions and reduction of emissions associated with the operation of the gas engines.

Dust Impacts

This assessment does not include a quantitative assessment of dust, as no additional coal will be processed and/or transported as a result of this Modification to that currently approved for each surface coal handling site. Additionally, no quantitative assessment of the minor impacts associated with the construction and operation of the ballast borehole and gas engines has been included due to the limited nature of the surface disturbance.

Assessment Criteria

Table 19 lists the air quality goals for pollutants relevant to the operation of the gas engines which require assessment by Department of Environment and Climate Change.

Table 19
Modification Air Quality Goals

Pollutant	Goal	Averaging Period	Agency
Carbon Monoxide (CO)	87 parts per million (ppm) or 100 mg/m ³ 25 ppm or 30 mg/m ³ 9 ppm or 10 mg/m ³	15-minute maximum 1-hour maximum 8-hour maximum	DECC DECC DECC, NEPM ¹
Nitrogen Dioxide (NO ₂)	0.12 ppm or 246 µg/m ³ 0.03 ppm or 62 µg/m ³	1-hour maximum ¹ Annual mean	DECC, NEPM DECC, NEPM
Sulphur Dioxide (SO ₂)	25 ppm or 712 µg/m ³ 0.20 ppm or 570 µg/m ³ 0.08 ppm or 228 µg/m ³ 0.02 ppm or 60 µg/m ³	10-minute maximum 1-hour maximum 24-hour maximum Annual average	DECC DECC, NEPM* DECC, NEPM* DECC, NEPM

* One day per year maximum allowable exceedances.

Existing Environment

Existing Air Quality

Data from Department of Environment and Climate Change's air quality monitoring network in the Lower Hunter region (Wallsend and Newcastle Athletics Field sites) were utilised as part of this assessment. An analysis of the available data, found the maximum 1-hour average carbon monoxide concentrations reached 3.6 mg/m³ while maximum 8-hour average carbon monoxide concentrations reached 2.8 mg/m³ at the Newcastle monitoring station. Both of these measurements are below the 1-hour and 8-hour average carbon monoxide air quality goals of 30 and 10 mg/m³ respectively.

At the Wallsend site, the maximum 1-hour average nitrogen dioxide concentrations were reported at 86.1 µg/m³ while the annual average nitrogen dioxide concentrations were 18.5 µg/m³. These measurements are below the relevant Department of Environment and Climate Change air quality goal of 246 µg/m³ and 62 µg/m³ respectively.

Annual average sulphur dioxide concentrations from the Wallsend site were 2.9 µg/m³ which are well below the 60 µg/m³ air quality goal. The maximum 1-hour average and maximum 24-hour average sulphur dioxide concentrations were 165.9 µg/m³ and 25.7 µg/m³ respectively.

These are below the 228 µg/m³ (1-hour) and 570 µg/m³ (24-hour) assessment criteria.

As the site proposed for the gas engines is close to the F3 freeway, it was necessary to consider the effect that emissions of nitrous oxide from traffic using the F3 freeway might have on the background concentrations of nitrous oxide close to the freeway. The RTA has developed a screening model for roadway emissions known as TRAQ. This was used for this assessment. The net maximum 1-hour average nitrogen dioxide concentration predicted by TRAQ is estimated to be 190.6 µg/m³. This figure can be used as an estimate of extreme worst-case 1-hour average nitrogen dioxide background concentration in the vicinity of the freeway for receptors beyond 50 m from the freeway.

Meteorological Data

Meteorological data utilised for the assessment was sourced from the Awaba meteorological station during the period September 2005 to 2006. The Awaba meteorological station is located approximately 6 km north of the gas engine site. The location of the meteorological station is such that the data should be representative of the wind patterns and dispersion conditions occurring at the proposed gas engines site. Data recovery during the assessed period was 100%.

A review of the data highlights that winds predominantly occur from the south west, with a smaller portion of the stronger winds blowing from the south east throughout the year.

Impact Assessment

Gas Engine Emissions

A worst-case modelling scenario utilising six by 2 Megawatts gas engines has been assumed for this assessment.

The predicted maximum concentrations as generated by AUSPLUME are shown in **Table 20**. The highest concentrations due to the plant are generally predicted to the south of the site. Since the modelling shows that all receptors are predicted to experience concentrations below the relevant assessment criterion it has not be considered necessary to examine the effects at individual receivers.

Figure 13 and **Figure 14** show the location of receivers surrounding Mandalong and the maximum 1-hour concentrations of nitrogen dioxide and sulphur dioxide as a result of the gas engines only. These figures should be read in conjunction with **Table 3** which lists land ownership and **Figure 3** and **Figure 4** which illustrates receivers surrounding the gas engines and allocates each property an individual identification number, highlighting if a residence is situated on that property.

In order to determine the impact of these model predictions, the maximum measured background levels (as previously discussed in **Section 7.3.2**) were added to the model predictions. **Table 20** shows all cumulative concentrations are predicted to be within the relevant air quality goal. Further discussion on calculating cumulative concentrations is presented in **Appendix E**.

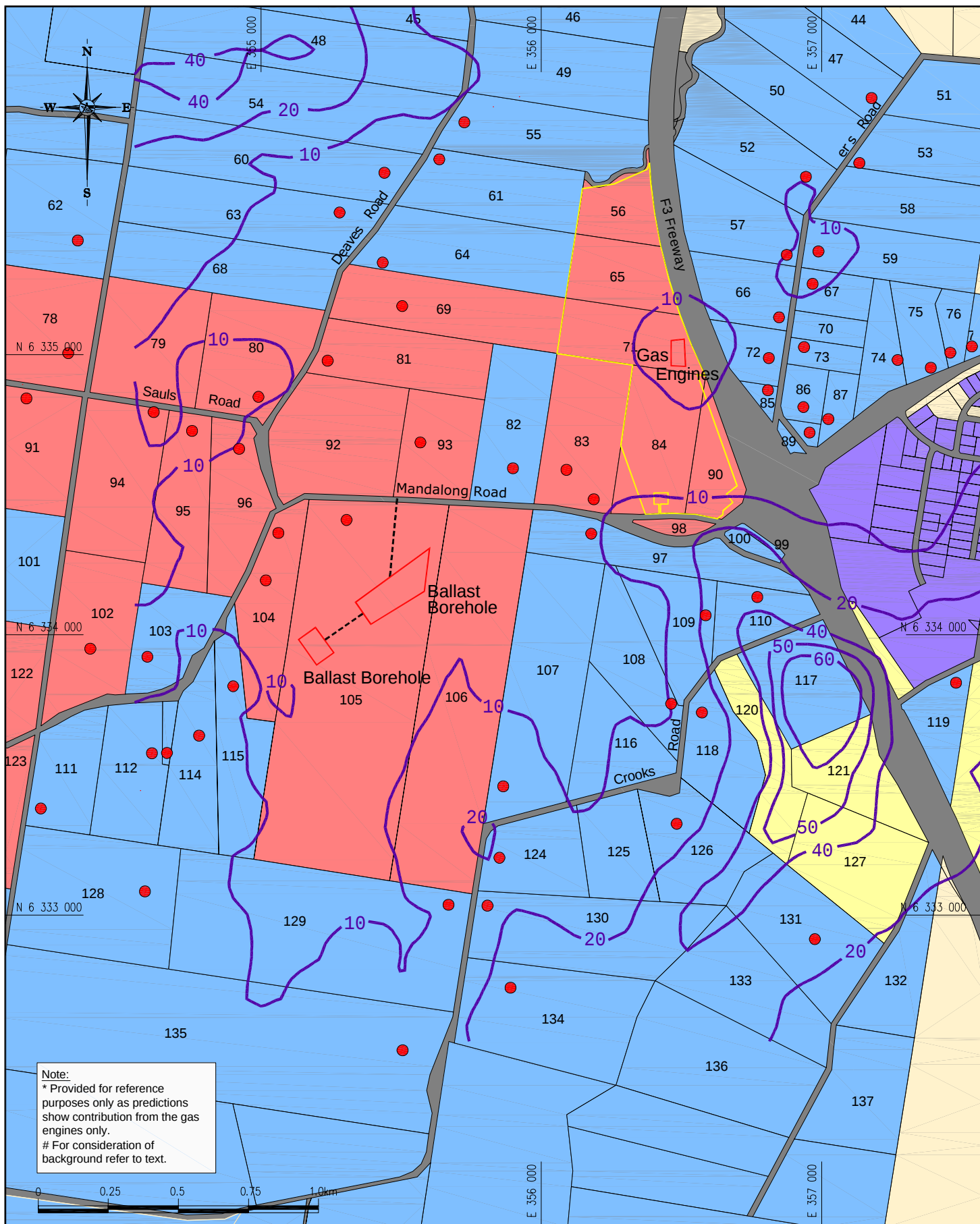
Regional Impacts

The nitrogen dioxide emissions from the proposed gas engines were assessed in relation to their potential to contribute to regional air pollution. The assessment found annual emissions of nitrogen dioxide, based on maximum annual emission rates are conservatively estimated to be approximately 109 t with the six gas engine units operating. This is comparable to an existing background level of 102,780 t in the Sydney air-shed. The gas engines would therefore make a very small contribution to total nitrogen dioxide emissions into the air shed and similarly, would have very little effect on ozone formation in the area.

Table 20
Predicted Ground Level Concentrations due to Gas Engines Operation

Pollutant	Averaging Time	Highest Predicted Concentration *	Typical Background Concentration	Cumulative Concentrations	Air Quality Goal
Carbon monoxide (mg/m ³)	15-minute	1.1	4.8	5.9	100
	1-hour	0.8	3.6	4.4	30
	8-hour	0.7	2.8	3.5	10
nitrogen dioxide (µg/m ³)	1-hour	74 55 close to F3	86 or 190 close to F3	160 or 245 close to F3	246
	Annual	23.2	18.5	41.7	62
Sulphur dioxide (µg/m ³)	10-minute	21.8	237.4	259.2	712
	1-hour	15.4	165.9	181.3	570
	24-hour	6.0	29.5	35.5	228
	Annual	1.0	2.9	3.9	60

* for the worst-case development (Case 1) .



Note:
 * Provided for reference purposes only as predictions show contribution from the gas engines only.
 # For consideration of background refer to text.

- Survey Areas
- - - Access Roads Survey Area
- Access Site
- Centennial Coal
- Crown Land
- Freehold Land
- Freehold Industrial Land
- Unknown
- Roads
- Residences
- Air Quality Contours* (mg/m³)





Source HAS (2008)
 Co-ordinate System MGA Zone 56

MANDALONG MINE

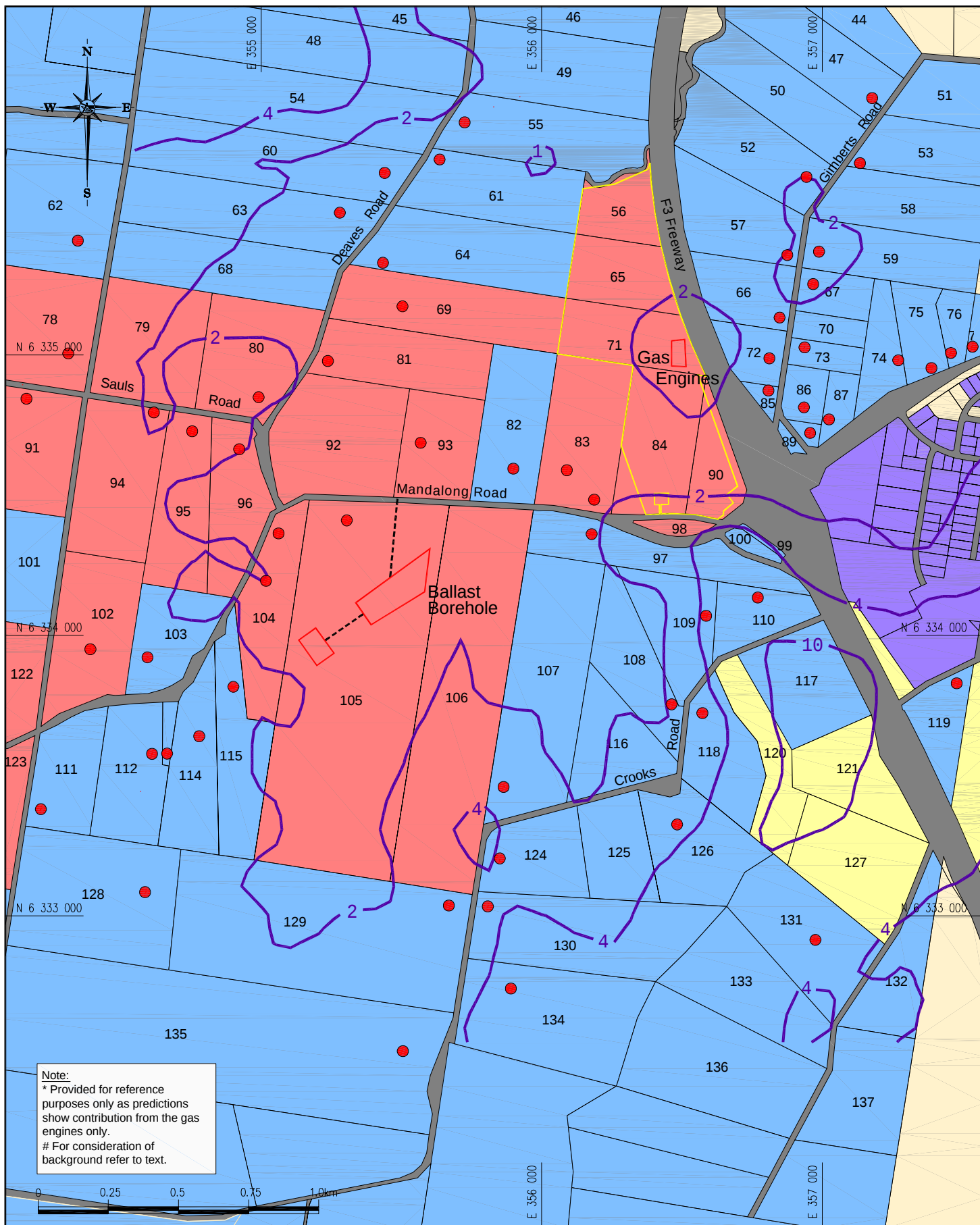
Air Quality Gas Engines only Emissions (1hr NO₂)

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Figure
13



- Survey Areas
- - - Access Roads Survey Area
- Access Site
- Centennial Coal
- Crown Land
- Freehold Land
- Freehold Industrial Land
- Unknown
- Roads
- Residences
- Air Quality contour* (mg/m³)



Centennial Coal
Mandalong

Source HAS (2008)
Co-ordinate System MGA Zone 56

MANDALONG MINE

Air Quality Gas Engines only Emissions (1hr SO₂)

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Date: 08.08.08

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Figure
14

Dust Emissions

As previously discussed in **Section 2.0**, Mandalong has development consent to extract up to 4 Mtpa of coal via an underground conveyor system which results in minimal dust emissions at the Mandalong Mine Services Site.

Additionally, Mandalong has approval to transport up to 4 Mtpa of coal from Mandalong Mine via the Delta Link Project to the Vales Point Power Station. As such the transport of up to 8 Mtpa of coal from Mandalong Mine has been approved. Therefore, no further assessment of dust impacts in relation to the proposed increase coal extraction has been assessed.

A review of dust deposition results from 1997-2007 was undertaken to confirm existing dust levels surrounding the operation. Monitoring locations are shown in **Figure 5**. Dust monitoring at the Mandalong Mine Access Site reveals a maximum recorded average of 1.8 g/m²/month. Monitoring at the Mandalong Mine Services Site has recorded a maximum average of 1.4 g/m²/month. All monitoring to date indicates dust impacts surrounding the operation are within the Department of Environment and Climate Change criteria of 4 g/m²/month. Consistent with recorded dust levels, no exceedances of the Department of Environment and Climate Change criteria are predicted as a result of the Modification.

Some dust emissions will occur when the ballast borehole is constructed and the site works for the gas engines are undertaken.

These construction works will be of limited duration (approximately two months) and can be managed using standard management techniques discussed in **Section 7.3.3**.

Predicted Greenhouse Impacts

Mining

Emissions of greenhouse gases will arise from the consumption of diesel fuel and electricity in the mining and transport of the coal and from the burning of the coal by customer(s).

The production of an extra 2 Mtpa of run of mine coal per year will be responsible for 12,116 t of carbon dioxide equivalent additional emissions in the proposed years of increased tonnage assuming that this coal is burnt in the year that it is produced.

It must be noted however that as this Modification is not seeking approval for the mining of any additional coal, just an increase in the rate of coal extraction, that at the end of the currently approved mine life no net additional Carbon Dioxide emissions will result from the burning of the coal than that originally approved.

Gas Engines

The annual emission of Carbon Dioxide from the gas engines will be 24,183 t/year compared with 184,674 t/year if the methane is not burnt and released into the atmosphere (assuming 40% of the methane is recovered and used to run the gas engines).

Over and above these carbon dioxide savings, the gas engines are predicted to generate up to 12 Megawatts of electricity. If this was generated at a conventional coal fired power station then 103,018 t carbon dioxide would result per annum (i.e. the gas engines will result in 78,835 t reduction in carbon dioxide equivalent per annum over the rest of the life of Mandalong Mine).

Table 21 summarises the carbon dioxide equivalent emissions associated with key components of this Modification.

This Modification will lead to increased emissions of carbon dioxide equivalent due to the production of up to 6 Mtpa of coal compared with the 3.353 Mtpa produced in 2006/2007. The gas engines will however deliver a saving in greenhouse gas emissions of up to 0.136 Mt of carbon dioxide equivalent compared with the current case where methane is released unburnt to the atmosphere.

Table 21
Annual Greenhouse Gas Emissions (tonnes carbon dioxide equivalent)

Component / Activity / Source	Scope 1	Scope 2	Scope 3	Total
Combustion of 4 Mt of Run of Mine coal in a power station			8,584,880	8,584,880
Combustion of 2 Mt of Run of Mine coal in a power station			4,292,440	4,292,440
Emissions due to electricity required to mine 6 Mt of Run of Mine coal	83,319	1,215		84,534
Emissions due to diesel required to mine 6 Mt of Run of Mine coal	2,723	303		3,026
Emissions of methane due to mining of 6 Mt of Run of Mine coal	1,898,459			1,898,459
Emissions of Carbon Dioxide due to mining 6 Mt of Run of Mine coal	22,665			22,665
Greenhouse gas equivalent of the methane proposed to be captured and burnt annually assuming it is released without burning (based on 40% capture)	184,674			184,674
Emissions of greenhouse gas equivalent from the burnt methane proposed to be captured and used to generate power or flared (based on 40% capture)	24,183			24,183
Emissions that would be liberated by a NSW coal-fired power station producing 12 Megawatts of electrical power for 8,760 hours (i.e. one year)	93,872		18,501	112,373

7.3.3 Mitigation & Management

The gas engine exhaust stacks will be designed and built to at least 10 m in height to minimise any adverse air quality impacts on neighbouring landowners and ensure necessary emission dispersion.

Standard dust control measures will be implemented during construction works associated with the gas engines and ballast boreholes to minimise dust impacts. This will include fitting of dust collection systems to drills used for the borehole and the application of water to dry dusty materials when drilling. All tracks and roads utilised during the construction will be maintained in a damp condition.

The current air quality monitoring program will continue to be relied upon to ensure the predicted air quality impacts and criteria are achieved.

7.4 WATER

A relevant water assessment was undertaken which primarily included a review of sediment and erosion control associated with the gas engines and ballast boreholes sites and a review of the mine water balance.

7.4.1 Sediment & Erosion Control

Background

The location of the gas engines is proposed adjacent to the existing Mandalong gas drainage plant, approximately 600 m north of the Access Site. Access will be via an existing gravel road from the Access Site.

The area is generally flat and clear of substantial vegetation, low lying and subject to ponding water.

The construction of a ballast borehole was assessed in the Cooranbong EIS however progression of mining operations has resulted in an alternate location further south west of the Access Site being determined (see **Figure 4**). The exact location will be determined prior to construction, however it is proposed within the survey area which is approximately 1.3 km south west of the Access Site, within a substantially cleared area currently used for agricultural purposes.

The area is generally flat and low-lying and prone to ponding of water following wet periods. There is an existing farm access track leading to the proposed borehole from Mandalong Road.

Impact Assessment

The gas engines are proposed to be located on an elevated pad adjacent to the existing gas drainage plant. The site will require some site preparation and earthworks to build the pad which will generate sediment movement. Minor clearing of groundcover species may also be required. Access to the area will be along the existing access road from the Access Site.

Construction of the ballast borehole will require borehole construction, extension and upgrade of the existing track for use as an access road and construction of a small ballast stockpile area, loading hopper, communication tower, fencing and bunding. Some clearing will be required along the access road alignment and within the borehole area perimeter fence.

Material which is excavated from the borehole during construction will be used in the shaping of the bunding. There is a potential for some sediment entrainment to result from the earthworks component of the construction.

Management & Mitigation

Temporary sediment control fencing will be installed around the proposed gas engine area, ballast borehole site and along the access track as necessary during construction.

The following standard mitigation measures will be implemented in accordance with the Mandalong Mine Erosion and Sediment Control Management Standard:

- The areas to be disturbed shall to be limited as much as is practicable to safely and effectively complete the works and be clearly marked to prevent excess or incidental clearing;
- Groundcover will remain undisturbed where possible to leave soils intact thereby minimise the potential for erosion;
- Exposure of soils to surface water runoff shall to be minimised by diverting flows away from cleared areas to prevent sediment material entering water ways; and
- Exposure of soil to rainfall or surface water flows shall be minimised by rehabilitating the disturbed areas as soon as practical and installing appropriate sediment control structures.

Following completion of construction of the ballast borehole, any disturbed areas (including any bunding) will be topsoiled, revegetated and managed to prevent any erosion.

Any disturbed areas shall be managed in accordance with the approved Erosion and Sediment Control Plan for Mandalong Mine.

7.4.2 Water Balance

Background

The existing water management system at Mandalong Mine is separated into different systems based on the three site areas – Access Site, Services Site and Delta Site (see **Figure 1**). Water management at each site is substantially independent of the other sites, with the exceptions that potable water use on underground mine equipment is supplied via the Services Site to the underground workings and excess underground water from the Mandalong and Delta underground workings which is transferred to the Services Site water management system. Sources of mine water include:

- External potable water supply (from the Hunter Water Corporation via Eraring Power Station and Morisset town water supply);
- Groundwater inflow to the underground workings;
- Raw coal moisture; and
- Local surface water runoff collected from disturbed areas at the surface sites.

Water demands include:

- Potable water (for domestic use, sewerage and machinery washdown);
- Potable water for underground operations;
- Water for dust suppression; and
- Water for irrigation.

Potable water is supplied to the Mandalong Mine Access Site for domestic use and washdown and is supplemented by surface water runoff collected from surface infrastructure areas which is stored for reuse in dust suppression and irrigation. Potable water supplied to the Services Site is used predominantly for underground operations and dust suppression.

In 2007, the total volume of external water supplied to Mandalong Mine was 290 Megalitres (ML), which corresponds to an average of 0.8 ML/day. Of this, approximately 40 ML was supplied to the Access Site and 248 ML was supplied to the Services Site and pumped underground for use on mining equipment. 2 ML was used at the Services Site for surface operations (Parsons Brinckerhoff, 2008).

Clean surface water runoff is separated from water affected by mining operations and is released from site. Runoff water from areas disturbed by mining operations is contained within sediment control dams, prior to reuse for irrigation or dust suppression.

Water underground is generated from two sources:

- Water from dust suppression and cooling systems on underground mine equipment; and
- Groundwater which enters the underground workings from the adjacent strata.

Groundwater is saline and generally unsuitable for reuse in the mine water management system due to its corrosive nature. Excess underground water is pumped to the Cooranbong Mine goaf area which has significant storage capacity and acts as a primary settlement area for the removal of suspended solids. This water is then pumped to the surface at the Services Site and then through a series of sediment ponds prior to discharge from site at EPA Licensed Discharge Point 001 as shown on **Figure 5**.

Annual groundwater inflow for 2007 was estimated by Parsons Brinckerhoff (2008) as approximately 26 ML at the Mandalong underground workings and as negligible at the Delta underground workings.

Dams used for sediment control at the Access Site have storage capacity sufficient to contain surface

water runoff from a 10 year average recurrence interval event of one hour duration. Centennial Mandalong holds Environmental Protection Licence 365 that permits the discharge of water offsite from the Services Site through an unnamed drainage path that reports to Muddy Lake on the western side of Lake Macquarie.

The licence permits the discharge of up to 5 ML/day of mine water at Licensed Discharge Point 001 and wet weather overflows of stormwater at Licensed Discharge Point 002 (see **Figure 5**). It also specifies pollution concentration limits and monitoring requirements and requires that Centennial Mandalong submits an Annual Return summarising compliance and monthly monitoring results.

Approximately 254 ML was pumped to the surface at the Services Site in 2007 from the underground workings. This water, combined with surface water runoff, resulted in offsite discharge from the Services Site of approximately 326 ML at Licensed Discharge Point 001. Around 70 ML of stormwater overflows were discharged at Licensed Discharge Point 002 in 2007. This equates to an average daily discharge of 0.9 ML at Licensed Discharge Point 001 in 2007, well below the permitted Licensed Discharge Point 001 discharge volume of 5 ML/day.

Runoff water from the Access Site flows to an existing gross pollutant control trap, then into the sediment control dams, with stormwater overflows entering the surrounding low-lying land. The flow and water quality at the spillway of the sedimentation dam is monitored. In 2007 approximately 46 ML overflowed through this structure.

A total of 138 ML of mine process water consisting of 115 ML of free moisture within the coal and 26 ML of groundwater was discharged from the site within the product coal transported to the power stations.

Surface water runoff collected at the surface of the Delta Site is transferred via a settlement pond system prior to discharge offsite in accordance with Delta Electricity's Environmental Protection Licence to an unnamed flow path that enters Lake Macquarie.

The 2007 Mandalong Mine water balance for 2007 is summarised in **Table 22**.

Impact Assessment

The Mandalong Mine water management system will remain substantially unchanged for the proposed increase in Run of Mine coal production from the currently approved 4 Mtpa to 6 Mtpa. Current water management strategies consistent with the approved Water Management Plan will continue to be implemented.

The volume of water managed through the system at the Access Site and the Delta Site will remain unchanged if production increases.

The sources of, and demands for water managed through the Services Site will remain substantially unchanged however the volume of water in this system will increase.

Specifically, the demand for externally supplied potable water and the volume of excess underground mine process water will increase. Therefore the critical issues for water management as a result of this Modification include:

- Availability of raw water supply; and
- Ability to discharge excess water in compliance with Environmental Protection Licence 365.

The annual mine water balance has been revised for the proposed increase in coal production to 6 Mtpa and is summarised in **Table 23**.

Table 22
Mandalong Mine Water Balance for 4 Mtpa

Detail	Access Site (ML)	Services Site (ML)	Delta Site (ML)	Total (ML)
WATER SUPPLY				
Potable Water	39	251	1	
Surface Water Runoff	48	248	28	
Groundwater *	0	16	10	
Underground mine process water (pumped to surface)	0	252	0	
Free moisture content in coal (excluding groundwater)	0	66	49	
Total	87	833	88	1,008
WATER DEMAND				
Domestic, admin, sewer, etc	37	2	0	
Washdown	2	1	1	
Underground operations	0	249	0	
Groundwater ^	0	13	10	
Evaporation	2	11	1	
Irrigation	2	0	0	
Total	43	276	12	331
DISCHARGE WATER#				
Surface Water Runoff & Underground Mine Process Water – (Services Site only)	44 (to surrounding land)	491 (to Licensed Discharge Point 001 and Licensed Discharge Point 002)	27 (to Delta Licensed Discharge Point)	677

* Includes groundwater pumped to the surface and process water absorbed in product coal.

^ Includes process water lost as additional product coal moisture.

Balance in total discharge water attributable to free moisture content in coal.

(Based on 2007 coal production of 4 Mtpa).

(Source : Parsons Brinckerhoff 2008)

Table 23
Predicted Mandalong Mine Water Balance for 6 Mtpa

Detail	Access Site (ML)	Services Site (ML) *	Delta Site (ML)	Total (ML)
WATER SUPPLY				
Potable Water	39	377	1	
Surface Water Runoff	48	248	28	
Groundwater *	0	23	15	
Underground process mine water (pumped to surface)	0	378	0	
Free moisture content in coal (excluding groundwater)	0	73	93	
Total	87	1,099	137	1,323
WATER DEMANDS				
Domestic, admin, etc	37	3	0	
Washdown	2	1	1	
Underground operations	0	373	0	
Groundwater ^	0	20	15	
Evaporation	2	11	1	
Irrigation	2	0	0	
Total	43	408	17	468
DISCHARGE WATER#				
Surface Water Runoff & Underground Mine Process Water – (Services Site only)	44 (discharged to surrounding land)	618 (discharged at Licensed Discharge Point 001 and Licensed Discharge Point 002)	27 (discharged to Delta LDP)	855

* Includes groundwater pumped to the surface and process water absorbed in product coal.

^ Includes process water lost as additional product coal moisture.

Balance in total discharge water attributable to free moisture content in coal.

(* Pro-rated from 2007 water balance volumes corresponding to coal production of 4 Mt).

(Source : Parsons Brinckerhoff & Centennial Mandalong 2008).

The water demand associated with mining will increase due to the proposed increase in coal production. The estimated annual potable water volume required to be supplied to the Services Site for an annual production of 6 Mtpa is approximately 377 ML.

Water collected in the underground workings will continue to be pumped to the surface of the Services Site for transfer to the Borehole Dam and then through the sediment pond system prior to discharge from site at Licensed Discharge Point 001. The estimated annual water surplus which will be generated at the Services Site for annual coal production of 6 Mtpa is 618 ML.

This corresponds to an average daily discharge volume of 1.7 ML/day which is less than Mandalong Mine's licensed discharge limit of 5 ML/day at Licensed Discharge Point 001.

In the event of an abnormally high rainfall event, resulting in very high short-term rainfall runoff, Environmental Protection Licence 365 permits a discharge of excess water from the Services Site water storage dam at Licensed Discharge Point 002. At the Access Site, surface water runoff is collected in various dams then transferred to the Macrophyte Pond prior to being directed toward Stockton Creek as surface flows for approximately 1.5 km through extensive Melaleuca forested areas.

Mitigation & Management

Surface water runoff will continue to be managed in accordance with the existing system with runoff from undisturbed areas diverted around the site and run-off from disturbed areas captured for reuse for dust suppression and irrigation in accordance with the approved Water Management Plan.

There will be no expansion of surface infrastructure facilities at any site and no increase in the dirty water catchment areas as a result of the production increase. No new water storage dams or sediment ponds are proposed to be constructed as part of this Modification.

7.4.3 Mitigation & Management

No substantial changes are proposed to the Mandalong Mine water management system as part of this Modification. The following key components of the existing site water management system will continue to be implemented in accordance with the approved Water Management Plan:

- Collection of rainfall runoff from surface infrastructure areas at the Services Site and direction through sediment control ponds (Water Quality Control Pond) prior to release at Licensed Discharge Point 001 and 002;
- Collection of rainfall runoff from surface infrastructure areas at the Access Site and direction to the water storage dam prior to reuse for irrigation and dust suppression;
- Pumping of minewater from the underground workings to the Cooranbong goaf for control of suspended sediment prior to pumping to the Services Site sediment pond system and discharge offsite at Licensed Discharge Point 001 in accordance with Environmental Protection Licence 365; and
- Surface water quality monitoring downstream of Licensed Discharge Point 001 on a monthly basis and downstream of Licensed Discharge Point 002 during times of stormwater discharge.

7.5 FLORA & FAUNA

7.5.1 Background

A flora and fauna impact assessment for this Modification has been undertaken by Hansen Bailey and is provided in full in **Appendix F**. A summary of this assessment is provided below.

This ecological assessment was primarily based on a field survey carried out in November 2007. The field study involved a survey of the areas associated with the two relevant components of this Modification, being the ballast borehole and gas engines facilities' sites (see **Figure 15**). In addition to the field studies undertaken, an extensive desktop review of relevant studies and literature was also completed.

7.5.2 Methodology

The methodology for the identification of flora and fauna present or potentially present in the survey areas involved an initial desktop study followed by a field survey.

The desktop study was undertaken to determine the listed threatened flora and fauna species that may potentially be present within the survey areas. The Wildlife Atlas, PlantNet and the Environmental Protection and Biodiversity Conservation Act Protected Matters Search Tool provided information about the distribution of these threatened species and ecological communities. The results of these searches are included in **Appendix F**.

A review of previous flora and fauna studies undertaken in or adjacent to the survey areas was conducted to gain a further understanding of the potential flora, fauna and vegetation communities present. These reports provided lists of flora and fauna previously recorded in the region and specific attention was given to the presence of threatened flora and fauna species. Information from aerial photographs and existing vegetation maps were also utilised to provide additional background information on vegetation prevalence, distribution, topography and the presence of water bodies in the two survey areas.



- Survey Areas
- - - Access Roads
- Pond
- Wetland
- Egret



MANDALONG MINE

Archaeology & Ecology Survey Areas

Cad File: 02608N.dwg

Date: 08.05.08

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Figure
15

The flora and fauna field survey carried out in November 2007 was undertaken in accordance with the Department of Environment and Climate Change's *Draft Guidelines for Threatened Species Assessment* (DEC, 2004) and assessed species and vegetation communities present in the survey areas including threatened species, populations and communities listed under State and Commonwealth legislation. Consideration was also given to the nature and condition of the flora assemblages and to the flora and fauna habitat values of the survey areas. In addition, the presence and extent of any noxious plants and animal species (as listed under the *National Parks & Wildlife Act 1974* and the *Environmental Protection and Biodiversity Conservation Act 1999*) were recorded.

Due to the degraded nature of the survey areas the field survey was limited to a diurnal visual inspection. This survey included a variety of different fauna sampling methods, employed to target a relevant range of fauna species. These methods included observations (visual, auditory, tracks and scats) and specific searches to target particular species. Targeted searches were concentrated in areas with the highest fauna habitat value, which was limited. In relation to water bodies, there is only one small pond occurring in the ballast borehole survey area and given the lack of permanent watercourses, a full aquatic survey was not deemed to be warranted. The presence of amphibians and reptiles was still observed during the fauna survey.

7.5.3 Impact Assessment

Flora

The field traverses of the ballast borehole survey area confirmed that cleared grasslands are the dominant vegetation community, with some mature trees and one small pond also present. The area was subject to high level of disturbance and is dominated by introduced grass and weed species including: Kikuyu, Purpletop, Blackberry and Fireweed and two larger introduced weed species Wild Tobacco Bush and Black Nightshade.

The pond was observed to contain wetland species including: Broadleaf Cumbungi and Tall Sedge. Some larger trees were also present including several large Forest Red Gum and Swamp Oak.

Within the ballast borehole survey area, a total of 15 plants from 15 families were recorded with no threatened flora, Endangered Populations or Critical Habitat identified. One species listed as a Weed of National Significance was recorded, namely Blackberry and two species listed under the *National Parks & Wildlife Act 1974* (Blackberry and Fireweed).

The field survey of the gas engines survey area confirmed the presence of cleared grasslands with an associated small wetland dominated by Tall Sedge. The area has been subjected to a high level of disturbance due to previous grazing activity and significant vegetation clearing. The remaining vegetation is dominated by introduced grass and herb weed species including: Kikuyu, Creeping Oxalis, Blackberry, Purpletop, Ink Weed, Fireweed and two larger introduced weed species, namely Wild Tobacco Bush and Black Nightshade.

The field survey of the gas engines survey area identified a total of 14 plants from nine families, with no threatened flora, Endangered Populations or Critical Habitat being recorded (*Threatened Species Conservation Act 1995* and *Environmental Protection and Biodiversity Conservation Act 1999*). One species listed as a Weed of National Significance was recorded (Blackberry) and three species listed under the *National Parks & Wildlife Act 1974* were recorded, namely Blackberry, Fireweed and Creeping Oxalis.

A full list of species identified during the field assessments undertaken for the two survey areas is included in **Appendix F**.

Fauna Habitat

Both the ballast borehole and gas engines survey areas were found to provide poor habitat for native fauna species. The ballast borehole survey area was largely cleared and used for grazing activities, while introduced grasses and weeds which provide few resources for fauna habitat dominated the vegetation present.

A natural and healthy pond existed at the ballast borehole survey area.

The gas engines survey area consisted mainly of rubble overgrown by introduced weeds. There was a small area of wetland adjacent to the eastern side of the survey area. The fauna habitats identified during the field assessments of the two survey areas are listed in **Appendix F**.

There was no Koala habitat present in the ballast borehole or gas engines survey areas. A review of previous ecological studies undertaken in the surrounding region showed that there have been no records of Koala sightings made in the past. In addition, the low percentage of Koala feed trees in both survey areas is much less than 15%, making both the ballast borehole and gas engines sites unlikely to be core Koala habitat (as defined by Schedule 2 of State Environmental Planning Policy 44).

Fauna

A single species of conservation significance was recorded during field surveys, namely the Cattle Egret (Migratory/Marine under the *Environmental Protection and Biodiversity Conservation Act 1999*). The Cattle Egret was found foraging near the pond within the ballast borehole survey area. This Modification of the ballast borehole survey area is not predicted to remove or substantially modify the existing habitat in this area for this species and consequently, an Assessment of Significance is not required.

Discussion

This Modification will result in the clearance of approximately 5 ha of disturbed grassland (4 ha and 1 ha to be cleared for the development of the ballast borehole and gas engines survey areas respectively). This small amount of clearing of the dominant grassland communities located within each of the survey areas is not anticipated to adversely affect any existing vegetation communities as they are already highly disturbed and dominated by exotic grasses and weed species.

While these grassland communities may still be used as foraging areas for generalist species, the continuous grazing by cattle combined with the relatively low species diversity present suggests that the areas surveyed do not provide optimal roosting and foraging habitat for the majority of the threatened species listed under the *Environmental Protection and Biodiversity Conservation Act 1999* and the *Threatened Species Conservation Act 1995* that have the potential to occur in the region.

Therefore, this Modification will not result in significant impacts on any listed species or communities and as such, an Assessment of Significance under the *Environmental Protection and Biodiversity Conservation Act 1999* Act and *Threatened Species Conservation Act 1995* is not warranted.

7.5.4 Mitigation & Management

The disturbance of the ballast borehole and gas engines survey areas are not anticipated to have any significant impacts on any ecological communities or species listed under the *Environmental Protection and Biodiversity Conservation Act 1999* and *Threatened Species Conservation Act 1995*.

The following impact mitigation and management measures will be implemented:

- The small pond in the ballast borehole survey area may provide habitat for native and migratory water bird species and as such will not be disturbed;
- Appropriate sedimentation controls shall be installed on the site, as necessary, to ensure that the pond is not impacted by sedimentation associated with the ballast borehole and associated facilities;
- Appropriate sedimentation control shall be installed within the gas engines survey area site, as necessary, to ensure that the small wetland area bordering the site is not impacted by sedimentation associated with the development of the area;

- The existing Flora & Fauna Management Plan will be revised as necessary to incorporate relevant aspects of this Modification;
- Mandalong Mine's regular weed management program will be revised to focus on the noxious weeds Blackberry, Fireweed and Creeping Oxalis; and
- The Clearance Procedure as shown in **Table 24** will be followed for the clearing of any hollow-bearing trees, should it be required.

Table 24
Vegetation Clearance Procedures

Ref	Description
1	Planning Considerations: • The area to be disturbed will be limited to the minimum area necessary; • The clearance area will be clearly marked on a plan, surveyed and ground-truthed with operators to ensure that no disturbance occurs outside the area; and • Seasonal factors will be taken into account when removing vegetation, with the aim of minimising disturbances to breeding or hibernating species, particularly species of special conservation significance. Autumn seasons would be the most suitable timing for vegetation clearing and removal of hollow-bearing trees (May / June).
2	Pre-clearing Disturbance Procedure: • If clearing of hollow-bearing trees is unavoidable, these trees will be inspected for wildlife (especially hollow-dependent fauna, such as gliders, bats and birds) four weeks prior to clearing by a suitably qualified person in possession of the necessary permits for handling animals and relocated as required; • Any hollow-bearing trees which are to be retained within the area will be flagged; • Immediately prior to the commencement of clearing, all hollow-bearing trees to be removed will be subject to a further pre-clearing survey by trained person. Specific tasks will include: - Inspect trees for the presence of reptiles, birds, bats and other mammals in tree hollows, fissures or under exfoliating bark; - Inspect trees for nesting birds; and - Flag all existing roosts / dens / nests. • If threatened species (listed under the <i>Environmental Protection and Biodiversity Conservation Act 1999</i> or <i>Threatened Species Conservation Act 1995</i>) are detected nesting in trees required to be cleared, an ecologist will be consulted to develop management plans or mitigation procedures for the species and to determine whether nests can be relocated.
3	Post-clearing Procedure: • Immediately following clearing, felled trees, including hollows (especially those greater than 20 cm diameter), will be inspected for injured wildlife and other fauna. Hollows containing fauna will be flagged. In the event of any injured native fauna being found, appropriate specialist advice will be sought and appropriate actions taken; • If threatened species are detected in hollows of felled trees, the location will be flagged, documented and recorded on GPS and by a suitably qualified person will be consulted to develop mitigation procedures for the species and to determine whether nests and/or species can be relocated; and • Felled trees will be allowed to stand for at least 24 hours to allow other fauna within hollows to vacate.

7.6 ABORIGINAL HERITAGE

An Aboriginal Archaeological & Cultural Heritage Impact Assessment for the various components of this Modification has been undertaken by Indigenous Outcomes and is provided in full in **Appendix G**.

7.6.1 Background

The surrounds of the ballast borehole and gas engines survey areas are generally comprised of broad, flat floodplains of the Stockton Creek / Morans Creek drainage systems and steep rugged ridges of the Watagan Mountains. The Watagan Mountains and the western area of Lake Macquarie are an outstanding visual feature of the region which forms the backdrop to the coastal and estuarine landscapes and provides a distinct physical barrier (by no means impassable) between coastal catchments and inland catchments that flow to the Hunter River.

The study area (see **Figure 15**) is located within the Lake Macquarie area and is comprised of the following landform units: ridge crests, spur crests, simple and basal slopes, gullies, drainage depressions, and swamp.

There is some potential for Indigenous Cultural Heritage material to be present in all terrain units within each of the survey areas.

7.6.2 Methodology

A search was undertaken of the Department of Environment and Climate Change Aboriginal Heritage Information Management System Site Register (see **Appendix G**) within 10 km of the survey areas.

A desktop review of a number of previous archaeological studies in the region was also undertaken as outlined in **Appendix G**.

The archaeological field survey of the ballast borehole and gas engines sites was undertaken on Thursday, 21 February 2008 by Cheryl Kitchener (Archaeologist, Indigenous Outcomes) in the company of a representative of the Darkinjung Local Aboriginal Land Council (DLALC).

Representatives from Awabakal Descendants Traditional Owners Aboriginal Corporation (ADTOAC)

and Awabakal Traditional Owners Aboriginal Corporation (ATOAC) attended an additional survey, for a component of the proposed modification which is no longer part of this application. No representatives from the Koombahtoo Local Aboriginal Land Council (KLALC) were available to attend the field survey.

7.6.3 Impact Assessment

Field Survey & Research

A total of eight Aboriginal Heritage Information Management System registered sites have been recorded within 10 km in the vicinity of the survey area; consisting of six artefact sites, a scarred tree and an axe grinding groove. The closest Aboriginal archaeological site registered in the Aboriginal Heritage Information Management System Database is located approximately 2.4 km from the survey areas.

A review of previous archaeological studies undertaken in the region suggests that open campsites, isolated finds, axe-grinding grooves and rock shelters with archaeological deposit have been found. These studies also indicate that:

- Open campsites are most likely in areas of low gradient associated with watercourses and also ridge and spur crests, however, artefact density should be highest near major creeks;
- Isolated finds could be found in any land unit;
- Sites will be more frequent near permanent water, but overall site density will be low;
- Rock shelters are most likely in areas of upper slope; and
- Grinding grooves may be present in association with creek lines but are more likely in the upper reaches of the creeks.

Non-Aboriginal land-use practices have affected the surveyed areas to varying extents. The land within the Mandalong Mine site has been greatly disturbed by past farming practices and infrastructure developments. An electricity transmission line easement traverses the borehole survey area, as does a vehicle track. Minor clearings or areas of ground disturbance exist.

Timber has been selectively removed and in several places, totally cleared and replaced with pasture grasses. Agricultural practices are evident in some sections of the property, although some tilling of the soil may have been involved in establishing the pasture grasses. Cattle have been grazed on at least the pastures and probably within the forest during historical times.

The proposed gas engines site is located adjacent other mining infrastructure and the F3 Freeway and is mostly highly disturbed.

During the field survey, no evidence of Aboriginal heritage was located within either the ballast borehole or gas engines survey areas. Discussions with representatives of the local Aboriginal community in attendance during the field survey did not reveal any cultural heritage knowledge of significant places within the areas assessed for this Modification. The survey areas were assessed by the DLALC, KLALC, ADTOAC and ATOAC as having low Archaeological significance.

The disturbed nature of the survey areas indicates that even if archaeological sites / Potential Archaeological Deposit remained undetected it is highly unlikely they would retain any archaeological integrity or assemblages with a complexity that would suggest further investigation.

Aboriginal Community Consultation

The DECC Guidelines (DECC, 2004) have been applied throughout this Modification to ensure an appropriate level of stakeholder consultation in relation to Aboriginal archaeology and Cultural Heritage is undertaken. A summary of the key stages of the consultation process undertaken during this archaeological and Cultural Heritage assessment is presented below in **Table 25** with details presented in **Appendix G**.

A draft of the Aboriginal Archaeological & Cultural Heritage Report was provided to the community for comment. Additional comments were received from the community and have been incorporated into the recommendations in **Section 7.6.4**.

Table 25
Summary of Aboriginal Stakeholder Consultation

Date	Description
20 December 2007	An advertisement was placed in the Lakes Mail calling for expressions of interest to this Modification.
8 January 2008	Letters were sent out to the registered Aboriginal community groups in the area, the Lake Macquarie City Council, the Native Title Services and the NSW Department of Aboriginal Affairs seeking further advice on any other Stakeholders that may also wish to be consulted as part of this Modification.
8 January 2008 – 20 February 2008	Representatives from the KLALC, DLALC, ATOAC and the ADTOAC expressed their interest in this Modification.
29 January 2008	Methodology for the field survey was provided to those Aboriginal Stakeholders who had expressed an interest in this Modification for the Aboriginal community members to provide comment.
29 January – 21 February 2008	Indigenous Outcomes held further meetings with the Aboriginal community members to discuss the proposed methodology and potential significance of the area.
29 January – 21 February 2008	Responses received from the Aboriginal community members in regard to the assessment methodology.
21 & 25 February 2008	Field assessment undertaken in conjunction with representatives from the local Aboriginal community who had expressed their interest in this Modification. Further discussions were held with the Aboriginal community members during the field surveys about the cultural significance of the area.
7 April 2008	Draft Aboriginal Cultural Heritage Impact Assessment Report provided to the Aboriginal community representatives for comment.
May – September 2008	Comments received from DLALC, ATOAC, ADTOAC and KLALC in relation to the draft Aboriginal Cultural Heritage Impact Assessment Report and incorporated into the final report. The final report was provided to each of the groups following this.

7.6.4 Mitigation & Management

This assessment did not locate any artefacts of Aboriginal origin or identify areas as Potential Archaeological Deposits within the ballast borehole or gas engines survey areas and it is highly unlikely that this Modification will impact upon any undetected sites that might retain archaeological integrity.

However, the following management procedures will be put in place to manage and protect items of Aboriginal heritage should they be discovered during ground disturbance works associated with the construction of the ballast borehole and gas engines:

- Members of the Aboriginal community will be invited to be present to inspect for items of Aboriginal Heritage during topsoil stripping activities;
- Relevant training commensurate with job descriptions will be provided to employees and contractors of Mandalong Mine in relation to Aboriginal heritage;
- Should items of Aboriginal heritage be found:
 - Work will cease;
 - Consultation with KLALC, DLALC, ADTOAC and ATOAC and DECC will occur; and
 - A protection zone will be established with work continuing outside that zone.
- Should skeletal remains be uncovered, works will immediately cease and notification provided to KLALC, DLALC, ADTOAC, ATOAC, Department of Environment and Climate Change and the NSW Police Department.

7.7 NON-ABORIGINAL HERITAGE

7.7.1 Background

In order to assess the potential impacts that this Modification may have on any surrounding items of Non-Aboriginal heritage, the historical and environmental background of the area was investigated. This review included:

- A search of relevant databases that contain listed heritage items including those held by the Australian Heritage Council, NSW Heritage Council, National Trust of Australia (NSW) and local council holdings;
- A review of the statutory requirements relating to heritage items that may be impacted upon by this Modification;
- Undertaking an assessment of the potential impacts of this Modification upon any identified Non-Aboriginal heritage items and identifying any items that may require further examination;
- A field inspection of both the ballast borehole and gas engines survey areas; and
- Reviewing previous Non-Aboriginal heritage assessments in the vicinity of the Environmental Assessment Boundary. The Cooranbong EIS and several related studies identified a number of heritage items in the vicinity.

7.7.2 Impact Assessment

Two known items of Non-Aboriginal heritage are located in close proximity to Mandalong Mine and include:

- A grave site, "Frosts Rest", listed under the *Lake Macquarie LEP 2004*; and
- A fragment of the original Brisbane Water-Wallis Plains Road, identified as the part of the "convict road" under Schedule 2, Conditions 81 and 82 of DA 97/800.

Both sites are located outside of the Mandalong Mine approved mining areas. The locations of the "Frosts Rest" grave site and fragment of the "convict road" are displayed on **Figure 8** and are labelled as H1 and H2, respectively.

The field inspection undertaken on 21 February 2008 did not reveal any items of Non-Aboriginal heritage (in accordance with the *Heritage Act 1977*) located within or adjacent to the ballast borehole or gas engines survey areas. As such, no impacts on items of non-Aboriginal heritage will occur as a result of this Modification.

7.7.3 Mitigation & Management

The existing Conservation Management Plan for the fragment of the “convict road” shall continue to be implemented.

As no additional items of significant Non-Aboriginal heritage were identified within the survey areas and no existing items in the vicinity are to be impacted by this Modification, no further specific management and mitigation measures are required.

7.8 VISUAL

A visual impact assessment has been undertaken by Hansen Bailey for relevant components of this Modification. The findings of this assessment are presented below with relevant photographs from selected viewing locations surrounding the site.

Table 3 lists landownership surrounding Mandalong Mine and **Figure 3** and **Figure 4** illustrates private residence locations adjacent to the ballast borehole and gas engines sites, and should be read in conjunction with this section.

7.8.1 Background

Existing Visual Setting

The Primary Viewing Catchment for this Modification is for the greater part determined by the potential visibility of the various components of this Modification. The Primary Viewing Catchment represents the area within which a majority of the critical views of this Modification are obtained. Due to the low vertical dimensions of the various components of this Modification and the extent of vegetation surrounding the areas, the Primary Viewing Catchment for this assessment is determined to be small. The existing visual environment includes the Mandalong Mine and its approved future mining operations and associated infrastructure. This visual assessment is based on the changes proposed to the existing visual environment as a result of this Modification.

The components of this Modification that are likely to be visible and may result in visual impacts to the neighbouring receivers include the gas engines and ballast borehole sites. The visual setting for each of these sites is provided in the following sections.

Gas Engines

The gas engines are proposed to be located in the northern area of the Access Site adjacent to the currently constructed methane drainage plant and the approved but not yet constructed enclosed gas flares. The F3 freeway is located to the east. As described in the Cooranbong EIS, the Mine Access Site has extensive vegetation located around its perimeter which screens a majority of the views towards this area from neighbouring receivers.

Some receivers along Gimberts Road to the east may have potential views towards the proposed gas engines. Views from other locations surrounding this Modification (i.e. private residences to the north west or south) are unlikely to obtain views towards the proposed infrastructure.

Ballast Borehole

The ballast borehole is proposed to be situated above the underground mine workings to the south west of the Access Site. The area generally consists of flat country with some rolling terrain towards the Watagan Mountains to the west. Significant areas have previously been cleared of native vegetation to accommodate rural and rural residential land uses.

Some remnant vegetation generally remains in areas along the natural drainage lines. The valley accommodates numerous items of rural infrastructure such as cattle yards, chicken sheds and various farm buildings (see **Figure 8**).

Due to the lack of vegetation, particularly shrubs and trees, some receivers surrounding the proposed ballast borehole location are likely to have views towards this infrastructure.

7.8.2 Methodology

The level of visual impact resulting from the ballast borehole and gas engines involve the consideration of both the visual sensitivity of the potential visual receivers within the Primary Viewing Catchment and the visual effect on the receptor as indicated in **Table 26**. Visual sensitivity is a measure of how critically the various components of this Modification are viewed by people utilising different land uses in the vicinity.

For the purposes of this visual impact assessment, the various components of this Modification were assessed based on the findings from previous visual assessments, a site inspection, photographs taken from various viewing locations and the review of aerial photographs and terrain data.

7.8.3 Impact Assessment

Visual sensitivity, visual effect and the resulting visual impact were assessed for each component of this Modification and are described below.

Gas Engines

Visual assessments have previously been undertaken for currently approved gas drainage plant and the gas flares in which the gas engines will be situated in their vicinity. The assessment for the gas drainage plant found that due to the low vertical heights of the gas drainage plant, views of this infrastructure from the surrounding residential areas will not be available from neighbouring residents (SKM, 2004).

The assessment undertaken for the approved, but not yet constructed gas flares concluded that this infrastructure would generally not be visible from the neighbouring residential areas as a result of the existing vegetation between the proposed infrastructure and the neighbouring residents. However, it was identified that minor impacts may be experienced at properties to the east of the Mine Access Site on Gimberts Road where views to the top of this infrastructure may occur (Umwelt, 2006).

The proposed gas engines will be of similar shape, size and colour to the approved gas flares and will comprise of shipping containers and an exhaust stack which will be 10 m high. The top 1 m to 4 m of the exhaust stacks may be visible from two properties (Receiver 57 & 66 on **Figure 4**) located to the east of the Mine Access Site on Gimberts Road. A site inspection has confirmed that Receivers 57 and 66 are not strongly orientated towards the gas engines and as such, they would have a moderate visual sensitivity to this component of this Modification.

Given the distance between the proposed gas engines and these properties and the small percentage of view that may be taken up by the exhaust stacks, the visual effects of the gas engines on these properties would be low, resulting in a low visual impact. No plume will be visible from the stacks. Views of the gas engines from all other residential areas surrounding the Mine Access Site will not be available due to the extent of the existing vegetation surrounding the site.

Table 26
Visual Impact Assessment Matrix

Visual Sensitivity	Visual Effect				
		High	Moderate	Low	Very Low
	High	High Impact	High Impact	Moderate Impact	Low Impact
	Moderate	High Impact	Moderate Impact	Low Impact	Low Impact
	Low	Moderate Impact	Low Impact	Low Impact	Low Impact

Source: JVP Designs (2006).

The gas engines will require some minor lighting facilities to be installed to facilitate site access during night periods and for security purposes. This lighting will be established at the lowest practical elevation and will be directed downward in order to minimise any adverse lighting impacts to neighbouring residents. Where practical, lighting will be wall mounted with horizontal bodies and floodlight reflectors which are designed to restrict stray light.

Ballast Borehole

The ballast borehole will comprise an access track, a level gravel pad, a small ballast stockpile of approximately 300 t, the borehole and associated hopper and communication facilities. As the ballast borehole will be located in the valley on generally flat cleared terrain, some privately owned neighbouring residences will have views of the facility.. Receivers 82, 97 and 115 (see **Figure 4**) may potentially obtain views of this component of this Modification through existing vegetation between the proposed borehole site and their residences.

Receiver 82 is located to the north east of the proposed ballast borehole site and is partially screened by existing vegetation located on Morans Creek (see **Plate 1**). The residence on this property is located approximately 400 m from the northern extent of the ballast borehole survey area and is strongly orientated towards this area. This privately owned residence attracts a moderate visual sensitivity as a result of this strong orientation. With this residence being partially screened by the existing vegetation, the visual impacts on this residence will be moderate.

Receiver 97 is located approximately 600 m to the east of the ballast borehole survey area and is generally screened by existing vegetation located on Morans Creek (see **Plate 2**). The residence is orientated away from this area and therefore would obtain a low visual sensitivity to this Modification. Given low visual effects resulting from this Modification due to the existing vegetation screening, a low visual impact would be experienced from this residence.

Receiver 115 is located approximately 280 m to the south east of the ballast borehole survey area. As shown in **Plate 3**, while this residence is strongly orientated towards the survey area it is partially screened by existing vegetation between the residence and the borehole area.

The ballast borehole is therefore expected to result in moderate visual impacts on this residence as a result of moderate sensitivity levels combined with moderate visual effects.

A number of other privately owned residences located in the vicinity of the ballast borehole survey area are either fully screened by existing vegetation or the topography between the residence and the survey area (see **Figure 4**). As such, these residences have been assessed as having low to very low visual impacts.

Some lighting facilities will be required to be installed in the compound for the ballast borehole for security purposes. This lighting will be established at the lowest practical elevation and will be directed downward in order to minimise any adverse lighting impacts to the neighbouring residents.

7.8.4 Mitigation & Management

The approved Landscaping and Revegetation Plan will be reviewed to incorporate the various components of this Modification to ensure that visual impacts to the neighbouring residences are appropriately managed.

Visual screening will be implemented on Centennial land to reduce impacts on privately owned landholders 82 and 115. The construction of the ballast borehole and associated facilities will consider any visual impacts on these residents and bunding and vegetation screens surrounding the compound will be planted as required.



Plate 1

Northern view from the ballast borehole survey area looking towards Receiver 82



Plate 2

Northern view from the ballast borehole survey area looking to east towards Receiver 97



Plate 3

Southern view from the ballast borehole survey area looking south west towards Receiver 115

The materials used for the construction of the gas engines and the ballast borehole will incorporate natural tones to blend in with the natural colour schemes with no reflective materials used.

Consideration of the location of neighbours and road users will be undertaken to ensure that any lighting requirements for the various components of this Modification will be directed away from these receivers to minimise adverse effects.

7.9 TRAFFIC & TRANSPORT

The Cooranbong EIS included an assessment of traffic impacts on Mandalong Road west of the F3 Freeway and at the intersection of the proposed Cooranbong mine entrance road with Mandalong Road. The Cooranbong EIS assessment was based on a maximum operational workforce of 220 employees with a maximum of 140 employees present onsite at any time.

As a result of this Modification, the maximum workforce will increase from 220 to 305 full-time-equivalent employees, however the workforce shift roster in place will ensure that the estimated maximum number of employees who will be present on site at any one time with the modification will remain at 140 employees.

A review of car parking facilities at the Mandalong Access Site has confirmed that currently, when 140 employees are present on site, approximately 104 vehicles are present in the car park.

Therefore, assuming continuation of existing workforce transportation patterns, the 200 parking spaces which are currently available on site will remain adequate to accommodate the proposed additional workforce.

The Mine Access Road is via Mandalong Road with approximately 90% of mine traffic likely to approach from the east (according to 2008 employee residential records). Mandalong Road in the vicinity of the mine is a two lane sealed road.

The intersection of Mandalong Road and the mine entrance road is an unsignalised Type C rural road intersection (AUSTROADS *Guide to Traffic Engineering Practice*). There is a dedicated deceleration/queuing lane, for traffic turning right from Mandalong Road into the mine access road, and a deceleration lane for eastbound traffic turning left off Mandalong Road into the mine access road.

The intersection was designed and constructed as part of the Cooranbong EIS approved by the Department of Planning in 1998. At that time the average daily traffic on Mandalong Road was 1,500 vehicles per day (Cooranbong Colliery life Extension Project EIS).

A recent traffic count undertaken on Mandalong Road in the vicinity of the mine access road in April 2008 measured average daily traffic volumes of 1,618 vehicles per day. This corresponds to a maximum design hour traffic volume of 240 vehicles per hour, assuming a maximum hourly volume of 15% daily volume. In accordance with the Austroads Guidelines, a cross-road such as the Mine Access Road, with a traffic volume of at least 300 vehicles per hour would still correspond to uninterrupted flow conditions on the through road, which in this case is Mandalong Road. Therefore the increase in traffic movements to the site due to the modification would not result in interruption to Mandalong Road traffic operations, and the existing Type C intersection at the mine access road provides adequate capacity for any additional traffic movements predicted to occur.

As construction and operation of the proposed ballast borehole will result in additional traffic on Mandalong Road a road traffic impact assessment for additional traffic movements associated with the construction and operation of the ballast borehole has been undertaken by Hansen Bailey and is included below.

7.9.1 Background

A ballast borehole has been approved however it is now required to be installed at a different location to the south west of the Access Site (see **Figure 1**).

The exact location will be determined in future, however it is proposed in an area approximately 1.3 km south west of the Access Site.

The proposed site access is via an existing unsealed farm access track leading south to the borehole area from Mandalong Road approximately 1.5 km west of the F3 freeway.

In the vicinity of the borehole site, Mandalong Road is a undivided, sealed rural road with unsealed shoulders and limited centre line markings only. The vertical road alignment is generally flat with grassed open drains on both sides.

The horizontal alignment is straight for a distance of approximately 300 m west and 600 m east of the intersection of the existing farm access track with Mandalong Road. The speed limit is 80 km/hr.

The pavement width in the vicinity of the entrance to the existing farm access track is approximately 7 m and there is no local pavement widening. There is a small culvert beneath the crossing to the entry to the farm access track. The eastern section of Mandalong Road from the bridge crossing of Morans Creek to the borehole entry point was upgraded in March 2008. This upgrade consisted of the following:

- Providing a new road sub-base and pavement, raising the road height up 1 m;
- Marking new road divider lines; and
- Reinstating the road edge table drains and stabilising the road edge batters (see **Plate 4**).

A traffic count was conducted on Mandalong Road at two locations immediately east and west of the Mandalong Mine Access Road (Kerry Anderson Drive) from 29 March 2008 to 6 April 2008. The traffic data collected from this count is summarised in **Table 27**. The vehicle classes referred to correspond to the Austroads vehicle classification system.

The level of service on a road is defined in the Austroads Guidelines as a qualitative measure of the operational conditions within a traffic stream, as perceived by motorists and passengers. The level of service categories generally describe the conditions in terms of factors which include speed and travel time, freedom to manoeuvre, traffic interruptions, comfort, convenience and safety.

Table 27
Mandalong Road Daily Traffic Volumes

Direction	Average Daily Vehicle Volumes			Total
	Light (Classes 1 & 2)	Rigid (Classes 3, 4 & 5)	Articulated (Classes 6 & above)	
Westbound				
• Weekday	803	42	14	859
• Weekend	697	25	9	731
• Weekly	773	37	13	823
Eastbound				
• Weekday	788	31	16	835
• Weekend	671	16	9	696
• Weekly	754	27	14	795
Total				
• Weekday	1,591	73	30	1,694
• Weekend	1,368	41	18	1,427
• Weekly	1,527	64	27	1,618

Source: National Transport Planning & Engineering (2008).



Plate 4
Mandalong Road Looking East Including Recent Upgrade

There are six levels of service ranging from A to F. Level A represents the best operating condition of free flow, virtually unaffected by the presence of other vehicles. Level F represents the worst with forced or break-down flow. Using the traffic volumes recorded in April 2008 the current level of service on Mandalong Road has been determined as Level A.

7.9.2 Impact Assessment

The proposed ballast borehole will be used for delivery of ballast material to the underground workings of Mandalong Mine.

The existing farm access track to the proposed borehole site will be upgraded and extended for use as an access road for the duration of borehole operation. Construction of the ballast borehole will also require construction of the borehole, a small ballast stockpile area, gravel pad and truck turning area, loading hopper, communications, fencing and bunding.

Construction of the borehole, associated infrastructure and access track upgrade will take approximately two months and be undertaken up to seven days per week during daylight hours. During this time there will be a small, temporary increase in heavy vehicle traffic along Mandalong Road between the site entrance on Mandalong Road and the F3 Freeway to the east. The heavy vehicle traffic will include trucks delivering materials, including steel casing, gravel and construction machinery. The construction workforce of approximately five employees will also generate minimal light vehicle traffic, travelling to and from the construction site for this limited time.

Following commissioning of the borehole, the activities associated with operation of the borehole which will generate additional traffic including the following:

- Occasional inspections by mine employees or contractors; and
- Delivery of ballast gravel.

There will not be a permanent workforce based at the ballast borehole site however it is estimated that one employee will travel to the site most weekdays from the nearby Access Site to oversee borehole operations and maintenance.

A maximum of two light vehicle movements in each direction, to and from the site, has been conservatively allowed in the assessment.

Ballast gravel will generally be supplied from quarries located in the vicinity of the town of Lochinvar north west of Newcastle. Therefore most gravel delivery trucks will approach the site via the F3 Freeway from the north, taking the Mandalong exit to the Freeway and travelling westbound along Mandalong Road to the site entrance. It is possible that a small number of vehicles may occasionally approach from a different direction, including the western side of Mandalong Road or the F3 Freeway from the south.

However, the volume of these is likely to be too small (less than 10 % from each alternative area) to be significant and any vehicles approaching from the south on the Freeway will still travel westbound on Mandalong Road to the site entrance and therefore contribute to the majority of the additional traffic which will occur on Mandalong Road between the F3 Freeway and the site entrance. It has been conservatively assumed for the traffic assessment that all gravel trucks will travel to the site to and from the east.

It is estimated that there will be approximately ten gravel deliveries per week to the borehole. These will generally occur as two deliveries per weekday limited to daylight hours. The delivery trucks will typically consist of trucks towing trailers equivalent to Austroads vehicle classes 4 or 5.

Therefore the estimated increase in vehicle traffic along Mandalong Road due to operation of the proposed ballast borehole will result in an additional two light vehicle and two heavy vehicle movements per day in each direction along Mandalong Road between the F3 Freeway and the borehole access track (see **Table 28**).

Table 28
Mandalong Road Predicted Weekday Traffic Volumes with this Modification

	Average Daily Vehicle Volumes			Total	% Increase from existing
	Light (Classes 1 & 2)	Rigid (Classes 3, 4 & 5)	Articulated (Classes 6 & above)		
Westbound	805	44	14	863	0.5 %
Eastbound	790	33	16	839	0.5 %
Total	1,595	77	30	1,702	0.5 %

This corresponds to an increase in weekday vehicle volumes as follows:

- Eastbound heavy vehicle increase of 4.2 % (from 47 to 49 vehicles per day);
- Westbound heavy vehicle increase of 3.6 % (from 56 to 58 vehicles per day);
- Eastbound total vehicle increase of 0.5 % (from 835 to 839 vehicles per day); and
- Westbound total vehicle increase of 0.5 % (from 859 to 863 vehicles per day).

The small increase in traffic predicted to occur due to this Modification will not impact the existing level of service of Mandalong Road which will remain as Level A.

The borehole will be operational for the life of the mine. Based on a typical annual traffic volume growth rate of 1.5 % per annum on Mandalong Road this predicted increase in traffic due to operation of the borehole will become even less significant in future years.

7.9.3 Mitigation & Management

In order to mitigate the impact of the predicted minor increase in heavy vehicle traffic associated with the ballast borehole, pavement widening works will be undertaken on both sides of Mandalong Road adjacent to the intersection with the borehole access track.

Pavement widening will include provision of a deceleration lane on the southern side of Mandalong Road, of sufficient width and length to permit other vehicles travelling west on Mandalong Road to continue safely past the intersection when trucks may be decelerating and turning left into the borehole site. Additionally, pavement widening on the northern side of Mandalong Road, opposite the borehole access road intersection, will be designed to enable eastbound traffic on Mandalong Road to safely overtake trucks exiting the borehole site to the east.

All design and construction works at the proposed intersection with the ballast borehole entry will be undertaken in accordance with the relevant engineering design standards and in consultation with the Lake Macquarie City Council.

Design of the pavement widening will also include the upgrade of the existing culvert beneath the access track and, if necessary, the relocation of any existing services within the road reserve on both sides of Mandalong Road. Road signage, to indicate the possibility of trucks turning at the intersection, will be provided in accordance with design guidelines.

A Section 138 approval under the Roads Act will also be sought prior to any works being undertaken on Mandalong Road.

7.10 PRELIMINARY HAZARD ANALYSIS

7.10.1 Introduction

The EAR's (see **Table 9**) stipulated a requirement for a Preliminary Hazards Analysis (PHA) to be conducted due to the close proximity of the proposed gas engines to the F3 Freeway. A PHA was undertaken by Advitech Pty Limited and is included in full in **Appendix H**. The PHA provides an overview of the likely potential hazards that may occur as a result of a hazardous or offensive development in accordance with the requirements of *State Environmental Planning Policy No. 33 – Hazardous and Offensive Development* (SEPP 33).

SEPP 33 requires developments which are potentially hazardous to undertake a PHA to determine the risk to people, property and the environment at the proposed location and in the presence of controls. Should such risk exceed the criteria of acceptability, the development is classified as 'hazardous industry' and may not be permissible within most industrial zones in NSW. The PHA has been undertaken in accordance with the relevant risk criteria in the *Hazardous Industry Planning Advisory Paper No. 4 - Risk Criteria for Land Use Safety Planning* (DoP, 1990) (HIPAP No. 4).

The purpose of this PHA was to:

- Identify all potential hazards associated with the development of the proposed gas engines for this Modification;
- Analyse the development of the proposed gas engines for both the consequences (effects) for people, property and the environment, and the probability (likelihood or frequency) of occurrence;
- Estimate the resultant risk to the surrounding land uses and environment; and
- Ensure that the proposed safeguards are adequate, and thus demonstrate that the operation of the gas engines will not impose level of risk that is intolerable with respect to their surroundings.

7.10.2 Impact Assessment

The gas engines proposed for this Modification have been classified by the Director General as potentially hazardous in relation to surrounding land users, namely the F3 Freeway adjacent to the eastern boundary of the Mandalong Mine Access Site. The hazard scenarios identified in the risk assessment relevant to the operations of the gas engines are presented in **Appendix H**.

The risk assessment uses guide words and descriptive scales to determine the probability of each identified hazard and its consequences. This provided an estimate of the likely rate of occurrence of hazardous events and their severity, from which a measure of the risk may be obtained through application of a risk matrix.

Multi-Level Risk Assessment (DoP, 1997) provides guidance on choosing the level of assessment required to determine that the gas engines will not pose a significant risk to surrounding land users. A risk assessment undertaken for the gas engines is included in **Appendix H** and demonstrated that there are no high level risks identified for off-site impacts.

Therefore, the current management measures in place at Mandalong have been found to adequately protect local land users. The Modification is considered to be 'not hazardous' and a qualitative study was deemed to be sufficient according to *Multi-Level Risk Assessment* (DoP, 1997).

The identified risk scenarios of the qualitative risk assessment for the gas engines were required to be compared with four qualitative risk criteria in HIPAP No. 4. The following criteria were assessed as required in the qualitative risk assessment for the gas engines:

- All avoidable risks should be avoided;
- The consequences of the more likely hazardous events should, wherever possible, be contained within the boundaries of the installation;

- The risk from a major hazard should be reduced wherever practical. If the consequences of an identified hazardous incident are significant to people and the environment, then all feasible measures should be adopted so that the likelihood of such an incident occurring is made very low; and
- Where there is an existing high risk from a hazardous installation, additional hazardous developments should not be allowed if they add significantly to that existing risk.

No dangerous goods defined under the Australian Code for the Transport of Dangerous Goods by Road and Rail will be stored at the proposed gas engines site. The only transport activity associated with the proposed gas engines is the initial delivery of the engines and occasional maintenance personnel travelling to the site. There will be no dangerous goods transport and therefore the development is classified as '*not potentially hazardous*' under the Australian Code for the Transport of Dangerous Goods by Road and Rail with respect to transport.

7.10.3 Mitigation & Management

Appropriate safeguards for all possible off-site impacts were identified for the gas engines to reduce any potential risks as much as possible at Mandalong. Measures that have been, or will be established for the gas engines to manage those events identified as having the potential for creating an off-site risk to land users include the following:

- Noise modelling to identify and address any adverse noise implications;
- Maintenance works being carried out during the day period, restricted transport routes and times consistent with those in the approved Mandalong Noise Management Plan;
- Establishing an engine control system and maintenance practices to ensure the engines are working within specified operational limits;
- Controlling the release of noxious combustion gases by annual measurement of the exhaust

gases; the use of low sulphur fuels and the stack height is designed to aid dispersion and meet DECC air quality guidelines;

- Crushed stone being applied to the ground surface of the compound to mitigate dust emissions;
- Establishment of a fire protection zone around the site of the gas engines the inclusion of the site in the current fire fighting system at Mandalong;
- Local power disturbance will be protected by spike protection and specified network operator requirements;
- Ensuring coolant is biodegradable and used in relatively small volumes, with each engine banded and spill control procedures in place to mitigate any loss of containment from the gas engines; and
- The methane will revert to the flares or the existing vent if there is an engine shutdown. A gas detection system and automatic shutoff valve at borehole collar will be included in the final design to reduce the likelihood of a methane gas loss of containment. In the unlikely event that some methane escapes the gas is sufficiently buoyant (at 40°C) to assist dispersion.

7.11 ECONOMICS

7.11.1 Background

This Modification will deliver a range of economic benefits to the Lake Macquarie Local Government Area and NSW more generally through employment, income and output. The social and economic impacts associated with Mandalong Mine include direct flow on effects through the sale of product coal, employee wages and services and the provision of contributions to the NSW Government and other relevant regulators.

7.11.2 Impact Assessment

To determine the potential socio-economic benefits of this Modification, the following assumptions were used to facilitate the economic analysis:

- Economic calculations were modelled on the proposed increase in the rate of coal production from the currently approved 4 Mtpa to 6 Mtpa Run of Mine;
- Wage calculations are based on an average for current and continuing employee numbers;
- Calculation of royalties is based on those payable to the current Department of Primary Industries royalty regime and reflect the short and long-term price and cost assumptions;
- Calculation of company taxes are those payable to the Commonwealth Government and reflect the short and long-term price and cost assumptions; and
- Estimates of contributions payable includes payments to the Australian Coal Association Research Program and reflect short and long-term coal sale volume assumptions.

A summary of the economic benefits to result from the proposed increase in annual coal extraction increase are shown in **Table 29**.

Based on the above assumptions, this Modification is estimated to make the following additional annual contributions to the NSW and regional economies:

- Additional payments of approximately \$8.3 million to full time equivalent contractors;
- Approximately \$4.3 million in Government Royalties and taxes;
- Approximately \$400,000 in contributions to the Australian Coal Association Coal 21 levy; and
- An increase in approximately \$200,000 in contributions payable to the Australian Coal Association Research Program.

7.11.3 Mitigation & Management

Centennial Mandalong will continue to source local employment where practical and provide regular updates to the local community and workforce on its operations and this Modification.

No additional social or economic mitigation and management measures for this Modification are proposed.

Table 29
Mandalong Modification Economic Contributions

Economic Contributions	Annual Economic Benefit (\$ '000)
Coal Production & Sales	
Approximate sales revenue	90,700
Wages & Contributions	
Full Time Equivalent Contractors	8,300
NSW Government Royalties	4,300
Australian Coal Association Research Program Contributions	200
Australian Coal Association Coal21 Levy \$0.20 / t	1,200
Local Community	
Maintenance	3,432
Mining Support Services	3,232

8.0 STATEMENT OF COMMITMENTS

In addition to the conditions of DA 97/800, Centennial Mandalong commits to the operational controls as outlined in **Table 30** for all activities associated with this Modification.

The aim of this Statement of Commitments is to ensure that any potential environmental impacts resulting from this Modification are minimised and managed by revising existing or implementing environmental management and monitoring strategies.

Table 30
Statement of Commitments

Ref	Commitment	EA Section
Operational Commitments		
1.	Undertake the components of this Modification generally in accordance with that described in Section 3.0 and as shown on Figure 5 of this Environmental Assessment.	3.0
2.	Gas engines to be constructed and operated generating 12 Megawatts capacity, with a stack height of at least 10 m to be fuelled by methane from Mandalong underground coal seams.	3.1.1
3.	Activities at the ballast borehole site and construction of the gas engines will occur during the day time only (i.e. 7:00 am to 6:00 pm).	3.1.1
4.	The coal extracted shall not exceed 6 Mtpa Run of Mine.	3.1.2
5.	Longwall panels will be designed up to 250 m in width ensuring all sensitive surface features remain safe, serviceable and repairable, to the approval of Department of Primary Industries.	3.1.4 & 7.1.6
6.	Construct the ballast borehole within the survey area shown on Figure 4 with earthen bunds and/or tree screening undertaken to mitigate visual impact on nearby private residences.	1.1.1
7.	Revise the existing Mining Operations Plan to incorporate components of this Modification and continue to develop Subsidence Management Plans in accordance with the Department of Primary Industries' guidelines.	4.3.2
8.	Seek a variation to Environmental Protection Licence 365 under the <i>Protection of the Environment Operations Act 1997</i> to take into account the proposed Modification.	4.3.3
Stakeholder Consultation		
9.	Continue to regularly advise the CCC and other relevant stakeholders consistent with the Mandalong Stakeholder Communication Strategy.	5.0
10.	Continue to communicate environmental management initiatives both internally and externally to regulatory authorities, near neighbours, the Aboriginal community and other interested stakeholders.	5.4
Environmental Management		
11.	Utilise existing Environmental Management Plans as required and continue to operate an Environmental Management System consistent with that described in this Environmental Assessment and where required, incorporate this Modification.	2.5
Noise		
12.	Mining related activities will be conducted in a manner which ensures noise emissions meet the criteria in Table 18 of this Environmental Assessment at private receivers.	7.2.3
13.	The gas engines will be constructed within a suitably designed building, utilising appropriate acoustic attenuation systems to provide the necessary level of noise control and meet the Sound Power Levels utilised for modelling purposes in this Environmental Assessment.	7.2.4
14.	Continue to monitor noise levels to ascertain compliance with criteria in this Environmental Assessment.	7.2.4
15.	A combined sound power level of 102 dBA from all engines, except standby units, when measured according to AS1217 (or equivalent) will be utilised for design purposes to meet modelled predictions.	7.2.3

Ref	Commitment	EA Section
Air Quality & Greenhouse		
16.	The gas engine exhaust stacks will be designed and built to Australian Standards to at least 10 m in height to minimise any adverse air quality impacts on neighbouring landowners and ensure the necessary emission dispersion.	7.3.3
Water		
17.	During construction, temporary sediment and erosion controls will be installed around the proposed gas engine area, ballast borehole site and along the access track as necessary.	7.4.1
18.	Following completion of construction of the ballast borehole, any disturbed areas (including any bunding) will be topsoiled, revegetated and rehabilitated in accordance with the Department of Primary Industries' guidelines.	7.4.1
19.	All water discharges shall be undertaken in compliance with the licensing conditions of the Environmental Protection Licence.	7.4
Flora & Fauna		
20.	The small pond in the ballast borehole survey area will not be disturbed as it may provide potential habitat for native and migratory water bird species.	7.5.4
21.	Erosion and sediment control structures and management procedures shall be put in place to minimise impacts to aquatic habitat and wetland areas within or surrounding the areas proposed for the ballast borehole and gas engines' sites.	7.5.4
22.	The Vegetation Clearance Procedure provided in Table 24 shall be utilised as required for the clearance of any hollow-bearing trees.	7.5.4
Aboriginal Heritage		
23.	Members of the Aboriginal community will be invited to be present to inspect topsoil stripping activities.	7.6.4
24.	Relevant training commensurate with job descriptions will be provided to employees and contractors of Mandalong Mine in relation to Aboriginal heritage.	7.6.4
25.	Should items of Aboriginal heritage be encountered during works, the Procedure shown in Section 7.6.4 of this Environmental Assessment will be implemented.	7.6.4
Visual & Lighting		
26.	Tree screening shall be developed to ensure that visual and lighting impacts to the neighbouring residences are appropriately managed.	7.8.4
27.	Visual screening to be implemented between the ballast borehole and the properties of receivers 82 and 115 in order to reduce visual impacts will consider bunding and vegetation screens as required.	7.8.4
28.	The materials used for the construction of the gas engines and the ballast borehole will consist of natural colour schemes to blend in with the natural environment with no reflective materials used.	7.8.4
29.	Consideration will be given to the location of residences and road users to ensure that any lighting requirements for the various components of this Modification will be directed away from these receivers to minimise any adverse effects.	7.8.4
Traffic & Transport		
30.	The design and construction of the intersection and culvert at the Mandalong Road and ballast borehole site entrance will be undertaken in consultation with Lake Macquarie City Council prior to works commencing.	7.9.3
31.	A Section 138 approval under the Roads Act will also be sought prior to any roadworks being undertaken on Mandalong Road.	7.9.3
32.	Relevant training will be provided to all operators at the ballast borehole site during construction and operation which will include (at least) instruction on safe driving practices.	7.9.3
Preliminary Hazard Analysis		
33.	Relevant management safeguards for all possible off-site impacts identified in the PHA for the gas engines shall be implemented at Mandalong to reduce any potential risks.	7.10.3

9.0 CONCLUSION

In accordance with the Environmental Assessment Requirements, this section of the Environmental Assessment provides a detailed justification for this Modification, taking into consideration the potential costs and benefits discussed above, and a discussion in relation to the suitability of the site.

9.1 ENVIRONMENTAL IMPACTS

This Environmental Assessment includes detailed assessment of all identified environmental and social issues associated with this Modification as discussed in Section 7.0. A risk assessment process has been used to rank the various environmental risks associated with this Modification. Reasonable and feasible mitigation measures have been devised to mitigate the risks identified.

As highlighted throughout this Environmental Assessment, all environmental impacts have been assessed on a worst-case scenario, assuming maximum extraction of 6 Mtpa is achieved, all components of this Modification are constructed and all activities described in the Cooranbong EIS are occurring.

No adverse impacts have been identified in relation to threatened flora and fauna, Aboriginal or non-Aboriginal heritage. Noise, air quality and subsidence impacts have been predicted to occur within relevant regulatory criteria, with greenhouse gas emissions' savings quantified as a result of the operation of the proposed gas engines fuelled by waste coal methane gas. Water discharge requirements associated with increased production will remain within currently approved limits, with water use predicted to minimally increase. Limited visual impacts to residences associated with the construction and operation of the ballast borehole have been predicted.

Traffic impacts from employees and deliveries will remain within currently approved predictions with limited additional traffic impacts from the operation of the ballast borehole identified.

An assessment of the potential hazard of the operation of the gas engines concluded a minimal risk to the community. Relevant management measures have been identified and included in the Mandalong Mine Statement of Commitments to ensure that minor environmental and social impacts associated with this Modification are mitigated.

9.2 MODIFICATION BENEFITS

A reduction in greenhouse gas emissions from Mandalong Mine of 0.136 Mtpa have been predicted as a direct result of the construction and operation of the proposed 12 Megawatt gas engines which will provide electricity to the NSW power supply.

Methane emissions currently generated by Mandalong Mine as a result of coal extraction will be diverted to the gas engines to generate electricity with any excess flared, as previously approved. Additionally, a reduction in greenhouse gas emissions will occur through the gas engines generating electricity and supplying it to the NSW grid in lieu of power supplied via coal-fired power stations.

This Modification, in addition to those generated by the existing Mandalong Mine, will deliver significant annual economic benefits to the Lake Macquarie area, regional economy and federally which include:

- Additional payments of approximately \$8.3 million to full time equivalent contractors;
- Approximately \$4.3 million in Government Royalties and taxes;
- Approximately \$400,000 in contributions to the Australian Coal Association Coal 21 levy; and
- An increase in approximately \$200,000 in contributions payable to the Australian Coal Association Research Program.

A workforce of up to 305 Full Time Equivalent personnel (from the 220 currently approved at the Access Site) will be required to allow Mandalong to extract and process the 6 Mtpa of Run of Mine coal sought as part of this Modification. Many of these additional positions will be filled from local and regional contractors and when combined with additionally required maintenance works, significant flow-on effects as a result of this Modification of \$6.6 M per annum are anticipated.

9.3 SITE SUITABILITY

Mandalong Mine has been extracting coal via the longwall mining method from the West Wallarah Seam since 2005. Approved coal processing and transport activities have also been undertaken at the site within the Mining Leases. Activities have been conducted in accordance with approvals to mine coal from the Mandalong Mine site granted by the Department of Planning and Department of Primary Industries, which have included development consent, a Commission of Inquiry and various approvals under the Mining Act. In addition, Lake Macquarie City Council Zoning shows the majority of the area within which Mandalong Mine operates is suitable for Zone (9) Natural Resources.

This Modification represents a continuation of the intended land use utilising the existing resource, facilities and transport methods to allow Mandalong Mine to continue to meet both domestic and international energy demands.

The proposed gas engines are within the footprint of the currently approved Mandalong Mine and the ballast borehole is proposed immediately above the approved footprint of the underground workings. The increase in production as sought will be extracted from the currently approved mining footprint utilising the same mining methods and equipment as currently employed.

Therefore the suitability of the site for the purpose of mining, processing and transporting coal (and all associated activities) has previously been assessed and approved by the relevant regulatory authorities.

This Modification as sought will allow the continuation of Mandalong Mine in its currently approved form, whilst allowing the capture of methane emissions and conversion into energy for utilisation within the NSW power grid.

10.0 ABBREVIATIONS

Abbreviation	Description
Access Site	Mandalong Mine Access Site which includes the Mandalong Mine underground workings and associated surface infrastructure near Morisset (and the old Cooranbong workings for ventilation and access).
AGL	AGL Energy Limited
CCC	Community Consultative Committee
dBA	The peak sound pressure level, expressed as decibels (dB) and scales on the 'A-weighted' scale, which attempts to closely approximate the frequency response of the human ear
DEC	Department of Environment & Conservation (Environmental Protection Authority), now DECC
DECC Guidelines	Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation (2005)
DECC	NSW Department of Environment and Climate Change
Delta Entry Site	The Delta Entry Site: which encompasses an entry and coal delivery system at the Vales Point Rail Unloader Facility near Wyee.
EPA	NSW Environmental Protection Authority
ESD	Ecologically Sustainable Development
ha	hectare
LEP	Local Environmental Plan
LGA	Local Government Area
Mining Act	Mining Act 1992
Mtpa	Million tonnes per annum
MW	Megawatts
MWh	Megawatt hours
Receiver	Property adjacent the DA Boundary containing a residence
Services Site	Mandalong Mine Services Site which includes the underground workings and surface infrastructure of the Cooranbong Entry Site (formerly Cooranbong Colliery surface facilities) near Dora Creek.

11.0 REFERENCES

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12.0 EA STUDY TEAM

Section	EA Component	Team Member and Company	
Centennial Project Management			
	Paul Williams Mary-Anne Crawford	Regional Environmental Co-ordinator Group Environment Manager	Centennial Coal
EA Management			
	Project Director Project Manager Project Co-ordinator	James Bailey Dianne Munro Nathan Cooper	Hansen Bailey
EA Sections			
-	Executive Summary	Dianne Munro	Hansen Bailey
1.0	Background	Nathan Cooper	Hansen Bailey
2.0	Existing Environment	Dorian Walsh	Hansen Bailey
3.0	Modification Description	Dianne Munro	Hansen Bailey
4.0	Regulatory Framework	James Bailey	Hansen Bailey
5.0	Stakeholder Consultation	Dianne Munro	Hansen Bailey
6.0	Risk Assessment	Dorian Walsh	Hansen Bailey
7.0	Impacts, Management & Mitigation	Juliet Bates / Melissa Walker / Nathan Cooper / Dorian Walsh	Hansen Bailey
8.0	Statement of Commitments	Dianne Munro	Hansen Bailey
9.0	Conclusion	Dianne Munro	Hansen Bailey
10.0	Abbreviations		
11.0	References		
12.0	EA Study Team		
Appendices			
Appendix A	Consent Conditions to be Modified	Dianne Munro	Hansen Bailey
Appendix B	Regulatory & Stakeholder Correspondence	Paul Williams / Katie Brassil	Centennial Coal
Appendix C	Environmental Risk Assessment	Dianne Munro	Hansen Bailey
Appendix D	Noise Impact Assessment	Mark Bridges	Bridges Acoustics
Appendix E	Air Quality & Greenhouse Impact Assessment	Dr Nigel Holmes	Holmes Air Sciences
Appendix F	Flora & Fauna Impact Assessment	Dr Monika Rhodes	Hansen Bailey
Appendix G	Aboriginal Cultural Heritage Impact Assessment	Cheryl Kitchener	Indigenous Outcomes
Appendix H	Preliminary Hazard Analysis	Jeremy Pola	Advitech Pty Limited
Drafting and Graphics Design by Pegasus Technical Pty Limited and Greenpond TSG			
Legal advice provided by Centennial Coal Internal Counsel			