

Environmental Assessment

Ventilation Air Methane Abatement
Demonstration Project

MANDALONG MINE

Section 75W Modification

June 2011

Submission of Environmental Assessment

Prepared under Section 75W of Part 3A of the *Environmental Planning and Assessment Act 1979*

EA Prepared by:

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Development Application:

Applicant Name: Centennial Mandalong Pty Ltd
Applicant Address: PO Box 1000
TORONTO NSW 2283
Land to be developed: Lot 6 DP 262159
Proposed Development: Modification to development consent DA 97/800 to enable the installation and ongoing operation of a Ventilation Air Methane Regenerative After Burner.

Certificate:

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

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

Name: GSS Environmental
Nicole Armit

Signature:



Date: 10 June 2011

This Project is funded by the NSW Department of Trade and Investment, Regional Infrastructure and Services (formerly Industry and Investment NSW) through the Clean Coal Fund, which is administered by the Minister for Resources and Energy. Any views expressed herein do not necessarily reflect the views of the NSW Department of Trade and Investment, Regional Infrastructure and Services or the NSW Government.

EXECUTIVE SUMMARY

Background

Mandalong Mine (Mandalong) is an underground longwall coal mining operation located in the Lake Macquarie Local Government Area (LGA), approximately 130 kilometres north of Sydney near Morisset, NSW. Mandalong is a relatively gassy mine and accounts for approximately 55 percent of Centennial's Scope 1 (direct) emissions per annum (2009/10 Financial Year), emitting approximately 1 Mt of CO₂-e each year.

99.5 percent of Mandalong's direct greenhouse gas emissions are as a result of fugitive emissions. These emissions are divided between high purity methane drainage gas (32 percent), and methane contained in the ventilation air drawn from the mine, in the form of high flow rate ventilation air methane (VAM), accounting for 68 percent of fugitive emissions. The high purity methane drainage gas can be abated by flaring the gas, or via the beneficial use of the gas in gas engines. Mandalong has an existing approval for the installation and operation of both enclosed methane gas flare units and gas engines.

Greenhouse gas emissions associated with VAM are much more difficult to abate, because the naturally-occurring gas becomes diluted in the large volumes of ventilation air that are flushed through the mine during standard mining operations. As methane typically constitutes less than 1 percent of the ventilation air expelled from an underground mine, the gas is too low in concentration to either flare or use to generate electricity.

One technology being investigated by Centennial Mandalong to abate greenhouse gas emissions associated with low concentration methane is ventilation air methane regenerative afterburners (VAM RABs). The VAM RAB system overcomes the problem of low concentration methane by directing the ventilation air into a large oxidation vessel, and oxidising the methane to carbon dioxide. This technology is based on well tested coke-oven principles, and has been developed by Corky's Sustainable Energy (CSE), a Newcastle-based engineering company.

Centennial Mandalong seeks to reduce the greenhouse gas emissions from Mandalong by reducing the amount of methane being ventilated to the atmosphere through the installation and ongoing operation of VAM RAB technology. The VAM RAB technology initially proposed for Mandalong includes installation and operation of a single VAM RAB unit as part of a demonstration project to demonstrate capture and abatement of approximately 10 cubic metres per second (m³/s), or one-thirtieth, of the mine's total VAM.

This project, which will be undertaken on behalf of the NSW government and the underground coal industry, is co-funded by the Department of Trade and Investment, Regional Infrastructure and Services (DTIRIS) via the NSW Clean Coal Fund (NSW CCF) (\$2.2 million plus GST), and Centennial Mandalong (\$0.6 million). The government funds are subject to the terms of a Funding Agreement, which was finalised on 1 March 2011.

This Environmental Assessment (EA) has been prepared to support an application by Centennial Mandalong Pty Ltd (Centennial Mandalong), to modify the Mandalong Development Consent DA 97/800 under section 75W of the EP&A Act. The proposed modification would allow for the installation of a single VAM RAB unit and associated infrastructure to demonstrate capture and abatement of approximately 10 m³/s of VAM.

A Preliminary Environmental Assessment (PEA) of the project was prepared and submitted, along with the Project Application, to the Department of Planning and Infrastructure (DP&I) on 7 March 2011. In response, in an email to Centennial dated 29 March 2011 the DP&I advised they had reviewed the PEA for the modification application and considered the proposed assessment of associated impacts described in the

document as appropriate. The DP&I further advised they would not be issuing Director-General's Requirements (DGRs) for the modification, and that the EA is to address the following:

- Hazards – including a Preliminary Hazard Analysis (PHA) demonstrating that the cumulative offsite risk from all credible incidents on the site for all existing, approved and proposed plant and equipment will not exceed the risk criteria in the Department's *Hazardous Industry Planning Advisory Paper No.4, Risk Criteria for Land Use Safety Planning* (addressed in **Section 8.2**);
- Noise – including an assessment of noise impacts to determine the level of cumulative impacts of the existing, approved and proposed equipment and plant on-site for near-by residential receivers (addressed in **Section 7.5**);
- Air Quality – including an assessment of air quality impacts from the planned operation of Ventilation Air Methane Abatement equipment to determine the level of impact on near-by residential receivers. The assessment must include a cumulative assessment of existing, approved and proposed methane abatement technologies at the site (addressed in **Section 7.7**); and
- The EA should also include an Environmental Risk Assessment to determine the level of assessment required for the modification for all other environmental impacts associated with the proposal (addressed in **Section 7.1**).

This EA assesses the matters relevant to the proposed modification and seeks to demonstrate that the proposed modification has limited environmental consequences beyond those already approved in Development Consent No. DA 97/800, nor will it change the nature of the development originally approved. The EA has been prepared by GSS Environmental (GSSE) on behalf of Centennial Mandalong.

Proposed Modification

The proposed modification involves the installation of a single VAM RAB unit and associated infrastructure, as follows:

- Installation of a single VAM RAB unit inclusive of VAM capture duct and RAB tower elements, adjacent to the existing Mandalong Ventilation Fans;
- Provision of site services to the VAM RAB. This includes an extension of the existing methane gas drainage pipeline to connect to the VAM RAB unit, as well as the provision of power from the gas monitoring switch room and water via pipeline proximate to the plant;
- Installation of a fire suppression system for the Motor Control Centre;
- Sourcing of fill from either an existing stockpile to the north west of the proposed location of the VAM RAB, or from offsite as required, to establish appropriate foundations for the VAM RAB unit;
- Rehabilitation of the existing stockpile area as required, following the sourcing of fill from this stockpile;
- Erection of fencing around the VAM RAB;
- Minor drainage works to ensure appropriate drainage at the site;
- Increasing the Mandalong Mine Development Consent noise criteria to be consistent with the Project Specific Noise Criteria.

The proposed modification will not result in any other changes to the operations at Mandalong. No additional coal production or any other changes to mining related activities are proposed. No dedicated

plant operators are required for the VAM RAB beyond the initial five weeks of experiments. During this initial period, continuous coverage (24 hours per day, seven days per week) will apply to collect data and to make adjustments as required. Beyond this time, the plant will essentially operate unattended with continuous monitoring and periodic on-site maintenance checks.

This project is phase one of a potential three phase project. Phases two and three could see installation and operation of up to 36 VAM RAB units at Mandalong and the integration of VAM RAB technology with existing and/or approved infrastructure (gas flares and gas engines) to create what is referred to as the Mandalong Greenhouse Abatement Facility (MGAF). Expansion and integration of VAM RAB technology at Mandalong beyond the initial 14 month demonstration period will be considered subject to initial tests, project finance and further project approvals.

Environmental Assessment

This EA, which includes Technical Appendices, documents the various studies that have been undertaken to examine potential impacts that may occur as a result of the proposed modification. The key areas addressed in the EA were identified during a risk assessment conducted by Centennial in February 2011. The key areas that have been assessed in detail are listed below. The associated technical reports are listed in brackets:

- Flora and Fauna (Hunter Eco, 2011, *Mandalong Mine Ventilation Air Methane Abatement Demonstration Project – Ecology Report*);
- Noise (SLR Consulting Australia Pty Ltd, 2011, *Mandalong Mine Ventilation Air Methane Abatement Demonstration Project – Noise Impact Assessment*);
- Greenhouse Gas (SLR Consulting Australia Pty Ltd, 2011, *Mandalong Mine Ventilation Air Methane Abatement Demonstration Project - Greenhouse Gas Assessment*);
- Air Quality (SLR Consulting Australia Pty Ltd, 2011, *Mandalong Mine Ventilation Air Methane Abatement Demonstration Project – Air Quality Impact Assessment*); and
- Cultural Heritage (RPS, 2011, *Mandalong Mine Ventilation Air Methane Abatement Demonstration Project – Cultural Heritage Assessment*).

Other issues addressed in the EA by GSSE include surface water, soil and land capability, visual amenity, and socio-economic and community aspects.

The VAM RAB unit will be installed in a disturbed area already containing Mandalong's existing ventilation and gas drainage infrastructure. The technical studies conclude that adverse environmental impacts associated with the project will be either negligible or very minimal, with limited environmental consequences beyond those already approved. In particular, impacts relating to air quality, noise, visual amenity, surface water resources, aboriginal and cultural heritage, and soils and land capability are anticipated to be negligible. Existing environmental management strategies will be applied to the proposed modification.

A small area containing the vegetation community Roughbarked Apple Swamp Forest, which is listed in the schedules of the *Threatened Species Conservation Act 1995* as an Endangered Ecological Community (EEC), will be cleared to allow for installation of the VAM RAB unit. An offset strategy is presented in this document, involving the rehabilitation of degraded areas with the Project Site which currently fragment the remnant EEC to ensure a net improvement in biodiversity outcomes.

Positive environmental outcomes are inherent in this project, given that the role of the VAM RAB unit is to reduce greenhouse gas emissions. Fugitive coal seam methane emissions account for the vast majority of direct greenhouse gas emissions from Mandalong, and the installation of the VAM RAB unit will reduce these emissions by 23,430 t CO₂-e. The Scope 2 emissions will increase slightly due to a small increase in

electricity consumption, however the project will lead to the overall emission of 23,270 fewer tonnes of CO₂-e from the mine.

Safety and Risk Management

Along with ensuring environmental impacts are avoided and/or minimised, safety is a primary consideration in this project. The technical and functional aspects of the project are secondary to ensuring that installation and operation of the unit is undertaken in a manner which does not pose a significant risk to mine or public safety.

A risk-based approach has therefore been used in all aspects of planning for the project. This approach has included the involvement of specialists in the risk assessment process, as well as specialist peer review. Mine safety is considered via a Hazard and Operability (HAZOP) study, Safety Integrity Level (SIL) assessment and through the use of the NSW WorkCover risk assessment tool; the 3-stage Construction Hazard Assessment Implication Review (CHAIR). Public safety is considered via a PHA, in accordance with the requirements of the DP&I.

Preliminary Hazard Analysis

The findings of the PHA determine that the project is acceptable subject to demonstration of appropriate safety features compliance to safety integrity levels to Australian Standard (AS) IEC 61511 (IEC 61508), compliance to the Mining Design Guideline (MDG) 41 for the hydraulic systems and the *Coal Mine Health and Safety Act 2002*, as it is applied by Centennial Mandalong.

Justification and Conclusion

Fugitive emissions from coal mines and oil and gas projects, as well as direct fuel combustion emissions from liquefied natural gas (LNG) projects, account for almost half of the predicted growth in Australia's total emissions from 2010 to 2020. The development and implementation of an effective abatement technology for fugitive emissions will therefore play a significant role in achieving a reduction in Australia's greenhouse gas emissions.

If the demonstration of VAM RAB technology is proven successful, the technology could be retro-fitted to any underground coal mine that has an issue with fugitive methane emissions above certain concentration limits (indicative 0.3 percent methane or greater), or be included in the design of ventilation systems for new mines. In addition, it would also provide an economic benefit given that these fugitive methane emissions under a carbon price mechanism would potentially be a significant cost impost to coal mining operations. The environmental and economic benefits of this project therefore have the potential to go well beyond Mandalong, with VAM RAB technology potentially having a significant role to play in the abatement of Australia's greenhouse gas emissions.

This is the only project being funded via the NSW CCF relating to the abatement of fugitive emissions from underground coal mines, and will therefore be a major contributor to the ongoing development and testing of clean coal technologies.

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ABBREVIATIONS

AHIMS	Aboriginal Heritage Information Management System
CCC	Community Consultative Committee
Centennial	Centennial Coal Company
Centennial Mandalong	Centennial Mandalong Pty Ltd
CCF	Clean Coal Fund
CO ₂ e	Carbon dioxide equivalent
DCM	Design, Construction and Maintenance
DECCW	Former NSW Department of Environment, Climate Change and Water
DGRs	Director General's requirements
DP&I	NSW Department of Planning and Infrastructure
DTIRIS	Department of Trade and Investment, Regional Infrastructure and Services
EA	Environmental Assessment
EECs	Endangered Ecological Communities
EIS	Environmental Impact Statement
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
EP&A Regulation	<i>Environmental Planning and Assessment Regulation 2000</i>
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
EPL	Environment Protection Licence
FY	Financial Year
GSSE	GSS Environmental
I & I NSW	Former Industry and Investment NSW
LEP	Local Environmental Plan
Major Projects SEPP	<i>State Environmental Planning Policy (Major Development) 2005</i>
Mandalong	Mandalong Mine
MGAF	Mandalong Greenhouse Abatement Facility
Mt	Million tonnes
Mtpa	Million tonnes per annum
MW	Megawatts
NGER Act	<i>National Greenhouse and Energy Reporting Act 2007</i>
NPW Act	<i>National Parks and Wildlife Act 1974</i>
OEH	Office of Environment and Heritage
PEA	Preliminary Environmental Assessment
POEO Act	<i>Protection of the Environment Operations Act 1997</i>
RAB	Regenerative afterburner
ROM	Run of Mine
TSC Act	<i>Threatened Species Conservation Act 1995</i>
VAM	Ventilation Air Methane

1.0 INTRODUCTION

1.1 Background

Mandalong Mine (Mandalong) is an underground longwall coal mining operation located in the Lake Macquarie Local Government Area (LGA), approximately 130 kilometres north of Sydney near Morisset, NSW. A locality plan is included in **Figure 1**.

Mandalong was granted Development Consent DA 97/800 by the then Minister for Urban Affairs and Planning on 14 October 1998 under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act), following the submission of the *Cooranbong Colliery – Life Extension Project Environmental Impact Statement (EIS)* (Umwelt 1998) and a Commission of Inquiry.

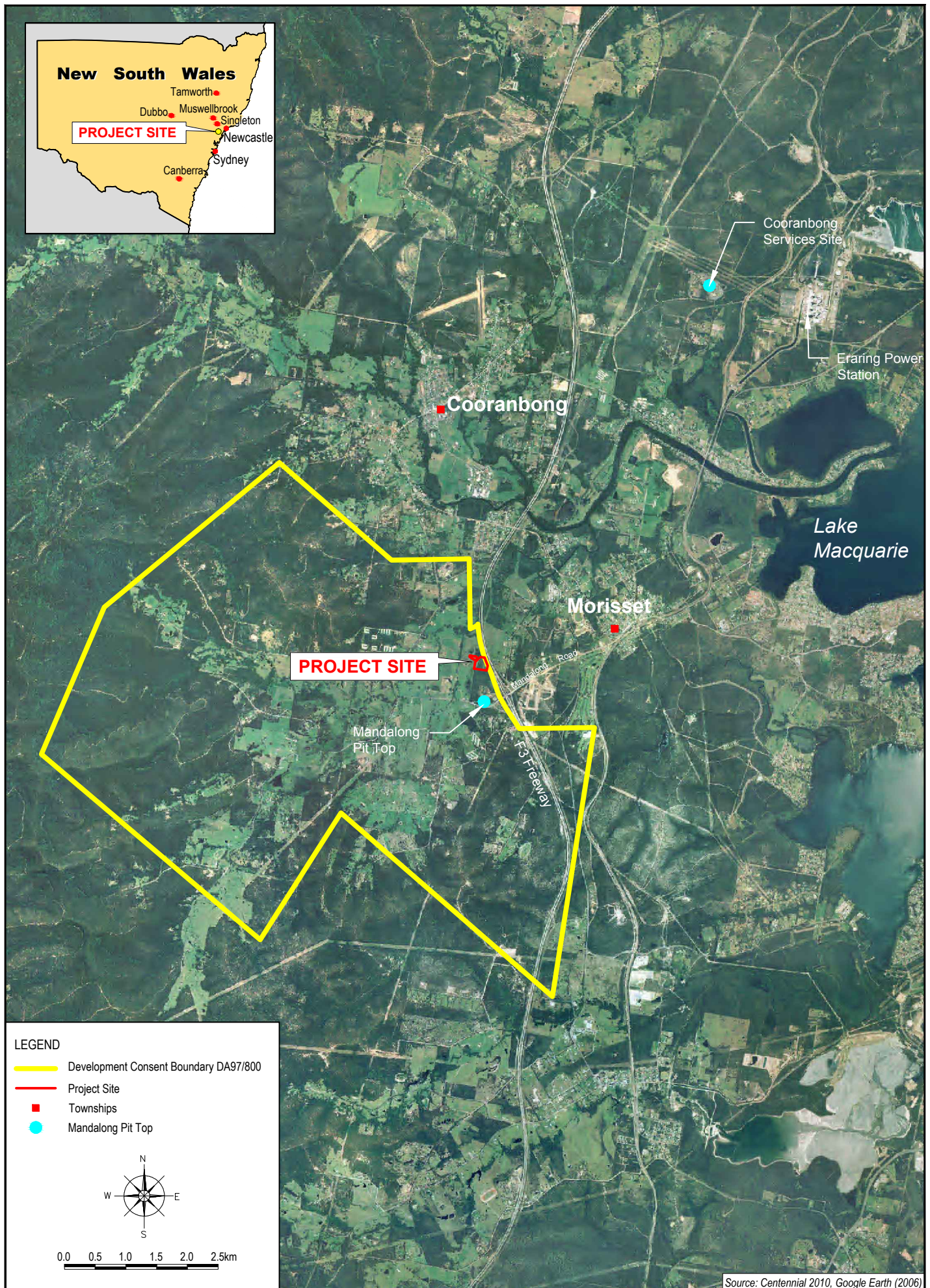
The current Mandalong longwall mining operation extracts coal from the West Wallarah Seam, formed by the convergence of the Wallarah and Great Northern Seams. The depth and characteristics of these target seams results in the retention of methane within the seams, which is released upon extraction. Methane is a greenhouse gas, with around 21 times the global warming potential of carbon dioxide. As a result, Mandalong is a relatively gassy mine and accounts for approximately 55 percent of Centennial's Scope 1 (direct) emissions per annum (2009/10 Financial Year), emitting approximately 1 Mt of CO₂-e each year.

99.5 percent of Mandalong's direct greenhouse gas emissions are as a result of fugitive emissions. These emissions are divided between high purity methane drainage gas (32 percent), which is drawn directly from the coal seams prior to mining via in-seam drainage, and methane contained in the ventilation air drawn from the mine, in the form of high flow rate ventilation air methane (VAM) (68 percent). The high purity methane drainage gas can be abated by flaring the gas, or via the beneficial use of the gas in gas engines. Mandalong has an existing approval for the installation and operation of both enclosed methane gas flare units and gas engines. The methane gas drainage plant has been constructed and has commenced operation. Construction of the gas flares by AGL is anticipated to be completed by December 2011. The assessment of gas engine potential and capacity continues with AGL.

Greenhouse gas emissions associated with VAM are much more difficult to abate, because the naturally-occurring gas becomes diluted in the large volumes of ventilation air that are flushed through the mine during standard mining operations. VAM typically has a concentration of less than one percent, well below the flammability limit of five percent methane in air. In addition, the combustion characteristics of VAM are highly variable, with methane concentrations never approaching the flammability limit. The remaining 68 percent of Mandalong's emissions are therefore much more difficult to abate or utilise as an energy source.

A number of technologies to oxidise low concentration methane/air mixtures are under development or are at the demonstration stage. One technology being investigated by Centennial Mandalong is ventilation air methane regenerative afterburners (VAM RABs), which comprise an oxidation vessel and a large (high thermal mass) ceramic heat exchanger that results in the oxidation of VAM, converting methane to carbon dioxide. This technology is based on well tested coke-oven principles, and has been developed and is being tested by Corky's Sustainable Energy (CSE), a Newcastle-based engineering company.

Centennial Mandalong Pty Limited (Centennial Mandalong) seeks to reduce the greenhouse gas emissions from Mandalong by reducing the amount of methane being ventilated to the atmosphere through the installation and ongoing operation of VAM RAB technology. The VAM RAB technology initially proposed for Mandalong includes installation and operation of a single VAM RAB unit as part of a demonstration project to demonstrate capture and abatement of approximately 10 cubic metres per second (m³/s), or one-thirtieth of the mine's total VAM. There is no heat recovery or generation component to this demonstration phase, as the focus of this project is to demonstrate operation of the VAM RAB unit at a low to moderate methane content of approximately 0.3 – 0.7 percent methane. Tests will be conducted over a 14 month period to verify performance of the technology, with results to be made available to industry under the terms of a Funding Agreement with the Department of Trade and Investment, Regional Infrastructure and Services



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(DTIRIS) (formally known as Industry and Investment NSW) (further detail on this agreement is provided below in **Section 4**).

This demonstration project is phase one of a potential three phase project. Phases two and three could see installation and operation of up to 36 VAM RAB units at Mandalong, and the integration of VAM RAB technology with existing and/or approved infrastructure (the gas flares and gas engines) to create what is referred to as the Mandalong Greenhouse Abatement Facility (MGAF). A fully developed and integrated MGAF could see the capture and abatement of up to 100 percent of the mine's Scope 1 emissions, with the potential to generate up to 12 megawatts (MW) of power. This is over 2.5 times the mine's electricity requirements. Expansion and integration of VAM RAB technology at Mandalong beyond the initial 14 month period will be considered subject to initial tests, project finance and further project approvals.

1.2 Document Purpose

This Environmental Assessment (EA) has been prepared to support an application by Centennial Mandalong to modify the Mandalong Development Consent DA 97/800 under section 75W of the EP&A Act. The proposed modification would allow for the installation of additional infrastructure at Mandalong Mine to capture and abate approximately 10 m³/s of ventilation air methane.

This EA assesses the matters relevant to the proposed modification and seeks to demonstrate that the proposed modification has limited environmental consequences beyond those already approved in Development Consent No. DA 97/800, which is attached as **Appendix 1**, nor will it change the nature of the development originally approved. The EA has been prepared by GSS Environmental (GSSE) on behalf of Centennial Mandalong.

1.3 The Proponent

The proponent is Centennial Mandalong Pty Ltd, a wholly owned subsidiary of Centennial Coal Company (Centennial). Centennial is a wholly owned subsidiary of Banpu Minerals (Singapore) Pte Limited (Banpu). Mandalong produces approximately 5.0 million tonnes of thermal coal annually for domestic and export markets via longwall mining methods.

Centennial supplies thermal and coking coal to the domestic and export markets, operating ten coal mines in NSW, making it one of the largest underground coal producers in the state. Centennial is a major fuel supplier to the NSW energy industry, fuelling approximately 46 percent of the State's coal-fired electricity. Approximately one third of Centennial's coal is sold to the export market and is exported through the Port of Newcastle and Port Kembla in NSW.

1.4 Overview of Proposed Modification

Centennial Mandalong is seeking to modify the current Development Consent DA 97/800 under section 75W of the EP&A Act to allow for the installation and ongoing operation of a single VAM RAB unit as a demonstration project to examine the performance capability of innovative, locally developed VAM RAB technology (referred to herein as 'the project'). More specifically, the project involves the following:

- Installation of a single VAM RAB unit inclusive of VAM capture duct and RAB tower elements, adjacent to the existing Mandalong Ventilation Fans;
- Provision of site services to the VAM RAB. This includes an extension of the existing methane gas drainage pipeline to connect to the VAM RAB unit, as well as the provision of power from the gas monitoring switch room and water via pipeline proximate to the plant;
- Installation of a fire suppression system for the Motor Control Centre;
- Sourcing of fill from either an existing stockpile to the north west of the proposed location of the VAM RAB, or from offsite as required, to establish appropriate foundations for the VAM RAB unit;

- Rehabilitation of the existing stockpile area as required, following the sourcing of fill from this stockpile;
- Erection of fencing around the VAM RAB;
- Minor drainage works to ensure appropriate drainage at the site;
- Increasing the Mandalong Mine Development Consent noise criteria to be consistent with the Project Specific Noise Criteria.

This project, which will be undertaken on behalf of the NSW government and the underground coal industry, is co-funded by DTIRIS via the NSW Clean Coal Fund (NSW CCF) (\$2.2 million plus GST), and Centennial Mandalong (\$0.6 million). The government funds are subject to the terms of a Funding Agreement, which was finalised on 1 March 2011. This is the only project being funded via the NSW CCF relating to the abatement of fugitive emissions from underground coal mines.

1.5 Approval Process

Development Consent DA 97/800 was originally granted for Mandalong by the then Minister for Urban Affairs and Planning on 14 October 1998 under Part 4 of the EP&A Act.

Pursuant to *State Environmental Planning Policy (SEPP) (Major Projects) 2005*, development referred to as a 'major project' requires assessment and approval from the Minister for Planning and Infrastructure in accordance with Part 3A of the EP&A Act. The SEPP classifies certain types of development comprising a major project. Development for the purpose of mining that is coal or mineral sands mining is defined as a major project in Schedule 1, Clause 5 of the SEPP.

An approval granted by the Minister under Part 3A of the EP&A Act to carry out a project may be modified under section 75W. In addition, Clause 8J(8) of the EP&A Regulation provides a mechanism whereby projects approved under Part 4 of the EP&A Act can be modified under section 75W.

Accordingly, this modification is sought under section 75W, and the proposal will be subject to assessment by the Director General of the Department of Planning and Infrastructure (DP&I) and determination by the Minister for Planning and Infrastructure in accordance with Part 3A of the EP&A Act. The development consent, if modified, will not become an approval under Part 3A of the Act, but will remain a Part 4 consent.

Following the change of government in NSW as a result of the state election in March 2011, the NSW planning system is currently undergoing significant change, with the first stage of phasing out Part 3A of the EP&A Act commenced. However, at the time of writing it is noted that approved projects can still be modified under section 75W until such time as Part 3A is repealed.

Further details regarding the approval process are provided in **Section 5.0**.

1.5.1 Director-General's Requirements

A Preliminary Environmental Assessment (PEA) of the project was prepared and submitted, along with the Project Application, to the DP&I on 7 March 2011. As part of the preparation of the PEA, a project risk assessment was undertaken by Centennial on 1 February 2011 to identify those aspects relating to the proposed modification which could possibly present a risk to the environment and surrounding community, and to assist in determining the level of environmental assessment required. A risk register was subsequently developed and included in the PEA submitted to the DP&I. Further details on the outcomes of the risk assessment are provided in **Section 7.1**.

In response, in an email to Centennial dated 29 March 2011 (see **Appendix 2**), the DP&I advised they had reviewed the PEA for the modification application and considered the proposed assessment of associated impacts described in the document as appropriate. The DP&I further advised they would not be issuing Director-General's Requirements (DGRs) for the modification, and that the EA is to address the following:

- Hazards – including a Preliminary Hazard Analysis (PHA) demonstrating that the cumulative offsite risk from all credible incidents on the site for all existing, approved and proposed plant and equipment will not exceed the risk criteria in the Department's *Hazardous Industry Planning Advisory Paper No.4, Risk Criteria for Land Use Safety Planning* (addressed in **Section 8.2**);
- Noise – including an assessment of noise impacts to determine the level of cumulative impacts of the existing, approved and proposed equipment and plant on-site for near-by residential receivers (addressed in **Section 7.5**);
- Air Quality – including an assessment of air quality impacts from the planned operation of Ventilation Air Methane Abatement equipment to determine the level of impact on near-by residential receivers. The assessment must include a cumulative assessment of existing, approved and proposed methane abatement technologies at the site (addressed in **Section 7.7**); and
- The EA should also include an Environmental Risk Assessment to determine the level of assessment required for the modification for all other environmental impacts associated with the proposal (addressed in **Section 7.1**).

1.6 Environmental Assessment Team

GSSE has prepared this EA on behalf of Centennial Mandalong. In addition, the following external consultants undertook specialist studies to assist in the assessment of the project:

- Hunter Eco – Ecological Assessment;
- SLR – Greenhouse Gas Assessment;
- SLR – Air Quality Assessment;
- SLR – Noise Assessment; and
- RPS – Cultural Heritage Assessment.

The assessment of all other relevant aspects of the project was undertaken by GSSE.

1.7 Document Structure

The EA has been prepared in accordance with the EP&A Act and the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation). The matters addressed within the EA are presented in a manner that clearly addresses the specific requirements of the DP&I.

In summary, the EA is structured as follows:

- Section 1: Introduction** - introduces the proponent and the project team involved in producing the EA, outlines the project background, provides a summary of the primary project components, and nominates the approval pathway.
- Section 2: Site Description** - provides an overview of the project site in terms of locality, land ownership and surrounding land uses.
- Section 3: Current Approved Operations** - provides a description of the existing approved operations at Mandalong.
- Section 4: Proposed Modification** - provides a detailed description of the project.

- Section 5: Statutory Requirements** - describes the planning approval and environmental legislative framework for the project, including the applicability of Commonwealth and State legislation, as well as local planning instruments.
- Section 6: Consultation** - provides details of consultation that has taken place with government agencies, the community, Aboriginal groups and other relevant stakeholders.
- Section 7: Environmental Assessment** - contains a description of the existing environment, an assessment of the potential environmental issues/impacts relevant to the project, and recommends management/mitigation measures where required.
- Section 8: Draft Statement of Commitments** - lists the draft Statement of Commitments proposed to be adopted throughout the life of the project in order to mitigate potential adverse impacts and ensure appropriate management and monitoring.
- Section 9: Safety and Risk Management** – discusses the risk-based approach applied to this project, as well as the findings of the PHA.
- Section 10: Justification and Conclusion** - outlines the justification for the project, including a discussion on Ecologically Sustainable Development as it relates to the project, and contains the conclusion to the EA.
- Section 11: References** - lists the reference documents referred to within the EA.

2.0 SITE DESCRIPTION

2.1 Site Locality

Mandalong Mine is located in the western Lake Macquarie region of NSW, approximately 130 kilometres north of Sydney, within the Lake Macquarie LGA. The site is situated west of the Sydney-Newcastle F3 Freeway, approximately 2.5 kilometres southwest of the Morisset Township. A locality plan is included in **Figure 1**.

The Mandalong mining operation comprises the underground workings and surface infrastructure of the following (refer **Figures 1** and **2**):

- The Mandalong Mine underground workings and surface infrastructure (Mandalong pit top) near Morisset;
- The Cooranbong Services Site underground workings and surface infrastructure near Dora Creek; and
- The Delta Entry Site, which encompasses an entry and coal delivery system, near Wyee at the Vales Point Rail Unloader Facility (approved under a separate development consent DA 35/2/2004).

2.2 Project Site

The project site for which this modification relates is illustrated in **Figure 3**, and is located north of the Mandalong pit top within the current Development Consent (DA 97/800) and Environment Protection Licence (EPL) 365 boundaries. The project site has been defined as approximately the Lot (Lot 6 DP 262159) containing the existing main mine ventilation and gas drainage infrastructure, and is the area in which the VAM RAB unit and associated infrastructure is to be installed. The project site also encompasses the area proposed for installation of the approved gas flares and gas engines. As illustrated in **Figure 3**, the actual area of disturbance within the project site associated with the installation of the VAM RAB is quite small at approximately 0.88 hectares in area.

The project site also includes a detached area of 0.55 hectares to the north west. This area consists of soil material stockpiled from construction of the F3 freeway, and consequently is referred to as the RTA stockpile. Fill may be sourced from this stockpile to assist in achieving appropriate levels across the project site, and as such is included in the project site for the proposed modification.

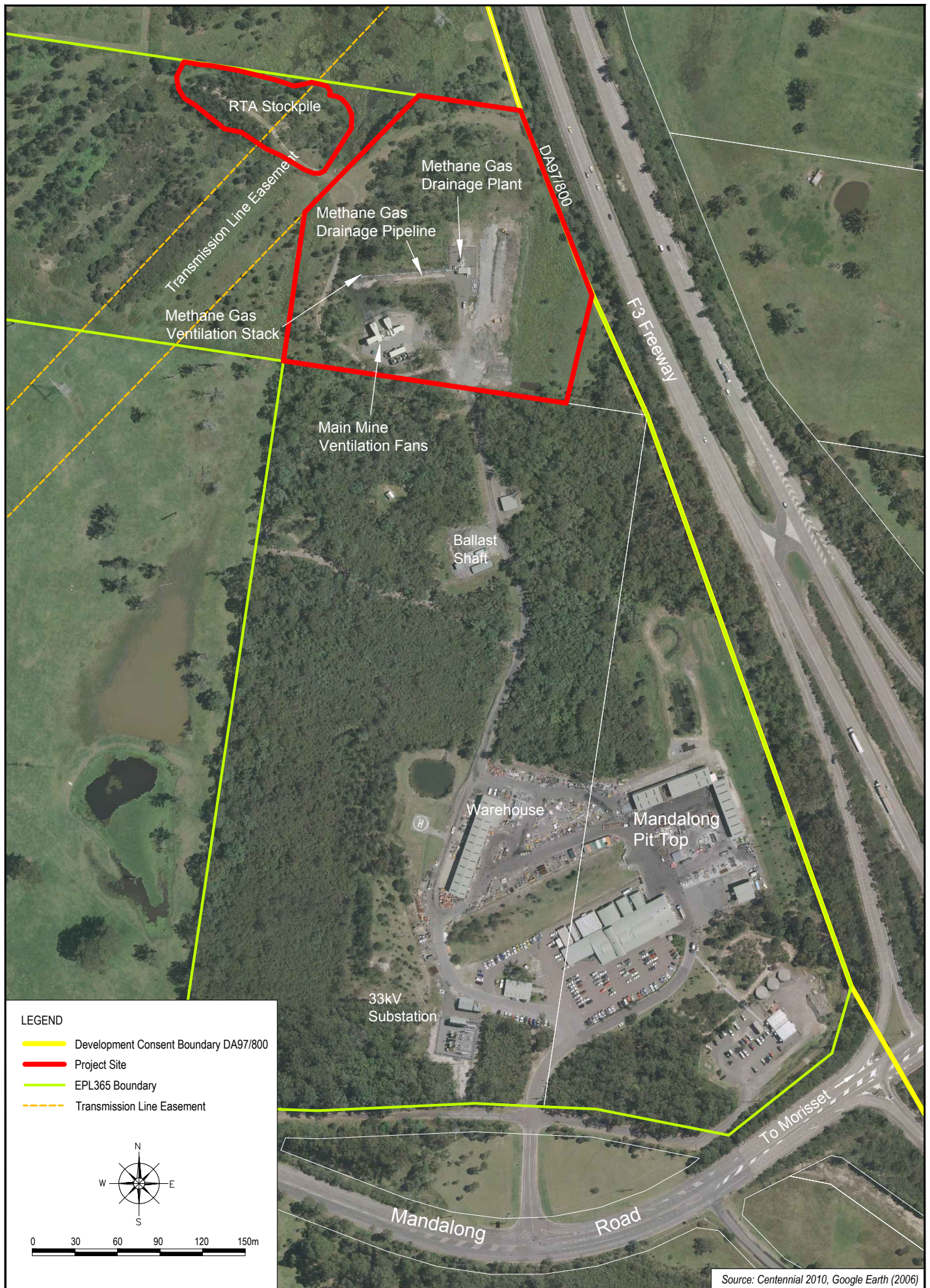
The project site and surrounding residences are located in undulating terrain, with elevated terrain located south and west of the site. The project site is situated at an approximate elevation of around 6 metres Australian Height Datum (AHD), with a ridge running in a north-southerly direction located just south of the site. The land levels out to the east of the project site towards Lake Macquarie.

2.3 Land Ownership

The land within the project site is owned by Centennial Fassifern Pty Limited, a wholly owned subsidiary of Centennial Coal. Land ownership within and surrounding the project site is illustrated in **Figure 4**.

2.4 Existing Land Use

The project site is located within an area zoned Natural Resources (Zone 9) in the *Lake Macquarie Local Environment Plan 2004* (LEP). The objectives of Zone 9 of the LEP include provision of land that has dual values as an economic natural resource and for environmental protection, among others. The LEP is discussed further in **Section 5**.



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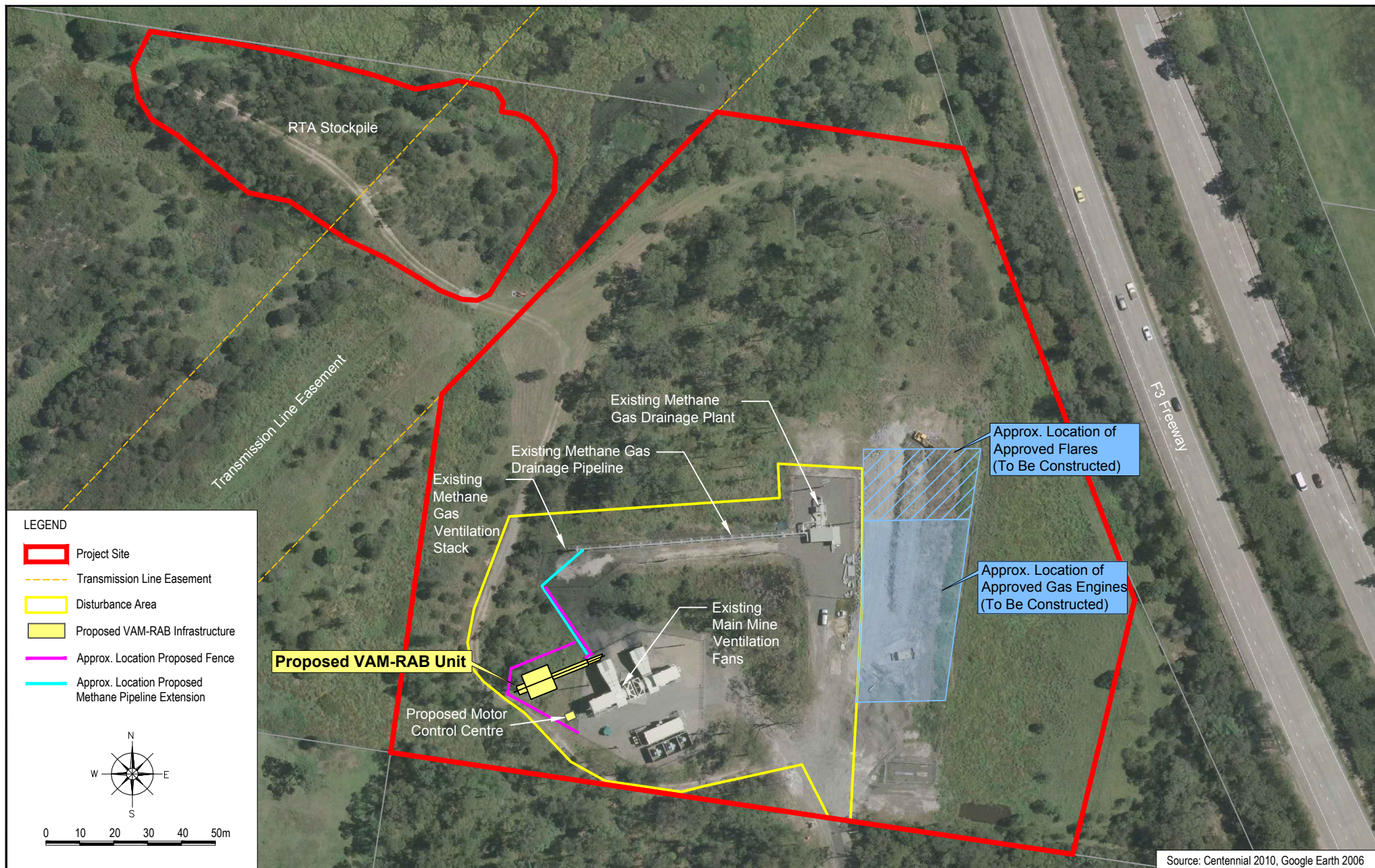
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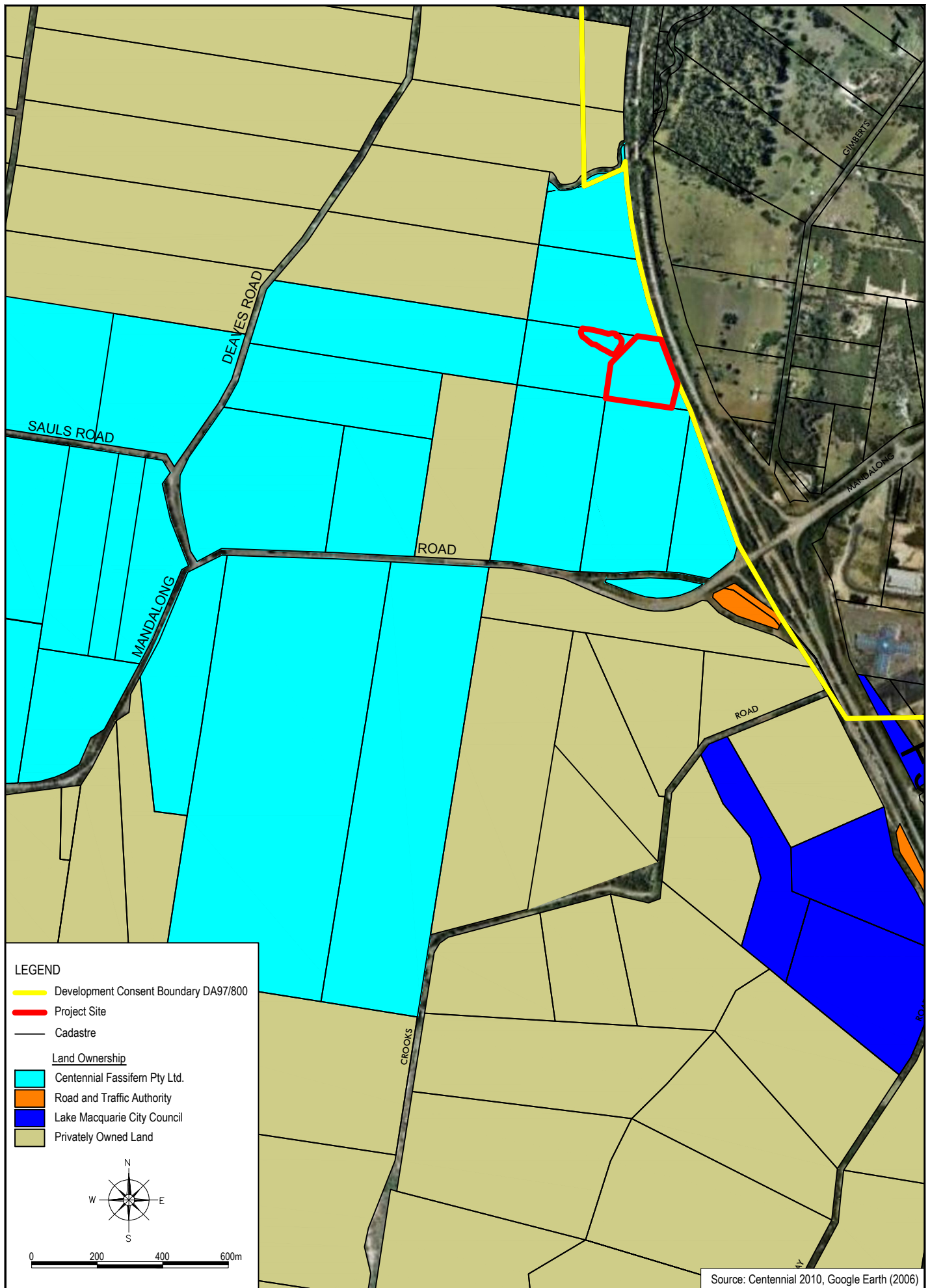
GSS ENVIRONMENTAL
Environmental, Land and Project
Management Consultants

Mandalong Mine Surface Infrastructure

FIGURE 2



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The local area which surrounds Mandalong's operations includes residential and rural properties. Major features of the area include:

- The township of Morisset, located approximately 2 kilometres east of the Mandalong pit top;
- The F3 Freeway, located east and immediately adjacent to the project site;
- The Main Northern Railway Line running north to south, located approximately 1.8 kilometres east of the project site;
- The Olney State Forest, located approximately 1 kilometre west of the current Mandalong longwall mining area; and
- The Eraring Power Station, located approximately 1.3 kilometres to the east of the Mandalong Services site (formerly Cooranbong Colliery).

The land use within the project site currently consists of the Mandalong ventilation fans and methane drainage infrastructure, including the main mine ventilation fan, methane gas drainage plant, methane gas pipeline, and the methane gas ventilation stack, as illustrated in **Figure 3**. The land is highly disturbed from previously approved activities.

3.0 CURRENT APPROVED OPERATIONS

3.1 Background

The Mandalong Mine was originally proposed by Powercoal Pty Ltd after an extensive drilling program, with an EIS submitted in 1997 and a Commission of Inquiry held in 1998. Mandalong was granted Development Consent DA 97/800 by the then Minister for Urban Affairs and Planning on 14 October 1998 under Part 4 of the EP&A Act. After obtaining development consent, Centennial, who purchased the mine from Powercoal in August 2002, constructed the Mandalong Mine site and decline tunnel to access the Mandalong mining area. Longwall mining operations commenced in January 2005.

Six modifications to the original Development Consent have since been approved, as follows:

- Development Consent DA 97/800 was first modified in 2001 under section 96(1A) of the EP&A Act to allow for minor changes to conditions of consent relating to the preparation of property subsidence management plans, longwall subsidence management plans and notification of landholder requirements;
- In 2005 a modification was approved under section 96(2) of the EP&A Act for the installation of methane drainage plant and the transport of 1,000 tonnes of coal from the Mine by road. Centennial Mandalong has since constructed and commenced operation of the methane drainage plant;
- Condition 60a(iii) of the 2005 modification included a requirement for Centennial Mandalong to submit a report on the progress towards implementing greenhouse gas abatement. In accordance with this condition, a report dated 24th June 2005 and a subsequent application was submitted to modify DA 97/800 to allow for the installation and operation of enclosed methane gas flare units for high purity methane drainage gas. This modification was approved in 2006; and
- In 2009 three modifications to the consent were approved for the:
 - o Construction and operation of gas engines to produce up to 12 MW of electricity using high purity methane drainage gas, an increase in the rate of Run of Mine (ROM) production to six million tonnes per annum (Mtpa), relocation of the approved ballast borehole, and an update of subsidence conditions to make them consistent with the current Subsidence Management Plan (SMP) process;
 - o Temporary increase in the amount of coal product transported by conveyor from Mandalong Mine to the Eraring Power Station stockpiles, and processing of Mandalong coal at the Newstan Colliery; and
 - o Modifications to the heights and locations of already approved but not yet constructed coal handling infrastructure at the Mandalong Services Site.

In addition to DA 97/800, Development Consent DA 35/2/2004 was granted in July 2004 by the Minister for Planning, approving the construction and operation of the coal handling and clearance system at the Delta Entry Site. It is noted however that this Environmental Assessment only relates to a proposed modification of DA 97/800.

3.2 Mine Overview

The Mandalong Mine utilises longwall mining techniques, and comprises the underground workings and surface infrastructure of the following (refer **Figure 1**):

- The Mandalong Mine underground workings and surface infrastructure near Morisset;

- The Mandalong Services Site underground workings and surface infrastructure near Dora Creek; and
- The Delta Entry Site, which encompasses an entry and coal delivery system, near Wyee at the Vales Point Rail Unloader Facility.

The current longwall mining operation at Mandalong extracts coal from the seam known as the West Wallarah, formed by the convergence of the Wallarah and Great Northern seams. Mandalong has approval to extract up to six million tonnes of ROM coal a year.

Operations are approved to operate 24 hours a day, 7 days a week.

3.3 Ventilation and Gas Management

The depth and characteristics of the West Wallarah Seam results in the retention of methane within the seam which is released upon extraction. To manage levels of methane gas underground, gas drainage is undertaken at Mandalong, whereby in seam pre-drainage boreholes are constructed in advance of the longwall panels to reduce underground gas levels. Mandalong has also recently commenced post-drainage of gas stored in mined longwall goaf areas to reduce the amount of gas that leaks through seals into the flank (bleeder) road on a falling barometer.

The methane gas is discharged via the methane gas drainage plant located at the Mandalong surface facilities area (refer **Figure 3** and **Plate 1**). This plant has a design capacity of 1400 litres per second (l/s) at between 70 and 95 percent methane purity. The plant vents drainage gas to the atmosphere and has approval to operate 24 hours per day, seven days per week.



Plate 1 – Methane gas drainage pipeline and ventilation stack at Mandalong

As discussed above in **Section 3.1**, Mandalong has approval for the installation and operation of both enclosed methane gas flare units and gas engines for the abatement of high purity methane drainage gas. More specifically, Centennial Mandalong has approval subject to the completion of a HAZOP study for the following:

- Six enclosed methane gas flare units, each with a generator and a flare stack of approximately 10 metres in height (to screen the flame produced by the flare), in a 20 x 20 metre compound adjacent to the existing methane gas drainage plant;

- Operation of the flares and gas drainage plant 24 hours per day, seven days per week; and
- The construction and operation of gas engines fuelled by coal mine methane gas with a total electricity generation capacity of up to 12 MW. The application for the consent modification to allow for the gas engines considered a gas engine configuration with six engines producing 2 MW each, for the purposes of modelling worst case atmospheric and noise emissions. The EA concluded that this configuration complied with the Office of Environment and Heritage (OEH) atmospheric and noise criteria.

The gas engines and flares have not yet been constructed, with methane currently vented to the atmosphere upon extraction via the methane gas ventilation stack. The proposed location of the flares and gas engines is illustrated in **Figure 3**. Construction of the flares is anticipated to be completed by December 2011. The assessment of gas engine potential and capacity continues with AGL. A network study is currently being undertaken by AGL with Phase 1 (network inquiry) complete.

The Mandalong ventilation system is managed by the statutory mine ventilation engineer. The main ventilation fans at the mine have a total capacity of 300 m³/s and are situated north of the mine pit top, as illustrated in **Figure 3** and **Plates 2** and **3**.



Plate 2 – Main mine ventilation fans



Plate 3 – Ventilation fan A

3.4 Environmental Management

Centennial Mandalong has developed an Environmental Management System (EMS) which provides a framework for managing environmental issues at Mandalong Mine. The major components of the EMS are:

- Centennial Coal's Environmental Policy;
- The Environmental Management Strategy; and
- Environmental Management Plans and monitoring program.

Environmental monitoring currently undertaken includes meteorology, air quality, noise, blasting, ecology, surface and groundwater, subsidence, vibration and heritage.

The existing EMS currently utilised by Mandalong will be amended, as required, to incorporate the proposed modifications and the relevant recommendations of this EA.

4.0 PROPOSED MODIFICATION

4.1 Background

Mandalong Mine is a relatively gassy mine, and accounts for approximately 55 percent of Centennial's Scope 1 emissions per annum (2009/10 Financial Year), directly emitting approximately 1 Mt of CO₂e each year.

The National Greenhouse Accounts Factors (NGA Factors) (DCCEE, 2010) defines two types of greenhouse gas emissions:

- **Direct emissions** are produced from sources within the boundary of an organisation and as a result of the organisations activities; and
- **Indirect emissions** are emissions generated outside the boundary of an organisation in the wider economy as a consequence of an organisations activities (particularly from its demand for goods and services), but which are physically produced by the activities of another organisation. Examples of indirect emissions are those as a result of the consumption of electricity.

The direct (Scope 1) greenhouse gas emissions from Mandalong are as a result of the following activities:

- Fugitive emissions from coal seam methane as a result of extraction activities;
- Diesel usage in both mobile and fixed plant;
- Consumption of sulfur hexafluoride for gas insulated switchgear and circuit breaker applications; and
- The use of grease and oils for lubrication of plant and equipment.

The fugitive emissions from coal seam methane constitute the vast majority of Scope 1 emissions attributable to Mandalong. The greenhouse gas assessment undertaken for this modification (SLR, 2011) reports the total Scope 1 emissions from Mandalong in 2010 as 1,195,126 tonnes of Carbon dioxide equivalents (t CO₂-e), with 1,189,985 t CO₂-e, or 99.5 percent, from fugitive coal seam methane emissions. 32 percent of these fugitive emissions is from high purity methane drainage gas, whilst 68 percent is from VAM. This gives the equivalent emissions of 380,795 t CO₂-e for the high purity methane and 809,190 t CO₂-e for the VAM (SLR, 2011).

The high purity methane drainage gas can be abated and utilised in gas flares and gas engines. Mandalong has an existing approval for the installation and operation of gas engines, as well as enclosed methane gas flare units. VAM, however, is much more difficult to abate, as discussed below.

4.1.1 Ventilation Air Methane

Methane released from underground coal mines through ventilation air is known as VAM. As discussed in **Section 1.3**, VAM typically has a concentration level of less than one percent, well below the lower flammability limit of five percent methane in air. The combustion characteristics of VAM are highly variable, with methane concentrations never approaching the flammability limit. VAM, accounting for 68 percent of Mandalong's emissions, is subsequently much more difficult to abate or utilise as an energy source than the high purity methane drainage gas due to the low concentration and variability of the methane, impurities (dust and moisture) and high air flow.

A number of technologies that utilise VAM as the principal fuel have been investigated by industry and/or are undergoing further research. These include Megtec's Vocsidiser and Biothermica's Vamox technology.

Another such technology being investigated by Centennial is VAM RABs, which are discussed further below.

4.1.2 VAM RABs

The VAM RAB system overcomes the problem of low methane concentration in VAM by directing the ventilation air through what is essentially a large industrial oven. VAM RABs are a type of homogenous Thermal Flow Reverse Reactor (TFRR) with multiple combustion chamber temperature control. They are fundamentally an oxidation vessel and a large (high thermal mass) ceramic heat exchanger that, using this oxidation technique, oxidises the VAM, converting the methane to carbon dioxide and water. This technology is based on well tested coke-oven principles, and has been developed and is being tested by CSE, a Newcastle-based engineering company.

For the purposes of mine ventilation air, the RAB unit (which is arranged as a series of chequer bricks stacked together and surrounded by insulating refractory walls) provides heat to the VAM as it rises through the chequer brick structure. The air is heated to approximately 700 degrees Celsius on the journey up through the chequer bricks to the combustion chamber at the top of the RAB. The oxidation chamber has a temperature of approximately 1,000 degrees Celsius where the methane is oxidised. Hot air continues to flow down through the other side of the chamber and heat is transferred from the air to the chequer bricks. The air then exits from the VAM RAB unit after transferring most of its heat to the chequer bricks, and with 99.9 percent of the methane oxidised to carbon dioxide during the process.

A VAM RAB unit is illustrated in **Plate 4**.

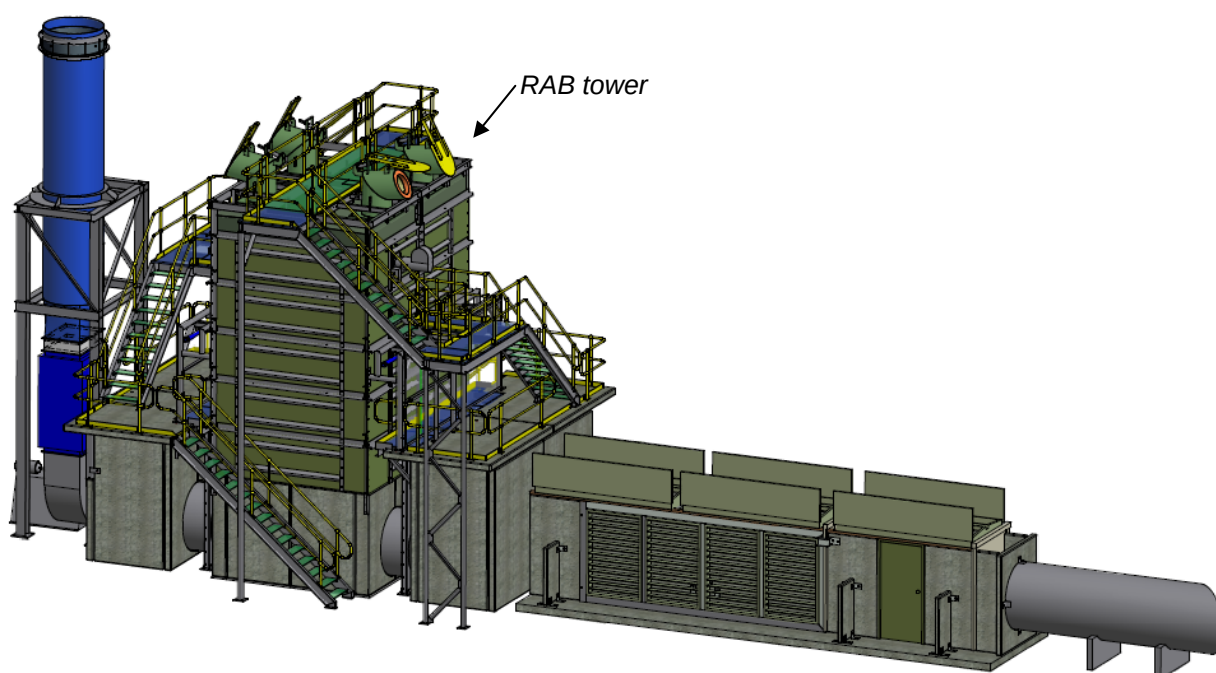


Plate 4 –Single VAM RAB unit layout

Source: CSE, drawing number 1101-PLA-002

A key feature of the technology is the ability to be self-sustaining without the need for additional energy to maintain the temperature in the combustion chamber. This is accomplished by preventing the heat from migrating out of the chamber via a periodic change in direction of the flow of the ventilation air through the system; hence the title 'Regenerative After Burner'.

A diagrammatic representation of a RAB tower, including cross sections through the RAB, is presented in **Plate 5**.

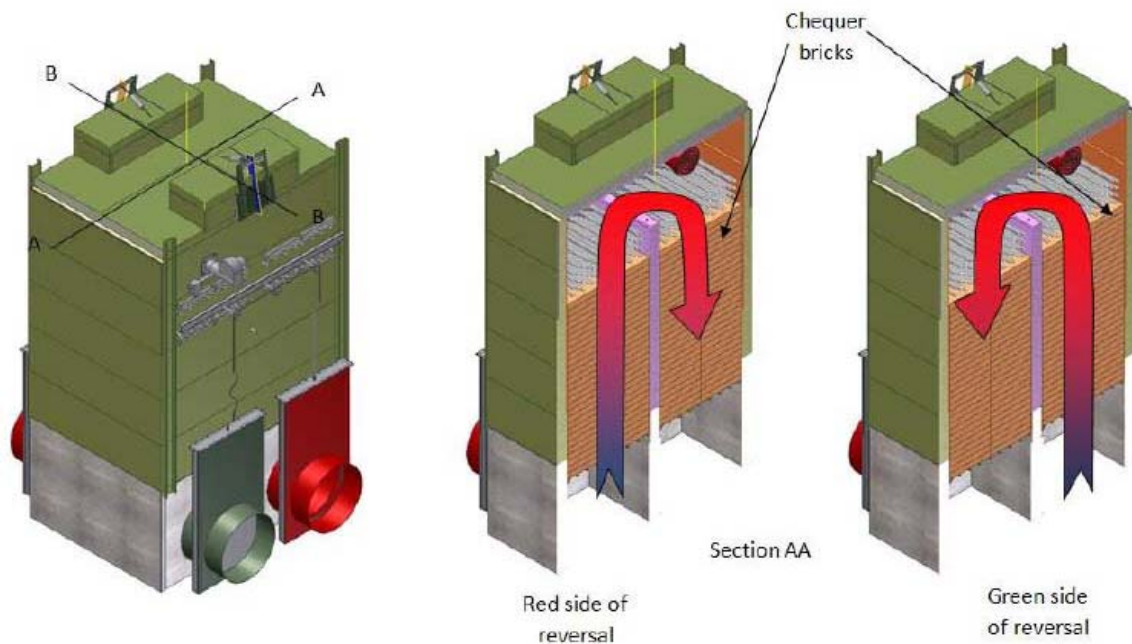


Plate 5 – Cross-Section and components of a single RAB tower

In order to produce the greatest output and efficiencies between the two methane emission sources; (i.e. methane drainage gas and VAM), Centennial Mandalong proposes in the long term to integrate the two sources, creating the Mandalong Greenhouse Abatement Facility (MGAF). A pre-feasibility study has been undertaken on the implementation of the VAM RAB technology at Mandalong, to be used in conjunction with the previously approved gas engines and gas flares, to develop the integrated MGAF of up to a 12 MW total generation capacity. This is over 2.5 times the mine's electricity requirement. The new technology, once integrated with existing and/or approved infrastructure at Mandalong, would reduce the quantity of methane being ventilated into the atmosphere from the mine through the oxidation of methane to carbon dioxide, whilst also providing a potential source of electricity generation that could be fed into the mines high voltage substation, providing additional capacity to the NSW power grid.

The long term over-arching objective of the MGAF is to therefore provide an innovative local solution to not only reduce potential climate change impacts of Mandalong's operations, but to improve power generation options for both the mine and the community.

4.2 Project Description

4.2.1 Overview

Centennial Mandalong is aiming to reduce the greenhouse gas emissions from Mandalong by reducing the amount of methane being ventilated to the atmosphere through the installation and ongoing operation of VAM RAB technology.

Centennial Mandalong is therefore seeking approval for the installation and ongoing operation of a single VAM RAB unit as a demonstration project to prove the VAM RAB technology on behalf of the NSW government and the underground coal industry. More specifically, the project involves the following:

- Installation of a single VAM RAB unit, inclusive of VAM capture duct and RAB tower elements, adjacent to the existing Mandalong Ventilation Fans. This single unit will not have heat recovery or

generation capability, with its purpose being to demonstrate the operation of a VAM RAB unit at low methane content, and the successful capture and abatement of VAM through the oxidation of the methane to carbon dioxide;

- Provision of site services to the VAM RAB. This includes an extension of the existing methane gas drainage pipeline to connect to the VAM RAB unit, as well as the provision of power from the gas monitoring switch room and water via pipeline proximate to the plant;
- Installation of a fire suppression system for the Motor Control Centre;
- Sourcing of fill from either an existing stockpile to the north west of the proposed location of the VAM RAB, or from offsite as required, to establish appropriate foundations for the VAM RAB unit;
- Rehabilitation of the existing stockpile area as required, following the sourcing of fill from this stockpile;
- Erection of fencing around the VAM RAB;
- Minor drainage works to ensure appropriate drainage at the site; and
- Increasing the Mandalong Mine Development Consent noise criteria to be consistent with the Project Specific Noise Criteria (discussed further in **Section 7.5**).

The conceptual configuration of the single VAM RAB unit for which approval is being sought, including the elements listed above, is presented in **Figure 3**.

A photo of a VAM RAB pilot plant at Bloomfield Colliery, similar to the unit to be constructed at Mandalong, is presented in **Plate 6**.



Plate 6 – Pilot VAM RAB unit at Bloomfield Colliery

The VAM RAB unit will be constructed adjacent to ventilation fan A, as illustrated in **Plate 7**.



Plate 7 – Main mine ventilation fans and indicative location of VAM RAB unit

The project is phase one of a potential three phase project. Phases two and three could see installation and operation of up to 36 VAM RAB units at Mandalong and the integration of VAM RAB technology with existing and/or approved infrastructure (gas flares and gas engines) to create what is referred to as the MGAF, as discussed above in **Section 4.1.2**. Expansion and integration of VAM RAB technology at Mandalong beyond the initial 14 month period will be considered subject to initial tests, project finance and further project approvals.

4.2.2 Project Funding and Administration

This project is co-funded by DTIRIS via the NSW CCF (\$2.2 million + GST) and Centennial Mandalong (\$0.6 million). The NSW CCF was established under the *Clean Coal Administration Act 2008* for the purposes of providing funding for the research into, and development of, clean coal technologies, to increase public awareness and for clean coal technology commercialisation. The Minister for Resources and Energy approves payments from the fund, with the NSW DTIRIS having day-to-day responsibility for administration.

This is the only project being funded by the NSW CCF relating to the abatement of fugitive emissions from underground mines.

The government funds are being provided to Centennial Mandalong in accordance with the quarterly funding schedule as per the terms of the funding agreement executed on 1 March 2011. Tests will be conducted over a 14 month period to verify performance of the technology with results to be made available to industry and other stakeholders via site visits, technical papers and other means.

4.2.3 Construction

Construction of the modular VAM RAB unit will take place offsite. However, foundations and civil works will be required onsite, which are expected to take approximately four weeks. During this time, equipment to be used includes, but is not limited to, the following:

- Sheepsfoot roller;

- Truck and trailer (for fill);
- Small excavator;
- Concrete truck;
- Concrete pump;
- Concrete vibrator; and
- Hand held tools.

Construction works will involve the trimming of approximately 200 millimetres of topsoil from the proposed location of the VAM RAB unit (refer **Figure 3**), and the placement of approximately of compacted fill to reach appropriate levels for installation of the unit. The quantity of fill is estimated at 200m³, subject to confirmation on the issue of construction drawings. Appropriate foundations will then be constructed, with the RAB tower and conditioning duct to be supported by shallow footings (stiffened raft slab beams) approximately 600 millimetres deep. There will therefore be minimal to no further excavation into natural soil.

The fill required to achieve adequate levels for construction will be sourced from either an existing stockpile of material excavated as part of the construction of the F3 freeway, referred to as the RTA stockpile and located to the north west of the proposed location of the VAM RAB (illustrated in **Figure 3** and **Plate 8** below), or will be imported from off site as required. Should fill be sourced from the RTA stockpile, this area would then be rehabilitated such that it is commensurate with the surrounding topography and vegetation.



Plate 8 – RTA Stockpile

Additional construction activities will include the construction of a fence around the VAM RAB unit; as well minor drainage works to be undertaken to ensure adequate erosion and sediment control during the construction and operational phases of the VAM RAB.

Construction will be limited to daylight hours between 7am and 6pm Monday to Friday, and 8am to 1pm on Saturday. No construction will be undertaken on Sundays or public holidays.

4.2.4 Operation

During operation of the demonstration project, a portion of the VAM will be collected from the mine on the surface at the mine fan evasee using a VAM capture duct with a setback option. As such there will be no direct connection to the mine fans so as to avoid any disruption to mine fan performance. The VAM capture duct and other design elements will be subject to a thorough risk-based assessment process by the project team. Consultation on safety risks and controls is planned with DTIRIS inspectors as part of a specific stakeholder consultation plan for the project.

The unit will primarily operate using VAM, with methane drainage gas to be used as a secondary fuel source. Drainage gas sourced from the adjacent methane drainage plant will be used initially to simulate VAM during the first five weeks, as well as a top-up fuel source used periodically to maintain operating temperature when the VAM contains a very low methane content (less than 0.3 percent methane) and the plant requires heat input. Drainage gas will also be used to pre-heat the refractory-lined RAB tower during the commissioning phase. To enable this supply of methane drainage gas, the existing methane drainage pipeline will be extended to connect with the VAM RAB, as illustrated in **Figure 3**.

Drainage gas sourced from the adjacent gas plant will be used initially to simulate VAM during the first five weeks, as well as a top-up fuel source used periodically to maintain operating temperature when the VAM contains a very low methane content (less than 0.3 percent methane) and the plant requires heat input. Drainage gas will also be used to pre-heat the refractory-lined RAB tower during the commissioning phase. There is no heat recovery or generation component as the focus of this project is to demonstrate operation of the VAM RAB unit at a low to moderate methane content (0.3 – 0.7 percent methane).

The proposed modification will not result in any other changes to the operations at Mandalong. No additional coal production or any other changes to mining related activities are proposed. No dedicated plant operators are required for the VAM RAB beyond the initial five weeks of experiments. During this initial period, continuous coverage (24 hours per day, seven days per week) will apply to collect data and to make adjustments as required. Beyond this time, the plant will essentially operate unattended with continuous monitoring and periodic on-site maintenance checks.

4.2.5 Environmental Management

The Environmental Management System discussed above in **Section 3.4** will continue to apply to all operations at Mandalong. Where required, Management Plans will be amended to incorporate the proposed modifications and relevant recommendations of this EA.

5.0 STATUTORY REQUIREMENTS

The project will be assessed in full consideration of the applicable statutory planning instruments of the Commonwealth and State, as well as associated planning and environmental frameworks. This section describes the statutory planning instruments relevant to the proposed modification, and assesses their implications in relation to the required approval process.

5.1 Commonwealth Legislation

5.1.1 Environmental Protection and Biodiversity Conservation Act 1999

The purpose of the Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act) is to ensure that actions likely to cause an impact on a matter of National Environmental Significance (NES) undergo a rigorous assessment and approval process. Under the EPBC Act, an action includes a project, undertaking, development or activity.

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

The EPBC Act identifies matters of NES as:

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

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

An Ecological Assessment was carried out for the modification by Hunter Eco. This assessment found that there are no Commonwealth listed threatened flora and fauna in the Project Site, and therefore concluded there will be no impact on any Commonwealth listed threatened flora or fauna species, or any other matter of NES. A referral to the Commonwealth Minister is therefore not required.

5.1.2 National Greenhouse and Energy Reporting Act 2007

The *National Greenhouse and Energy Reporting Act 2007* (NGER Act) came into effect on 29 September 2007, and introduces a single national reporting framework for the reporting and dissemination of information about greenhouse gas emissions, greenhouse gas projects, and energy use and production of corporations. The first annual reporting period began on 1 July 2008 (Department of Climate Change and Energy Efficiency, 2008). The NGER Act makes registration and reporting mandatory for corporations whose energy production, energy use or greenhouse gas emissions meet specified thresholds. Centennial reports emissions from the corporation which includes those from Mandalong.

5.2 NSW State Legislation

5.2.1 Environmental Planning and Assessment Act 1979

The EP&A Act is the principal piece of legislation overseeing the assessment and determination of development proposals in NSW. It aims to encourage the proper management, development and conservation of resources, the protection of the environment, and ecologically sustainable development (ESD).

Development Consent DA 97/800 was originally granted for Mandalong by the then Minister for Urban Affairs and Planning on 14 October 1998 under Part 4 of the EP&A Act. This consent has subsequently been modified on six occasions. Centennial Mandalong now seeks a further modification to DA 97/800 pursuant to the provisions of section 75W of Part 3A of the EP&A Act.

A Project Application supported by a PEA was submitted to the DoPI on 7 March 2011. In response, the DoPI advised via an email to Centennial Mandalong dated 29 March 2011 (included **Appendix 2**) that they had reviewed the PEA for the modification application and considered the proposed assessment of associated impacts described in the document as appropriate. The DoPI further advised they would not be issuing Director-General's Requirements for the modification.

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

- (8) *For the purposes only of modification, the following development consents are taken to be approvals under Part 3A of the Act and section 75W of the Act applies to any modification of such a consent:*
- (a) *a development consent granted by the Minister under section 100A or 101 of the Act,*
 - (b) *a development consent granted by the Minister under State Environmental Planning Policy No 34 - Major Employment-Generating Industrial Development,*
 - (c) *a development consent granted by the Minister under Part 4 of the Act (relating to State significant development) before 1 August 2005 or under clause 89 of Schedule 6 to the Act,*
 - (d) *a development consent granted by the Land and Environment Court, if the original consent authority was the Minister and the consent was of a kind referred to in paragraph (c).*

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

Pursuant to *State Environmental Planning Policy (Major Development) 2005* (Major Projects SEPP), development referred to as a 'major project' requires assessment and approval from the Minister for Planning and Infrastructure in accordance with Part 3A of the EP&A Act. Schedule 1 of the Major Projects SEPP classifies certain types of development as 'major projects'. Coal mining is a class of development listed in Schedule 1 of the Major Projects SEPP, and as such this project would be a project to which Part 3A applies.

Accordingly, this modification is sought under section 75W, and the proposal will be subject to assessment by the Director General of the DoPI and determination by the Minister for Planning and Infrastructure. The development consent, if modified, will not become an approval under Part 3A of the Act, but will remain a Part 4 consent.

5.2.2 Other NSW State Legislation relevant to the modification

The provisions and requirements of additional NSW legislation relevant to this project are summarised in **Table 1**.

Table 1 – Summary of NSW Legislation Relevant to the Modification

Act	Relevance to the Modification
<i>Protection of the Environment Operations Act 1997 (POEO Act)</i>	The POEO Act is administered by the OEH and requires licencing for environmental protection, including waste generation and disposal, water, air and noise pollution. Mandalong operates under EPL 365. Under the POEO Act, an EPL is required for premises at which a scheduled activity is conducted. Schedule 1 of the POEO Act lists activities that are scheduled activities for the purposes of the Act. There will be no requirement for Centennial Mandalong to seek a variation to the existing EPL 365 for the addition of this activity.
<i>Mining Act 1992</i>	Centennial Mandalong currently holds a number of mining leases, namely ML 1443, CCL 762, CCL 746, MPL 191, MPL 329, ML 1431, ML 1543, and ML 1553. The site for the installation and operation of the VAM RAB unit is within ML 1443.
<i>Water Management Act 2000/ Water Act 1912</i>	The proposed construction and operation of the VAM RAB unit at Mandalong does not require the extraction of groundwater or surface water and therefore no further licenses will be required.
<i>National Parks and Wildlife Act 1974 (NPW Act)</i>	An archaeological survey has been conducted for this EA, which is discussed further in Section 7.8. No Aboriginal sites or objects were found in the project site. If previously unrecorded Aboriginal artefacts are discovered during construction, work must stop in the vicinity of the discovery so that further disturbance is prevented. Centennial Mandalong would notify the OEH and follow their requirements.
<i>Heritage Act 1977</i>	The archaeological survey (refer Section 7.8) did not identify any items of heritage significance in the project site.
<i>Threatened Species Conservation Act 1995</i>	An ecological assessment (refer Section 7.2) has been conducted as part of this EA, and found there will be no impact on any State or Commonwealth listed threatened flora or fauna species. An Endangered Ecological Community (EEC) was identified within the project site. A strategy for the management and mitigation of impacts on this EEC are discussed further in Section 7.2 .

5.3 Environmental Planning Instruments

5.3.1 Lake Macquarie Local Environmental Plan 2004

The project site is located within the Lake Macquarie LGA. Under the provisions of the *Lake Macquarie Local Environmental Plan 2004 (LEP)*, the project site is within an area zoned Natural Resources (Zone 9). The objectives of Zone 9 include, among others, to:

- 1 (a) provide land that has dual values as an economic natural resource and for environmental protection;
- (b) recognise the dual values of the land and integrate economic use of the land with ecological sustainability;
- (g) permit habitat disturbance to facilitate forestry, surface activities for underground mining and other extraction of mineral and gravel resources and energy generation works.

The project involves works to abate greenhouse gas emissions from Mandalong and is therefore considered to be consistent with the ecological sustainability objectives of Zone 9. The works involved are

related to surface activities for underground mining, and so again, are consistent with the objectives of Zone 9. Hence the development is not prohibited under a LEP and the Minister is not prevented from approving the development.

Despite these provisions of the LEP, the relevant, prevailing planning instrument is the Mining SEPP as discussed in the sections below.

5.3.2 State Environmental Planning Policies

Pursuant to section 75R(3) of the EP&A Act, environmental planning instruments, other than State Environmental Planning Policies, do not apply to a project approved under Part 3A of the Act. However, section 75I(2)(e) states that environmental planning instruments that would otherwise substantially govern the carrying out of the project must be referenced by the Director General in the Environmental Assessment. This section therefore considers the provisions of such environmental planning instruments in relation to the proposed modification.

SEPP (Major Projects) 2005

The primary aims of this SEPP are to identify development to which development assessment and approval processes under Part 3A of the Act applies, and to identify any such development that is a critical infrastructure project for the purpose of Part 3A of the EP&A Act. Specific types of development or development within particular areas are listed in the various schedules attached to the SEPP. Any development referred to in the schedules requires assessment under Part 3A of the Act, with the Minister being the consent authority.

As described above, coal mining is defined as a major project in Schedule 1 of the SEPP, and Clause 8J(8) of the EP&A Regulation provides a mechanism whereby projects approved under Part 4 of the EP&A Act can be modified under section 75W. Therefore, modification of the existing approval can be sought under Part 3A of the EP&A Act.

SEPP (Mining, Petroleum Production and Extractive Industries) 2007

The aims of the policy, in recognition of the importance to NSW of mining, petroleum production and extractive industries, 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;*
- b) *to facilitate the orderly and economic use of development of the land containing mineral, petroleum and extractive material resources; and*
- c) *to establish appropriate planning controls to encourage ecologically sustainable development through the environmental assessment, and sustainable management, of development of mineral, petroleum and extractive resources.*

The project will reduce the Scope 1 greenhouse gas emissions from Mandalong, thus reducing the potential climate change impacts of Mandalong's operations. It is therefore considered that this proposed modification is consistent with the aim of the SEPP of encouraging ecologically sustainable development.

Part 3 of the SEPP discusses matters a consent authority must consider when assessing development applications. In particular, Clause 12 (a) states that the consent authority must consider the following:

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

- iii. *any ways in which the development may be incompatible with any of those existing, approved or likely preferred uses.*

The VAM RAB unit is to be constructed within the area currently containing Mandalong's ventilation and methane gas drainage infrastructure, and is therefore consistent with the current land use in the area.

Clause 14 of the SEPP relates to natural resource and environmental management, requiring the consent authority to consider the impacts of a development application on water resources, threatened species and biodiversity, and minimisation of greenhouse gases. The aim of the project is to examine the performance of VAM RAB technology in reducing greenhouse gas emissions from the operation. In addition, potential impacts on water resources and threatened species have been investigated as part of the preparation of this EA, as discussed further in **Section 7**.

SEPP 33 – Hazardous and Offensive Development

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

In accordance with the requirements of the DP&I, a Preliminary Hazard Analysis (PHA) of the project was undertaken by the developers of the VAM RAB technology, CSE. The PHA provides an overview of the potential hazards that may occur as a result of the development in accordance with SEPP 33. The PHA was conducted in accordance with the *Hazardous Industry Planning Advisory Paper No. 4 – Risk Criteria for Land Use Safety Planning* (DoP, 1990) (HIPAP No. 4), and further details are provided in **Section 8.2**.

SEPP 44 – Koala Habitat Protection

SEPP No 44 - Koala Habitat Protection applies to the extent that a consent authority is restricted from granting development consent to proposals on land identified as core koala habitat without the preparation of a Plan of Management. The proposed site for the installation of the VAM RAB facility is within previously disturbed land and contains no core koala habitat. Therefore a Koala Plan of Management for the proposed development is not required.

6.0 CONSULTATION

6.1 Overview

Centennial Mandalong has undertaken consultation with state and federal government, government authorities, Aboriginal groups, and other relevant stakeholders in preparation of this EA. The sections below further outline the consultation undertaken.

6.2 Government Consultation

6.2.1 NSW Department of Planning and Infrastructure

A PEA was submitted to the DP&I in March 2011 to confirm the approval pathway for the project, and to request DGRs for the EA. The DP&I responded via email on the 29 March 2011, confirming that the proposed assessment of associated impacts described in the PEA will be appropriate for the modification. As a result, no DGRs were issued for the Project.

A copy of the email from DP&I is contained in **Appendix 2**.

6.2.2 NSW Clean Coal Council

The *Clean Coal Administration Act* was passed in June 2008 and established the NSW Clean Coal Council (the Council) and the \$100 million NSW CCF. The Council brings together representatives of industry (coal and electricity generators), research institutes and the NSW Government to consider how best to support low emissions coal technologies (clean coal technologies) research and development in NSW¹.

A significant function of the NSW Clean Coal Council is to provide advice and make recommendations to the Government concerning the funding of projects under the NSW CCF that encourage the development of low emissions coal technologies.

Centennial has engaged in ongoing consultation with the Council, and in particular Rick Fowler (Director, Clean Coal Council Secretariat Branch), regarding funding for this project since Centennial Mandalong's application was submitted in December 2009. Several meetings and other correspondence between the Council and Centennial Mandalong have taken place since this time, culminating in the negotiation and approval of a funding agreement dated 1 March 2011 to the value of \$2.2 million plus GST.

Centennial Mandalong also gave a presentation on the project at the NSW Low Emissions Coal Technologies Summit on 8 and 9 June 2010. It was at this Summit that the Minister announced the 10 projects to receive \$13 million in funding (total value of projects \$47 million) under the CCF. The Summit was attended by 125 delegates from mining, infrastructure and investment industries, as well as staff from overseas Consulates based in Sydney.

A joint press release with the Council is currently being drafted regarding the project. This is also a condition of the funding agreement to promote stakeholder awareness.

6.2.3 NSW Department of Trade and Investment, Regional Infrastructure and Services

The NSW DTIRIS is responsible for the day-to-day administration of funding agreements negotiated under the provisions of the *Clean Coal Administration Act 2008*. As such, Centennial Mandalong has also engaged in consultation with the DTIRIS regarding the funding for this project, discussed above in **Section 6.2.2**.

¹ Source: <http://www.dpi.nsw.gov.au/minerals/resources/low-emissions-coal/nsw-clean-coal-council-and-clean-coal-fund>

A briefing of NSW Department of Primary Industries (DPI) inspectors (mining, electrical and mechanical) on the project with a particular focus on safety management has been scheduled for 20 June 2011 at Centennial's Fassifern Office. This will be followed by an invitation to attend a proposed off-site testing of the VAM RAB unit in July.

6.2.4 Australian Federal Government

Centennial staff undertook informal discussions with Tony Abbott (Federal Opposition Leader) in December 2009 during a visit to Bloomfield Colliery to inspect the VAM RAB pilot plant.

Discussions have also been held with Greg Combet at various times during 2010/11 in his capacity as Federal Minister for Climate Change and Energy Efficiency regarding carbon pricing and coal industry assistance.

6.3 Community Consultation

The VAM RAB project was discussed with the Mandalong Community Consultative Committee on two occasions; at the meetings on 11 November 2010 and 12 May 2011. No issues were raised.

In addition, a story on the VAM RAB project will be published in the next Mandalong newsletter ('The Mandalong Mailbox'). This newsletter is due for distribution by the end of July 2011, and is made available to the public on the Centennial Coal website, as well as being posted out to all residents within the Mandalong Mine Lease area.

6.4 Local Aboriginal Community Consultation

Aboriginal consultation in relation to the assessment and management of Aboriginal heritage for this project was undertaken in accordance with the *Aboriginal Cultural Heritage Consultation Requirements (ACHCRs) for Proponents* (DECCW 2010). The ACHCRs includes a four stage consultation process with specific timeframes stipulated for each stage.

Full details regarding the consultation conducted with Aboriginal Community Stakeholders is provided in the Cultural Heritage Assessment undertaken by RPS, including a log of Aboriginal consultation, and is attached as **Appendix 8**. The following is a summary of the consultation undertaken.

In accordance with the ACHCRs, local Aboriginal Community Stakeholders were consulted, supplied suitable project information, and provided the opportunity for input into the heritage management process. Eight Aboriginal stakeholder groups were identified as potentially having an interest in the project following the stage 1 identification process. These groups were advised of the project, and invited to express their interest in being involved in the consultation process via a letter dated 11 February 2011. Five groups registered their interest in the project as a result of the expression of interest letters, as well as an advertisement placed in the Lakes Mail on 10 February 2011, and are listed below.

1. Awabakal Local Aboriginal Land Council (LALC)
2. Westlakes Aboriginal Community
3. Awabakal Traditional Owners Aboriginal Corporation
4. Cacatua Culture Consultants
5. Awabakal Descendants Traditional Owners Aboriginal Corporation

These groups were subsequently provided information regarding the proposed heritage assessment methodology and strategy for collecting information on cultural heritage significance in a letter dated 2 March 2011.

Both the Awabakal Traditional Owners Aboriginal Corporation and the Awabakal Descendants Traditional Owners Aboriginal Corporation responded to the methodology, confirming the methodology was acceptable. A representative from each of these groups, along with a representative from Westlakes Aboriginal Community took part in the field survey, conducted on the 6 April 2011.

Following the field survey, a copy of the draft Cultural Heritage Assessment Report was provided to the five registered groups for comment. Two Aboriginal Community Stakeholders provided written responses; the Awabakal Traditional Owners Aboriginal Corporation and the Awabakal Descendants Traditional Owners Aboriginal Corporation. Both groups responded saying they were satisfied with the overall content of the reports, offering a few additional comments.

Copies of the written responses from both groups are included in Cultural Heritage Assessment report attached as **Appendix 8**. Further detail on the Cultural Heritage Assessment is provided in **Section 7.8**.

6.5 Industry Consultation

The results of this project will be made available to industry under the terms of the Funding Agreement with DTIRIS. This industry wide communication will be undertaken in the form of technical papers and news articles in industry publications detailing the results of the project following construction, operation and testing over the proposed 14 month period to verify performance of the technology of the VAM RAB unit. Open days will also be held for relevant stakeholders to view the operating plant, and obtain further information, during the 14 month demonstration period.

7.0 ENVIRONMENTAL ASSESSMENT

7.1 Project Environmental Risk Assessment

A preliminary environmental risk assessment of the proposed modification was conducted in February 2011 by Centennial Mandalong with the aim of identifying those issues relating to the project that represent the greatest risk to the local environment and community, as well as assisting in setting the level of assessment required to address each identified risk within the EA.

The risk assessment assessed all stages of the project, i.e. site establishment, construction, and operation. Decommissioning was not assessed as part of the risk assessment as it is anticipated that the VAM RAB unit will continue to operate for the life of the mine. The issues that were specifically assessed in the risk assessment include:

- Flora and Fauna
- Aboriginal/Cultural Heritage
- European Heritage
- Noise
- Air Quality
- Surface Water
- Soils
- Visual Amenity
- Greenhouse Gas

Once they were identified, the various project risks were assessed in light of the mitigation measures and management strategies already in place at Mandalong (i.e. documented in management plans and operational procedures). Where the risks were considered unacceptable, or a knowledge gap was identified in the information available, specialist consultants were engaged to undertake further assessments and to present additional mitigation measures that may be required.

A Risk Assessment Report, including a risk register, was prepared to document the outcomes of the risk assessment, and is attached as **Appendix 3**. A summary of the Centennial risk matrix used, and the management requirements in accordance with the Centennial Risk Standard and Risk Matrix is provided in **Table 2**.

Table 2 – Requirements for Management of Risks (Centennial Risk Standard)

Risk Ranking	Risk Category		Generic Management Actions
1 to 4	E	Extreme	Immediate intervention required from senior management to eliminate or reduce this risk.
5 to 9	H	High	Imperative to eliminate or reduce risk to lower level by the introduction of control measures. Management planning required at senior level.
10 to 15	S	Significant	Corrective action required, senior management attention needed to eliminate or reduce risk.
16 to 19	M	Moderate	Corrective action to be determined, management responsibility must be specified.
20 to 25	L	Low	Monitor and manage by corrective action were practicable.

The risk assessment did not identify any 'extreme' or 'high' risk environmental issues relating to the project. A number of 'significant' issues were identified, relating to site establishment activities and the associated earthworks, as follows:

- Loss of vegetation, including EECs;
- Loss of fauna habitat; and
- Impacts on surface water.

A specialist consultant was therefore engaged to undertake the assessment relating to impacts on flora and fauna. An assessment of surface water impacts was also addressed by GSSE.

Environmental risks ranked as 'moderate' risks, also related to site establishment activities, were identified as follows:

- Impacts on threatened flora species (specialist engaged); and
- Leeching/runoff of acid sulphate soils (addressed by specialists within GSSE).

A number of other minor risks (ranked as 'low') were identified in the risk assessment. To ensure all potential impacts were identified, and appropriate mitigation measures adopted where required, specialists were engaged to undertake the assessments relating to these aspects, with the exception of visual amenity which was undertaken by GSSE, as listed below:

- Noise;
- Greenhouse Gas;
- Air Quality;
- Aboriginal and European Heritage; and
- Visual Amenity.

The following sections discuss all of the aspects listed above. The structure of the following sections is:

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

7.2 Flora and Fauna

7.2.1 Introduction

An Ecological Assessment was undertaken by Hunter Eco for the proposed modification, and a full copy of this report is attached as **Appendix 4**. The Ecological Assessment identified and assessed potential flora and fauna impacts associated with the construction and operation of the project, and was undertaken in accordance with the following guidelines:

- *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (Working Draft)* (DEC 2004);
- *Draft Guidelines for Threatened Species Assessment* (DEC and DPI 2005); and
- *Threatened Species Survey and Assessment Guidelines – Introduction to Field Survey Methods* (DECCW 2009).

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

7.2.2 Existing Environment

The project site is located on the eastern side of the Mandalong floodplain, which consists of a mosaic of cleared grazing land, scattered trees and areas of remnant vegetation. The elevation of the project site is around 6 metres, and other than areas artificially built up, the land is subject to periodic inundation with very little drainage. A number of interconnected wetlands are present in the area.

The project site is a very small part of an already small area of remnant vegetation. The project site has previously been largely disturbed, with Mandalong's ventilation and methane drainage infrastructure present on the site.

Previous ecological mapping of the Mandalong area by Hunter ECO (2010) identified two EECs in the vicinity of the project site; MU38 Redgum – Roughbarked Apple Swamp Forest EEC located to the west of the project site, and Freshwater Wetlands EEC located to the east. Both of these EEC's are listed under Schedule 1 of the NSW TSC Act. A field survey was also undertaken, with floristic data collected from random meander around the project site, and from targeted plots in representative areas of the different communities present.

Vegetation Communities

A vegetation community map of the project site was prepared as part of the Ecological Assessment, with the communities described according to the classification of the National Parks and Wildlife (NPWS) document *Vegetation Survey Classification and Mapping Lower Hunter and Central Coast Region* (NPWS, 2000). Data from the plots was compared with the NSW scientific Committee determinations for EECs.

The Ecological Assessment mapped six vegetation communities in and around the project site. These communities are illustrated in **Figure 5**, and are listed below:

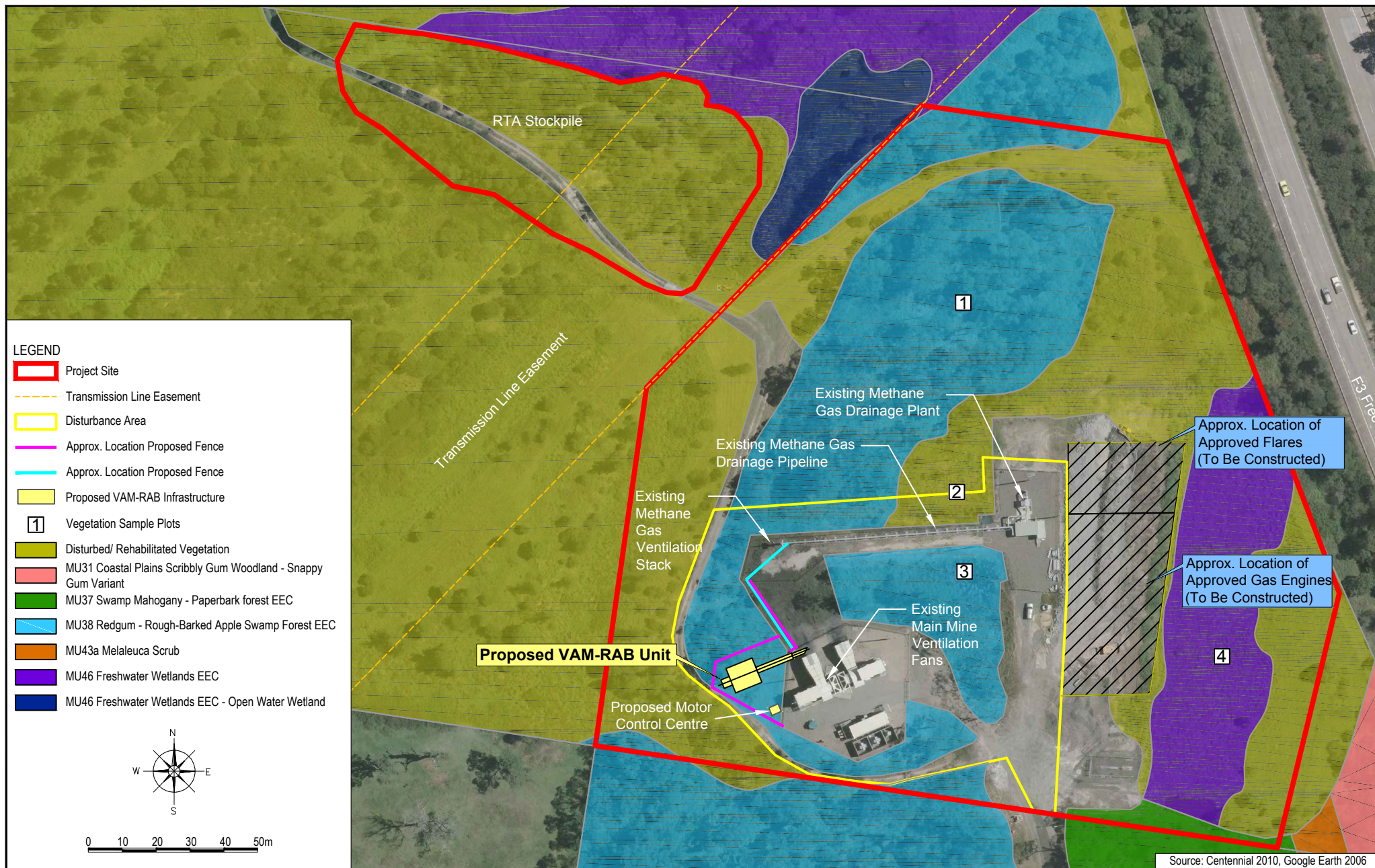
- MU31 Coastal Plains Scribbly Gum Woodland – Snappy Gum Variant;
- MU37 Swamp Mahogany – Paperbark Forest;
- MU38 Redgum – Roughbarked Apple Forest;
- MU43a Melaleuca Scrub;
- MU46 Freshwater Wetland Complex; and
- Disturbed or Rehabilitated Vegetation.

Two of these vegetation communities are located within the proposed disturbance area for the single VAM RAB unit, as listed in **Table 3**. One of these communities, MU38, is listed under the TSC Act as an EEC. No Commonwealth listed EEC's are present in the project site. The rest of the disturbance area is already cleared and contains existing mine ventilation and gas drainage infrastructure.

Table 3 – Vegetation communities in the proposed disturbance area for the single VAM RAB unit

Community	Total area (m ²)
Disturbed/rehabilitated vegetation	290
MU38 Redgum – Roughbarked Apple Swamp Forest EEC	3540

The vegetation community MU38 Redgum – Roughbarked Apple Swamp Forest is characterised in the project site by a canopy of *Eucalyptus amplifolia* subspecies *amplifolia* redgums and *Angophora floribunda* apple. In some locations there is a midstorey of *Melaleuca nodosa* paperbarks, and in others no midstorey exists. There is no shrub layer and the ground layer is made up of sometimes dense *Carex appressa* and *Poa affinis*, along with *Entolasia marginata* and various herbs and other grasses. MU38 is part of the EEC: *River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner* bioregions, with the NSW Scientific Committee determination specifically referring to MU38 as being part of this EEC.



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The area within the project site classified as disturbed/rehabilitated vegetation (approximately 290m²) is dominated by the exotic grasses *Paspalum urvillei* and *Axonopus fissifolius*. The RTA stockpile area, as expected, is also classified as disturbed/rehabilitated vegetation. 66 species were identified in the stockpile area, of which 26 were weeds and 4 were non-endemic species. The area has a dense shrub layer, and a ground cover dominated by exotic grasses.

Flora

A total of 123 flora species were recorded within the project site during the field survey. Of these, 34 species were weeds and 4 species were non-endemic natives that had been planted as rehabilitation vegetation following the completion of the F3 freeway. A full list of the species recorded is provided in the Ecological Assessment Report, attached as **Appendix 4**.

In addition to the field survey, a list of threatened flora species was obtained from the Atlas of NSW Wildlife from within a 5 kilometre radius of the project site. A similar list was obtained using the Protected Matters Search Tool for species protected under the EPBC Act. This search found that nine threatened flora species listed in the Schedules of the TSC Act have been recorded within a 5 kilometre radius of the project site. The Protected Matters Search Tool identified seven species listed in the schedules of the Federal EPBC Act, of which, six were also listed in the TSC Act.

Fauna

Five fauna species were recorded during the field survey of the project site, as listed in **Table 4**.

Table 4 – Fauna species recorded at the Project Site

Scientific Name	Common Name
<i>Macropus giganteus</i>	Eastern Grey Kangaroo
<i>Wallabia bicolor</i>	Swamp Wallaby
<i>Malurus cyaneus</i>	Superb Fairy Wren
<i>Acanthiza nana</i>	Yellow Thornbill
<i>Zosterops lateralis</i>	Silvereye

A list of threatened fauna species was also obtained from the Atlas of NSW Wildlife from within a 5 kilometre radius of the project site. A similar list was obtained using the Protected Matters Search Tool for species protected under the EPBC Act.

This search found 15 birds, five marsupials, one mega bat, five micro bats and three amphibians listed in the Schedules of the TSC Act that have previously been recorded within 5 kilometres of the project site. The Protected Matters Search Tool identified three birds, one mega bat, one micro bat, three marsupials, one rodent, five amphibians and one reptile recorded, as well as 11 migratory species.

7.2.3 Threatened Species Assessment

Threatened Flora Species

The majority of the threatened flora species recorded within 5 kilometres of the project site are found in dry habitat, of which there is none in the project site. Whilst *Maundia triglochinos* has been recorded in a wetland about 50 metres to the north there is no wetland habitat for this species within the project site. *Melaleuca biconvexa*, whilst abundant across the Mandalong floodplain, the nearest record is approximately 1 kilometre west of the project site.

Threatened Fauna Species

No threatened fauna species were identified during the field survey within the project site.

With regards to the threatened fauna species recorded within 5 kilometres of the project site, the Assessment found that there were no habitat hollows for micro bats to roost in or for the prey, such as Ring-tailed Possum, of large forest owls. There was no habitat connectivity for gliders to access the area. In addition, even though wet, the habitat was unsuitable for any of the three amphibian species recorded in the wider area: no wallum paperbark habitat for the Wallum Froglet; no sandstone ponded drainage lines in moist forest for the Giant Barred Frog; and no Hawkesbury Sandstone for the Red-crowned Toadlet.

At best, the habitat in the project site would be part of a home range for itinerant nectar feeding species (feeding on Redgum blossom) such as Swift Parrot, Regent Honey-eater or Grey-headed Flying-Fox.

With regards to the federally listed species, the low-lying moist habitat in the project site whilst unsuitable for most species, could be suitable for the Australian Painted Snipe, although there have been no records of the species in the immediate region. In addition, the habitat within the project site would not be suitable for any of the migratory terrestrial species identified, however, could be visited by any of the four migratory wetland species.

7.2.4 Impact Assessment

The primary impacts of the proposed project will be the clearing of a small area of the vegetation community MU38 Redgum – Roughbarked Apple Swamp Forest, which is part of the listed EEC *River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions*. This EEC is not listed under the federal EPBC Act. Approximately 0.35ha of this EEC is within the proposed disturbance area for the single VAM RAB unit and associated infrastructure, as illustrated in **Figure 5**. This remnant EEC is fragmented by degraded areas as a consequence of past activity, particularly the construction of the F3 freeway.

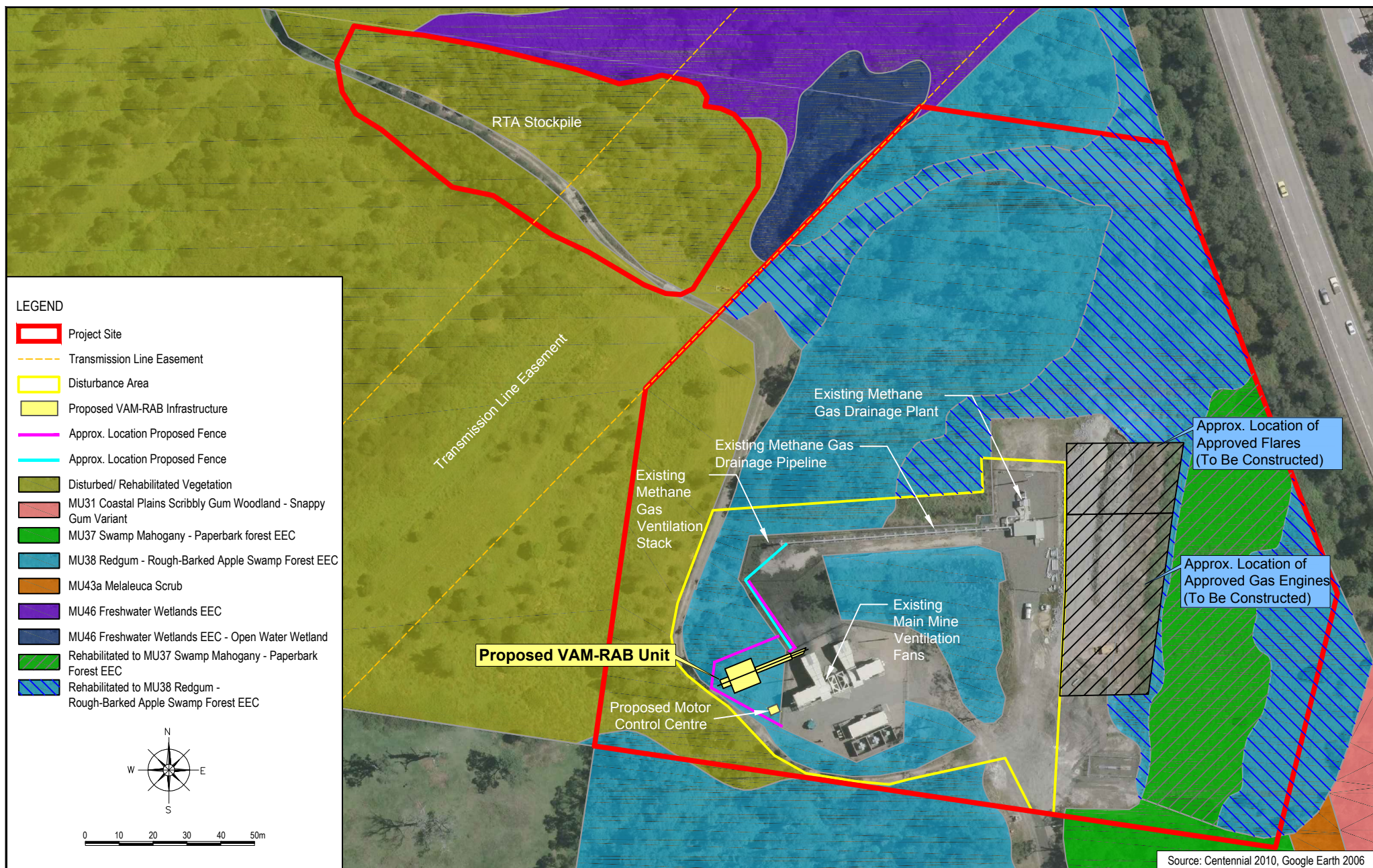
The Ecological Assessment assessed the predicted impacts of the proposed modification by applying the NSW State 7-part test and the Commonwealth test of impact. This assessment found that there will be no impact on any State or Commonwealth listed threatened flora or fauna species. With regards to the EEC, the assessment found that the loss of a small area of this EEC will not have a significant impact on the surrounding remnant, stating that:

“The habitat to be modified or removed is located around the perimeter of the existing ventilation fans and gas extraction plant and is split by an access track along the southern side. Half of the area to be modified or disturbed is already an island surrounded by infrastructure and access road. The modification or loss of any of this habitat would not create further fragmentation and not have a significant impact on the surrounding remnant. The loss of any of this community would not negatively impact on the survival of the remaining community; this is self-evident in that the current remnant has persisted despite the past clearing in and around it.”

7.2.5 Offset Strategy

In keeping with the improve or maintain principle, as well as Ecologically Sustainable Development, a strategy to offset the clearing of the EEC is proposed.

As mentioned above in **Section 7.2.4**, the EEC in the immediate vicinity of the proposed works is fragmented by areas of vegetation which have been degraded by past activities, particularly the construction of the F3 freeway. These degraded areas amount to approximately 1.25 hectares. Rehabilitation of these degraded areas is proposed, and will result in approximately 2 hectares of continuous habitat within the project site. This will adjoin 3 hectares to the south of the project site, creating 5 hectares of continuous habitat. The areas to be rehabilitated are presented in **Figure 6**.



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Two communities are proposed to be rehabilitated in these degraded areas. 0.9ha of MU38 Redgum – Roughbarked Apple will be established in the areas currently mapped as 'disturbed/rehabilitated vegetation' in the project site, and 0.37 ha of MU37 Swamp Mahogany – Paperbark will be established in the area currently mapped as MU46 on the eastern side of the approved gas engines and flares (illustrated in **Figure 6**). This MU46 community has come about as a consequence of past clearing of the tree and shrub cover. The Ecological Assessment compared the data from Plot 3 (MU38 within the proposed disturbance area) and a plot within the MU37 community, and found that the biodiversity of the area will be doubled when the rehabilitation is established in this area.

The species to be established in the rehabilitation will be sourced from local provenance to avoid genetic conflicts between local and imported species. Redgums will be *Eucalyptus amplifolia* grown from seed collected from trees in the Mandalong floodplain. Weed management works will also be undertaken in the rehabilitated areas to ensure improved rehabilitation outcomes.

It is noted that a bushfire risk assessment will be conducted prior to the rehabilitation taking place to determine the width of an Asset Protection Zone (APZ) to be maintained around the gas flares and engines. In this zone the rehabilitation density will be tailored to suit the APZ requirements.

7.2.6 Conclusion

The disturbance area associated with the installation of the VAM RAB unit and proposed infrastructure contains approximately 0.35 hectares of MU38 Redgum – Roughbarked Apple Swamp Forest, which is part of an EEC listed under the TSC Act.

This EEC is fragmented by degraded areas disturbed by previous activities. Scope exists for the rehabilitation of the existing disturbed areas within and adjoining the project site. This rehabilitation will offset the loss or modification of the EEC to the extent that the overall result will be a net gain in the amount of community in the area.

There will be no impact on any State or Commonwealth listed threatened flora or fauna species.

7.3 Surface Water

GSSE has undertaken the appropriate assessment and reporting of surface water issues and management requirements within the EA. This included a review of the existing environment, potential impacts, and any mitigation measures to ensure that the risk of any offsite surface water impacts is minimised.

7.3.1 Existing Environment

The project site is located on the eastern side of the Mandalong floodplain. The elevation across the Site is around 6 metres, and, other than for those areas artificially built up, the land is subject to periodic inundation with very little drainage. A number of interconnected wetlands exist in the area.

The Ecological Assessment identified the presence of a wetland within the project site, to the east of the existing ventilation and gas drainage infrastructure in the area, adjacent to the F3 freeway. The nearest that the NPWS (2000) classification comes to describing the combination of the species present in this wetland area is MU46 Freshwater Wetland Complex EEC. As a consequence of past clearing, the condition of this wetland is highly variable. It is noted that the Ecological Assessment recommends the rehabilitation of this wetlands area be undertaken as part of the offset plan for the project, as described in **section 7.2** above.

From a regional perspective, the project site is located within the broader catchment of Lake Macquarie. Morans Creek flows in a northerly direction to the west of the project site, joining Stockton Creek to the north, which then flows in a generally north-easterly direction under the F3 freeway, eventually joining Dora Creek, which in turn flows into Lake Macquarie.

7.3.2 Potential Impacts

The surface works proposed as part of the modification are minimal, over a small area, and do not lie over any existing drainage paths. The surface water impacts of the project are therefore anticipated to be minor, and are primarily those associated with the clearing of land for the construction of the VAM RAB unit, with the resulting risk of erosion and sedimentation of nearby surface water resources.

The location of the VAM RAB unit is separated from the Freshwater Wetland Complex by built up areas associated with the proposed locations of the approved gas flares and engines. The risk of any impact on these wetlands as a result of the installation of the VAM RAB unit is therefore considered to be very low.

7.3.3 Mitigation Measures

During the construction phase, some areas within the project site will need to be cleared, and therefore the implementation of appropriate sediment and erosion control measures will be required to ensure that the risk of offsite discharge is minimised. Any risk of off-site impacts will be mitigated by the implementation (and revision, if required) of the existing *Mandalong Mine – Underground Mining Environmental Management Plan* (May 2006). All sediment control structures will be designed in accordance with the guidelines laid out in the DECCW publication *Guidelines for Managing Urban Stormwater: Soils and Construction – Volume 2E Mines and Quarries* (the Blue Book).

In addition, land disturbance will be minimised by clearing the smallest practical area of land ahead of construction and earthmoving activities, whilst also ensuring that the land is disturbed for the shortest possible time. Given the potential for inundation, the foundations for the VAM RAB unit will also be built up using compacted inert fill to ensure appropriate levels are achieved.

7.3.4 Conclusion

The predicted impacts on surface water resources within and surrounding the project site as a result of the proposed modification are anticipated to be negligible. Appropriate erosion and sedimentation control measures will be implemented, particularly during construction, to ensure that the potential for any impacts on nearby surface water resources, including the interconnected wetland in the area, are minimised.

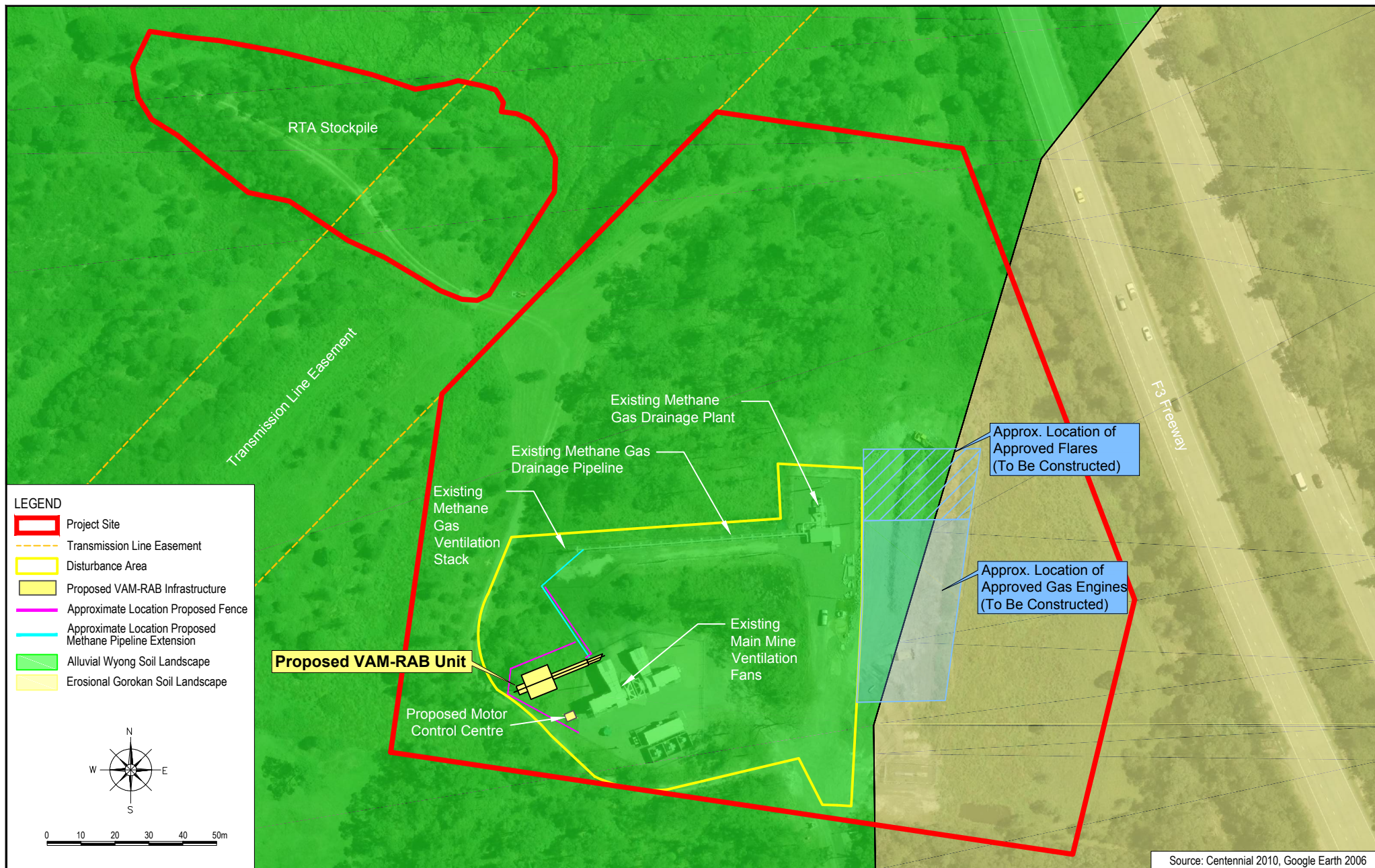
7.4 Soils and Land Capability

7.4.1 Existing Environment

The project site is located on the lower mid-slope of the immediate surrounding landscape, and is situated on the border of two soil landscapes as described in the '*Soils Landscapes of the Gosford – Lake Macquarie 1:100,000 Sheet (1993)*'. The alluvial Wyong soil landscape underlies the majority of the project site, underlying the entire disturbance area associated with the VAM RAB unit, and extends to the west of the site. The rest of the project site is underlain by the erosional Gorokan soil landscape, which extends to the east. The soil landscapes in and surrounding the project site are illustrated in **Figure 7**, and are described further below.

The Gorokan (gk) soil landscape consists of undulating low hills and rises on lithic sandstones of the Tuggerah Formation. The broad crests and ridges, long gently inclined slopes and broad drainage lines are within 30 metres local relief and <15 percent slope gradients. Soil types associated with this landscape generally consist of yellow duplex and grey brown duplex soils with a very high erosion hazard, localised foundation hazard, and are generally strongly acidic with low fertility. The rural capability of this soil landscape is classified as high to severe limitations for regular cultivation but low limitations for grazing (land capability IV, V or VI).

The Wyong (wy) soil landscape consists of broad poorly drained deltaic floodplains and alluvial flats of Quaternary sediments on the central coast lowlands. Slope gradients are generally less than 3 percent, with local relief less than 10m. Soil types generally consist of deep yellow duplex and brown duplex soils with localised flooding, waterlogging and streambank erosion hazard, as well as localised acid sulphate



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soils that are poorly drained with very low fertility. The rural capability of this soil landscape is classified as high to severe limitations for cultivation within low lying waterlogged areas, however low limitations in non-waterlogged areas albeit low fertility, and low to moderate limitations for grazing (land capability ranges between III and VII).

The location of the proposed disturbance area associated with the VAM RAB unit is within the Wyong soil landscape, which indicates that there is potential for the presence of localised acid sulphate soils. Further to this, a geotechnical assessment was conducted for the project by Doulas Partners (2011). The results of laboratory testing conducted as part of this assessment were consistent with the soil landscape mapping, indicating the presence of acid sulphate soils at the site. This is also consistent with the results of testing undertaken for the approved gas engines.

Acid sulphate soils are naturally occurring soils, which contain either extremely acidic or potentially extremely acidic soil horizons due to the oxidation or potential oxidation of iron sulphides, primarily pyrite (FeS_2). Potential acid sulphate soils are waterlogged soils rich in pyrite that have not been oxidised. However, in the event of excavation or drainage works that allows the aeration of these soils, the pyrite is oxidised to sulphuric acid and can become an actual acid sulphate soil. Actual acid sulphate soils usually overly potential acid sulphate soils and can indicate sites with a high risk of further acidification.

In 1998, the NSW Department of Land and Water Conservation released the *Acid Sulfate Soil Risk Maps* and associated guidelines. These maps predict the distribution of acid sulphate soils based on an assessment of the geomorphic environment. The maps have three primary map classes:

- High Probability of Occurrence of Acid Sulfate Soils;
- Low Probability of Occurrence of Acid Sulfate Soils; and
- No Known Occurrence of Acid Sulfate Soils.

Where there is a high or low probability of occurrence of acid sulphate soils, the likely depth to the acid layer is provided.

7.4.2 Impact Assessment

The project site is situated within the Acid Sulphate Soil Risk Map 73 Morisset, and indicates a low probability at depth greater than 3 metres below ground surface.

The extent of excavation for the project will be minimal. It is anticipated that the only soil disturbance will be the stripping and salvaging of topsoil down to a depth of 200 millimetres. Between 700 millimetres and 1,200 millimetres of compacted fill will then be placed on the surface. The depth of foundations is expected to be contained within the compacted fill material, without the need to disturb the original soil profile below the 200 millimetre stripped topsoil level. These design features and construction plans result in a very low to nil risk of disturbing acid sulphate soils or potential acid sulphate soils during the construction of the VAM RAB.

All excavations associated with construction of the VAM RAB will be installed with steel reinforcement and filled with concrete within a short period of time as per standard construction timetables. There will therefore be very limited opportunity for the aeration of excavation works.

7.4.3 Mitigation Measures

Given that the project site is located within the Wyong soil landscape, which indicates that there is the potential for the presence of localised acid sulphate soils, a number of mitigation measures have been incorporated into the construction design for the project. As described above in **Section 7.4.2**, only approximately 200 millimetres of topsoil will be stripped and salvaged from the site, with inert compacted fill to be placed over the existing soil profile. This fill is expected to house the foundations of the structure without further excavation of the original soil profile. These design features and construction plans result in

a very low to nil risk of disturbing acid sulphate soils or potential acid sulphate soils during the construction of the VAM RAB.

In the unlikely event that acid sulphate soils or potential acid sulphate soils are disturbed or exposed during construction works, the existing approved Mandalong Acid Sulphate Soil Management Plan will be implemented. This management plan identifies the mitigation measures to be implemented in the event of the presence of acid sulphate soils, stating that such soils will be handled in accordance with the *Acid Sulphate Soil Manual* (NSW Acid Sulphate Soil Management Advisory Committee, 1998). This is consistent with recommendations of the geotechnical report (Douglas Partners, 2011), which state that an acid sulphate soil management plan will be required if excavation or disturbance of the natural site soils, below the upper topsoil layer, is proposed.

The presence of acid sulphate soils will also be taken into account in the design of concrete steel structures if they are to be in contact with the natural ground, in accordance with recommendations of the geotechnical report.

The soils within the project site exhibit a high erosion hazard and therefore appropriate erosion and sedimentation controls will be implemented to minimise the impacts of erosion and sedimentation during ground disturbance. Details of the erosion and sediment control measures are outlined in **Section 7.3**.

7.4.4 Conclusion

Construction of the VAM RAB unit will be managed in such a way so as to ensure a very low to nil risk of disturbing acid sulphate soils or potential acid sulphate soils during the construction phase of the project.

7.5 Noise

7.5.1 Introduction

In correspondence dated 29 March 2011 the DP&I indicated that the EA must address the following with regard to noise:

"an assessment of noise impacts to determine the level of cumulative impacts of the existing, approved and proposed equipment and plant on-site for near-by residential receivers."

A Noise Impact Assessment was undertaken for the proposed modification by SLR Consulting Australia Pty Ltd (SLR), who have monitored operational noise levels from Mandalong on an annual basis since 2008. A full copy of this report is attached as **Appendix 5**. The assessment considers the cumulative impact of the existing, approved and proposed equipment and plant on-site at the nearest residential receivers to Mandalong, and thus satisfies the requirement of the DP&I.

The Noise Impact Assessment includes the following:

- A summary of previous noise assessments and ongoing noise compliance measurements undertaken at Mandalong;
- Project Specific Noise Criteria;
- Development of a noise model for the Mandalong pit top, including the project; and
- An assessment of the predicted construction and operational noise impacts with reference to the relevant noise criteria.

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

7.5.2 Existing Environment

The project site and surrounding residences are located in undulating terrain, with elevated terrain located south and west of the site. The project site is situated at an approximate elevation of 6 metres AHD, with a ridge running in a north-southerly direction located just south of the site. The land levels out to the east of the site towards Lake Macquarie.

A number of privately owned residences are located in the area surrounding the project site. The Noise Impact Assessment identified 10 nearest non-project related residences as sensitive receptor locations in the immediate vicinity of the project site, as illustrated in **Figure 8**. The potential noise impacts relating to the project were then assessed at these sensitive receptor locations.

7.5.3 Methodology

SLR used a computer model to predict noise emissions from the project. The model used topographic and operational information, together with noise source data, ground cover, shielding by barriers and/or adjacent buildings and atmospheric information to predict noise levels at the nearest potentially affected receivers. Prediction of noise emission levels was carried out under calm and prevailing atmospheric conditions (winds from the south-west). A worst case scenario of the occurrence of temperature inversions during the night time period was also considered.

Sound power levels of relevant existing and approved plant and equipment were obtained from measurements of plant already operating at the site or have been sourced from an SLR database of similar equipment. The sound power level of the proposed VAM RAB unit has been estimated at 97 dBA based on measurements conducted of a similar unit and information provided by the manufacturer.

Project Specific Noise Criteria for the project were adopted from *Mandalong Mine Modification to Development Consent Noise and Vibration Impact Assessment* by Bridges Acoustics (May 2008). SLR reconsidered this criteria with reference to the recent SLR monitoring data, collected in the vicinity of Mandalong over the past three years in accordance with the approved Noise Monitoring Program, and deemed the Project Specific Noise Criteria determined by Bridges to still be relevant at this time.

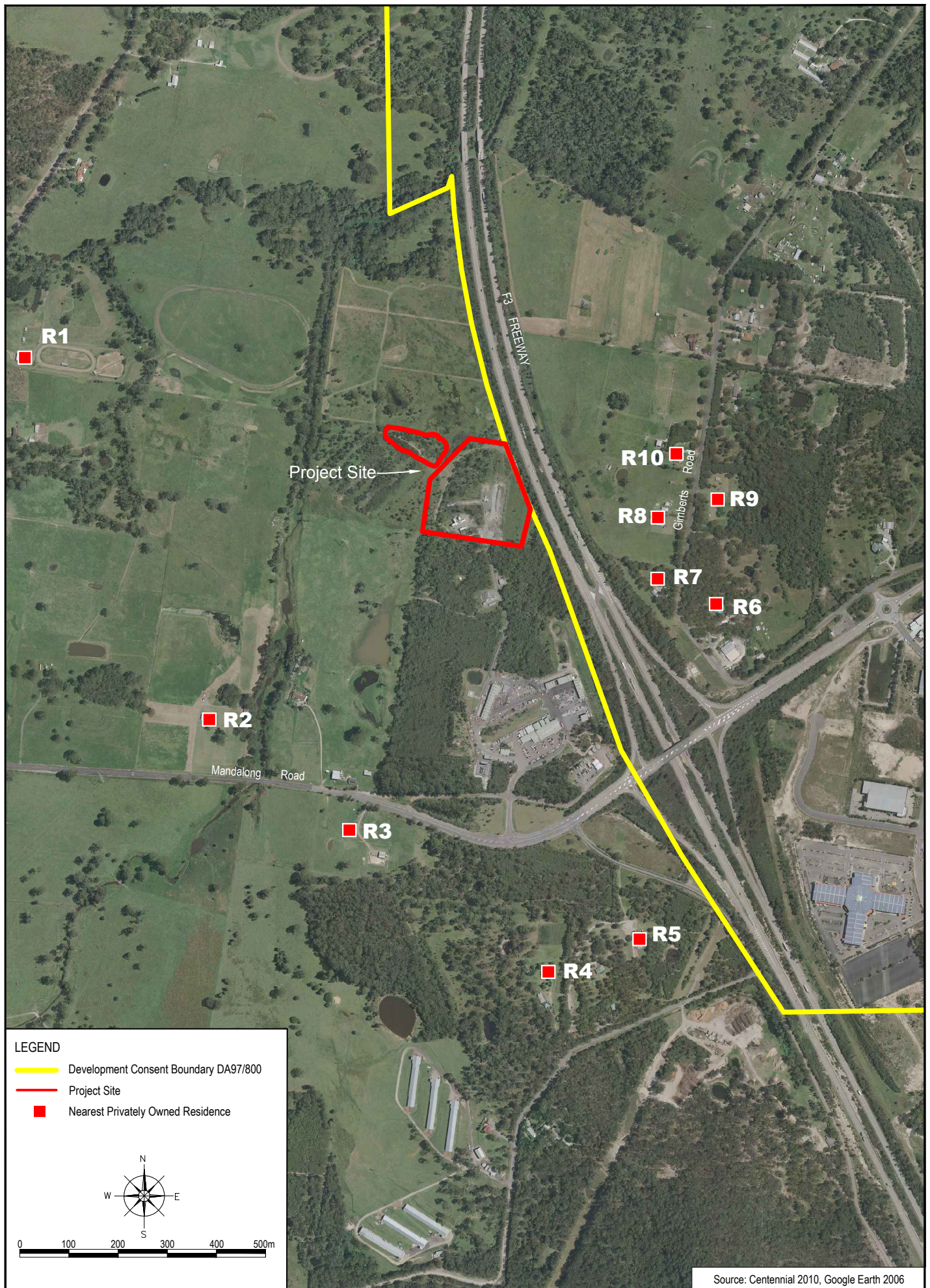
The Project Specific Noise Criteria, as presented in Bridges Acoustics, 2008, and adopted for this project are presented in **Table 5**.

Table 5 – Adopted Project Specific Noise Criteria at Residences

Location (as per Figure 8)	Period	Intrusive Criteria LAeq(15minute)	Amenity Criteria LAeq(Period)
M2 (West of Mine) [R1 - R5]	Day	54 dBA	50 dBA
	Evening	54 dBA	45 dBA
	Night	42 dBA	40 dBA
M3 (East of Mine) [R6 - R10]	Day	60 dBA	54 dBA
	Evening	56 dBA	48 dBA
	Night	48 dBA	47 dBA

The existing Development Consent conditions relevant to noise at Mandalong were established based on predicted noise emissions provided in the Noise Impact Assessment conducted by Bridges for the 2008 Development Consent Modification (Bridges, 2008). SLR considered it appropriate to assess the current proposed modification with reference to the Project Specific Noise Criteria (presented in **Table 5**), rather than the current consent conditions relating to noise, for two main reasons:

- The proposed modification involves the installation of additional plant to that previously assessed; and



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- Additional meteorological scenarios were considered in the Noise Impact Assessment for this project. The Bridges (2008) assessment considered a prevailing easterly wind in the evening and calm conditions only during the day and night. SLR however considered both calm and prevailing atmospheric conditions across the day, evening and night time, which, upon analysis of weather data were found to be winds from the south-west. Temperature inversions were also considered.

7.5.4 Potential Impacts

Construction Impacts

Construction impacts were predicted using the assumption that all construction equipment would operate simultaneously. This scenario is highly unlikely, however was assessed so as to consider the worst case scenario. In addition, construction will only be undertaken during the day, and therefore noise predictions were conducted for daytime only, under both calm and adverse (south-west wind) conditions.

The results of the construction noise predictions are presented in **Table 6**.

Table 6 – Construction Noise Predictions

Residential Location	Predicted Construction Noise Level LA10(15minute) (dBA)		Construction Noise Goal* LA10(15minute) (dBA) (Day time)
	Calm	SW Wind	
R1 (64)	35	30	69
R2 (82)	40	32	
R3 (97)	39	32	
R4 (109)	35	30	
R5 (110)	36	30	
R6 (86)	43	47	76
R7 (85)	47	51	
R8 (72)	48	52	
R9 (73)	44	49	
R10 (66)	46	51	

*Based on an assumed construction period of up to 4 weeks, and as outlined in Schedule 2 Condition 43 of DA 97/800

As shown in **Table 6**, construction noise levels associated with the installation of the VAM RAB unit are predicted to be below the relevant noise goal for the daytime period at all assessed residential locations under calm and prevailing weather conditions.

Operational Impacts – Intrusive noise levels

Noise modelling results under all considered meteorological conditions indicate that the addition of the proposed VAM RAB unit is predicted to increase noise levels by less than 1 dBA at some of the nearest assessed residential locations, whilst not affecting noise levels at the other nearest receptors. The predicted change in noise levels associated with the installation and operation of the VAM RAB unit is presented in **Table 7**.

Table 7 – Predicted Noise Level Change at Nearest Receptors Associated With Operation of VAM RAB Unit

Location*	Period	Predicted Noise Level Increase (dBA) – VAM RAB		
		Calm Conditions	SW Wind	Temp Inversion
R1	Day	0	0	-
	Evening	0	0	-
	Night	0	0	0
R2	Day	<1	0	-
	Evening	<1	0	-
	Night	0	0	0
R3	Day	0	0	-
	Evening	0	0	-
	Night	0	0	0
R4	Day	<1	0	-
	Evening	<1	0	-
	Night	0	0	0
R5	Day	0	0	-
	Evening	0	0	-
	Night	0	0	0
R6	Day	0	0	-
	Evening	0	0	-
	Night	<1	0	0
R7	Day	<1	0	-
	Evening	<1	0	-
	Night	<1	0	0
R8	Day	0	0	-
	Evening	0	0	-
	Night	0	0	1
R9	Day	0	<1	-
	Evening	0	<1	-
	Night	<1	0	0
R10	Day	<1	0	-
	Evening	<1	0	-
	Night	0	<1	1

*As illustrated in Figure 8.

The results presented in **Table 7** show that the operation of the single VAM RAB unit at Mandalong will have minimal impact on the nearest receptors with regards to noise levels. Under adverse meteorological conditions (south-west wind), noise levels will only increase by <1dBA at two nearest residences. The presence of a temperature inversion will also only increase noise levels by 1dBA at two residences. Under calm daytime conditions, noise levels are predicted to increase by <1dBA at six of the nearest assessed residences.

Furthermore, noise emission levels from Mandalong Mine, including the proposed VAM RAB, are predicted to meet the relevant Project Specific Noise Criteria for all considered meteorological conditions at all assessed residential locations.

It is noted that the results of current noise modelling indicate current mine noise emission levels are predicted to be up to 8 dBA above the current consent conditions at Mandalong. This is due to the fact that the current Mandalong Mine Consent conditions relevant to noise were established based on predicted

noise emissions provided in Mandalong Modification to Development Consent Environmental Assessment - Appendix D (Bridges Acoustics, May 2008). Bridges' predictions differ from the current noise modelling primarily due to the different meteorological scenarios considered. Bridges assessment considered prevailing easterly winds in the evening, and only calm conditions in the day and night time periods. Temperature inversions were also not considered.

The meteorological scenarios considered as part of the current noise impact assessment represent acoustically worst-case conditions at the nearest potentially affected residential receivers and, thus, are considered appropriate for assessment purposes. Therefore, Centennial Mandalong is seeking a modification to its current consent conditions to have the noise criteria modified to be consistent with the Project Specific Noise Criteria.

Operational Impacts – Amenity noise levels

Amenity noise levels ($LA_{eq}(\text{Period})$) have been estimated by SLR from the predicted intrusive levels ($LA_{eq}(15\text{minute})$) based on the following assumption:

$$LA_{eq}(\text{Period}) = LA_{eq}(15\text{minute}) - 2 \text{ dBA}$$

Predicted amenity noise emission levels at the nearest potentially affected residential locations are provided in **Table 8**. For simplicity, the worst case only is presented; for the night-time only, since this period provides the strictest criteria, and under worst-case meteorological conditions i.e. temperature inversion and south-west wind.

Table 8 – Predicted Amenity Noise Levels including the VAM RAB Unit

Location	Period	Predicted Noise Level $LA_{eq}(\text{Period})$ (dBA)		Project Specific Noise Criteria ($LA_{eq}(\text{Period})$)
		Temp. Inversion	SW wind	
R1	Night	30	<30	40
R2	Night	37	<30	40
R3	Night	40	<30	40
R4	Night	36	<30	40
R5	Night	39	<30	40
R6	Night	38	38	47
R7	Night	41	41	47
R8	Night	41	41	47
R9	Night	37	38	47
R10	Night	39	40	47

As illustrated in **Table 8**, noise amenity levels from Mandalong, including the proposed VAM RAB, are predicted to meet the relevant Project Specific Noise Criteria during the night-time period under adverse meteorological conditions at all assessed residential locations.

Operational Impacts – Sleep Disturbance

The nature of the noise generated by the VAM RAB unit is that of constant fan-type noise. Hence, no additional impacts in terms of potential for sleep disturbance are expected from operation of the VAM RAB.

7.5.5 Mitigation Measures

Standard work procedures and maintenance tasks have been developed and implemented at Mandalong to minimise noise levels. These procedures will continue to be implemented at Mandalong for this proposed modification. In addition, a number of mitigation measures relating to the project will be employed to ensure

noise impacts are minimised. These measures have been taken into account in the noise assessment, and are as follows:

- Construction will be limited to daylight hours between 7am and 6pm Monday to Friday, and 8am to 1pm on Saturday. No construction will be undertaken on Sundays or public holidays;
- Off-site modular construction of the VAM RAB will reduce on-site construction time; and
- Changes to surface operations at Mandalong will be very limited.

It is also noted that noise monitoring is conducted at Mandalong Colliery in accordance with the Mandalong annual attended noise monitoring program, and will continue following installation of the VAM RAB unit. Each round of noise monitoring conducted by SLR (2008, 2009 and 2010) determined that noise emission levels from Mandalong Mine were inaudible at most monitoring locations and below the relevant criteria at all locations.

7.5.6 Conclusion

The operation of a single VAM RAB unit at Mandalong is predicted to have minimal noise impacts on the surrounding residences, increasing noise levels by less than 1 dBA at some of the nearest assessed residences, whilst not affecting noise levels at the other nearest receptors. The overall noise emission levels from Mandalong, including the proposed VAM RAB unit, are predicted to meet the relevant Project Specific Noise Criteria for all considered meteorological conditions at all assessed residential locations.

The results of current noise modelling indicate mine noise emission levels are predicted to be up to 8 dBA above the current consent conditions at Mandalong. This is due to the fact that the current Mandalong Mine Consent conditions relevant to noise were established based on predicted noise emissions provided in Bridges, 2008. Bridges' predictions differ from the current noise modelling primarily due to the different meteorological scenarios considered.

The meteorological scenarios considered as part of the current noise impact assessment represent acoustically worst-case conditions at the nearest potentially affected residential receivers and, thus, are considered appropriate for assessment purposes. Therefore, Centennial Mandalong is seeking a modification to its current consent conditions to have the noise criteria modified to be consistent with the Project Specific Noise Criteria.

Construction noise levels are predicted to be well below the relevant noise goal for the daytime period at all assessed residential locations under calm and prevailing weather conditions.

7.6 Greenhouse Gas Assessment

7.6.1 Introduction

A greenhouse gas assessment was undertaken by SLR for the proposed modification, and a full copy of this report is attached as **Appendix 6**. The following is a summary of the findings of this report. For further details the full assessment report should be referred to.

The greenhouse gas assessment for the project includes the following:

- Calculation of greenhouse gas emissions associated with the project in accordance with the requirements of the National Greenhouse and Energy Reporting Act 2007 (NGER Act), and by applying all relevant emission factors and methods documented in the NGER System Measurement, *Technical Guidelines* (June 2010), as well as the *NGA Factors* (DCCEE, July 2010);
- Assessment of the significance of greenhouse gas emissions for the project in relation to national greenhouse gas objectives, and the project's greenhouse gas implications in terms of Federal and NSW Government policies and protocols; and
- Outlines measures for the minimisation and management of greenhouse gas emissions and energy use as required.

The *NGA Factors* (DCCEE, 2010) defines two types of greenhouse gas emissions:

- **Direct emissions**, which are produced from sources within the boundary of an organisation and as a result of the organisations activities; and
- **Indirect emissions**, which are emissions generated outside the boundary of an organisation in the wider economy as a consequence of an organisations activities (particularly from its demand for goods and services), but which are physically produced by the activities of another organisation. Examples of indirect emissions are those as a result of the consumption of electricity.

The greenhouse gas assessment describes the emissions sources that contribute to Scope 1, 2 and 3 greenhouse gas emissions from Mandalong. In summary:

- Scope 1 emissions – are direct emissions that are controlled by Mandalong, and include fugitive emissions from coal seam methane as a result of extraction activities, diesel usage in both mobile and fixed plant, the consumption of sulfur hexafluoride for gas insulated switchgear and circuit breaker applications, and the use of grease and oils for lubrication of plant and equipment;
- Scope 2 emissions – are indirect emissions associated with the consumption of generated and purchased electricity; and
- Scope 3 emissions – are all other indirect emissions controlled independently of Mandalong, but are a consequence of Mandalong's activities, for example the extraction, production and transport of fuel burned for the generation of electricity consumed at Mandalong, and the electricity lost in delivery in the transmission and distribution network.

7.6.2 Results of the Greenhouse Gas Assessment

The current greenhouse gas emissions attributable to Mandalong based on the latest 2010 data, as well as the predicted greenhouse gas emissions following installation of the single VAM RAB unit, are presented in **Table 9** below. Note that only Scope 1 and Scope 2 emissions are reported. The greenhouse gas assessment considered that Scope 3 emissions will not be affected by the proposed modification, as sources within this scope category, namely combustion of product coal, transport via road, employee business travel and outsourced activities, will not be changed by the installation and operation of the proposed VAM RAB unit. All rates of activity of these sources are to remain unchanged and as such have not been included in the greenhouse gas assessment.

Table 9 – Summary of Greenhouse Gas Emissions Attributable to Mandalong with and without proposed modification

Emission Scope	Emission Source	Current emissions (t CO ₂ -e) per annum	Emission (t CO ₂ -e) per annum with <u>single VAM RAB unit operational</u>	Difference after modification
Scope 1	Fugitive methane emissions	1,189,985	1,166,555	-23,430
	Diesel combustion, stationary sources	2,080	2,080	Nil Change
	Diesel combustion, transport	2,760	2,760	Nil Change
	Use of sulfur hexafluoride	3	3	Nil Change
	Use of greases and oils	298	298	Nil Change
Total Scope 1		1,195,126	1,171,696	-23,430
Scope 2	Electricity	52,648	52,808	160
Total Scope 1 and 2		1,247,774	1,224,504	-23,270

As can be seen in **Table 9**, the most significant direct emissions from Mandalong are associated with fugitive emissions. 99.5 percent of the Scope 1 emissions in 2010, and 95% of the total Scope 1 and 2, were from fugitive coal seam methane emissions. 32 percent of these fugitive emissions were attributed to high purity methane drainage gas, whilst 68 percent was from VAM. This gives the equivalent emissions of 380,795 t CO₂-e for the high purity methane and 809,190 t CO₂-e for the VAM (SLR, 2011).

Installation of the single VAM RAB unit will reduce the greenhouse gas emissions attributable to VAM by 23,430 t CO₂-e per annum. Scope 1 emissions from other direct sources will remain unchanged. It is predicted that the Scope 2 emissions will increase slightly due to the consumption of additional electricity of 180,000kWh per annum, resulting in an additional 160 t CO₂-e. Overall therefore, the installation of the single VAM RAB unit will lead to a reduction in Scope 1 and 2 emissions by 23,270 t CO₂-e.

The greenhouse gas assessment does not include the reductions provided by the use of the high purity methane in gas flares and gas engines that has previously been assessed and approved, however it is noted that the installation of this approved infrastructure will significantly reduce Scope 1 emissions from Mandalong even further.

7.6.3 Conclusion

The proposed modification will result in a reduction in greenhouse gas emissions from Mandalong through the oxidation of VAM to carbon dioxide. Fugitive coal seam methane emissions account for the vast majority of direct greenhouse gas emissions from Mandalong, with the installation of the VAM RAB unit reducing these emissions by 23,430 t CO₂-e, and overall leading to the emission of 23,270 fewer tonnes of CO₂-e from Mandalong.

7.7 Air Quality

An Air Quality Impact Assessment was undertaken by SLR for the proposed modification, and a full copy of this report is attached as **Appendix 7**. The following is a summary of the findings of this report. For further details the full assessment report should be referred to.

The assessment was conducted in accordance with relevant air quality assessment guidelines, including the NSW DECCW's *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (DECC, 2005), and utilised the CALPUFF (version 6.2) modelling system.

As discussed in **Section 1.5** the DP&I did not issue DGRs for the project. However, in correspondence dated 29 March 2011 the DP&I indicated that the EA must address the following with regards to air quality:

"... an assessment of air quality impacts from the planned operation of Ventilation Air Methane Abatement equipment to determine the level of impact on near-by residential receivers. The assessment must include a cumulative assessment of existing, approved and proposed methane abatement technologies at the site."

As previously discussed, methane emissions from Mandalong include high purity methane drainage gas, as well as VAM. Abatement technologies for the abatement of the high purity methane already approved for Mandalong include enclosed methane gas flare units, as well as gas engines with up to 12 MW of capacity, to utilise the gas for power generation. The Air Quality Impact Assessment included a cumulative assessment of all equipment on site, including these proposed abatement technologies, thus ensuring the requirements of the DP&I were met.

As part of the cumulative assessment, in assessing the air quality impacts from the approved methane abatement technologies, two separate scenarios were modelled which take into consideration the operation of the approved gas flares and gas engines:

- Scenario 1: Gas flaring – as a worst case scenario for the operation of the gas flares, emissions from the flares were estimated assuming 100 percent of the methane from the gas drainage plant will be flared.

- Scenario 2: Gas engines – as a worst case scenario for the operation of the gas engines, modelling has been carried out assuming that 100 percent of the methane from the gas drainage plant is combusted in the gas engines. This assumes that the gas engines are capable of utilising all methane drainage gas, with the flare units to remain as back-up for peak gas flows.

7.7.1 Existing Environment

Air quality influences in the immediate locality surrounding the project site include Mandalong Mine itself, the adjacent F3 freeway to the east of the project site, poultry sheds to the south and north west, and Eraring Power Station located approximately 5 kilometres north east.

The site-specific background air quality levels adopted by SLR for the assessment is summarised in **Table 10**.

Table 10 – Background Air Quality Data (SLR, 2011)

Air Quality Parameter	Averaging Period	Assumed Background Level
CO (mg/m ³)	15 minutes	4.8
	1 hour	3.6
	8 hours	2.8
NO ₂ (µg/m ³)	1 hour	86.1
	Annual	18.5
SO ₂ (µg/m ³)	10 minutes	237.4
	1 hour	165.9
	24 hours	25.7
	Annual	2.9

A number of privately owned residences are located in the area surrounding the project site. As discussed above in **Section 7.5**, 10 nearest non-project related residences have been identified as sensitive receptor locations in the immediate vicinity of the project site, as illustrated above in **Figure 8**. The potential air quality impacts relating to the project were then assessed at these sensitive receptor locations.

7.7.2 Potential Impacts

VAM RAB Unit – Construction impacts

The air quality impacts from construction of the VAM RAB are expected to be minimal, given that the area in which the VAM RAB is to be installed is already partially disturbed, and that construction is expected to take less than four weeks.

VAM RAB Unit – Operational impacts

Exhaust emissions from the VAM RAB unit are summarised in **Table 11**.

Table 11 – Exhaust Composition of a Single VAM RAB unit

Substance	Chemical Formula	Mass/Mass (%)	Volume/Volume (%)
Water	H ₂ O	13.6	20.2
Carbon dioxide	CO ₂	0.8	0.5
Carbon monoxide	CO	0.0	0.0
Methane	CH ₄	0.0	0.0
Nitrogen	N ₂	68.5	65.2
Oxygen	O ₂	17.1	14.2

Note: Chemical composition provided by CSE. Exhaust composition is valid under the assumptions that:

- there is no CO or CO₂ entering the RAB;
- the CH₄ concentration is 0.5 % M/M;
- the relative humidity at 20°C is 90 %; and
- there is a complete combustion in the VAM RAB.

The stack emissions from the VAM RAB unit consist predominantly of water, nitrogen and oxygen, and will not pose a hazard to any surrounding sensitive receptors. The VAM is drawn through a conditioning duct where large particulates drop out of the ventilation air and it is assumed that no particulate matter is emitted from the VAM RAB unit.

Given that emissions of criteria pollutants (CO, SO₂, and NO₂) from the VAM RAB were shown to be minimal, emissions from the VAM RAB were therefore not included in the cumulative assessment, discussed in the sections below.

Scenario 1 – Gas flaring

Results of the dispersion modelling for the gas flares at each of the nearest sensitive receptors, is presented in **Table 12**.

Table 12 – Predicted Incremental Concentrations at Sensitive Receptors – Gas flaring Alone

Receptor ID	CO (mg/m ³)			NO ₂ (µg/m ³)		SO ₂ (µg/m ³)			
	15-min	1-hour	8-hour	1-hour	Annual	10-min	1-hour	24-hour	Annual
R1	1.5	1.2	0.2	40.1	0.2	NA	NA	NA	NA
R2	1.6	1.2	0.4	41.8	0.3	NA	NA	NA	NA
R3	1.8	1.4	0.5	47.7	0.4	NA	NA	NA	NA
R4	2.0	1.5	0.4	53.3	0.3	NA	NA	NA	NA
R5	1.7	1.3	0.4	43.1	0.3	NA	NA	NA	NA
R6	3.0	2.2	1.1	77.1	1.0	NA	NA	NA	NA
R7	2.6	2.0	1.1	68.1	1.0	NA	NA	NA	NA
R8	2.5	1.9	0.9	64.9	1.7	NA	NA	NA	NA
R9	2.9	2.2	1.3	75.3	2.0	NA	NA	NA	NA
R10	2.2	1.6	0.8	56.3	2.5	NA	NA	NA	NA

In addition to analysing the maximum predicted incremental concentrations for each sensitive receptor, an analysis of the maximum predicted concentrations present within the entire modelling domain was performed. The results of this analysis was been paired with background concentrations provided in **Table 10** above, to determine if cumulative impacts comply with project goals. The results are summarised in **Table 13**.

Table 13 – Highest Concentrations of Pollutants at Sensitive Receptors – Gas Flaring Alone

Pollutant	Averaging Time	Background Concentration	Predicted Concentration	Cumulative Concentration	Assessment Criterion
CO (mg/m ³)	15 minutes	4.8	3.0	7.8	100
	1 hour	3.6	2.3	5.9	30
	8 hours	2.8	1.4	4.2	10
NO ₂ (µg/m ³)	1 hour	86.1	79.2	165.3	246
	Annual	18.5	3.7	22.2	62

As shown in **Table 13**, no exceedances of the Project criteria are predicted at any identified sensitive receptor location.

Scenario 2 – Gas engines

The results of the dispersion modelling for the gas engines are presented **Table 14**.

Table 14 – Predicted Incremental Concentrations at Sensitive Receptors – Gas Engines Alone

Receptor ID	CO (mg/m ³)			NO ₂ (µg/m ³)		SO ₂ (µg/m ³)			
	15-min	1-hour	8-hour	1-hour	Annual	10-min	1-hour	24-hour	Annual
R1	0.3	0.3	0.1	23.0	0.2	6.8	4.8	0.5	<0.1
R2	0.3	0.2	0.1	20.3	0.2	6.0	4.2	0.5	<0.1
R3	0.4	0.3	0.1	28.7	0.2	8.5	5.9	0.5	<0.1
R4	0.4	0.3	0.1	26.1	0.2	7.7	5.4	0.5	<0.1
R5	0.3	0.2	0.1	21.2	0.2	6.3	4.4	0.5	<0.1
R6	0.4	0.3	0.1	26.2	0.2	7.8	5.4	0.9	<0.1
R7	0.4	0.3	0.1	24.0	0.2	7.1	5.0	0.9	<0.1
R8	0.3	0.3	0.2	22.7	0.3	6.7	4.7	1.4	0.1
R9	0.3	0.2	0.2	20.9	0.3	6.2	4.3	1.1	0.1
R10	0.3	0.2	0.1	19.7	0.3	5.8	4.1	0.7	0.1

These results were then paired with background concentrations to determine if cumulative impacts comply with project goals. The results are summarised below in **Table 15**.

Table 15 - Highest Concentrations of Pollutants at Sensitive Receptors – Gas Engines Alone

Pollutant	Averaging Time	Background Concentration	Predicted Concentration	Cumulative Concentration	Assessment Criterion
CO (mg/m ³)	15 minutes	4.8	1.7	6.5	100
	1 hour	3.6	1.3	4.9	30
	8 hours	2.8	0.3	3.1	10
NO ₂ (µg/m ³)	1 hour	86.1	118.2	204.3	246
	Annual	18.5	1.0	19.5	62
SO ₂ (µg/m ³)	10 minutes	237.4	35.0	272.4	712
	1 hour	165.9	24.4	190.3	570
	24 hours	29.5	2.0	31.5	228
	Annual	2.9	0.2	3.1	60

No exceedances of the project criteria are predicted at any of the identified sensitive receptor locations.

7.7.3 Mitigation Measures

Standard work procedures have been developed and implemented at Mandalong to minimise air quality levels. These procedures will continue to be implemented at Mandalong for this proposed modification. Given that the air quality impacts from the installation and operation of the approved and proposed methane abatement technologies have been shown to be minimal, no other mitigation measures are required.

7.7.4 Conclusion

The air quality impacts from the installation and operation of the VAM RAB unit are considered to be negligible. Similarly, the predicted air quality impacts associated with the approved gas flares and gas engines are predicted to be minimal, and will not exceed project criteria at any of the identified sensitive receptor locations. In addition, the proposed modification does not involve any increase in production and therefore will not lead to an increase in particulate emissions.

7.8 Aboriginal and Cultural Heritage

The proposed modification involves minimal disturbance to an already largely disturbed area, and therefore the likelihood of disturbance to both Aboriginal and European heritage is considered unlikely. However, a Cultural Heritage Assessment was undertaken for the proposed modification by RPS to ensure any potential implications for heritage are identified and mitigation measures recommended where required. A full copy of this report is attached as **Appendix 8**.

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

7.8.1 Methodology

The section 75W approval pathway for the modification application means that the heritage assessment was conducted as a full Part 3A process, and involved the following:

- A search of the relevant State and Federal heritage registers and listings, including the OEH Aboriginal Heritage Information Management System (AHIMS) and the register for native title claimants;
- Identification of Aboriginal Land Councils, Elders and other interested parties through the ACHCRs (DECCW, 2010);
- Consultation with registered Aboriginal stakeholders in the area. This included a field survey of the area with representatives of the Aboriginal community to identify sites of potential archaeological significance;
- Assessment of archaeological and cultural heritage values;
- Evaluation of potential impacts; and
- Preparation of mitigation and management strategies if required.

7.8.2 Existing Environment

A search of the AHIMS identified a total of 111 previously recorded Aboriginal sites across the regional area, with stone artefacts being the most predominant site type. No Aboriginal sites have been previously recorded in the project site.

Consultation with the Aboriginal community was carried out throughout the assessment process in accordance with the requirements of the ACHCRs (DECCW, 2010). Further details on the consultation undertaken with local Aboriginal Community Stakeholders are provided in **Section 6.4** of this report.

A field survey of the project site was conducted on 6 April 2011 by a Senior Archaeologist from RPS, and representatives from the Westlakes Aboriginal Community, Awabakal Traditional Owners Aboriginal Corporation and Awabakal Descendants Traditional Owners Aboriginal Corporation. The project site was divided into eight survey units, with each surveyed for Aboriginal artefacts.

No Aboriginal sites or objects were identified in any of the eight survey units during the field survey. Discussion with the Aboriginal stakeholders present during the field survey concluded that there were no areas of Aboriginal cultural significance within the project site.

A predictive model of the project site was also formulated by RPS following review of the relevant environmental and archaeological information. It was predicted that the most predominant types of sites would be artefact scatters, isolated finds and Potential Archaeological Deposits. However, as the project site is highly disturbed from previous land use practices, and no Aboriginal sites or objects were identified, it is considered that there are no likely *in situ* deposits.

RPS found no evidence of any European cultural heritage items.

7.8.3 Potential Impacts

As no sites or objects of Aboriginal or European cultural significance were identified within the project site, there are no identified risks to cultural heritage as a result of development works taking place.

7.8.4 Mitigation Measures

Whilst no Aboriginal or European cultural heritage sites or objects were identified within the project site, the following mitigation measures will be implemented.

- All relevant Centennial Mandalong staff and contractors are made aware of their statutory obligations for heritage under the NPW Act and the *Heritage Act 1977*, which is implemented by Centennial Mandalong during their mine induction process;
- If Aboriginal site/s are identified in the project site during works, then all works in the area will cease, the area cordoned off and contact made with OEH Enviroline 131 555, a suitably qualified archaeologist and the relevant Aboriginal stakeholders, so that it can be adequately assessed and managed;
- In the unlikely event that skeletal remains are uncovered, work must cease immediately in that area and Centennial Mandalong will need to contact the NSW Police Coroner to determine if the material is of Aboriginal origin. If determined to be Aboriginal, they must then contact the OEH Enviroline 131 555 and relevant Aboriginal Community Stakeholders in order to determine an action plan for the management of the skeletal remains prior to works re-commencing; and
- If during the course of clearing works significant European cultural heritage material is uncovered, work in that area will cease and the NSW Heritage Branch notified. Works should only recommence when an appropriate management strategy has been formulated.

7.9 Visual Amenity

A visual impact assessment of the Project was conducted by GSSE, and involved an evaluation of the existing visual character of the landscape surrounding the project site, as well as an assessment of potential visual impacts that may be associated with installation and operation of the single VAM RAB unit.

The visual assessment included a cumulative assessment of potential visual impacts from the proposed VAM RAB unit, as well as approved (gas engines and gas flares) and existing mine ventilation and gas drainage infrastructure within the project site.

The methodology for the assessment of visual amenity involved the following:

- A site inspection to gain an understanding of the existing visual character of the area, as well as ascertaining the extent of visual barriers between the proposed location of the VAM RAB unit, existing gas management infrastructure, and the nearest privately owned residences; and
- Visual assessment, involving the generation of visual profiles from the nearest privately owned residences surrounding the project site.

The outcomes of this assessment are discussed below.

7.9.1 Existing Environment

The project site and surrounding residences are located in undulating terrain, with elevated terrain located south and west of the site. The project site is situated at an approximate elevation of 6 metres AHD, with a ridge running in a north-southerly direction located just south of the site. The land levels out to the east of the site towards Lake Macquarie.

The project site is bounded by the F3 freeway to the east, with the Mandalong Mine pit top, and Mandalong Road, to the south. Rural residential areas exist to the north and west. A number of privately owned residences are located in the area surrounding the project site, as illustrated above in **Figure 8**.

Photos illustrating the existing environment are presented in **Figures 10 and 11**. **Figure 9** shows where these photos were taken from.

7.9.2 Potential Impacts

Visual profiles were generated from the nearest sensitive receptors to the proposed location of the VAM RAB unit to assess the potential impact on visual amenity at these residential locations, as shown in **Figure 12**. These visual transects were produced based on a 3D digital terrain model of the Mandalong Valley, and are presented in **Figure 13**. The existing ventilation fans and approved gas flares were also included in these transects to ensure a cumulative impact assessment was considered.

As **Figure 13** shows, the view from all of the nearest privately owned residences to the VAM RAB unit, as well as the ventilation fans and gas flares, is obscured by existing vegetation. The cumulative visual amenity impact associated with the project is therefore considered to be very low.

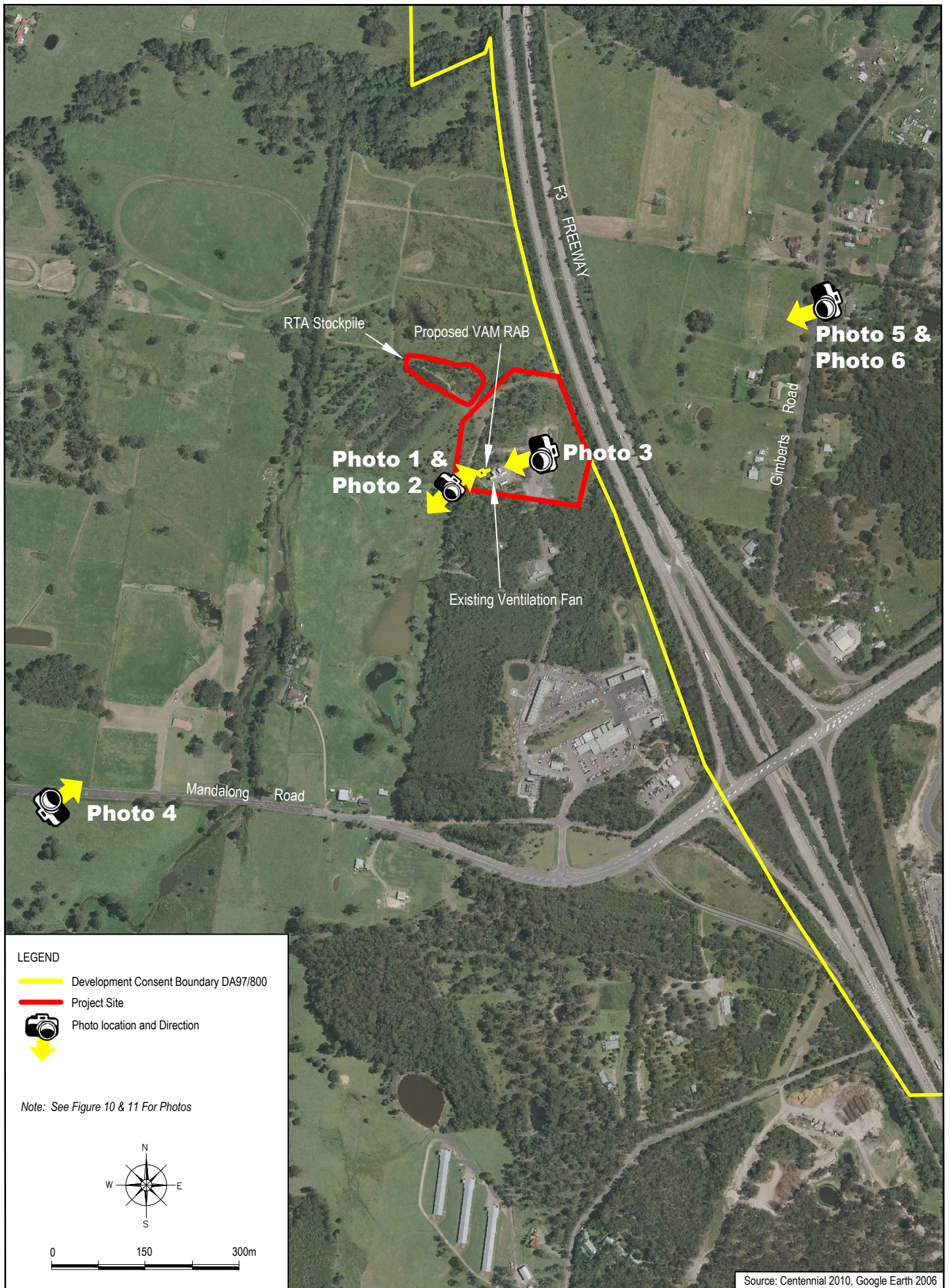
7.9.3 Mitigation Measures

A number of mitigation measures have been incorporated into the design of the project to further ensure any potential for visual amenity impacts are minimised, as follows:

- The stack height is to be restricted to 10.6 metres and the RAB tower is to be restricted to approximately 9.1 metres high;
- The proposed VAM RAB infrastructure is to be painted a 'mist green' colour, excluding safety components such as handrails; and
- The proposed VAM RAB unit and associated infrastructure is consistent with both the existing or already approved ventilation and gas management infrastructure in the area.

7.9.4 Conclusion

It is predicted that the VAM RAB unit will not be visible from any of the nearest privately owned residences, and therefore the visual amenity impact associated with installation and operation of the VAM RAB unit is considered to be very low. The unit is to be installed in an area already containing ventilation and gas management infrastructure, and so is consistent with the current land use in the project site. The site is relatively isolated from local residences, and existing vegetation will act as a visual barrier between the proposed location of the VAM RAB and all nearest privately owned residences.



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GSS ENVIRONMENTAL
Environmental, Land and Project
Management Consultants

Visual Assessment Photo Locations
FIGURE 9



PHOTO 1 - View looking east towards Ventilation Fan and proposed site of VAM RAB

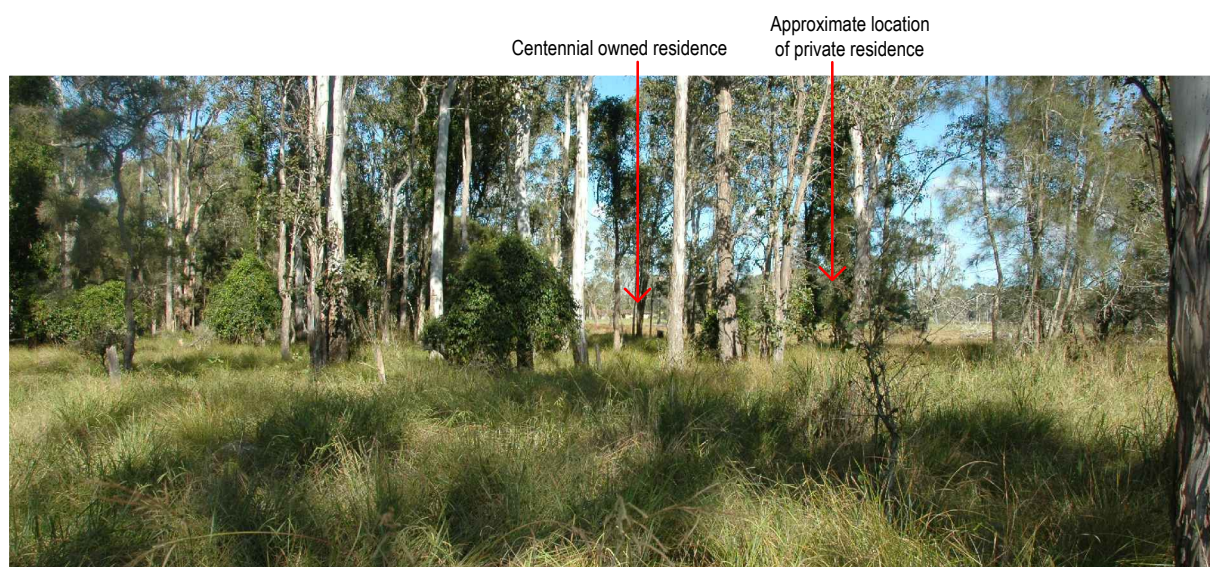


PHOTO 2 - View from VAM RAB Site looking towards residences on Mandalong Road

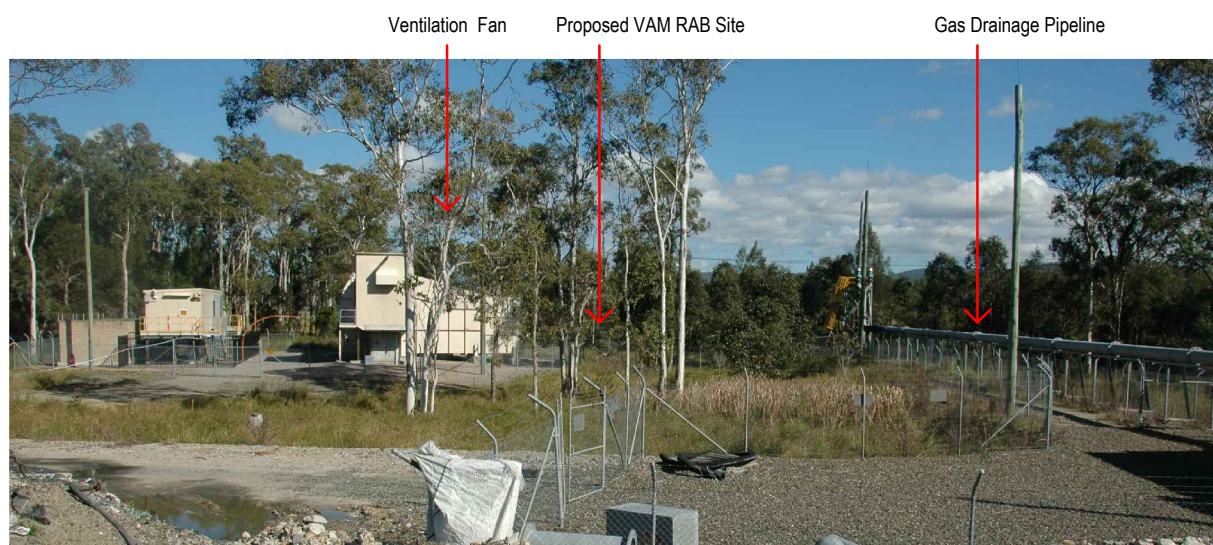


PHOTO 3 - View looking west towards Ventilation Fan and proposed site of VAM RAB

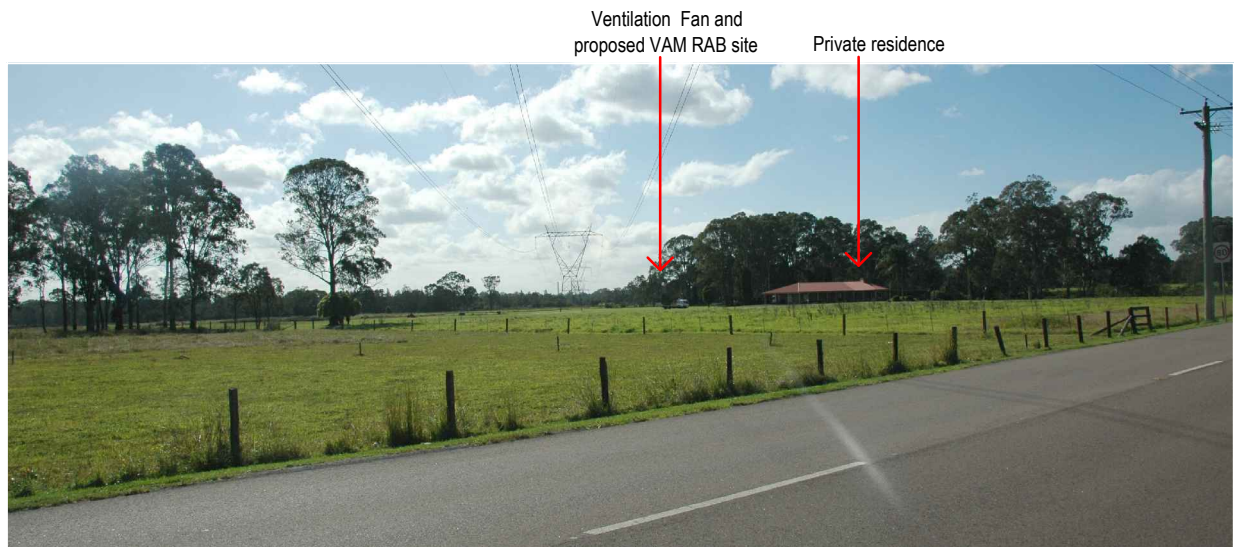


PHOTO 4 - View looking along transmission line from Mandalong Road towards proposed site of VAM RAB

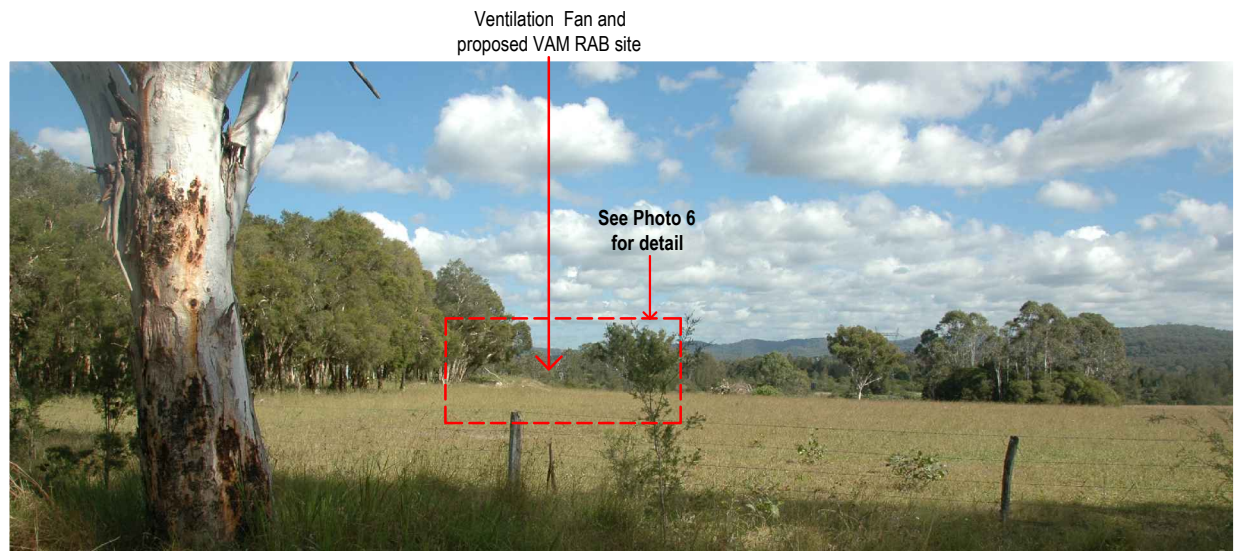


PHOTO 5 - View from Gimberts Road looking towards proposed site of VAM RAB

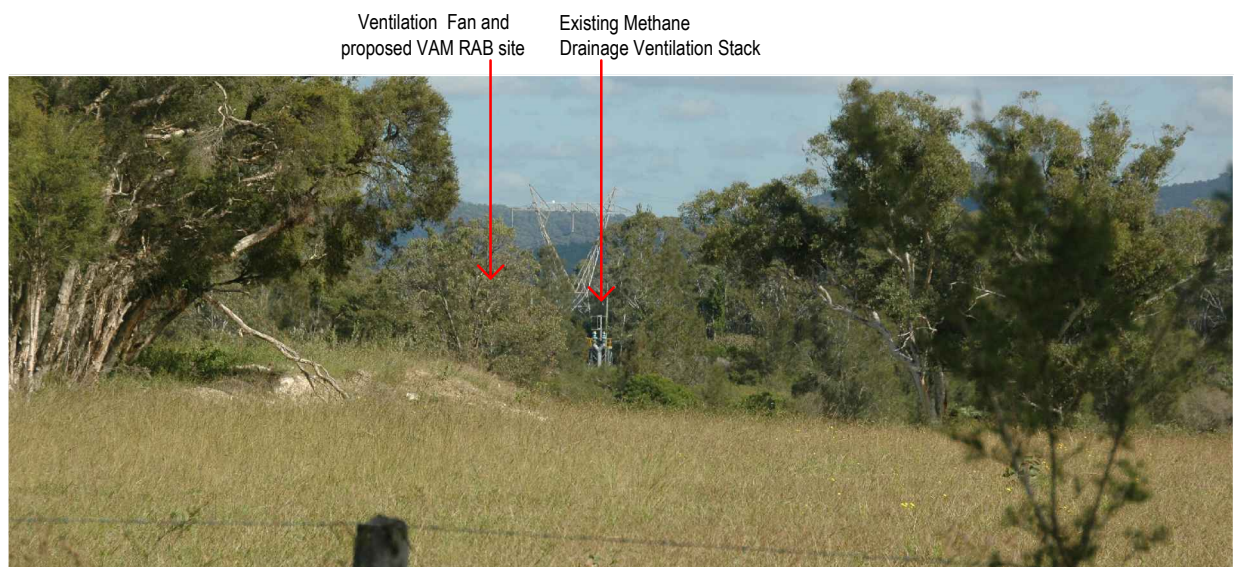
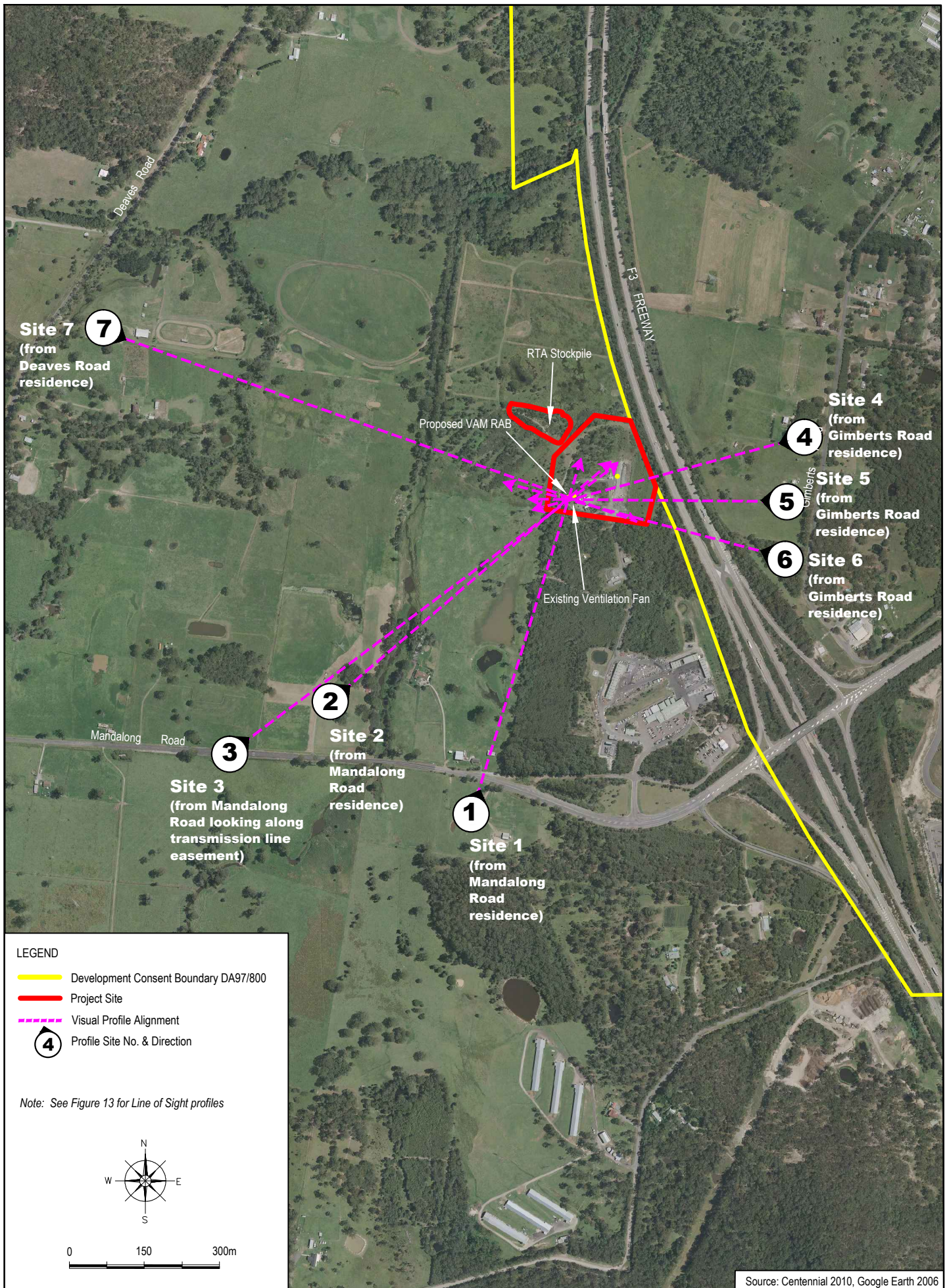
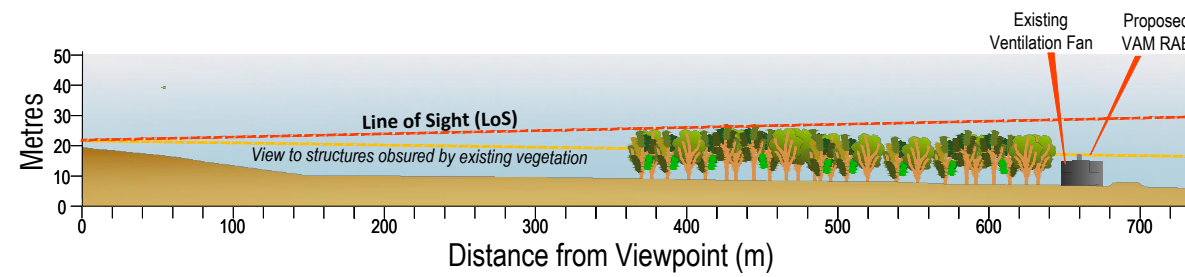


PHOTO 6 - View from Gimberts Road looking towards proposed site of VAM RAB

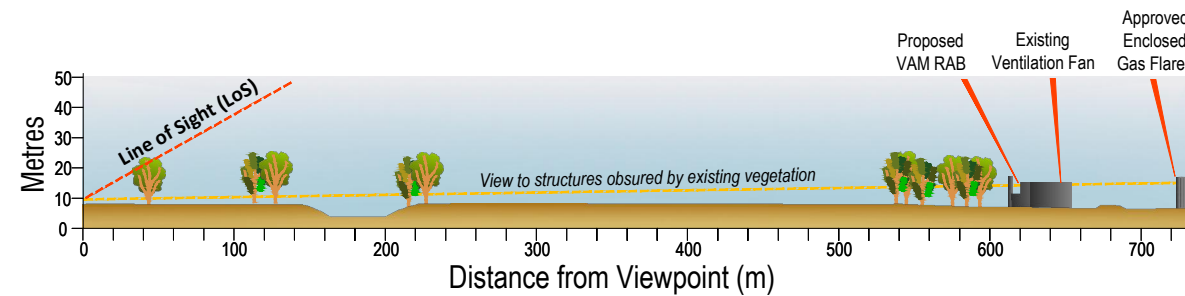


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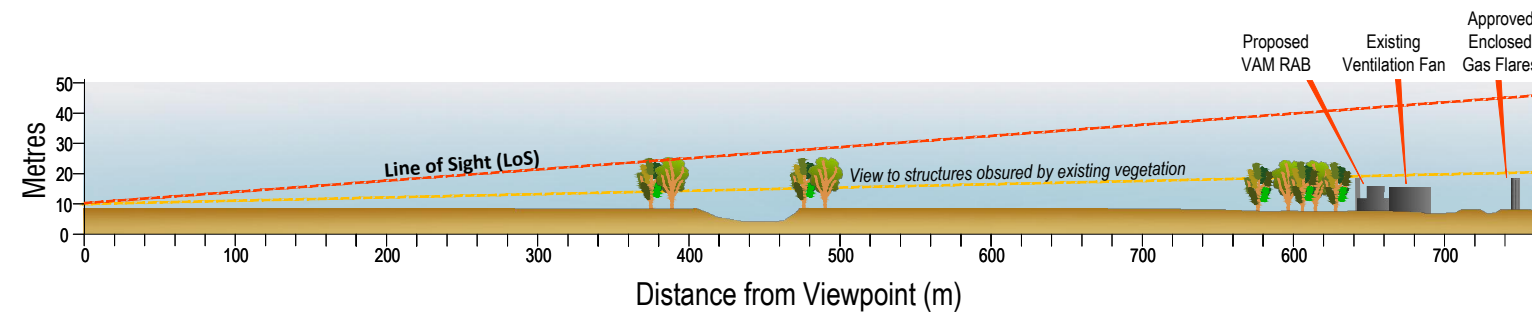
LINE OF SIGHT (LoS) from Site 1 - Mandalong Road



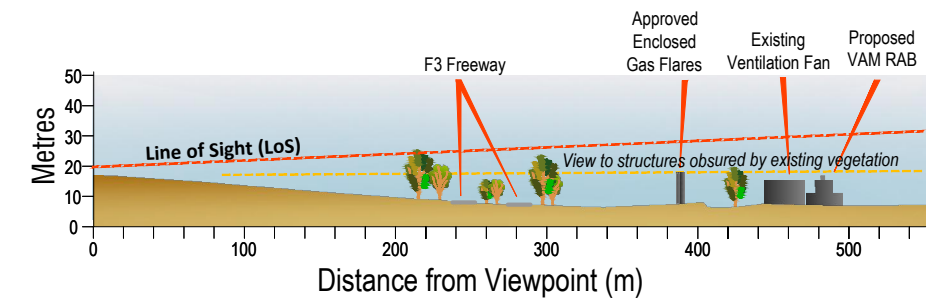
LINE OF SIGHT (LoS) from Site 2 - Mandalong Road



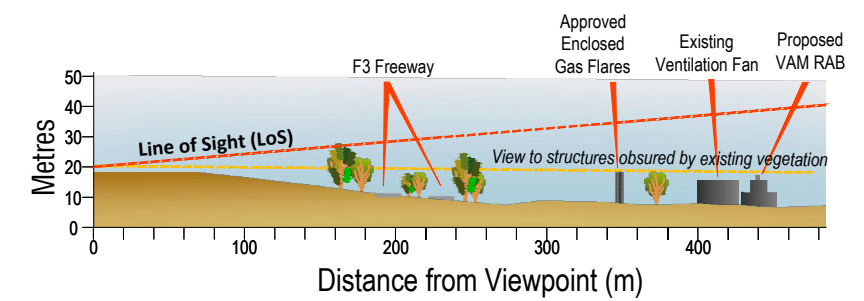
LINE OF SIGHT (LoS) from Site 3 - Mandalong Road



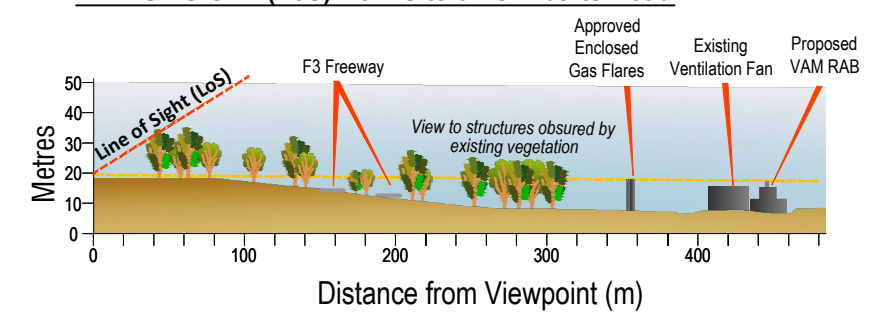
LINE OF SIGHT (LoS) from Site 4 - Gimberts Road



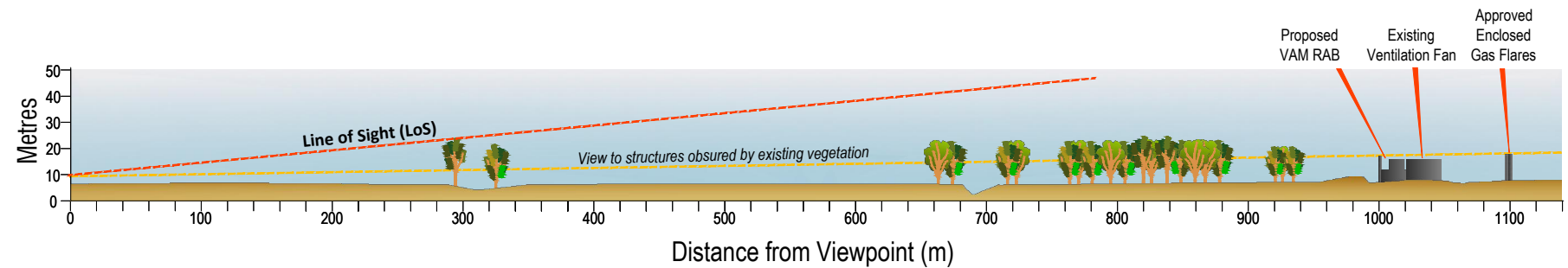
LINE OF SIGHT (LoS) from Site 5 - Gimberts Road



LINE OF SIGHT (LoS) from Site 6 - Gimberts Road



LINE OF SIGHT (LoS) from Site 7 - Deaves Road



NOTES:

Vertical Exaggeration = 2

For Visual Profile locations refer to:
"Figure 12 Visual Assessment Profile Sites"

LEGEND

0 50 100 150 200m
Horizontal Scale: 1 : 5 000

0 25 50 75 100m
Vertical Scale: 1 : 2 500

Further to this, elements to ensure visual impacts are kept to a minimum have been incorporated in the design of the VAM RAB, including restricting the height of the VAM RAB tower to 10.6 metres, in keeping with the approved gas flares which are also approximately 10 metres in height, as well as ensuring the colour of the VAM RAB and associated infrastructure, 'mist green', is in keeping with the surrounding landscape.

7.10 Socio-Economic and Community

The objective of the project is to provide an innovative local solution to reduce potential climate change impacts of Mandalong's operations. At present, a reliable and effective abatement technology for VAM has not been proven to suit the operating environment for underground coal mines, particularly in the low to moderate gas concentration range (0.3 to 0.7 percent methane). The project aims to address these issues by examining the performance of an innovative, locally developed technology at Mandalong. If the demonstration project proves successful, the technology has the potential to be retro-fitted to any underground coal mine that has an issue with fugitive methane emissions above certain concentration limits (indicative 0.3 percent methane or greater), or be included in the design of ventilation systems for new mines. As such the potential benefits of the successful implementation of this technology may go well beyond Mandalong's operations.

8.0 SAFETY AND RISK MANAGEMENT

8.1 Overview

Along with ensuring environmental impacts are avoided and/or minimised, safety is a primary consideration in this project. The technical and functional aspects of the project are secondary to ensuring that installation and operation of the unit is undertaken in a manner which does not pose a significant risk to mine or public safety.

A risk-based approach has therefore been used in all aspects of planning for the project. This approach has included the involvement of specialists in the risk assessment process, as well as specialist peer review.

A Risk Management Plan has been developed by the VAM RAB supplier and operator, CSE, to identify risk scenarios and control measures for the VAM RAB unit, including interfaces with existing plant (for example mine services). Both mine and public safety are considered in the plan. Mine safety is considered via a Hazard and Operability (HAZOP) study, Safety Integrity Level (SIL) assessment and through the use of the NSW WorkCover risk assessment tool; the 3-stage Construction Hazard Assessment Implication Review (CHAIR). Public safety is considered via a PHA. Further details on the PHA are provided below in **Section 8.2**.

A third party peer review of the Risk Management Plan and all risk assessment reports has commenced on behalf of Centennial Mandalong with Advitech. Other specialists will be engaged to assist Centennial Mandalong with the assessment of selected legislative and safety management aspects. As discussed in **Section 6.2.3**, a briefing of NSW DPI inspectors (mining, electrical & mechanical) on the project with a particular focus on safety management has been scheduled for 20 June 2011 at Centennial's Fassifern Office.

A comprehensive Safety Management Plan will be developed and implemented prior to the commencement of site works. This plan will be progressively developed and implemented in accordance with key steps in the project plan, such as civil works, plant construction, and commissioning.

8.2 Preliminary Hazard Analysis

8.2.1 Introduction

In correspondence dated 29 March 2011, the DP&I indicated that the EA for the proposed modification must address the following with regard to hazards:

"...a Preliminary Hazard Analysis (PHA) demonstrating that the cumulative offsite risk from all credible incidents on the site for all existing, approved and proposed plant and equipment will not exceed the risk criteria in the Department's Hazardous Industry Planning Advisory Paper No.4, Risk Criteria for Land Use Safety Planning."

Accordingly, a PHA was undertaken by the developers of the VAM RAB technology, CSE, for the design, construction, commissioning, experimentation, operation and maintenance of the VAM RAB unit. A PHA Report was prepared to document the outcomes of the PHA, and is attached as **Appendix 9**. The following is a summary of the findings of this report, and for further details the full report should be referred to.

SEPP 33 requires developments that 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. If the risk is deemed unacceptable, the development is classified as 'hazardous industry' and may not be permissible within most industrial zones in NSW. To ensure compliance with the *SEPP No 33 - Hazardous and Offensive Development*, as well as the DP&I's requirements, the PHA was conducted in accordance with

the Hazardous Industry Planning Advisory Papers (HIPAP) No.4, *Risk Criteria for Land Use Planning* and No. 6, *Guidelines for Hazard Analysis*.

The purpose of the PHA conducted for the project was to:

- Identify all potential hazards associated with the project;
- Analyse all hazards in terms of their consequences in relation to people and the biophysical environment and their likelihood of occurrence;
- Quantify the analysis and estimate the resultant risks to surrounding land uses and the environment; and
- Assess the risks in terms of the location, land use planning implications and existing criteria and ensure the proposed safeguards are adequate and thus demonstrate that the operation will not impose an unacceptable level of risk.

When assessed against the societal, environmental or cumulative risk criteria detailed in section 2.4 - *Risk Criteria for Potentially Hazardous Development* of HIPAP No. 4, the VAM RAB unit itself does not present any credible hazards which exceed the guidelines. However, due to the critically and potentially hazardous nature of the existing infrastructure at any site at which a VAM RAB is designed to be used i.e. mine ventilation and associated infrastructure, the risk criteria in section 2.5 – *Risk Criteria in the Vicinity of Potentially Hazardous Facilities* was deemed to be applicable for this PHA.

The risk assessment process included a review of the applicability of generic risks posed by the application of VAM RAB technology to any underground coal mine. The Risk Assessment is documented in Enclosure 2 to the PHA report - *Generic VAM RAB Risk Assessment*, also included in **Appendix 9**. The hazard scenarios identified and the control measures proposed are presented in this Risk Assessment Report.

The PHA report notes that a key component of the DP&I's requirements relating to the PHA was a review of the impact of the project on the existing land use. Hence the selected approach was to assess the risks associated with operation of the VAM RAB unit to ensure that the risks are within the guideline criteria and there is no cumulative impact.

The risk assessment undertaken for the project included an evaluation of the hazards related to steam, hot water storage and heat recovery equipment. It is noted that whilst these elements are not part of this demonstration project, they may form part of phases two and three, should these phases go ahead subject to the success of this demonstration project, project finance and further project approvals, and as such have been included for completeness.

8.2.2 Hazard Analysis Results

With regards to potential hazards the PHA found the following:

- All potential hazards were identified via HAZOP and Failure Modes Events Analysis (FMEA). All hazards which are controlled by inclusion in the design of safety systems will be qualified by testing and independently certified by a third party as part of the SIL assessment process; and
- The quantities of dangerous goods identified as part of the hazard identification process are below screening thresholds.

The PHA determined that the land use injury risk criteria is less than the guidelines of the NSW DP&I for a proposed development for land use (residential and sensitive) as follows:

- Incidental heat flux radiation is calculated to be less than 4.7 kW/m at a frequency less than 50×10^{-6} pa;

- Incident explosion overpressure is determined to be less than 7kPa at a frequency less than 50×10^{-6} pa; and
- Toxic exposure concentrations are below both injurious levels and physiological irritant levels at a frequency less than 50×10^{-6} pa.

The PHA therefore determined that the risk criteria for property damage and accident propagation imposed by the NSW DP&I for a proposed development adjacent to potentially hazardous installations are not exceeded by this project.

8.2.3 Conclusion

The findings of the PHA determine that the project is acceptable subject to the demonstration of appropriate safety features compliance to safety integrity levels to Australian Standard (AS) IEC 61511 (IEC 61508), compliance to the Mining Design Guideline (MDG) 41 for the hydraulic systems and the *Coal Mine Health and Safety Act 2002*, as it is applied by Centennial Mandalong.

9.0 DRAFT STATEMENT OF COMMITMENTS

The existing environmental management system and associated management plans will continue to apply to all operations at Mandalong, and will be amended, as required, to incorporate the proposed modifications and relevant recommendations of this EA.

Table 16 presents a compilation of the actions and initiatives the Proponent commits to implement, in addition to those already implemented at Mandalong, if the proposed modification is approved. These commitments are designed to effectively monitor, manage and/or mitigate the potential environmental and social impacts of the proposed modification.

For further details, refer to the relevant sub-sections above in **Section 7.0**.

Table 16 – Draft Statement of Commitments

Action	Timing
Flora and Fauna	
Approximately 1.25 ha of degraded areas within the project site will be rehabilitated. 0.9ha of MU38 Redgum – Roughbarked Apple Swamp Forest EEC will be established in the areas currently mapped as 'disturbed/rehabilitated vegetation' in the project site, and 0.37 ha of MU37 Swamp Mahogany – Paperbark Forest EEC will be established in the area currently mapped as MU46 on the eastern side of the approved gas engines and flares (illustrated in Figure 6). The species to be established in the rehabilitation will be sourced from local provenance to avoid genetic conflicts between local and imported species. Redgums will be <i>Eucalyptus amplifolia</i> grown from seed collected from trees in the Mandalong floodplain. Weed management works will also be undertaken in the rehabilitated areas to ensure improved rehabilitation outcomes.	Post Construction
A bushfire risk assessment will be conducted prior to the rehabilitation taking place to determine the width of an APZ to be maintained around the gas flares and engines. In this zone the rehabilitation density will be tailored to suit the APZ requirements.	Prior to rehabilitation works commencing
Surface Water	
Appropriate erosion and sediment controls will be implemented during the construction phase and prior to re-vegetation establishment during the operation phase. Measures will include: - Land disturbance will be minimised by clearing the smallest practical area of land ahead of construction and earthmoving activities, whilst also ensuring that the land is disturbed for the shortest possible time. - Temporary sediment fencing will be constructed on the downstream side of all disturbance areas to treat sediment-laden runoff.	Prior to and during construction
Soils and Land Capability	
In the unlikely event that acid sulphate soils or potential acid sulphate soils are disturbed or exposed during construction works, the existing approved Mandalong Acid Sulphate Soil Management Plan will be implemented.	During construction

Action	Timing
Aboriginal and Cultural Heritage	
All relevant contractors associated with construction and operation of the VAM-RAB unit will be made aware of their statutory obligations for heritage under the NPW Act and the <i>Heritage Act 1977</i> , during their mine induction process.	Prior to construction works commencing
Noise	
Construction will be limited to daylight hours between 7am and 6pm Monday to Friday, and 8am to 1pm on Saturday. No construction will be undertaken on Sundays or public holidays.	During construction
Visual Amenity	
The VAM RAB stack height is to be restricted to 10.6 metres and the RAB tower is to be restricted to approximately 9.1 metres high. The proposed VAM RAB infrastructure is to be painted a 'mist green' colour, excluding safety components such as handrails.	

10.0 JUSTIFICATION AND CONCLUSION

10.1 Project Justification

Fugitive emissions in the form of low concentration methane (i.e. less than one percent) from coal mine ventilation air are a significant issue for the NSW coal industry and economy. In NSW approximately 10 Mt of CO₂-e are derived from underground coal mine fugitive emissions (National Greenhouse Gas Inventory 2008). These emissions have both environmental and economic implications. The Federal Government is currently considering a carbon price mechanism that may place a carbon liability on coal mines. If effective abatement techniques are not developed, the viability of these mines may be reduced. An effective abatement technology will also significantly reduce the greenhouse gas emissions in NSW.

Australia releases official projections of its greenhouse gas emissions annually. The latest 2010 projections provide a full update of Australia's emissions projections, including a projection of baseline emissions for the Kyoto Protocol first commitment period (2008–12) and to 2020, as well as an indicative projection of Australia's emissions out to 2030. This provides the basis for estimating the 'abatement challenge' Australia faces in meeting its 2020 targets. Based on these projections, Australia requires additional abatement of between 160 Mt CO₂-e and 272 Mt CO₂-e in 2020, depending on the target².

The predicted growth in Australia's greenhouse gas emissions to 2020 is dominated by emissions associated with the extraction and processing of energy resources driven by strong export demand. Fugitive emissions from coal mines and oil and gas projects, as well as direct fuel combustion emissions from liquefied natural gas (LNG) projects, account for almost half of the predicted growth in Australia's total emissions from 2010 to 2020.

The latest projections report that fugitive emissions are predicted to reach 43 Mt CO₂-e per year over the Kyoto period, an increase of 46 percent above the 1990 level, after the effects of current greenhouse measures are taken into account. In 2020, fugitive emissions are projected to reach 69 Mt CO₂-e. The indicative projection to 2030 indicates emissions are expected to reach 83 Mt CO₂-e³.

These latest greenhouse gas projections highlight the importance of finding an effective abatement technology for fugitive emissions in achieving a reduction in Australia's greenhouse gas emissions. The challenge however is finding a suitable technology that can abate fugitive emissions given the extremely low concentration of methane in these emissions. As methane typically constitutes less than 1 percent of the ventilation air expelled from an underground mine, the gas is too low in concentration to either flare or use to generate electricity.

The VAM RAB system overcomes the problem of low concentration methane by directing the ventilation air into a large oxidation vessel, and oxidising the methane to carbon dioxide. If the demonstration of VAM RAB technology is proven successful, the technology could be retro-fitted to any underground coal mine that has an issue with fugitive methane emissions above certain concentration limits (indicative 0.3 percent methane or greater), or be included in the design of ventilation systems for new mines. In addition, it would also provide an economic benefit given that these fugitive methane emissions under a carbon price mechanism would potentially be a significant cost impost to coal mining operations. This technology therefore has a potentially significant role to play in the abatement of Australia's greenhouse gas emissions.

² Source: <http://www.climatechange.gov.au/publications/projections/australias-emissions-projections/emissions-projection-2010>, accessed 24/5/2011

³ Source: <http://www.climatechange.gov.au/publications/projections/australias-emissions-projections/emissions-projection-2010.aspx#fugitives>, accessed 24/5/2011

This project is the only project being funded via the CCF relating to the abatement of fugitive emissions from underground mines, and therefore will play a significant role in the ongoing development and testing of clean coal technologies.

As stated previously, there is no heat recovery or generation proposed as part of this demonstration project. This component is subject to a separate on-going study with GSSE to investigate heat recovery options to serve the dual roles of both plant protection (i.e. the ability to dump waste heat to prevent over temperature events when the methane in the VAM is at higher levels, such as greater than 0.5 percent) and providing a more sustainable approach (power generation capability versus abatement only). Such investigations are beyond the scope of this demonstration project, however if viable and safe heat recovery can be applied at selected sites, subsequent plants may have this feature applied. Should a heat recovery be applied, this will provide power generation options for both the mine and community, adding another advantage to the project.

10.2 Ecologically Sustainable Development (ESD)

(ESD has emerged as a primary objective of environmental protection in NSW. ESD is an objective of the EP&A Act under section 5(a)(vii) of the Act, and is defined under section 6(2) of the *Protection of the Environment Administration Act 1991* as -

6(2) For the purposes of subsection (1)(a), ecologically sustainable development requires the effective integration of economic and environmental considerations in decision-making processes. Ecologically sustainable development can be achieved through the implementation of the following principles and programs:

- (a) the precautionary principle—namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation...*
- (b) inter-generational equity—namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations,*
- (c) conservation of biological diversity and ecological integrity—namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration,*
- (d) improved valuation, pricing and incentive mechanisms—namely, that environmental factors should be included in the valuation of assets and services....*

The overall objectives of ESD are to use, conserve and enhance our natural resources. This ensures that ecological processes are maintained facilitating improved quality of life, now and into the future.

In order to provide sound management of underground mining operations, Mandalong understands that a well-designed and run operation will avoid irreversible or costly environmental degradation through polluting activities. The Environmental Management Plans in place at Mandalong are designed to demonstrate environmental due diligence and to implement procedures that provide ongoing monitoring and maintenance of the operation in line with the objectives of ESD.

10.2.1 The Precautionary Principle

The precautionary principle requires that, in the absence of any other scientific information, caution should be applied when developing projects to consider environmental and social impacts.

The proposed modification has been extensively explored and modelled for impacts related to flora and fauna, greenhouse gas emissions, Aboriginal heritage, air quality, and noise related impacts. In addition, other aspects such as visual amenity, surface water, soils and socio-economic impacts have also been considered.

These studies, combined with stakeholder consultation and input, have enabled Mandalong to understand the impacts of the project on environmental and social factors, and therefore identify existing management controls and/or develop appropriate management and mitigation strategies to address these factors.

10.2.2 Social and Inter-Generational Equity

Social equity requires that the needs of future generations are considered with respect to any activity. In regard to this, the proposed modification will not create permanent impact on the natural and human environments outside of existing conditions. The very nature of this project, in that it will reduce the impact of mining operations in relation to the emission of greenhouse gases, illustrates a consideration of the needs of future generations.

10.2.3 Conservation of Biological Diversity

The proposed modification will not result in significant loss of vegetation. The minor surface infrastructure will be installed in an area predominately already disturbed by mining related activities. A small area of the endangered ecological community Roughbarked Apple Swamp Forest will be cleared, and an offset strategy is presented in this document (refer **section 7.2.5**) to ensure a net improvement in biodiversity outcomes.

10.3 Conclusion

Centennial Mandalong seeks to reduce the greenhouse gas emissions from Mandalong by reducing the amount of methane being ventilated to the atmosphere through the installation of additional infrastructure to capture and abate approximately 10 m³/s of VAM.

Centennial Mandalong is therefore seeking to modify the current Development Consent DA 97/800 under section 75W of the EP&A Act to allow for the installation and ongoing operation of a single VAM RAB unit as a demonstration project to examine the performance capability of innovative, locally developed VAM RAB technology.

The VAM RAB unit will be installed in a disturbed area already containing Mandalong's existing ventilation and gas drainage infrastructure. The technical studies conclude that adverse environmental impacts associated with the project will be either negligible or very minimal, with limited environmental consequences beyond those already approved. In particular, impacts relating to air quality, noise, visual amenity, surface water resources, aboriginal and cultural heritage, and soils and land capability are anticipated to be negligible. Existing environmental management strategies will be applied to the proposed modification.

A small area of the Roughbarked Apple Swamp Forest EEC will be cleared to allow for installation of the VAM RAB unit. An offset strategy is presented in this document, involving the rehabilitation of degraded areas which currently fragment the remnant EEC to ensure a net improvement in biodiversity outcomes.

Positive environmental outcomes are inherent in this project, given that the role of the VAM RAB unit is to reduce greenhouse gas emissions. Fugitive coal seam methane emissions account for the vast majority of direct greenhouse gas emissions from Mandalong, and the installation of the VAM RAB unit will reduce these emissions by 23,430 t CO₂-e. The Scope 2 emissions will increase slightly due to a small increase in electricity consumption, however the project will lead to the overall emission of 23,270 fewer tonnes of CO₂-e from the mine.

Mandalong is a relatively gassy mine and emits approximately 55 percent of Centennial Coal's Scope 1 greenhouse gas emissions. At Mandalong, fugitives account for approximately 99.5 percent of the direct Scope 1 emissions from the mine. The installation of technology to abate these fugitive emissions will therefore have significant environmental benefits, and following the introduction of a carbon price mechanism, would also have economic benefits for the mine.

Fugitive emissions in the form of low concentration methane from coal mine ventilation air are a significant issue for the NSW coal industry and economy. If the demonstration of VAM RAB technology is proven successful, the technology could be retro-fitted to any underground coal mine that has an issue with fugitive methane emissions above certain concentration limits (indicative 0.3 percent methane or greater), or be included in the design of ventilation systems for new mines. The environmental and economic benefits of this project therefore have the potential to go well beyond Mandalong.

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