Environmental Assessment

The Awaba Colliery Mining Project

Volume 1 – Main Report

Volume 2 – Appendices

September 2010

FUTURE POWER | Centennial Coal

The Awaba Colliery Mining Project
Project Approval 10_0038
Environmental Assessment

This document may only be used for the purpose for which it was commissioned and in accordance with the *Terms of Engagement* for that commission.

Prepared on behalf of Centennial Coal Company Limited by:

GSS ENVIRONMENTAL
Environmental, Land and Project Management Consultants

GSS ENVIRONMENTAL
PO Box 907
Hamilton NSW 2303

Project Manager: Craig Bagnall
B E (Env) (Hons)
Project Manager, Associate Environmental Engineer

Project Officer: Anthony Reid
B EnvSc
Environmental Scientist

Date of Issue: September 2010
GSSE Reference: CCC03-004

Submission of Environmental Assessment (EA)

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

EA Prepared By:

Name:	Craig Bagnall Associate Environmental Engineer	Anthony Reid Environmental Scientist
Qualifications:	Bachelor of Environmental Engineering	Bachelor of Environmental Science
Company:	GSS Environmental	
Address:	PO Box 907, Hamilton NSW 2303	

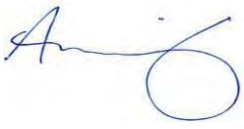
Development Application:

Proponent Name:	Centennial Newstan Pty Limited
Proponent Address:	PO Box 1000, Toronto NSW 2283
Land to be Developed:	Numerous Lots and DPs (refer **Table 2.1** in **Section 2.4**); and Crown Land. Wilton Road, Awaba NSW 2283 Parish of Awaba County of Northumberland Local Government Area City of Lake Macquarie
Development Description:	The Awaba Colliery Mining Project

Declaration:

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

- It addresses the Director-General's Requirements provided to the Proponent on 22nd April 2010 under Section 75F of the *Environmental Planning and Assessment Act 1979;*
- It contains all available information that is relevant to the environmental assessment of the proposed development to which the document relates; and
- It is true in all material particulars and does not, by its presentation or omission of information, materially mislead.

Name:	GSS Environmental Craig Bagnall	Anthony Reid
Signature:		
Date:	September 2010	

EXECUTIVE SUMMARY

Introduction & Overview

Awaba Colliery is a small underground coal mine operated by Centennial Newstan Pty Ltd (Newstan), a wholly owned subsidiary of Centennial Coal Company Ltd (Centennial). The mine is located within the Newcastle coalfield, south of the Awaba village on the western side of Lake Macquarie, near Newcastle NSW. Mining operations commenced at the Awaba Colliery in 1947, prior to the commencement of any planning controls, and have continued without abandonment since that time. Consequently, the Awaba Colliery presently operates pursuant to section 109(1) of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) and clause 6B(1) of the *State Environmental Planning Policy (Major Development) 2005*.

An application for a Part 3A Project Approval was lodged in March 2010 by Centennial for the *Awaba Colliery Mining Project* (the "Project"), which seeks approval from the Minister for Planning to allow ongoing and extended underground mining and associated surface operations. The project was declared by NSW Department of Planning as a Major Project under Part 3A of the EP&A Act, with Director General's Requirements (DGRs) issued on 22nd April 2010 (DA10_0038) for assessment under Section 75F of the Environmental Planning and Assessment Act (1979).

Subsequently, this Environmental Assessment has been prepared by GSS Environmental supported by specialist consultant studies utilising a risk-based approach for the identification, assessment and management of potential environmental impacts associated with the Project. These assessments have been undertaken to meet the requirements of the DGRs and issues identified by other agencies including issues identified during the consultation process undertaken for the project. The Project is outlined further below.

Project Description

No significant changes to existing coal handling are proposed by the Project. Minimal changes are proposed to existing surface operations, with a proposed new surface disturbance relating to increased Pollution Control Dam (PCD) capacity. All existing surface and underground infrastructure at Awaba Colliery, including previous surrounding workings (for ongoing ventilation and access), will continue to be relied upon.

Awaba Colliery is seeking an approval from the Minister of Planning under the provisions of Part 3A of the EP&A Act to:

- Continue bord and pillar development and pillar extraction by continuous miners within the "Main South Area" (being the remaining sections of Stage 2 and Revised Stage 3, refer Study Area 2);
- Extend bord and pillar development and pillar extraction by continuous miners into the "East B" Area (refer Study Area 3);
- Produce, handle and distribute up to 880,000 tonnes of Run of Mine coal per annum (financial year) using existing surface facilities;
- Continue the use of existing ancillary surface facilities (all Study Areas);
- Expand the existing Pollution Control Dam (refer Study Area 1);
- Continue the delivery of coal to the Newstan Colliery and/or the Eraring Power Station using the existing private haul road/transport facilities (refer Study Area 4).

The Study Areas that have been assessed as part of this EA are shown on Figure 2.1a and include the following:

- Study Area 1 – Surface Facilities and Ancillary Infrastructure – This area includes the colliery pit top facilities (including office and amenities buildings, existing coal crushing plant, workshop and storage areas) ventilation shafts, an existing quarry and mine dewatering bore (10 South Bore).
- Study Area 2 – Continued Mining within Existing Main South Area staged SMP Approval Areas (including the Remaining Coal to be Mined within Stage 2 and the Revised Stage 3) – The impacts associated with mining in these areas have previously been assessed in Subsidence Management Plan (SMP) Applications. The Stage 2 Area application was approved by Industry and Investment in September 2008, with the SMP Application for the Revised Stage 3 Area submitted to Industry and Investment NSW (I&I) in December 2009 awaiting approval. These areas are defined by a 26.5 degree angle of draw (as per DPI-MR SMP Guidelines, 2003). The outcomes from the SMP assessment are summarised along with any impacts that are not considered to have been adequately addressed for this EA. In relation to Stage 2 Area, only the coal remaining from the 1st of August 2010 will require approval for this Project;
- Study Area 3 – Proposed Project Mining Areas - Consideration of the proposed Mining Area (East B Area) defined as the proposed workings plus 26.5 degree angle of draw (i.e. as per DPI-MR SMP Guidelines, 2003);
- Study Area 4 – Existing Internal Private Haul Road – This haul road will be utilised for transporting coal from the Awaba Colliery operations to Newstan Collieries existing Run of Mine Stockpile or Rail Loop and subsequently transported to the Port of Newcastle or Port Kembla for shipping to export markets (to be undertaken in accordance with the Newstan Colliery development consent) and also to the Eraring Power Station. It is noted that a modification to the Newstan Colliery development consent (DA 73-11-98) will be applied for under the EP&A Act to allow for the preparation of coal sourced from the Awaba Colliery using the existing Newstan Colliery infrastructure.

Project Benefits

The EA outlines a range of positive benefits that will accompany the Project at a local, regional and state level. While the Project does not involve any significant change to employment, and only a slight increase in the coal production rate, it has been anticipated that the operations will extend the mine life for approximately five years or more. This will in turn secure employment and associated flow on effects for the life of the project.

Notable benefits include, but are not limited to, the following:

- Continued direct employment (for approximately 100 personnel, including contractors) and indirect employment levels for approximately five years or more;
- Direct employment will result in gross annual wages totalling approximately $15.7 million;
- Continued opportunities for local residents in relation to employment, training and lifestyle;
- Continued community participation and support i.e. sporting group sponsorship, assistance to local schools and charities. This also strengthens social networks throughout the LGA and instils a sense of community among residents;
- Injection of approximately $40.5 million per year into the local, regional, state and national economies for the life of the Project. This expenditure is likely to generate additional economic activity and flow on effects, providing further employment opportunities;
- Optimal recovery of available coal resources prior to end of mine life (avoiding sterilisation of remaining resources at the existing mine);
- Provision of competitively priced, high quality coal for domestic and international customers to provide for the energy requirements of the people of NSW and elsewhere;
- Continued additional export income for Australia;
- Improved understanding of heritage significance of historical workings;
- Improved surface water and ground water understanding and management; and
- Provision of a formalised contemporary approval for the well-established mine which pre-dates the Environmental Planning and Assessment Act (EP&A Act), 1979.

Consultation

Centennial has established and maintains an open and two-way communication with neighbours, authorities and stakeholders. As part of the preparation of the Environmental Assessment (EA), a dedicated Stakeholder Engagement Plan was established for the Project and opportunities for input into the EA process was provided as part of a transparent process to identify and address key issues for the Project.

These opportunities are described in Section 6 of the EA and included:

- Individual meetings with adjacent neighbours as required;
- Community Newsletters issued to the surrounding community;
- Advertisement of the Preliminary Environmental Assessment (PEA) inviting comment;
- Consultation with key government stakeholders to discuss the project and issues (including meetings with I&I, DoP, NOW, and Lake Macquarie City Council (LMCC) representatives). The outcomes of this process included the Director-General's Requirements (DGRs) issued for the Project by the NSW Department of Planning (DoP), and other relevant stakeholders;
- Consultation with the local Aboriginal Community as part of a specialist Aboriginal and Cultural Heritage Assessment;
- Consultation with relevant non-mine infrastructure stakeholders, including processes within recent SMP applications and current consultation regarding the Project;
- Meetings and 'toolbox talks' with Awaba Colliery employees;
- Provision and promotion of the Project on the Centennial website including progressive availability of assessment documentation as it is developed; and
- Public exhibition of the EA (following finalisation) where any individual or group is able to make a formal submission to the Minister on the proposal.

Key Environmental Issues and Assessment

Potential environmental issues associated with the Project were identified through the risk and consultative approach as outlined above. A Preliminary Broad-Brush Risk Assessment (BBRA) for the Project was completed in January 2010 by an appropriate risk team specifically assembled for the Project with the aim of identifying all issues to be considered under the Part 3A process. The wider BBRA for the Project is also supported by separate and specific Subsidence Risk Assessments undertaken for each of the three (3) mining areas, including those submitted as part of SMP applications for approval by the I&I. Subsequently, environmental aspects were prioritised for assessment and management for the Project as outlined further below and in Table (i).

Further to this, it is noted that the proposed continuation of the established and proven mine design using pillar extraction within narrow panels (developed in consultation with I&I) and successfully employed within adjacent mining areas, is deliberately aimed to protect the surface and hence prevent or minimise potential impacts. This includes the establishment of buffer zones excluding secondary extraction below 2nd order and higher streams and maintaining minimum depths of cover to protect the surface. Maximum subsidence within these areas using these methods is predicted to be less than 200 mm, and has historically been below this in adjacent mined areas with similar panel geometry. Notwithstanding this, as part of the conservative and risk-based approach employed at Awaba Colliery (outlined below), assessment also considers the unlikely (and unpredicted) worst case scenario of 'plug failure' potentially resulting in approximately up to 2.5 metres of subsidence.

While the information presented within the EA and in the appended specialist assessments should be read in its entirety, Table (i) below provides a very broad overview of the key outcomes of the environmental assessment.

Table (i) – Broad Overview of Environmental Assessment Issues

Environmental Issue	Overview of Key Findings
Groundwater	• Awaba Colliery has been operating since 1947. Historical mining has resulted in the depressurisation of the main aquifers (coal seams) and mining experience has verified this, with very minor inflows observed during mining. • There were no predicted potential impacts upon registered groundwater users identified within a seven (7) kilometre radius of the Application Area, as groundwater is unlikely to be sourced from the Great Northern Seam. • Flow rates into the underground workings are not anticipated to substantially increase as a result of the Project. • De-watering of underground workings through the 10 South bore is not expected to pose a significant impact due to the minor contribution by Awaba Colliery to the overall inputs into the receiving Ash Dam.
Surface Water	• The expansion of the existing Pollution Control Dam (PCD) within an existing previously disturbed area will provide an increased capacity to cater for the 10 year, 24 hour design storm event, and reduce the potential for discharges through LDP009. The improved performance of the PCD is expected to further assist in reducing the potential for impact of Awaba Colliery on Stony Creek.
Socio-Economic	• Subject to actual mining conditions and relevant market drivers, the Project will enable operations to continue over a period of approximately five years or more. This will secure on-going employment opportunities and socio-economic flow-on benefits over this time for the local community and up to one hundred (100) staff and contractors.
Aboriginal Heritage	• No Aboriginal sites requiring AHIMS registration were identified within the Application Area. • The proposed expansion of the Pollution Control Dam (PCD) lies within an existing previously disturbed area which was not identified as holding any archaeological significance. • There were five areas of archaeological sensitivity identified within Study Areas 2 and 3, requiring additional management (including inspections).
Traffic and Transport	• No additional traffic will be generated by the Project. • Interaction of coal haulage with traffic using public roads will be avoided by the continued use of the existing private haul roads, utilised to transport coal to Newstan Colliery to the north or Eraring Power Station to the South. • Wilton Road and the Awaba Colliery access road intersection has adequate capacity to cope with the existing and projected traffic levels.
Subsidence	• The maximum predicted subsidence in the Application Area is 200 millimetres. This will be a function of the sag of the conglomerate (typically in the order of 10 to 100 millimetres for the panel widths utilised to date observed in adjacent mining areas) and the compression of the pillar system (typically in the order of 50 to 100 millimetres for the panel widths utilised to date observed in adjacent mining areas). • The mine design has conservatively incorporated a hierarchy of risk management controls (including engineering controls, elimination, substitution and administrative/monitoring controls) in order to maintain the overburden integrity and ensure high levels of safety underground and in doing so also protect the surface environment. • The unlikely 'worst-case' subsidence outcome would be the result of the spanning Teralba Conglomerate failing, causing a type of 'plug' subsidence (noting that this is not offered as a subsidence prediction and conservatively included as an absolute 'worst case' event). This type of subsidence would result in the formation of vertical faces of around 2.5 metres height at the edge of the extracted panels.

Environmental Issue	Overview of Key Findings
European Heritage	• No currently listed/registered heritage items were identified within the Application Area. • The buildings in the pit top area associated with Awaba State Mine have been identified in a previous heritage study for Lake Macquarie City Council (LMCC) as having local heritage significance in terms of representing extractive industries in the area, but are not currently listed within the current Local Environment Plan for LMCC. There are no proposed changes to historic pit top buildings or infrastructure. • The abandoned Awaba-Wangi rail line was identified as sharing its significance with the Awaba State Mine and the Wangi Power Station as examples of extractive industries within the Lake Macquarie LGA. It was assessed that, if deformation of the remaining components of the rail line occurs as a result of mining, this would not detract from the significance of the item.
Noise	• The results of the noise impact assessment indicate that operational noise levels are predicted to meet the project specific noise criteria established with reference to the DECCW Industrial Noise Policy (INP) at all considered residential locations under all modelled scenarios.
Air Quality	• Modelled predictions indicate acceptable air quality impact at all privately-owned residences throughout the life of the mine.
Greenhouse Gas Emissions	• The results of the greenhouse gas assessment indicate that the total emissions (Scope 1, 2, and 3) attributable to the Project would equate to approximately 742,650 t CO_2-e/annum.
Flora and Fauna	• There were no significant impacts identified on vegetation communities, threatened flora and fauna, or to the connectivity of habitats for the Project. • The proposed expansion of the Pollution Control Dam (PCD) lies within an existing previously disturbed area.
Waste Management	• The Project will not generate any new waste materials or additional waste volumes on an annual basis, and all waste streams will continue to be managed in accordance with current waste management strategies successfully employed at the site.
Soil and Land Capability	• The only potential impacts upon soil are related to erosion and sediment control during minor surface disturbance, primarily associated with the expansion of the Pollution Control Dam.
Hazards Management	• Of the hazards assessed (including hazardous materials, asbestos, spontaneous combustion, bushfire and public safety) the proposed Project was not expected to result in an increased environmental or safety risk.

Environmental Safeguards, Management & Mitigation Measures

Further to the management and mitigation measures outlined in Table (i) above, as a well established mine Awaba Colliery has an existing Environmental Management System (EMS) to appropriately identify, mitigate and manage environmental aspects of the operation to safeguard the environment. An outline of these measures is provided below.

As a requirement of the Centennial EMS, Awaba Colliery has developed Environmental Management Plan(s) (EMP's) in accordance with the aspects identified in the risk assessment to address the minimum:

- Processes for identifying and managing major environmental aspects/impacts/risks;
- Processes for monitoring and managing compliance with regulatory requirements;
- Measurement and monitoring of environmental performance and corrective actions;
- Pollution Prevention and Emergency Preparedness strategies;
- Roles and Responsibilities;
- Specific management plans for significant risk areas;
- Training; and
- Auditing and reviewing.

Existing management plans that have been developed for the Awaba Colliery (and will continue to be implemented for the Project, with updating where required) include:

- Asbestos Management Plan;
- Bushfire Management Plan;
- Dust Management Plan;
- Water Management Plan (in draft); and
- Subsidence Management Plan, incorporating the following:
  - Public Safety Management Plan;
  - Watercourse Management Plan;
  - Power Line Management Plan;
  - Roads, Tracks and Trails Management Plan;
  - Telstra Management Plan; and
  - Spontaneous Combustion Management Plan.

Additionally, environmental monitoring at Awaba Colliery is also conducted in accordance with EPL443 and EMP's required by the Mine. These plans are consistent with the Centennial Standard ECMS-006 Monitoring and Evaluation specifying the environmental sampling standards for all monitoring (collection and analysis) which, is to be undertaken in accordance with Australian Standards and DECCW requirements. Internal audits of the Awaba Colliery EMS are also conducted as specified in *E&CMS 06 Minimum Environmental Performance Standard Audit and Inspection*. The EMS audits investigate compliance with the EMS, Standards and Procedures. In addition, independent audits of the implementation of, and compliance with, the EMS are periodically undertaken (also specified in *E&CMS 06)*.

A *Statement of Commitments* has also been developed for this Environmental Assessment to address aspects requiring further action to mitigate potential impacts, including updating (or development) of management plans where required for various aspects. These include Water Management, Aboriginal and Cultural Heritage, Life of Mine planning, and the ongoing implementation of the established Stakeholder Engagement Plan.

Justification and Conclusion

The proposed Project will not significantly alter the nature of existing operations undertaken at the site, nor will it require significant modification to the existing infrastructure which supports the mining operation. The objectives of the Awaba Colliery Mining Project are to:

- Continue mining operations in the remaining areas of the Main South Area (Stage 2 and Revised Stage 3) and extend mining into the East B Area by undertaking bord and pillar development and pillar extraction within narrow panels using continuous miners. Mining operations will have a focus on:
  - maximising resource recovery and maintaining continuity of coal production from the existing Awaba Colliery;
  - maximising the use of existing infrastructure; and
  - securing on-going employment opportunities and socio-economic flow-on benefits;
- Produce, handle and distribute up to 880,000 tonnes of Run of Mine coal per annum (financial year), using existing surface facilities, for competitive supply to domestic and export markets;
- Expand the existing Pollution Control Dam;
- Continue the delivery of coal to the Newstan Colliery and/or the Eraring Power Station using the existing private haul road/transport facilities; and
- Continue to conduct mining at the Awaba Colliery in an environmentally responsible manner to ensure the potential for adverse impact is minimised. This has been demonstrated through the Environmental Assessment and specialist investigations taking into account the principles of Ecologically Sustainable Development.

The potential environmental impacts of the Project have been kept to a minimum through:

- Negligible surface disturbance (the only construction proposed is an expansion to the existing Pollution Control Dam (PCD) which is located in an existing previously disturbed area) (see Section 4);
- A dedicated mine design with a successful and proven history in previously mined areas (including the recent 3 North Area and mined sections of Main South Area Stage 2) to eliminate or minimise potential surface subsidence impacts. This includes maintaining depth of cover above levels required to prevent 'plug failures'' in shallow areas, and implementation of buffer zones for secondary extraction exclusion around key infrastructure items (all located within Study Area 2) and around 2nd order creeks and higher in all current mining areas (see Sections 4, 8.8);
- Obtaining a detailed understanding of the issues and potential impacts for the Project using a risk-based approach to appropriately identify and assess relevant environmental aspects (see Section 8). The multi-disciplinary assessment and consultation has been to a level of detail commensurate with the scale of the Project, industry standards and the legislative framework under which the Project is permitted;
- Implementation of the existing proactive strategies and management plans employed at the Awaba Colliery to avoid, minimise, mitigate, offset or manage potential impacts, with commitment to update those or develop new plans where required (including development of a dedicated Aboriginal and Cultural Heritage Management Plan for Awaba Colliery) (see Table 11.1 below and Section 10);
- Implementation of the Statement of Commitments (see Section 10).

Awaba Colliery has shown a commitment to the principles of Ecologically Sustainable Development (ESD) and understands that social, economic and environmental objectives are interdependent. Awaba Colliery acknowledges that a well designed and effectively managed operation will avoid significant and/or costly environmental impact or degradation. The dedicated mine design and the suite of existing environmental management plans have been developed on a risk-basis to appropriately identify, mitigate and manage environmental risk. These demonstrate environmental due diligence and provide procedures for on-going management and monitoring of the operation in-line with the objectives of ESD.

The socio-economic output of the Project, particularly in terms of direct and indirect employment and flow-on benefits, is anticipated to make a positive contribution to Lake Macquarie LGA and the surrounding region, and as a *continuing* operation with minimal changes, the Project will not significantly influence social and community infrastructure requirements.

Accordingly, it is considered that the Project will meet environmental performance and socio-economic benefit requirements in order for the Project to be considered for approval.

TABLE OF CONTENTS

1.0 INTRODUCTION 11
1.1 BACKGROUND 11
1.2 THE PROPONENT 11
1.3 DOCUMENT PURPOSE 14
1.4 DOCUMENT STRUCTURE 14
1.5 OVERVIEW OF THE PROJECT 15
1.6 DIRECTOR GENERAL'S REQUIREMENTS 16
1.7 PROJECT APPROVAL PROCESS AND INDICATIVE TIMELINE 18
2.0 SITE DESCRIPTION 20
2.1 SITE LOCATION 20
2.2 PROJECT APPLICATION AREA 20
2.3 STUDY AREAS 20
2.4 LAND USE AND OWNERSHIP 23
2.4.1 Nearest Sensitive Receptors *24*
2.5 GEOLOGY, SOILS AND TOPOGRAPHY 27
2.6 CLIMATE 27
2.6.1 Data Sources *27*
2.6.2 Temperature and Humidity *28*
2.6.3 Rainfall *28*
2.6.4 Evaporation *29*
2.6.5 Wind *30*
2.6.6 Atmospheric Stability Classes and Temperature Inversions *31*
3.0 EXISTING MINE OPERATIONS 33
3.1 EXISTING APPROVALS 34
3.2 LAND PREPARATION 35
3.3 MINING 35
3.4 COAL HANDLING, PROCESSING, STOCKPILES AND DISPATCH 36
3.4.1 Coal Handling of Materials Delivered from Awaba Colliery to Newstan *36*
3.4.2 Coal Handling of Materials Delivered from Awaba Colliery to Eraring *37*
3.5 PLANT AND EQUIPMENT 37
3.6 MINE SUPPORT FACILITIES AND SITE ACCESS 37
3.6.1 Mine Access and Associated Infrastructure *37*
3.6.2 Coal Handling, Preparation and Transport Infrastructure *37*
3.6.3 Workshop, Services and Administration Infrastructure *37*
3.6.4 Water Management Infrastructure *38*
3.6.5 Pollution Control Infrastructure *38*
3.6.6 Other Infrastructure *38*
3.6.7 Non-mine Owned Infrastructure *38*
3.6.8 Site Access *39*

3.7 TRANSPORT....39
3.8 WATER MANAGEMENT....42
3.9 ENVIRONMENTAL MANAGEMENT....43
3.9.1 Introduction....43
3.9.2 Policy....43
3.9.3 EMS and Management Plans....43
3.9.4 Monitoring and Reporting....44
3.9.5 Audits and Continuous Improvements....44
3.10 EMPLOYMENT & ECONOMIC CONTRIBUTIONS....45
3.10.1Employment....45
3.10.2Economic Contribution....45
3.11 REHABILITATION AND FINAL LANDFORM....45
3.11.1Progressive Rehabilitation....45
4.0 PROJECT DESCRIPTION 47
4.1 OVERVIEW OF PROJECT....47
4.2 HOURS OF OPERATION AND PROJECT LIFE....47
4.3 MINING....47
4.4 COAL HANDLING, PROCESSING, STOCKPILES AND DISPATCH....48
4.5 PLANT AND EQUIPMENT....48
4.6 MINE SUPPORT FACILITIES AND SITE ACCESS....48
4.7 TRANSPORT....48
4.8 WATER MANAGEMENT....49
4.9 EMPLOYMENT....49
4.10 REHABILITATION AND FINAL LANDFORM....49
5.0 PLANNING CONSIDERATIONS 50
5.1 COMMONWEALTH LEGISLATION....50
5.1.1 Environment Protection and Biodiversity Conservation Act 1999....50
5.1.2 National Greenhouse Energy Reporting Act 2007....50
5.1.3 Native Title Act 1993....50
5.2 NSW STATE LEGISLATION....51
5.2.1 Environmental Planning and Assessment Act 1979....51
5.2.2 Other NSW legislation....51
5.2.3 State Environmental Planning Policies....52
5.3 REGIONAL ENVIRONMENTAL PLANS....53
5.4 LOCAL ENVIRONMENTAL PLAN....53
5.4.1 Lake Macquarie Local Environmental Plan 2004....53
6.0 CONSULTATION & SOCIO-ECONOMIC IMPACTS 54
6.1 INTRODUCTION....54
6.2 CONSULTATION STRATEGY AND STAKEHOLDER IDENTIFICATION....55
6.2.1 Consultation Strategy....55
6.2.2 Stakeholder Identification....55

6.3 IMPACT ASSESSMENT 57
6.3.1 Identified Impacts 57
6.3.2 Socio-Economic Impacts 60
6.4 CONSEQUENCE OF POTENTIAL IMPACTS 63
6.4.1 Identified Impacts 63
6.4.2 Socio-Economic Impacts 63
6.5 MITIGATION & MANAGEMENT MEASURES 64
6.6 CONCLUSION 64
7.0 MINE SUBSIDENCE 65
7.1 INTRODUCTION 65
7.2 GEOTECHNICAL CONDITIONS 65
7.2.1 Great Northern Seam Profile 65
7.2.2 Roof Characteristics - Teralba Conglomerate 65
7.2.3 Floor Characteristics – Awaba Tuff 65
7.2.4 Faults 66
7.3 PREVIOUS SUBSIDENCE AND DEVELOPMENT OF CURRENT MINE PLANNING AND DESIGN 66
7.4 SUBSIDENCE RISK ASSESSMENT 67
7.5 SUBSIDENCE PREDICTIONS FOR THE PROJECT MINING AREAS 68
7.5.1 Study Area 2 – Main South Area: Stage 2 & Revised Stage 3 Areas 68
7.5.2 Study Area 3 – East B Area 70
7.6 SUBSIDENCE IMPACT ASSESSMENT 70
7.7 SUBSIDENCE MANAGEMENT AND MITIGATION MEASURES 70
7.8 CONCLUSION 72
8.0 IDENTIFICATION OF KEY ENVIRONMENTAL ISSUES 73
8.1 INTRODUCTION AND OBJECTIVES 73
8.2 PROPOSED ACTIVITIES WITH THE POTENTIAL TO CAUSE ENVIRONMENTAL IMPACTS 73
8.3 RISK ASSESSMENT 74
8.4 RISK REGISTER 74
9.0 ASSESSMENT AND MANAGEMENT OF KEY ENVIRONMENTAL ISSUES 78
9.1 WATER MANAGEMENT 78
9.1.1 Introduction and Background 78
9.1.2 Existing Environment 82
9.1.3 Water Management Impact Assessment 95
9.1.4 Consequences of Potential Water Management Impacts 98
9.1.5 Water Management and Mitigation Measures 99
9.1.6 Conclusion 101
9.2 ABORIGINAL HERITAGE 102
9.2.1 Introduction 102
9.2.2 Consultation 102
9.2.3 Existing Environment 103
9.2.4 Aboriginal Heritage Impact Assessment 108

9.2.5 Consequences of Potential Aboriginal Heritage Impacts *108*
9.2.6 Management and Mitigation Measures *109*
9.2.7 Conclusion *109*
9.3 TRAFFIC AND TRANSPORT 110
9.3.1 Introduction *110*
9.3.2 Existing Road Traffic Environment *111*
9.3.3 Road Traffic Impact Assessment *113*
9.3.4 Consequence of Potential Road Traffic Impacts *117*
9.3.5 Road Traffic Management and Mitigation Measures *117*
9.3.6 Conclusion *117*
9.4 LIFE OF MINE AND REHABILITATION 118
9.4.1 General Rehabilitation Principles and Objectives *118*
9.4.2 Conceptual Post-Mining Land Use *119*
9.4.3 Conceptual Post-Mining Landform *120*
9.4.4 Progressive Rehabilitation *120*
9.4.5 Revegetation *121*
9.4.6 Rehabilitation Monitoring and Maintenance *121*
9.4.7 Preliminary Rehabilitation Success Criteria *122*
9.5 EUROPEAN HERITAGE 124
9.5.1 Introduction *124*
9.5.2 Existing Environment *124*
9.5.3 European Heritage Impact Assessment *126*
9.5.4 Consequences of Potential European Heritage Impacts *126*
9.5.5 Management and Mitigation Measures *127*
9.5.6 Conclusion *127*
9.6 NOISE MANAGEMENT 128
9.6.1 Introduction *128*
9.6.2 Existing Environment *128*
9.6.3 Noise Impact Assessment *129*
9.6.4 Consequences of Potential Noise Impacts *135*
9.6.5 Noise Management and Mitigation Measures *135*
9.6.6 Conclusion *135*
9.7 AIR QUALITY MANAGEMENT 136
9.7.1 Introduction *136*
9.7.2 Existing Environment *137*
9.7.3 Air Quality Impact Assessment *138*
9.7.4 Consequences of Potential Air Quality Impacts *142*
9.7.5 Air Quality Management and Mitigation Measures *142*
9.7.6 Conclusion *142*
9.8 GREENHOUSE GAS 144
9.8.1 Introduction *144*

9.8.2 Existing Environment *144*
9.8.3 Greenhouse Gas Impact Assessment *146*
9.8.4 Consequences of Potential Greenhouse Gas Impacts *148*
9.8.5 Greenhouse Gas Management and Mitigation Measures *148*
9.8.6 Conclusion *148*
9.9 ECOLOGY 149
9.9.1 Introduction *149*
9.9.2 Existing Environment *149*
9.9.3 Ecology Impact Assessment *154*
9.9.4 Consequences of Potential Ecology Impact *155*
9.9.5 Mitigation and Management Measures *155*
9.9.6 Conclusion *156*
9.10 WASTE MANAGEMENT 157
9.11 SOILS AND LAND CAPABILITY 158
9.11.1Introduction *158*
9.11.2Existing Environment *158*
9.11.3Soil and Land Capability Impact Assessment *160*
9.11.4Consequences of Potential Soil and Land Capability Impacts *161*
9.11.5Management and Mitigation Measures *161*
9.11.6Conclusion *162*
9.12 HAZARDS MANAGEMENT 163
9.12.1Hazardous Material Management *163*
9.12.2Spontaneous Combustion *163*
9.12.3Bush Fire *163*
9.12.4Public Safety *163*
9.12.5Conclusion *164*
10.0 STATEMENT OF COMMITMENTS 165
11.0 JUSTIFICATION AND CONCLUSION 169
11.1 ENVIRONMENTAL IMPACTS 169
11.2 PROJECT BENEFITS 172
11.3 ECOLOGICALLY SUSTAINABLE DEVELOPMENT (ESD) 172
11.3.1The Precautionary Principle *173*
11.3.2Social Equity, Inter-Generational Equity *173*
11.3.3Conservation of Biological Diversity and Ecological Integrity *174*
11.3.4Improved Valuation and Pricing of Environmental Resources *174*
11.4 CONCLUSION 175
12.0 REFERENCES 176

TABLES

TABLE 1.1 – DIRECTOR GENERAL REQUIREMENTS FOR THE PROJECT 16
TABLE 1.2 – AWABA COLLIERY PROJECT APPROVAL PATHWAY AND INDICATIVE TIMELINE 19
TABLE 2.1 – SCHEDULE OF LAND WITHIN THE APPLICATION AREA 23
TABLE 2.2 – NEAREST SENSITIVE RECEPTORS 24
TABLE 2.3 – AVERAGE MONTHLY TEMPERATURE AND RELATIVE HUMIDITY STATISTICS 28
TABLE 2.4 – COORANBONG ANNUAL RAINFALL STATISTICS 29
TABLE 2.5 – SEASONAL FREQUENCY OF OCCURRENCE OF WIND SPEED INTERVALS 31
TABLE 2.6 – DESCRIPTION AND FREQUENCY OF ATMOSPHERIC STABILITY CLASSES 32
TABLE 3.1 – SUMMARY OF EXISTING AWABA COLLIERY MINE OPERATIONS 33
TABLE 3.2 – MINERAL AUTHORITIES 35
TABLE 3.3 – SUMMARY OF OTHER EXISTING APPROVALS, LICENSES AND PERMITS 35
TABLE 3.4 – TYPICAL PERFORMANCE INDICATORS 44
TABLE 3.5 – AWABA COLLIERY ANNUAL ECONOMIC CONTRIBUTIONS 45
TABLE 6.1 – GOVERNMENT AGENCIES ISSUES AND RESPONSE 57
TABLE 6.2 – COMMUNITY ISSUES AND RESPONSE 59
TABLE 6.3 – OTHER RELEVANT STAKEHOLDERS ISSUES AND RESPONSE 59
TABLE 6.4 – ABORIGINAL COMMUNITY PERCEIVED ISSUES AND RESPONSE 60
TABLE 6.5 – SUMMARY OF INDENTIFIED SOCIO-ECONOMIC IMPACTS AND RESPONSE 61
TABLE 6.6 – AWABA COLLIERY ANNUAL ECONOMIC CONTRIBUTIONS 62
TABLE 6.7 – INDUSTRY EMPLOYMENT STATISTICS (POPULAR INDUSTRY SECTORS) COMPARED WITH MINING 62
TABLE 6.8 – WORKING ARRANGEMENT 62
TABLE 6.9 – WORKFORCE RESIDENTIAL LOCATION 63
TABLE 7.1 – HIERARCHY OF SUBSIDENCE MANAGEMENT CONTROL MEASURES 71
TABLE 8.1 - PRIORITY RISK CATEGORIES FOR MANAGEMENT AND PROPOSED ADDITIONAL CONTROLS 75
TABLE 8.2 - REQUIREMENTS FOR MANAGEMENT OF RISKS IN ACCORDANCE WITH THE CENTENNIAL RISK STANDARD 77
TABLE 9.1 – CLEAN WATER STRUCTURE DIVERSION CAPACITIES 83
TABLE 9.2 – AWABA COLLIERY PIT TOP WATER MANAGEMENT STRUCTURES 86
TABLE 9.3 – UNDERGROUND WATER MANAGEMENT STRUCTURES 90
TABLE 9.4 – EXISTING WATER QUALITY 93
TABLE 9.5 – MONITORING PROGRAM 100
TABLE 9.6 – WILTON ROAD PROJECTED TRAFFIC VOLUMES 111
TABLE 9.7 – PEAK HOUR FLOW ON TWO-LANE RURAL ROAD (VEHICLES/HOUR) 112
TABLE 9.8 – REHABILITATION OBJECTIVES AND INDICATORS FOR REHABILITATION SUCCESS 122
TABLE 9.9 – SUMMARY OF EXISTING AMBIENT NOISE LEVELS 129
TABLE 9.10 – PREDICTED NOISE LEVELS - AWABA COLLIERY 130
TABLE 9.12 – LIKELY PARTICULATE GENERATING ACTIVITIES OCCURRING AT AWABA COLLIERY 137
TABLE 9.13 – EMISSIONS INVENTORY SUMMARY 137
TABLE 9.14 – BACKGROUND AIR QUALITY USED FOR ASSESSMENT PURPOSES 138
TABLE 9.15 – BACKGROUND AND INCREMENTAL DUST DEPOSITION - ANNUAL AVERAGE 139

TABLE 9.16 – BACKGROUND AND INCREMENTAL TSP - ANNUAL AVERAGE 139
TABLE 9.17 – ANNUAL AVERAGE PM_{10} CONCENTRATIONS 139
TABLE 9.18 – SUMMARY OF EXISTING GREENHOUSE GAS EMISSIONS 145
TABLE 9.19 – SUMMARY OF PROJECT RELATED ACTIVITY DATA RELEVANT TO GHG EMISSIONS (CURRENT AND PROPOSED OPERATIONS) 146
TABLE 9.20 – SUMMARY OF GHG EMISSIONS ATTRIBUTABLE TO THE PROJECT (CURRENT AND MODIFIED) 147
TABLE 9.21 – COMPARISON OF MODIFIED PROJECT GHG EMISSIONS WITH STATE AND NATIONAL TOTALS 2007 148
TABLE 9.22 – VEGETATION COMMUNITIES AND SITE AREA 150
TABLE 9.23 – PROBABLE THREATENED SPECIES (NSW STATE) 150
TABLE 9.24 – PROBABLE THREATENED SPECIES (COMMONWEALTH) 151
TABLE 9.25 – WASTE SOURCES AT AWABA COLLIERY 157
TABLE 9.26 – SOIL LANDSCAPE UNITS 159
TABLE 10.1: EXISTING MANAGEMENT PLANS FOR THE AWABA COLLIERY 165
TABLE 10.2 – PROPOSED CONSTRUCTION (POLLUTION CONTROL DAM) – STATEMENT OF COMMITMENTS 167
TABLE 10.3 – MINING OPERATIONS – STATEMENT OF COMMITMENTS 167
TABLE 11.1 – BROAD OVERVIEW OF ENVIRONMENTAL ASSESSMENT ISSUES 170

FIGURES

FIGURE 1.1 – LOCATION PLAN 12
FIGURE 1.2 – PROJECT APPLICATION AREA 13
FIGURE 2.1A – PROJECT APPLICATION STUDY AREAS 21
FIGURE 2.1B – PROJECT APPLICATION STUDY AREAS (DETAILED) 22
FIGURE 2.2 – LAND OWNERSHIP AND SENSITIVE RECEPTORS 25
FIGURE 2.3 – MINING LEASES 26
FIGURE 2.4 – AVERAGE MONTHLY RAINFALL STATISTICS 29
FIGURE 2.5 – AVERAGE DAILY EVAPORATION RATES – NEWSTAN WEATHER STATION 30
FIGURE 2.6 – ANNUAL WIND ROSE FOR THE APPLICATION AREA (2008) 30
FIGURE 3.1 – EXISTING MINE INFRASTRUCTURE AND SURFACE FACILITIES 40
FIGURE 3.2 – NON-MINE INFRASTRUCTURE 41
FIGURE 7.1 – SUBSIDENCE INVESTIGATIONS AND RISK ASSESSMENTS FOR THE PROJECT MINING AREAS 67
FIGURE 7.2 – AWABA COLLIERY MINE DESIGN SECONDARY EXTRACTION EXCLUSION AREAS 69
FIGURE 9.1 – AWABA COLLIERY WATER MANAGEMENT SCHEMATIC 79
FIGURE 9.2 – AWABA COLLIERY HYDROGEOLOGICAL MODEL EXTENT 81
FIGURE 9.3 – AWABA COLLIERY CATCHMENT AREAS 84
FIGURE 9.4 – AWABA COLLIERY CLEAN WATER DIVERSION 85
FIGURE 9.5 – AWABA COLLIERY DIRTY WATER DIVERSION 87
FIGURE 9.6 – AWABA COLLIERY DISCHARGE POINT LOCATIONS 89
FIGURE 9.7 – AWABA COLLIERY PREVIOUS ARCHAEOLOGICAL ASSESSMENTS 105
FIGURE 9.8 – AWABA COLLIERY ARCHAEOLOGICAL SENSITIVITY 107
FIGURE 9.9 – AWABA COLLIERY EXISTING AND PROJECTED INTERSECTION LEVEL OF SERVICE 115

FIGURE 9.10 – AWABA COLLIERY PROPOSED SIGNAGE PLAN 116
FIGURE 9.11 – AWABA COLLIERY OPERATIONAL NOISE CONTOURS (DB(A) $L_{AEQ(15MIN)}$) 133
FIGURE 9.12 – AWABA COLLIERY OPERATIONAL NOISE CONTOURS (DB(A) $L_{AEQ(15MIN)}$) 134
FIGURE 9.13 – AWABA COLLIERY AIR QUALITY IMPACT ASSESSMENT 141
FIGURE 9.14 – AWABA COLLIERY AIR QUALITY MONITORING NETWORK 143
FIGURE 9.15 – AWABA COLLIERY VEGETATION MAP 152
FIGURE 9.16 – AWABA COLLIERY THREATENED SPECIES 153

PLATES

PLATE 9.1 – AWABA COLLIERY ADMINISTRATION BUILDINGS, BUILT C1950 125
PLATE 9.2 – DRIFT PORTAL WITH STATE COAL MINE AWABA INSCRIPTION (FOREGROUND), WORKSHOPS (BACKGROUND). 125

APPENDICES

APPENDIX 1 – CENTENNIAL ENVIRONMENTAL POLICY
APPENDIX 2 – CONSULTATION
APPENDIX 3 – SOCIAL IMPACT ASSESSMENT
APPENDIX 4 – SUBSIDENCE IMPACT ASSESSMENT
APPENDIX 5 – RISK ASSESSMENT
APPENDIX 6 – WATER MANAGEMENT ASSESSMENT
APPENDIX 7 – CULTRAL HERITAGE IMPACT ASSESSMENT
APPENDIX 8 – TRAFFIC IMPACT ASSESSMENT
APPENDIX 9 – NOISE IMPACT ASSESSMENT
APPENDIX 10 – AIR QUALITY IMPACT ASSESSMENT
APPENDIX 11 – ECOLOGY IMPACT ASSESSMENT

ABBREVIATIONS

ABS	Australian Bureau of Statistics
AEMR	Annual Environmental Management Report
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
ANZECC	Australian and New Zealand Environmental Conservation Council
BBRA	Broad Brush Risk Assessment
BOM	Bureau of Meteorology
CCL	Consolidated Coal Lease
Centennial	Centennial Coal Company Ltd
CO_2	Carbon Dioxide
CO_2-e	Carbon Dioxide Equivalent
CPP	Coal Preparation Plant
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DA	Development Application
DECCW	NSW Department of Environment, Climate Change and Water
DEWHA	NSW Department of Environment, Water, Heritage and the Arts
DGRs	Director General's Requirements
DoP	NSW Department of Planning
DPI-MR	NSW Department of Primary Industries (Mineral Resources)
EA	Environmental Assessment
EAR	Environmental Assessment Requirements
ECD	Environment and Community Database
EEC	Endangered Ecological Communities
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
EMS	Environmental Management System
EP&A Act	Environmental Planning and Assessment Act 1979
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
EPL	Environment Protection Licence
ESD	Ecologically Sustainable Development
GDE	Groundwater Dependant Ecosystem
GHG	Greenhouse Gas
GSSE	GSS Environmental
ha	Hectare
ICCRs	Interim Community Consultation Requirements for Applicants
I&I	Industry and Investment, NSW
ILUA	Indigenous Land Use Agreement
INP	Industrial Noise Policy
kL	Kilolitre

KLALC	Koompahtoo Local Aboriginal Lands Council
LDP	Licensed Discharge Point
LEP	Local Environmental Plan
LGA	Local Government Area
LMCC	Lake Macquarie City Council
LOS	Level of Service
ML	Megalitre
MPL	Mining Purposes Lease
MSA	Main South Area
Mt	Million Tonnes
MWh	Megawatt Hours
Newstan	Centennial Newstan Pty Ltd
NGER Act	National Greenhouse and Energy Reporting Act
NP&W Act	National Parks and Wildlife Act 1974
NSW	New South Wales
NTA	Native Title Act
PCD	Pollution Control Dam
PEA	Preliminary Environmental Assessment
PM_{10}	Particulate Matter less than 10 Microns
POEO Act	Protection of the Environment Operations Act 1997
Project	Awaba Colliery Mining Project
REP	Regional Environmental Plan
ROM	Run of Mine
RTA	Roads and Traffic Authority
SEP	Stakeholder Engagement Plan
SEPP	State Environmental Planning Policy
SIDRA	Intersection Traffic Modelling Software
SMP	Subsidence Management Plan
t	Tonnes
TAPM	The Air Pollution Model
TSC Act	Threatened Species Conservation Act 1995
TSP	Total Suspended Particulates
TSS	Total Suspended Solids

1.0 INTRODUCTION

1.1 Background

Awaba Colliery is a small underground coal mine operated by Centennial Newstan Pty Ltd, a wholly owned subsidiary of Centennial Coal Company Ltd (Centennial). The mine entry and primary surface facilities are located approximately one kilometre south of the Awaba village and 5.5 kilometres (km) south west of Toronto on the western side of Lake Macquarie, near Newcastle NSW. Awaba Colliery has been producing coal by bord and pillar method since 1947. The locality of the mine is illustrated on Figure 1.1.

Awaba Colliery is a small operation with approximately 100 employees, historically producing around 800,000 tonnes of thermal coal annually. Since commencing mining operations in 1947, over 30 million tonnes of coal has been won from the Great Northern Seam using a combination of first workings development, pillar extraction, pillar quartering, and pillar stripping. Pillar extraction within the old existing workings using modern continuous mining methods is now extending the mine life, as outlined further below.

Mining operations commenced at the Awaba Colliery in 1947, prior to the commencement of any planning controls, and have continued without abandonment since that time. Consequently, the Awaba Colliery presently operates pursuant to section 109(1) of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) and clause 6B(1) of the *State Environmental Planning Policy (Major Development) 2005*. An application for a Part 3A Project Approval has been lodged by Centennial for the *Awaba Colliery Mining Project (the "Project")*, which seeks approval from the Minister of Planning to allow an extension of underground mining and the ongoing use of associated surface operations. The whole of the project is more specifically described in Section 4. The Project Application Area (*the "Application Area"*) (including focus study areas) is detailed further in Section 2.2, and is illustrated on Figure 1.2.

Minimal changes are proposed to existing surface operations, with one proposed additional surface disturbance relating to increased pollution control dam capacity, located in a previously disturbed area. No significant changes to coal handling are proposed. Underground mining areas requiring approval to allow continued mine operations and production are detailed in Section 2.3 and Section 4 respectively.

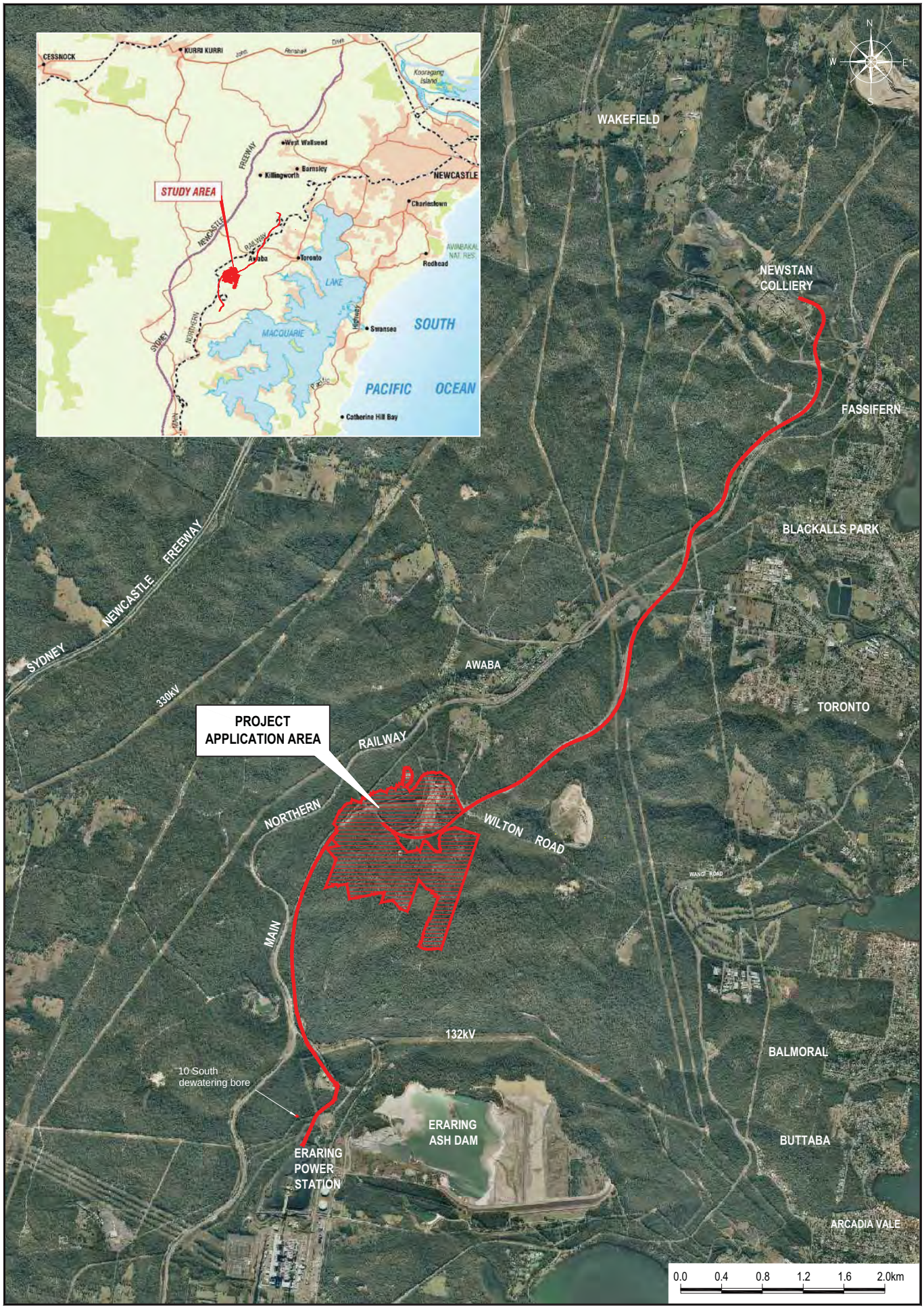
At present, it is anticipated that the Project will recover approximately 2.0 million tonnes of coal which will be extracted over a period of at least five years or more, depending on actual mining conditions and relevant market drivers.

A form of pillar extraction of narrow panels is used to recover coal in pillars developed previously by bord and pillar methods. This development of bords (roadways) and pillars is ongoing but in some areas were developed many years ago. This mining method currently utilises continuous miners. Mine planning ensures panels are not extracted where depth of cover or surface constraints preclude total extraction. This mining method was developed in consultation with the Department of Primary Industries – Mineral Resources (now known as Industry and Investment, NSW (I&I)) and has been utilised successfully to date as outlined within the Environmental Assessment (EA), and is proposed to be continued for the Project.

Mining has been ongoing in the Main South Area (MSA) following staged SMP approvals received from I&I in 2007 and 2008 under the *NSW Mining Act, 1992*. Current mining operations are described in detail in Section 3.3.

1.2 The Proponent

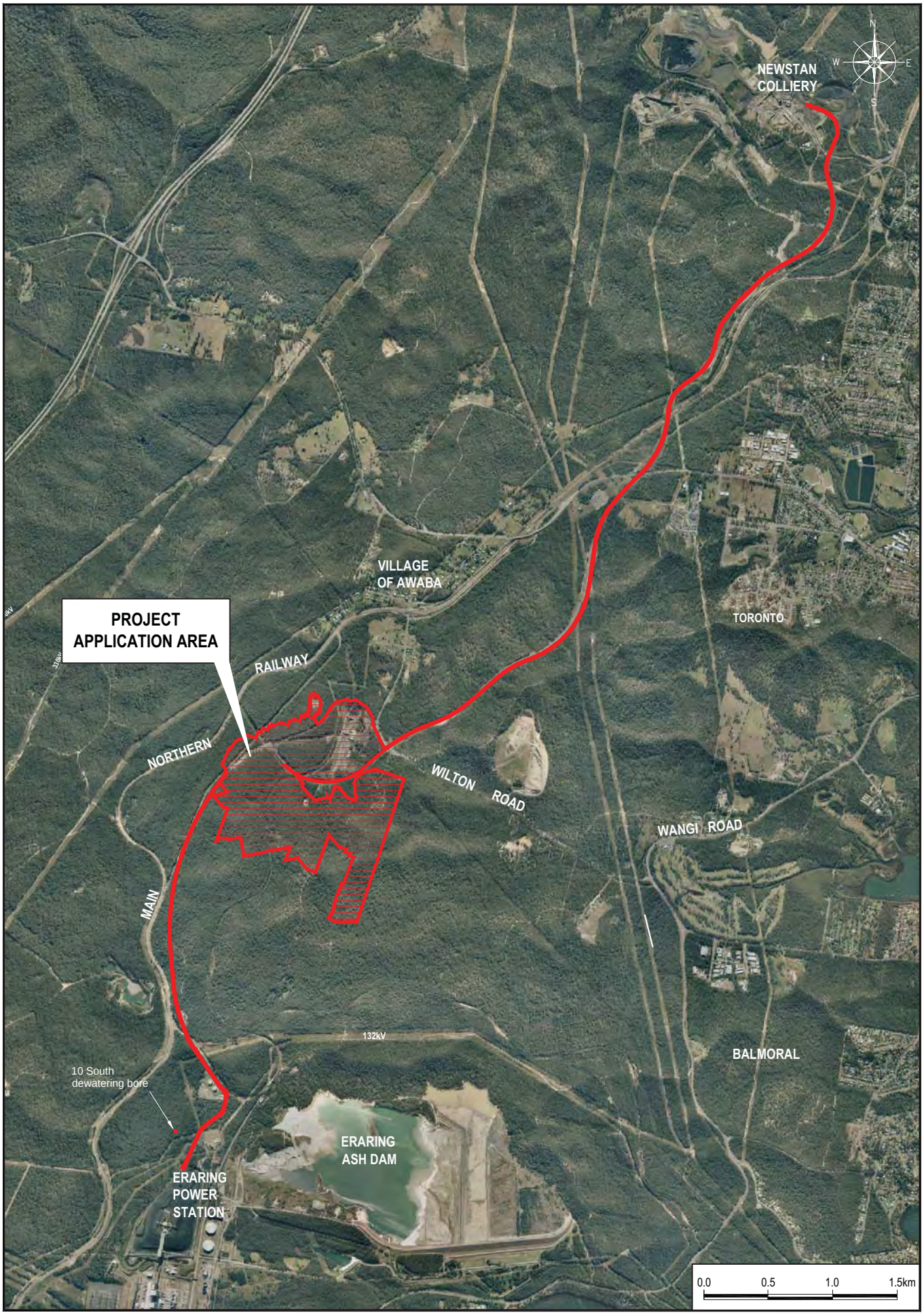
The Proponent is Centennial Newstan Pty Limited (Centennial Newstan). The Awaba Colliery is owned and operated by Centennial Newstan, a 100% subsidiary of Centennial Coal Company Limited (Centennial) which supplies thermal and semi soft coking coal to domestic and export markets, providing NSW with coal for approximately 47% of the State's coal fired electricity. Centennial is the largest independent coal company in Australia in terms of production and operates 9 coal mines in NSW, making it one of the largest underground coal producers in NSW. Approximately a third of Centennial's coal is sold to the export market and is exported through the Port of Newcastle and Port Kembla, NSW. Awaba Colliery operates as an underground coal mining operation, producing coal by continuous mining methods.



To be printed A4

GSS ENVIRONMENTAL
Environmental, Land and Project Management Consultants

Location Plan
Figure 1.1



To be printed A4

GSS ENVIRONMENTAL
Environmental, Land and Project Management Consultants

Project Application Area

Figure 1.2

1.3 Document Purpose

This Environmental Assessment (EA) has been prepared by GSS Environmental (GSSE) on behalf of Centennial to support an application to allow an extension of underground mining and the ongoing use of associated surface operations at the Awaba Colliery and has been prepared in accordance with the provisions of Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

Section 1.5 outlines (and Section 5 details) the key aspects of the Project which trigger the requirement for Part 3A approval beyond the continuing use rights historically provided pursuant to section 109 of the NSW Environmental Planning and Assessment Act 1979 (EP&A Act) and clause 6B of the State Environmental Planning Policy (Major Development) 2005.

The proposed Project will not significantly alter the nature of existing operations undertaken at the site, nor will it require significant modification to the existing infrastructure which supports the mining operation.

This Environmental Assessment has been prepared using a risk-based approach to appropriately identify and assess environmental aspects relevant to the Project, and seeks to demonstrate that the limited potential environmental impacts associated with the proposed Project are appropriately managed and mitigated.

1.4 Document Structure

This Environmental Assessment has been prepared in accordance with the Director General Requirements for the Project and includes eleven sections of text, a references section and appendices including reports from specialist investigations and the Project risk assessment. The key environmental issues relating to the Project, the risks associated with these and their relative importance to the Project have been identified through an ongoing process of consultation involving key stakeholders from government, industry, the surrounding community and specialist consultant assessments.

The structure of the report is as follows:

Section 1 – Introduction

Provides a background to the mine and introduces the Project, the proponent and the Environmental Assessment. This section briefly describes the nature of existing operations at the Awaba Colliery and includes a history of mining which has been undertaken at the site. This Section concludes with an overview of the approval process, including the relevant milestones which must be met along the approval path.

Section 2 – Site Description

Provides a detailed description of the Application Area including general surrounds, proposed and existing mining areas and the identification of four (4) specific study areas relevant to the EA within the Application Area. This section identifies the important features and climatic conditions of the surrounding landscape, and includes an overview of land ownership and use in the vicinity of the proposed Application Area.

Section 3 – Existing Mine Operations

Provides a description of the existing mine operations. This section identifies the relevant licenses and approvals, and mining processes utilised at Awaba Colliery. This includes the history and extent of the existing operations, supporting infrastructure and basic water management principles employed at the mine. This Section includes broader considerations for the site in its local context including the Environmental Management procedures for the mine and employment economic contributions. This section concludes with an overview of considerations for mine closure including rehabilitation and final landform.

Section 4 – Project Description

Provides a detailed description of the Project and aspects of the mine operation which will be altered from existing operations following approval. This includes analysis of broader potential impacts such as employment economic contributions and examination of life of mine considerations such as rehabilitation and final landform.

Section 5 – Planning Considerations

Outlines the planning considerations relevant to the Project including legislation drawn from Local, State and Federal government agencies.

Section 6 – Consultation & Socio-Economic Impacts

Details the consultation undertaken as part of this EA, and addresses the perceived socio-economic impacts identified through consultation process. Major stakeholders included local and state government agencies, representatives of the local Aboriginal community, local community groups and various interested individuals.

Section 7 – Mine Subsidence

Details the development of the mine design based on previous experience and subsidence monitoring and provides subsidence predictions for the proposed mining areas (Study Areas 2 and 3).

Section 8 – Identification of Key Environmental Issues

Details the process undertaken to identify the key environmental issues for the Project and discusses the outcomes of these assessments in identifying, assessing and appropriately managing potential risks.

Section 9 - Assessment and Management of Key Environmental Issues

Identifies and assesses features of the local environment which may be potentially affected by the Project. This section details the assessment and management of key environmental issues and outlines the potential impacts associated with the Project, including specialist investigations for key environmental aspects. For each issue identified, this EA also presents a series of mitigation measures to be implemented to reduce the overall potential impact of the Project.

Section 10 – Statement of Commitments

Provides a Statement of Commitments by Centennial regarding the operation, maintenance and eventual closure and rehabilitation of the mine.

Section 11 – Justification and Conclusion

Provides conclusions for the EA and justifications of the Project in terms of the environmental, physical, social and economic considerations. This section also identifies the objectives of Ecological Sustainable Development and how they apply to the Project.

References

Provides a detailed list of the documents referred to for information and supporting data used to compile this Environmental Assessment, including all specialist investigations.

1.5 Overview of the Project

Awaba Colliery is seeking an approval from the Minister of Planning under the provisions of Part 3A of the EP&A Act to:

- Continue bord and pillar development and pillar extraction by continuous miners within the "Main South Area" (being the remaining sections of Stage 2 and Revised Stage 3, refer Study Area 2);
- Extend bord and pillar development and pillar extraction by continuous miners into the "East B" Area (refer Study Area 3);
- Produce, handle and distribute up to 880,000 tonnes of Run of Mine coal per annum (financial year) using existing surface facilities;
- Continue the use of existing ancillary surface facilities (refer Study Area 1);
- Expand the existing Pollution Control Dam (refer Study Area 1);

- Continue the delivery of coal to the Newstan Colliery and/or the Eraring Power Station using existing the private haul road/transport facilities (refer Study Area 4).

The Application Area for the Project has been described in Section 2.2 and is illustrated on Figure 1.2.

1.6 Director General's Requirements

The Director General of the NSW Department of Planning has issued the following requirements for this Environmental Assessment. Table 1.1 below lists the requirements and where these have been assessed within the EA.

Table 1.1 – Director General Requirements for the Project

Director General Requirements	Section Where Addressed
The Environmental Assessment of the Project must include:	
• an executive summary	**Executive Summary**
• a detailed description of the Project, including:	
- need for the Project;	**Section 3, 4, 9 and 11**
- alternatives considered, including justification for the proposed mine plan; and	
- various stages of the Project.	
• a risk assessment of the potential environmental impacts of the Project, identifying the key issues for further assessment;	**Section 8 and Appendix 5**
• a detailed assessment of the key issues specified below, and any other significant issues identified in the risk assessment (see above), which includes:	
- a description of the existing environment, using sufficient baseline data;	
- an assessment of the potential impacts of the Project, including any cumulative impacts, taking into consideration any relevant guidelines, policies, plans and statutory provisions (see below); and	**Section 9**
- a description of the measures that would be implemented to avoid, minimise and if necessary, offset the potential impacts of the Project, including detailed contingency plans for managing any significant risks to the environment;	
• a statement of commitments, outlining all the proposed environmental management and monitoring measures;	**Section 10**
• a conclusion justifying the Project on economic, social and environmental grounds, taking into consideration whether the Project is consistent with the objects of the Environmental Planning & Assessment Act 1979; and	**Section 11**
• a signed statement from the author of the Environmental Assessment, certifying that the information contained within the document is neither false nor misleading.	
Subsidence – including:	
• accurate predictions of potential subsidence effects (both systematic and non-systematic, paying particular attention to the long term stability of final pillars and the avoidance of pillar runs and to areas of limited cover depth) including potential cumulative effects and a sensitivity analysis;	**Section 7 and Appendix 3**
• identification of sensitive receptors potentially affected by subsidence (such as environmental features, and infrastructure) and an assessment of significance and sensitivity of those receptors;	
• assessment of the potential impacts of subsidence effects on the natural and built environment, with particular reference to sensitive receptors;	
• identification of how mine design has been or will be used or adapted to manage and	

Director General Requirements	Section Where Addressed
mitigate subsidence impacts; • identification of how predicted and unpredicted subsidence impacts would be rehabilitated, including methodologies and response times; and • identification of further research required to address any uncertainties or information gaps.	
Soil and Water – including: • a detailed site water balance, including a description of site water demands, water supply and disposal methods; • detailed modelling and assessment of potential impacts on: - the quality and quantity of existing surface water and groundwater resources; - groundwater dependent ecosystems; - affected licensed water users and basic landholder rights; and - the riparian, ecological, geomorphological and hydrological values of watercourses; • a detailed description of the proposed water management system (including all infrastructure and storages) and water monitoring program; • a detailed description of measures to minimise all water discharges, and • a detailed description of measures to mitigate surface water and groundwater impacts.	**Section 9.1, 9.11 and Appendix 6**
Biodiversity – including: • a detailed assessment of the potential impacts on any terrestrial and aquatic threatened species, populations, ecological communities or their habitats; and • a detailed description of the measures that would be implemented to avoid or mitigate impacts on biodiversity.	**Section 9.9 and Appendix 11**
Noise & Vibration – including a quantitative assessment of potential operational and transport noise impacts.	**Section 9.6 and Appendix 9**
Air Quality – including a quantitative assessment of potential air quality impacts.	**Section 9.7 and Appendix 10**
Traffic & Transport – including a detailed assessment of potential impacts on the safety and performance of both the road and rail network, and any railway crossings.	**Section 9.3 and Appendix 8**
Rehabilitation & Mine Closure – a detailed description of the proposed rehabilitation and mine closure strategies for the Project, having regard to the key principles in Strategic Framework for Mine Closure, including: • rehabilitation objectives, methodology, monitoring programs, performance standards and proposed completion criteria; • decommissioning and management of surface infrastructure; • nominated final land uses, having regard to any relevant strategic land use planning or resource management plans or policies; and • the potential for integrating the rehabilitation strategy with any other offset strategies in the region.	**Section 9.4**
Heritage – both Aboriginal and non-Aboriginal;	**Section 9.2, 9.5 and Appendix 7**
Greenhouse Gases – including: • a quantitative assessment of the potential scope 1, 2 and 3 greenhouse gas emissions of the Project;	**Section 9.8 and Appendix 10**

Director General Requirements	Section Where Addressed
• a qualitative assessment of the potential impacts of these emissions on the environment; and • an assessment of all reasonable and feasible measures that could be implemented on site to minimise greenhouse gas emissions and ensure the Project is energy efficient.	
Hazards – including bushfires.	**Section 9.12**
Waste – including: • accurate estimates of the quantity and nature of the potential waste streams of the Project; and • a detailed description of the measures that would be implemented to minimise, handle and dispose of waste on site.	**Section 9.10**
Social & Economic – including a detailed assessment of the costs and benefits of the Project as a whole, and whether it would result in a net benefit for the NSW community.	**Section 6.0 and Appendix 3**
During the preparation of the Environmental Assessment, you should consult with the relevant local, State or Commonwealth Government authorities, service providers, community groups and affected landowners. In particular you must consult with the: • Department of Environment, Climate Change and Water, including the NSW Office of Water; • Industry and Investment NSW; • Mine Subsidence Board; • Land and Property Management Authority; • Department of Transport and Infrastructure; • Lake Macquarie City Council; and • Hunter-Central Rivers Catchment Management Authority. The consultation process and the issues raised must be described in the Environmental Assessment.	**Section 6, Appendices 2,3**

1.7 Project Approval Process and Indicative Timeline

The Project will be assessed under Part 3A of the *Environmental Planning and Assessment Act 1979*. As such, the Minister for Planning is the relevant consent authority. Under Part 3A of the Act, it is a requirement that the application for approval must be made prior to the receipt of the Director General's Requirements (DGRs). The application for approval was submitted to the Department of Planning (DoP) on 23 March 2010.

Based on current mine planning requirements for the Awaba Colliery, Centennial are seeking Approval for the Project by October 2010 to allow continued operations under (required) formal development consent. A summary of the indicative Project approval timeline is outlined in Table 1.2 below.

Table 1.2 – Awaba Colliery Project Approval Pathway and Indicative Timeline

Action	Indicative Timeline
Submit Preliminary Environmental Assessment to Department of Planning	23rd March 2010
Receive Environmental Assessment Requirements	22nd April 2010
Submit Environmental Assessment for adequacy review (21 days)	September 2010
Exhibit EA and invite public submissions (minimum 30 days)	October 2010
Submit a response to submissions (if required)	November 2010
Department of Planning assessment and Planning Assessment Commission (PAC) determination (90 days)	February 2011

2.0 SITE DESCRIPTION

2.1 Site Location

The Awaba Colliery entry and primary surface facilities are located approximately one kilometre south of the Awaba village and 5.5 kilometres south west of Toronto on Wilton Road on the western side of Lake Macquarie. The site is situated on Crown Land under lease to Centennial for the purpose of mining, and is adjacent to the Newstan-Eraring haul road owned by Eraring Energy. A locality plan is included as Figure 1.1.

Awaba Colliery is situated within the Newstan Colliery Holding, and operates within the bounds of Consolidated Coal Lease (CCL) 746 issued (as a renewal) pursuant to Section 114(1)(a) of the *Mining Act 1992*. Underground mining has been continuous in the existing Consolidated Coal Lease area since 1947.

2.2 Project Application Area

The Project Application Area (the "Application Area") is illustrated on Figure 1.2. The Application Area has been identified as the footprint of the proposed Project including proposed mining areas and related surface operations that are considered relevant to the continuation of Awaba Collieries operations, as well as, the existing workings areas that will continue to be relied upon for ventilation and other mining related purposes, access to proposed mining areas or for any required emergency evacuation.

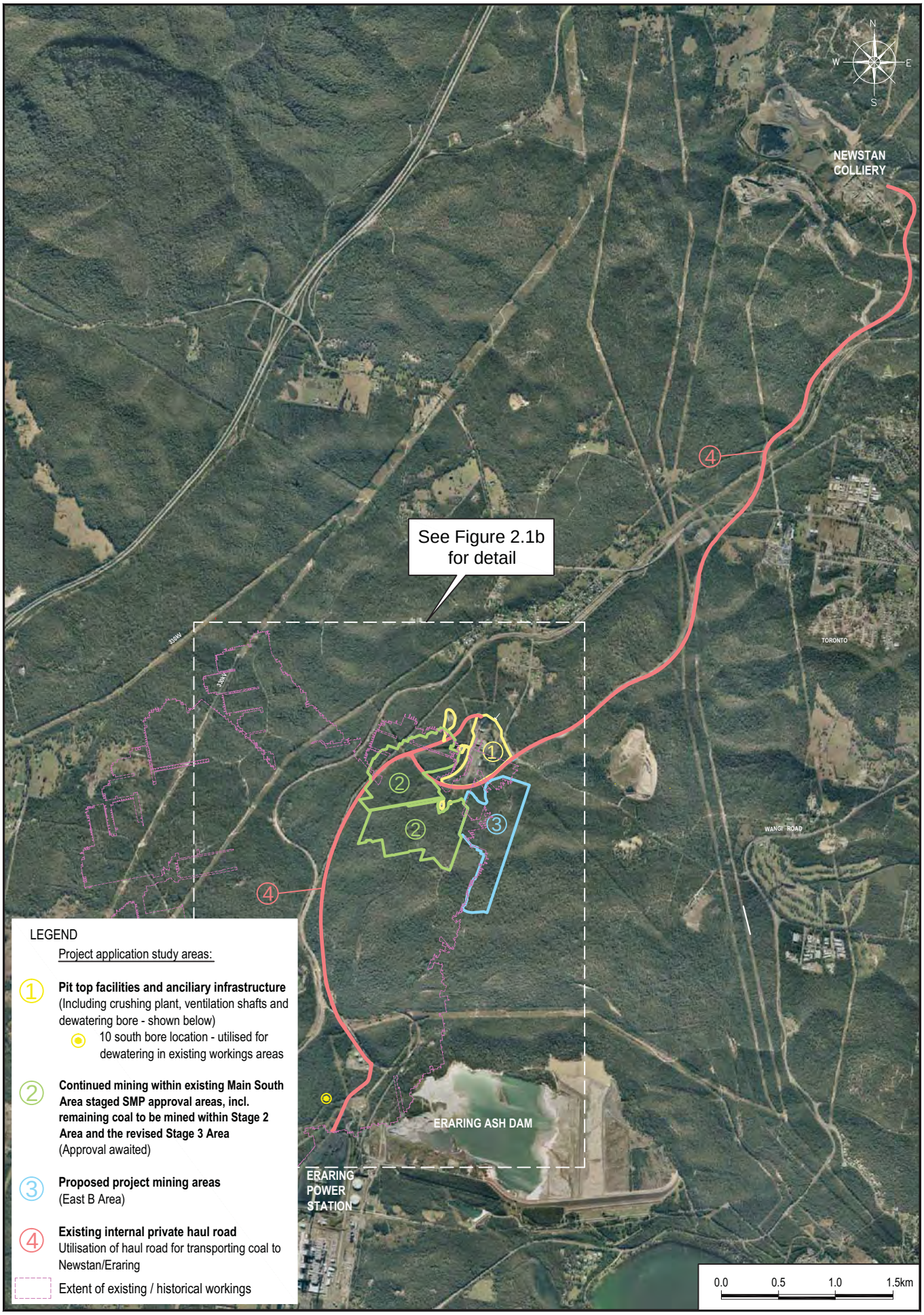
The Application Area has been broken into a number of Study Areas based on the types of activities to be undertaken for the Project. These Study Areas are outlined below in Section 2.3. The extent of the existing workings has not been included as a Study Area as it is considered inappropriate to obtain retrospective approval for historical operations. Additionally, there are no activities proposed in these areas for the Project and ongoing management of these areas is covered by the existing Awaba Colliery Mining Lease conditions.

2.3 Study Areas

The Study Areas that have been assessed as part of this EA are shown on Figures 2.1a and 2.1b and include the following:

- Study Area 1 – Surface Facilities and Ancillary Infrastructure – This area includes the colliery pit top facilities (including office and amenities buildings, existing coal crushing plant, workshop and storage areas) ventilation shafts, an existing quarry and mine dewatering bore (10 South Bore).
- Study Area 2 – Continued Mining within Existing Main South Area staged SMP Approval Areas (including the Remaining Coal to be Mined within Stage 2 and the Revised Stage 3) – The impacts associated with mining in these areas have previously been assessed in Subsidence Management Plan (SMP) Applications. The Stage 2 Area application was approved by Industry and Investment in September 2008, with the SMP Application for the Revised Stage 3 Area submitted to I&I in December 2009 awaiting approval. These areas are defined by a 26.5 degree angle of draw (as per DPI-MR SMP Guidelines, 2003). The outcomes from the SMP assessment will be summarised along with any impacts that are not considered to have been adequately addressed for this EA. It is important to note that, in relation to Stage 2 Area, only the coal remaining from the 1st of August will require approval for this Project (this boundary has been indicated on Figure 2.1b); and
- Study Area 3 – Proposed Project Mining Areas - Consideration of the proposed Mining Area (East B Area) defined as the proposed workings plus 26.5 degree angle of draw (i.e. as per DPI-MR SMP Guidelines, 2003);
- Study Area 4 – Existing Internal Private Haul Road – This haul road will be utilised for transporting coal from the Awaba Colliery operations to Newstan Collieries existing Run of Mine Stockpile or Rail Loop and subsequently transported to the Port of Newcastle or Port Kembla for shipping to export markets (to be undertaken in accordance with the Newstan Colliery development consent) and also to the Eraring Power Station. It is noted that a modification to the Newstan Colliery development consent (DA 73-11-98) will be applied for under the EP&A Act to allow for the preparation of coal sourced from the Awaba Colliery using the existing Newstan Colliery infrastructure.

In general, potential environmental impacts associated with mine access, ventilation and other services provided through the existing workings areas to the active and proposed mining areas have also been addressed.

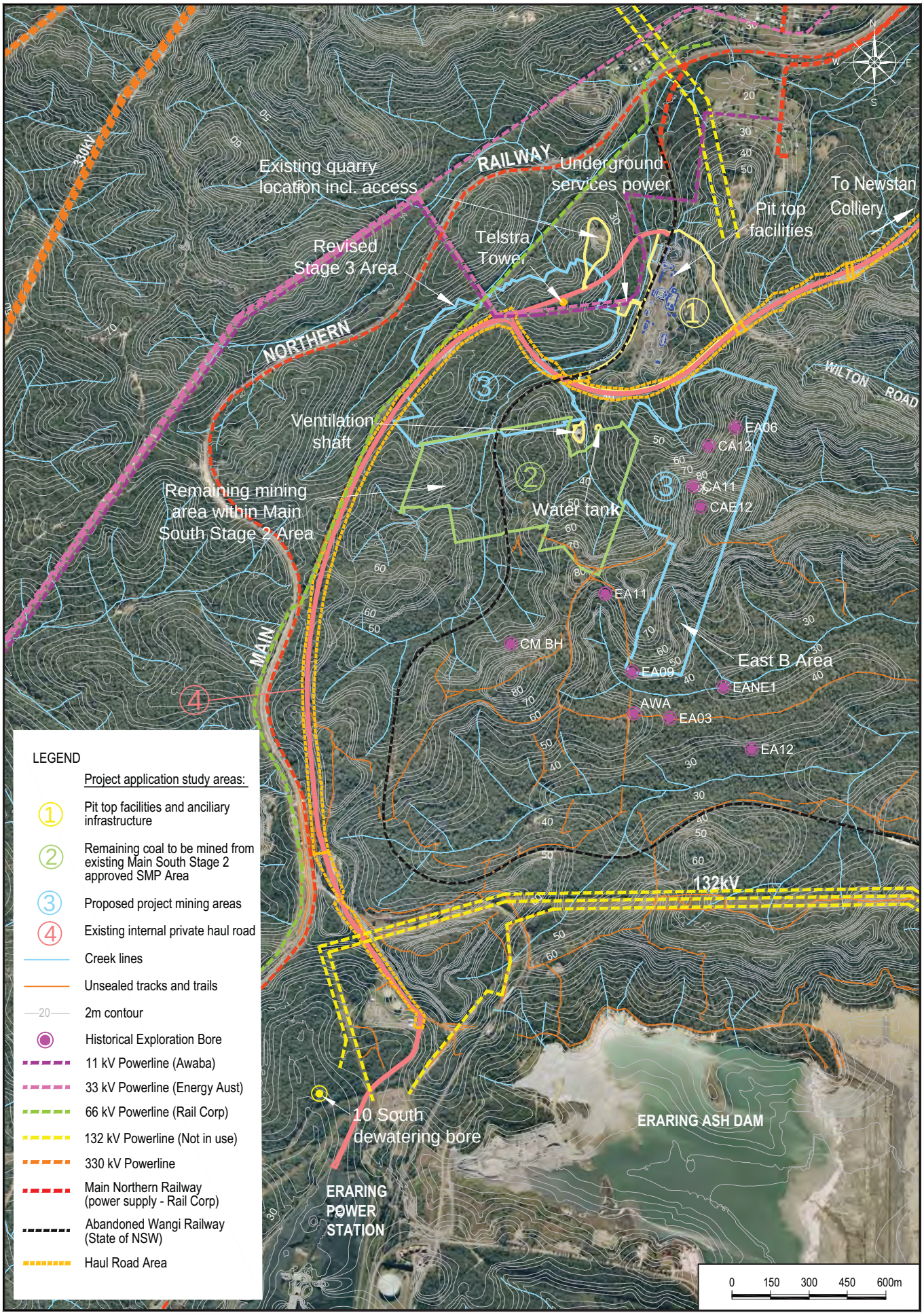


To be printed A4

GSS ENVIRONMENTAL
Environmental, Land and Project Management Consultants

Project Application Study Areas

Figure 2.1a



To be printed A4

GSS ENVIRONMENTAL
Environmental, Land and Project Management Consultants

Project Application Study Areas Detailed

Figure 2.1b

2.4 Land Use and Ownership

Awaba Collieries surface facilities are located in hilly forested country, on the western slopes of a north-south trending spur which is approximately one kilometre south of the Awaba village. The immediate vicinity is bush land, located on Crown Land, generally extending at least two kilometres in all directions from the colliery, except to the north where the Awaba village is located. The closest residence (in Olney Street, Awaba) is approximately 550 metres north of Awaba Colliery.

Figure 2.2 presents the land ownership in and surrounding the Application Area, and Figure 2.3 illustrates the existing mining leases held over the Application Area. There are no private lands or dwellings within the Application Area. The Application Area borders privately owned land (Aboriginal land owned by Koompahtoo Local Aboriginal Land Council (KLALC)) on the eastern side as illustrated on Figure 2.2.

Approximately one kilometre east of Awaba Colliery is the Awaba Waste Disposal Site and an area of bush land used by the Westlakes Automobile Club. Approximately one kilometre west of the Colliery is the Main Northern Railway line.

Wilton Road, linking the Toronto-Morisset road to the Awaba village, passes approximately 150 metres east of Awaba Colliery. The Newstan-Eraring private coal haul road links Awaba Colliery with Newstan to the north and Eraring Power Station to the south.

The historic land use for the Application Area and surrounds includes mining, with the area having been extensively undermined by previous mining activities. Newstan operates within close proximity to the north east of Awaba Colliery. There is also a range of surface infrastructure within the Application Area, as detailed in Section 3.6.

The private Haul Road used to transport coal from Awaba Colliery is owned by Eraring Energy with whom Centennial Newstan Pty Ltd has an agreement with for its use. The road is located on crown land used under Permissive Occupancy #16313 held by Eraring Energy. A small section of the haul road access from the Awaba Colliery stockpile area to the junction with the main haul road (T-junction) is owned by Centennial Newstan. The road is constructed on Crown Lands leased by Centennial Newstan.

The remainder of the Application Area is located on Crown Lands under lease to Awaba Colliery.

A schedule of land within the Application Area for the Project is provided in Table 2.1.

Table 2.1 – Schedule of Land within the Application Area

The Awaba Colliery Mining Project					
Parish	**Portion / Lot No**	**Study Area to which this Applies**	**Parish**	**Portion / Lot No**	**Study Area to which this Applies**
Awaba	Lot 4 DP 1031778	4	Awaba	Lot 110 DP 755207	3
Awaba	Lot 5 DP 1031778	4	Awaba	Lot 153 DP 755207	2 and 4
Awaba	Lot 12 DP 1031778	4	Awaba	Lot 155 DP 755207	4
Awaba	Lot 14 DP 1031778	4	Awaba	Lot 205 DP 755207	4
Awaba	Lot 15 DP 1031778	4	Awaba	Lot 206 DP 755207	4
Awaba	Lot 16 DP 1031778	4	Awaba	Lot 207 DP 755207	4
Awaba	Lot 19 DP 1031778	4	Awaba	Lot 211 DP 755207	4
Awaba	Lot 12 DP 1031859	4	Awaba	Lot 212 DP 755207	1
Awaba	Lot 11 DP 1050120	4	Awaba	Lot 213 DP 755207	1 and 2
Awaba	Lot 447 DP 1064562	4	Awaba	Lot 214 DP 755207	1 and 2
Awaba	Lot 100 DP 1127677	4	Awaba	Lot 215 DP 755207	1
Awaba	Lot 101 DP 1127677	4	Awaba	Lot 216 DP 755207	1
Awaba	Lot 462 DP 1138964	3	Awaba	Lot 223 DP 755207	4
Awaba	Lot 7304 DP 1149082	2	Awaba	Lot 224 DP 755207	4
Awaba	Lot 7305 DP 1149082	1, 2 and 3	Awaba	Lot 225 DP 755207	4

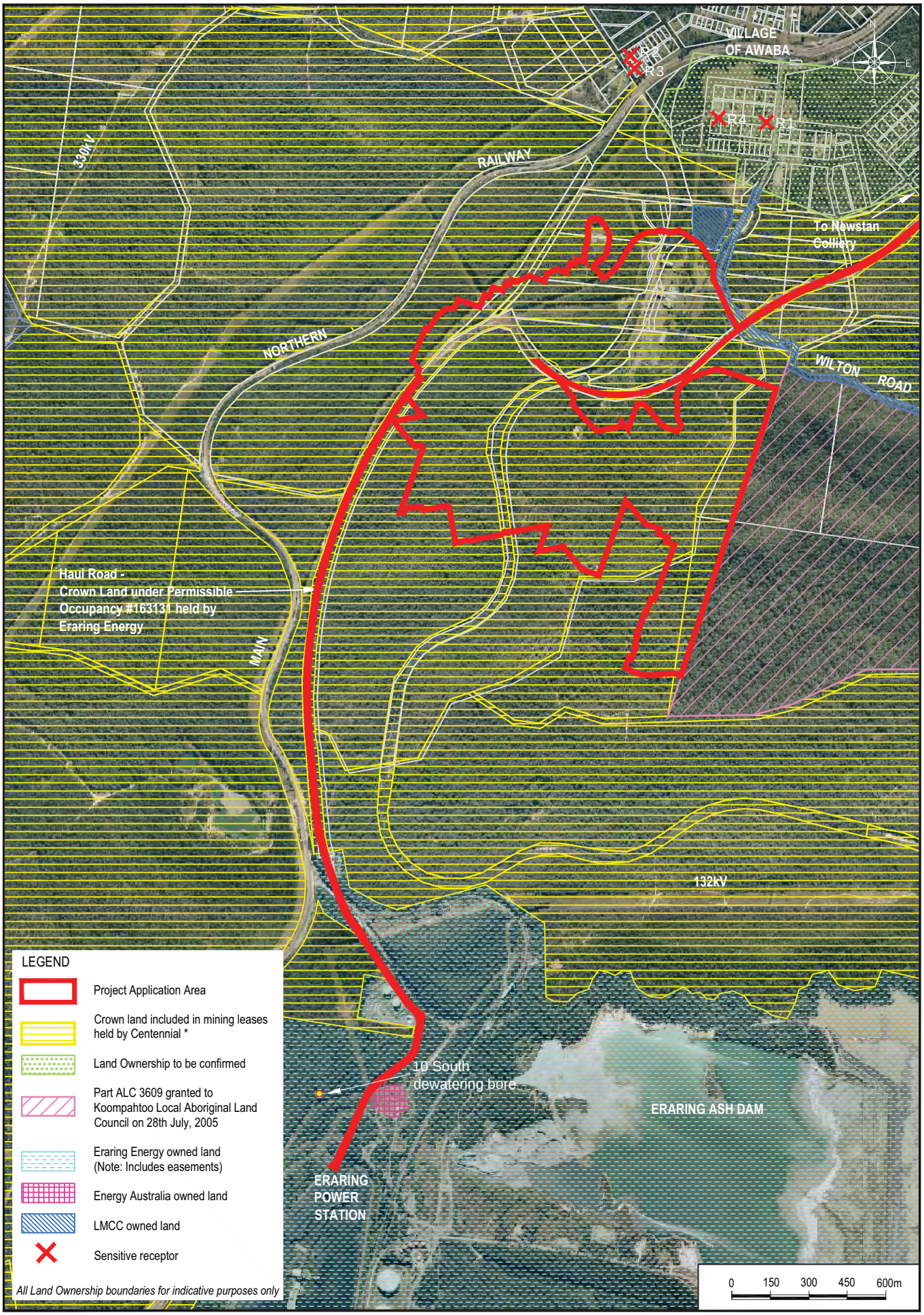
The Awaba Colliery Mining Project					
Parish	**Portion / Lot No**	**Study Area to which this Applies**	**Parish**	**Portion / Lot No**	**Study Area to which this Applies**
Awaba	Lot 5 DP 239629	1	Awaba	Lot 226 DP 755207	4
Awaba	Lot 6 DP 239629	1	Awaba	Lot 230 DP 755207	4
Awaba	Lot 8 DP 239629	1	Awaba	Lot 102 DP 755218	4
Awaba	Lot 9 DP 239629	1	Awaba	Lot 619 DP 817275	4
Awaba	Lot 318 DP 39722	4	Awaba	Lot 8 DP 821188	4
Awaba	Lot 322 DP 39722	4	Awaba	Lot 100 DP 828283	4
Awaba	Lot 1 DP 582126	2	Awaba	Lot 101 DP 828283	4
Awaba	Lot 441 DP 583057	4	Awaba	Lot 211 DP 840670	4
Awaba	Lot 64 DP 755207	4			

2.4.1 Nearest Sensitive Receptors

A number of residences are located in the area surrounding the Application Area. The nearest residences have been identified as sensitive receptor locations to be taken into account during the assessment (in particular for the noise and air quality impact assessments). A list of the nearest sensitive receptors (R1 to R4) identified in the immediate vicinity of the Application Area, and their respective distances from the Application Area boundary is provided in Table 2.2. Nearest sensitive receptor locations are shown on Figure 2.2.

Table 2.2 – Nearest Sensitive Receptors

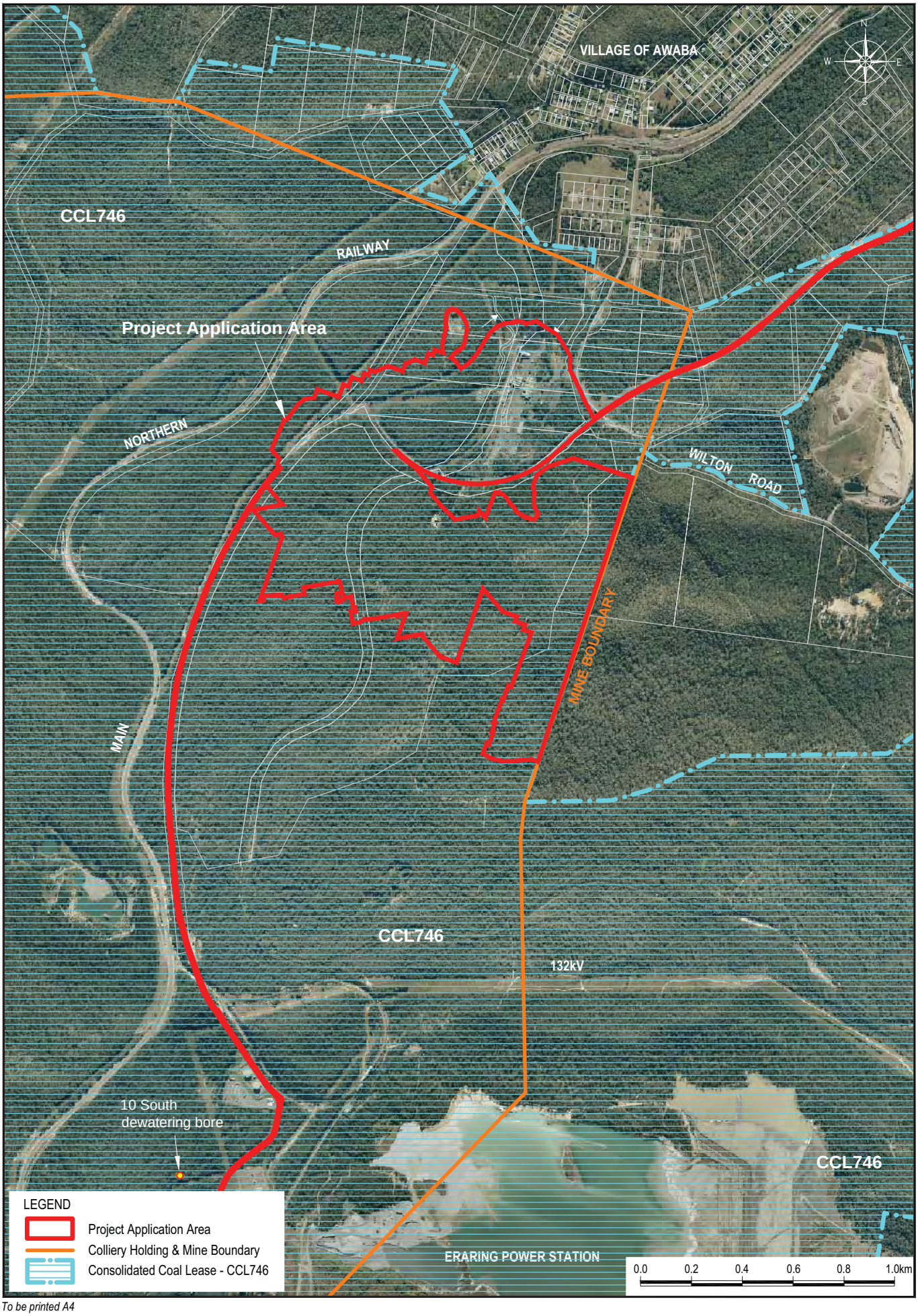
Receptor ID	Location	Distance (km) / Direction from Site Boundary	Elevation (m, AHD)
R1	9 Olney St, Awaba	0.6 / NNE	30
R2	15 Evans St. Awaba	0.8 / N	32
R3	51 Puddy Ln, Awaba	0.7 / N	29
R4	1A Olney St, Awaba	0.5 / NNE	32



To be printed A4

GSS ENVIRONMENTAL
Environmental, Land and Project Management Consultants

Awaba Colliery
Land Ownership and Sensitive Receptors
Figure 2.2



To be printed A4

GSS ENVIRONMENTAL
Environmental, Land and Project Management Consultants

Mining Leases

Figure 2.3

2.5 Geology, Soils and Topography

The Application Area occurs on rolling low hills of the Awaba Hills soil landscape. This soil landscape is situated on predominately coarse-grained sediments of the Narrabeen Group and Newcastle Coal Measures. The soils of this landscape tend to be shallow, hard setting and stony (Murphy, 1993).

The Application Area is comprised of mainly forested undulating land ranging from 25 m to 90 m AHD (Australian Height Datum) in elevation. Slope gradients are generally between 10-25%. The majority of the Application Area is located within the Stony Creek catchment with a small portion of the Application Area on the eastern side flowing into either of the Kilaben Creek in the south or an unnamed creek in the north.

Awaba Colliery is located to the north of the Sydney Basin. The coal deposits within the Application Area belong to the late Permian Age Newcastle Coal Measures.

Mining at the Awaba Colliery has been concentrated in the Great Northern Seam. The formation underlying the Great Northern seam is the Awaba Tuff. The formation overlying the Great Northern Seam is the Teralba Conglomerate. This unit immediately overlies the Great Northern Seam and continues to the surface. The Teralba Conglomerate will commonly maintain unsupported roof spans of more than 50 m for an indefinite period.

The Great Northern seam is the only coal seam currently worked at the Awaba Colliery although there are extensive resources in the Fassifern, Young Wallsend, Borehole and West Borehole Seams. Existing workings in the Great Northern Seam are quite extensive, having terminated against the major north/south zone of seam deterioration in the east, the colliery boundary in the south, and outcrop in the South East and North West. The remaining reserves that can be economically recovered by underground mining in the Great Northern Seam are located within the Application Area.

2.6 Climate

2.6.1 Data Sources

There are three (3) weather stations located in the area surrounding the Application Area. These include:

- Nobby's Head - Bureau of Meteorology (BOM)
- Cooranbong-Lake Macquarie - BOM; and
- Newstan Colliery.

Nobby's Head is a Bureau of Meteorology monitoring location which has been used as a regional representative site for temperature and humidity data. This provides a background context whereby the meteorological condition for the Project has been modeled and assessed. The data from Nobby's Head was not used for modeling but instead has been used as a regional reference to the Application Area (Heggies 2010b).

The Cooranbong BOM station is located approximately 10.5 kilometres to the south of the Awaba Colliery. This dataset was used in the model for the detailed site water balance as it was a more complete dataset than the Newstan Colliery. A sensitivity analysis of the Cooranbong and Newstan Colliery rainfall data was undertaken by comparing the data between 2005 and 2010, from this it was determined that the data was comparable and the Cooranbong station rainfall data would provide a reasonable representation of the rainfall at Awaba Colliery (GHD, 2010b). The Cooranbong station was also considered as a suitable dataset for the air quality impact assessment modeling, however, it was considered to be too far from the Application Area to represent local wind regimes, has only been operational since the middle of 2008 and the high percent calms within the dataset are considered potentially erroneous (Heggies, 2010b).

The Newstan monitoring locality is 5.5 kilometres from the Application Area, and is considered to be representative of site conditions of the Awaba Colliery. Within the Newstan meteorological data northerly winds from the north north-west to north north-east are absent, however are not considered to be significant to the assessment as there are no receptors nearby south of the mine. The prevailing winds recorded are from the south, and are considered to represent the worst case meteorological conditions, with the majority of winds being towards the sensitive receivers in the community, and is considered highly conservative and an applicable dataset to use in this assessment (Heggies 2010b). The Newstan Colliery data was used for modeling in the specialist noise and air quality assessments for the Project (Heggies (2010a) and Heggies (2010b) respectively).

2.6.2 Temperature and Humidity

The long-term monthly average temperature at Newcastle Nobby's Head is presented in Table 2.3. The warmest month of the year is January with a mean maximum temperature of 25.6°C and a mean minimum of 19.2°C. The coolest month is July with a mean maximum temperature of 16.7°C and a mean minimum temperature of 8.4°C.

Table 2.3 also presents the long-term monthly average humidity in the region surrounding the Application Area which can be described as moderate. The mean 9am relative humidity at Newcastle Nobby's Head ranged between 68% and 80%, while the 3pm relative humidity varied between 56% and 74% throughout the year (BOM, 2010, as cited in Heggies, 2010b). This was compared with the relative humidity data collected at Newstan, which showed that the 9am and 3pm annual average relative humidity recorded throughout 2008 was 79% and 80% respectively.

Table 2.3 – Average Monthly Temperature and Relative Humidity Statistics

Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Temperature													
Mean maximum temperature (°C)	25.6	25.4	24.7	22.8	20.0	17.5	16.7	18.0	20.2	22.1	23.5	24.9	21.8
Mean minimum temperature (°C)	19.2	19.3	18.2	15.3	12.0	9.7	8.4	9.2	11.4	14.0	16.1	18.0	14.2
Relative Humidity													
Mean 9am relative humidity (%)	77	80	79	78	79	79	77	72	70	68	72	74	75
Mean 3pm relative humidity (%)	72	74	72	66	64	64	59	56	59	64	68	71	66

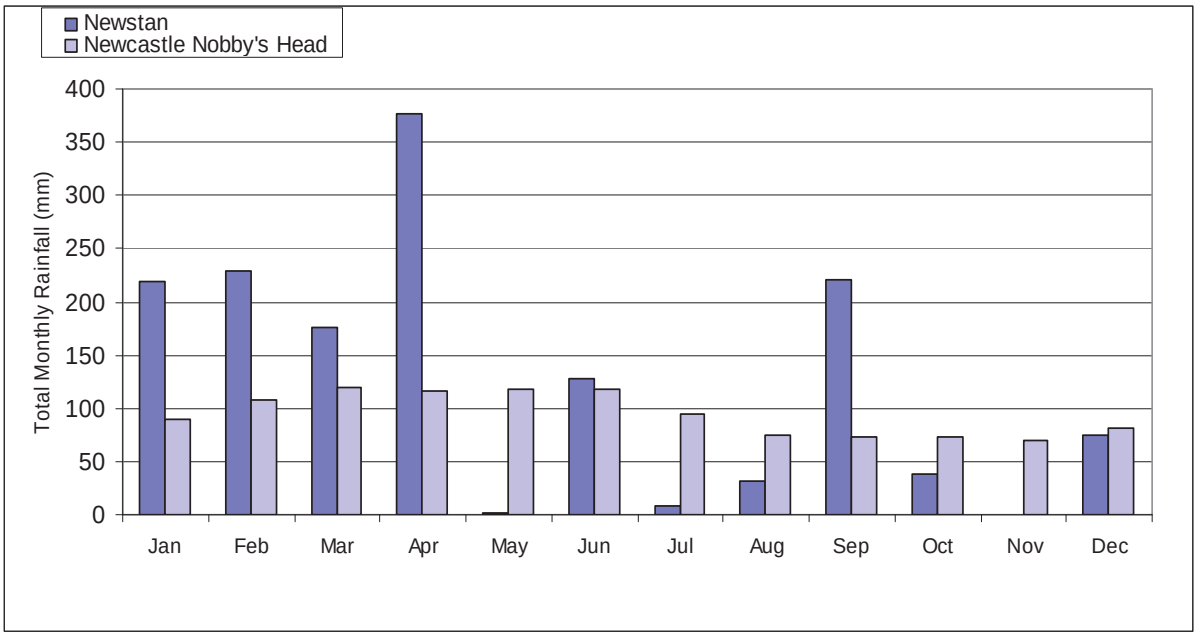
2.6.3 Rainfall

A graph displaying the recorded total monthly rainfall measured at Newstan during 2008 is shown in Figure 2.4. Also shown is the monthly mean rainfall measured at Newcastle Nobby's Head between 1862 and 2010 (BOM, 2010, as cited in Heggies, 2010b).

Rainfall experienced in the greater region surrounding the Application Area can be described as low to moderate, with the historic annual average rainfall recorded at Newcastle Nobby's Head totaling approximately 1136.5 mm. Review of data recorded at Newstan during 2008 shows that, while some months (notably May, July and November) were lower than the corresponding regional monthly average, total rainfall recorded during 2008 was approximately 1505 mm and therefore higher than the regional average (Heggies, 2010b).

Rainfall in the region surrounding the Application Area is typically lower during the winter months with a maximum generally experienced during the summer months.

Figure 2.4 – Average Monthly Rainfall Statistics



In addition, Table 2.4 presents annual average rainfall statistics from the Cooranbong station. It is noted that this information has been used in the surface water assessment to determine the design for the proposed surface water structures and to determine the site water balance (as discussed in Section 2.6.1).

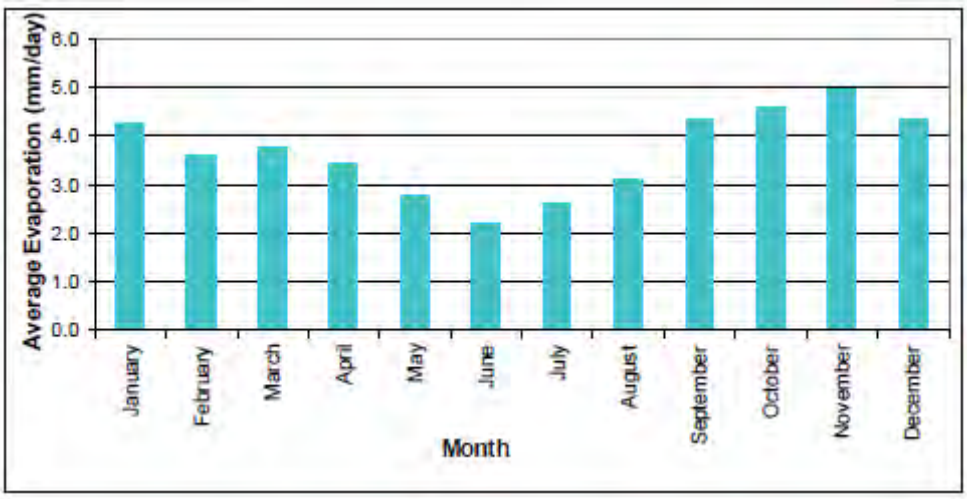
Table 2.4 – Cooranbong Annual Rainfall Statistics

Statistic	Rainfall (mm)
Minimum annual rainfall	658
Average annual rainfall	1139
Median annual rainfall	1007
Maximum annual rainfall	1943

2.6.4 Evaporation

Daily evaporation data from the Newstan Meteorological Station was provided by Awaba Colliery. This information was reviewed for the five years of data and average monthly evaporation rates were determined. It is noted that this information has been used in the surface water assessment to assist in determining the site water balance. The average daily evaporation for Awaba Colliery is presented in Figure 2.5. This figure indicates that the average daily rate of evaporation ranges from approximately 2 to 5 mm/day with evaporation rates highest in November and lowest in June.

Figure 2.5 – Average Daily Evaporation Rates – Newstan Weather Station



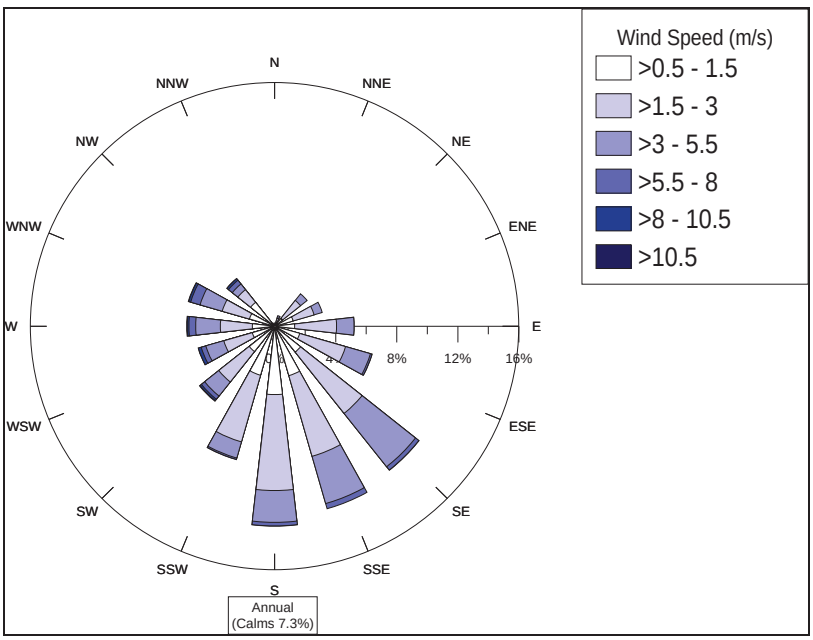
2.6.5 Wind

Wind regimes have the potential to increase the influence of noise and dust concentrations at sensitive receptors, which are principally located north of the mine in Awaba Village (Figure 2.2). Provided below is an overview of the wind environment used during the noise and air quality modeling presented in Sections 8.9 and 8.10. The information presented below has been sourced from the specialist noise and air quality assessments (Heggies (2010a) and Heggies (2010b) respectively).

A summary of the 2008 annual wind speed and direction experienced at Newstan and adopted for the assessment is presented as a wind rose in Figure 2.6. This figure indicates that winds experienced are predominately light to moderate winds (between 1.5 m/s and 5.5 m/s and primarily from the southeast to the south. Calm wind conditions (wind speed less than 0.5m/s) were observed to occur 7.3% of the time throughout 2008.

As mentioned in Section 2.5.1, it is recognised that within the Newstan meteorological data, northerly winds from the north north-west to north north-east are absent. This appears to be due to a fault with the weather station. Notwithstanding this, the prevailing winds are from the south as illustrated in Figure 2.6 below, and are considered to represent worst case meteorological conditions for potential impacts at the nearest receivers. The Newstan meteorological data is considered highly conservative and an applicable data set to use for this assessment (Heggies, 2010a).

Figure 2.6 – Annual Wind Rose for the Application Area (2008)



Seasonal wind roses are also provided within the specialist Air Quality Impact Assessment by Heggies (2010b) provided in Appendix 10. The following presents a summary of the seasonal wind environment within the Application Area:

- In spring light to fresh winds (between 1.5 m/s and 3 m/s) from east southeast to the south and relatively moderate winds (between 3 m/s and 5.5 m/s) from south southwest to northwest predominate;
- In summer fresh to light winds are experienced predominately from the southeast to the south;
- In autumn fresh to light winds are experienced predominately from the south to south southwest; and
- In winter fresh to light winds are experienced predominately from the south southeast to the west northwest.

In addition, Heggies (2010a) note that winds with a speed of less than 3m/s have the potential to increase noise levels at downwind receivers. The NSW Industrial Noise Policy requires that where winds from a particular direction occur for more than 30% of the time during a particular season during the day, evening or night, then they must be considered during noise assessments. An analysis of the wind environment from the Newstan Colliery meteorological data is provided in Table 2.5. The percentage occurrence figures provided in bold are those that exceed the 30% threshold. This table indicates that a prevailing southerly wind is a feature of the area.

Table 2.5 – Seasonal Frequency of Occurrence of Wind Speed Intervals

Period	Season	Calm	Wind Direction	0.5 – 2 m/s	2 – 3 m/s	0.5 – 3 m/s
Day	Summer	4.2%	SE±45^{o}	12.0%	15.4%	27.4%
	Autumn	2.9%	SSE±45^{o}	20.6%	16.0%	**36.6%**
	Winter	2.6%	S±45^{o}	16.6%	14.7%	**31.3%**
	Spring	1.1%	SE±45^{o}	11.7%	15.8%	27.6%
Evening	Summer	5.2%	ENE±45^{o}	20.6%	17.0%	**37.5%**
	Autumn	8.3%	S±45^{o}	25.2%	11.2%	**36.4%**
	Winter	7.2%	SSW±45^{o}	26.2%	13.2%	**39.4%**
	Spring	4.4%	SSE±45^{o}	20.2%	8.7%	28.9%
Night	Summer	13.7%	S±45^{o}	**32.4%**	9.6%	**42.0%**
	Autumn	14.2%	S±45^{o}	29.7%	10.5%	**40.2%**
	Winter	6.4%	S±45^{o}	23.1%	14.5%	**37.6%**
	Spring	9.8%	S±45^{o}	26.1%	9.9%	**36.1%**

2.6.6 Atmospheric Stability Classes and Temperature Inversions

Atmospheric stability refers to the tendency of the atmosphere to resist or enhance vertical motion. This vertical motion will influence the ability for suspended dust to be transported away from the Application Area. In addition, stable atmospheric conditions permit the formation of temperature inversions, typically during the night in the cooler months. The Pasquill-Turner assignment scheme identifies six Stability Classes, “A” to “F”, to categorise the degree of atmospheric stability. Class A represents very unstable atmospheric conditions, while Class F represents very stable atmospheric conditions.

Atmospheric stability classes were assessed by Heggies (2010b) for use in the dispersion modeling process. Direct measurements for 2008 of hourly average wind speed and wind direction at the Newstan Colliery meteorological data were input into the ‘The Air Pollution Model’ (TAPM) meteorological model (developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO)) to provide the required meteorological modeling. Table 2.6 presents a description and the frequency of occurrence of atmospheric stability classes in the vicinity of the Application Area.

Table 2.6 – Description and Frequency of Atmospheric Stability Classes

Atmospheric Stability Class	Category	Description	Frequency of Occurrences
A	Very unstable	Low wind, clear skies, hot daytime conditions	7%
B	Unstable	Clear skies, daytime conditions	12%
C	Moderately unstable	Moderate wind, slightly overcast daytime conditions	9%
D	Neutral	High winds or cloudy days and nights	31%
E	Stable	Moderate wind, slightly overcast night-time conditions	19%
F	Very stable	Low winds, clear skies, cold night-time conditions	22%

Temperature inversions, when they occur, have the ability to increase noise levels by focusing sound waves. Temperature inversions occur predominantly at night during the winter months. For a temperature inversion to be a significant characteristic of the area it needs to occur for approximately 30% of the total night-time during winter, or about two nights per week (Heggies, 2010b).

Meteorological data was not available to allow the determination of the percentage occurrence of temperature inversions during winter nights (Heggies, 2010a). Accordingly, a *worst case analysis* was therefore undertaken and the occurrence of temperature inversion during the night-time period has been considered as part of the noise assessment undertaken for the EA (refer Section 9.6 and Appendix 9 for details). Default temperature inversion values, as defined in the INP, have been assumed during the night-time period. Further details are provided in Section 7.1.1 of the Noise Impact Assessment (Appendix 9).

3.0 EXISTING MINE OPERATIONS

This section will provide a brief description of the existing operations currently being undertaken at Awaba Colliery and other key relevant approvals currently held relating to the operations (for example Subsidence Management Approvals from I&I).

Awaba Colliery forms part of the Newstan Colliery Holding and operates under one mining lease (Consolidated Coal Lease 746) and two mining purposes leases (MPL327 and MPL328). These mining leases allow for first working development while secondary extraction has been undertaken subject to approvals obtained from I&I in accordance with Clause 88 of the *Coal Mines Health and Safety Regulations (2006)* and Subsidence Management Plan (SMP) approvals issued under the NSW Mining Act (1992). All mining operations are primarily controlled by the conditions contained within the above mentioned mining leases and the provisions of the *Coal Mine Health and Safety Act 2002* and the *Mining Act 1992*. Environmental conditions for the Awaba Colliery are also provided by the Environmental Protection License (EPL443) issued by the DECCW under the *Protection of the Environment Operations Act 1997*.

In general terms the Awaba Colliery operations are comprised of the following features listed within Table 3.1, and are further explained below in Sections 3.1 to 3.11.

Table 3.1 – Summary of Existing Awaba Colliery Mine Operations

Key Feature	Description of Existing Operations	Proposed Change
Mining Method	Bord and Pillar development and Pillar Extraction within narrow panels by continuous miners. This method was developed in consultation with I&I and successfully used since 2007 in the Main South Area and 3 North Area.	No change
Mining Areas	Mining is ongoing in existing/historical workings areas of the Main South Area in remaining areas of **Stage 2** (SMP Approved 2008). Mining will similarly continue into the existing workings of the **Revised Stage 3 Area**.	Proposed **East B Area** includes both existing/historical workings areas and new mining areas.
Predicted Subsidence in Mining Areas	Predicted maximum subsidence is assessed to be less than 200 mm (upper limit used for assessment) although generally subsidence is within a range of 90-135mm. Maximum subsidence measured to date is 119mm. Awaba Colliery also undertakes a very conservative risk-based approach through also considering the highly unlikely *worst case* scenario of a "plug" failure event (2000mm subsidence) in mining areas.	No significant change Key environmental aspects have been reviewed and assessed for potential impacts in each mining area within this Environmental Assessment for the Project.
Production	Approximately 800,000 tonnes per annum.	No significant change, but allowing for potential productivity improvements 880,000 tonnes
Hours of Operation	24 hours per day, 7 days per week	No change
Employment	Approximately 100 staff and contractors employed personnel	No significant change
Coal Preparation	Coal is crushed on-site at the Awaba Colliery Coal Preparation Plant (CPP). (Note: No reject material)	No change

Key Feature	Description of Existing Operations	Proposed Change
Land Preparation	As Awaba Colliery is a well established underground mine with adequate support infrastructure and a well defined resource boundary there is minimal land preparation undertaken for exploration or construction purposes.	No change for mining areas. Minor change in surface facilities area to expand capacity of the site's Pollution Control Dam, which will be undertaken in a previously disturbed area. No other changes proposed.
Infrastructure	Infrastructure and support facilities at Awaba Colliery generally includes infrastructure for mine access and ventilation, coal handling, preparation and transport, workshop and administration, water management and pollution control.	No change
Mine Access	Access to Awaba Collieries Surface Facilities is off Wilton Road.	No change
Product Coal Transport	Coal is loaded into trucks, from the Final Product Bin or by a front end loader (when coal has been stockpiled), for transport along a private haul road to either Newstan Run of Mine stockpile or Rail Loop (export) or Eraring Power Station.	No change
Water Management	The aim of water management system is to divert clean water away from areas of potential "dirty" water, such as, coal stockpiles and some hardstand areas. Dirty water is pumped from the surface into the underground where it is filtered through goaf areas before being discharged through a number of existing licensed discharge points or the 10 South Bore into the Eraring Energy Ash Dam.	Minor change in surface facilities to expand capacity of the site's Pollution Control Dam. Assessment of the existing water management system (including underground dewatering via 10 South Bore) has been undertaken for this EA.
Rehabilitation	Rehabilitation is currently undertaken in accordance with the site's existing Life of Mine Plan (approved by I&I). Rehabilitation that occurs at Awaba Colliery generally relates to the filling of any sink holes. Rehabilitation of a number of former Licensed Discharge Points has also occurred, however, monitoring may still occur in these locations.	No significant change. All rehabilitation will continue to be undertaken in accordance with the site's existing Life of Mine Plan. Small portions of the area used for services and infrastructure are to be decommissioned and rehabilitated progressively as deemed appropriate.

3.1 Existing Approvals

Mining operations commenced at the Awaba Colliery in 1947, prior to the commencement of any planning controls, and have continued without abandonment since that time. Thus, mining at the Awaba Colliery is not presently carried out under any existing planning approval under the EP&A Act, but operates pursuant to continuing use rights under section 109(1) of the EP&A Act and clause 6B(1) of the *State Environmental Planning Policy (Major Development) 2005.*The Awaba Colliery is situated within the Newstan Colliery Holding and operates within the bounds of Consolidated Coal Lease (CCL) 746, which was issued (as a renewal) pursuant to Section 114(1) of the *Mining Act* 1992. Current mining methods utilised within the Main South Area, Stage 2, is undertaken in accordance with a Subsidence Management Plan (SMP) approved in 2005 and updated in 2009 by I&I NSW.

Figure 2.3 and Table 3.2 presents the mineral authorities held for the Awaba Colliery.

Table 3.2 – Mineral Authorities

Mineral Authority	Mineral (ha)	Surface (ha)	Expiry Date
CCL 746	2519	1910	31/12/2028
MPL 327	nil	1.041	25/03/2014
MPL 328	nil	0.397	25/03/2014
Source: Awaba Colliery – Annual Environmental Management Report for the period January 2009 to December 2009 (2010)			

Table 3.3 presents a summary of other existing approvals, licenses and permits for the Awaba Colliery.

Table 3.3 – Summary of Other Existing Approvals, Licenses and Permits

Licence	Grant Date	Anniversary / Renewal Date	Covering
Environment Protection Licence 443	11 November 2002	01 January	Coal Mining – between 0 - 500,000t produced[1]
Subsidence Approval	September 2008	2015	Main South Stage 2 Area
Subsidence Approval	Approval awaited (application submitted in December 2009)	N/A	Main South Revised Stage 3 Area
Note 1: Modification to EPL443 to the scale of operation (amongst others) was applied for in March 2009. No response has been received from DECCW to date.			

3.2 Land Preparation

The proposed Project will maintain the existing throughput and, as such, mine infrastructure will be limited to the existing infrastructure, including the items detailed in Section 3.6. Any construction works undertaken at the Awaba Colliery will be related to necessary maintenance of existing plant and infrastructure.

3.3 Mining

Mining at Awaba Colliery has been ongoing in the Great Northern Seam since 1947. The mine in this time has extended to the limits of its boundaries and is now retreating to extract the remaining safely accessible coal. The Great Northern Seam ranges from less than 2.0 m to more than 4.0 m in thickness but generally varies between 2.5 and 3.5 m. The Great Northern seam within the Awaba Colliery is shallow, ranging from 15 to 100 m depth of cover. The seam dips generally in the westerly direction, and is generally thinner to the east.

The primary method of production in recent years has been pillar extraction within narrow panels leaving coal pillars or barriers between adjacent narrow panels. The majority of the pillars are pre- existing, having been developed many years ago.

In areas where there are large pre-existing pillars or blocks of "virgin coal", roadways are driven and supported with additional pillars (in virgin coal) formed using traditional bord and pillar mining methods. These pillars are then subsequently extracted (or left as barriers). All coal is won using continuous miner machines. The mining sequence involves extracting between three or four rows of pillars and leaving at least one row as support. Depending on geotechnical advice, the resulting voids from this method may range between approximately 40 m and 100 m in width (key design parameter), and up to 500 m in length.

Mine planning ensures panels are not extracted where depth of cover or surface constraints preclude total extraction. This mining method was developed in consultation with I&I and has been utilised successfully to date as outlined below. Further details on

mine design parameters and subsidence management and mitigation measures used in mine design and planning have been outlined in Section 7.0.

The mining method is based on the requirement to maximise resource recovery while preventing any rapid uncontrolled collapse of the overlying Teralba Conglomerate impacting on the goaf edge stability, safety for the underground miners or subsidence on the surface. The proposed layout minimises the risk of rapid collapse of the conglomerate by keeping spans in the extraction panels to less than approximately 100 metres. There is a high level of confidence in this design as the Teralba Conglomerate is known to be a relatively consistent unit across the majority of the mining area. In general, void widths of up to 100 m are considered conservative and ongoing geotechnical advice is sought to confirm the void widths before extraction. Predicted maximum subsidence for the current mining method is typically assessed to be less than 200 mm (upper limit used for assessment) although generally subsidence is predicted to be (and has historically has been) within a range of 90-135 mm.

Mining has been ongoing in the Main South Area (MSA) following staged SMP approvals received from the I&I in 2007 and 2008 under the *NSW Mining Act, 1992*. Mining undertaken to date in the MSA has involved the following:

- Stage 1 – This area is located at the southern end of the MSA and received SMP approval in 2007. This was the first area to utilise the current mining method, developed in consultation with I&I, of pillar extraction using narrow panels. Mining within Stage 1 area was completed in June 2009.
- Stage 2 – The second stage of the MSA gained SMP approval in September 2008. Mining in this area was undertaken using the same total extraction method used successfully in Stage 1. Mining is currently being undertaken in this area and will continue for the life of the operation.

It is noted that a Subsidence Management Plan application has been submitted for *Stage 3* of the MSA in December 2009and comprises part of the proposed Project as detailed in Section 4.

In addition, it is also noted that mining has recently been successfully completed in the smaller *3 North Area,* (adjoining part of the eastern side of the MSA) using the previously described pillar extraction mining method. The 3 North Area received SMP approval in March 2009 and mining was completed in January 2010.

The operating hours at Awaba Colliery are 24 hours seven days per week.

The current operational structure includes two (2) production panels working up to three (3) unit shifts per day each.

3.4 Coal Handling, Processing, Stockpiles and Dispatch

Mined coal is transferred to the surface by a number of conveyors and through the Run of Mine (ROM) Bin before arriving at the Coal Preparation Plant (CPP) located at the Awaba Colliery pit top area. The CPP is comprised of three screens that coal is initially passed through before entering the primary and one of the two secondary crushers. The final product size is adjusted to suit market demands and is generally less than 100 mm. This material is then delivered to the Final Product Bin by conveyor. From the Final Product Bin coal can be loaded into trucks for transport off-site, or, stockpiled in an adjacent area.

Awaba Colliery has the capacity to stockpile up to 30,000 tonnes of ROM coal.

3.4.1 Coal Handling of Materials Delivered from Awaba Colliery to Newstan

Coal from Awaba Colliery is currently delivered by truck to the Newstan Colliery rail loop pad and exported in accordance with the methods described within the Newstan Colliery Life Extension Project EIS (Newstan EIS) (Umwelt, 1998) and development consent (DA 73-11-98). It is noted that a separate approval is being sought under the EP&A Act by Newstan Colliery to modify DA 73-11-98 to allow processing of coal sourced from the Awaba Colliery using the existing Newstan Colliery Coal Handling and Preparation Plant. This proposal would allow coal from the Awaba Colliery to be delivered to the existing 80,000 tonne capacity Newstan Colliery Run of Mine (ROM) coal stockpile. From this ROM stockpile the coal would be reclaimed into the washery through reclaim tunnels where coal handling and processing would be the same as that used for the Newstan Colliery coal as approved and described in the Newstan EIS (Umwelt, 1998).

It is proposed that coal from Awaba Colliery be washed at Newstan in accordance with the process described in the Newstan EIS. The washed product would then be stored on the rail loop pad prior to export. This coal handling process and all storage volume limits would be consistent with the existing Newstan Colliery consent (i.e. there would be no change in the processes or volumes detailed and approved by the Newstan EIS (1998), however, the source of the coal would need to be modified).

3.4.2 Coal Handling of Materials Delivered from Awaba Colliery to Eraring

Coal is also transported from Awaba Colliery to Eraring at varying rates, depending on market demands. This coal is delivered by trucks via the private haul road and placed within the Eraring approved coal storage area.

3.5 Plant and Equipment

The Awaba Colliery utilises two continuous miners for coal extraction and a range of other ancillary equipment both in the underground workings and during operations at the Surface Facilities. The types of equipment used for the operation of the Awaba Colliery include equipment for coal mining, processing, loading and product haulage. The typical plant and equipment used at the Awaba Colliery have been used to model the operational scenarios for noise and air quality, as discussed in Section 9.6 and 9.7, respectively.

3.6 Mine Support Facilities and Site Access

Awaba Colliery is a well established mine operating since 1947. Centennial purchased the operation from Powercoal in 2002 and has been operating the mine since this time.

All existing surface and underground infrastructure at Awaba Colliery, including previous surrounding workings (for ongoing ventilation and access), will continue to be relied upon. The existing mine infrastructure and surface facilities are illustrated on Figure 3.1.

Surface infrastructure at Awaba Colliery comprises:

- Mine Access & Associated Infrastructure
- Coal Handling, Preparation & Transport Infrastructure
- Workshop, Services and Administration Infrastructure
- Water Management Infrastructure
- Pollution Control Infrastructure
- Other Miscellaneous Infrastructure (site security etc)
- Non-mine Owned Infrastructure

These items are each outlined further in the following sections below.

3.6.1 Mine Access and Associated Infrastructure

- Former Men and Materials Drift (1947) – ventilation only
- Tunnel Conveyor Drift (1947) & associated 800 tonne inseam bin
- Men and Materials Drift (1987)
- Overland Conveyor Drift (1987)
- Up-cast ventilation shaft and apparatuses
- Downcast Shaft

3.6.2 Coal Handling, Preparation and Transport Infrastructure

- Coal handling facilities for breaking, crushing, sizing and storing product.
- Surface covered conveyor systems.
- Private haul road connecting to Newstan and Eraring Power Station (Eraring Energy Haul Road). The haul road is of bitumen construction and has previously been undermined by total extraction

3.6.3 Workshop, Services and Administration Infrastructure

- Workshop facilities.

- Workshop annex wash down facilities
- Enclosed and bulk open material and equipment stores facilities
- Administration and bathroom facilities
- Air compressors
- Electrical substation, powerlines and associated equipment
- Quarry used to win material for rehabilitation of subsidence cracks, construction, road works and track maintenance;
- Access roads and car-parking facilities
- Surface storage areas – open hard stand
- High tension electrical switchyard.
- Fire station and integrated fire equipment

3.6.4 Water Management Infrastructure

- Grey water facility (LDP008)
- Barnes Dam Pump Station (LDP005)
- 6 additional licensed discharge points (pump stations).
- 3 x 200,000L emergency water storage tanks
- 10 South bore (and associated Pump Station)
- Incoming water supply from Toronto
- Sewerage facility

3.6.5 Pollution Control Infrastructure

- Pollution Control Dam (PCD) (LDP009) to manage 'dirty' water (mine water) within Pit Top Facilities. It is noted that the capacity of the PCD is proposed to increase for the Project, as described in Section 4.8.
- Hard stand area reporting to an oil/water separator & associated oil collection systems.
- Coal Handling Plant drive in sumps and retention area
- Dust suppression system for CPP trucking
- Continuous telemetry equipment which monitors the water levels of the Pollution Control Dam

3.6.6 Other Infrastructure

The pit top area is fenced with a chain mesh and barbed wire security fencing. Colliery gates are closed and locked where appropriate.

3.6.7 Non-mine Owned Infrastructure

There are a number of non-mine owned infrastructure within and surrounding the Application Area. These are concentrated in Study Area 2 (the Main South Stage 2 Area and Revised Stage 3 Area).

None of these occur within Study Area 3 (the East B Area).

These include (but are not limited to), the following:

- Telstra telecommunications tower (within Revised Stage 3 Area);
- Underground services power;
- Powerlines (including 11kV, 33kV and 66kV power supplies);
- Abandoned Wangi Railway (crosses Main South Stage 2 Area and Revised Stage 3 Area);

- Main Northern Railway (outside Application Area to the west); and
- Awaba Waste Disposal Site (outside Application Area to northeast).

The location of these infrastructure items in relation to the Application Area is shown on Figure 3.2. It is noted that consultation has been undertaken with each of the infrastructure owners during preparation of the relevant SMP applications for the Revised Stage 3 Area and the remaining Main South Stage 2 Area.

As there are no infrastructure items within the East B Area, it has been considered appropriate that no further consultation in relation to subsidence impacts upon non-mine owned infrastructure be undertaken for the EA. Notwithstanding this, some infrastructure owners (namely, Telstra and Energy Australia) were notified of the Project, however, no comments were received in response to the notification. Consultation has been outlined in Section 6.7.

3.6.8 Site Access

Access to Awaba Collieries surface facilities is off a local council road, Wilton Road. Site access has been successfully operating without major incident since 1947.

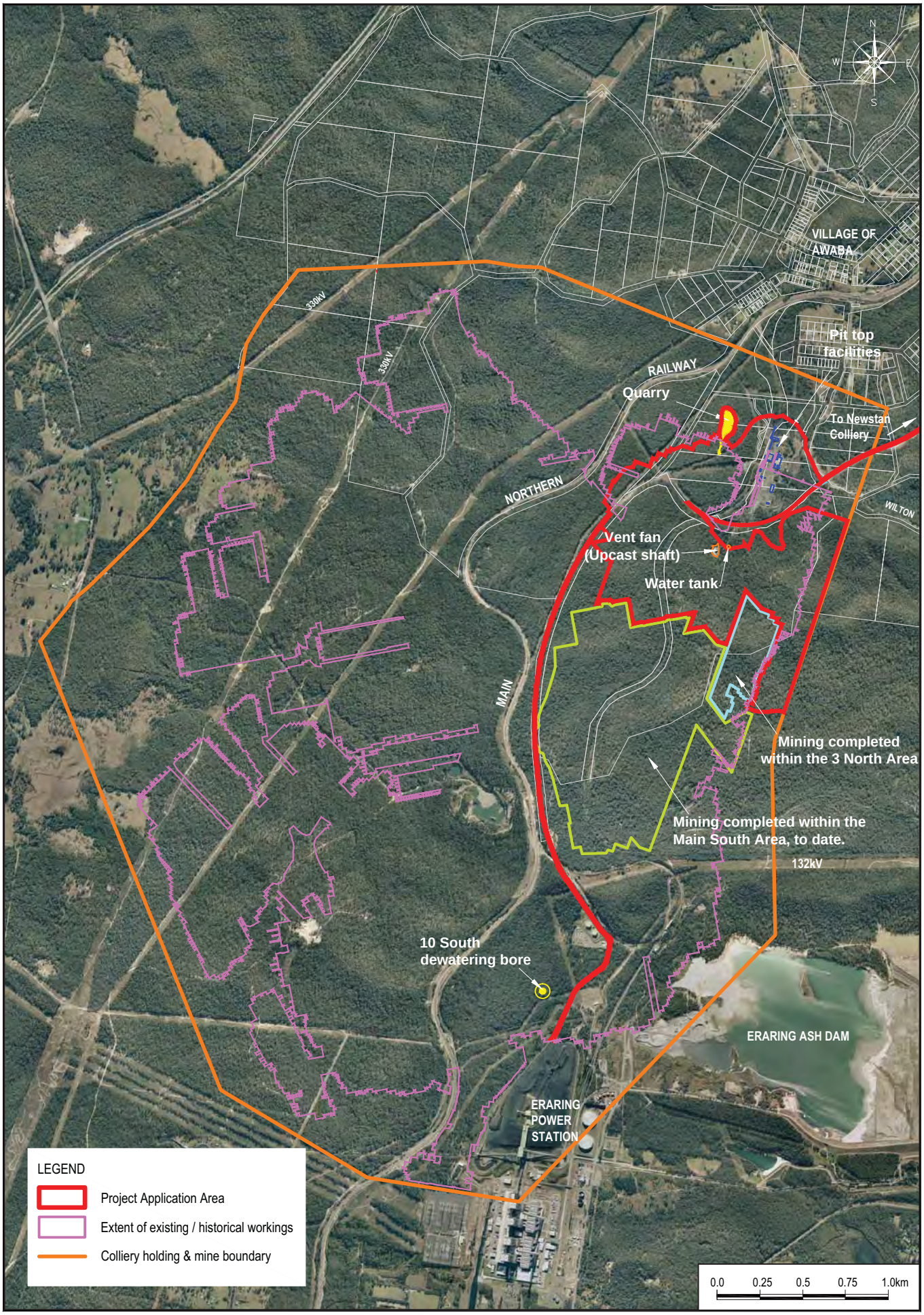
A Traffic Assessment was undertaken to determine if the continued use of the site access is appropriate. This assessment is discussed in further detail in Section 9.3.

3.7 Transport

Crushed and screened coal is transported to the Newstan Rail Loop (approximately 8 km north of Awaba Colliery) via the privately owned Newstan-Eraring Haul Road under existing agreements with the road owner (Eraring Energy). It is proposed that once the coal reaches the Newstan facilities (refer Section 3.4.1 above) at the CPP, it is washed, stockpiled and railed to the Port of Newcastle or Port Kembla. The private haul road is shown as *Study Area 4* on Figures 2.1a and 2.1b.

Coal is also transported south on the private haul road to Eraring Power Station's facilities (refer Section 3.4.2 above) for use by the power station under agreements between Centennial and Eraring Energy.

Typically during a financial year all ROM coal is transported off site to either of these two customers. The proportion sent to each depends on market demand at the time. It is possible that 100% of production in a year may be sent to either Newstan or Eraring.

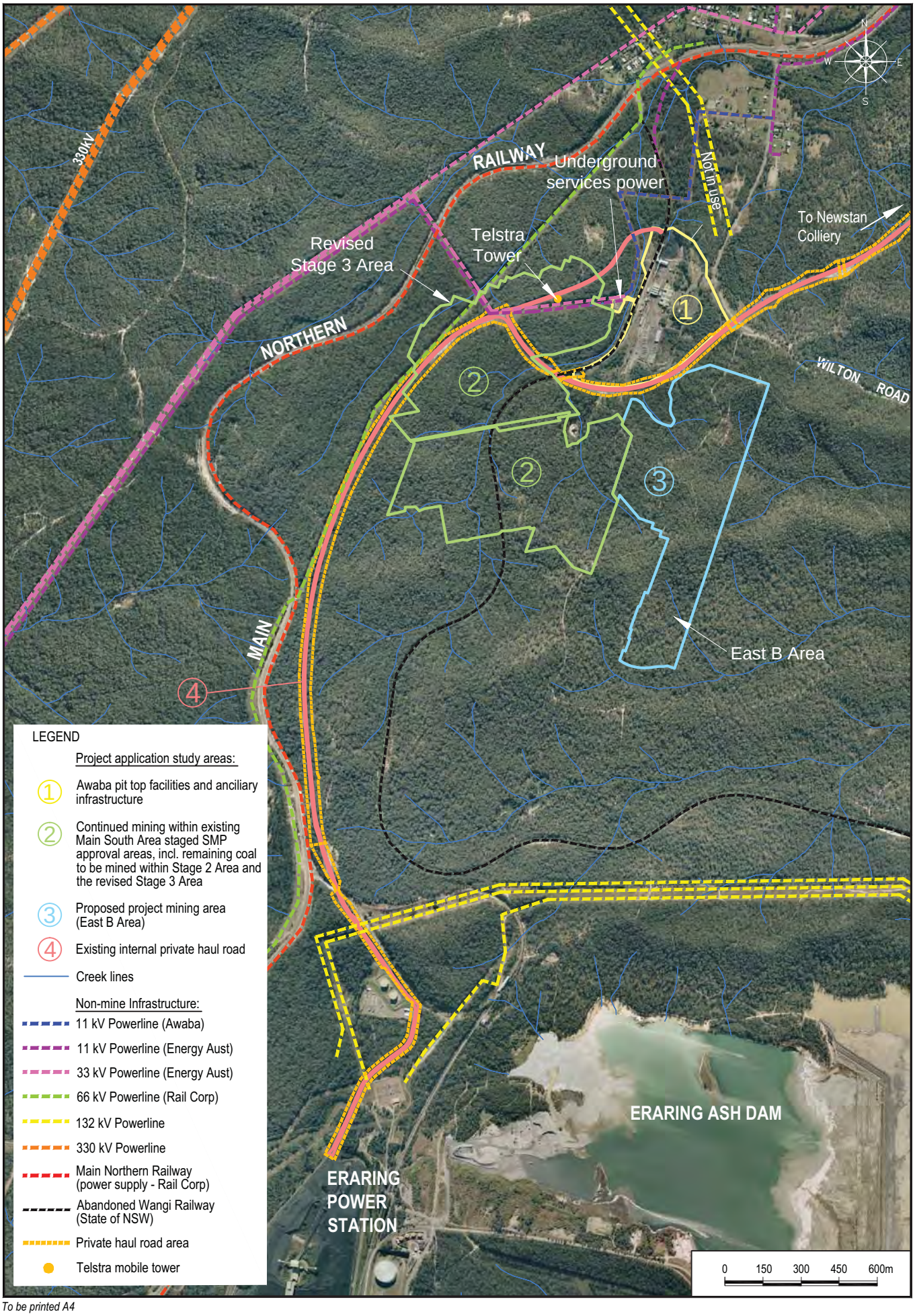


To be printed A4

GSS ENVIRONMENTAL
Environmental, Land and Project Management Consultants

Existing Mine Infrastructure and Surface Facilities

Figure 3.1



To be printed A4

GSS ENVIRONMENTAL
Environmental, Land and Project Management Consultants

Non-mine Infrastructure

Figure 3.2

3.8 Water Management

The Awaba Colliery pit top is located adjacent to Stony Creek. The aim of Awaba Collieries Draft Water Management Plan is to ensure that clean water is diverted away from potential contamination areas and discharged directly into Stony Creek downstream of disturbed areas.

The pit top area surface water management is separated into two water streams:

- "clean water" is the water that has not passed over areas likely to contain coal fines and/or hydrocarbons; and
- "dirty water" is all water likely to have passed over parts of the site that contain fines and/or hydrocarbons.

The surface water defined as "clean" is diverted around the "dirty" areas using a series of stormwater drains under the pit top area and is directed to the adjacent watercourse (Stony Creek). This is in accordance with the Awaba Colliery Environmental Management System (EMS) and the Draft Water Management Plan which provides the framework to reduce the risk of downstream contamination and to achieve compliance with EPL 443.

Clean water is diverted from buildings including the main administration building, bathhouse, workshop complex and hard stand areas via a network of downpipes, dish drains and underground storm water pipes directly into Stony Creek. This minimises the potential for contamination and maximises the effectiveness of the water pollution control system in the event of excessive rainfall.

Dirty water runoff is retained within the Pollution Control System and pumped to underground workings for residence time and filtration through goaf areas before being discharged through a number of existing licensed discharge points or the 10 South Bore into the Eraring Energy Ash Dam.

Awaba Colliery utilises a Pollution Control Dam (PCD) on site for the management of the dirty water system. The PCD comprises of water that is initially directed to an oil separator (i.e. runoff from areas likely to contain hydrocarbons exposed to rainfall or runoff from the vehicle wash down area), as well as, water from areas that potentially contain coal fines (i.e. near to the bin loading facility, Coal Preparation Plant (CPP) and/or temporary coal stockpile area). Water can be discharged from the PCD into the underground workings or be released through a Licensed Discharge Point (LDP009) in accordance with strict discharge water quality criteria.

During normal dry weather conditions, the PCD is kept to minimum level so as to maximise the available retention volume during rainfall events. There are two pumps located in the dam that are triggered using automatic levels, during rainfall events, and water is then pumped underground to prevent an uncontrolled discharge from LDP009.

Currently, if the water level exceeds the capacity of the pumps within the PCD, then the dam fills up and discharges via the spillway (LDP009) into Stony Creek (during these times of discharge a sample must be taken, where it will be analysed to ensure the discharge is within EPL 443 conditions).

The Awaba Colliery is noted as being a ‘dry’ mine with very little inflows of water due to a history of depressurisation of the coal seam aquifer and de-watering. On this basis, groundwater management at the Awaba Colliery is generally a combination of surface water that has been pumped to the underground workings (i.e. mine water) and water filtering through the existing workings area to the southern area of the mine. From here the water is allowed to settle out prior to being pumped to the surface via a borehole (10 South), at a constant rate of 5.5 litres per second. This water is then pumped to the Eraring Ash Dam surface settling ponds.

Awaba Colliery also has a number of Licensed Discharge Points (LDPs) that have been rehabilitated (LDP002, LDP003 and LDP006 at the southern end of the Hussey Quarry). LDP001, LDP004 and LDP007 have also been rehabilitated - however the bores are still in place and LDP004 and LDP007 are also currently used to monitor water levels. It is also noted that LDP005 ceased to be used for pumping groundwater in March 2010, however, will be required in the future.

3.9 Environmental Management

3.9.1 Introduction

Awaba Colliery operates under an Environmental Management System (EMS) developed to compliment Centennial's strategies and aims, and to be compatible with the Centennial Environmental Policy by promoting environmental awareness, and aims to minimise the impacts of the operation.

The EMS applies to:

- Awaba Colliery lease area – all surface and underground operations;
- All personnel who have specific responsibilities and duties within the EMS and associated standards and procedures; and
- All mine employees, contractors and external parties.

The site EMS has been developed and implemented in accordance with the Centennial EMS framework to comply with the environmental management expectations of Centennial's internal standards, regulatory authorities and the local community.

The EMS framework document and accompanying Standards, Procedures and Plans are part of the Awaba Mine management system. Compliance with the system's requirements is an expectation of all employees of the Awaba Colliery.

3.9.2 Policy

Awaba Colliery accepts and has adopted the Centennial Environmental Policy that sets out the Company aims and values applicable to all employees and contractors. The Policy underpins the Centennial Environment and Community Management Standards. The Environmental Policy (Appendix 1) has been endorsed by the Board of Directors and Mine Manager and is a commitment from top management to the community and the Mine's employees.

3.9.3 EMS and Management Plans

As a requirement of the Centennial EMS, Awaba Colliery has developed Environmental Management Plan(s) (EMP's) in accordance with the aspects identified in the risk assessment to address the minimum:

- Processes for identifying and managing major environmental aspects/impacts/risks;
- Processes for monitoring and managing compliance with regulatory requirements;
- Measurement and monitoring of environmental performance and corrective actions;
- Pollution Prevention and Emergency Preparedness strategies;
- Roles and Responsibilities;
- Specific management plans for significant risk areas;
- Training; and
- Auditing and reviewing.

Existing management plans that have been developed for the Awaba Colliery include:

- Asbestos Management Plan;
- Bushfire Management Plan;
- Air Quality Management Plan;
- Water Management Plan (in draft);
- Life of Mine Plan;
- Flora and Fauna Management Plan; and
- Subsidence Management Plan, incorporating the following:
  - Public Safety Management Plan;

- Watercourse Management Plan;
- Power Line Management Plan;
- Roads, Tracks and Trails Management Plan;
- Telstra Management Plan; and
- Spontaneous Combustion Management Plan.

3.9.4 Monitoring and Reporting

Environmental Monitoring at Awaba Colliery is conducted in accordance with EPL443 and EMP's required by the Mine. These plans are consistent with the Centennial standard *ECMS-006 Monitoring and Evaluation* specifying the environmental sampling standards for all monitoring (collection and analysis) which, is to be undertaken in accordance with Australian Standards and DECCW requirements.

Compliance against the limits in the EPL is checked monthly and non compliances entered into the Environment and Community Database (ECD) to document these in the monthly environmental and operations reports. Reporting of non-compliances with EPL licence limits occurs as described in the Centennial standard *ECMS-003 Incident Reporting and Investigation*.

Awaba Colliery monitors the social impacts of its operations, recording and reporting complaints by entering these into the ECD and reviewing the nature of complaints on a monthly basis. This assists in determining the environmental aspects of the complaint and required additional controls or management strategies to limit the impacts.

A set of environmental performance indicators has been developed and regularly reviewed and updated as a part of the Mine's business plan. The environmental performance indicators are monitored and reported in the monthly environment reports. These indicators comprise both positive performance indicators and lag indicators. Specific indicators and performance targets are determined on an annual basis, although, the typical indicators are provided in Table 3.4.

Table 3.4 – Typical Performance Indicators

Positive Performance Indicators	Lag Indicators
Training Sessions	License Exceedance
Site Inspections	Community Complaints
EMS Audits	Incidents
Corrective Actions	

Awaba Colliery assesses performance against the environmental performance indicators by recording these in the ECD and evaluating them in the monthly environmental report. Additionally, the implementation of corrective actions is also monitored and documented using the ECD and reported in the monthly environmental performance report.

3.9.5 Audits and Continuous Improvements

Continuous improvement is achieved through the following:

- monitoring and review;
- internal and external communication with stakeholders;
- implementation of corrective and preventative actions; and
- tracking progress against objectives and targets and environment and community programs.

Specific objectives for each Policy commitment are reviewed annually as part of the Centennial's business plan. Once objectives have been set environmental targets for the Mine are established to provide a means by which to measure the success against the objectives.

The environmental objectives and targets from the business plan are approved by the General Manager. Awaba Colliery seeks to meet the relevant objectives and targets through the development of the Mine's business plan which incorporates environmental

and community objectives and targets. Targets are clearly defined and measurable where practical. The progress against the relevant objectives and targets is reviewed through the internal performance reporting system and staff performance reviews.

Non-conformances may become evident as a result of inspections, and monitoring (Section 3.9.4) through audit findings or complaints. Non-conformances identified as a part of inspections or monitoring are investigated, action plans developed (where required) and issues remediated. A review of procedures may be required to prevent further non-conformances, and training.

Audits give an assessment of the implementation of the EMS, compliance with ISO 14001, Policy and objectives and targets and environmental performance. They also allow for continual improvement and resource allocation.

Internal audits of the Awaba Colliery EMS are conducted as specified in *E&CMS 06 Minimum Environmental Performance Standard Audit and Inspection*. The EMS audits investigate compliance with the EMS, Standards and Procedures. In addition, independent audits of the implementation of, and compliance with, the EMS are periodically undertaken (also specified in *E&CMS 06)*.

To gain an independent view on environmental performance an external statutory audit occurs as per the Centennial audit schedule in *E&CMS 06*, and is initiated by Centennial. The scope of external audits is detailed in *E&CMS 06*.

3.10 Employment & Economic Contributions

3.10.1 Employment

The Awaba Colliery directly employs approximately 90 people, with up to 10 additional contractors employed. Of the combined approximately 100 full-time positions at the Awaba Colliery, approximately 75% of these are shift workers.

3.10.2 Economic Contribution

Table 3.5 presents the economic contribution made by the Awaba Colliery to the local, regional, state and National economies over a recent 12 month period.

Table 3.5 – Awaba Colliery Annual Economic Contributions

Item	Contribution
Gross Wages (Awaba Colliery employees only)	$14.8M
Gross Wages (Mining Contractor only)	$0.9M
Awaba Colliery Invoices Paid	$19.6M
Local Taxes (including rates and contributions)	$0.3M
State Taxes (including pay roll tax)	$0.7M
Royalties	$4.2M
Total	**$40.5M**

3.11 Rehabilitation and Final Landform

Rehabilitation of the site is undertaken in accordance with the *Life of Mine Plan* for Awaba Colliery approved by I&I in June, 2009. The *Life of Mine Plan* has been updated for this Project and is discussed in detail in Section 9.4. As mentioned above, recent rehabilitation at Awaba Colliery has involved the decommissioning of pump stations LDP002, LDP003 and LDP006, while also including repairs to sink holes in the western areas of the Awaba Colliery mining lease. Disturbed areas are rehabilitated using a cover crop and a local native seed mix to minimise the potential for erosion and to re-establish native vegetation in the area.

3.11.1 Progressive Rehabilitation

The approved *Life of Mine Plan* for Awaba Colliery provides the overall strategy and methods for undertaking rehabilitation within the Awaba Colliery. During the life of the Project small portions of the 17 hectares used for services and infrastructure are to be decommissioned and rehabilitated progressively as deemed appropriate. The details for the progressive rehabilitation of the

surface facilities, during the decommissioning of the Awaba Colliery, are provided within the approved Life of Mine Plan. This progressive rehabilitation will be carried out in four stages and generally, involve the following:

- Stage 1 – Sealing of shafts and boreholes – There are two shafts, one upcast and one downcast that will require to be filled. An independent consulting firm will be engaged to supply engineering details of the Shaft Capping with plans to be prepared in consultation with the District Inspector. Boreholes will be sealed in accordance with Clause 137 of the *Coal Mines Regulation Act 1982 No. 67*, at such time they are no longer required for the Awaba Colliery operations.
- Stage 2 – Sealing of drift entries – There are four drift entries that require filling, as above, sealing plans will be prepared in consultation with the District Inspector.
- Stage 3 – Demolition and removal of surface infrastructure – There are a number of buildings on the surface that will either be demolished or removed from site. This is inclusive of hard stand areas and car parking areas. All bitumen from roads and car parks and any other hard stand areas will be recycled by the contractor. Recycling of building materials will be maximised and documented by the contractor for report in the AEMR. Some of the surface infrastructure at the Awaba Colliery is in excess of 50 years age. A heritage assessment, including consultation with the Heritage Office, will be undertaken to assess the significance of the pit top buildings, determine heritage listing and appropriate action prior to works commencing.
- Stage 4 – Surface contouring and revegetation – Final contouring will be undertaken to provide a landform near as practicable to the original contours of the land. Rehabilitation will be undertaken using flora species commensurate with the surrounding landscape.

4.0 PROJECT DESCRIPTION

4.1 Overview of Project

Awaba Colliery is seeking an approval from the Minister of Planning under the provisions of Part 3A of the EP&A Act to:

- Continue bord and pillar development and pillar extraction by continuous miners within the "Main South Area" (being the remaining sections of Stage 2 and Revised Stage 3, refer Study Area 2);
- Extend bord and pillar development and pillar extraction by continuous miners into the "East B" Area (refer Study Area 3);
- Produce, handle and distribute up to 880,000 tonnes of Run of Mine coal per annum (financial year) using existing surface facilities;
- Continue the use of existing ancillary surface facilities (all Study Areas);
- Expand the existing Pollution Control Dam (refer Study Area 1);
- Continue the delivery of coal to the Newstan Colliery and/or the Eraring Power Station using the existing private haul road/transport facilities (refer Study Area 4).

The Application Area for the Project has been described in Section 2.2 and is illustrated on Figure 1.2.

4.2 Hours of Operation and Project Life

The Project does not represent any changes to the current hours of operation of the Awaba Colliery which will continue to operate 24 hours a day 7 days a week. In addition, the Project will not require any substantial setup beyond the scope of existing work methods.

At present, it is anticipated that the Project will recover approximately 2.0 million tonnes of coal which will be extracted from those areas depicted in Study Area 2 and Study Area 3 (see Figure 2.1b) over a period of approximately five years or more, depending on actual mining conditions and relevant market drivers.

All existing ancillary surface facilities, supporting infrastructure, workings and their associated uses will continue to be relied upon by the Awaba Colliery (no significant change) as outlined further in Section 4.3 below. These aspects of the Project will continue to be used until such time as the Awaba Colliery is placed on care and maintenance, and thereafter throughout that phase also.

When the Awaba Colliery is placed on care and maintenance, this will be done in accordance with the *Life of Mine Plan* approved by I&I in 2009, until such time that a final Detailed Life of Mine Strategy has been developed as described in Section 4.10.

4.3 Mining

There will be no significant changes to mining methods explained in Section 3.1 for the Project. This includes predicted subsidence levels and operational structure. Production rates may be slightly increased from approximately 800,000 to 880,000 tonnes per annum, depending on mining efficiency and market demands. This section provides an overview of existing areas of mining at Awaba Colliery, including a proposed extension into East B Area and continuation of mining in existing sections of the Main South Area (Stage 2 and Revised Stage 3 areas), as outlined below. Mine design and subsidence is further detailed in Section 7.0.

The proposed East B Area contains a proportion of coal that extends beyond the existing footprint of mining at Awaba Colliery and includes areas of both existing workings and areas requiring new workings to be developed. Subsequently, areas of new workings are lateral extensions to the mine footprint which will require new development approval (being sought under the current Part 3A application). The East B area is located to the east of the Main South Stage 2 Area. The overlying surface in the East B Area is predominantly bush land on crown land leased to Centennial Newstan and contains no significant surface infrastructure. This area forms *Study Area 3* for the Project, as illustrated on Figures 2.1a and 2.1b.

Mining will also be continued at Awaba Colliery in two (2) separate areas, these have been outlined below and illustrated as *Study Area 2* on Figures 2.1a and 2.1b:

- Remaining sections of Stage 2 of the Main South Area (currently being mined) – this area was approved by I&I in September 2008 following an SMP application (as modified) under the NSW *Mining Act, 1992*.
- Revised Stage 3 Area (of Main South Area) – this area has recently undergone a number of specialist surveys relating to a SMP application submitted in December 2009 (approval currently awaited from I&I prior to December 2010).

Mining operations commenced at the Awaba Colliery in 1947, prior to the commencement of any planning controls, and have continued without abandonment since that time. Consequently, the Awaba Colliery presently operates pursuant to section 109(1) of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) and clause 6B(1) of the *State Environmental Planning Policy (Major Development) 2005*. Existing areas of mining within the above-mentioned three (3) mining areas have historically been undertaken under continuing use rights afforded under these pieces of legislation, and whilst these rights continue, the current Part 3A application also includes these areas in order to provide the mine with clarity, certainty and consistency for ongoing mining operations.

Annual production, handling and distribution of approximately 880,000 tonnes per financial year is required.

Existing mining areas, as detailed in Section 3.1 and illustrated on Figure 3.1, will continue to be utilised for ongoing mining operations including (but not limited to) mine access, emergency management and underground services and infrastructure.

4.4 Coal Handling, Processing, Stockpiles and Dispatch

No changes are proposed to the current coal handling, preparation or stockpile procedures to the existing operations detailed in Section 3.4.

The Awaba Colliery requires approval to deliver coal via the private haul road to the Newstan Colliery ROM coal stockpile (in addition to the Rail Loop stockpile). This is assessed within Study Area 4. Newstan Colliery has submitted an application to modify its development consent in order to process coal received from the Awaba Colliery (as described in Section 3.4.1).

4.5 Plant and Equipment

No changes are proposed to the typical plant and equipment used at the Awaba Colliery described in Section 3.5.

4.6 Mine Support Facilities and Site Access

No changes are proposed to the current infrastructure and facilities described in Section 3.6, with the only exclusion being the expansion of the Pollution Control Dam (PCD) explained further below in Section 4.8, with related water management considerations detailed in Section 9.1.5.

Mine access from Wilton Road will continue to be utilised and no significant change is anticipated from current use.

4.7 Transport

No changes are proposed to the current transport procedures. The Project will continue to use the Newstan-Eraring private haul road to transport coal from the operations to Newstan and Eraring as described in Section 3.7. The private haul road is shown as *Study Area 4* on Figures 2.1a and 2.1b.

4.8 Water Management

The Project will involve the expansion of the existing Pollution Control Dam (PCD), such that the dam will have a capacity to store a 1 in 10 year Annual Recurrence Interval 24 hour storm. This expansion will improve the Water Management for Awaba Colliery by increasing the site's dirty water storage capacity.

The 10 South Bore described in Section 3.8 will continue to be used for groundwater management and underground dewatering under both operational and care and maintenance conditions. Further discussion regarding the 10 South Bore is included in Section 9.1.

No increase in potable water demand rate is required.

The domestic wastewater generation rate from the Pit Top facilities will be similar to that which currently exists as there is no plan for an increase or significant change in staff numbers. Disposal of the domestic wastewater will remain as currently exists at site.

4.9 Employment

Employment levels at the Awaba Colliery would be essentially unchanged from those presented in Section 3.10. This will remain the case until the mine is placed into a care and maintenance operating role.

4.10 Rehabilitation and Final Landform

Progressive rehabilitation will continue to be undertaken in accordance with the approved Life of Mine Plan described in Section 3.11 and obligations of Consolidated Coal Lease CCL746. During the life of the Project small portions of the 17 hectares used for services and infrastructure are to be decommissioned and rehabilitated progressively as deemed appropriate.

Following the completion of mining within the proposed areas for the Project, Awaba Colliery will be placed into care and maintenance until a final life of mine strategy can be developed in consultation with relevant stakeholders.

It is also noted that other areas of historical existing workings within the Consolidated Coal Lease and beyond the Application Area (dating back to 1947) will continue to be managed and rehabilitated post-mining (where required) in accordance with the requirements of the Life of Mine Plan and CCL746 in consultation with I&I, with measures including (but not necessarily limited to) the following:

- Ongoing quarterly subsidence inspections;
- Any subsidence identified will be managed in accordance with the Awaba Colliery Public Safety Management Plan and the Watercourse Management Plan, which include remediation strategies;
- I&I to be notified upon identification of subsidence;
- Rehabilitation of subsidence will be reported in the AEMR; and
- Security deposit is held by I&I for the ongoing implementation of rehabilitation within the historical workings.

Notwithstanding the above, the following specific obligations under CCL746 will be completed prior to relinquishment of the lease following mine closure:

- Rehabilitation of surface of any lands disturbed by mining operations and associated activities to the satisfaction of the Minister (of I&I) (in accordance with Section 20);
- Upon completion of operations on the surface or expiry of the lease, buildings, machinery, plant, equipment, constructions and works as may be directed by the Minister shall be removed and the surface rehabilitated and left in a clean, tidy and safe condition to the satisfaction of the Minister (I&I) (Section 25);
- Where rehabilitation is required, in accordance with Section 26, Centennial shall:
  - Reinstate, level, regrass, reforest, and recontour areas that have been damaged or deleteriously affected by mining operations and ensure such areas are permanently stabilized to the satisfaction of the Minister;
  - Fill in, seal or fence any excavation within CCL746 to the satisfaction of the Minister.

5.0 PLANNING CONSIDERATIONS

The Project is subject to the legislative requirements of the Commonwealth and State, as well as local planning and environmental frameworks where applicable. This section describes the approval pathway for the Project, as well as discussing the Project in the context of these legislative requirements.

5.1 Commonwealth Legislation

5.1.1 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999 (Cth)* (EPBC Act) commenced on 16 July 2000 and is administered by the Commonwealth Department of the Environment, Water, Heritage and the Arts (DEWHA).

Part 3 of the EPBC Act states that an action which "*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 of the Commonwealth Minister for Environment, Heritage and the Arts (the Minister).

In January 2007 the Commonwealth and NSW governments signed a Bilateral Agreement which allows the assessment regimes under Part 3A, Part 4 and Part 5 of the EP&A Act to be automatically accredited under the EPBC Act. The Bilateral Agreement applies only to proposals that the Minister has determined are controlled actions under the EPBC Act, with the exception of nuclear actions (DoP 2007).

The flora and fauna investigations carried out for the Project have determined that there are threatened species and EEC's, which are listed under the EPBC Act, within the Application Area. Consequently, Centennial will refer this action to the Minister under the relevant provisions of the EPBC Act. Further information on flora and fauna is provided in Section 9.9.

5.1.2 National Greenhouse 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 (DCC, 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 the Awaba Colliery.

5.1.3 Native Title Act 1993

The Native Title Act (NTA) recognises that Aboriginal people can have rights and interests to land which derives from their traditional laws and customs. Native title rights can include rights to: live on the land, access the land for traditional purposes, protect important places and sites, collect food and medicinal resources from native plants, hunt and fish, teach traditional law and customs, and to have input into landuse practices and development planning. Native title can be negotiated in three ways; through a Native Title Claim (applications and determinations), through an Indigenous Land Use Agreement (ILUA), or future act agreements.

An ILUA is an agreement between a native title group and other parties who use or manage the land and waters. The ILUA process allows for negotiation between indigenous groups and other parties over the use and management of land and water resources, as well as providing a means for coming to a formal agreement. ILUA are binding once they have been registered on the Native Title Tribunal's Register of Indigenous Land Use Agreements.

Lands within the Project study areas are subject to an ILUA which was entered into on the 28th of May 1999 by the Wonnarua People (Wonnarua Nation Aboriginal Corporation) and Powercoal Pty Ltd which has since been acquired by Centennial. As such, Centennial is bound by the terms of the ILUA which are set out in the Master Deed. Clause 7 of the Master Deed outlines Centennials obligations, including provisions for compliance with an Aboriginal Heritage Protection Protocol (Clause 7.2). The Aboriginal Heritage Protection Protocol is set out in Schedule 5 of the Deed, providing detail regarding cultural heritage protocols. In particular, Schedule 5 requires that an Aboriginal Cultural Heritage survey needs to be undertaken where there is

potential for mining operations to impact land which has not previously been mined or areas which have not previously been subject to heritage investigations. At least 30 days notice needs to be given to the Wonnarua People if land is to be disturbed by mining and a survey needs to be undertaken by a representative of the Wonnarua People and may also include; an archaeologist, surveyor, or representative of Centennial.

The Deed is subject to a confidentiality clause (being clause 18) and as such detailed commentary regarding the Deed, between the Wonnarua people and Centennial, are not provided in this document.

5.2 NSW State Legislation

5.2.1 Environmental Planning and Assessment Act 1979

Mining operations commenced at the Awaba Colliery in 1947, prior to the commencement of any planning controls, and have continued without abandonment since that time. Thus, mining at the Awaba Colliery is not presently carried out under any existing planning approval under the EP&A Act, but operates pursuant to continuing use rights under section 109(1) of the EP&A Act and clause 6B(1) of the *State Environmental Planning Policy (Major Development) 2005*.

Part 3A of the EP&A Act provides an approval process for projects deemed to be Major Projects.

Section 75B(1) of the EP&A Act defines projects to which Part 3A applies:

> *This Part applies to the carrying out of development that is declared under this section to be a project to which this Part applies:*
>
> *(a) by a State environmental planning policy, or*
>
> *(b) by order of the Minister published in the Gazette (including by an order that amends such a policy). …*

Schedule 1 of the State Environmental Planning Policy (SEPP) (Major Development) 2005, also referred to as the Major Development SEPP, describes development that is declared to be a project to which Part 3A of the EP&A Act applies. The Project was considered to be a project to which Part 3A of the EP&A Act applies under Schedule 1, Group 2 (*Mining, petroleum production, extractive industries and related industries*) clause 5, sub clause (1)(a) of the Major Development SEPP:

> *5 Mining*
>
> *(1) Development for the purpose of mining that:*
>
> *(a) is coal … mining, …*

5.2.2 Other NSW legislation

Mining Act 1992

Centennial currently holds mining lease CCL 746 over the majority of the Application Area (excluding the private haul road), as illustrated in Figure 2.3. An SMP Application for the Revised Stage 3 Area was submitted to I&I in December 2009. An SMP for Stage 2 of the Main South Area was approved in 2005 and updated in 2008 by I&I for the current mining method.

Protection of the Environment Operations Act 1997 (POEO Act)

The POEO Act is administered by the Department of Environment, Climate Change and Water (DECCW) and requires licensing for environmental protection, including waste generation and disposal, water, air, and noise pollution. Awaba Colliery currently operates under current Environment Protection Licence 443 (EPL443) and would continue to do so for the life of the Project. A variation to EPL443 may be sought for inclusion of any relevant changes under the Project.

Water Management Act 2000 and Water Act 1912

The *Water Act 1912* and *Water Management Act 2000* contain provisions for the licensing of water capture and use. It is understood that a formal Water Sharing Plan recognised under the *Water Management Act 2000* is not currently in place for the area of the Project. Subsequently, the *Water Act 1912* is relevant to the Project with respect to potential licensing requirements.

The Project may require approvals and/or water licences under the *Water Act 1912*, administrated by NSW Office of Water, for groundwater and surface water extraction, where applicable. These would be obtained, as required, in accordance with the prescriptions of the Act following approval.

National Parks and Wildlife Act 1994

Under section 75U(1)(d) of the EP&A Act, a permit under section 87 or consent under section 90 of the NP&W Act is not required for a project approved under Part 3A of the EP&A Act.

Heritage Act 1977

Under section 75U(1)(c) of the EP&A Act, an approval under Part 4, or an excavation permit under section 139 of the *Heritage Act 1977,* is not required for a project approved under Part 3A of the EP&A Act. In addition, section 75U(2) of the EP&A Act, Division 8 of Part 6 of the *Heritage Act 1977* does not apply to prevent or interfere with carrying out of an approved project.

Threatened Species Conservation Act 1995

An ecological assessment was undertaken to identify any threatened species in the Application Area, as well as strategies for the management and mitigation of impacts. Results of the ecological assessment are discussed further in Section 9.9.

5.2.3 State Environmental Planning Policies

The following State Environmental Planning Policies (SEPP's) were considered regarding the Project.

SEPP (Major Development) 2005

SEPP (Major Development) 2005 defines certain developments that are major projects requiring assessment under Part 3A of the EP&A Act and determination by the Minister for Planning. It was formerly known as the SEPP (Major Projects) 2005. Schedule 1 of the SEPP identifies development for the purposes of coal mining as a project to which Part 3A applies.

SEPP (Mining, Petroleum Production and Extractive Industries) 2007

This SEPP aims to provide for the proper management and development of mineral, petroleum and extractive material resources for the social and economic welfare of the State. Clause 5 of the SEPP addresses its relationship with other environmental planning instruments. Subclause (3) and subclause (4) are relevant to the Project.

> (3) *Subject to subclause (4), if this Policy is inconsistent with any other environmental planning instrument, whether made before or after this Policy, this Policy prevails to the extent of the inconsistency.*
>
> (4) *Subclause (3) does not apply to any inconsistency between this Policy and any of the following State Environmental Planning Policies:*
>
> (a) *State Environmental Planning Policy (Major Development) 2005,*
>
> (b) *State Environmental Planning Policy No. 14 – Coastal Wetlands,*
>
> (c) *State Environmental Planning Policy No. 26 – Littoral Rainforests,*
>
> *Regardless of when the inconsistency arises.*

Therefore, if there were any inconsistencies between the *Lake Macquarie LEP 2004*, and the *SEPP (Mining, Petroleum Production and Extractive Industries) 2007*, the latter would prevail. Clause 7(1) of the SEPP states that underground mining may be carried out on any land with development consent. The proposed development is for underground mining and is therefore permissible with consent in the location of the Application Area.

This SEPP also removed mining developments from Schedule 1 of SEPP 11 – Traffic Generating Development, meaning that SEPP 11 no longer applies to mining projects.

The following clauses within this SEPP will also need to be considered duirng approval of this Project:

- Clause 13 – addresses the relationship between the proposed development and potential impact on land use(s)

- Clause 14 – addresses the relationship between the proposed development and the potential impact on natural resource and environmental management. Subclause 2 states an assessment of greenhouse gas emissions from the development must be assessed as part of this development.
- Clause 15 – states that the consent authority must consider the efficiency of the development in terms of resource recovery, reuse, recycling and minimisation of waste.
- Clause 16 – refers to a number of transport conditions including transportation by public roads, limitation of truck movements and consultation requirements with the RTA.
- Clause 17 – refers to a number of rehabilitation conditions, including:
  - Preparation of a plan showing the end use of rehabilitation
  - Waste generation and soil contamination
  - Ensure rehabilitation practices during and at the completion of rehabilitation do not jeopardise public health.

SEPP 33 – Hazardous and Offensive Development

SEPP 33 - Hazardous and Offensive Developments requires the consent authority to consider whether an industrial proposal is 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.

If the storage of Dangerous Goods is required, then a licence will be applied for from the WorkCover Authority NSW.

SEPP 44 – Koala Habitat Protection

The aim of SEPP 44 is to encourage the '*proper conservation and management of areas of natural vegetation that provide habitat for Koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline*.' Schedule 1 lists the local government areas to which SEPP 44 applies, and requires an investigation be carried out to determine if 'core' or 'potential' Koala habitat is present and is likely to be disturbed. Lake Macquarie LGA is currently listed under Schedule 1. SEPP 44 applies to the extent that a consent authority is restricted from granting development consent from proposals on land identified as core koala habitat without the preparation of a Plan of Management. Due to the limited amount of disturbance proposed by the Project this SEPP was not considered likely to be applicable, however, the ecological assessment prepared for the EA has addressed this issue. Further discussion is provided in Section 9.9.

5.3 Regional Environmental Plans

As of 1st July 2009, Regional Environmental Plans (REPs) are no longer part of the hierarchy of environmental planning instruments in NSW. All previous REPs are now deemed SEPPs.

The Hunter Regional Environmental Plan 1989 has been repealed by the SEPP (Repeal of REP Provisions) and therefore has not been considered for this Project. Furthermore, while the Hunter REP 1989 (Heritage), which is now a deemed SEPP, applies to the Lake Macquarie LGA, there are no items listed within the schedules to which this SEPP applies that occur within the Application Area.

5.4 Local Environmental Plan

5.4.1 Lake Macquarie Local Environmental Plan 2004

The Study Area is located within the Lake Macquarie Local Government Area. With regard to the *Lake Macquarie Local Environmental Plan 2004* (LEP) the pertinent matters are:

- Zonings - the site is part Zone 9 Natural Resourses and part Zone 7(2) Conservation (Secondary); and
- Clause 19 – development for the purpose of a mine.

Despite these provisions of the LEP, the relevent, prevailing planning instrument is the Mining SEPP as discussed in Section 5.2.3.

6.0 CONSULTATION & SOCIO-ECONOMIC IMPACTS

6.1 Introduction

This section of the EA provides an outline of the strategy and processes undertaken to identify and consult with relevant stakeholders for the Project. The process was used in determining perceived issues for consideration within the various risk-based assessments undertaken for the Project. Potential socio-economic conditions, impacts and benefits relevant to well-being associated with the project are also included in this section.

A *Stakeholder Engagement Plan (SEP)* was specifically developed by Centennial for the Project under which stakeholder identification and consultation has been undertaken. This includes ongoing consultation with local and state government authorities, neighbouring landholders, Aboriginal groups and other relevant stakeholders.

The purpose of the SEP was to provide a consistent management framework to identify and consult with stakeholders with an interest in the Project and to ensure appropriate monitoring and reporting of community initiated enquiries.

The Stakeholder Engagement Plan was developed to perform the following tasks:

- Identify Awaba Collieries stakeholder groups;
- Manage and facilitate the engagement of stakeholders;
- Identify mechanisms for communicating with stakeholders;
- Define means of recording feedback from stakeholders and the mine's response;
- Ensure appropriate monitoring and reporting of community initiated enquiries and contact; and
- Ensure contact information is maintained and monitored in the Centennial Environment and Community Database (ECD).

In addition to this, Awaba Colliery maintains an environmental complaints database on-site as part of their operation in order for any community concerns to be received. A record of all stakeholder engagement for the Project is included in Appendix 2.

In the absence of an existing study or investigation, socio-economic impacts of the Project were considered within the BBRA to have the potential to be a significant risk in the context of failure to attain project approval that could result in adverse socio-economic impacts in the surrounding community and the Local Government Area (LGA). Accordingly, a Social Impact Assessment (SIA) has been developed by Centennial for the Project and is included in Appendix 3. The purpose of the SIA was to:

- Identify the perceived impacts and concerns of the community and stakeholders and how the perceived impacts are considered and assessed within the EA;
- Provide assessment of any potential socio-economic impacts from the Project; and
- Identify and develop mitigation measures where necessary.

The SIA has been developed to identify the perceived impacts for the Project as identified through the consultation process, and assess potential socio-economic impacts of the Project. The assessment of these perceived risks has been undertaken with reference to the specific technical assessments undertaken by various specialists for the Project. It is noted that a technical risk assessment was undertaken for the Project and is explained in Section 8. The sections below provide a summary of the consultation undertaken for the Project, and the perceived impacts for the Project.

6.2 Consultation Strategy and Stakeholder Identification

A background to the Local Government Area (LGA) and community that the Project is situated within is outlined below for context, and the strategy to identify and consult with the community and stakeholders, is provided in the following sections.

The Lake Macquarie LGA is located 100 km northeast of Sydney on the NSW east coast, directly north of the Wyong LGA. The region covers an area of 754 square kilometres comprising a landscape of mountains, beaches and coastal plains encircling Lake Macquarie, coastal saltwater lagoon. Lake Macquarie is on the southern border of the coastal Hunter region and the city of Lake Macquarie is the fastest growing region in the Hunter. The Lake Macquarie LGA is the fourth most populous in NSW. The larger urban centres in the region are Toronto, Belmont, Morisset, Swansea/Caves Beach and Charlestown. Covering 110 square kilometres with 174 kilometres of shoreline, Lake Macquarie is the dominant landscape feature of the region, accounting for 14.5% of the LGA's area.

The majority of land in the Lake Macquarie LGA is zoned for residential purposes. Industry takes up the next largest portion of land, followed by intensive agriculture and rural land. A large portion of land in the LGA is part of the Watagans National Park. Open space accounts for over 2,000ha of the Lake Macquarie LGA, which is used primarily for the many recreational activities for which the area is famous (SoER, 2009).

6.2.1 Consultation Strategy

The consultation process involved the development of a SEP for the Project and implementation of the consultation strategy outlined in Appendix 2 and Appendix 3. A summary of the strategy is outlined below:

- Prepare a Preliminary Environmental Assessment (PEA) and make the document publicly available following submission to the Department of Planning;
- Advertise to the community to make them aware of the Project;
- Hold one-on-one consultations, site inspections and further discussions with key stakeholders/authorities, providing additional information if/where required to address any issues;
- Conduct specific consultation with the Aboriginal Community in accordance with the ICCRs of the DECCW (Interim Community Consultation Requirements, 2004);
- Address any feedback received following consultation within the Project;
- Submit an Environmental Assessment (EA) for adequacy review by Department of Planning and address any concerns (if required);
- Submit final Environmental Assessment and make publicly available following submission to the Department of Planning; and
- Respond to any submissions once the Environmental Assessment is available for public/stakeholder comment.

Centennial has undertaken consultation, in accordance with the SEP, with local and state government authorities, Aboriginal groups and other relevant stakeholders for this Project. It is noted that in addition to the consultation undertaken for the Project, there has also been an extensive history of consultation undertaken by the Awaba Colliery during separate SMP application processes for both the Main South Stage 2 and Revised Stage 3 Areas (Study Area 2).

6.2.2 Stakeholder Identification

In accordance with the Stakeholder Engagement Plan, the Awaba Colliery has identified relevant stakeholders for inclusion in the consultation process for the Project. The consultation process for the Project has allowed the Awaba Colliery to effectively maintain and continue to develop trust through ongoing engagement and communication; contribute to good working relationships by proactively anticipating and addressing concerns about the Project; and, provide a framework for incorporating community feedback into internal/external reviews and addressing community concern. Stakeholders identified for the Project includes those listed in the following sections.

6.2.2.1 Government Agencies

The consultation for the Project involved the preparation of a Preliminary Environmental Assessment (PEA) that was submitted to the NSW Department of Planning (DoP) in order to allow DoP to assess any potential issues and provide the Director General Requirements (DGRs) to be addressed within this Environmental Assessment.

In order to appropriately provide the DGRs for the Project, DoP requested that Centennial provide relevant government agencies with a copy of the PEA and asked that they provide comments to DoP. A summary of consultation with relevant government agencies and any perceived issues for the Project is included in Section 6.3.1.1. The relevant government agencies consulted for the Project included:

- NSW Department of Planning;
- Industry and Investment NSW;
- NSW Department of Environment, Climate Change and Water;
- NSW Office of Water;
- Hunter-Central Rivers Catchment Management Authority;
- NSW Roads and Traffic Authority;
- Lake Macquarie City Council; and
- NSW Mine Subsidence Board.

6.2.2.2 Community

Community consultation for the Project was undertaken by Centennial in accordance with the SEP, which provides the consultation strategy to be implemented and identifies the relevant stakeholders for the Project. Consultation included:

- *Advertisement* - an article published in the Lakes Mail regarding the Project notifying the community of the Project;
- *Community Newsletter* - residents of Awaba village and a member of the Newstan Colliery Community Consultation Committee whom resides in Awaba village were provided with a newsletter with details of the Project.
- *Public Exhibition of the PEA* - the PEA was also made publically available on the DoP and Centennial websites.

It is recognised that the employees of Awaba Colliery comprise an important part of the community and have been identified in the existing SEP for ongoing consultation for the Project.

Community consultation for the Project is summarised in Section 6.3.1.2.

6.2.2.3 Other Relevant Stakeholders

There are a number of other relevant stakeholders that have been engaged in consultation with the Awaba Colliery during previous SMP applications for both the Main South Stage 2 (2005/2007) and Revised Stage 3 Areas (2009), which comprise the mining areas within Study Area 2. These relate to the non-mine owned infrastructure within the mining subsidence impact areas in Study Area 2. Details of the consultation undertaken for the previous SMP applications are summarised in Section 6.3.1.3 and provided (in full) in the SMP written reports available on the Centennial website – www.centennialcoal.com.au. These stakeholders included:

- Energy Australia;
- Telstra;
- RailCorp; and
- Eraring Energy.

The outcomes of consultation with other relevant stakeholders is summarised in Section 6.3.1.3.

6.2.2.4 Aboriginal Community

The consultation process with local Aboriginal stakeholders followed the *Interim Community Consultation Requirements* (ICCRs) (DECCW, 2004). These guidelines were followed for key processes required including identifying Aboriginal parties, providing them with information and consulting with them on methodology, assessment and the recommendations for management of the sites. The registered groups and / or individuals identified for the Project included:

- Awabakal Traditional Owners Aboriginal Corporation
- Daniella Chedzey
- Wonn1 Contracting
- Awabakal Descendants Traditional Owners Aboriginal Corporation
- Gidawaa Walang Cultural Heritage Consultancy
- Wonnarua Nation Aboriginal Corporation
- NSW Aboriginal Land Council acting on behalf of Koompahtoo Local Aboriginal Land Council (KLALC)

Consultation with the Aboriginal community is summarised in Section 6.3.1.4 and discussed in further detail in Section 9.2.2and the specialist report in Appendix 6.

6.3 Impact Assessment

6.3.1 Identified Impacts

A variety of issues were raised by identified stakeholders throughout the consultation process. These issues have been recognised within the EA and are summarised in the following sections below.

6.3.1.1 Government Agencies

The relevant government agencies involved in the consultation process for the Project are listed in Section 6.2.2.1. These agencies were afforded the opportunity to provide feedback on the PEA and input into the specific DGRs for the Project. A summary of the concerns raised by government agencies and how each of these has been addressed is provided in Table 6.1.

Table 6.1 – Government Agencies Issues and Response

Stakeholder	Issues Raised/Comments	Section Where Addressed
DoP	Director General Requirements for the Project were issued on the 22/04/10	These have been discussed in **Section 1.6** and addressed throughout this report.
I&I	Requested specific statement of commitment for subsidence monitoring and rehabilitation post mining, rehabilitation to be discussed including post mining land use and landforms, rehabilitation objectives and mine closure completion criteria.	Rehabilitation is discussed in **Sections 3.11, 4.10** and **9.4**, in addition, the approved Life of Mine Plan has been updated to encompass these requirements.
DECCW	Key information requirements requested by DECCW are: the impacts on water quality; the impacts on quantity in water resources; subsidence impacts; and the impacts on threatened species and their habitat.	These have been considered in the preparation of the key specialist reports for the Project and are discussed within **Section 9.1**.
NOW	Requested that the following be identified/addressed; no hydraulic connection between the mining operation and surface water sources (including connected alluvium), no impact on adjacent licensed water users, basic landholder rights, minimum base water flows in Stony or Kilaben Creeks, or groundwater dependant ecosystems, finalisation of mine operations which prevents ingress of surface water flows to mine workings.	These have been considered in the preparation of the water management assessment and are discussed in **Sections 9.1, 9.2** and **9.3**.

Stakeholder	Issues Raised/Comments	Section Where Addressed
HCRCMA	***No major issues were raised***, however, it was noted that the Hunter-Central Rivers Catchment Action Plan be included in the list of references for the Project.	**N/A**
RTA	***No major issues were raised***, however, RTA provided the guidelines for traffic generating development to be included in the list of references for the Project. RTA also requested that Lake Macquarie City Council be consulted regarding the traffic assessment requirements.	The guidelines were considered in the preparation of the traffic assessment and are discussed in **Section 9.3**, while consultation with the RTA and LMCC is discussed in **Appendix 8**.
LMCC	***No major issues were raised***, however, LMCC provided a number of planning documents and guidelines to be included in the list of references for the Project.LMCC were also consulted during the specialists traffic assessment, no issues were raised.	These have been considered in the preparation of the relevant key specialist reports and this EA.
MSB	A presentation by Awaba Colliery to MSB was undertaken by Centennial Newstan as part of the SMP Application in October 2009, which included a discussion on the proposed Revised Stage 3 and East B areas, infrastructure, past operations in the Main South area and the strata behaviour & subsidence results to date. ***No issues were raised.***	**N/A**

As demonstrated in Table 6.1, all perceived issues with the exception of infrastructure have been considered within the EA including through the completion of specialist assessments.

In addition, the SIA conducted an analysis of potential socio-economic impacts associated with the Project and social infrastructure/services which include those provided by government agencies. This consists of facilities and services that support the community of Awaba including: roads, school, medical, shops, sewage treatment, electricity and water supply.

The Awaba Colliery Mining Project will potentially increase production from 800,000 to 880,000 tonnes per annum whilst employment levels are not expected to change significantly. The Project will utilise existing plant, equipment and infrastructure and will not result in any significant requirements or impacts upon the existing social infrastructure. The Awaba Colliery has been operating continuously at the site since 1947 and to date no formal complaints regarding social infrastructure impacts have been received (indeed, Awaba Colliery has been acknowledged for its support to the local community including schools and sporting clubs).

With respect to roads and potential traffic generation, the specialist traffic assessment for the Project (GHD 2010c) concluded that no additional traffic will be generated by the Project. Employment levels for Awaba Colliery will reduce over time due to the number of employees and contractors being reduced towards end of mine life. Deliveries are expected to remain similar to current levels until the end of mine life. The private haul road will continue to be used for coal haulage such that no public roads are used. Notwithstanding this, the traffic impact assessment for the Project found that Wilton Road had more than sufficient capacity to handle continued growth up to 2020 (GHD 2010c, see Appendix 8).

6.3.1.2 Community

As outlined earlier, community consultation for the Project involved advertisements in the local print media, newsletters and the PEA (which was made publically available on the DoP and Centennial websites). As shown in Table 6.2, there have been no issues raised during the community consultation for the Project.

Table 6.2 – Community Issues and Response

Stakeholder	Issues Raised/Comments	Section Addressed
Awaba Colliery Employees	***No issues were raised***.	**N/A**
Awaba village residents	***No issues were raised***.	**N/A**
General public responses to advertisement/PEA exhibition	***No issues were raised***.	**N/A**

6.3.1.3 Other Relevant Stakeholders

As mentioned in Section 6.2.2.3 the other relevant stakeholders identified for the Project related to the non-mine owned infrastructure within the mining subsidence impact areas. As there are no infrastructure items within Study Area 3, and all infrastructure owners for mining areas in Study Area 2 have previously been consulted during SMP Applications which indicated that they were satisfied with the level of management for the Awaba Colliery operations, it was considered appropriate that the consultation strategy for the Project and this EA not necessarily include these stakeholders as existing consultation and management plans has been adequate. Table 6.3 provides a summary of the consultation undertaken for the previous SMP applications.

Table 6.3 – Other Relevant Stakeholders Issues and Response

Stakeholder	Issues Raised/Comments	Section Addressed
Energy Australia	Consultation has been completed with Energy Australia for the previous SMP applications[1]. These processes involved the preparation of management plans that addressed any concerns. ***No further issues were raised***. In addition, Energy Australia was also provided information regarding the Project. ***No issues were raised***.	**N/A**
Telstra	Consultation has been completed with Telstra for the Revised Stage 3 SMP application. A management plan for infrastructure items was prepared and signed off by both Telstra and Awaba Colliery. ***No further issues were raised***. In addition, Telstra was also provided information regarding the Project. ***No issues were raised***.	**N/A**
RailCorp	Consultation has been completed with RailCorp for the previous SMP applications[1]. Mine design has been specifically been prepared to address any concerns regarding the Main Northern Railway and associated infrastructure. ***No further issues were raised***.	**N/A**
Eraring Energy	Consultation has been completed with Eraring Energy for the previous SMP applications[1]. These processes involved the preparation of management plans that addressed any concerns. ***No issues were raised***. Contact was made with Eraring Energy on 20th August 2010 regarding 10 South Bore. Eraring Energy is aware of the bore and its input into the Eraring Ash Dam. ***No initial issues were identified and consultation is ongoing.***	**N/A**
Note 1: 'previous SMP applications' refers to both previous applications to the Project that make up Study Area 2 (Main South Stage 2 and Revised Stage 3 Areas).		

6.3.1.4 Aboriginal Community

As outlined earlier above, consultation with the Aboriginal community was undertaken in accordance with the ICCRs (DECC, 2008). In addition to consultation being undertaken for the entire Project, it is also noted that consultation (and field surveys) has also previously been undertaken for each of the proposed mining areas as summarised in Section 9.2 of the EA and detailed in the specialist Cultural Heritage Assessment report in Appendix 7. Table 6.4 provides a summary of the consultation undertaken with the Aboriginal community. Further details regarding the assessment and management of the identified issues are discussed within Section 9.2.

Table 6.4 – Aboriginal Community Perceived Issues and Response

Stakeholder	Issues Raised/Comments	Section Addressed
Aboriginal and other Interested Groups	Aboriginal consultation has been completed for the previous SMP applications[1]. This has included a number of field surveys and individual specialist assessments covering the Application Area. The recommendations and accompanying management plans from these specialist assessments have typically addressed any concerns regarding the Aboriginal heritage management at Awaba Colliery. ***No further issues were raised***.	**Section 9.2**
Note 1: 'previous SMP applications' refers to both previous applications to the Project that make up Study Area 2 (Main South Stage 2 and Revised Stage 3 Areas).		

6.3.2 Socio-Economic Impacts

The SIA for the Project identified a range of socio-economic conditions related to well being, and impacts associated with the Project. The majority of socio-economic impacts relating to well-being associated with the Project have been addressed by specialty reports (eg noise, air quality, water, traffic, heritage etc). The exceptions to these are economic contributions and employment (see Table 6.5). Relevant mitigation measures that have been recommended by these reports are provided in Appendix 3 and are summarised in Section 6.5. Economic contributions and employment are discussed in further detail below in Sections 6.3.2.1 and 6.3.2.2.

Table 6.5 – Summary of Indentified Socio-economic Impacts and Response

Socio-Economic Impact	Response
Economic contributions	This was identified by the SIA and has been discussed in **Section 6.3.2.1**.
Traffic	A traffic assessment was undertaken for the Project and is discussed in **Section 9.3**. The traffic assessment is also included as **Appendix 8** to this EA.
Hazard Management	Hazard management at the Awaba Colliery includes a number of plans and systems for management of hazardous materials, as well as, bushfires and spontaneous combustion. These plans and systems are discussed in detail in **Section 9.12**.
Aboriginal & European Heritage	A Cultural Heritage Impact Assessment (CHIA) for the Awaba Colliery was undertaken for the Project and is discussed in **Sections 9.2** (Aboriginal) and **9.5** (European). The CHIA is also included as **Appendix 7** to this EA.
Employment	This was identified by the SIA and has been discussed in **Section 6.3.2.2**.
Environment	The potential social impacts upon noise, air quality, water and ecology were identified by the SIA. Each of these environmental aspects has been assessed by a specialist consultant and is discussed in **Sections 9.1, 9.6, 9.7** and **9.9**, respectively. It is noted that each of these assessments are also included as appendices to this EA for further information.

6.3.2.1 Economic Contributions

The Awaba Colliery currently makes annual economic contributions of $40.5 million (see Table 6.6). Approximately half of these contributions are in the form of invoices paid which has significant flow on effects throughout the community/region/state. $15.7 million is paid in gross wages annually, which in turn has positive impacts upon the employment rate of the region and the local and regional economies. The local and NSW governments also receive a combined annual contribution of $1 million in taxes and rates. Economic contributions of the Awaba Colliery also provide flow on effects throughout the regional economy. The Awaba Colliery also provides financial support in the form of sponsorship to a variety of community organisations and events throughout the Lake Macquarie Local region. These include:

- Macquarie Scorpions Rugby League Football Club;
- Team Lake Macquarie 2010;
- Life Education Australia;
- Carols by the Lake 2009;
- The Southlake Christmas Spectacular 2009;
- Westpac Rescue Helicopter;
- Toronto Meals on Wheels;
- Awaba Public School;
- Paddlefest 2010;
- Westlakes Junior Soccer Club; and
- The Lake Macquarie Australia Day Festival 2010.

Table 6.6 – Awaba Colliery Annual Economic Contributions

Item	Contribution
Gross Wages (Awaba Colliery employees only)	$14.8M
Gross Wages (Mining Contractor only)	$0.9M
Awaba Colliery Invoices Paid	$19.6M
Local Taxes (including rates and contributions)	$0.3M
State Taxes (including pay roll tax)	$0.7M
Royalties	$4.2M
Total	**$40.5M**

At present, it is anticipated that the Project will recover approximately 2.0 million tonnes of coal, which will be extracted over a period of approximately five years or more, depending on actual mining conditions and relevant market drivers. Accordingly, approval of the Project will result in the continuation of economic contributions.

Further positive economic impacts as a result of the Project include the provision of competitively priced, high quality coal for domestic and international customers to provide for the energy requirements of the people of NSW and elsewhere, and additional export income for Australia with the benefits associated with improved terms of trade.

Some negative impacts would occur within the region in the event that the Project was not approved. The annual economic contributions detailed in Table 6.6 would no longer be injected into the local and regional economy. Associated flow on effects throughout the local community of Awaba and Lake Macquarie region would also be adversely impacted.

6.3.2.2 Employment

The Awaba Colliery employs approximately 100 people, including 88 full time employees and up to a further 12 contractors. Whilst mining only accounts for 1.3% of employment in the Lake Macquarie LGA relative to other industries (see Table 6.7)(Australian Bureau of Statistics (ABS), 2006), mining and mining-related businesses are still intrinsic to the region's economic strength, with Centennial Coal being one of the largest underground coal suppliers in NSW (DoP, 2008). The state of NSW has an average employment within the mining sector of 0.5% (ABS, 2006). The Awaba Colliery employs approximately 100 people (see Table 6.8), this accounts for 6% of the total people employed in the mining industry within the Lake Macquarie LGA.

Table 6.7 – Industry Employment Statistics (Popular Industry Sectors) compared with Mining

Industry	Lake Macquarie LGA		Wyong LGA		NSW	
	Number	Percent	Number	Percent	Number	Percent
Health Care and Social Assistance	10,045	8.6%	6,322	7.5%	304,335	7.0%
Retail Trade	9,812	8.4%	7,830	9.3%	323,929	7.5%
Manufacturing	8,511	7.3%	6,077	7.2%	277,986	6.4%
Mining	1,465	1.3%	244	0.3%	20,318	0.5%
Source: Australian Bureau of Statistics – 2006 Census						

Table 6.8 – Working Arrangement

Work Arrangement	Number of Employees
Full-time	88
Part-time	-
Shift Work	65
Day Shift Only	23

As noted earlier in this section, subject to actual mining conditions and relevant market drivers, at present it is anticipated that the approval of the Project could sustain these positions for a period of approximately five years or more, prior to the mine entering care and maintenance under the approved Life of Mine Plan. This would have positive impacts relating to employment levels in the Lake Macquarie region.

In the event that the Project was not approved there would be negative impacts relating to employment levels at the Awaba Colliery. The positions would likely only be sustained until the completion of existing extraction operations at the end of 2011. This will have no direct impact on employment levels within the town of Awaba (see Table 6.9), although there will be effects throughout the local region. Impacts due to closure would be managed in accordance with the approved Life of Mine Plan.

Table 6.9 – Workforce Residential Location

Location	Number of Employees
Awaba	-
Blackalls Park	4
Lake Macquarie (Other)	24
Other	60

6.4 Consequence of Potential Impacts

6.4.1 Identified Impacts

6.4.1.1 Government Agencies

As discussed in Section 6.3.1.1, the majority of the identified impacts raised through the consultation process with relevant government agencies have been addressed through specific specialist assessments (discussed elsewhere in this EA). As indentified by the SIA and discussed in Section 6.3.1.1, there would be no additional impacts upon the social infrastructure surrounding the Awaba Colliery, or within the local area. It is considered that there would be no consequences from the Project.

6.4.1.2 Community

There were no potential impacts identified, as such there would be no consequences from the Project.

6.4.1.3 Other Relevant Stakeholders

There were no potential impacts identified which have not previously been consulted, assessed and managed for. As such, there would be no additional consequences from the Project.

6.4.1.4 Aboriginal Community

There were no Aboriginal sites requiring AHIMS registration identified for the Project, however, consultation with the Aboriginal community has identified areas of potential archaeological significance. The assessment and future management of these areas has been detailed within Section 9.2.

6.4.2 Socio-Economic Impacts

6.4.2.1 Economic Contributions

The SIA identified that approval of the Project would result in the continuation of some economic contributions until Awaba Colliery enters care and maintenance. This includes contributions in the form of wages, invoices, taxes and contributions to local community organisations and events.

The SIA considered that negative impacts would occur within the region in the event that the Project was not approved. Whilst negative economic impacts would occur if the project failed to gain approval, the consequences are considered relatively minor. It is noted that Centennial continues to maintain a presence within the Lake Macquarie area with a number of other mines, which similarly support local community organisations and events and contribute to wages, invoices and taxes for residents of the Lake Macquarie and surrounding areas.

6.4.2.2 Employment

The approval of the Project could sustain the employment of approximately 100 personnel (staff and contractors) for approximately five years or more, depending on actual mining conditions and relevant market drivers. This would result in positive flow on benefits with the local and surrounding communities. It has been considered that there would be no significant negative consequences from the Project extending life for this period.

6.5 Mitigation & Management Measures

The Project-related benefits for the community surrounding the Awaba Colliery will be maximised and adverse impacts minimised to the greatest extent possible through the implementation of the mitigation measures and management procedures that have been outlined within the specialist assessments outlined in Tables 6.1 and 6.5, and discussed in Section 9. In addition, the following measures and procedures will also ensure positive socio-economic outcomes for the Project:

- The Awaba Colliery will continue to provide ongoing economic contribution to the local community. It is noted that, in the event that the Awaba Colliery was no longer operational a variety of community groups and sporting bodies would potentially be impacted with regard to sponsorship. Centennial operates a number of mine sites throughout the Lake Macquarie region and will continue to maintain its presence and strive to support the community;
- The Awaba Colliery will continue to review any request by a community organisation for support or assistance throughout the life of the Project;
- An open and consultative approach will be maintained with the residents and community surrounding the Awaba Colliery throughout the life of the Project;
- Continued implementation of the Awaba Stakeholder Engagement Plan;
- The existing Awaba Colliery Community Information Line will be maintained for the life of the Project. This will allow the community to pose questions, request information or make complaints about the operation. The Awaba Colliery Community Information Line is (02) 4950 3435; and
- All community complaints and enquiries are recorded in the Awaba Colliery Environment and Community Database. This ensures that any follow-up actions to any complaints received regarding the operation are completed promptly.

6.6 Conclusion

It is estimated that during the life of the Project approximately $81 million would be contributed to the local, regional, state and national economies. It is noted that the Project will provide a continuation of employment for 100 employees and contractors, and will provide beneficial flow-on effects for the local community and surrounding areas.

The continued operation of the Awaba Colliery over the past sixty-three years has provided numerous socio-economic benefits throughout the region. Although it is not predicted that there will be a direct increase in employment or economic activity because of the Project approval, it is however, anticipated that it will effectively sustain the current benefits during the period of active mining at Awaba Colliery. This is very important to the socio-economic wellbeing of the region, which is already subject to a 6.7% rate of unemployment. Therefore, assuming that the Project receives approval, potential adverse socio-economic impacts will be temporarily negated within the region.

7.0 MINE SUBSIDENCE

7.1 Introduction

The term 'subsidence' generally refers to the deformation of the ground mass surrounding a mine due to the mining activity. The term is a broad one, and includes all mining-induced ground movements, including both vertical and horizontal displacement, tilt, strain and curvature (NSW DoP, 2008).

Study Areas 2 and 3 are the areas predicted to be affected by subsidence during the Project, where active mining and coal extraction will be undertaken. Study Area 2 comprises the continuation of mining in existing/historically mined workings within the Main South Area (MSA) (consisting of remaining mining in Stage 2 and the Revised Stage 3 areas). Study Area 3 includes the extension of mine workings into the East B Area, as detailed further in Section 4.3 of this Environmental Assessment.

The following sections provide an overview of mine characteristics, planning and design, and subsidence predictions for the current mining method used at Awaba Colliery, which is proposed to be continued by this Project. This includes discussion of the following aspects:

- Existing geotechnical conditions for the mine;
- The risk-based and conservative approach to mine planning and design to prevent or minimise potential subsidence;
- Previous subsidence monitored in adjacent mined areas (using the current mining method);
- Subsidence predictions for proposed Project mining areas by the specialist subsidence consultant (Seedsman Geotechnics).

Subsidence predictions for Project mining areas were utilised in the environmental risk assessment processes undertaken for the Project (refer Section 8 and Appendix 5), and the subsequent environmental impact assessments detailed throughout Section 9 and within the specialist studies appended to this EA.

7.2 Geotechnical Conditions

7.2.1 Great Northern Seam Profile

Awaba Colliery mines the Great Northern Seam and in the Application Area the depth ranges between approximately 20 metres and 60 metres (refer Figure 7.2). The full thickness of the Great Northern Seam is in the range of 2.5 metres to 3.8 metres depending on the location.

7.2.2 Roof Characteristics - Teralba Conglomerate

The stratigraphic unit above the Great Northern Seam is the Teralba Conglomerate and this extends all the way to the surface. The Teralba Conglomerate generally consists of massive conglomerate and sandstone with minor siltstone and mudstone lenses less than one (1) metre thick and very minor carbonaceous lenses less than 100 millimetres thick (Revised Stage 3 SMP Written Report, 2009). Within the Awaba Colliery lease area, the Teralba Conglomerate thins regionally from greater than 40 metres thick in the west to approximately 20 metres in the east.

The ability for the Teralba Conglomerate to maintain unsupported roof spans, following mining, has been a key mine design factor for the current mining method. Analysis suggests that the Teralba Conglomerate has the ability to span voids for extraction panels up to 150 metres wide, at depths of cover in excess of 30 metres. It is noted that secondary extraction has conservatively targeted panels of width less than 100m, and areas with of depth of cover in excess of 25 metres (with first workings in areas of depth of cover in excess of 20m). .

7.2.3 Floor Characteristics – Awaba Tuff

Over much of the Awaba Colliery the Great Northern Seam is immediately underlain by the Awaba Tuff, which is typically composed of inter-bedded very low to low strength tuffaceous siltstone and sandstone beds (Revised Stage 3 SMP Written Report, 2009). Thickness of the individual beds can vary significantly, although in the Application Area (Study Areas 2 and 3) it is generally between 2.7 to 4.5 metres in thickness (Seedsman, 2010).

This unit has tended to be problematic in terms of floor heave and trafficability difficulties throughout the Lake Macquarie region which is, in particular, related to the swell of the material when exposed to water (Revised Stage 3 SMP Written Report, 2009).

Floor materials with less than 0.5 megapascal strengths have been suggested to probably be associated with pillar collapse at Awaba Colliery (Seedsman 2010). Accordingly secondary extraction does not commence until floor coring and geotechnical review is undertaken to meet mine design criteria.

7.2.4 Faults

The geological plan attached to the 2005 SMP application for the Main South Area shows a series of normal faults occurring in swarms of three or four, and about 500 metres apart. Throws are indicated to be 0.5-1.5 metres. There is no evidence to suggest that such normal faults have been implicated in unexpected subsidence events (i.e. 'plug failure' or 'sink holes') with the Teralba Conglomerate. However, when mining operations are being conducted in close proximity to these faults, evaluation of mine safety will determine the need to leave additional coal stooks of varying size.

7.3 Previous Subsidence and Development of Current Mine Planning and Design

Prior to the development of the current mining method outlined below, historical mine workings at Awaba Colliery beyond the Application Area experienced a number of subsidence events characterised by rapid floor heave in working panels and resulting surface subsidence. No significant additional rib spall was noted. The extraction strategy in these areas was based on stripping one side of the existing standing pillars (which had been developed in earlier periods by bord and pillar methods). It is noted that these rapid subsidence events occurred in areas where the pillars had very high factors of safety, and it was concluded that a failure of the Awaba Tuff in the *floor* was more likely than a coal pillar failure (Seedsman, 2010).

As a result of difficulties experienced using the above historical mining methods, a new mine plan was formulated which minimises potential for significant subsidence events to occur. This current mining method was developed in consultation with I&I and has been used successfully at Awaba Colliery since mid 2007 (Seedsman 2010).

The current mine design at the Awaba Colliery is based on exploiting the spanning capabilities of the strong Teralba Conglomerate roof, and is referred to as the "bridging layout". In general, pillars within panels that are no more than 100m wide are stripped by a maximum of 15m leaving small stooks to manage wind blast hazard. A row of standing pillars will then be left before another panel is formed. The rows of pillars have factors of safety relating to the coal strength greater than unity and on this basis their stability should be consistent with contemporary pillar extraction and longwall mining practice. Another key aspect of the planning for the bridging layout is that floor failure does not result in rapid and uncontrolled collapse of the strata above the extraction panels. It is recognised that the floor may fail if very low strength material is present, and this hazard can be managed to some degree by testing the floor prior to extraction.

The development of the current mine design allows the Awaba Colliery to conservatively exclude secondary extraction from potentially sensitive areas. These secondary extraction exclusion areas are shown on Figure 7.2 and include:

- Areas where depth of cover to the Great Northern Seam is less than 25 metres;
- Protection barriers for second and third order streams (20m barriers for second order streams and 50m barriers for third order streams);
- Protection barriers for infrastructure within the Application Area, including:
  - The Newstan-Eraring private Haul Road;
  - Power poles; and
  - Telstra tower.
- The main northern railway protection zone (defined as the sum of 20m from the nearest rail, a step out distance defined by a 35° angle of draw, and an additional distance of 100m);
- A 20m barrier between the mining areas and the mining lease boundary; and
- An appropriate barrier between adjacent secondary extraction areas (panels).

In general, the amount of subsidence is a function of the sag of the conglomerate and the compression of the pillar system. These are generally in the order of 10 to 100 millimetres and 50 to 100 millimetres, respectively, for the panel widths utilised to date in adjacent mining areas (Seedsman, 2010).

The *maximum* vertical subsidence associated with this current mining method of extraction is around 125 millimetres. The 20 millimetre subsidence impact line is shown to be between 0 and 100 metres from the end of the panels (Seedsman, 2010). The

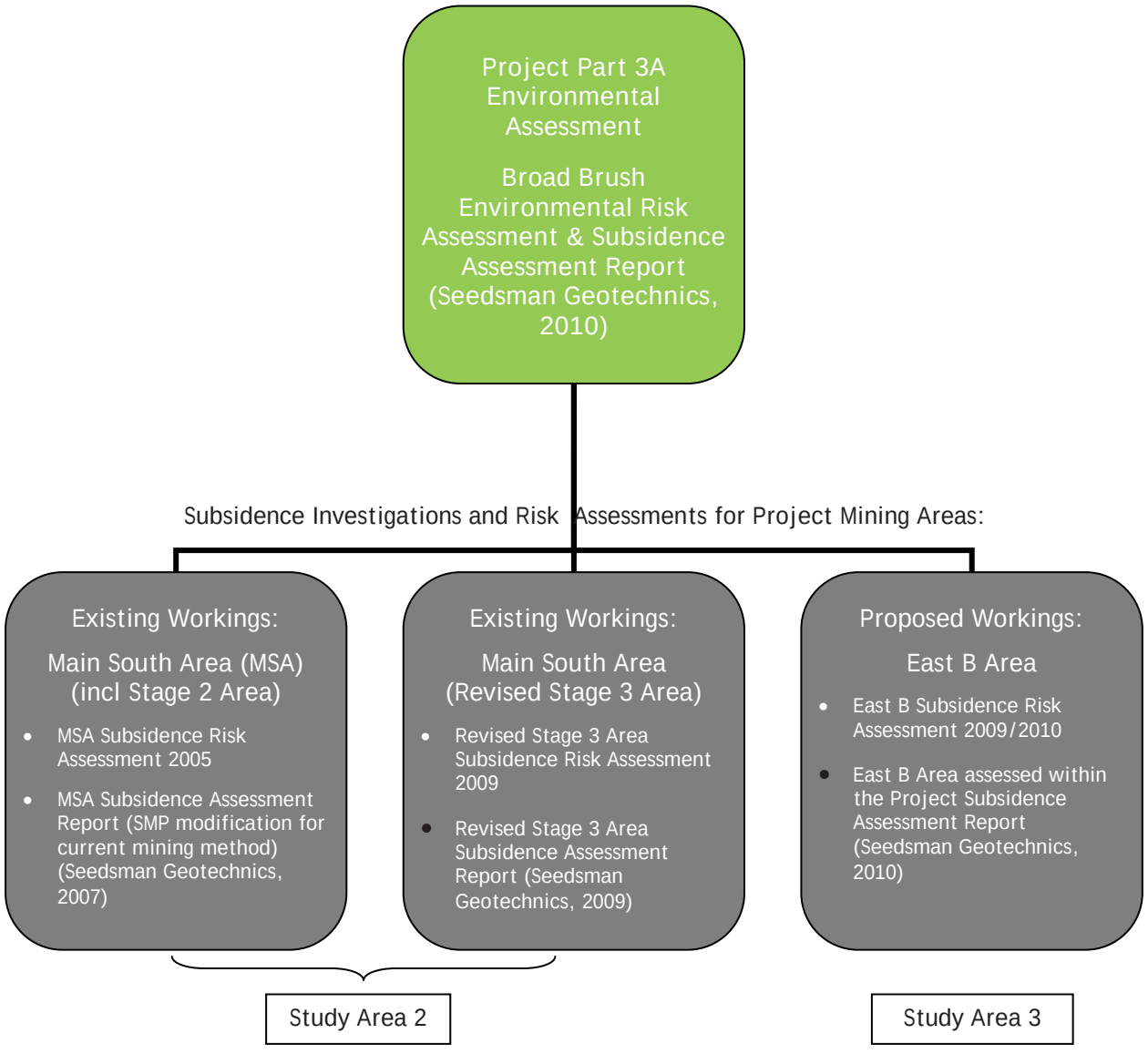
subsidence predictions for areas using this mining method have been verified by subsidence monitoring surveys undertaken in accordance with the existing Subsidence Monitoring Program, and explained in the subsidence assessment (Seedsman, 2010). Further discussion regarding the predicted subsidence for Study Areas 2 and 3 using this mining method is provided below in Section 7.5. Full descriptions of the history of the current mining method and subsidence prediction methodology is provided in Seedsman (2010) presented in Appendix 4.

7.4 Subsidence Risk Assessment

Centennial utilises a risk-based approach to the identification, assessment and management of potential subsidence impacts at Awaba Colliery. Each current mining area is the subject of specialist subsidence investigations and risk assessments to identify information gaps, assess the adequacy of existing controls, and identify any additional mitigation or management measures required.

The risk assessment process for the Project has utilised three separate subsidence environmental risk assessments for each of the Project mining areas (existing and proposed) to support the subsidence impact components of the over-arching *Broad Brush Risk Assessment* for the Project's Environmental Assessment, as illustrated below in Figure 7.1. Further detail on the risk assessment processes undertaken for the Project is discussed in detail in Section 8 and presented in a report in Appendix 5.

Figure 7.1 – Subsidence Investigations and Risk Assessments for the Project Mining Areas



The priority risk aspects requiring management for potential subsidence impact that were identified by the various risk assessments included the following:

- Ensuring the safety of the public and mine workers in mining areas;
- Protection of surface water courses;
- Protection of surface infrastructure;
- Consideration for any potential sites of Aboriginal Heritage significance; and
- Consideration for any potential areas of ecological significance.

These aspects provided direction for mine planning and design in those areas, determining the scope of investigations required to assess potential environmental impacts in proposed mining areas for the Project (refer Section 8), and provide adequate management and mitigation measures (refer Section 9).

7.5 Subsidence Predictions for the Project Mining Areas

A subsidence assessment for the Project was prepared by Seedsman Geotechnics Pty Ltd (2010) and the results of this assessment are presented in a report titled *"Centennial Awaba Pty Ltd Subsidence Assessment Part 3A Submission"*. This report has been included in Appendix 4 and is herein referred to as Seedsman (2010). The report provides a summary of the development of the current mining method strategy employed by Awaba Colliery, analysis of recent subsidence results and assessment of subsidence within the two potentially subsidence affected Study Areas (Study Area 2 and 3). A summary of this subsidence assessment is provided below.

In general, subsidence levels of approximately 100mm are predicted above the pillars with an additional 100mm above the extraction panels (Seedsman 2010). The predicted maximum subsidence is 200mm and the associated tilts and strains will not be measurable with standard survey tools (Seedsman 2010).

Notwithstanding this, a 'worst case' scenario is also assessed for a 'plug failure', which has a negligible likelihood of developing and is conservatively provided as the basis for risk assessment. This unlikely outcome would be the result of the spanning Teralba Conglomerate completely failing, causing a type of 'plug' subsidence resulting in the formation of vertical faces of around 2.5 metres height at the edge of the panels (Seedsman, 2010). Mine design has addressed the risk of plug failure through the development of a hierarchy of subsidence management control measures detailed in Table 7.1.

Specific predictions for proposed mining layouts within Study Areas 2 and 3 for the Project are provided in the following sections below.

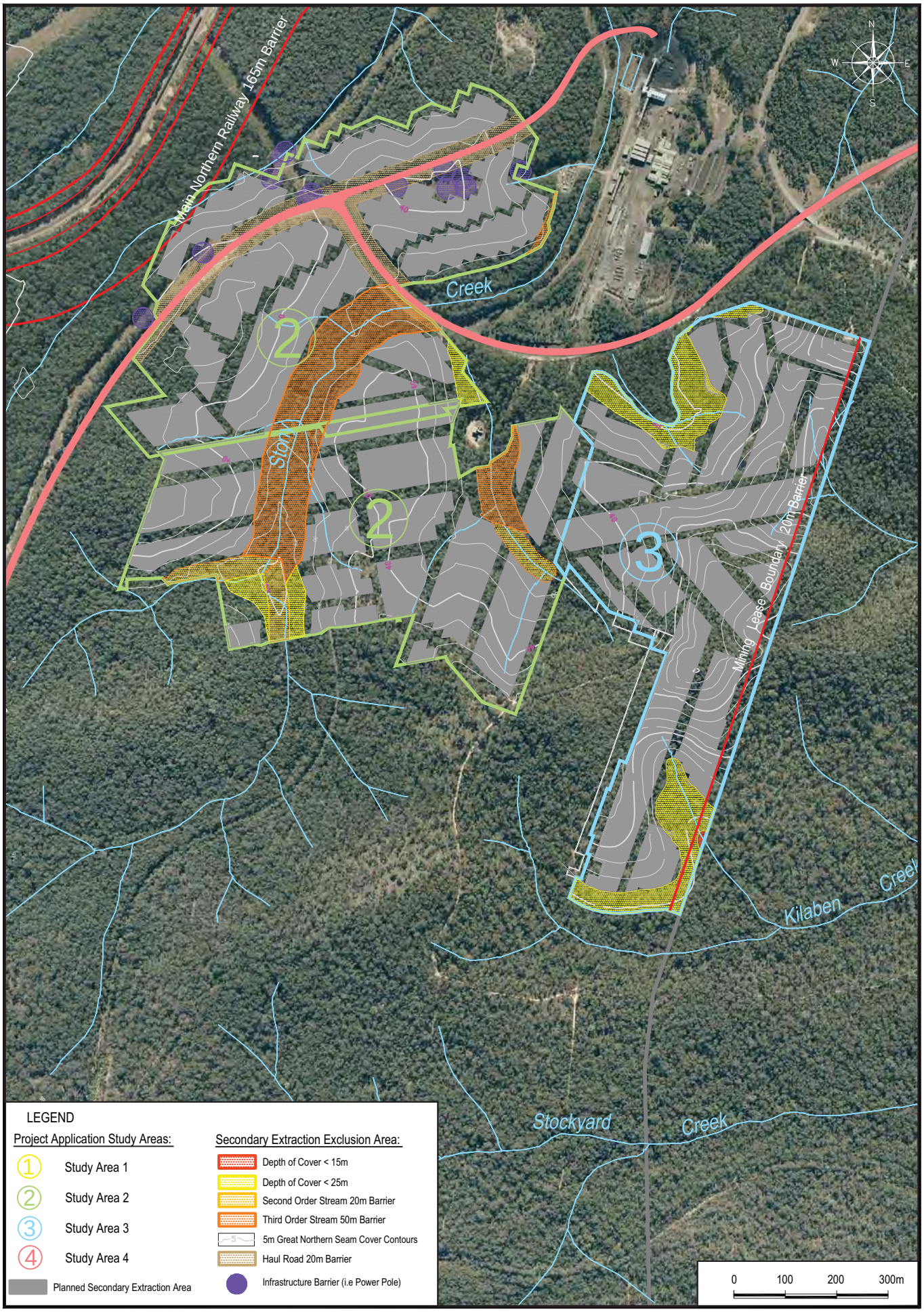
7.5.1 Study Area 2 – Main South Area: Stage 2 & Revised Stage 3 Areas

The layout for secondary extraction within Study Area 2 is shown in Figure 7.2 uses a somewhat staggered pattern so as to not extract under the haul roads, power lines and other infrastructure on the surface. The resulting voids will be generally in the order of 60 to 80 metres wide.

The layout of Study Area 2 includes 2 types of "pillars":

- In-panel pillars – mostly a single row of pillars between the panels – these are required for underground safety considerations, however, these have factors of safety of less than the long-term stable threshold; and
- Barrier pillars – mostly 3 rows of pillars left under surface infrastructure so that the risk of adverse subsidence deformations is effectively zero. The barrier pillars are long term stable, and the subsidence above the central line pillars will be less than 60 millimetres.

The predicted maximum vertical subsidence is of the order of 200 millimetres, and extending out to a 20 millimetre level within a 45° angle of draw developed over a width of approximately 200 metres (two void areas and one pillar row), so the associated tilts and strains will be very low (Seedsman, 2010). It is noted that section of the private haul road that forms Study Area 4 of this EA also traverses Study Area 2, and accordingly, has been considered in the mine design, subsidence predictions and impact assessments as required.



To be printed A4

GSS ENVIRONMENTAL
Environmental, Land and Project Management Consultants

Awaba Colliery Mine Design
Secondary Extraction Exclusion Areas

Figure 7.2

7.5.2 Study Area 3 – East B Area

The layout of Study Area 3 is shown in Figure 7.2. This area lies to the east of the South Headings Mains and differs from recent mining at Awaba as the area requires development of additional first workings prior to extraction. Following first workings development (at depths of cover greater than 20 metres) using bord and pillar mining, selected pillars will be extracted to form the panel and pillar layout similar to that adopted recently at the Awaba Colliery. There is to be no secondary extraction of pillars at depths of cover less than 25 metres and the width of the extraction panels will vary between 46 to 85 metres (Seedsman, 2010).

The prediction for subsidence in Study Area 3 is a function of the sag of the conglomerate (in the order of 10 to 100 millimetres for the panel widths utilised to date) and the compression of the pillar system (in the order of 50 to 100 millimetres for the panel widths utilised to date in adjacent mining areas). The 20 millimetre subsidence limit is predicted to be within 50 metres of the end of the extraction panels.

7.6 Subsidence Impact Assessment

The conservative but unlikely worst case scenario of a plug failure and the maximum predicted subsidence levels for the Project Mining areas in Study Areas 2 and 3 provided by Seedsman Geotechnics (2010), were utilised as the basis for the Project risk assessments (refer Section 8) in identifying information gaps or potential inadequacies in existing mitigation and management measures that may require further investigation and assessment.

Subsequently, a number of specialist investigations were identified and undertaken to investigate and assess key aspects that may be impacted by potential mine subsidence within Study Areas 2 and 3. These include:

- Aboriginal and European Heritage (refer Appendix 7);
- Surface and Groundwater (refer Appendix 6); and
- Ecology/Flora & Fauna (refer Appendix 11).

These specialist investigations, in addition to other environmental aspects identified by the risk process including public safety and surface infrastructure, are discussed in detail throughout Section 9 of the EA (including assessment of potential impacts, consequences and mitigation and management). Full copies of the specialist reports are appended to the EA as listed above.

It is noted that for Study Area 2 (Main South Stage 2 and Revised Stage 3 Areas), potential subsidence impacts have been previously assessed in detail as part of environmental assessments under the SMP Applications originally submitted for Main South Stage 2 Area in 2005 and revised in 2007 and for the Main South Revised Stage 3 Area in 2009. These studies have been considered and summarised within the current specialist investigations undertaken for and appended to this EA, and summarised within Section 9. It is also noted that section of the private haul road that forms Study Area 4 of this EA also traverses Study Area 2, and accordingly, has been considered in the mine design, subsidence predictions and impact assessments (including within the above SMP Application for the Revised Stage 3 Area) as required .

7.7 Subsidence Management and Mitigation Measures

The key driver in the development of the layout is to maintain high levels of safety underground and in doing so also protect the surface environment. This requires that the overburden integrity is maintained. The mine design at Awaba Colliery has conservatively incorporated a hierarchy of risk management controls. A summary of the hierarchy of subsidence management control measures for each of the Study Areas is provided in Table 7.1, based on information provided in Seedsman (2010). Further explanation of these controls is provided below and in Seedsman (2010) in Appendix 4.

Table 7.1 – Hierarchy of Subsidence Management Control Measures

Management Control		Study Area	
		2	3
Elimination – pillar extraction has been eliminated from the following areas	Within a nominal 125 metre from the Rail boundary[1]	✓	n/a
	Under the haul roads and other infrastructure or the identified water courses	✓	n/a
	At depths of cover less than 25 metres[2]	✓	✓
Substitution	The layout adopted has significantly lower subsidence than the alternatives. The proposed mining method is a continuation of the existing mining that has been implemented successfully since 2007 after being developed in consultation with I&I.	✓	✓
Engineering Controls[3]	Factor of safety for pillar failure	1.4-1.7	>1.6
	Factor of safety for compressive failure of the spanning Teralba Conglomerate	not specified	2.0
Administrative Controls – The following will be undertaken to monitor and ensure mine design prevents subsidence levels above those predicted in **Section 7.5**	Progressive coring or other testing of the floor in extraction areas and adjacent to rail prior to second workings	✓	✓
	Regular inspections of any water courses especially after heavy rainfall.	✓	✓
	Subsidence cross line(s) to confirm pillar compression and sag predictions.	✓	✓

Source: Seedsman 2010

Note 1: This represents the barrier that was required by the Government Principal Subsidence Engineer (PSE) for the earlier application of this extraction method. It is noted that there has been no recorded instance of the "pillar run" or even anomalous subsidence for which the PSE has concerns at either Awaba Colliery or at the adjacent Newstan Colliery when similar pillars have been undermined by longwall extraction.

Note 2: It is noted that there is also only very limited planned extraction in areas where depth of cover is less than 30 metres.

Note 3: The engineering controls for mine design are reflected in the void sizes and position.

While the mine design has incorporated the above hierarchy of risk management controls, Awaba Colliery has also developed and utilised a number of management plans for the Main South Stage 2 and Revised Stage 3 Areas (collectively these comprise Study Area 2) during previous SMP Applications, as illustrated in Figure 7.2. This includes the following:

- Public Safety Management Plan;
- Powerline/Infrastructure Management Plan (including specific Management Plan for Telstra Assets);
- Roads, Tracks and Trails Management Plan;
- Spontaneous Combustion Management Plan;
- Watercourse Management Plan; and
- Subsidence Management Plan

These management plans will continue to be utilised during mining within Study Area 2. It is noted that Study Area 3 (the East B Area) will also be subject to a Subsidence Management Plan, or equivalent, which will be developed in consultation with the Department of Planning following submission of this EA. These measures are discussed further in the context of the Project in Section 10.

Further, it is noted that mitigation and management measures in the context of each specific environmental aspect are also discussed throughout Section 9 of this EA, including Sections 9.1 (watercourses), 9.2 (Aboriginal heritage), 9.5 (European heritage) and 9.9 (flora and fauna).

7.8 Conclusion

The mining method proposed for the Project has been utilised successfully at the Awaba Colliery since being developed in consultation with I&I in mid 2007. The proposed mine layout is based on the application of well-established rock mechanics principles that are applied conservatively (Seedsman, 2010). Pillar extraction is conducted only after a number of engineering and administrative controls are applied. The engineering analyses are applied in parallel with back analysis of previous behaviours at the site and ongoing monitoring.

The risk based approach Awaba Colliery uses for mine planning and its operational process, along with the management controls discussed within Sections 9 and 10 of this EA , has resulted in the final location of extraction voids being an outcome of a comprehensive management strategy that not only provides a safe and productive workplace but also results in acceptable subsidence outcomes (Seedsman, 2010).The unlikely possibility of the worst case 'plug failure' scenario occurring has been managed by using a proven mining method and designing the layout in accordance with the preventative hierarchy of management controls. Further mitigation of such an unexpected event would therefore need to be reactive in nature and, whilst this has considered ahead where possible within the current relevant management plans for the mine, would be further developed at such time in consultation with relevant agencies to accommodate specific requirements of the actual event.

8.0 IDENTIFICATION OF KEY ENVIRONMENTAL ISSUES

8.1 Introduction and Objectives

The Awaba Colliery utilises a Risk Assessment process to identify environmental, safety and business risks to its operation. This process involves its employees (and contractors where appropriate) identifying existing controls and recommending any necessary additional controls for all risks identified. The focus is on the inter-relationship between people, machinery, methods of work, the environment and the community. This process is guided by the overarching Environmental Policy adopted by Centennial which clearly states that it values its role in sustainable development and aims to manage its business to achieve balanced environmental, economic and social aspects. The Policy states Centennial's commitment to minimising environmental impacts and to continual improvement in environmental management and performance (Appendix 1).

The compilation of this EA was undertaken through a risk based and consultative approach. The primary objective of the risk assessment process was to identify those issues relating to the Project where further information or investigation would address any existing knowledge gaps or any potential needs for improving existing mitigation and management measures to ensure the residual risk for the Project is acceptably low. Where the risks were considered unacceptable, or there was a knowledge gap in the information available, specialist investigations were undertaken where required.

A number of seperate risk assessments undertaken for the Project. The *Broad Brush Risk Assessment (BBRA)* represents the fundamental risk assessment for the overall Project and aims to identify all issues relating to the Project. Specific risk assessments for potential *subsidence-related* environmental impacts and management for underground mining areas of the Project were undertaken separately to the BBRA. These form supporting documents to the over-arching BBRA for the Project and are cross referenced within (and appended to) the BBRA (Appendix 5). The processes used in the subsidence risk assessments included specialist investigations for subsidence predictions and key environmental impacts. Full details are provided in the reports for each area prone to subsidence risk (i.e. Study Areas 2 and 3).

The scope of the BBRA undertaken for the Project was defined by the activities for the Project with the potential to cause an environmental impact as described in Section 8.2. The following sub-sections detail the issues raised in each separate risk assessment, the controls in place to address the risks identified and any proposed additional controls to address higher ranking risks.

8.2 Proposed Activities with the Potential to Cause Environmental Impacts

The proposed activities identified for the Project with the potential to cause an environmental impact included:

- Potential subsidence-related impacts for the three proposed mining areas within Study Areas 2 and 3. Potential subsidence related impacts were addressed in specific Subsidence RA's completed for each specific area and cross-referenced within and appended to the BBRA for the Project. Section 7 provides a detailed description of the predicted subsidence-related impacts for the Project.
- An increase in production from 800,000 to 880,000 tonnes per annum, including those associated with:
  - The Awaba Colliery pit top facilities, in particular the surface operations associated with the crushing and loading of coal to trucks for transport; and
  - Transport of coal along the internal haul road to either of the Newstan Colliery or Eraring Power Station.
- The use of an existing quarry on a campaign basis to win material used for construction, road building and related purposes. It should be noted that there is no further/increased disturbance proposed for the Project, which will only involve the removal of stockpiled material; and
- surface disturbance associated with the construction of the proposed expanded PCD (which is located in a previously disturbed area).

8.3 Risk Assessment

The BBRA for the the Project was completed in January 2010. The workshop was facilitated by GSSE (Craig Bagnall, Project Manager), with stakeholders from Centennial and technical specialist consultants attending. A primary objective of the BBRA was to assemble the relevant stakeholders in the Project to identify the activities, aspects and possible impacts associated with the proposed activities of the Project. The issues that were specifically assessed included:

- Land Ownership
- Flora and Fauna
- Surface and Groundwater
- Traffic and Transport
- Noise and Vibration
- Subsidence
- Air Quality
- Greenhouse Gas
- European Heritage
- Aboriginal/Cultural Heritage
- Site Services
- Visual Amenity
- Soils and Land Capability
- Rehabilitation and Life of Mine
- Community Consultation
- Waste Management
- Socio-Economic

The purpose of the over-arching BBRA was to identify those issues relating to the Project that, in the absence of any further investigation or assessment to fill information gaps or potential inadequacies in existing management measures, had the potential to present the greatest risk to the environment and surrounding community. Once they were identified, the various Project risks were assessed while considering the existing management controls already in place at Centennial (i.e. documented in management plans and operational procedures).

As mentioned above, risk assessments for potential *subsidence-related* environmental impacts and management were undertaken for each of the proposed mining areas for the Project. Due to the amount of detail provided in these assessments, it has been considered appropriate that these assessments be cross referenced within and appended to the BBRA. This process has involved specialist investigations for subsidence predictions and key environmental impacts.

The Project risk associated with subsidence has been assessed in the following reports:

- Main South Area Subsidence Risk Assessment, including Stage 2 Area (October, 2005) – prepared as part of the SMP application for Main South Area (approved). This area forms part of *Study Area 2* for the Project.
- Revised Stage 3 Area Subsidence Risk Assessment (September 2009) – undertaken for the SMP Application for Revised Stage 3 Area submitted to I&I in December 2009 (approval awaited). This area forms part of *Study Area 2* for the Project;
- East B Area Subsidence Risk Assessment (February 2010) – prepared for this Part3A application. This area forms *Study Area 3* for the Project;

Full details regarding the environmental impacts and management of subsidence-related risks is provided in the reports for each area above (included all existing and proposed controls identified), as appended to the BBRA report which is included as Appendix 5.

8.4 Risk Register

A Risk Assessment Report (including the risk register), attached as Appendix 5, was prepared to document the outcomes for all aspects of the Project identified throughout the Risk Assessment process. This includes appendices providing full risk assessment reports of the related subsidence risk assessments for the proposed mining areas for the Project.

A list of potentially significant environmental issues identified in the BBRA in order from most significant to least significant according to risk rank is provided below. These are the environmental issues considered by the risk assessment team to require particular attention or further information/assessment within the Environmental Assessment in order to ensure that the residual risk is acceptably low for the Project. Table 8.1 below summarises the potentially high, significant, and moderate risks found by the team with existing controls in place (refer Appendix 2 for details of existing controls if required), including proposed additional controls.

Table 8.1 - Priority Risk Categories for Management and Proposed Additional Controls

Risk Category	Highest Risk Ranking (RR) with Existing Controls	Proposed Additional Controls Required to Minimise Risk
Potentially High Risks (must require additional investigations/controls)		
Public & Personnel Safety due to subsidence	7 (high)[1] *(Stage 2 area only)*	• Original 2005 SMP risk assessment for Stage 2/Main South Area didn't assess with existing controls in place (i.e. 'raw' risk). Considered adequate with controls in place, including significantly conservative mine design, minimum depths of cover to avoid significant surface cracking/plug failures, plans of management for infrastructure and public safety. • Notwithstanding this, Infrastructure and Public Safety Management Plans will prudently be reviewed during EA to ensure all risk aspects and controls captured.
Non-Mine Infrastructure due to subsidence	7 (high)[1] *(Stage 2 Area only)*	• Original 2005 SMP risk assessment for Stage 2/Main South Area didn't assess with existing controls in place (i.e. 'raw' risk). Considered adequate with controls in place, including mine plan is altered to protect surface features (e.g. poles), subsidence monitoring & review, consultation with stakeholders, plans of management for infrastructure, It is noted that with controls in place, damage to infrastructure in the similar Revised Stage 3 Area was considered a *low* risk during assessment (2009). • Notwithstanding this, plans of management for infrastructure will be prudently reviewed during EA to ensure all risk aspects and controls captured.
Groundwater	9 (high)	• Creation of a hydro-geological model for the Awaba Colliery based on Centennial Newstan. • Specialist groundwater assessment including cumulative impacts required for Part 3A application including any required mitigation measures (including required additional regulatory approvals for 10 South Bore dewatering).
Surface Water	9 (high) *(pit top areas only)*	• Specialist surface water assessment of Pit Top Area operations including cumulative impacts required for Part 3A application including any required mitigation measures. • Annual detailed water balance to quantify site water usage. • Proposed additional mine dirty water dam capacity budgeted. • Review of SMP investigations and assessments (including cumulative impacts) required for Part 3A application (EA) including any additional required mitigation measures. • Surface water flow path analysis recommended assessing downstream impacts in the unlikely event of worst case ('plug failure') scenario.
Potentially Significant Risks		
Socio Economic impact from Project refusal	12 (significant)	• No additional controls are proposed
Aboriginal & Cultural Heritage	13 (significant)	• Specialist archaeology assessment required for Part 3A application including any required mitigation measures. • Commence additional Aboriginal Community Consultation. • Review Newstan Colliery Holding Aboriginal Heritage Management Plan and update as required.

Risk Category	Highest Risk Ranking (RR) with Existing Controls	Proposed Additional Controls Required to Minimise Risk
Community Consultation	13 (significant)	• Consultation log to be developed for Part 3A application consultation process. • Complete consultation for East B mining area
Potentially Moderate Risks		
Subsidence[2]	17 (moderate)	• Specialist studies will conservatively review previous SMP investigations and risk assessment and the adequacy of these controls for the current mining method and mine layout for the current mining areas in Main South Stage 2 Area. • Controls recommended within the completed *East B Area* Subsidence Risk Assessment (appended to the BBRA – **Appendix 5**) are considered adequate for this Project. • Controls recommended within the completed *Revised Stage 3 Area* subsidence risk assessment (appended to the BBRA – **Appendix 5**) are considered adequate for this Project.
Life of mine & Rehabilitation	17 (moderate)	• No additional controls are proposed at this stage. • Life of Mine and Rehabilitation Risk Assessment to be conducted prior to commencement of closure works.
European Heritage	17 (moderate)	• Specialist archaeology assessment required for Part 3A application including any required mitigation measures.
Traffic & Transport	17 (moderate)	• No additional controls proposed however Awaba Colliery will undertake consultation with DoP and Council/RTA to determine their EA requirements. • Specialist traffic assessment required for Part 3A application including any required mitigation measures.[3]
Contaminated Land	18 (moderate)	• No additional controls are proposed at this stage. • Contaminated Land will be considered for the Life of Mine and Rehabilitation planning.
Noise	18 (moderate)	• Specialist noise assessment including cumulative impact required for Part 3A application.
Air Quality	18 (moderate)	• Specialist air quality assessment including cumulative impacts required for Part 3A application.
*Note 1: Only 'raw' risk (considered with no existing controls in place) was conservatively assessed for original risk assessment for Main South Area in 2005. Controls were identified but not re-ranked, with general approach that identified controls were adequate to address risks to suitable levels. A full copy of the risk report is appended to the BBRA for the Project contained in **Appendix 5**.*		
*Note 2: During consultation with I&I it was raised that spontaneous combustion should be considered for the Project. This risk has previously been assessed by Awaba Colliery within the various subsidence risk assessments as a low risk, however, discussion of spontaneous combustion has prudently been included in this Environmental Assessment (**Section 9.12.2**)*		
*Note 3: During the risk assessment it was determined that a traffic assessment for the Project would not be required, however, Awaba Colliery has conservatively undertaken an assessment of the public access road for the Environmental Assessment (**Section 9.3**). Further, as discussed in Section 5.46 and 5.47, consultation with Council/RTA revealed there were no issues with the site access or the level of assessment.*		

Table 8.2 provides a summary of management requirements in accordance with the Centennial Risk Standard and Risk Matrix.

Table 8.2 - Requirements for Management of Risks in accordance with the 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.

A summary of the other minor risks and environmental issues considered for the Project has also been included in this Environmental Assessment and includes:

LOW

- Ecology;
- Greenhouse gas emissions (GHG);
- Waste management;
- Soils;
- Visual amenity;
- Hazards management; and
- Contaminated land.

Accordingly, the existing controls in place for these aspects are considered adequate. Notwithstanding this, whilst ranked as low risks, for completeness some of these aspects have had additional specialist assessment completed for the Environmental Assessment, in particular an Ecology and Greenhouse Gas Assessment. This includes referring the Project to the Department of the Environment, Water, Heritage and the Arts under the *Environment Protection and Biodiversity Conservation Act* (1999).

9.0 ASSESSMENT AND MANAGEMENT OF KEY ENVIRONMENTAL ISSUES

9.1 Water Management

9.1.1 Introduction and Background

Water management at the Awaba Colliery has developed progressively over the life of the mine in order to adapt to the existing mining conditions. The systematic management of both surface and underground waters at the mine has developed over time into an integrated system where, for example, the quality and quantity of some components of managed surface water discharges are systematically linked to underground water management processes. Accordingly, a systematic and risk-based approach to the identification, assessment and management of potential impact risks to both surface and underground water has been undertaken, and each are discussed and presented within this section of the EA, as outlined further below.

Historical mining has resulted in the depressurisation of the main aquifers (coal seams) since mining began in 1947. As a result, limited groundwater inflows have been observed into mine workings and current areas of underground mining at Awaba Colliery are considered to essentially be a 'dry' mine operation with respect to natural groundwater.

Notwithstanding this, the Awaba Colliery water management system has historically integrated surface water management and underground mine water management via the transfer of surface waters into the underground workings area, primarily to minimise licenced surface discharges to the natural creek systems and to allow the suspended solids to settle out prior to discharge through the licensed discharge de-watering bores. As such the groundwater management system at the Awaba Colliery is a combination of both rainfall recharge which enters from the surface and mine water pumped from the surface water pollution control structures into the underground workings area. Hence, the majority of underground water (rather than natural 'groundwater') at Awaba Colliery is generally considered to be *'mine water'*.

Surface water management at Awaba Colliery includes both the management of natural watercourses within Project mining areas (Study Areas 2 and 3, as outlined further below), and the management of catchment runoff to the pit top surface facilities (Study Area 1). Surface waters in Study Area 1 consist of runoff from the contributing catchment that reports to the existing surface water storages including the Pollution Control Dam, in-seam coal storage bin and maturation pond. The potable and waste water systems are also included as components of the surface water system at Awaba Colliery. The water management system is illustrated on the schematic provided in Figure 9.1.

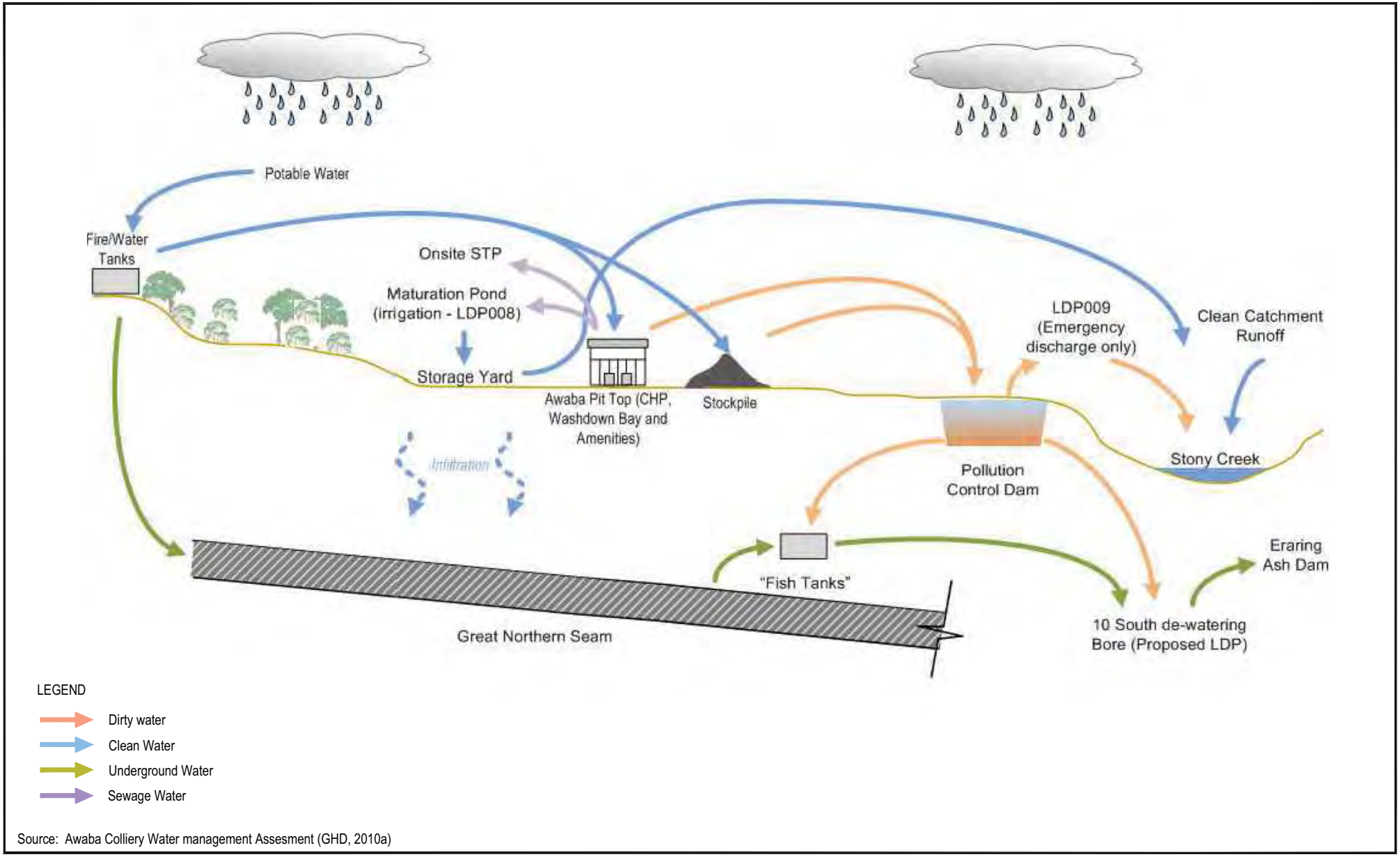
The existing water management system and any potential environmental impacts associated with the management of this system have been considered in the BBRA undertaken for the Project. Priority risks identified within the BBRA for the water management system requiring further investigation, assessment or additional controls, included the following:

- Potential environmental impacts for the long-term groundwater management through the potential filling of underground workings over time;;
- The potential for rainfall events to exceed the capacity of the existing water management system and cause unintended discharges from the Licensed Discharge Point (LDP009);

Additional water management risks identified by the BBRA that were satisfied by existing controls included:

- Potential impacts regarding the spill or failure of the bunded storage area causing discharge of polluted water;
- Potential impacts from subsidence upon the natural stream systems(protected by current mine design controls and adopted buffer zones); and
- Groundwater system/aquifer impacts, as well as inflows of groundwater to underground workings during mining.

As a result of the identification of these potential risks, and in order to address the DGRs issued for the Project, a water management assessment for the Project was undertaken by GHD in a report titled *"Awaba Colliery Water Management Assessment"* herein after referred to as GHD (2010a), which has been included as Appendix 6. The water management assessment also included a detailed operational water balance assessment titled *"Awaba Colliery Water Balance Assessment"* herein after referred to as GHD (2010b), attached as Appendix B to GHD (2010a).



Source: Awaba Colliery Water management Assesment (GHD, 2010a)

To be printed A4

GSS ENVIRONMENTAL
Environmental, Land and Project Management Consultants

Awaba Colliery
Water Management Schematic
Figure 9.1

The objective of the water management assessment was to identify and assess the potential impacts of construction and operation of the Project on water management (GHD, 2010a). The scope for the water management assessment included:

- Confirmation of surface and underground mine water management systems;
- Assessment of the surface water management system;
- Review of surface and mine water quality data, and the receiving waters using trigger values determined by the preferred ANZECC/ARMCANZ (2000) approach; and
- Establishment of a detailed site water balance, including:
  - Application of the detailed site water balance to quantify the water budget for the Awaba Colliery for the existing operations and changes proposed by the Project; and
  - Development of a hydrogeological model of the Great Northern Seam workings at the Awaba Colliery in order to assess the capacity of the Awaba Colliery underground workings to receive decant water from the Pollution Control Dam and the associated de-watering requirements under both operational and post-closure (care and maintenance) conditions.

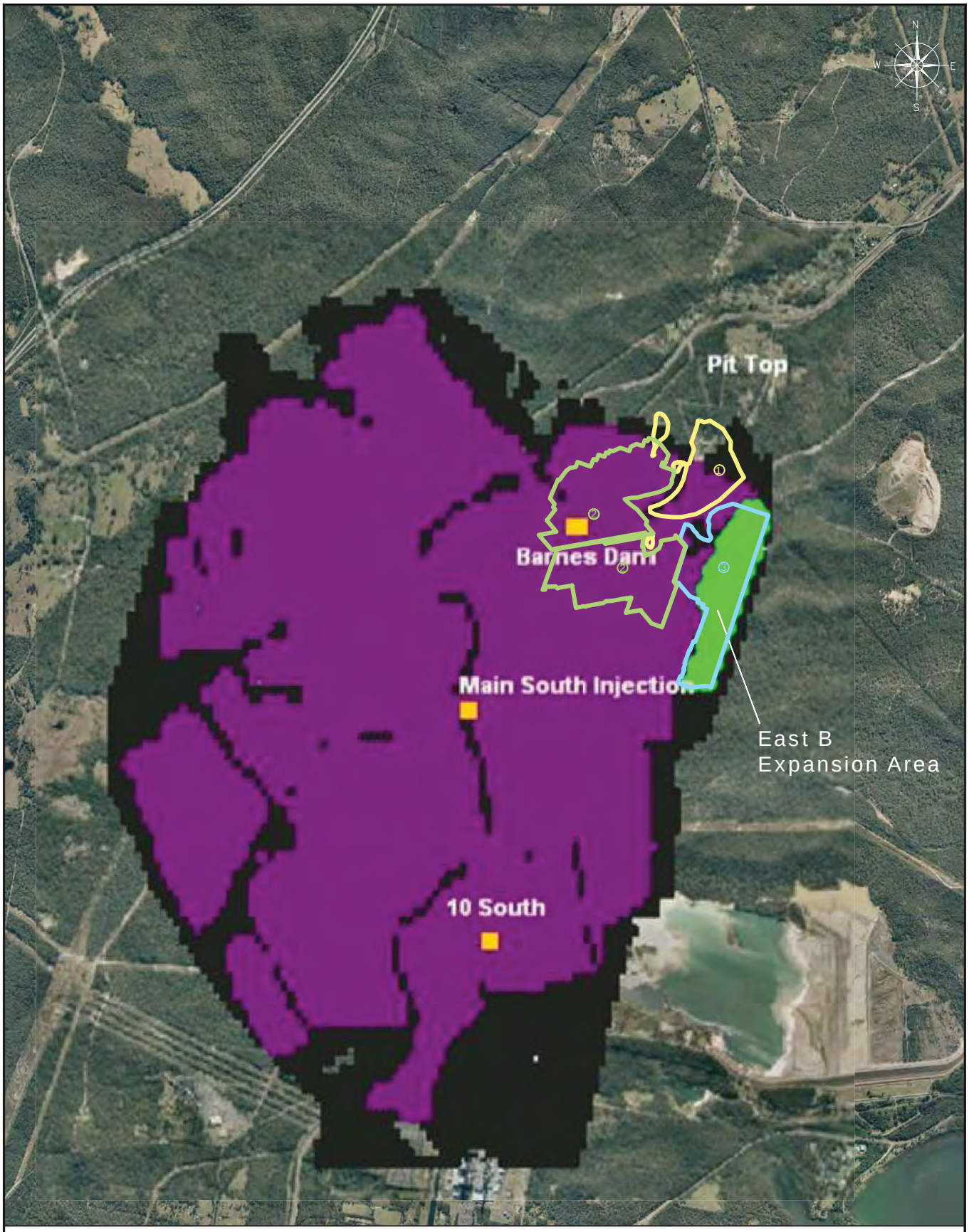
The water management assessment has addressed the surface water management impacts, particularly in relation to Study Area 1 (i.e. the Awaba Colliery pit top facilities and existing quarry), but also considered the transfer of water to the existing underground workings areas and subsequent mine de-watering through LDP005 and the 10 South Bore.

The spatial extent of the hydrogeological model is shown on Figure 9.1, given the regional nature of groundwater it was considered inappropriate to confine the hydrogeological model to the Project Study Areas. The northern boundary is created by outcropping of the Great Northern Seam. The remaining boundaries are generally defined by areas of seam splitting, deterioration and/or fracturing. The hydrogeological model was also limited vertically to the floor of the Great Northern Seam since the underlying Awaba Tuff is known to create a barrier to water flow (GHD, 2010b).

Additionally, the potential surface water impacts to natural watercourses within the Project mining areas in Study Areas 2 and 3 were addressed separately by Hunter Eco within the ecology assessment for the Project (Appendix 11). A summary of the hydrology component of the Hunter Eco report is included below. Furthermore, the ecological assessment detailed the potential impacts from the Project on Groundwater Dependant Ecosystems (GDE's) in Study Areas 2 and 3.

Study Area 4 was not addressed within the water management assessment as it is an existing haul road that was constructed in accordance with all relevant approvals and there are no changes proposed for this Project.

A summary of the existing and proposed water management system for the Project, as well as, identification and mitigation of any identified potential environmental impacts caused by the management of this system is provided within the following sections.



LEGEND

Great Northern Seam

Mine Workings

Project Application Study Areas:

① Study Area 1

② Study Area 2

③ Study Area 3

0.0 0.5 1.0 1.5km

Source: Awaba Colliery Water Balance Assessment (GHD, 2010b)

To be printed A4

GSS ENVIRONMENTAL
Environmental, Land and Project Management Consultants

Awaba Colliery
Hydrogeological Model Extent
Figure 9.2

9.1.2 Existing Environment

Figure 9.2 provides a schematic of the water management system at the Awaba Colliery, which generally, consists of the following:

- Surface water:
  - Runoff from the contributing catchment within and surrounding the pit top area (Study Area 1) which results in discharges into Stony Creek via clean water diversions and LDP009, or, transfer of water to the underground workings area (refer to underground/mine water); and
  - Natural streams within the mining areas (Study Areas 2 and 3).
- Groundwater (including underground mine water):
  - Rainfall recharge which enters from the surface;
  - Mine water pumped from the surface water pollution control structures into the underground workings area;
  - The transfer of water from the active workings areas to the underground storage areas/tanks; and
  - The de-watering of the underground workings area via existing LDP's to natural waterways and the 10 South de-watering bore to the Eraring Ash Dam
- Potable and waste water, including:
  - Water provided to water / fire tanks to service buildings and surface facilities.
  - Grey water from buildings directed to the Maturation Pond;
  - Sewage transferred to on-site septic system (pit top buildings);
  - Evaporation from the Maturation Pond; and
  - Discharges through LDP008 from the irrigation area associated with the Maturation Pond.

The following sections below provide an outline of these existing water management systems at the Awaba Colliery.

9.1.2.1 Current Surface Water Management

The existing water management system at Awaba Colliery has been developed progressively over the life of the mine and enables transfer between surface and underground water storages as outlined in the schematic provided in Figure 9.2. Surface water management consists of runoff from the contributing catchment that reports to the existing surface water storages. It is noted that the potable and waste water systems are also included as components of the surface water system at Awaba Colliery.

The objectives of the Awaba Colliery water management system are primarily related to the separation of clean and dirty water ('clean' water being natural unpolluted catchment flows, and 'dirty' water being sediment laden runoff or other potentially polluted runoff from disturbed areas). The majority of clean water runoff is diverted around the pit top to reduce the volume of water reporting to the dirty water management system, and avoid any potential contamination. The management for dirty water runoff involves the diversion of dirty water (through collection sumps, pipes and open drains) and eventual storage and treatment within the existing Pollution Control Dam.

The measures that have been put in place include sedimentation ponds, oil water separators, clean water diversions and maintenance practices for hardstand areas, which are described in further detail in the water management assessment (GHD, 2010a) attached as Appendix 6. An overview of surface water management is provided below.

Clean Water Management

Awaba Colliery does not harvest any clean catchment runoff nor does it extract water from any of the watercourses within the lease area.

The external clean water catchment is managed to enable a reduction in the volume of water contributing to the dirty water system, and to divert and deliver natural clean flows downstream. This is provided through a series of diversion drains that intersect the runoff before it enters disturbed areas (i.e. upstream of the pit top area). The diverted flows are either directed around the pit top area or conveyed within a piped network beneath the pit top prior to discharge into Stony Creek. The clean water catchment area is indicated in Figure 9.3, while the location of the clean water diversion structures is shown on Figure 9.4.

In addition to the clean water diversion structures described above, roof runoff from the administration, bathhouse and workshop buildings is collected through downpipes and directed to the underground piped stormwater network. This network discharges directly into Stony Creek. To maintain the nominated clean hardstand areas as clean catchments, regular sweeping of these areas is undertaken. These areas are also regularly inspected to ensure that they remain clean.

The capacity of each clean water diversion structure was compared to the estimated peak flow rate, with the outcomes presented in Table 9.1. This information shows that the existing clean water diversions have sufficient capacity to cater for flows up to the 100 year ARI with the exception of downstream of the maturation pond which equates to approximatly the 20 year ARI. It is noted that the *Managing Urban Stormwater – Soils and Construction, Volume 2E: Mines and Quarries* (DECC, 2008), requires the minimum design criteria for temorary drainage controls for a site with a duration of disturbance of greater than 3 years to be the 20 year ARI for all environments.

Table 9.1 – Clean Water Structure Diversion Capacities

Diversion Location	Contributing Catchment Area (ha)	Peak Flow (100 Yr m^3/s)	Capacity of existing diversion structure (m^3/s)
Downstream of Maturation Pond	4.8	0.9	0.6[1]
Rear of Storage Yard	6.0	1.1	5.0
Southern External Catchment	12.4	2.0	3.0
Note 1: This equates to approximately a 20 year ARI capacity.			

It is noted that the location of the existing on-site quarry within Study Area 1 is such that there are no external catchments contributing to this area, therefore no clean water diversions are required for the quarry.

LEGEND

- Pit Top Catchment Overall Boundary
- Pollution Control Structures
- Dirty Water Catchment
- 10m Contours
- Water Course

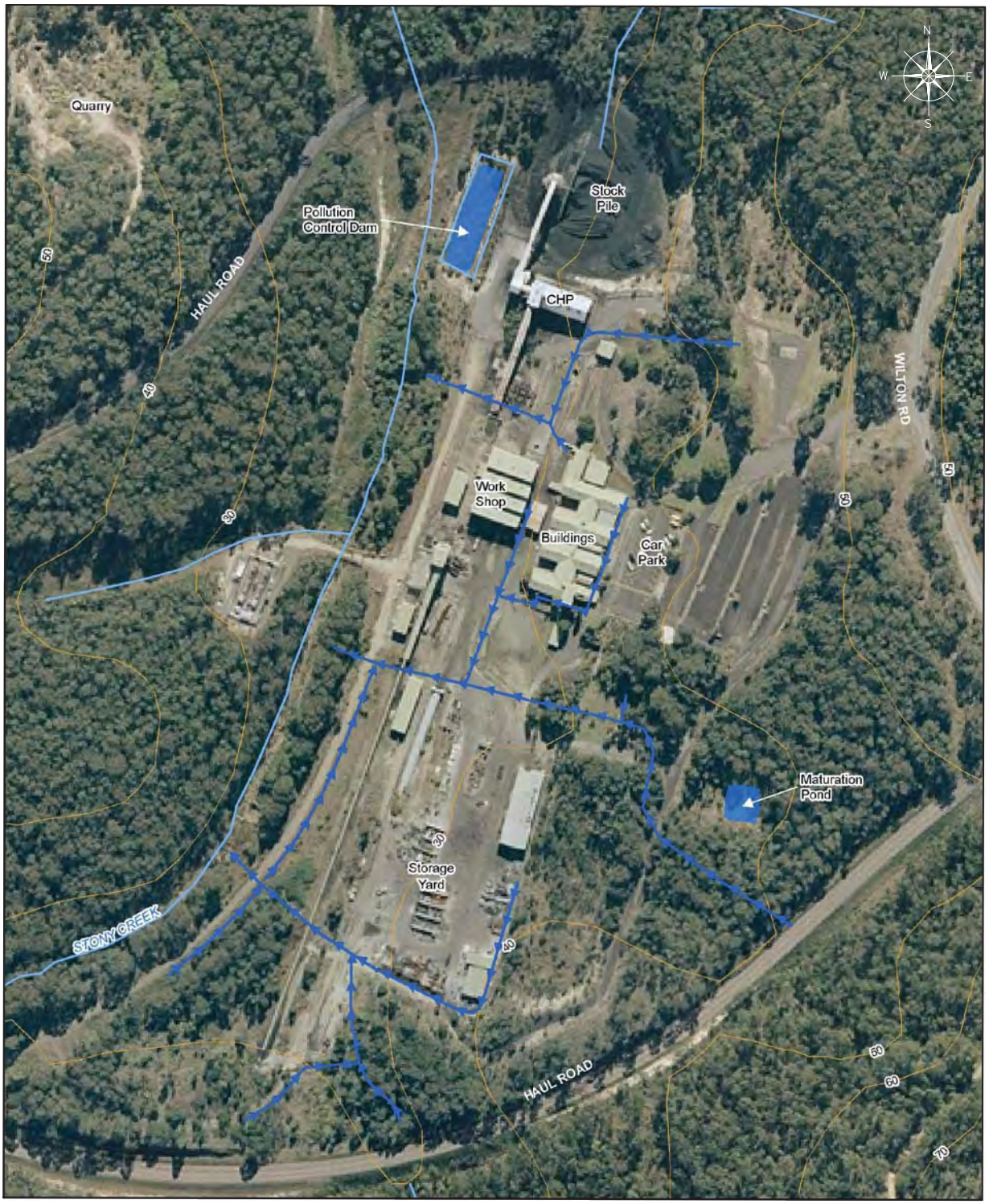
0 50 100 150 200m

Source: Awaba Colliery Water management Assesment (GHD, 2010a)

To be printed A4

GSS ENVIRONMENTAL
Environmental, Land and Project Management Consultants

Awaba Colliery
Catchment Areas
Figure 9.3



LEGEND

- Clean Water Diversion
- 10m Contours
- Water Course
- Pollution Control Structures

0 30 60 90 120m

Source: Awaba Colliery Water management Assesment (GHD, 2010a)

To be printed A4

GSS ENVIRONMENTAL
Environmental, Land and Project Management Consultants

Awaba Colliery
Clean Water Diversion
Figure 9.4

Dirty Water Management

Dirty water runoff from the washdown bay and diesel tank area is directed to the oil water separator for treatment prior to discharge into the existing Pollution Control Dam. An in-seam coal storage bin is located on the surface above the conveyor drift. Water from the boot wash and diesel parking bay, as well as general water make from the pit bottom area, is collected at the bottom of the conveyor drift by the in-seam coal storage bin. This water is then pumped to the existing Pollution Control Dam. The dirty water diversions are shown on Figure 9.5.

The existing Pollution Control Dam is the final structure for the management of dirty water prior to discharge (through LDP009) to Stony Creek. The performance of this structure therefore, has an impact on the downstream environment. The existing Pollution Control Dam has a total capacity in the order of 3.2 ML to cater for an overall catchment area of approximately 2.4 hectares (GHD, 2010a).

During rainfall events dirty water runoff collected in the existing Pollution Control Dam is pumped to a storage area underground to reduce the amount of water being discharged through LDP009. The pumping capacity for removal of dirty water is limited to 11 litres per second (L/s). Pumping commences once a water level of 26.96m AHD is reached and ceases at the low water level of 26.90m AHD. This operational system only provides approximately 0.8 ML for the temporary storage of runoff during a rainfall event.

An analysis of the potential for the Pollution Control Dam to be overtopped was undertaken for the Project using a number of Average Recurrence Interval (ARI) storm events. The results of this analysis are provided in Appendix 6. It was determined that in its current form, the Pollution Control Dam could be overtopped by reasonably regular rainfall events (GHD, 2010a), including the one year ARI two hour and two year ARI 30 minute rainfall events. The potential impacts indicated by these results are discussed in Section 9.1.4. Subsequently, the capacity of the Pollution Control Dam is proposed to be increased under this Project as outlined later in Section 9.1.4.1.

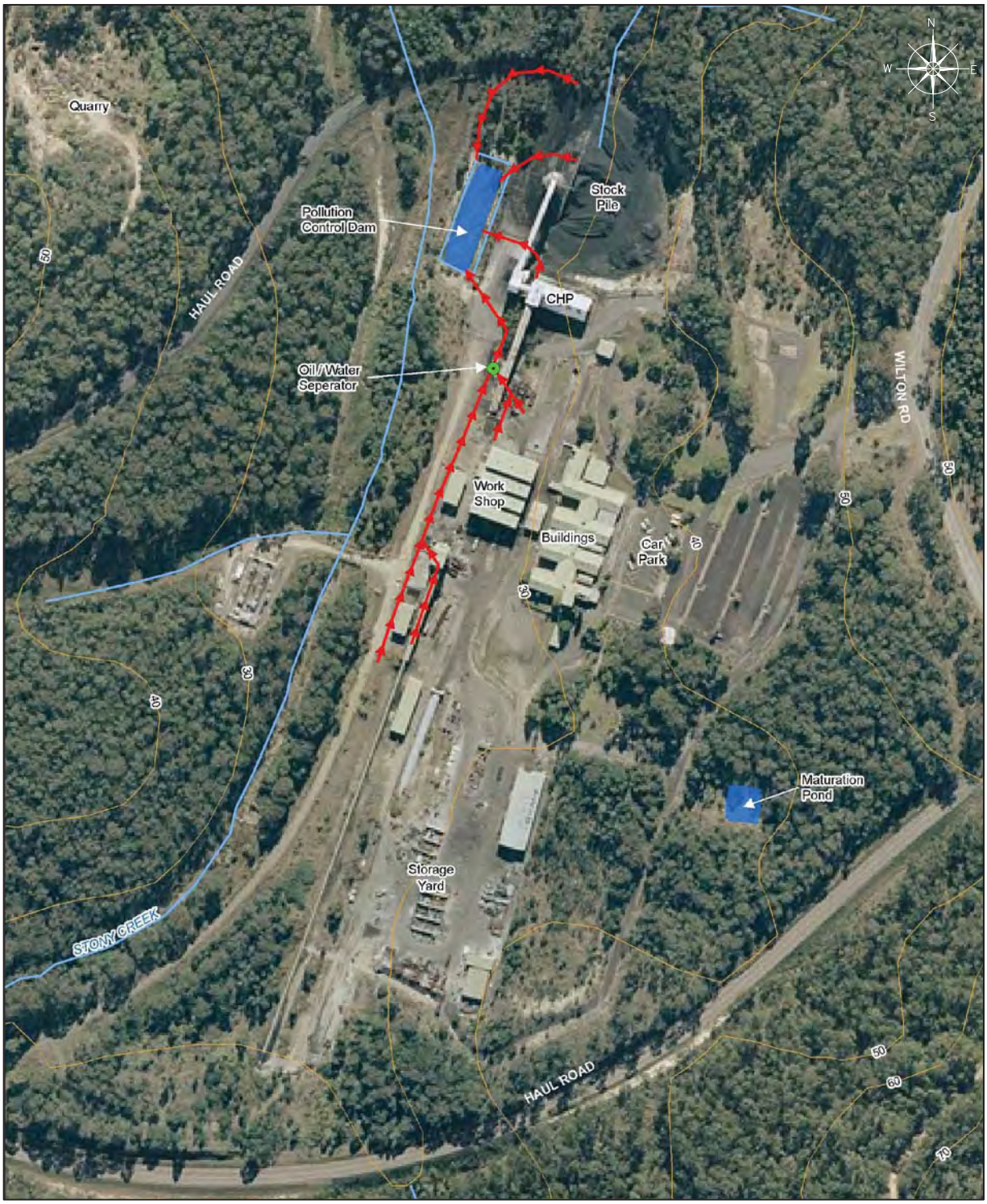
Consideration was also given to the management of dirty water runoff generated from within the quarry, in accordance with *Managing Urban Stormwater: Soils and Construction (Volume 2E: Mines and Quarries, DECC 2008)*, which recommends that erosion and sediment control works, for areas of disturbance with durations exceeding three (3) years, cater for runoff generated from events up to and including the 20 year ARI. This means that any measures put in place should be hydraulically and structurally stable in the 20 year event. For the quarry, this requires management of a maximum of 0.2 m^3/s through measures such as catch drains, levels spreaders, check dams and sedimentation fences.

Existing measures that have been put in place to manage runoff include re-shaping of the maintenance track east of the quarry and installation of sediment fences adjacent to the access track. These were considered by GHD (2010a) to be inadequate. Further discussion of the identified impacts and recommended mitigation measures is provided below in Sections 8.2.3 and 8.2.5, respectively.

Details of the water management structures associated with the Awaba Colliery pit top are provided in Table 9.2. The capacity of individual structures was not considered as part of the assessment as the catchment areas contributing to each structure will not be altered as a result of the Project (GHD, 2010a). The capacity of the overall system is discussed in Section 8.3.

Table 9.2 – Awaba Colliery Pit Top Water Management Structures

Location	Capacity (ML)
Oil Water Separator	0.06
In-Seam Coal Storage Bin	0.06[1]
Pollution Control Dam	3.2
Note 1: Estimated.	
Source: GHD (2010a) – Table 4.3	



LEGEND

- Dirty Water Diversion
- 10m Contours
- Water Course
- Pollution Control Structures
- Oil/Water Separator

0 30 60 90 120m

Source: Awaba Colliery Water management Assesment (GHD, 2010a)

To be printed A4

GSS ENVIRONMENTAL
Environmental, Land and Project Management Consultants

Awaba Colliery
Dirty Water Diversion
Figure 9.5

Watercourses

There are a number of named and un-named watercourses that either originate in or pass through the lease boundary area associated with Awaba Colliery. Each of these watercourses contribute to Lake Macquarie, including the named watercourses Lords Creek, Stockyard Creek, Kilaben Creek, Stony Creek and Palmers Creek.

Of these watercourses, only Stony Creek is directly impacted as a result of discharge from the pit top however mine workings are located beneath several other watercourses. The impact on these other watercourses within the Project mining areas (Study Areas 2 and 3) has been assessed by Hunter Eco as part of the Environmental Assessment process. These impacts are discussed in Section 9.1.3.

Awaba Colliery does not harvest any clean catchment runoff nor does it extract water from any of the watercourses within the lease area.

Stony Creek is located adjacent to the Awaba Colliery pit top and ultimately discharges into Lake Macquarie. Stony Creek is reasonably well defined with a width in the order of 5 to 10 metres and the invert of the creek is well vegetated with variety of typical wetland flora species (i.e. phragmites and/or typha). Approximately 600 metres downstream of the pit top area, the channel loses definition with the creek line discharging into a swampy environment up to 50 metres in width.

Overall, Stony Creek is generally well vegetated and stable. The quality of water being discharged into Stony Creek has also been considered and is discussed in Section 9.1.2.3 of this report. while the potential for hydrologic impact is discussed in Section 9.1.3.

Potable and Waste Water

Potable water is provided to Awaba Colliery by Hunter Water Corporation. This water is directed to the sprinkler system associated with the stockpile area and the potable water/fire tanks. Waste water at Awaba Colliery includes both grey water and sewage.

There are two 200,000 litre tanks to which Hunter Water Corporation provide potable water. Potable water is supplied to the offices and bathhouse (under head pressure) as well as the underground working face and other surface facilities such as the washdown bay and coal handling plant (via a pump station). The stored potable water is also available for fire fighting on both the surface and underground.

Grey water from the bathhouse and other buildings contributes to the maturation pond prior to being discharged through the irrigation system (LDP008) to the east of the pit top area as indicated on Figure 9.6. Runoff from the irrigation area is then considered to be clean and reports to the clean water diversions prior to discharge into Stony Creek.

The treatment of sewage at Awaba Colliery is managed through both a pit top and an underground system, designed to be self sustaining. Sewage from the pit top buildings is treated through an on-site septic system located on the western side of the workshop while underground sewage is managed by air operated toilets.

Existing Licensed Discharge Points (LDP)

Awaba Colliery's Environmental Protection Licence (EPL) 443 includes both volumetric and concentration limits for the licenced discharge of water off site. The location of Awaba Colliery's licensed discharge points are indicated on Figure 9.6 and include:

- LDP001 - Not currently in use. Borehole still exists;
- LDP002 - Not currently in use. Borehole still exists;
- LDP003 - Not currently in use / decommissioned. Removed;
- LDP004 - Not currently in use. Borehole still exists;
- LDP005 - Barnes Dam not currently in use as at March 2010;
- LDP006 - Not currently in use / decommissioned. Removed;
- LDP007 - Not currently in use. Borehole still exists;
- LDP008 - Discharge of irrigation water and stormwater runoff adjacent to utilisation area; and
- LDP009 - Discharge of mine water from the Pollution Control Dam into Stony Creek.

To be printed A4

GSS ENVIRONMENTAL
Environmental, Land and Project Management Consultants

Awaba Colliery
Discharge Point Locations
Figure 9.6

9.1.2.2 Current Underground Water Management

Mine Water Management

Mine water management has developed progressively to adapt to existing mining conditions. Underground water contributing to the management system includes the natural recharge of the active underground workings via surface seepage and the pumping of water from the Pollution Control Dam into the underground storage area (i.e. existing workings).

Prior to March 2010, water in the underground workings was collected and then transferred to the underground storage (Barnes Dam) to allow the settling of fines prior to being pumped to the surface through LDP005. Under this regime there was also some discharge through the existing 10 South de-watering bore contributing to the Eraring Ash Dam.

As part of the progressive development of mine water management, the Barnes Dam underground storage has been replaced with a storage area referred to as the "Fish Tanks" (as defined by the glossary of terms within the water management assessment (GHD, 2010a)). These Fish Tanks collect underground water which is then transferred to the underground storage area associated with the 10 South de-watering bore. Subsequently, discharges through LDP005 have temporarily ceased, and currently the 10 South de-watering bore is used to de-water the underground workings.

The 10 South bore extends from the surface to the Great Northern seam and currently has the capacity to extract 5.5 L/s (175 ML/year) from the underground workings. Discharges from the 10 South bore are conveyed to the Eraring Ash Dam.

In additon to the bores used to convey groundwater to the surface, the Awaba Colliery also manages a number of underground storage areas to improve management of underground water. The facilities to store water underground are outlined in Table 9.3.

Table 9.3 – Underground Water Management Structures

Location	Capacity (ML)
Barnes Dam	5[1]
Fish Tank	0.009
Note 1: Estimated from the floor contours contained within the hydrogeological model.	
Source: GHD (2010b) – Table 2.2	

The following output was obtained from the hydrogelogical model, as detailed in the water balance assessment (GHD, 2010b):

- Underground water make into Barnes Dam (pre March 2010 conditions) ranges from approximately 0.03 ML/day to 0.3 ML/day.
- Underground water make into 10 South Dam (pre March 2010 conditions) ranges from approximately 0.04 ML/day to 0.12 ML/day.

It is noted that the period for which this output relates to was a lower than average rainfall period and therefore slightly higher flow rates were adopted for the detailed water balance.

Project Site Aquifers

The geology within the Awaba Colliery lease area affects both the mining operations and management of water. Water management is affected as the stratigraphy will influence the potential for infiltration into the workings. The location of regional aquifers in relation to the workings can also affect the management of water on-site (GHD, 2010b).

Groundwater systems in the area were described in a groundwater study commissioned by Centennial to determine the extent of the Stony Creek Alluvium Study (Australasian Groundwater and Environmental Consultants (AGEC), 2008). This study determined that there were three (3) main hydrogeological units (aquifers) in the Awaba Colliery area, these are summarised as follows (in order of increasing depth);

- Alluvial Aquifers – alluvium reaches were investigated by AGEC (2008) for second and third order stream sections of Stony Creek. Alluvium was noted along the length of all second and third order sections investigated, however

continuity/interconnection along the creek length appeared restricted by less permeable sequences (interbedded clayey sequences). The lateral extent of the aquifer varied between 6m to 30m each side of the stream sections, while, the maximum thickness is approximately in the order of 2.4m (thickness of most downstream test point during investigation). It is noted that while there is no specific data on upper first order creek sections, it is generally inferred that alluvium depth and extent is greater downstream. Recharge of the alluvial aquifers is by surface creek flow and lateral seepage of more permeable weathered sandy profiles of valley sides.

- Shallow Weathered Zone Aquifers - comprise surficial soils and weathered bedrock and appear localised and not laterally extensive. Aquifer depth varies with weathering and extent of permeable fracture systems. These zones are likely to include perched aquifers at the interface of soils and bedrock and zones of locally increased permeability due to bedrock weathering. Recharge is primarily thought to be through rainfall infiltration/vertical seepage.
- Triassic & Permian Strata Aquifers - include separate units, particularly the higher permeability Permian coal seam strata and the major overlying low permeability dry sandstone (with lesser siltstone and shale) of the interburden/overburden. Groundwater storage is predominantly associated with the coal seams of the Permian strata within interconnected cleats and joint pattern, with low-moderate permeability. As with the Shallow Weathered Zone aquifers, recharge in the deeper Triassic/Permian bedrock aquifers is thought to be primarily through rainfall infiltration/vertical seepage.

There is no regional aquifer located above the Great Northern Seam and the existing workings have been generally dry with minimal groundwater inflow (GHD, 2010b).

Groundwater Dependant Ecosystems

Groundwater Dependent Ecosystems (GDE) are specialised ecosystems that rely on the persistence of groundwater. As mentioned above AGEC (2008) conducted a survey of the Stony Creek alluvium and found that an unconfined groundwater aquifer existed in the alluvial bed of Stony Creek. Vegetation along this part of Stony Creek is representative of a GDE and progressively develops downstream as water accumulates (Hunter Eco, 2010). It is noted that the GDE mapped across the Application Area (refer to Figure 9.15) is listed under the Threatened Species Conservation Act as an Endangered Ecological Community - Swamp Sclerophyll Forest on Coastal Floodplains.

It was assessed this riparian vegetation would be dependent on both stormwater flow along the drainage line as well as basal flow originating from shallow groundwater seeping down the ridges to the drainage lines (Hunter Eco, 2010). Further discussion regarding the ecological impacts upon GDEs is provided in Section 9.9.

Registered Bores

GHD (2010a), conducted a search of the NSW Groundwater Bore Database. This search identified 16 registered bores within approximately 7 km of the Awaba Colliery. An assessment of the potential impacts upon these registered groundwater bores is provided in Section 9.1.3.2.

9.1.2.3 Water Quality

A review of the existing water quality associated with the Awaba Colliery was undertaken for the Project. The review of water quality included surface water locations (including discharge locations) which, due to the integratrated water management system of the mine as outlined earlier, include components of underground mine water within surface discharges at 10 South Bore (and LDP005 historically).

The review involved developing appropriate trigger values for physical and chemical stressors and toxicants through a comparison between local reference data and the default ANZECC/ARMCANZ (2000) trigger values. The recommended trigger values for nutrients and heavy metals used for the Project are provided within the water management assessment (GHD, 2010a). The water quality review gave consideration to the following six (6) monitoring locations:

- Upstream – is considered to be the most representative of the background water quality of Stony Creek and is located upstream of LDP009. It is noted that discharges from LDP005 (decommissioned in March 2010) would have occurred upstream of this location GHD (2010a);
- Downstream – is located downstream of LDP009, within Stony Creek;
- Lake Macquarie – is located approximately 8.5 kilometres downstream of LDP009;
- LDP009 – is located at the discharge location for the Pollution Control Dam at the Awaba Colliery Pit Top. Discharges through LDP009 have essentially been limited to event based discharges;
- LDP005 – is located approximately one kilometre to the south west of the Awaba Colliery pit top and discharges into Stony Creek. It is noted that discharges through LDP005 temporarily ceased since March 2010, and currently the 10 South de-watering bore is used to dewater from the underground workings; and
- 10 South de-watering bore – is located approximately 500 metres west of the Eraring Ash Dam, into which it discharges, approximately 3.5 kilometres south of the Awaba Colliery pit top.

It is noted that due to the historical mining at Awaba Colliery in the main regional aquifer (i.e. the Great Northern coal seam), the coal seam aquifer has long since been de-pressurised and de-watered. As such the water quality assessment for the Project has considered the mine water quality from the two main de-watering bores.

The period of data reviewed for each of the monitoring locations is provided in the water management assessment (GHD, 2010a).

A summary of the water quality review is provided in Table 9.4.

Table 9.4 – Existing Water Quality

Parameter	Location	Water Quality Observation (GHD, 2010a)
pH	Upstream and Downstream	Over 75% of reported results at both locations are within the ANZECC/ARMCANZ (2000) trigger value range for lowland rivers and over 90% are within the EPL 443 discharge limit range.
	LDP009	All reported pH levels within the EPL 443 discharge limit range.
	10 South & LDP005	Over 97% of reported results through LDP005 and 10 South were within the ANZECC/ARMCANZ (2000) trigger value range for lowland rivers and over 99% for both locations are within the EPL 443 discharge limit range.
Electrical Conductivity (EC)	Upstream and Downstream[1]	Surface water within the Stony Creek tributary is fresh to brackish ranging from 186 to 3410 µS/cm. These monitoring locations are above the Stony Creek tidal limit and it has therefore been suggested that the EC variability is attributable to the interaction of rainfall runoff with the licensed discharge of groundwater extracted from the Great Northern seam workings through LDP005 (recently decommissioned)
	LDP009[2]	the event based discharges were determined to be primarily fresh with EC in the order of 270 µS/cm.
	10 South & LDP005	The median EC ranged between 2508 µS/cm (from LDP005) and 6095 µS/cm (from 10 South bore). This resulted in brackish and saline discharges.
TSS	Upstream and Downstream	Over 90% of reported concentrations were less than the EPL 443 discharge limit of 50 mg/L
	LDP009[3]	TSS concentrations through LDP009 for event based discharges exceeded the concentration limits nominated in EPL 443
	10 South & LDP005	98% of the reported discharge concentrations were below the EPL 443 discharge limit (50 mg/L) and the ANZECC/ARMCANZ (2000) maximum trigger value for NSW lowland rivers. Additionally, approximately 50% of results for 10 South and 88% for LDP005 were less than the recommended trigger value for coastal lowland rivers (6 mg/L).
Turbidity	Upstream and Downstream[4]	All reported results (with the exception of three) were less than the ANZECC/ARMCANZ (2000) maximum trigger value for NSW lowland rivers (50 NTU) at Downstream, while at Upstream turbidity exceeded the trigger value on seven occasions between March 2007 and March 2010.
	LDP009[5]	Turbidity of event based discharges through LDP009 exceeded the concentration limits nominated in EPL 443.
	10 South & LDP005	Over 95% of the reported discharge concentrations were below the EPL 443 discharge limit (50 mg/L) and the ANZECC/ARMCANZ (2000) maximum trigger value for NSW lowland rivers. Additionally, approximately 65% of results for 10 South and 53% for LDP005 were less than the recommended trigger value for coastal lowland rivers (6 mg/L).
Oil and Grease	LDP009, Upstream and Downstream	Results were consistently below the laboratory detection limit and/or less than the EPL discharge limit (10 mg/L).
Arsenic[6]	All locations (see note 6)	Results indicated that both total and dissolved arsenic, were within the default ANZECC/ARMCANZ (2000) trigger values.
Copper[6]	Upstream	The total copper levels were all below the default ANZECC/ARMCANZ (2000) trigger value. For dissolved copper, 35% of the recorded concentrations were above the default ANZECC/ARMCANZ (2000) trigger value, however, all results were below the revised trigger level with the application of the 'water hardness' factor.

Parameter	Location	Water Quality Observation (GHD, 2010a)
	LDP009 & LDP005	All discharges from LDP009 and 60% of discharges from LDP005 recorded concentrations for total copper above the default ANZECC/ARMCANZ (2000) trigger value. With the application of the 'water hardness' factor all recorded total copper concentrations, for LDP009 and LDP005, were below the revised trigger level.
	10 South	75% of discharges recorded concentrations for total copper above the default ANZECC/ARMCANZ (2000) trigger value. With the application of the 'water hardness' factor 25% of the recorded discharges were above the revised trigger level.
Lead[6]	Upstream & LDP005	Results indicated that both total and dissolved lead, were within the default ANZECC/ARMCANZ (2000) trigger values.
	LDP009 &10 South	All recorded discharges through LDP009 and 13% of the discharges through 10 South were above the default trigger values, however, all recorded discharges complied with the revised trigger value with the application of the 'water hardness' factor.
Zinc[6]	Upstream & LDP009	All recorded discharges from LDP009 and approximately 80% from upstream were determined to be above the default ANZECC/ARMCANZ (2000) trigger values, however, all recorded discharges complied with the revised trigger value with the application of the 'water hardness' factor.
	10 South & LDP005	All of the recorded concentrations discharged through 10 South and LDP005 for zinc were above default ANZECC/ARMCANZ (2000) trigger value, with the application of the 'water hardness' factor, 25% of the recorded discharge concentrations for 10 South and 47% for LDP005 were above the revised trigger level.

Note 1: EC levels at 'Downstream' consistently exceeded those reported at 'Upstream' for the period between August 2008 and January 2009.

Note 2: The discharge through LDP009 between October 2008 and December 2008 was generally brackish, with EC ranging from 3160 to 3530 µS/cm. This discharge is likely to have raised the EC at 'Downstream' during late 2008.

Note 3: TSS concentrations through LDP009 for the period between October 2008 and December 2008 were within the concentration limits nominated in EPL 443.

Note 4: Turbidity levels reported at the 'Upstream' monitoring location were generally higher than those reported at 'Downstream'

Note 5: During the period between October 2008 and December 2008, the turbidity of the LDP009 discharge was consistently less than the turbidity within Stony Creek as well as the recommended trigger value for coastal lowland rivers.

Note 6: An assessment of heavy metals was undertaken for the period of September 2009 to March 2010 for five monitoring locations ('upstream', Lake Macquarie, LDP009, LDP005 and 10 South).

Furthermore, AGEC also conducted a groundwater assessment for the Centennial Newstan Statement of Environmental Effects in 2007 (AGEC, 2007). While this study was not within the Application Area, the results are assumed to be representative of the regional area (including the Awaba Colliery). The AGEC (2007) groundwater report compared the monitoring of groundwater quality and quantity with the ANZECC (Australian and New Zealand Environment Conservation Council) 2000 Guidelines. The comparison indicates:

- Groundwater in the alluvial aquifer is unsuitable for human consumption in many locations due to salinity and high iron concentrations and is primarily a low yielding aquifer being used primarily for stock water;
- The alluvial aquifer is of limited area extent and has an environmental value classified as "primary industry". It includes localised areas of fresh water, such as swamps and deeply incised channels supporting permanent water holes, classified as "aquatic ecosystems"; and
- The low yield and poor quality water of the coal seam aquifers similarly leads to a "primary industry" classification for environmental value.

AGEC (2007) concluded that the alluvial and bedrock aquifers are not significant groundwater resources as yields are low and quality is generally poor.

9.1.3 Water Management Impact Assessment

9.1.3.1 Surface Water Management

Clean Water Management

There were no potential impacts upon the clean water management system identified for the Project. As there is no significant change proposed to the surface infrastructure within the pit top area (with the exception of the expansion of the Pollution Control Dam), it is not anticipated that there will be any impacts on the existing surface water behaviour (GHD, 2010a).

Dirty Water Management

The capacity of the existing Pollution Control Dam has been determined to be limited, and as such discharges can occur during what are considered to be reasonably regular rainfall events (GHD, 2010a), refer Section 9.1.2.1. Accordingly, the proposed Project involves the expansion of the PCD. The results of the water balance assessment (GHD, 2010b) indicated that the proposed expansion of the PCD would result in a decrease in discharge through LDP009, during years of higher rainfall. It is noted that the proposed expansion of the PCD would also require additional dirty water management during construction, these mitigation measures have been discussed in Section 9.1.5.1.

Furthermore, while no changes are proposed for the existing quarry, the function of this facility is to provide material for on-site remedial works, as such, there is a potential for activities in this area to result in an increase in sediment laden water being discharged due to increased disturbance of the quarry base. The existing measures are not considered to be appropriate for the current form of the quarry (GHD, 2010a) and additional measures including reshaping of the quarry floor with infall drainage have been proposed as outlined later in this section. The consequences of these identified impacts are discussed in Section 9.1.4.1.

Watercourses

The review of water quality being discharged through LDP009 located at the spillway of the PCD (refer to Section 9.1.2.3) indicated that the majority of the results for pH, EC and oil anad grease were within the limits provided by EPL443, however, during event based discharges the level of TSS exceeded the conditions of EPL 443. The contribution of TSS over the level nominated in EPL 443 is a result of the limited capacity of the PCD which is to be expanded under the Project. As indicated in Section 9.1.2.1, Stony Creek is generally well vegetated and stable suggesting that the impact of Awaba Colliery on Stony Creek is negligible (GHD, 2010a). The improved performance of the PCD (which decreases the number of annual event based discharges) will further assist in reducing any potential impact of the Awaba Colliery on the Creek (GHD, 2010a).

Awaba Colliery does not harvest any clean catchment runoff nor does it extract water from any of the watercourses within the lease area. The hydrologic impact of Awaba Colliery on watercourses is therefore considered to be negligible as there is no removal of clean runoff from the overall natural surface water system. Further, conservative mine design to protect the surface includes buffer zones around 2nd order and higher creeks and provides a minimum design depth of cover in extraction areas to prevent potential impact. However, the potential for subsidence related impacts upon surface hydrology with flow on effects for surrounding/downstream ecosystems, has conservatively been considered for the Project mining areas in Study Areas 2 and 3.

Hunter Eco (2010) states that, subsidence would need to result in major changes to the surface hydrology of an area for a significant impact to occur to ecosystems. It is not anticipated that for the maximum predicted subsidence scenario (200mm) that major changes to surface hydrology would occur (Hunter Eco, 2010). It is noted that the potential impacts to surrounding ecology which may result from potential impacts to surface hydrology have also been considered and are discussed in further detail in Section 9.9, while the potential impacts to the surface hydrology are discussed below.

Unless quantitative values can be provided for the elements of the hydrological cycle, it is not possible to determine the quantitative impact of an interruption in the cycle. However it is possible to determine the net impact of alterations to the cycle by using streamflow analysis. In an assessment of the unlikely worst case subsidence scenario (i.e. plug failure), Hunter Eco (2010) noted that the water cycle would be potentially impacted by the loss of flow from the area of subsided surface into the mine workings. In addition, the un-subsided areas upstream of the impacted area which flow into the subsided area (in the short duration while ever the impacted area remained unremediated) would potentially be disrupted and cause potential impacts upon the downstream environment.

In the unlikely 'worst case' event of a plug failure, the void which would have the greatest impact on flow in Stony Creek would result in the loss of approximately *4%* of flow. It is noted that this loss of flow to Stony Creek would have the potential to impact upon a downstream Endangered Ecological Community (EEC) (Hunter Eco, 2010). Notwithstanding this, with the anticipated response by the mine in such an event (refer Section 9.1.5) includes remedial works as soon as practicable such that the extent of flow interruption would be expected to be temporary. Potential impacts, along with potential impacts upon the smaller upstream patch of EEC, have been discussed in Section 9.9.

Potable and Waste Water

There were no potetnial impacts upon the potable and waste water management identified for the Project. These water management systems will continue to opreate in the existing condition for the Project.

Existing Licensed Discharge Points

The potential impacts for water being discharged from the existing LDPs have been discussed above (for watercourses). There were no further potential impacts identified for the LDPs. It is noted that the Project will result in fewer discharges from the existing LDP005 (recently temporarily decommissioned) and LDP009 (due to a proposed increase in PCD capacity).

9.1.3.2 Underground Water Management

Mine Water Management

It is considered that water make will likely not increase as a result of pillar extraction of existing workings. In addition, it is unlikely that the first workings proposed for the East B area will generate much water make. The MODFLOW model predicted that this area would be relatively dry during mining (GHD, 2010b).

The results of the water balance assessment (GHD, 2010b) indicated that the removal of LDP005 will result in an increase in discharges to the Eraring Ash Dam through 10 South. Further, it is noted that the removal of LDP005 will result in a general trend for an increase in water stored in 10 South water storage area. The pumping for the existing and proposed conditions at 10 South indicates that an increase in discharge from the 10 South de-watering bore will be required to maintain safe water levels. Based on the seam floor contours at the 10 South water storage area, it is recommended that the long term underground water level in this area should generally remain below approximately -2 to -1 m AHD to avoid flooding of workings to the west.

The hydrogeological model determined that based on a long term extraction rate of 0.48 ML/day (or 173.6 ML/year) (i.e. current capacity) at 10 South, underground water levels will rise in this area to approximately -1 m AHD within the period of time modelled. Furthermore, it was determined that a daily discharge of 1.2 ML/day (or 440 ML/year) would be sufficient to maintain the underground water level at or below -2 m AHD, required in order to maintain a safe water level within the underground workings (GHD, 2010b).

The potetnial impacts from the increaesd discharge of the 10 South de-watering bore into the Eraring Ash Dam has also been considerd for the Project and is discussed in Section 9.1.3.3.

Project Site Aquifers

As there is no regional aquifer located above the Great Northern Seam (GHD, 2010b), and mine design has incorporated barriers left around 2nd and 3rd order streams (and their potetntial aluvial aquifers), there were no potetnial impacts upon the Project site aquifers identified for the Project.

Groundwater Dependant Ecosystems

GDE and riparian vegetation can be impacted to varying degrees by subsidence where stream flow is altered through bed cracking or ponding. *Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands* is a key threatening process listed in schedule 3 of the *Theartened Species Conservation Act 1995* (TSC Act).

Downstream impacts should also be considered as GDE's develop as a result of the cumulative increase in groundwater availability. The overall slopes on the subject site are such that subsidence of the range predicted, even in the unlikely worst case

'plug failure' scenario, would not result in any diversion of water from the existing drainage lines meaning that there would be no impact on downstream GDE's (Hunter Eco, 2010). The assessment of these impacts has, in addition to the assessment undertaken for the Project, also been well documented through various reports undertaken for specific SMP Applications in recent years for both the 3 North Area and more recently Revised Stage 3 Area (the latter is available to be viewed on the Centennial website – www.centennialcoal.com.au/).

It is noted that potential ecological impacts upon GDE's was undertaken by Hunter Eco (2010), these are discussed in Section 9.9.

Registered Bores

The search of the NSW Groundwater Bore Database identified 16 registered bores within approximately 7 km of the Awaba Colliery pit top. Since these bores are beyond the outcrop of the Great Northern Seam, which Awaba Colliery mines, it is likely that they intercept the Fassifern Seam and will not be impacted by the Project.

Overall, the bore search indicates that groundwater usage in the area by local landholders is limited. In addition, the hydrogeological model did not estimate any substantial increase in water make (i.e. loss of groundwater from surrounding aquifers) as a result of the project (GHD, 2010a). From this it can be reasoned that impacts from the Project upon groundwater users would be minimal.

9.1.3.3 Water Quality

A reduction in the number of event based discharges through LDP009, due to the increased temporary storage capacity associated with the Pollution Control Dam, will result in a reduction in the annual pollutant load contributing to Stony Creek.

As indicated in Section 9.1.2.3, the quality of event based discharges in relation to pH, EC and oil and grease are within the concentration limits of EPL 443. Therefore the improvements to the PCD will have negligible impact on these pollutants. However for TSS and turbidity, the concentrations of these pollutants during event based discharges exceeded the concentration limits nominated in EPL 443. Consequently the improvements proposed for the PCD will reduce the volume of sediment being discharged into Stony Creek in times of high rainfall.

A comparison of ANZECC/ARMCANZ (2000) trigger values and Lake Macquarie ambient values indicated that there were numerous parameters for which Lake Macquarie exceeded the ANZECC/ARMCANZ (2000) guideline values. This is potentially due to historical discharges from heavy industry such as the Pasminco Sulphide Factory and power stations (Wangi and Eraring) (GHD 2010a).

The assessment of water quality data at 'Upstream', 'Downstream' and LDP009 indicated that the quality of water leaving the Awaba Colliery lease area was generally better than the water quality in Lake Macquarie. The exceptions to this included TSS, Arsenic (total and dissolved), Manganese (total and filtered), Aluminium (dissolved) and zinc (dissolved). However for each of these (with the exception of TSS) the quality of the Awaba Colliery discharges were within the limits of the ANZECC/ARMCANZ (2000) trigger values (refer to Section 9.1.2.3 for further detail).

The groundwater quality assessment focussed on the quality of mine water being pumped through the mine de-watering bores, namely LDP005 and 10 South. A recent change to the groundwater management system has involved the temporary removal of LDP005, with 10 South bore remaining as the current sole de-watering bore.

GHD (2010a) indicated that the removal of LDP005, which contributes to Stony Creek, may reduce the percentage of brackish water within the watercourse.

Consideration was given to the potential impact of the discharge of saline water through 10 South, into the Eraring Ash Dam. The current Eraring Power Station EPL (EPL1429) contains the same concentration limits for pH and TSS, and therefore, as shown in Table 9.4, water quality limits are met for all recorded pH levels and 98% of TSS records (GHD, 2010a). It is noted that there are no concentration limits for EC on either the Eraring Power Stations EPL1429, or, the Awaba Colliery EPL443. A comparison was therefore undertaken by GHD (2010a), to the 50th percentile ECs within Lake Macquarie, this determined that discharges through 10 South were 85% lower than 50th percentile concentrations within the Lake.

9.1.4 Consequences of Potential Water Management Impacts

9.1.4.1 Surface Water Management

Clean Water Management

There were no potential impacts identified, as such there would be no consequences from the Project.

Dirty Water Management

The water management assessment identified that the capacity of the existing Pollution Control Dam is limited and as such discharges occur during reasonably regular rainfall events (GHD, 2010a). Two (2) options for increasing the capacity (to cater for the 10 year 24 hour design storm event) of the Pollution Control Dam were investigated by GHD (2010a). This investigation is included as Appendix A to GHD (2010a). The preferred option includes lowering the existing pollution control dam water level by 0.5m and the construction of an additional storage.

The water management assessment also identified that additional erosion and sediment control measures will be required during the construction of the proposed PCD and at the existing quarry location (GHD, 2010a). These recommendations have been included in Section 9.1.5.1.

Watercourses

Recent changes to mine water management, and the proposed expansion of the PCD, will assist to reduce the number of discharges from the Awaba Colliery into Stony Creek. It is noted that this would have overall beneficial impacts upon water quality within Stony Creek.

The streamflow analysis undertaken for the Project indicated that there would be a 4% loss in flow into Stony Creek during the unlikely worst case 'plug failure' event (Hunter Eco, 2010). It is envisaged that this would be temporary and be restored as soon as practicable by remedial works. It is noted that for the predicted levels of subsidence (i.e. maximum of 200mm) the surface hydrology would not be impacted (Hunter Eco, 2010). Therefore it has been considered that there will be no consequences from the Project.

Potable and Waste Water

There were no potential impacts identified, as such there would be no consequences from the Project.

Existing Licensed Discharge Points

There were no potential impacts identified, as such there would be no consequences from the Project.

9.1.4.2 Underground Water Management

Mine Water Management

A comparison of the existing and proposed (without an increase in pumping capacity) discharges from Awaba Colliery into the Ash Dam was undertaken. The existing discharge of 155 ML/year (0.42 ML/day) equates to approximately 2% of the total inflows into the Ash Dam while the increased discharge (for the proposed conditions) of 173.6 ML/year (0.46 ML/day) accounts for around 3% of the total inflows.

Under both the existing and proposed conditions, discharges from Awaba Colliery (through 10 South) contribute only a minor portion of inflows into the Eraring Ash Dam (GHD, 2010b).

To provide greater flexibility for Awaba Colliery to enable the maintenance of an underground water level of -2 m AHD (primarily to manage water beyond the Application Area in existing workings west of the Main Northern railway line), an increased pumping capacity to 1.2 ML/day has been recommended. In the event that this is adopted, the impact of Awaba Colliery on the Eraring Ash Dam would increase to 8.5% of the total inflows. Again this is not considered to be a significant impact on the Ash Dam (GHD, 2010b).

Project Site Aquifers

There were no potential impacts identified, as such there would be no consequences from the Project.

Groundwater Dependant Ecosystems

If the hydrology is altered substantially, over a long enough time period, then there is the possibility that the vegetation will change in composition to species more suited to the new conditions. Examples would be where groundwater is depleted and groundwater dependent species are gradually replaced by species more tolerant of drier conditions or where water accumulates and more water dependent vegetation develops. Due to the predicted level of subsidence and the mine design such consequences are not expected for the Project (Hunter Eco, 2010).

Registered Bores

There were no potential impacts upon registered groundwater users identified within a seven (7) kilometre radius of the Application Area (GHD, 2010a), as such, there would be no consequences for the Project.

9.1.4.3 Water Quality

As detailed in Section 9.1.3.3, the quality of water leaving the Awaba Colliery was generally better than the water quality in Lake Macquarie, as such it was determined that there would be no consequences from the Project.

In addition, the majority of discharges from 10 South bore to the Eraring Ash Dam are within the prescribed concentration limits of EPL1429. It is also noted (see Section 9.1.4.2) that the proposed increase in groundwater being de-watered through the 10 South bore would not cause a significant impact on the dam volume. From this it has been deduced that there will be no groundwater quality impacts associated with the Project, caused by the proposed increase in de-watering through the 10 South bore.

9.1.5 Water Management and Mitigation Measures

9.1.5.1 Management and Mitigation Measures

Awaba Colliery identified a number of mitigation strategies that have been (or will be) implemented for the Project in order to minimise and manage the potential environmental impacts from its water management system. These include:

- Minimal additional construction activities (area of the PCD expansion only) and surface disturbances;
- Utilisation of existing water management structures (including Pollution Control Dam, oil/water separator, clean and dirty water diversions, bunded storage areas, etc);
- Environment Protection License for discharges from the Awaba Colliery;
- An existing Draft Water Management Plan;
- An existing Watercourse Management Plan;
- Historical mining at the Awaba Colliery has depressurised the aquifer, this has been affirmed by the coal seam typically being ‘dry’ while mining and during routine inspections;
- Surface inspections for subsidence cracking and appropriate rehabilitation;
- Conservative mine design, including restrictions to secondary extraction under creeks or their alluvial deposits (i.e. 20 metre barriers for second order streams and 50 metre barriers for third order streams) (refer to Section 7 for detail); and
- The existing Public Safety Management Plan and the Watercourse Management Plan would be referred to, in the unlikely event of subsidence above the expected 200mm (such as plug failure), to provide mitigation measures that would be implemented (including remediation strategies).
- A variation to EPL443 will be sought that incorporates a Pollution Reduction Program (PRP) for water quality monitoring for Awaba Colliery in accordance with ANZECC requirements.

Further to these management and mitigation measures, the following recommendations have been prepared to address potential impacts identified for Study Area 1 through the water management assessment for the Project (GHD, 2010a).

Study Area 1

The following mitigation measures will be implemented at Awaba Colliery to ensure that the potential impacts from the water management during the life of the Project are minimised:

- Maintenance of the nominated 'clean' hardstand areas as clean catchments, including regular sweeping of these areas. These areas are also regularly inspected to ensure that they remain clean;
- The capacity of the Pollution Control Dam is proposed to be increased. This will assist to reduce the discharge of dirty water from Awaba Colliery to the downstream environment;
- During the construction of the additional storage associated with the Pollution Control Dam, a number of sediment and erosion control measures will be required. It is recommended that these measures be determined during the detail design phase and be in accordance with the recommendations of both *Managing Urban Stormwater: Soils and Construction (Vol 1)* and *Managing Urban Stormwater: Soils and Construction (Vol 2E)*;
- Shaping of the base of the quarry should be undertaken to enable the retention of dirty water runoff generated during rainfall events up to the 20 year ARI design event as well as installation of a sediment trap near the existing access track;
- The existing sediment and erosion control measures associated with the quarry should also be monitored monthly to ensure their integrity and performance. Additionally, at times when additional material is being won from the quarry, monitoring of these measures should be increased to weekly;
- While 10 South bore is not a surface feature, water discharged from this location contributes to the Eraring Ash Dam. Due to the minor contribution of Awaba Colliery to the overall inputs into the Ash Dam, no mitigation measures have been proposed for this location; and
- In order to maintain the underground water level at a safe water level within the underground workings the 10 South de-watering bore will have an increased pumping capacity from 0.48 ML/day to 1.2 ML/day.

It is noted that, any additional groundwater licenses required for the Project will be sought for following approval.

9.1.5.2 Monitoring and Reporting

Study Area 1

To enable ongoing assessment of water quality discharged from Awaba Colliery, the existing monitoring program will be maintained for the life of the Project. This monitoring program is outlined in Table 9.5.

Table 9.5 – Monitoring Program

Location	Frequency	Monitored Parameters
LDP001, LDP002, LDP003, LDP004, LDP005, LDP006 and LDP007	Monthly (when discharging)[1]	pH, TSS, oil and grease, EC, turbidity
LDP009	Events Based	pH, TSS, oil and grease, sulphate, TP, TN, turbidity, TDS, EC, BOD, Ca, Mg, Na, K, NO_x, total hardness. Total: Cu, Pb, Hb, Ni, Co, Se, Ag, Zn, Al, As, Ba, B, Cd, Fe, Mn, Chloride, Cr, Cyanide, Flouride, Ammonia as N. Filtered: Cu, Pb, Hg, Ni, Co, Se, Ag, Zn , Al, As, Ba, B, Cd, Fe, Mn, Cr
LDP008, 10 South[2, 3], Upstream[2] and Downstream[2]	Monthly	pH, TSS, oil and grease, EC, turbidity

	Bi-Annual (i.e. twice a year)	pH, TSS, oil and grease, sulphate, TP, TN, turbidity, TDS, EC, BOD, Ca, Mg, Na, K, NO_x, total hardness. Total: Cu, Pb, Hb, Ni, Co, Se, Ag, Zn, Al, As, Ba, B, Cd, Fe, Mn, Chloride, Cr, Cyanide, Flouride, Ammonia as N. Filtered: Cu, Pb, Hg, Ni, Co, Se, Ag, Zn , Al, As, Ba, B, Cd, Fe, Mn, Cr
Note 1: These LDPs are intermittently required for use. Currently, none of these LDPs are used for discharging. *Note 2: Currently only monthly monitoring. Bi-annual monitoring recommended.* *Note 3: It is noted that the 10 South de-watering bore is also used to monitor (weekly) changes in the level of water stored in underground depressions. These results will be used to verify that the rate of extraction at 10 South Bore is sufficient.*		

Study Area 2 and 3

The following measures apply to all lands within Study Areas 2 and 3 of the Application Area:

- Undertake pre-mining and post-mining inspections along creek lines.
- Watercourse Management Plan (established in recent years for SMP Areas and to be updated for the Project).

9.1.6 Conclusion

While no changes are proposed for the existing small quarry, the function of this facility is to provide material for on-site remedial works, as such, there is a potential for activities in this area to result in an increase in sediment laden water being discharged due to increased disturbance of the quarry base. The existing measures are not considered to be appropriate for the current form of the quarry (GHD, 2010a) and minor improvements (including reshaping of the quarry floor for infall drainage) have been proposed by the mine as outlined in Section 9.1.5.1.

The hydrologic impact of the Project on watercourses is considered to be negligible (GHD, 2010a). The Awaba Colliery does not harvest any clean catchment runoff nor does it extract water from any of the watercourses within the CCL746 boundary. Furthermore, it is noted that for the predicted levels of subsidence the surface hydrology would not be impacted.

The water management assessment identified that the proposed expansion of the PCD would result in a decrease in discharge through LDP009, during years of higher rainfall. It is suggested that, although the contribution of TSS from the existing PCD during event-based discharges is over the level nominated in EPL 443, the impact of discharges from LDP009 at the Awaba Colliery on the water quality in Stony Creek is negligible, and the improved performance of the PCD will further assist in reducing any potential impact of the Awaba Colliery on Stony Creek. It is noted that the assessment of water quality data indicated that the quality of water leaving the Awaba Colliery was within the limits of the ANZECC/ARMCANZ (2000) trigger values.

Recent changes to mine water management, resulting in fewer discharges from the existing LDP005 (recently temporarily decommissioned), will further assist to reduce the number of discharges from the Awaba Colliery into Stony Creek.

It is noted that the reduction in discharges from LDP005 will result in an increase in discharges through the 10 South de-watering bore. In addition the water management assessment indicated that the pumping capacity of the 10 South de-watering bore would need to be increased in order to maintain a safe water level within the underground workings. It was assessed that the contributions from 10 South to the Eraring Ash Dam were minor, and that the water quality from the de-watering of underground workings was generally in accordance with the existing Eraring Power Station EPL.

As there is no regional aquifer located above the Great Northern Seam, and mine design has incorporated barriers left around 2nd and 3rd order streams (and their potetntial aluvial aquifers), there were no potetnial impacts upon the Project site aquifers identified for the Project. In addition, and any GDE's present relying upon the alluvial aquifers will also not be impacted upon in the predicted subsidence scenario due to the mine design and planned barriers.

It was assessed that impacts from the Project upon groundwater users would be minimal. A search indicated that groundwater usage in the area by local landholders is limited and that the hydrogeological model did not estimate loss of groundwater from surrounding aquifers.

9.2 Aboriginal Heritage

9.2.1 Introduction

The Project BBRA considered that without conducting any surveys or consultation with the Aboriginal community the potential impact from surface activities upon potential Aboriginal sites was a *significant risk*. Additionally, the potential for subsidence-related impacts to affect the Aboriginal heritage was considered a *moderate risk*. Accordingly, a specialist archaeology assessment for the Project was undertaken including consultation with the Aboriginal community and a field survey.

An Aboriginal heritage assessment for the Project was undertaken by RPS Harper Somers O'Sullivan (RPS) in a report titled "Cultural Heritage Impact Assessment: For Awaba Colliery" herein after referred to as RPS (2010b). This report has been included in Appendix 7. This assessment considers the potential for Aboriginal archaeological sites to occur, the location of any registered sites within the Study Area, and the implications for the project with regard to any existing or potential archaeological material located in the Study Area. This assessment generally involved the following:

- A search of the relevant State and Federal heritage registers and listings, including the DECCW and the register for native title claimants;
- Identification of Aboriginal Land Councils, Elders and other interested parties through consultation with DECCW;
- Liaison and partnership with the Aboriginal community;
- A review of all relevant documentation and statutory requirements with regard to Aboriginal heritage;
- Review of data from the DECCW Aboriginal Heritage Information Management System (AHIMS) to identify known Aboriginal sites;
- A review of environmental information and previous archaeological work to develop a predictive model for Aboriginal archaeological site patterning within the Study Area;
- An assessment of archaeological sensitivity within the Study Area;
- Evaluation of potential impacts; and
- Preparation of mitigation and management strategies.

As identified in Section 9.2.3.2 several previous heritage assessments have been undertaken within and surrounding the area (shown on Figure 9.7). These have included surveys covering all proposed mining areas for the Project. It is noted that in preference to performing additional surveys in these areas, the heritage assessment for the Project has relied on these previous assessments to provide archaeological sensitivity mapping and mitigation and management measures (RPS, 2010b). This methodology was presented to the registered interested groups during Stage 2 of the ICCR consultation process (as described in Section 9.2.2 no issues were raised at this time. A summary of the RPS (2010b) cultural heritage assessment as it applies to the Aboriginal heritage of the site is provided below.

9.2.2 Consultation

The purpose of Aboriginal community consultation is to provide an opportunity for the relevant Aboriginal stakeholders to have input into the heritage management process. Consultation with the Aboriginal community has been ongoing by the Awaba Colliery for surveys within the Application Area since 2005. Details regarding the history of Aboriginal community consultation, including all relevant consultation for this Project, have been provided in Section 6.5. A summary is provided below.

A number of heritage assessments have involved consultation with the Aboriginal community for various portions of land within the Application Area (as outlined in Section 9.2.3.3. These heritage assessments were undertaken for different consent authorities, including the Mine Subsidence Board and Department of Planning, and as such have used varying methods for Aboriginal consultation in accordance with the specifications of the relevant consent authority.

The consultation process with local Aboriginal stakeholders specifically for the Project followed the DECCW *Interim Community Consultation Requirements* (ICCRs) (2004) as recommended in the DEC 2005 *Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (for Part 3A assessments). These guidelines were followed for identifying Aboriginal parties, providing them with information and consulting with them on methodology, assessment and the recommendations for management of the sites.

It is noted that new consultation guidelines *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (2010) were released in April 2010. However, DECCW advised that for projects in which consultation had commenced prior to the 12 April 2010, these could continue under the ICCR process. Consultation for the Project under the ICCR guidelines was commenced in March 2010, therefore consultation was not required to recommence under the new 2010 guidelines.

An advertisement was published in the Newcastle Herald (3 April 2010), inviting Aboriginal stakeholders to register an expression of interest. Seven (7) Aboriginal groups and / or individuals formally expressed interest at the end of the registration period.

Following this the registered stakeholders were notified of the methodology to be used for the assessment. A copy of the Aboriginal Heritage Impact Assessment was forwarded to the seven (7) registered groups for comment in April 2010. No issues were raised by the Aboriginal groups during consultation for the Project. A consultation log of all relevant consultation for the Awaba Colliery is included as an appendix to the heritage assessment (RPS, 2010b) (see Appendix 7).

In addition, in the 1990s, Aboriginal consultation culminated in the formulation of the ILUA (Master Deed 1999). The ILUA has ensured ongoing consultation with the Wonnarua People (Wonnarua Nation Aboriginal Corporation - WNAC), over the last decade for lands within and adjacent to the Application Area. As a portion of the East B Area (Study Area 3) is located within an area that has not been previously mined or surveyed, the ILUA for the area was engaged. This has involved additional consultation with WNAC for this Project.

9.2.3 Existing Environment

9.2.3.1 Aboriginal Heritage Context

The Aboriginal heritage assessment process requires that the significance of Aboriginal sites within a study area is assessed. It is important that Aboriginal sites are contextualised within the local and regional landscape, in order to inform the assessment of significance. The Aboriginal heritage context is also needed in order to develop a predictive model of Aboriginal sites in the study area. The Aboriginal heritage context is presented in Section 4 of the heritage assessment (RPS 2010b). A summary of the archaeological context for the surrounding local area is provided below.

A search of the Aboriginal Heritage Information and Management System indicate that 30 sites have been recorded within five kilometres of the study area. The most common site types were middens followed by rock shelters and artefact scatters. No registered AHIMS sites are located within the study area (RPS 2010b).

9.2.3.2 Previous Surveys

Several previous heritage assessments have been undertaken within and surrounding the area (shown on Figure 9.7). These assessments have been used as the basis to provide recommendations and mitigation measures for the Project. The previous surveys have been undertaken since 1982 to present for various projects including Environmental Assessments, Subsidence Management Plan applications and an Exploration Drilling Program that involved the creation of sensitivity mapping and accompanying management protocols. These surveys have been described in Section 4.2 of RPS (2010b) which is attached in Appendix 7, and include:

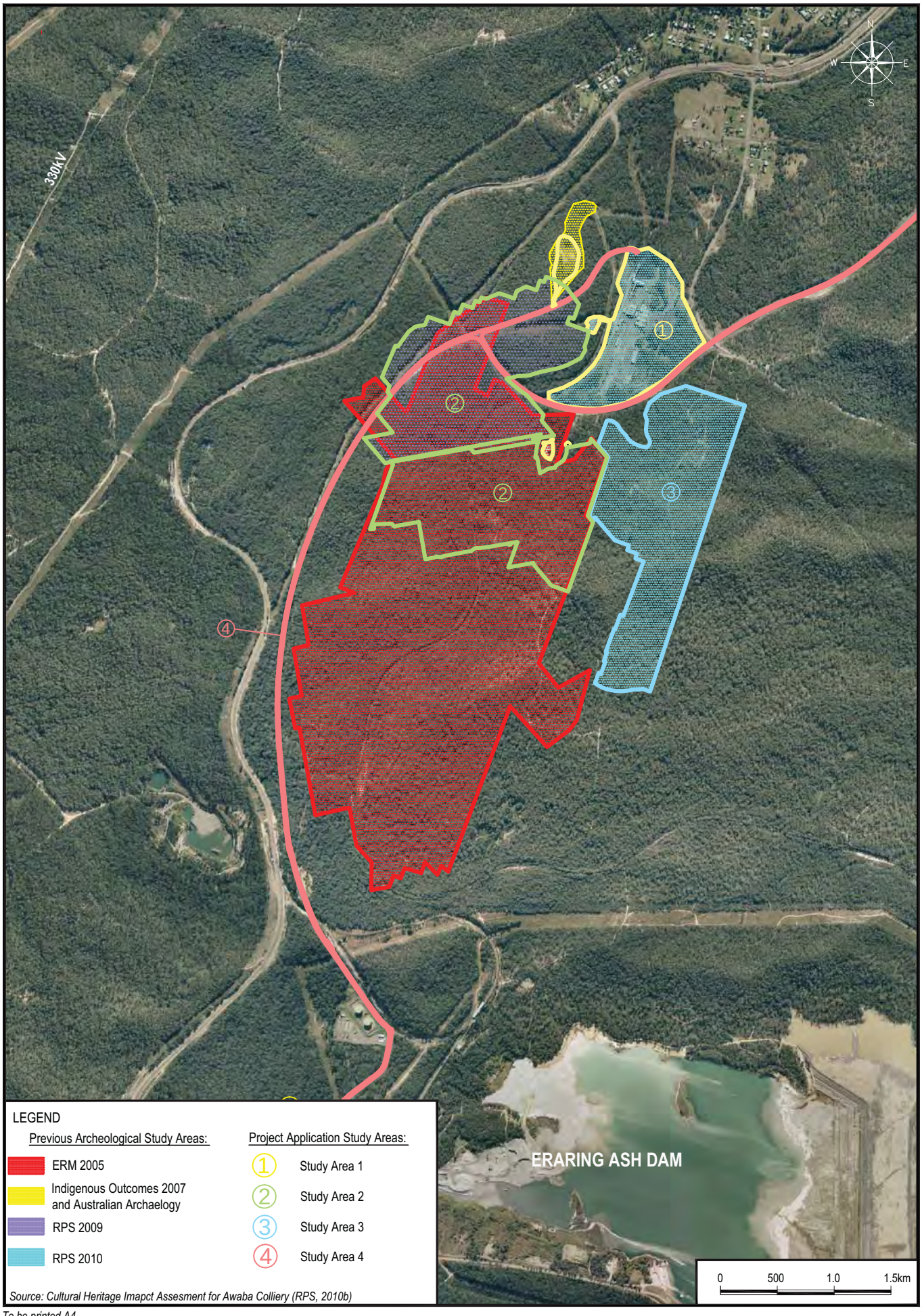
- Brayshaw (1982) Archaeological survey for expansion of Awaba State Mine
- Dean-Jones (1989) Archaeological survey of proposed gravel quarry, Awaba State Mine
- Resource Planning Pty Ltd (1991) Archaeological survey at Awaba
- Umwelt (1998) Archaeological Survey for Newstan Colliery Life Extension Project
- Umwelt (2004) Archaeological survey for Centennial Newstan Longwalls 22 and 23
- ERM (2005) Archaeological Survey for Awaba Colliery Outbye Pillar Extraction
- RPS (2008a) Awaba East Exploratory Drilling Program
- RPS (2008b) SMP Archaeological Assessment 3 North Area
- RPS (2009a) Archaeological Assessment Awaba East Exploration Area Stage 2 Drilling Area
- RPS (2009b) SMP Archaeological Assessment Revised Stage 3 Area
- RPS (2010a) Cultural Heritage Impact Assessment East B Area

9.2.3.3 Predictive Model

Based on the results of the surveys conducted within and surrounding the Application Area (see Section 9.2.3.2, RPS (2010b) established the following predictive model for the distribution of Aboriginal heritage sites within the Application Area:

- Scarred / modified trees have been predicted in areas where sufficient old growth vegetation remains;
- Rock shelters suitable for habitation could be present in areas where suitable outcropping occurs, if close to a reliable water source;
- Grinding grooves may be present where rock outcropping with a suitable smooth surface occurs in conjunction with a reliable water source which could either be a permanent drainage line or ponds / pools of water;
- The artefact scatters occur on ridge lines and in greater density along the valley bottoms with major creek lines featuring reliable water sources; and
- Isolated finds may be found across all landforms.

Additionally, RPS (2010b) state that slope has a large impact on site location. Most sites are located on gentle slopes with a gradient of less than 2 degrees. Sites may be located on slopes with a gradient higher than 10 degrees if an alternative access route is present in addition to the slope itself (i.e. along a ridge / crest)



To be printed A4

GSS ENVIRONMENTAL
Environmental, Land and Project Management Consultants

Awaba Colliery
Previous Archaeological Assessments

Figure 9.7

9.2.3.4 Survey Results

Study Area 1

There are limited construction activities and surface disturbance proposed for the Project, mainly relating to the expansion of the PCD and quarry operations (it is noted that there will be no extension of the disturbance footprint within the existing quarry). The PCD area was inspected on the 16th of April, 2010 by RPS archaeologist Tessa Boer-Mah, as well as, members of the Aboriginal community, Shane Frost and James Frost of ADTOAC and Arthur Fletcher of WNAC. The PCD inspection revealed that the area was already highly disturbed and no Aboriginal material was identified.

Study Area 2

The western portion of Study Area 2 was surveyed on the 7th and 13th of October 2009 by RPS archaeologist Lisa Campbell, with Aboriginal stakeholders Arthur Fletcher (WNAC) and Ashley Hudson (KLALC). No Aboriginal site requiring AHIMS registration was identified (RPS 2009b). However, an area of high archaeological sensitivity was identified along Stony Creek and a small area of moderate archaeological sensitivity along the northern boundary, adjacent to a tributary of Stony Creek (as shown on Figure 9.8), as detailed in the specialist report by RPS (2010b) (refer Appendix 2).

The south western portion of Study Area 2 was surveyed on the 12th and 13th of September, 2005 by ERM in consultation with local Aboriginal stakeholder group WNAC (represented by Scott Franks). No Aboriginal sites or areas of archaeological sensitivity were identified (ERM 2005).

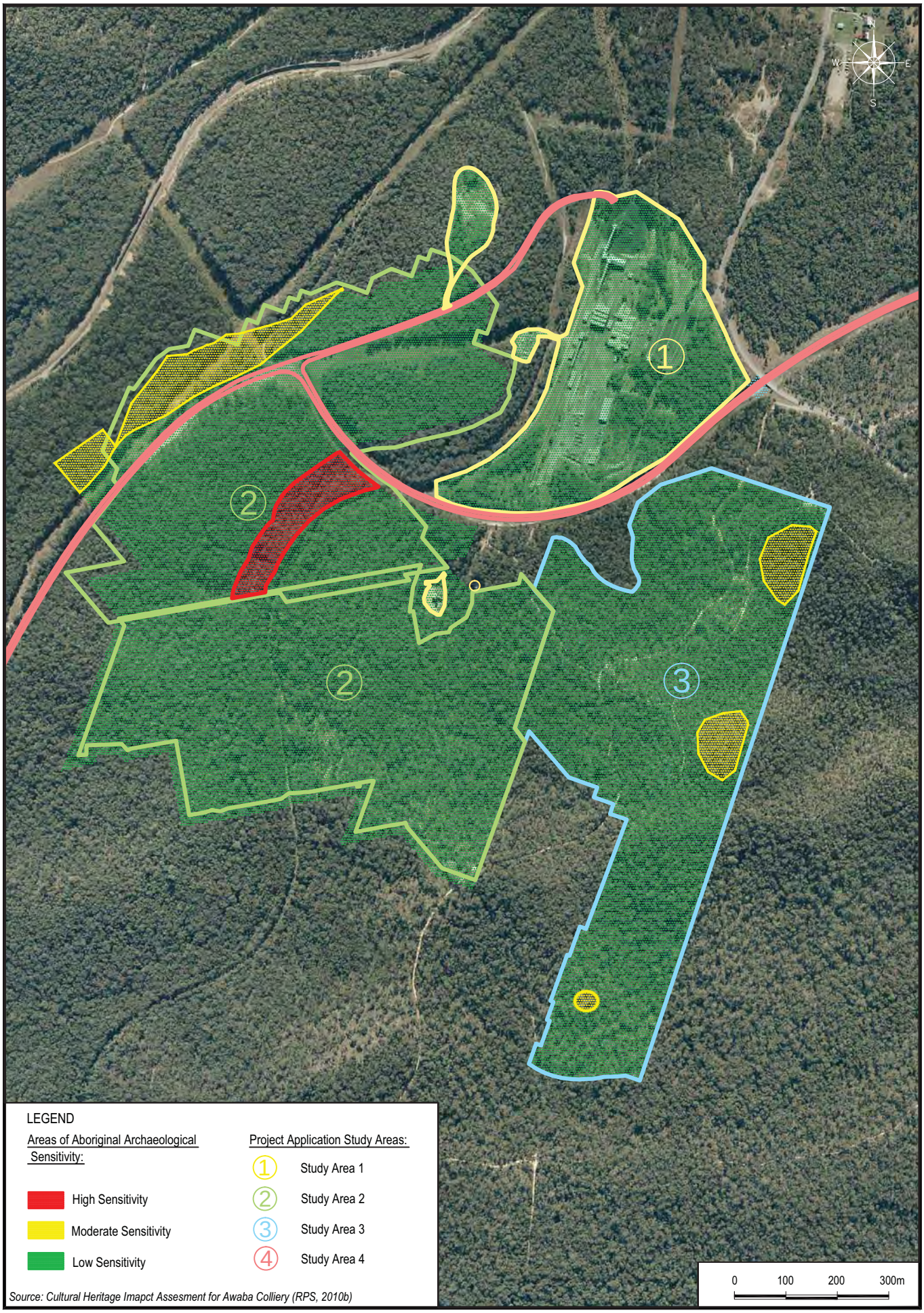
Study Area 3

The northern portion of East B was surveyed on the 7th and 13th of October 2009 by RPS archaeologist Lisa Campbell, with Aboriginal stakeholders Arthur Fletcher (WNAC) and Ashley Hudson (KLALC). No Aboriginal sites requiring AHIMS registration were identified, nor were areas of high or moderate sensitivity identified (RPS 2010a).

The southern portion of Study Area 3 was surveyed on the 16th of April, 2010 by RPS Senior Archaeologist Tessa Boer-Mah with Aboriginal stakeholders Arthur Fletcher (WNAC) and Shane and James Frost (ADTOAC). No Aboriginal sites requiring AHIMS registration were identified, but one area of moderate archaeological sensitivity was identified (RPS 2010a) (as shown on Figure 9.8).

Study Area 4

No Aboriginal sites or areas of archaeological sensitivity have been identified within the haul road of Study Area 4.



Source: Cultural Heritage Imapct Assesment for Awaba Colliery (RPS, 2010b)

To be printed A4

GSS ENVIRONMENTAL
Environmental, Land and Project Management Consultants

Awaba Colliery
Archaeological Sensitivity

Figure 9.8

9.2.4 Aboriginal Heritage Impact Assessment

Study Area 1

No Aboriginal sites or material were identified in this area. Consultation with ADTOAC and WNAC revealed that both stakeholder groups were satisfied that no further archaeological works are required prior to the proposed expansion of the Pollution Control Dam in this area.

There are no further proposed activities that will occur in previously undisturbed areas within this Study Area.

Study Area 2

No Aboriginal sites requiring AHIMS registration were identified in Study Area 2 (RPS 2009b and ERM 2005). However, an area of high archaeological sensitivity was identified along Stony Creek and a small area of moderate archaeological sensitivity along the northern boundary, adjacent to a tributary of Stony Creek. As there are no identified Aboriginal sites in Study Area 2 subsidence will not impact on known Aboriginal sites.

Study Area 3

No Aboriginal sites requiring AHIMS registration were identified within Study Area 3. One area of moderate archaeological sensitivity was identified (RPS 2010a). As there are no identified Aboriginal sites in Study Area 3 subsidence will not impact on known Aboriginal sites.

Study Area 4

No Aboriginal sites or areas of archaeological sensitivity have been identified within the haul road of Study Area 4. The Project will not impact Aboriginal heritage in Study Area 4.

9.2.5 Consequences of Potential Aboriginal Heritage Impacts

Study Area 1

There were no potential impacts identified within this Study Area, as such there would be no consequences from the Project.

Study Area 2

Study Area 2 contains an area of high archaeological sensitivity and a small area of moderate archaeological sensitivity (RPS 2009b). Any subsidence beyond the predicted levels (i.e. that led to surface cracking, soil exposure or plug failure) would require these areas to be inspected by a suitably qualified archaeologist and the Aboriginal community.

Study Area 3

Study Area 3 contains an area of moderate archaeological sensitivity (RPS 2010a). Any subsidence beyond the predicted levels (i.e. that led to surface cracking, soil exposure or plug failure) would require these areas to be inspected by a suitably qualified archaeologist and the Aboriginal community.

Study Area 4

There were no potential impacts identified within this Study Area, as such there would be no consequences from the Project.

9.2.6 Management and Mitigation Measures

The Awaba Colliery identified a number of mitigation strategies that have been implemented in order to minimise and manage the impact from its operation upon Aboriginal Heritage. These include:

- Minimal additional construction activities (area of the PCD expansion only) and surface disturbances;
- Permit to Clear procedure for all surface disturbances;
- Mine design (as discussed in Section 9.4); and
- Previous specialist archaeological assessments (including management measures and recommendations) for areas within the Application Area. In particular this has included assessments for each of the proposed mining areas (ERM 2005, RPS 2009b and RPS 2010a).

The following recommendations have been supplied by RPS (2010a) and apply to all lands within the Application Area, as well as, relevant onsite personnel and Centennial staff to address the proposed impacts to Aboriginal heritage as identified above:

- There are no Aboriginal heritage constraints for the proposed activities in Study Areas 1 or 4;
- Areas of moderate and high archaeological sensitivity (as identified in Study Areas 2 and 3) should be monitored for cracking, soil exposure or plug failure, if any of these occur, then a suitably qualified archaeologist and the Aboriginal community should be contacted to inspect the area;
- All relevant Centennial staff should be made aware of their statutory obligations for heritage under NSW *National Parks & Wildlife Act* (1974) and the NSW *Heritage Act* (1977), which may be implemented as a heritage induction;
- All areas of moderate and high archaeological sensitivity should be included in Centennial's environmental management framework for Awaba Colliery, so that staff are aware that these areas will require management, in certain instances;
- An Aboriginal Cultural Heritage Management Plan (ACHMP) will be incorporated as part of the ongoing management of heritage within Awaba Colliery. The ACHMP will include strategies which specifically address identified archaeological sensitive areas within the Application Area, as well as, contingency strategies for any additional heritage issues which may arise (including conservative measures for the unlikely event of greater than predicted subsidence such as 'plug failure');
- In the unlikely event of subsidence above the expected 200mm (such as plug failure), then all areas affected should be inspected by a suitably qualified archaeologist, in consultation with the Aboriginal community;
- If an Aboriginal site is identified in the project area, then all works in the area should cease, the area cordoned off and contact made with DECCW Enviroline 131 555, a suitably qualified archaeologist and the relevant Aboriginal stakeholders, so that it can be adequately assessed and managed; and
- If subsidence, or any other impacts, extend beyond the project application area, then further archaeological assessment and management will be required.

9.2.7 Conclusion

There have been a number of surveys conducted within the Application Area with no Aboriginal sites identified. However, there are some areas of moderate and high archaeological sensitivity. Awaba Colliery has a number of existing and proposed mitigation measures in place in order to manage any potential impact upon Aboriginal sites.

9.3 Traffic and Transport

9.3.1 Introduction

The Project BBRA considered that without further investigation there was a potential *moderate risk* from employee and contractor movements arriving at and leaving from the Awaba Colliery (including deliveries and off site maintenance, etc.) to cause interaction with and potential impacts to public safety. In order to assess the potential risk identified a specialist traffic assessment for the Project was undertaken, including consultation with the Department of Planning, Lake Macquarie City Council and the Roads and Traffic Authority. It is noted there has been no evidence of any traffic incidents at the site access since the mine started operating in 1947.

The traffic assessment for the Project was undertaken by GHD in a report titled "*Centennial Coal Report for Awaba Colliery Traffic Assessment*" herein after referred to as GHD (2010c). This report was undertaken in accordance with the RTA *Guide to Traffic Generating Developments* (2002) and with reference to the relevant Austroads publications and Australian Standards relating to road design and road safety. The traffic assessment has been included in Appendix 8, a summary is provided below.

The objective of the traffic assessment was to examine the existing public road condition in the area around the Awaba Colliery and to assess any potential for impact of the proposed ongoing operation of Awaba Colliery. This involved an assessment of the intersection of Wilton Road and the Awaba Colliery access road and its approaches, which included a site inspection to obtain intersection geometry, measure sight distances, to confirm traffic movements at a change of shift at Awaba Colliery and to observe traffic movements and driver behaviour in the vicinity of the intersection (GHD, 2010c).

The assessment was limited to the impact of employee and delivery traffic generated by the existing operations at Awaba Colliery, which are not expected to be significantly changed due to the Project. It is noted that all coal haulage traffic is via the existing Newstan-Eraring private haul road owned by Eraring Energy and therefore did not form part of the traffic assessment for the Project. Therefore the traffic assessment specifically relates only to *Study Area 1*, and is not required or relevant for any of the other three Project Study Areas.

It is noted that the traffic assessment did not assess the impacts of the Project upon the rail network, as there is no coal transported by rail from the Awaba Colliery. It is noted that coal delivered to the Newstan Colliery may be transported by trains. However, this is undertaken in accordance with the methods explained in the Newstan EIS (Umwelt, 1998) and the existing Newstan Colliery development consent.

The Wilton Road intersection was modelled using the traffic evaluation tool SIDRA (version 4.0), which is used to measure capacity, level of service and performance of intersections. GHD (2010c) obtained the traffic data for the assessment from the Lake Macquarie City Council (LMCC). This dataset was observed in 2002 on Wilton Road at the nearest location to the Awaba Colliery access intersection, approximately two kilometres away. This data was extrapolated to 2010 based on the traffic growth rate of the nearest main road, Wangi Road, and the worst hour of traffic data was then used to model the peak traffic of the Awaba Colliery intersection. The data was further extrapolated to 2015 and 2020 to analyse future road and intersection performance (GHD, 2010c).

The Awaba Colliery has a scheduled change of shift at 6:30am, 2:30pm and 10:30pm. Although these do not coincide with the peak traffic on Wilton Road (based on the traffic data described above), a conservative approach to the analysis was taken by assuming a coincidence between the Awaba Colliery peak traffic flow and the public road peak traffic flow. As such, the GHD (2010c) assessment has modelled the worst-case scenario for traffic movements at the site access intersection.

Consultation regarding the traffic-related issues for the Project has been detailed in Section 6.2. In summary both the Lake Macquarie City Council and the Roads and Traffic Authority indicated they were satisfied with the results of the assessment and all proposed recommendations.

9.3.2 Existing Road Traffic Environment

9.3.2.1 Existing and Forecast Road Traffic Levels

Wilton Road Traffic

Traffic flow and traffic speed data for Wilton Road was supplied by LMCC for the period between 10 and 17 January 2002. The traffic count data showed the classes of vehicles using Wilton Road over the surveyed week. The Austroads classifications range from 1 to 12. Classes 1 and 2 are considered as light vehicles, i.e. motorcycles and cars, while classes 3 to 12 are considered as heavy vehicles.

During the traffic survey 25% of the vehicles surveyed were classified as heavy vehicles. It is noted that the survey location was located between Wangi Road and the Awaba Waste Management Facility south of the Awaba Colliery access road. Therefore, the traffic survey would have included service vehicles entering and departing this facility that would generally not drive past the Awaba Colliery intersection (GHD, 2010c). However, this data was used for modelling and is considered a very conservative estimate of traffic volumes passing the Awaba Colliery intersection (GHD, 2010c).

Annual Average Daily Traffic (AADT) data was recorded on Wangi Road at Stockyard Creek Bridge, approximately 200 metres south of the Wangi Road / Wilton Road intersection. The data shows that between 1995 and 2004 growth was approximately 1-2% a year. Therefore, in the absence of other information, GHD (2010c) applied a growth rate of 2% pa to the 2002 traffic count data to estimate the 2010 traffic volume on Wilton Road.

A summary of the traffic volumes on Wilton Road based on the traffic data supplied by LMCC, and extrapolated by GHD (2010c), is shown in Table 9.6.

Table 9.6 – Wilton Road Projected Traffic Volumes

Year	LV	HV	Two-way Peak Hour Volume (Weekday)	One-way Peak Hour Volume (Weekday)
2002	67	23	178	90
2010	79	27	209	106
2015	87	29	230	116
2020	96	32	254	128
Source: GHD (2010c) – Table 5.1				

Awaba Colliery Traffic

There are currently approximately 100 contractors and staff at Awaba Colliery and it is in operation 24 hours a day, seven days a week. The traffic assessment has generally assessed the worst-case traffic scenario (GHD, 2010c) and modelled the peak traffic movements using the following assumptions:

- Traffic growth on Wilton Road is assumed to be 2% per year;
- 45 staff arriving and 30 leaving in light vehicles at the peak shift changeover based on the following shift changes for Awaba Colliery:
  - 45 employees 6:30 am – 2:30 pm
  - 30 employees 2:30 pm – 10:30 pm
  - 25 employees 10:30 pm – 6:30 am
- There are eight deliveries per day (these are expected to remain similar to current levels until the end of mine life), therefore the worst-case model assumes that four delivery trucks arrive and leave (4 arrive / 4 leave); and
- The distribution of traffic is approximately 50% turning north towards Awaba village and 50% turning south towards Balmoral.

9.3.2.2 Existing Road Conditions

Wilton Road is an unclassified two-lane two-way sealed road under the control of LMCC that extends west from Wangi Road. At the village of Awaba, Wilton Road joins to Awaba Road. There are two junctions for Wilton Road, one at Wangi Road in the south and one at Cessnock Road in the north. The posted speed limit is 80 kilometres per hour between Wangi Road and approximately 300 metres past the Awaba Colliery access road, where the speed limit reduces to 60 kilometres per hour and the surrounding land use becomes rural-residential with direct driveway access from Wilton Road. Wilton Road does not have street lighting and passes through land enclosed by thick vegetation. There are generally one-metre wide sealed shoulders on both sides of the road and a double barrier centre line. It was noted during the site inspection by GHD (2010c) several guideposts on Wilton Road are missing due to vehicles running off the road on the curve north of the Awaba Colliery access.

The Awaba Waste Management Facility is located approximately halfway between the Awaba Colliery intersection and Wangi Road (1.4 kilometres from Wangi Road and 1.2 kilometres from Awaba Colliery). The section of Wilton Road in the vicinity of the Awaba Waste Management Facility has a winding alignment and a narrower road formation with generally narrow unsealed shoulders. Wilton Road crosses the Newstan-Eraring private haul-road via an overbridge approximately 200 metres to the south of the Awaba Colliery access road.

The Level of Service (LOS) criteria on two-lane two-way rural roads, as defined in the RTA's *Guide to Traffic Generating Developments*, is shown in Table 9.7. These threshold values are based on a design speed of 80 kilometres per hour and rolling terrain with 40% 'no overtaking'. The estimated existing traffic volume on Wilton Road is below the threshold volume for level of service B. This LOS indicates a free flow to stable flow conditions with spare capacity (GHD, 2010c).

Table 9.7 – Peak Hour Flow on Two-Lane Rural Road (Vehicles/Hour)

Level of Service	Vehicles per Hour
B	264
C	485
D	595
E	1283
Source: RTA Guide to Traffic Generating Developments (2002), as cited in GHD (2010c) –Table 4.3	

Additionally, the existing performance of the Wilton Road/Awaba Colliery access road intersection was also assessed by analysing the estimated peak period traffic flows using the SIDRA (Version 4) modelling software.

The intersection of Awaba Colliery and Wilton Road is a T-intersection. There is no hold line or signage, and as such the site access operates as a Give Way intersection. The adequacy of the existing pavement to accommodate large turning vehicles was assessed using the intersection geometry and the turn path of 19 metre articulated vehicle. This determined that the existing intersection is able to satisfactorily accommodate these turn paths (GHD, 2010c).

There is no advance signage warning drivers on Wilton Road of traffic turning at the Awaba Colliery access road with the exception of the sign at the intersection which is considered too small and was obscured by vegetation during the site inspection (GHD, 2010c).

To provide safe access for vehicles from the Awaba Colliery to the local road network, minimum sight distances are required at the Awaba Colliery intersection. The *Lake Macquarie Council Development Control Plan Number 1* specifies minimum sight distances for access driveways. This plan provides that for a driveway providing access for between 25 and 250 car spaces, in an 80 kilometres per hour speed zone, the absolute minimum sight distance is 105 metres.

Terrain in the vicinity of the Awaba Colliery access road is generally level. GHD (2010c) measured the sight distances on Wilton Road on the approaches to the intersection. These were 130 metres on the northern approach and 220 metres on the southern approach. There are 200 car parking spaces at the Awaba Colliery and therefore, in accordance with the *Lake Macquarie Council Development Control Plan Number 1* there is sufficient sight distance at the intersection (GHD, 2010c). However, it is noted by GHD (2010c) that the removal of roadside vegetation in the eastern verge would further improve sight distance to the access road intersection

9.3.2.3 Traffic Safety

The approach to the Awaba Colliery access road is generally legible. The crash data provided by RTA indicated that there were no recorded crashes in the vicinity of the site access intersection for the period from 2004 to 2009.

Observations from the site indicate that a tree in the eastern verge opposite the Awaba Colliery access road is within the 'clear zone' and may be hazardous to a vehicle that runs off the road. Other vegetation in the eastern verge obscures intersection sight lines, however, as discussed in Section 9.3.2.2 the sight lines approaching the intersection are considered adequate. The volume of traffic turning right into the Awaba Colliery is small and is expected to remain constant or decline over the remaining life of the mine operations. GHD (2010c) reported that the SIDRA analysis results indicate that it is unlikely that a driver would need to stop before finding a suitable gap in oncoming traffic to turn safely, and therefore the probability of a southbound vehicle having to avoid a vehicle waiting to turn is very low.

9.3.2.4 Accident Statistics

A summary of the crash history for Wilton Road between Cessnock Road and Wangi Road covering a period of five years between July 2004 and July 2009 was supplied by RTA for the Project. This data provided that there have been no crashes recorded by RTA on Wilton Road in the vicinity of the Awaba Colliery access road during the past five years. The nearest crash was recorded 540 metres from Awaba Colliery access road (GHD, 2010c).

The crash history provided by RTA indicates that on the 5.4 kilometre length of road, there were:

- 13 crashes;
- 5 crashes causing injury; and
- No fatal crashes.

Four of the five injury crashes occurred on a narrow winding section of Wilton Road in the vicinity of the Awaba Waste Management Facility. Several of these crashes involved 'runoff-road-hit-object' type incidents, reflecting the very narrow formation of the road at that location.

9.3.3 Road Traffic Impact Assessment

9.3.3.1 Proposed Project-related Road Traffic Environment

Coal Haulage

The existing private haul roads will continue to be utilised to transport domestic coal to Newstan Colliery to the north or Eraring Power Station to the South. Overpasses along the haul roads ensure any interaction of coal haulage with traffic using public roads is avoided.

Additionally, *there will be no mining near or under public roads* that would require further assessment (GHD, 2010c).

Traffic Volume Estimates

No additional traffic will be generated by the Project. The traffic modelling for the Project assumed the existing level of traffic generated by the Awaba Colliery is expected to remain relatively constant for the life of the mine. Employment levels for Awaba Colliery will reduce over time. The number of employees and contractors will be reduced heading towards the end of mine life. Deliveries are expected to remain similar to current levels until the end of mine life.

The projected traffic volumes on Wilton Road due to ambient traffic growth to 2020 and based on historic growth trends is discussed in Section 9.3.2.1 and are shown in Table 9.6.

9.3.3.2 Proposed Road Conditions

The volume of traffic turning right into the Awaba Colliery is small and is expected to remain constant or decline over the remaining life of the mine operations.

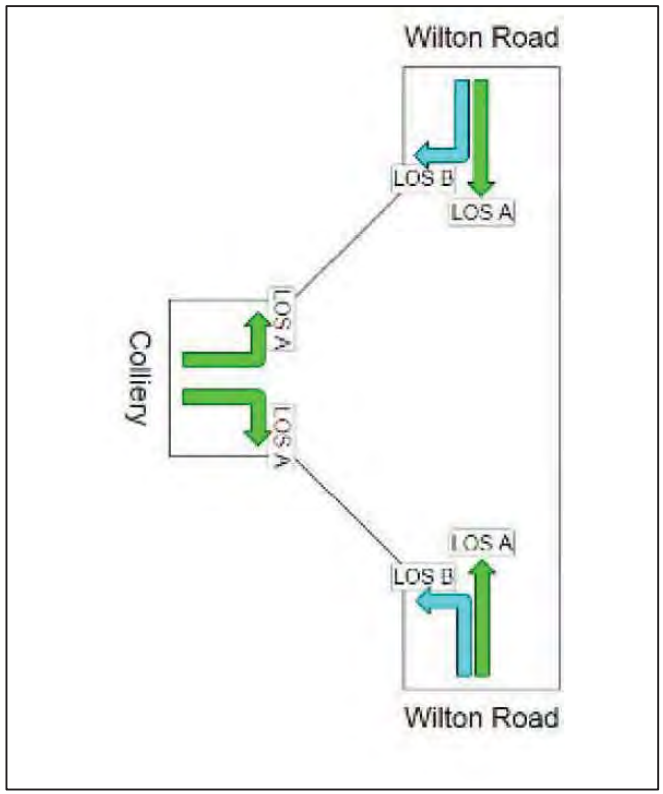
The threshold values for LOS criteria on two-lane two-way rural roads (shown in Table 9.7) used for the traffic assessment (GHD, 2010c) is based on a design speed limit of 80 kilometres per hour and rolling terrain with 40% 'no overtaking'. The estimated future peak hour traffic volumes in 2015 and 2020 on Wilton Road (refer Section 9.3.2.1 – Table 9.6) are below the threshold volumes for LOS class B. Therefore the predicted future level of service for traffic using Wilton Road for the life of the Project can be described as Class A/B. This indicates a free flow to stable flow conditions with spare capacity.

The results for LOS, analysed using the SIDRA (Version 4) modelling software, are the same for all years modelled (i.e. 2010, 2015 and 2020) and are shown in Figure 9.9. Based on the intersection LOS reported for future years, it is clear that the intersection will continue to operate at a good level of service with minimal delays to traffic and with spare capacity.

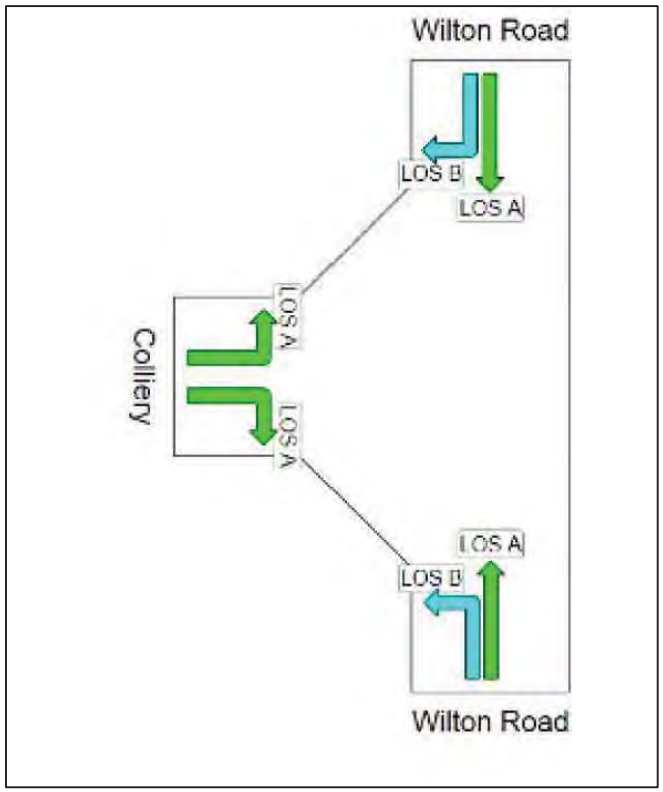
9.3.3.3 Traffic Safety

Although it was determined that the likelihood of a vehicle needing to deviate onto the shoulder at the Wilton Road and Awaba Colliery access intersection is low (refer to Section 9.3.2.3), it is proposed that the verge be cleared of vegetation for such occasions (GHD, 2010c).

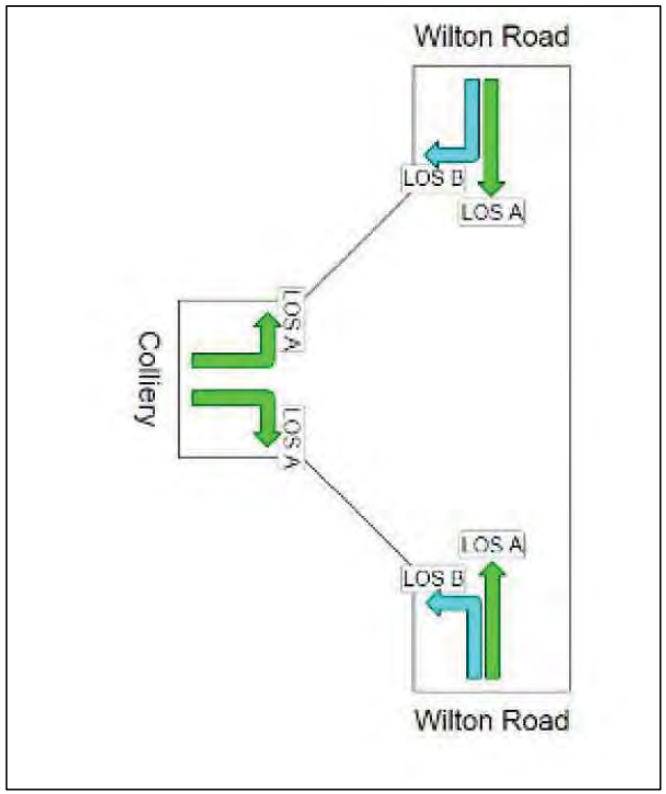
It was also considered that there was an inadequate amount of warning signs on Wilton Road advising drivers of the Awaba Colliery access road (GHD, 2010c). There is one small direction sign at the Awaba Colliery access intersection that is obscured by trees and bushes for southbound traffic. GHD (2010c) indicated that this potential safety issue would be addressed through the addition of signs in the positions as indicated on Figure 9.10 as they would increase drivers' awareness of the intersection and generally improve the legibility of the intersection.



2010



2015



2020

LEGEND

Colour code based on Level of Service

- LOS A
- LOS B
- LOS C
- LOS D
- LOS E
- LOS F
- Continuous

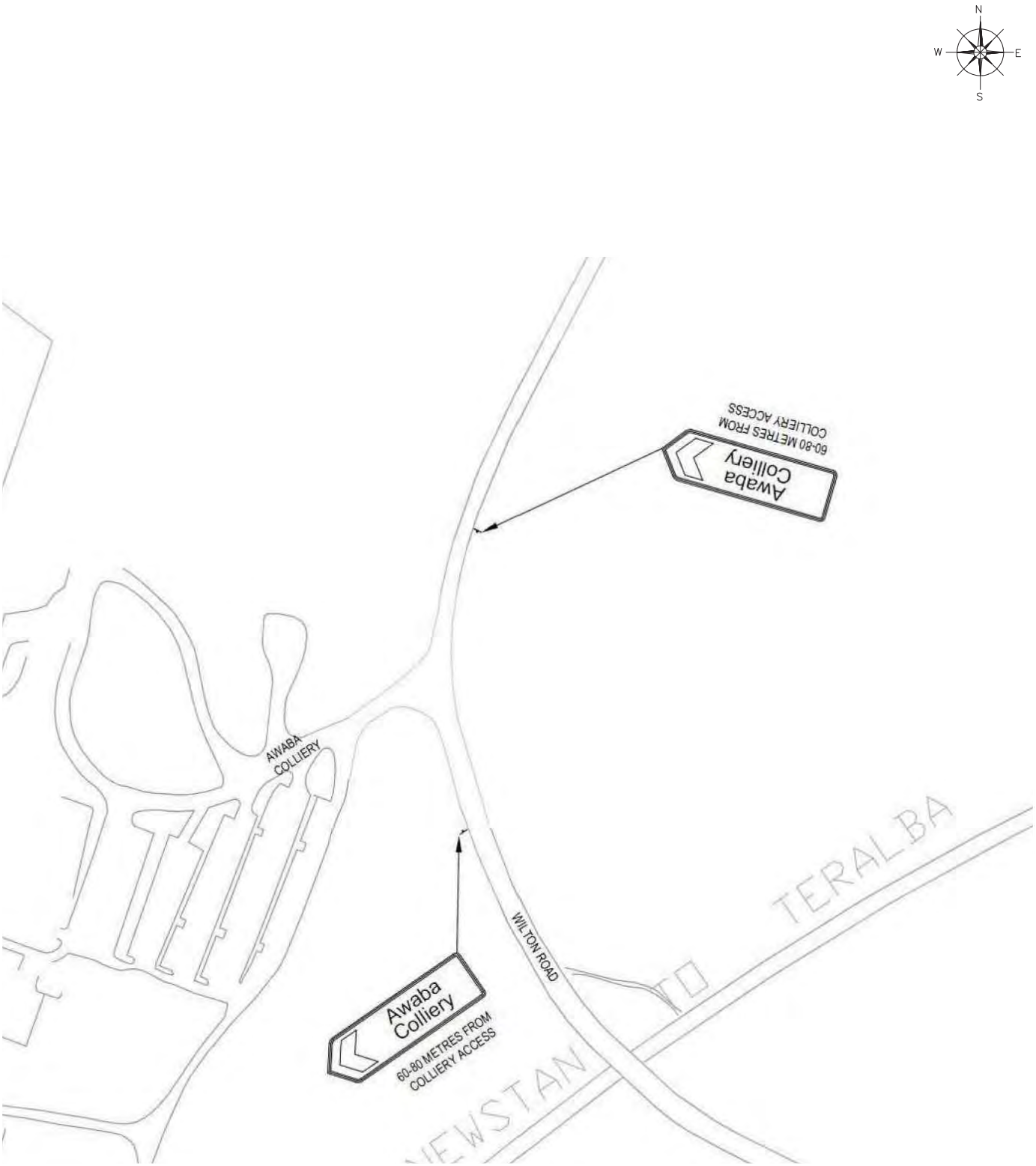
Source: Report for Awaba Colliery Traffic Assesment (GHD, 2010c)

To be printed A4

GSS ENVIRONMENTAL
Environmental, Land and Project Management Consultants

Awaba Colliery
Existing and Projected Intersection Level of Service

Figure 9.9



Source: Report for Awaba Colliery Traffic Assesment (GHD, 2010c)

To be printed A4

GSS ENVIRONMENTAL
Environmental, Land and Project Management Consultants

Awaba Colliery
Proposed Signage Plan
Figure 9.10

9.3.4 Consequence of Potential Road Traffic Impacts

9.3.4.1 Road Conditions

The Project will not result in the generation of additional traffic. Based on the intersection LOS reported for future years, it is clear that the intersection will continue to operate at a good level of service with minimal delays to traffic and with spare capacity. Therefore there will be no consequences from the Project on the existing road conditions.

9.3.4.2 Traffic Safety

GHD (2010c), identified a lack warning signs on Wilton Road advising drivers of the Awaba Colliery access road, however with sight distances meeting the required specifications (refer to Section 9.3.2.2), and with the proposed additional signage (as shown on Figure 9.10) it has been considered that there will be no consequences from the Project on traffic safety.

9.3.5 Road Traffic Management and Mitigation Measures

The GHD (2010c) traffic assessment showed that Wilton Road and the Awaba Colliery access road intersection has adequate capacity to cope with the existing and projected traffic levels. It is also noted that there were no accidents near the Wilton Road / Awaba Colliery access road intersection during for the period of crash history data provided by RTA. However, the following recommendations are made to improve safety at the Awaba Colliery access road:

- Improve signage as shown in Figure 9.10; and
- Replace missing guideposts on Wilton Road adjacent to Awaba Colliery access.

In accordance with the proposed additional controls provided in the BBRA, it is noted that Awaba Colliery engaged in consultation with the Lake Macquarie City Council and the Roads and Traffic Authority during preparation of the traffic assessment. Both agencies indicated they were satisfied with the conclusions and recommendations presented within the report (further details regarding the consultation for the traffic assessment is provided in Section 6.2).

9.3.6 Conclusion

The GHD (2010c) traffic assessment concluded that the Wilton Road and its intersection with the Colliery access road have sufficient traffic capacity for at least the next ten years. GHD (2010c) notes that the sight distance between southbound traffic on Wilton Road and traffic leaving the Colliery access road would be improved by clearing of vegetation in the eastern verge of Wilton Road, however, it is noted that the existing sight distances on both approaches to the Colliery are in accordance with the relevant council development plans and standards.

It was also noted that the volume of traffic turning right into the Awaba Colliery is small and is expected to remain constant or decline over the remaining life of the mine operations (GHD, 2010c).

Assessment of the safety along Wilton Road established that there was insufficient traffic signage to warn approaching drivers of turning traffic at the Colliery access and there were also missing guideposts along sections of Wilton Road near the Colliery access road (GHD, 2010c). These have been addressed by the recommendations provided in Section 9.3.5.

Considering that all coal haulage is undertaken along a private haul road, and with the above controls in place Centennial believes that there are no traffic constraints relating to the Project.

9.4 Life of Mine and Rehabilitation

Given the remaining mine life expectancy, life of mine management and rehabilitation was identified as a *moderate risk* by the risk team requiring management and mine planning at Awaba Colliery. The Awaba Colliery currently manages rehabilitation in accordance with the existing *Life of Mine Plan* (Centennial, 2008), which was approved by I&I in 2009, however, this has been updated during this Project following consultation with I&I.

The Life of Mine Plan addresses mine decommissioning, final landform design, rehabilitation, and post-mine-life maintenance and monitoring of lands pursuant to the mining leases within Awaba Colliery. Due to investigations currently underway assessing the potential for further use of Awaba Colliery, it is envisaged that following the completion of mining, Awaba Colliery will be placed in *Care and Maintenance*. The care and maintenance process for Awaba Colliery will involve the temporary shutdown of the operation, at the end of current and proposed mining, whilst future operational and final land use options are confirmed and finalised. The care and maintenance period would trigger a review of the Life of Mine Plan generally in accordance with the requirements of the *Strategic Framework for Mine Closure* (Australian and New Zealand Minerals and Energy Council (ANZMEC) and the Minerals Council of Australia (MCA), 2000). This would involve the preparation and implementation of a staged decommissioning plan for any components of the Awaba Colliery that can be decommissioned during that period, taking into account the potential for future operations and the outcomes of ongoing consultation (including Council) and heritage reviews for relevant buildings onsite (refer Section 9.5 for further details). Potential future options for the Awaba Colliery are discussed in Section 9.4.2.

The key aspects relating to the decommissioning and closure of the Awaba Colliery site will be outlined in an updated Life of Mine Plan.

The principal objectives of mine closure planning considered include:

- Providing an overall framework for mine closure including rehabilitation and decommissioning strategies that are consistent with the expectations of the I&I NSW;
- Establishing clear and agreed criteria, which can be used to provide the standard against which the final mine rehabilitation and post mining land use can be assessed;
- Reducing or eliminating adverse environmental effects once the mine ceases operation;
- Ensuring closure is completed in accordance with good industry practice; and
- Ensuring the closed mine does not pose an unacceptable risk to public health and safety.

The following sections outline the rehabilitation objectives and primary components of rehabilitation on completion of all mining and mining-related activities associated with the Project.

9.4.1 General Rehabilitation Principles and Objectives

Short-term rehabilitation objectives for the Awaba Colliery include:-

- Rehabilitate all areas of disturbance no longer required for mining-related operations;
- Remove redundant infrastructure from surface areas; and
- Control vermin, feral animals and noxious weeds.

The overall long term mine rehabilitation objective is to provide a low maintenance, geotechnically stable and safe landform that blends in with the surrounding topography suitable for subsequent land use as determined through consultation with stakeholders and company requirements. Specific long-term objectives include:

- Prevent public access to former underground workings;
- If required, preserve surface infrastructure that is heritage listed;
- Re-establishing land disturbed by the operation of the Awaba Colliery to an appropriate final land use;
- Provide habitat for fauna and corridors for fauna movement within the final landform;

- Monitor rehabilitation success in terms of physical and biological parameters;
- Relinquishment of the surface leases as rehabilitation objectives are achieved; and
- Compliance with appropriate Company and regulatory policies and guidelines.

Whilst the surface disturbances associated with the Awaba Colliery are limited, the Awaba Colliery is committed to ensuring progressive rehabilitation in order to minimise the areas of exposure and hence reduce the potential for erosion and sedimentation, impacts on surface water hydrology, and public safety impacts.

The Awaba Colliery is an underground mine where the major disturbance area is the Pit Top (within Study Area 1 of this Project), which is approximately 17 hectares. Other areas of disturbance within the Awaba Colliery include:

- Decommissioning of existing Licensed Discharge Points and other bore holes;
- Surface and mine support facilities (as listed in Section 3.6) including:
  - Mine access and associated infrastructure (i.e. ventilation fan sites, etc);
  - Coal handling, preparation and transport infrastructure;
  - Workshop, services and administration infrastructure;
  - Water management infrastructure;
  - Pollution control infrastructure; and
  - The existing quarry.
- Unexpected subsidence impacts, such as sink holes or surface cracking. It is noted that these potential subsidence impacts are not predicted to occur within the Application Area, however, such events have occurred within the Awaba Colliery in historical mining areas (using a separate mining method to that proposed for this Project). A monitoring program for the existing workings areas with the potential for such subsidence is used by Awaba Colliery to identify these areas so that rehabilitation can occur in a timely manner (in accordance with Mining Lease requirements).

Progressive rehabilitation is undertaken at the Awaba Colliery, with disturbed areas generally undergoing rehabilitation immediately upon being identified (in the case of sink holes or other unexpected subsidence impacts), or at the earliest convenience (as is the case for infrastructure no longer required for the Awaba Colliery operations). Rehabilitation of disturbed areas will involve the reshaping of the landforms, installation of appropriate water management works (if required) and establishment of areas of native vegetation (and potentially pasture species as detailed in Section 9.4.5) required to achieve the preferred post-mining land use (see Section 9.4.2).

9.4.2 Conceptual Post-Mining Land Use

The final land use will be dependent on a number of potential requirements including, but not limited to, the potential use of the Awaba Colliery surface facilities for the ongoing operations associated with Newstan Colliery and/or other possible industrial or commercial users, and the potential heritage significance of some of the pit top buildings (which will be subject to a heritage assessment of significance prior to decommissioning). Where practicable and appropriate, options for potential ongoing utilisation of useful assets (such as relevant buildings) may also be considered, as outlined further below. However, it is proposed that the final land use of the majority of the Awaba Colliery lease area will include bushland made up of predominantly endemic species.

This involves the decommissioning and removal of relevant buildings and other surface infrastructure, the installation of appropriate long term surface water management structures and revegetation of all disturbed areas.

Returning the disturbed land to native bushland is, at this point in time, the preferred option. There may be additional appropriate land use options at mine closure and in consultation with stakeholders at that time, any such options will need to be assessed as appropriate. In terms of post-mining land use(s), the following potential options may also be considered:

a) Heritage Area

Prior to the decommissioning of any of the pit top buildings, the Awaba Colliery will undertake a heritage assessment of significance. Specific land use options will be developed depending on the outcomes of this assessment. Should the heritage assessment of significance identify the Awaba Colliery pit top buildings as having a high archaeological value, the final land use

would need to be developed in accordance with relevant stakeholders (including the Lake Macquarie City Council) and the NSW Heritage Office.

b) Industrial Area

The workshops, store, bathhouse and offices may also provide for a light industrial land use such as an engineering/workshop complex, or, as a bulk storage/container/internodal facility. This post-mining land use option would need to be developed in consultation with the Lake Macquarie City Council to ensure that the appropriate zoning is applied to the land to allow for a light industrial land use.

c) Potential Mining Use

The administration buildings, workshop, CPP, associated stockpile and haul truck loading facility could be maintained for coal preparation or other mining related activities.

9.4.3 Conceptual Post-Mining Landform

The post-mining landform will be dependent on the final land use. The existing Life of Mine Plan shows the proposed final landform, which has been designed to mimic the surrounding topography to provide, to as best as possible, a landform commensurate with that prior to the establishment of the Awaba Colliery. However, this design will be reviewed and updated, if required, to ensure the final landform suits the requirements for the final land use.

The final landform would also incorporate contour/graded banks installed during the development of the final landform. The spacing and ultimate dimensions of these structures would be a function of the final slope and catchment area and, consequently, would be determined at the time of installation. On the steeper slopes, bank spacing should generally range between 50 and 80 metres, however, all permanent contours and water management structures will be developed in accordance with the recommendations of the *Managing Urban Stormwater: Soils and Construction (Vol 2E)*, or other relevant guidelines.

Other features forming part of the final landform within the Awaba Colliery will be the use of rock-lined drop structures and sediment basins used for surface water management and erosion and sediment control. These structures will be maintained until a stable vegetated surface is established.

9.4.4 Progressive Rehabilitation

Awaba Colliery will continue to adopt a progressive approach to the rehabilitation of disturbed areas within the Application Area in accordance with the approved Life of Mine Plan. The progressive rehabilitation approach adopted by the Awaba Colliery has been described in detail in Section 3.11.1, and includes the following four stages:

- *Stage 1 – Sealing of shaft entries and boreholes (as required)* – There are two shafts at the Awaba Colliery, one upcast and one downcast, which will be required to be sealed. An independent consulting firm will supply engineering plans for sealing, which will be prepared in consultation with the District Inspector. Boreholes will be sealed in accordance with Clause 137 of the *Coal Mines Regulation Act 1982* No. 67, at such time they are not needed to de-water the existing workings for potential future Newstan Colliery operations;
- *Stage 2 – Sealing of drift entries* – There are four drifts at the Awaba Colliery which will be required to be sealed, sealing plans will be prepared in consultation with the District Inspector. Material for sealing the drifts and shafts will be sourced from stockpiled inert materials, removed during surface contouring;
- *Stage 3 – Demolition and removal of surface infrastructure* – There are a number of buildings on the surface that will either be demolished or removed from site, including hard stand areas and car parking areas. These are described in Section 9.4.1 and listed in Section 3.6. All bitumen from roads and car parks and any other hard stand areas would be recycled by the hired demolition contractor, or, if appropriate, used at the Awaba Colliery in order to seal drifts and shafts. The demolition stage would aim to maximise the recycling of building materials, with the results documented by the contractor, and reported in the AEMR

  It is noted that the decommissioning of the Awaba Colliery will also depend on the results of a heritage assessment of significance for the pit top buildings and consultation with relevant stakeholders for an appropriate post-mining land use; and

- *Stage 4 – Surface contouring and revegetation* – The final land form and revegetation will be dependent on the final land use option for the Awaba Colliery. At this stage the preferred option, as provided by the approved Life of Mine Plan, final contouring will be commensurate, where practicable, with the original contours of the land.

9.4.5 Revegetation

A significant proportion of the Project Area is existing native vegetation. In the areas where revegetation is required, the approach to be adopted for the Awaba Colliery is based on the objective to create a landform consistent with other naturally occurring landforms and vegetation compositions in the local area. It is anticipated that the rehabilitated areas will also provide additional habitat and a corridor for native fauna.

Areas where revegetation may be required include:

- Potential sinkholes in existing workings areas (areas mined using previous mining methods outside the Application Area);
- During the decommissioning of existing Licensed Discharge Points and other bore holes; and
- Other infrastructure no longer required for the Awaba Colliery operations.

Revegetation will generally be progressively established as areas are cleared, capped and contoured.

The revegetation process involves establishing tree, shrub and grass species selected from the Awaba area. The preferred method of establishment is by direct seeding, with supplement tube stock, if required.

Cover crops of annual and perennial grasses may also be selectively used where rapid stabilisation of the soil surface is required. Species used will typically include fast growing, short-lived species and perennial grasses and legumes. Revegetation using this method will be undertaken in accordance with the approved Life of Mine Plan.

Following the establishment of revegetated areas, maintenance of the area will be undertaken in accordance with the approved Life of Mine Plan.

9.4.6 Rehabilitation Monitoring and Maintenance

A commitment to effective rehabilitation involves an on-going monitoring and maintenance program throughout and beyond the operation of the mine. Areas being rehabilitated will be regularly inspected in accordance with the approved Life of Mine Plan and assessed against the long and short-term rehabilitation objectives. During regular inspections, aspects of rehabilitation to be monitored will include:

- Evidence of any erosion or sedimentation from areas with establishing vegetation cover;
- Success of tree and shrub plantings;
- Adequacy of drainage controls and any other installed surface water management feature;
- Presence/absence of weeds; and
- General stability of the rehabilitation site.

Where the rehabilitation success appears limited, maintenance activities will be initiated. These may include re-seeding and where necessary, the application of specialised treatments such as composted mulch to areas with poor vegetation establishment. Tree guards will be placed around planted tube stock if grazing by native animals is found to be excessive.

If drainage controls are found to be inadequate for their intended purpose or compromised by wildlife, these will be repaired and/or temporary fences installed to exclude animals. Should areas of excessive erosion and sedimentation be identified, remedial works such as importation of additional clean fill, soil material and/or the redesigning of water management structures to address erosion may be undertaken where required.

No time limit has been placed on post-mining rehabilitation monitoring and maintenance. Maintenance will continue until such time as the objectives are met, although it is generally accepted that it will be at least five years beyond closure.

9.4.7 Preliminary Rehabilitation Success Criteria

The rehabilitation success criteria for the Awaba Colliery will be developed for an updated Life of Mine Plan. These will be developed in accordance with the appropriate company and regulatory policies and guidelines to ensure the most appropriate and efficient rehabilitation techniques are applied. Additionally, Awaba Colliery will also seek advice, as required, from representatives of I&I, DoP, DECCW and specialist consultants regarding any additional actions that may need to be adopted during the operation of the mine.

Consultation with I&I for this Project has also identified that rehabilitation for the Awaba Colliery must also include commitments for subsidence management following the cessation of mining operations including, monitoring, inspection and remediation. The preliminary rehabilitation objectives, the typical indicators of these objectives and the criteria used to measure the success of final rehabilitation are outlined in Table 9.8.

Table 9.8 – Rehabilitation Objectives and Indicators for Rehabilitation Success

Rehabilitation Objective	Indicator	Criteria
Landform stability	*Stability*	All disturbed areas should be stabilised, including construction of a stable landform following rehabilitation works. Appropriate final land-use options would be explored with options for the Awaba Pit Top being consistent with planning objectives outlined by Lake Macquarie City Council.
	Slope gradient	No less than 75% of rehabilitated areas has slopes <10°. Where the slopes are steeper, additional water management structures will be utilised (as required).
	Erosion control	Erosion control structures are installed at intervals commensurate with the slope of the landform which minimise the risk of erosion as much as possible. Dimensions and frequency of occurrence of erosion rills and gullies are generally no greater than that in reference sites that exhibit similar landform characteristics.
	Surface Water Drainage	Use of contour banks and diversion drains to direct water into stable areas or sediment control basins. All landforms will be free draining except where specific structures have been constructed for the storage of water as required for sediment and erosion control or some post mining land use. All ripping must prevent surface water runoff, and be in accordance with criteria established.
	Subsidence	Any subsidence within the application area is within the maximum predicted limits outlined within the Subsidence Management Plan for the Project and any impacts associated with the Project are appropriately remediated as per the management procedures outlined within the Subsidence Management Plan. In addition, areas of high risk would be monitored in accordance with the existing Subsidence Management Plan.
Water quality	*EC, pH, TSS and oil and grease*	Ensure receiving waters affected by surface water runoff are within the contaminant limits of the Environmental Protection Licence (EPL). The quality of water leaving the site should not cause significant deterioration of water quality for the downstream beneficial user(s) or water quality objectives of the receiving waters declared under the Section 73 of the Water Act (1912)
Vegetation	*Land use*	Area accomplishes and remains as a healthy native woodland, or any other preferred land use in accordance with the approved Life of Mine Plan.

Rehabilitation Objective	Indicator	Criteria
	Surface cover	In areas of surface disturbance a minimum of 70% vegetative cover is present (or 50% if rocks, logs or other features of cover are present). No bare surfaces >20 m^2 in area or >10 m in length down slope. Erosion is limited and ecosystem function is considered restored.
	Species composition	Comprise a mixture of native trees and shrubs representative of regionally occurring woodland. Vegetation communities should be developed to attract and support the re-colonisation by native flora and fauna species found in the region such that ecosystem function is appropriately restored.
	Resilience to disturbance	Established species survive and/or regenerate after disturbance. Weeds do not dominate native species after disturbance or after rain. Pests do not occur in substantial numbers or visibly affect the development of native plant species. Introduction and spread of weeds and pests, should be prevented and an active program in place to minimise their presence
	Sustainability	Species are capable of setting viable seed, flowering or otherwise reproducing. Evidence of second generation of shrub and understorey species. Vegetation develops and maintains a litter layer evidenced by a consistent mass and depth of litter over subsequent seasons. More than 75% of shrubs and/or trees (within areas of surface disturbance) are healthy when ranked healthy, sick or dead. All disturbed surfaces should be revegetated to a self sustaining condition similar to vegetation in comparable local areas
Public Safety	*Safety audit & safety record*	Risk assessment to be undertaken in accordance with relevant guidelines and Australian Standards and risks reduced to levels agreed with the stakeholders. Implementation of recommendations from risk assessment.

9.5 European Heritage

9.5.1 Introduction

The Project BBRA considered that without further investigation, the potential impact from surface activities upon any European heritage items was a *moderate risk*. Additionally, the potential for subsidence-related impacts to affect any European heritage items was also considered a *moderate risk*, without further investigation. Accordingly, a specialist archaeology assessment was undertaken for the Project including any required mitigation measures.

A European heritage assessment for the Project was undertaken by RPS Harper Somers O'Sullivan (RPS) in a report titled "Cultural Heritage Impact Assessment: For Awaba Colliery" herein after referred to as RPS (2010b). This report has been included in Appendix 7. The assessment for European heritage generally involved the following:

- A review of all relevant documentation and statutory requirements with regard to European heritage;
- A review of previous archaeological work and relevant heritage databases for sites within the Application Area;
- An assessment of the archaeological sensitivity within the Application Area;
- Evaluation of potential impacts; and
- Preparation of mitigation and management strategies.

The European heritage within the Application Area has been identified and inspected in numerous reports completed since 1993. These assessments have been used to provide the information regarding the existing environment relating to the European heritage *items* (Section 9.5.2). RPS (2010b) has provided an impact assessment for the identified European heritage items and recommended mitigation measures to manage the impacts (Sections 9.5.3 and 9.5.5, respectively). A summary of this cultural heritage assessment as it applies to the non-Indigenous heritage of the site is provided below.

9.5.2 Existing Environment

Study Area 1

Awaba State Coal Mine was opened on the 14th of July 1948 by J.M. Baddeley (MLA) to supply coal for the Lake Macquarie (now Wangi) Power Station. Coal was originally supplied via a branch rail-line until the c1970 and then by truck (RPS 2010b).

The Awaba Colliery buildings comprise offices, bathhouse, lamp room, boiler house, coal loader/screen, workshops and drift portals. The majority of buildings date from c1950 and were constructed with orange-red brick and low pitched gable roofs (Plate 8.1). The workshops and drift portals are situated on a lower level northwest of the administration buildings (Plate 8.2). The drift portals bear the name of the mine, as opened in 1948.

The buildings in the pit top area associated with Awaba State Mine (AW-07) have been identified in a previous heritage study as having very high local heritage significance in terms of representing extractive industries in the area (Suters Architects Snell 1993a; Suters Architects Snell 1993b, as cited in RPS, 2010b). It was assessed as having high significance on a regional level and moderate in terms of state significance. AW-07 area appears in the Draft City of Lake Macquarie heritage map.

The statement of significance identifies that Wangi Power Station was the first coalfields sited power station in NSW (Suters Architects Snell 1993b, as cited in RPS, 2010b). Thus the pit top buildings at Awaba Colliery share their significance with Wangi Power Station. It was also identified that the rural setting of the pit top area, surrounded by forest clad ridges had an aesthetic value which is unmatched in the Lake Macquarie area (Suters Architects Snell 1993b, as cited in RPS, 2010b).

Plate 9.1 – Awaba Colliery administration buildings, built c1950

Plate 9.2 – Drift portal with State Coal Mine Awaba inscription (foreground), workshops (background).

Study Area 2 Non-Indigenous Heritage

RPS (2010b) reported that non-Indigenous heritage within the study area includes the abandoned Awaba-Wangi rail line (RT-03), a single track rail line on wooden sleepers, which spans the study area. Two power poles associated with this rail line were also identified (there was no cable between the poles). The rail line shares its significance with the Wangi Power Station (WG-01) and the Awaba State Mine (AW-07) as an example of extractive industries within the Lake Macquarie LGA (RPS 2010b).

Study Area 3

No non-Indigenous Heritage items are listed on the Australian Heritage Database, the NSW Heritage Inventory or the Lake Macquarie City Council Local Environment Plan. The surveys of the area did not identify any non-Indigenous heritage items (RPS 2010b).

Study Area 4

No non-Indigenous Heritage items are listed on the Australian Heritage Database, the NSW Heritage Inventory or the Lake Macquarie City Council Local Environment Plan. No non-Indigenous heritage items or places have been identified within the haul road of Study Area 4 (RPS 2010b).

9.5.3 European Heritage Impact Assessment

Study Area 1

There are no proposed changes to historic pit top buildings or infrastructure in this area and therefore there is no risk of impact to non-Indigenous heritage associated with the Project.

Study Area 2

Subsidence may cause some deformation of the rail line and possibly affect the two power poles identified. The rail line (RT-03) is significant for its representation of extractive industries in the Lake Macquarie LGA. If deformation of the rail line occurs as a result of mining, this would not detract from the significance of the item, but form part of the life-history of the rail easement and could possibly add to the interpretative value of the area. Potential impacts posed by the Project are not considered detrimental to this proposed heritage item (RPS 2010b).

Study Area 3

No non-Indigenous heritage items have been identified in this area. As there are no identified non-Indigenous sites in Study Area 3 subsidence will not impact on known heritage sites.

Study Area 4

No non-Indigenous heritage items or places have been identified within the haul road of Study Area 4. Activities in Study Area 4 of the Application Area will not impact on non-Indigenous heritage.

9.5.4 Consequences of Potential European Heritage Impacts

Study Area 1

There were no potential impacts identified within this Study Area, as such there would be no consequences from the Project.

Study Area 2

(RPS 2009b) identified that subsidence may cause some deformation of the abandoned Awaba-Wangi railway, a proposed heritage item. It was noted that this would not detract from the significance of the item, but form part of the life-history of the rail easement and could possibly add to the interpretative value of the area. As the potential impacts posed by the Project are not considered detrimental it is considered there would be no consequences from the Project.

Study Area 3

There were no potential impacts identified within this Study Area, as such there would be no consequences from the Project.

Study Area 4

There were no potential impacts identified within this Study Area, as such there would be no consequences from the Project.

9.5.5 Management and Mitigation Measures

The Awaba Colliery identified a number of existing control measures as part of the current operations that would assist to minimise and manage the impact from its operation upon European heritage. These include:

- Minimal additional construction activities (area of the PCD expansion only) and surface disturbances;
- Permit to Clear procedure for all surface disturbances;
- Mine design (as discussed in Section 9.5); and
- Previous specialist archaeological assessments (including management measures and recommendations) for areas within the Application Area. In particular this has included assessments for each of the proposed mining areas (ERM 2005, RPS 2009b and RPS 2010a).

There were no European heritage constraints identified for Study Areas 1, 2, 3 or 4. This is provided based on there being no modifications to the pit top area, other than the expansion of the pollution control dam. However, the following mitigation measures have been provided by RPS (2010b) to ensure any potential impacts to European heritage are managed:

- All relevant Centennial staff should be made aware of their statutory obligations for heritage under NSW NP&W Act (1974) and the NSW Heritage Act (1977), which may be implemented as a heritage induction; and
- If subsidence, or any other impacts, extend beyond the Application Area, then further archaeological assessment and management may be required.

9.5.6 Conclusion

The assessment of European heritage has drawn upon previous surveys and assessments within the Application Area to identify and assess the potential impacts from the Project. Awaba Colliery has a number of existing and proposed mitigation measures in place in order to manage any potential impact upon European heritage sites.

It was concluded by RPS (2010b) that, with the above controls in place, there were no European heritage constraints for the Project.

9.6 Noise Management

9.6.1 Introduction

The potential noise impacts for the Project, as assessed by the Project BBRA, included those caused by the Awaba Colliery plant and machinery (fixed and mobile), and transport of coal by trucks to either Newstan Colliery or Eraring Energy along the private haul road. Prior to any investigation being undertaken the potential impacts associated with the Awaba Colliery plant and machinery were considered to be *moderate risks*, while coal transport was considered a *low risk*. Accordingly, in order to identify and mitigate the potential noise impacts for the Project, a specialist noise assessment including assessment of any cumulative impacts was undertaken. It is noted that there has been no blasting at Awaba Colliery for approximately 20 years and none is proposed for the Project, hence blasting has not formed part of the noise impact assessment for the Project.

An Environmental Noise Impact Assessment was undertaken by Heggies Pty Ltd (Heggies) for the Project in a report titled "*Awaba Underground Coal Mine Part 3A Application Noise Impact Assessment*" herein referred to as Heggies (2010a). The objective of the assessment was to identify the potential impacts of noise from operations at the Awaba Colliery and to provide advice with regard to effective mitigation strategies where necessary.

The Noise Impact Assessment was prepared with reference to Australian Standard AS 1055:1997 *Description and Measurement of Environmental Noise* Parts 1, 2 and 3 and in accordance with the DECCW Industrial Noise Policy (INP). Where issues relating to noise are not addressed in the INP, such as sleep disturbance, reference has been made to the NSW Environmental Noise Control Manual (ENCM) and the Environmental Criteria for Road Traffic Noise (ECRTN). The *Interim Construction Noise Guideline* (DECCW, 2009) was also referenced for construction type activities.

Ambient noise surveys were conducted to characterise and quantify the existing acoustical environment in the area surrounding the Awaba Colliery. The existing acoustical environment is described in Section 9.6.2, and generally typifies a suburban environment (Heggies, 2010a). The results from the background noise monitoring were used to establish the amenity criteria for the Project. The resulting operational specific noise criteria for the Project are detailed within the noise impact assessment (Heggies, 2010a) and are presented in Section 9.6.3.

Other relevant criteria used in the noise impact assessment for the Project included sleep disturbance noise goals and the construction noise goals, which were developed with reference to the relevant guidelines mentioned above. The potential impacts from the Project were also assessed against these criteria, and are discussed in Section 9.6.3. It is noted that construction activity would not occur during the evening or night-time periods, and has therefore not formed part of the assessment against the construction noise goals (Heggies, 2010a).

The noise emissions from the Awaba Colliery were predicted using the SoundPLAN computer model. This model uses a three-dimensional digital terrain map 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. The data used for the modelling was supplied by Centennial, and the assumptions made in the modelling are presented in Section 7.1.1 of the noise impact assessment (Heggies, 2010a). It is noted that the *operational scenario modelled is likely to represent an acoustically worst-case scenario* (Heggies, 2010a).

As the Awaba Colliery is an underground mine potential noise impacts for Study Areas 2 and 3 are considered negligible and therefore have not formed part of the noise impact assessment (Heggies, 2010a). The following sections provide a summary of the key findings of the noise impact assessment, which assessed the cumulative effects from the operation of the Awaba Colliery (i.e. a combination of both Study Areas 1 and 4).

For further details regarding the assessment methodology, data used for the assessment, and identified potential impacts, refer to Appendix 9.

9.6.2 Existing Environment

Ambient noise surveys were conducted to characterise and quantify the existing acoustic environment during the day, evening and night-time periods in the area surrounding the Awaba Colliery. A background monitoring survey was undertaken at two (2) residential locations on Olney Street, Awaba, considered representative of the nearest potentially affected noise-sensitive receivers to the Awaba Colliery.

The background noise monitoring consisted of continuous, unattended noise logging and operator attended noise surveys. The operator attended noise surveys help to define noise sources and the character of noise in the area and are, therefore, used to qualify unattended noise logging results. The results of the noise monitoring were used to determine the intrusiveness and amenity criteria for the project.

Unattended noise monitoring was undertaken at the locations mentioned above from Tuesday 30 March to Friday 9 April 2010 inclusive. It is noted that mining operations were not being conducted at Awaba Colliery for the duration of the unattended monitoring due to a scheduled shut-down period. This assisted the assessment of background noise levels by properly quantifying the noise amenity of the area without the operation of the Awaba Colliery.

Operator attended noise measurements were conducted during the day and night-time periods at the same noise monitoring locations as the unattended survey. The purpose of this survey was to qualify the unattended noise logging results and to determine the contribution of existing industrial noise sources (including Awaba colliery) to the total ambient noise environment.

Results of the background attended and unattended noise monitoring undertaken for the Project are provided in Sections 5.2 and 5.3, respectively, of the noise impact assessment (Heggies, 2010a). A summary of the results from the background surveys are given in Table 9.9.

Table 9.9 – Summary of Existing Ambient Noise Levels

Location	Period[1]	Background L_{A90}[2] Noise Level	Measured $L_{Aeq(Period)}$[3]	Estimated Existing Industrial Contribution L_{Aeq}
		Rating Background Level		
11 Olney St	Day	33 dBA	50 dBA	<49 dBA
	Evening	38 dBA	52 dBA	<39 dBA
	Night	36 dBA	45 dBA	<34 dBA
1A Olney St	Day	33 dBA	51 dBA	<49 dBA
	Evening	34 dBA	53 dBA	<39 dBA
	Night	31 dBA	47 dBA	<34 dBA

Source: Awaba Underground Coal Mine Part 3A Application Noise Impact Assessment (Table 9)

Note 1: Daytime 7.00 am to 6.00 pm; Evening 6.00 pm to 10.00 pm; Night-time 10.00 pm to 7.00 am
On Sundays and Public Holidays, Daytime 8.00 am to 6.00 pm; Evening 6.00 pm to 10.00 pm; Night-time 10.00 pm to 8.00 am
Note 2: The L_{A90} represents the level exceeded for 90% of the interval period and is referred to as the average minimum or background noise level
Note 3: The equivalent continuous noise level (L_{Aeq}) is defined as the level of noise equivalent to the energy average of noise levels occurring over a measurement period

9.6.3 Noise Impact Assessment

9.6.3.1 Operational Noise Modelling Results

Noise emission levels were predicted from the proposed development for the typical operational scenario described in Section 7 of the noise impact assessment (Heggies, 2010a).

Noise levels predicted at the nearest potentially affected residential locations are provided in Table 9.10. Noise contour maps are provided in Figures 9.11 and 9.12 for each meteorological scenario considered. It is noted that noise from all sources that contribute to the total noise from the site have been examined to identify characteristics that may cause greater annoyance (for example tonality, impulsiveness etc). Where these characteristics are considered to be present, appropriate modifying factors have been applied as outlined in the INP (Heggies, 2010a).

The results presented in Table 9.10 indicate that operational noise levels are predicted to meet the project specific noise criteria at all considered residential locations under all modelled scenarios. Since the operational scenario modelled is likely to represent an acoustically worst-case scenario, actual operational noise levels from the Project are likely to be less than those predicted (Heggies, 2010a).

Table 9.10 – Predicted Noise Levels - Awaba Colliery

Location	Period	Predicted Noise Level $L_{Aeq(15minute)}$ (dBA)			Project Specific Noise Criteria (L_{Aeq})
		Calm	Southerly Wind	Temperature Inversion	
11 Olney St, Awaba	Day	< 30	< 30	n/a	38 dBA
	Evening	< 30	< 30	n/a	38 dBA
	Night	< 30	< 30	< 30	38 dBA
1A Olney St, Awaba	Day	34	37	n/a	38 dBA
	Evening	32	36	n/a	38 dBA
	Night	32	36	36	36 dBA
9 Olney St, Awaba[1]	Day	< 30	< 30	n/a	38 dBA
	Evening	< 30	< 30	n/a	38 dBA
	Night	< 30	< 30	< 30	38 dBA
Brisbane St, Awaba[2]	Day	< 30	< 30	n/a	38 dBA
	Evening	< 30	< 30	n/a	38 dBA
	Night	< 30	< 30	< 30	36 dBA
John St, Blackalls Park[2]	Day	< 30	< 30	n/a	38 dBA
	Evening	< 30	< 30	n/a	38 dBA
	Night	< 30	< 30	< 30	36 dBA
Puddy Lane, Awaba[2]	Day	30	35	n/a	38 dBA
	Evening	< 30	33	n/a	38 dBA
	Night	< 30	33	33	36 dBA
Wilton Road, Awaba[1]	Day	< 30	< 30	n/a	38 dBA
	Evening	< 30	< 30	n/a	38 dBA
	Night	< 30	< 30	< 30	38 dBA

Note 1: Project Specific Noise Criteria applicable to 11 Olney Street have been adopted at these locations

Note 2: As a conservative approach, given that it is likely that ambient noise levels at these locations are higher than those measured at Olney Street, the Project Specific Noise Criteria applicable to 1A Olney Street have been adopted at these locations

9.6.3.2 Cumulative Noise Assessment

The potential cumulative noise impacts from existing and successive developments were assessed by Heggies (2010a) with a view to maintain acceptable noise amenity levels for residences. It is noted that there are no other developments (with the exception of the future Newstan Colliery's Mine Access Facilities) in the vicinity of the subject site that have received development consent.

Newstan Colliery has approval to construct and operate Mine Access Facilities on the Awaba Colliery Site. To date these facilities have not been constructed. An assessment of the potential noise impacts from the Newstan Mine Access Facilities was contained in the EIS for the Newstan Colliery Life Extension Project dated November 1998. As part of this EIS an assessment of cumulative noise from the Awaba Colliery and Newstan Mine Access Facilities was predicted as detailed in Table 9.11.

Table 9.11 Predicted Cumulative Noise Impact Awaba Colliery and Newstan Mine Access Facility

Location	Period	Intrusive Predicted Noise Level $L_{Aeq(15\ minute)}$(dBA)				Cumulative Amenity Level $L_{Aeq(period)}$		Amenity Criteria (LAeq)
		Awaba Colliery		Newstan Mine Access Facilities				
		Calm	Adverse	Calm	Adverse	Calm	Adverse	
1A Olney Street	Day	34	37	< 30	< 30	32	34	55dBA
	Evening	32	36	< 30	< 30	30	33	45dBA
	Night	32	36	< 30	< 30	30	34	40dBA
Puddy Lane	Day	30	35	< 30	< 30	< 30	33	55dBA
	Evening	< 30	33	< 30	< 30	< 30	31	45dBA
	Night	< 30	33	< 30	< 30	< 30	31	40dBA

These results indicate that the operation of the Awaba Colliery and the Mine Access Facilities will comply with all relevant amenity criteria. Cumulative noise impacts of the Project with other existing industrial noise sources has already been assessed in the determination of the existing amenity levels at surrounding potentially affected noise sensitive areas (as discussed in Section 9.6.2).

Results of the operational noise modelling (shown in Table 9.10) indicated that the Project specific noise emission criteria would be met at all potentially affected residential receivers. These results also indicate that, as the existing amenity levels are representative of the potential cumulative noise, these potential cumulative noise impacts would meet the noise emission criteria at all potentially affected residential receivers.

9.6.3.3 Sleep Disturbance Analysis

Noise events considered being representative of acoustically significant plant and equipment used at the Awaba Colliery, for the sleep disturbance analysis, included loading into an empty truck and those associated with haul truck drive-off or pass-by. It is noted that, while the loading of haul trucks has been considered, the sleep disturbance analysis did not consider the requirement for trucks to reverse on site as a noise event during the night-time period due to the layout of the site.

These typical L_{Amax} noise levels were entered into the noise model and predictions were made at the nearest residential areas in Awaba under adverse weather conditions at night. It is noted that this analysis provides a worst-case prediction as the use of the L_{Amax} noise level is likely to be greater than the actual noise events (Heggies, 2010a).

The highest noise level at any residential area is predicted to occur as a result of truck pass-by events on the private haul road in the presence of a temperature inversion. It was predicted that external noise levels up to L_{Amax} 45 dBA may occur at residences in Olney Street, Awaba and John Street, Blackalls Park under these circumstances. These results are below the most stringent recommended sleep disturbance noise goal of 46 dBA (Heggies, 2010a).

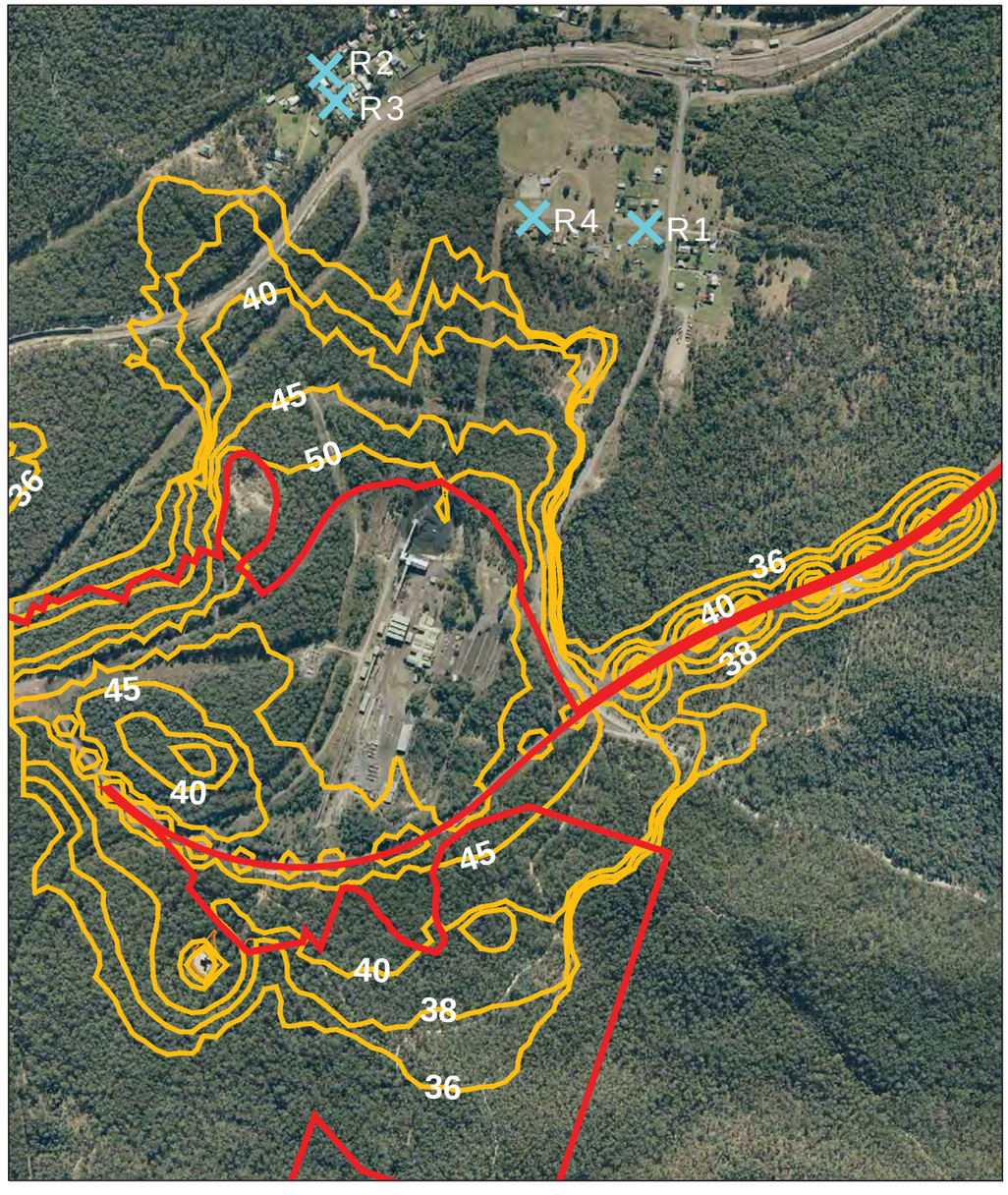
9.6.3.4 Construction Noise Assessment

Construction activities proposed for the Project are temporary in nature (up to 2 weeks duration), and will only occur during the daytime period. An assessment of the potential noise impacts during this construction period indicated that noise levels from construction works are expected to be in the order of 30 dBA, while the relevant daytime construction noise goal is 43 dBA (Heggies, 2010a).

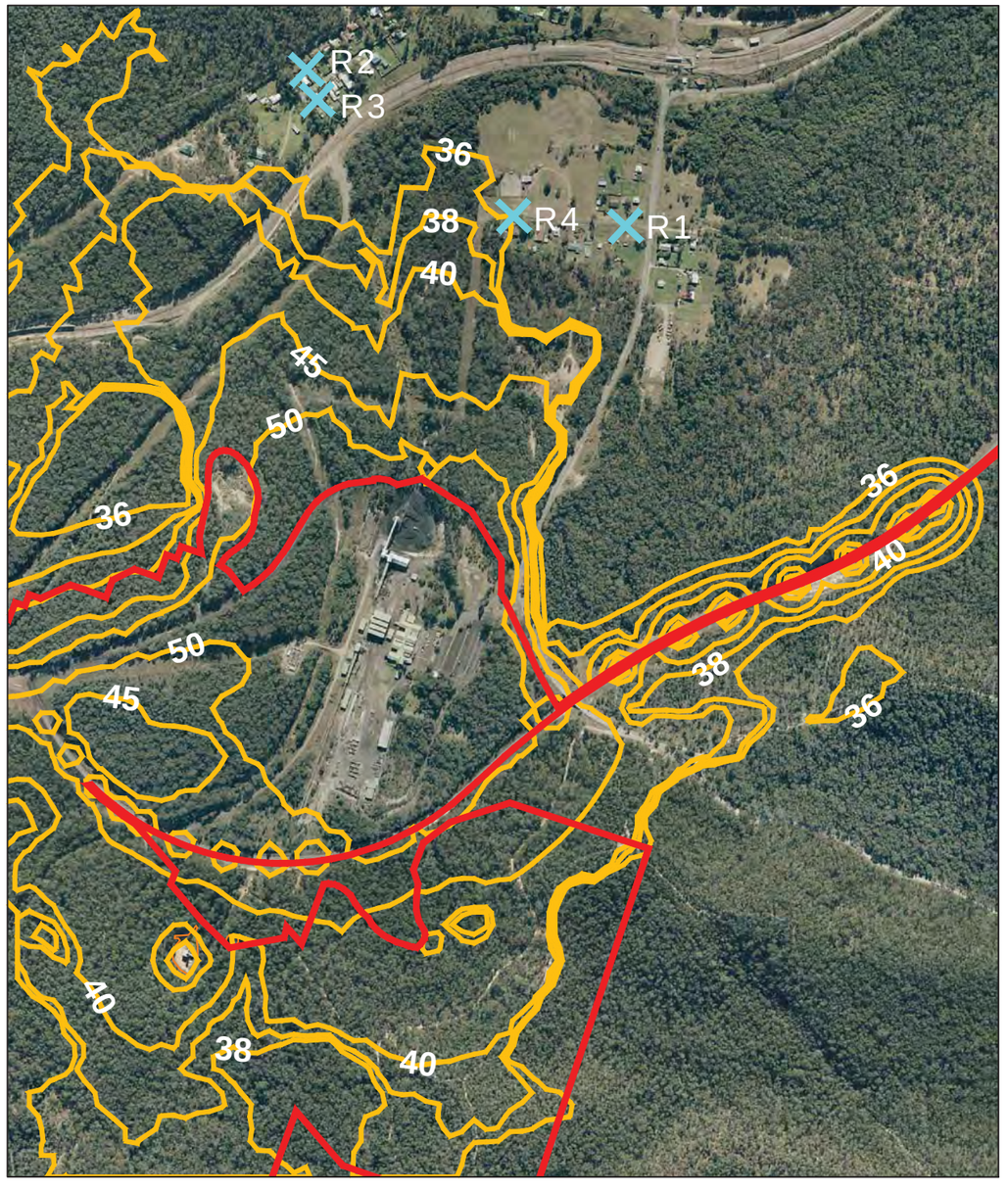
It is predicted that noise impacts will be unlikely to occur from construction-type activities at the Awaba Colliery (Heggies, 2010a).

9.6.3.5 Vibration Assessment

Blasting has not been undertaken at the Awaba Colliery for approximately 20 years, and is not proposed to occur for the life of the Project. The main vibration generating activities considered for the vibration assessment included the operation of mobile equipment such as the loader and trucks. Given the separation distance between mining operations and the nearest potentially affected residential locations, vibration levels from these activities are predicted to be negligible and below levels for human perception at the nearest residential locations (Heggies, 2010a).



Calm Meteorological Conditions



Temperature Inversion

LEGEND

- Project Application Boundary
- Noise contour
- Sensitive receptor

Source: Awaba Underground Coal Mine Part 3A Application: Noise Impact Assessment (Heggies, 2010b)

0 200 400 600 800 1.0km

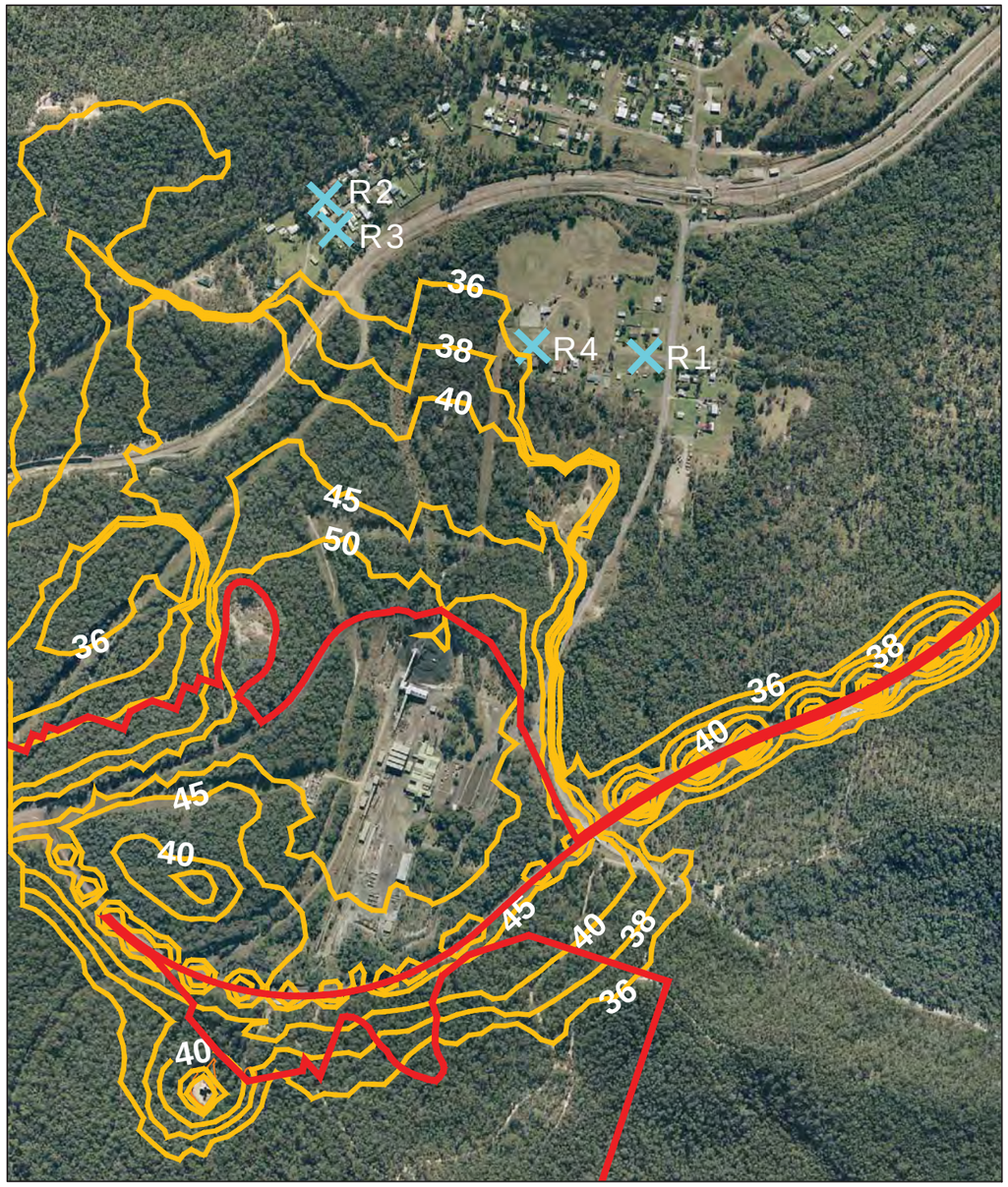
To be printed A3

GSS ENVIRONMENTAL
Environmental, Land and Project Management Consultants

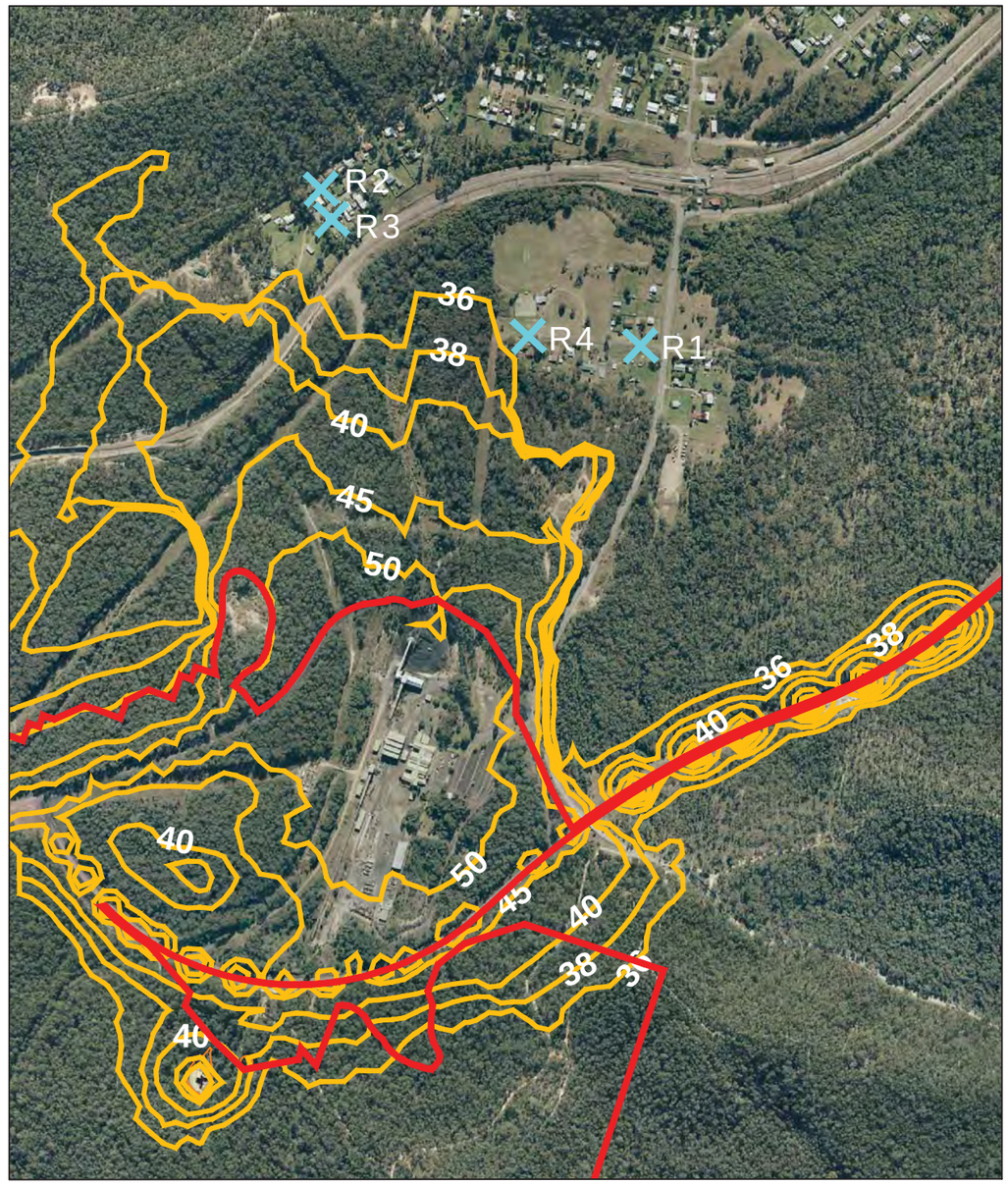
Awaba Colliery

Operational Noise Contours (dB(A) $L_{Aeq(15min)}$)

Figure 9.11



3m/s Southerly Wind (Day Time)



3m/s Southerly Wind (Evening/Night)

LEGEND

- Project Application Boundary
- Noise contour
- Sensitive receptor

0 100 200 300 400 500m

Source: Awaba Underground Coal Mine Part 3A Application: Noise Impact Assessment (Heggies, 2010b)

To be printed A3

GSS ENVIRONMENTAL
Environmental, Land and Project Management Consultants

Awaba Colliery
Operational Noise Contours (dB(A) $L_{Aeq(15min)}$)
Figure 9.12

9.6.4 Consequences of Potential Noise Impacts

9.6.4.1 Operational Noise Modelling Results

The results of the noise impact assessment indicate that operational noise levels are predicted to meet the project specific noise criteria at all considered residential locations under all modelled scenarios. Therefore there are no consequences for potential noise impacts for the Project.

9.6.4.2 Cumulative Noise Assessment

There were no potential cumulative noise impacts identified for the Project, as such there are no consequences.

9.6.4.3 Sleep Disturbance Analysis

The results of the sleep disturbance analysis indicate that noise levels are predicted to meet the most stringent recommended sleep disturbance noise goal. Therefore there are no consequences for potential sleep disturbance impacts for the Project.

9.6.4.4 Construction Noise Assessment

There were no potential construction noise impacts identified for the Project, as such there are no consequences.

9.6.4.5 Vibration Assessment

There were no potential vibration impacts identified for the Project, as such there are no consequences.

9.6.5 Noise Management and Mitigation Measures

The Awaba Colliery identified a number of existing mitigation strategies that have been implemented in order to minimise and manage the potential impact from its operation upon the noise amenity. These include:

- No significant changes to the operational activities are proposed for the Project, therefore there are no significant changes to the existing acoustical environment expected;
- Minimal additional construction activities (area of the PCD expansion only) and surface disturbances;
- Standard work procedures and maintenance tasks to minimise noise emissions;
- Enclosed conveyors and processing plant; and
- The low density of surrounding potentially sensitive receptors along with the natural topographical and vegetation screening.

9.6.6 Conclusion

Noise emission levels have been predicted assuming that the existing noise management and mitigation measures (refer Section 9.6.5) are, and will continue to be, implemented. As noise impacts from the Project were deemed negligible by the noise impact assessment (Heggies, 2010a), no additional noise management or mitigation measures have been considered.

9.7 Air Quality Management

9.7.1 Introduction

The BBRA for the Project considered that without further investigation dust, and other, emissions from the Awaba Colliery plant and machinery (both fixed and mobile) may have a the potential to cause an exceedance of the relevant DECCW criteria. This was considered a *moderate risk*. The potential air quality impacts from the transport of coal by trucks along the private haul road were also considered, however, this was determined to be a *low risk*, due to the trucks travelling along sealed roads with covered loads. To ensure the potential air quality impacts for the Project were properly identified and assessed, a specialist air quality assessment that included, assessing any cumulative impacts and recommending any required mitigation measures was undertaken.

An Air Quality Impact Assessment was undertaken by Heggies Pty Ltd (Heggies) for the Project in a report titled "*Awaba Underground Coal Mine Part 3A Application Air Quality Impact Assessment*" herein referred to as Heggies (2010b). The objective of the assessment was to identify the potential impacts of air pollutants from the operation of the facility and to provide advice with regard to effective mitigation strategies where necessary.

The Air Quality Impact Assessment was prepared in accordance with the NSW Department of Environment and Climate Change and Water's "*Approved Methods for the Modelling and Assessment of Air Pollutants in NSW*" (NSW Department of Environment and Conservation [DEC], 2005) (herein referred to as the Approved Methods). The particulate dispersion modelling for the Project was undertaken using the Ausplume Gaussian Plume Dispersion Model that DECCW has approved for use in the majority of applications in New South Wales (Heggies, 2010b).

The scenario modelled for the air quality assessment presents the worst case scenario for the Project. An explanation of the assumptions and data used for the assessment is provided in Section 7 of the Air Quality Impact Assessment (Heggies, 2010b). Activities associated with the existing Awaba Colliery operations with the potential to generate particulates have been identified in Section 9.7.2.1. It is noted that, as the Project is proposed to be a continuation of the existing surface operations, potential sources of dust are considered to be the same. These dust generating activities have been quantified for the Project as outlined in Section 9.7.2.2.

The air quality goals adopted for the assessment of the Project are those specified in the Approved Methods or the *"Ambient Air Quality National Environment Protection Measure"* (NEPM) (National Environmental Protection Council, 1998). In summary, the specific goals being applied to this study are as follows:

- PM10: A 24-hour maximum of 50 µg/m^3; and
  An annual average of 30 µg/m^3.
- TSP: An annual average of 90 µg/m^3.
- Deposited Dust: An incremental (Project only) annual average dust deposition level of 2 g/m^2/month; and
  A total annual average dust deposition level of 4 g/m^2/month (Project and other sources).
- Nitrogen Dioxide A 1-hour average of 246 µg/m^3; and
  An annual average of 62 µg/m^3.
- Carbon Monoxide A 1-hour average of 30 µg/m^3; and
  An annual average of 10 µg/m^3.

It should be noted that for the purposes of assessing potential air quality impacts from the Project only Study Area 1 has been considered to be required (principle sources of dust), as the impacts from Study Areas 2, 3 and 4 are considered to be minimal and have not been included as part of this assessment (Heggies, 2010b).

The following sections provide a summary of the key findings of the Air Quality Impact Assessment. For further details, the full assessment report contained within Appendix 10 should be referred to.

9.7.2 Existing Environment

9.7.2.1 Particulate Sources and Emissions from Awaba Colliery

Atmospheric pollutants generated by activities occurring at the Awaba Colliery primarily comprise fugitive emissions of particulates (PM_{10} and TSP), those generated through the combustion of fuel in vehicles (nitrogen oxides [NO_X], sulphur dioxide [SO_2], volatile organic compounds [VOCs], carbon monoxide [CO], PM_{10}) and fugitive emissions from the coal seam.

Emissions of combustion related pollutants from Awaba Colliery sources are small and resulting concentrations at the nearest receptors negligible, taking into account the plant and equipment used at Awaba Colliery and the fact that it is an underground coal mine. Therefore, Heggies (2010b) focussed on the fugitive emissions of dust and particulates for the Project.

Major sources of particulate pollution from current mining activities at Awaba Colliery are expected to occur as a result of the activities presented in Table 9.12.

Table 9.12 – Likely Particulate Generating Activities Occurring at Awaba Colliery

Activity	Particulate Emission Source
Stockpiles / Open Areas	Wind erosion of stockpiles and open areas
Overflow	Overflow of coal from the Bin via chute to the stockpile
Truck loading	Loading trucks from coal chute and loader
Awaba Quarry	Extraction of stockpiled materials
Source: Heggies (2010b) – Table 3	

It is noted that the transport of coal by trucks along the private haul road to either Newstan Colliery or Eraring Energy has not been considered a particulate emission source, as the haul road is sealed and all haul trucks are required to cover their loads while travelling from one location to the other (Heggies, 2010b).

9.7.2.2 Emissions Inventory

The quantities of particulate emissions from the Project have been estimated using various factors developed by the Commonwealth Department of the Environment, Water, Heritage and the Arts (DEWHA) *National Pollutant Inventory (NPI) Emission Estimation Technique Manuals* (EETM). Where appropriate EETM factors are not available, factors developed by the US EPA have been used. Table 9.13 below presents the emissions inventory for the Project.

Table 9.13 – Emissions Inventory Summary

Location	Activity	TSP Emission Factor	PM_{10} Emission Factor	Emission Factor Units
Quarry	Excavator on overburden	0.025	0.012	kg/t
	Truck loading	0.005	0.002	kg/t
Coal processing and handling	Front end loader on coal	0.025	0.012	kg/t
	Loading stockpiles (via conveyor)	0.004	0.0017	kg/t
	Truck loading (from loading chute)	0.0004	0.00017	kg/t
Stockpiles and exposed areas	Main stockpile wind erosion	0.04	0.02	kg/ha/hr
	Exposed area	0.04	0.02	kg/ha/hr
	Quarry stockpile and exposed area	0.04	0.02	kg/ha/hr
Product transportation	Quarry haul road	1.997	0.532	kg/VKT
Source: Heggies (2010b) – Table 12				

9.7.2.3 Neighbouring Pollutant Sources

Sources of atmospheric pollution surrounding the Application Area are mainly from mining activities from the mines in the vicinity of Awaba Colliery (Heggies, 2010b). Mining activities in the vicinity of Awaba Colliery include:

- Newstan Colliery (approximately 5.5 km northeast);
- Myuna Colliery (approximately 5.4 km northeast); and
- Eraring Power station (approximately 3.3 km south- southwest), this includes the Eraring Ash Dam which is also a potential source of atmospheric pollution.

Given the above, it is considered that the surrounding coal mining operations have the potential to cause cumulative impacts upon receptors surrounding the Application Area due to the relatively small distances between the Application Area and these identified sources.

Concentrations of pollutants can also be elevated under certain conditions, such as bushfires or dust storms. Although these events are relatively infrequent, they do occur and can result in elevated concentrations of particulates over several days in some instances. These events can be identified through the use of a network of air quality monitors as simultaneous elevations of particulate will be noted across an area.

9.7.2.4 Background Air Quality for Assessment Purposes

For the purposes of the Heggies (2010b) assessment the background air quality concentrations/levels presented in Table 9.14 were adopted. These background air quality data have been adopted from the annual average monitored values from site data and daily varying background 24-hour PM_{10} concentrations from the DECCW Wallsend monitoring site.

Table 9.14 – Background Air Quality Used for Assessment Purposes

Air Quality Parameter	Concentration / Level
PM_{10}	Daily varying (24-hour)
	21.5 µg/m^3 (annual average)
TSP	47.0 µg/m^3 (annual average)
Dust Deposition	2.0 g/m^2/month (annual average)
Source: Heggies (2010b) – Table 11	

9.7.3 Air Quality Impact Assessment

Results of the dispersion model predictions for the Project Site are presented in the following sections. It is noted that a sensitivity analysis was carried out within the dispersion modelling using a synthetic generated file from The Air Pollution Model (TAPM) to account for the identified limitation in the meteorology data as discussed in Section 5 of the Air Quality Impact Assessment (Heggies, 2010b). The results of the sensitivity analysis identified that the potential impacts upon sensitive receptors were higher using the Newstan observational data due to the high incidences of southerly's from that dataset. Therefore the results shown below present the worst-case scenario for potential air quality impacts (Heggies, 2010b).

9.7.3.1 Dust Deposition

Table 9.15 shows the results of the dispersion modelling for dust deposition (annual average) resulting from the Project operations at each of the identified receptors. The results indicate that total annual average dust deposition levels at all receptors surrounding the Project are predicted to be below the Project criterion of 4 g/m^2/month (cumulative dust deposition) when using a conservative background deposition level of 2.0 g/m^2/month. A contour plot of the predicted total annual dust deposition experienced around the site is presented in Figure 9.13.

Table 9.15 – Background and Incremental Dust Deposition - Annual Average

Residence ID	Dust Deposition Annual Average (g/m2/month)			
	Background	Increment	Background + Increment	Assessment criterion
R1	2	0.4	2.4	4
R2	2	0.5	2.5	4
R3	2	0.6	2.6	4
R4	2	0.6	2.6	4
Source: Heggies (2010b) – Table 13				

9.7.3.2 Total Suspended Particulates (TSP)

Table 9.16 shows the results of the dispersion modelling for TSP from the Project at each of the identified receptors using the emission rates calculated by Heggies (2010b). A contour plot of the incremental increase in TSP concentrations attributable to the Project is presented in Figure 9.13. The contour plot is indicative of the concentrations of TSP that could potentially be reached under the worst-case meteorological conditions modelled.

Table 9.16 – Background and Incremental TSP - Annual Average

Residence ID	TSP Annual Average (µg/m^3)			
	Background	Increment	Background + Increment	Assessment criterion
R1	47.0	3.0	50.0	90
R2	47.0	5.0	52.0	90
R3	47.0	5.4	52.4	90
R4	47.0	5.1	52.1	90
Source: Heggies (2010b) – Table 14				

9.7.3.3 Particulate Matter (PM_{10})

An annual average background concentration of 21.5 µg/m^3 has been applied to obtain an indication of the potential cumulative impacts associated with the Project and to allow comparison with the annual average PM_{10} criterion. The results indicate that annual average PM_{10} levels at all receptors surrounding the Project are predicted to be below the Project criterion of 30 µg/m^3. These results are shown in Table 9.17.

Table 9.17 – Annual Average PM_{10} Concentrations

Residence ID	PM 10 - Annual Average (µg/m3)			
	Background	Increment	Background + Increment	Assessment criterion
R1	21.5	1.2	22.7	30
R2	21.5	1.9	23.4	30
R3	21.5	2.1	23.6	30
R4	21.5	2.1	23.6	30
Source: Heggies (2010b) – Table 20				

Additionally, dispersion modelling for 24-hour maximum PM_{10} concentrations resulting from the Project operations at each of the identified receptors was also undertaken. These results indicated that the 24-hour average PM_{10} (background plus predicted increment) are all in exceedance of 50 µg/m3 at all the nearest sensitive receptors. It is noted by Heggies (2010b) that this

exceedance is attributed to the background PM_{10} used for the assessment and the results have shown that no additional exceedances have occurred as a result of the proposed expanded operations from the Project.

A contour plot of the predicted PM_{10} concentrations experienced around the site is presented in Figure 9.13.

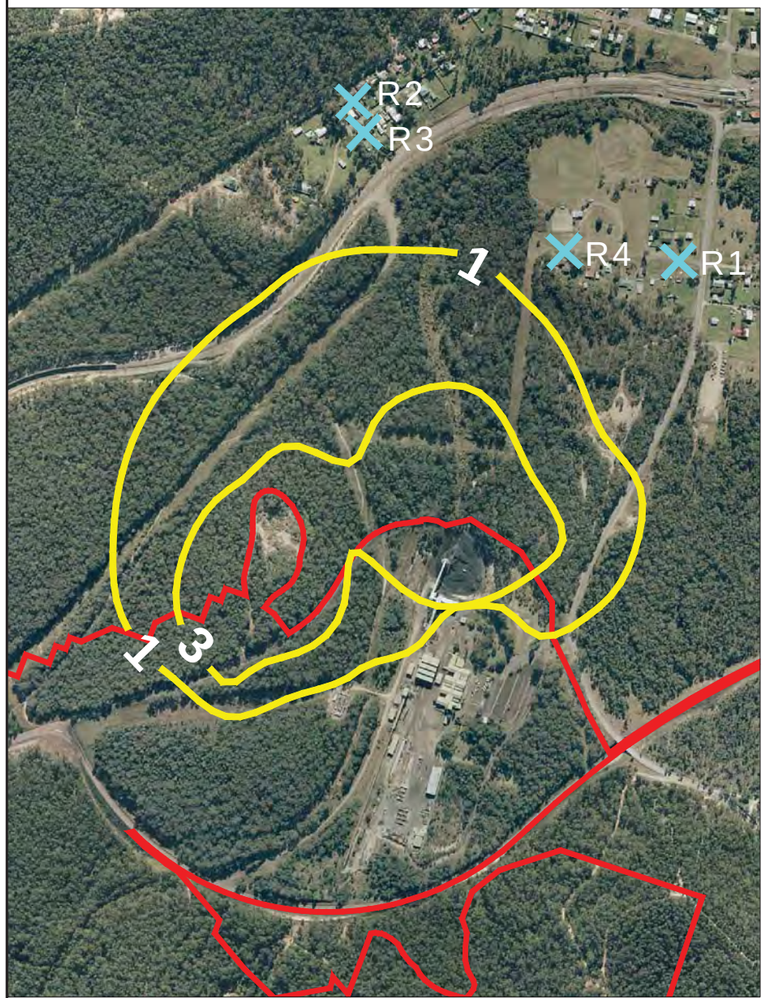
9.7.3.4 Underground Ventilation Emissions

There is one ventilation fan situated within the Application Area, designed to stimulate the movement of fresh air to underground mining areas and remove emissions associated with the mining activities (diesel combustion, coal seam gas extractive operations).

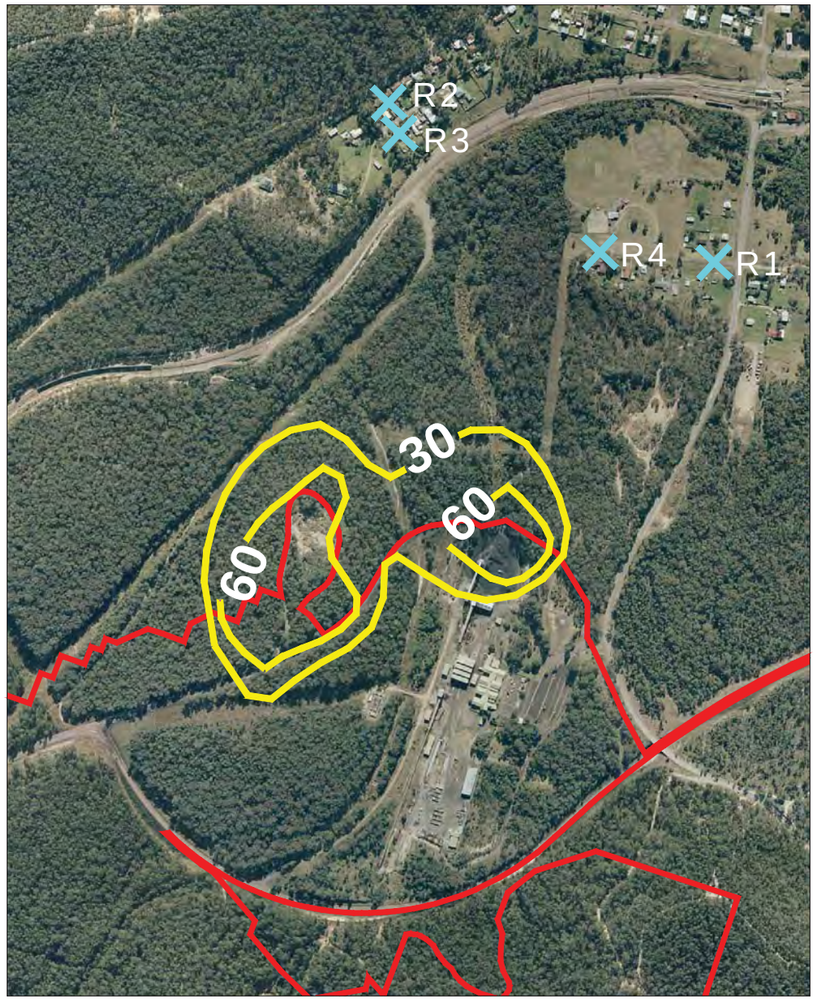
Based on the level of annual underground extraction proposed for the Project and the knowledge of potential emissions associated with significantly larger underground coal mines, it is considered that minimal impacts will be associated with the emissions from the mine ventilation system. However, the air quality impact assessment (Heggies, 2010b) considered the potential for these underground emissions to exceed the specific emission goals for the Project provided in Section 9.7.1.

There was no data available to determine site specific emissions of NO_2 and CO. Conservative assumptions to approximate NO_2 and CO emissions from the ventilation system were provided by Heggies (2010b) (refer Appendix 10) in order to estimate the qualitative ventilation system emission rates. These emission rates were input into the atmospheric model.

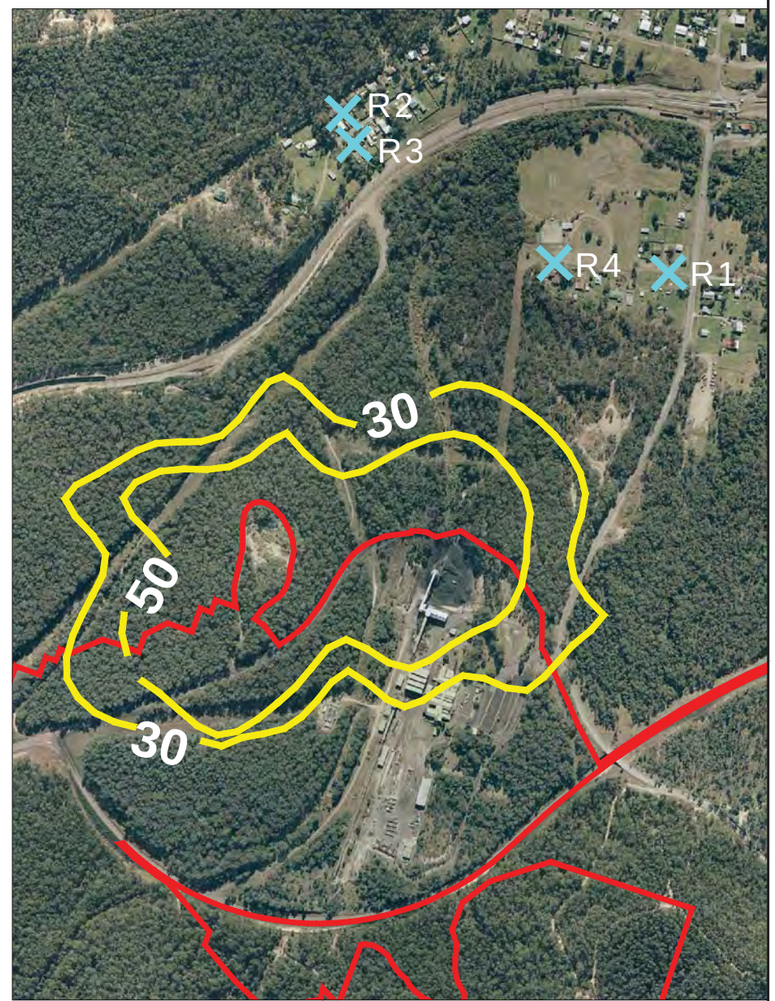
The results of the dispersion modelling for both NO_2 and CO were negligible (<0.1 $\mu g/m^3$) at all nearest sensitive receivers. Therefore the relevant assessment criteria for the Project have been determined to be achieved at each of the identified sensitive receivers.



Predicted Total Annual Dust Deposition (g/m ^{2})



Predicted Annual Average TSP Concentrations (µg/m^3)



Predicted 24hr Average PM_{10} Concentrations (µg/m^3)

LEGEND

- Project Application Area
- Dust concentration contour
- Sensitive receptor

Source: Awaba Underground Coal Mine Part 3A Application: Air Quality Impact Assessment (Heggies, 2010b)

0 100 200 300 400m

To be printed A3

GSS ENVIRONMENTAL
Environmental, Land and Project Management Consultants

Awaba Colliery
Air Quality Impact Assessment
Figure 9.13

9.7.4 Consequences of Potential Air Quality Impacts

The results of the Air Quality Impact Assessment have shown that the proposed activities for the Project will not result in an exceedance of the air pollutants presented in Section 9.7.3. Therefore there would be no consequences from the Project.

9.7.5 Air Quality Management and Mitigation Measures

The results of the Air Quality Impact Assessment have included the existing air quality management controls implemented by Awaba Colliery. The mitigation measures implemented by the Awaba Colliery are described in the Dust Management Plan (Centennial Coal Awaba Colliery, 2009). This management plan will continually be used by Awaba Colliery to provide management and monitoring strategies for potential air quality impacts throughout the life of the mine.

Current air quality mitigation and management measures employed at Awaba include:

- Designated haulage routes where vehicles are restricted to the most direct route with minimal manoeuvring;
- Speed limits;
- Water spraying of unsealed roads, manoeuvring areas and stockpiles;
- Sealing of haul roads. All haul roads (excluding the road into the quarry) are sealed;
- Vacuum sweeping adjacent to coal stockpiles, haul roads and hard stand areas;
- Covering of truck loads entering and leaving the premises;
- Enclosures on all main conveyors; and
- Enclosed coal chute at stacking conveyor discharge point.

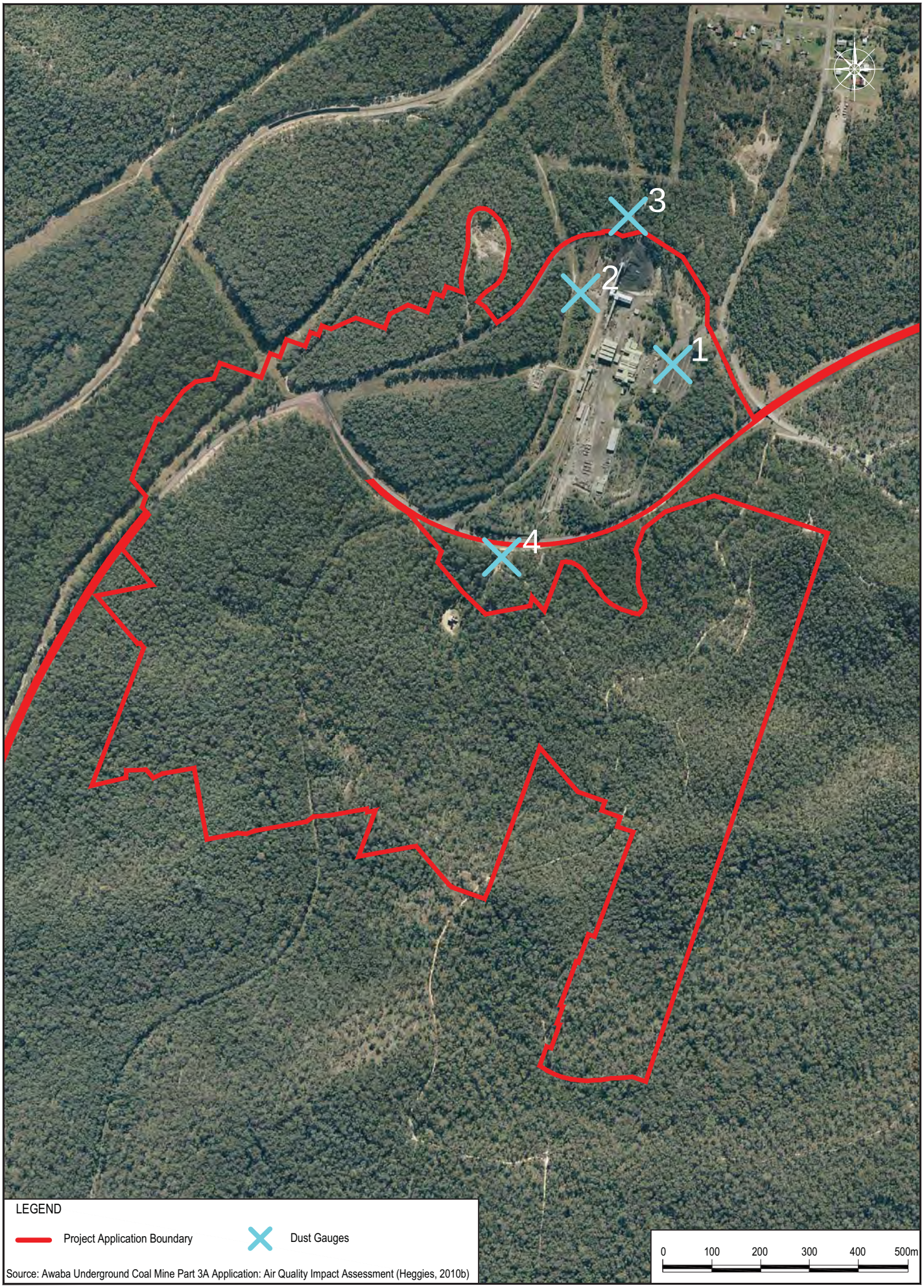
In addition, Awaba Colliery maintains a monitoring network to measure the air quality impacts associated with the operation. The pollutant monitored by the Awaba Colliery air quality monitoring network is dust deposition. Figure 9.14 illustrates the distribution of the Awaba Colliery air quality monitoring network. This monitoring network will continue to be maintained by the Awaba Colliery to measure any potential additional impacts from the Project.

9.7.6 Conclusion

The Air Quality Impact Assessment conducted by Heggies modelled dust deposition levels, Total Suspended Particulates (TSP), PM_{10} and underground ventilation emissions for the Project as outlined in Section 9.7.3. This study indicated that the Project would comply with the relevant criteria. In summary:

- Dust deposition levels are predicted to be below the Project air quality criteria at all surrounding dwellings;
- Cumulative annual average TSP concentrations are predicted to be below the Project air quality goal at all surrounding dwellings;
- Cumulative annual average PM_{10} concentrations are predicted to be below the Project air quality goal at all surrounding dwellings;
- Cumulative maximum 24 hour PM_{10} concentrations attributable to the Project are predicted to be below the Project air quality goals at all surrounding dwellings, excluding periods of regional pollution events; and
- Nitrogen dioxide and carbon monoxide emission levels were negligible (<0.1 $\mu g/m^3$) at all nearest sensitive receivers.

The study undertaken by Heggies indicates that current mitigation measures being implemented by Awaba Colliery appear adequate. Whilst it is recommended that these measures continue to be employed at the site in the future, there is no requirement for further mitigation strategies.



To be printed A4

GSS ENVIRONMENTAL
Environmental, Land and Project Management Consultants

Awaba Colliery
Air Quality Monitoring Network
FIGURE 9.14

9.8 Greenhouse Gas

9.8.1 Introduction

The potential for the Project to result in a significant increase in greenhouse gas emissions and associated impacts was considered by the BBRA to be a *low risk*. Notwithstanding this a quantitative greenhouse gas assessment for the Project was undertaken by Heggies and was included in the air quality impact assessment (Heggies, 2010b) that is included in Appendix 10. This assessment was undertaken in accordance with the National Greenhouse and Energy Act 2007, the Regulations and the *National Greenhouse and Energy Reporting (Measurement) Determination 2008* (collectively referred to as NGERS) and the "*National Greenhouse Accounts (NGA) Factors*" (herein referred to as the NGA Factors) (Commonwealth Department of Climate Change, 2009).

The definitions used for the Project for scope 1 and scope 2 emissions are provided by the *National Greenhouse and Energy Reporting Regulations 2008*. It is noted that the NGERS legislation does not provide a definition of scope 3 emissions, therefore these estimations have been undertaken in accordance with the NGA factors. These are explained in further detail in Section 9.1 of the air quality impact assessment (Heggies, 2010b).

The quantitative greenhouse gas assessment for the Project examined the potential Scope 1, 2 and 3 greenhouse gas emissions. Quantification of potential Project emissions involved the assessment of both carbon dioxide (CO_2) and other non-CO_2 greenhouse gas emissions, although, for comparative purposes, non-CO_2 greenhouse gases are awarded a "CO_2-equivalence" (CO_2-e) based on their contribution to the enhancement of the greenhouse effect. It is noted that short-lived gases such as, carbon monoxide (CO), nitrogen dioxide (NO_2), and non-methane volatile organic compounds (NMVOCs), vary spatially and it is consequently difficult to quantify their global radiative forcing impacts. For this reason these gases were not considered for the GHG assessment (Heggies, 2010b).

It is noted that the Awaba Colliery has limited capacity to reduce Scope 3 GHG emissions. Reductions in the emissions of GHG resulting from the extraction and transport of fossil fuels which are then used on site (eg electricity and diesel) are beyond the control of Awaba Colliery but are reported here for completeness, as required by DoP. Also beyond the control of the Awaba Colliery are the operations of coal consumers, however, Scope 3 emissions associated with the combustion of product coal has diligently been included in this assessment as described below.

A summary of the estimated potential greenhouse gas (GHG) emissions associated with the Project is provided below.

9.8.2 Existing Environment

The data used for the assessment was provided by Centennial for the period July 2008 to June 2009. This data was the most recent complete financial year of data which has been independently audited and verified to meet the requirements of the NGERS legislation. The activity data assessed for the Project included the following:

- Total Run of Mine (ROM) Coal Production (805,825 tonnes);
- Total Electricity Consumption (kilowatt-hours);
- Total Diesel Consumption (litres);
- Solid Waste to Landfill (tonnes);
- Fugitive Emissions of Coal Seam Methane (CH_4) and CO_2 via ventilation shafts (m^3 and percentage content of CO_2 and CH_4 in ventilation return air);
- Emissions from use of sulphur hexafluoride (SF6);
- Emissions from the use of Liquid Petroleum Gas (LPG);
- Emissions from the use of oils and greases (consumed without combustion); and
- Weekly Total Employee Vehicle Movements.

A summary of the existing GHG emission sources is provided in Table 9.18.

Table 9.18 – Summary of Existing Greenhouse Gas Emissions

Project Component	Direct Emissions	Indirect Emissions	
	Scope 1	Scope 2	Scope 3
Fugitive Emissions	Emissions from the release of coal seam methane and carbon dioxide as a result of extraction activities.	N/A	N/A
Diesel	Emissions from the combustion of diesel at the Project in both mobile and fixed plant and equipment (Includes ROM coal transport by coal haulage contractor)	N/A	Estimated emissions attributable to the extraction, production and transport of diesel consumed at the Project Site.
Liquid petroleum gas	Emissions from the combustion of LPG at the Project in both mobile equipment	N/A	N/A
Consumption of sulphur hexafluoride	Consumption of SF_6 for gas insulated switchgear and circuit breaker applications	N/A	N/A
Electricity	N/A	Emissions associated with the consumption of generated and purchased electricity at the Project Site.	Estimated emissions from the extraction, production and transport of fuel burned for the generation of electricity consumed at the Project Site and the electricity lost in delivery in the transmission and distribution network.
Coal Combustion	N/A	N/A	Emissions from the combustion of coal from the Project
N/A = Not applicable			
Source: Heggies (2010b) – Table 23			

To assess the GHG impact of the proposed Awaba operations (up to 880,000tpa extraction rate), activity data has been scaled to reflect the proposed modified operations as outlined in Table 9.19. The calculated annual activity data provided by Centennial reflecting the current operations are also presented.

Table 9.19 – Summary of Project Related Activity Data relevant to GHG emissions (Current and Proposed Operations)

Activity	Quantity (Current[1])	Quantity (Proposed)	Scaling Factor Applied
Annual ROM production (t)	805,825	880,000	1.09 (880,000t/805,825t)
Annual Electricity Consumption (kWh)	12,965,019	14,158,430	1.09
Annual Diesel Consumption Mine Operation (L) Coal Haulage by Contractor (L)	 115,275 279,995	 125,886 305,768	 1.09 1.09
Solid Waste to Landfill (t)	43	43	Assumed no change in waste generation
Sulphur hexafluoride (SF_6) (kg)	8.028	8.028	Assumed no change
Liquid Petroleum Gas (LPG) (kg)	200	200	Assumed no change
Oil/ greases used (L)	209,492	228,346	1.09
Employee Vehicle Movements	4,680	4,680	Assumed no change in employee numbers
Note 1: Current Operations based on information provided by Centennial for the period July '08 to June '09			
Source: Heggies (2010b) – Table 22			

9.8.3 Greenhouse Gas Impact Assessment

The greenhouse gas sources included in the assessment are as follows:

- Scope 1 Emissions:
  - Fugitive emissions including coal seam methane and carbon dioxide;
  - Diesel usage; and
  - Consumption of liquid petroleum gas and sulphur hexafluoride.
- Scope 2 Emissions:
  - Indirect emissions resulting from the consumption of purchased electricity.
- Scope 3 Emissions:
  - Extraction, production and transport of fuel burned for the generation of electricity and electricity consumed in the transmission and distribution system;
  - Extraction, production and transport of diesel consumed at the project;
  - Employees commuting to and from work;
  - Waste generation; and
  - Combustion of product coal.

Heggies (2010b) notes that the following Scope 3 GHG emission sources were not included within the assessment:

- Employee business travel; and
- Outsourced activities.

Calculated Scope 1, Scope 2 and Scope 3 emissions of greenhouse gas resulting from the emissions sources outlined above for the existing operations (based on 805,825 tonnes per annum ROM extraction rate) and the proposed operation (880,000 tonnes per annum ROM extraction rate) are presented in Table 9.20.

Table 9.20 – Summary of GHG Emissions Attributable to the Project (Current and Modified)

Emissions Scope	Emissions Source	Activity Data		Activity Rate	Emission Factor (CO_2-e)		Total Emissions (t CO_2-e/annum)	
		Current	Modification		Emission Factor	Units	Current	Modification
Scope 1	Fugitive Emissions[1]	805,825	880,000	t/annum	-	-	13,160	13,160
	Diesel Combustion	395	431	kL/annum	69.9[2]	kg CO_2-e / GJ	1,066	1,162
	LPG consumption	0.39	0.39	kL/annum	60.8	kg CO_2-e / GJ	1	1
	Use of sulphur hexafluoride	8.028	8.028	kg/annum	23.9	t CO_2 / kg	1	1
	Use of oils / grease	204	223	kL/annum	1.08	t CO_2 / kL	221	241
Sub-Total Scope 1							**14,449**	**14,565**
Scope 2	Electricity Consumption	13	14	MWh/annum	0.89	kg CO_2-e / kWh	11,539	12,601
Sub-Total Scope 2							**11,539**	**12,601**
Scope 3	Diesel Combustion	395	431	kL/annum	5.3[2]	kg CO_2-e / GJ	81	88
	Electricity Consumption	13	14	MWh/annum	0.18	kg CO_2-e / kWh	2,334	2,549
	Waste Generation	43	43	t/annum	1.1	t CO_2-e / t waste	47	47
	Employee Transport	1,460	1,460	L/annum	5.3	kg CO_2-e / GJ	0.3	0.3
	Coal Combustion	805,825	880,000	tpa ROM	20.7	kg CO_2-e / GJ	652,000	712,800
Sub-Total Scope 3							**654,462**	**715,484**
TOTAL							**680,450**	**742,650**

Note 1: Fugitive emissions are related to the ventilation data viz, Flow, Pressure, Temperature and gas % and it is considered that these parameters and therefore the fugitive emissions will not change materially with the proposed additional production. Emissions are as reported for the Awaba Colliery during the 08/09 year under NGERS using NGERS Method 4.

Note 2 For transport energy purposes.

Source: Heggies (2010b) – Table 24

9.8.4 Consequences of Potential Greenhouse Gas Impacts

Emissions of greenhouse gas in NSW were reported to be 163 Mt in 2008 27% of the Australian total greenhouse gas emissions of 597 Mt. Comparison of the emissions attributable to the proposed Project with NSW and Australia emission totals is presented in Table 9.21. The results of the greenhouse gas assessment indicate that the total emissions (Scope 1, 2, and 3) attributable to the project would equate to approximately 0.45% and 0.12% of the total 2007 greenhouse gas emissions in NSW and Australia, respectively.

Table 9.21 – Comparison of Modified Project GHG Emissions with State and National Totals 2007

Emission Scope	Estimated Emissions (tCO2-e/annum)	Percentage of NSW 2007 GHG Emission Total	Percentage of Australian 2007 GHG Emission Total
1	14,565	0.0089	0.0024
TOTAL (1,2 and 3)	742,650	0.45	0.12
Source: Heggies (2010b) – Table 25			

9.8.5 Greenhouse Gas Management and Mitigation Measures

Awaba is currently implementing a number of measures to minimise to the greatest extent practicable greenhouse gas emissions from Awaba Colliery. Relevant measures are described below:

- Maximising energy efficiency as a key consideration in the development of the mine plan. For example, significant savings of greenhouse gas emissions (through increased energy efficiency) are achieved by mine planning decisions which minimise transportation distances for ROM coal and therefore fuel use.

Additional measures that Awaba Colliery is striving to achieve include:

- Utilise ventilation modelling to identify opportunities to reduce ventilation flow thus energy used by main fan as the production areas become closer to the mine pit bottom and ventilation circuit resistance is lowered
- Implement cost effective measures to improve energy efficiency;
- Regular maintenance of plant and equipment to minimise fuel consumption; and
- Consideration of energy efficiency in plant and equipment selection/phase.

9.8.6 Conclusion

The total GHG emissions (Scope 1, 2 and 3) from the proposed increase in ROM production for the Project are predicted to be 742,650 t CO_2-e per annum. This will consist of direct (Scope 1) emissions, which are estimated to be approximately 14,565 t CO_2-e per annum, and indirect (Scope 2 and 3) emissions, which are estimated to be 728,085 t CO_2-e per annum.

The predictions for the total GHG emissions for the Project indicate an increase by 62,200 t CO_2-e per annum or 8.4% from the 2008/2009 financial year. The majority of the increase in GHG emissions (60,800 t CO_2-e per annum) is a result of the combustion of coal by third parties. The remaining increase of 1,400 t CO_2-e per annum is a combination of emissions from Scope 2 emissions from electricity consumption at the Awaba Colliery, and both Scope 1 and 3 emissions from the use of diesel, oils and grease.

9.9 Ecology

9.9.1 Introduction

The Project BBRA identified a *"low"* potential ecological risk that surface and underground operations would result in an impact upon threatened species and/or endangered ecological communities, and/or breach the *Commonwealth Environment Protection and Biodiversity Act 1999* (EPBC Act). However, as a precautionary measure, an ecological assessment for the Project was undertaken by Hunter Eco in a report titled *"Awaba Colliery Mining Project: Part 3A Application Ecology Assessment"* and is included in Appendix 11. The report was prepared according to the *Draft Guidelines for Threatened Species Assessment under Part 3A of the Environmental Planning and Assessment Act 1979* (DECC & DoP, 2005). This assessment considers the potential for ecological surface disturbances to occur, the potential impact resulting from expected subsidence in proposed mining areas, and the risks associated with the project in regard to ecological implications. Impact assessments in mining areas were prudently considered with respect to both predicted maximum subsidence as well as unlikely worst case scenarios. This assessment generally involved the following:

- Review of *NSW Threatened Species Conservation Act 1995* (TSC ACT) and the Commonwealth EPBC Act for the consideration of threatened species and communities potentially occurring at the project site;
- Vegetation community mapping - The implementation of standardised vegetation communities to develop a predictive model for ecological site characterisation within the Study Area;
- An assessment of ecological sensitivity within the Study Area;
- Evaluation of potential impacts;
- Evaluation of the likelihood of significant ecological disruption; and
- Preparation of mitigation and management strategies.

In order to assess the potential for ecological impacts by subsidence, vegetation communities were classified and mapped within the Application Area and in particular across Study Areas 2 and 3 which contain the active mining areas (comprising the continuation of existing mining within Main South Area (Stage 2 and Revised Stage 3 areas) and the proposed extension into the *East B Area*). The location of any threatened species of flora or fauna observed during field work were also recorded. Using the vegetation communities as habitat surrogates, the potential threatened flora and fauna species occurring were determined based on current available knowledge of their habitat requirements (Hunter Eco, 2010).

Given that there would be no habitat clearing and that the only impact would be surface deformation up to a maximum predicted of 200mm, no fauna trapping or targeted field searches for fauna were conducted. For the purposes of the ecology impact assessment, all fauna species that would be likely to occur in the surface habitat types were conservatively assumed to be present (Hunter Eco, 2010).

9.9.2 Existing Environment

Vegetation Communities

Vegetation communities were mapped within and surrounding the Application Area using the ground-truthing methods described by DECC (2008, as cited in Hunter Eco, 2010). The investigation area is shown on Figure 9.15, and shows the vegetation communities within a broader context in which the potential impacts may occur. The results of the vegetation community mapping are provided in Table 9.22 and are considered to represent the habitat for threatened flora and fauna species, and permitted Hunter Eco (2010) to assess the likelihood of any of these species being present. Each of the following vegetation communities are identified by groupings of species within the canopy, shrub and ground layers. Details of specific species for each vegetation community can be found in Section 4 of the ecology impact assessment included in Appendix 11.

Table 9.22 – Vegetation Communities and Site Area

Community	Impact Area (ha)	Investigation Area (ha)
MU15 Coastal Foothills Spotted Gum – Ironbark Forest	10	29
MU30 Coastal Plains Smooth-barked Apple Woodland	48	167
MU31 Coastal Plains Scribbly Gum Woodland	19	70
MU37 Swamp Mahogany Paperbark Forest (EEC)	0	1
Undefined riparian forest	2	30
Disturbed	2	8

Groundwater Dependent Ecosystems

Groundwater dependent ecosystems (GDE) are specialised ecosystems that rely on the persistence of groundwater (Hunter Eco, 2010). Australasian Groundwater & Environmental Consultants conducted a survey of the Stony Creek alluvium (AGEC 2008, as cited in Hunter Eco, 2010) and found that an unconfined groundwater aquifer existed in the alluvial bed of Stony Creek along the section that contains riparian vegetation (as shown on Figure 9.15). The aquifer is recharged by infiltration from direct rainfall and appears to be intermittent along the length of Stony Creek, being intersected by less permeable clayey sequences. However, the vegetation along this part of Stony Creek is representative of a GDE and progressively develops downstream as water accumulates.

Threatened Species Assessment

The threatened species present in any area are dependent on the habitat types represented. The probable threatened species that might be present in the Application Area were determined using separate methods for each of the NSW State listed threatened species and the Commonwealth listed threatened species. For the NSW State listed threatened species data was obtained from the NPWS Atlas of NSW Wildlife for an area within ten (10) kilometres of the Application Area boundary, and for the Commonwealth listed threatened species the protected matters search tool was used to determine the threatened species within five (5) kilometres of the Application Area, additionally the protected matters search tool was used to identify migratory bird species within a ten (10) kilometre radius. An overview of the findings presented in the ecology impact assessment is provided below (and illustrated on Figure 9.16), with detailed results presented in the ecology impact assessment (Hunter Eco, 2010).

The results from the search for threatened species for the NSW State are shown in Table 9.23. The likelihood of presence for each of the species recorded in the Atlas of NSW Wildlife was also determined for the assessment (Hunter Eco, 2010). Of the total 58 species presented by Hunter Eco (2010) it was identified that the Application Area provided suitable habitat for only 23, with one additional species (*Tetratheca juncea*) being recorded with the Application Area. The remaining species were identified as having either marginal or, unsuitable habitat (Hunter Eco, 2010).

Table 9.23 – Probable Threatened Species (NSW State)

Order	Likelihood of Presence				Total Species
	Recorded Present	Suitable Habitat	Marginal Habitat	Unsuitable Habitat	
Flora	1	3	1	3	8
Amphibians	-	-	-	7	7
Reptiles	-	2	-	1	3
Birds	-	9	-	12	21
Mammals	-	9	3	7	19
Total	**1**	**23**	**4**	**30**	**58**

The probable Commonwealth listed threatened species for the Application Area, as determined through the search of the protected matters research tool, are shown in Table 9.24. The likelihood of presence for each of the species identified by the protected matters research tool was also determined for the assessment (Hunter Eco, 2010). Of the total 20 species presented by Hunter Eco (2010) it was identified that the Application Area provided suitable habitat for 11 species, with two additional species (*Tetratheca juncea* and *Grevillea parviflora subsp. parviflora*) being recorded within the Application Area. The remaining species were identified as having unsuitable habitat (Hunter Eco, 2010).

Table 9.24 – Probable Threatened Species (Commonwealth)

Order	Status[1]	Likelihood of Presence			Total Species
		Recorded Present	Suitable Habitat	Unsuitable Habitat	
Flora	V	2	5	-	7
	E	-	-	1	1
Birds	V	-	1	-	1
	E	-	1	1	2
Marsupials	V	-	1	1	2
	E	-	1		1
Bats (megachiropteran and microchiropteran)	V	-	2	-	2
Amphibians	V	-	-	3	3
	E	-	-	1	1
Total		**2**	**11**	**7**	**20**
Note 1: V = vulnerable, E = endangered					

Migratory Species – Commonwealth

In addition to the probable threatened species shown in Table 9.24, the protected matters research tool also identified seven migratory bird species that are recognized as a matter of Commonwealth significance. It is noted that the Application Area provides suitable habitat for four of these species, and is considered to be either marginal or unsuitable for the remaining.

LEGEND

- Site Boundary
- Area Subject to Subsidence
- Disturbed Habitat
- MU15 Coastal Foothills Spotted Gum - Ironbark Forrest
- MU30 Coastal Plains Smooth-barked Apple Woodland
- MU31 Coastal Plains Scribbly Gum Woodland
- MU37 Swap Sclerophyll Forrest EEC
- Undefined Riparian Community

Source: Awaba Colliery Continuation of Mining Project: Part 3A Application Ecology Assesment. (Hunter Eco, 2010)

To be printed A4

GSS ENVIRONMENTAL
Environmental, Land and Project Management Consultants

Awaba Colliery
Vegetation Map
Figure 9.15

LEGEND

- Site Boundary
- Area Subject to Subsidence
- Ground Truthed Data Point
- Grevillea Parviflora
- Tetratheca Juncea
- Little Lorikeet
- Glossy Black-Cockatoo
- Disturbed Habitat
- MU30 Coastal Plains Smooth-barked Apple Woodland
- MU31 Coastal Plains Scribbly Gum Woodland
- MU37 Swap Sclerophyll Forrest EEC
- Undefined Riparian Community

Base Plan Data Source: Awaba Colliery Continuation of Mining Project: Part 3A Application Ecology Assesment. (Hunter Eco, 2010)

To be printed A4

GSS ENVIRONMENTAL
Environmental, Land and Project Management Consultants

Awaba Colliery
Threatened Species
Figure 9.16

9.9.3 Ecology Impact Assessment

The potential ecological impacts were assessed for two possible subsidence scenarios. The first scenario is the predicted case (maximum 200mm) and the other is for an unlikely worst case 'plug failure' scenario, noting however that the mine plan has been specifically designed to eliminate or significantly reduce the possibility of such an event (as described in Section 9.4). For the worst case scenario a void was selected that conservatively represented the likely greatest ecological impact (i.e. which void had the largest surface area) and the potential impacts of that void failing were assessed. An overview of the potential impacts assessed within the ecology impact assessment is provided below.

It is noted that detailed assessments of the potential impacts for the specific threatened species, both NSW and Commonwealth listed threatened species, have been included as appendices to the ecology impact assessment (Hunter Eco 2010).

9.9.3.1 Vegetation communities

The three main vegetation communities MU15, MU30 and MU 31 within the Application Area are hardy, dry sclerophyll vegetation and a small change in the surface would have no impact on their viability (Hunter Eco, 2010). Furthermore, subsidence within the predicted range (up to 200mm maximum) would not have a significant impact on any of the identified vegetation communities (Hunter Eco, 2010).

Hunter Eco (2010) identified that in the unlikely worst case scenario (i.e. plug failure) two vegetation communities would potentially be impacted, namely these were *Coastal Plains Smooth-barked Apple Woodland* and *Coastal Plains Scribbly Gum Woodland*. This may result in the loss of individual species, and if the void remained unremediated, changes to the micro-environment may occur which has the potential to influence vegetation composition in this area. The potential surface area affected by the worst case 'plug failure' scenario is less than four (4) hectares and as such these potential impacts are not considered to be significant.

Additionally, the overall slopes on the Application Area are such that subsidence of the range predicted would not result in any diversion of water from the existing drainage lines meaning that there would be no impact on downstream GDE's (Hunter Eco, 2010). However, 'plug failure' would alter the hydrology of the surface with rainfall flowing into the cavity and flowing into the underground mine workings. This would have both local impacts as well as downstream impacts. Appropriate measures to address this potential impact are discussed in Section 9.9.5.

9.9.3.2 Threatened flora

The Smooth-barked Apple and Scribbly Gum vegetation are preferred habitat for *Tetratheca juncea* (Driscoll 2003) and it is quite possible that the species is present in this habitat in addition to the recorded locations. *Grevillea parviflora subsp. parviflora* can be found in a variety of habitats and could also be present elsewhere to the recorded locations. Both species are hardy and the small expected surface deviation would not threaten any local population with extinction (Hunter Eco, 2010).

For the chosen void in the unlikely worst case scenario assessment *Tetratheca juncea* is known to occur and it is also possible for *Grevillea parviflora* subsp *parviflora* and *Cryptostylis hunteriana* to occur. If the void remained unremediated changes to the micro-environment could result in the loss of any individual threatened species. Remediation would be conducted in accordance with the Public safety and Watercourse Management Plans. The specific remediation would depend on the actual subsidence event. This would also potentially result in the loss of any threatened flora species growing in the original habitat (Hunter Eco, 2010). Remediation would aim to minimise any damage to threatened species populations.

9.9.3.3 Threatened fauna

The threatened fauna species likely to be using the subject site are highly mobile and would not be impacted on by small surface changes that would not result in significant habitat changes.

It is also noted that the mobility of threatened fauna means that they would not be impacted directly by a plug failure, however, the sheer-sided cavities would become a potential pit trap for terrestrial fauna species (whilst it remained unremediated). There would also be the possibility of trees with habitat hollows being lost along with any occupants during the process of restoring the cavity back to the original surface (Hunter Eco, 2010).

9.9.3.4 Habitat connectivity

A detailed assessment of the potential habitat connectivity impacts, for the specific identified threatened species, both NSW and Commonwealth listed threatened species, considered likely to occur within the Application Area, was undertaken for the Project, and are included as appendices to the ecology assessment (Hunter Eco, 2010). These assessments concluded that for all species assessed the existing connectivity would not be altered (Hunter Eco, 2010).

9.9.4 Consequences of Potential Ecology Impact

Overall, there were no significant impacts identified on vegetation communities, threatened flora and fauna, or to the connectivity of habitats (Hunter Eco, 2010). Therefore there are no expected consequences from the Project based on these findings.

9.9.5 Mitigation and Management Measures

The Awaba Colliery identified a number of mitigation strategies that have been implemented in order to minimise and manage the potential impacts from this Project upon the flora and fauna. These include:

- Minimal additional construction activities (area of the PCD expansion only) and surface disturbances;
- Mine design specifically planned to eliminate or significantly reduce potential for impacts, particularly plug failures (as discussed in Section 9.4);
- Permit to Clear procedure for all surface disturbances (including any subsidence repair and rehabilitation works); and
- The existing Newstan Flora and Fauna Management Plan. This plan outlines a variety of mitigation measures which have been adapted as practice by the Awaba Colliery including:
  - Prior to development commencing pre-clearing surveys will be undertaken. If threatened or regionally significant species are noted during these surveys, the location or designs of the works will be modified, where possible, to avoid impacts on these species; and
  - If the Environmental Coordinator identifies any threatened flora or significant impacts on threatened or regionally significant flora that was not identified in the EIS process qualified fauna consultants will be employed to advise on appropriate mitigation measures, in line with the Flora and Fauna Management Plan. This protocol will be implemented during all construction works.

In addition to the above mitigation measures the following existing measures are also recognised by the Awaba Colliery in order to minimise potential ecological impacts in the worst case 'plug failure' scenario:

- The existing Public Safety Management Plan and the Watercourse Management Plan would be referred to in order to provide mitigation measures that would be implemented (including remediation strategies);
- Diversion channels may be considered, where required, for installation to direct flow from the upper catchment immediately around the void area and natural flow paths would be re-established to ensure that there is only minimal loss of surface and sub-surface water flows, and therefore, minimal impacts on the vegetation communities (particularly GDE's); and
- Any disturbances would be inspected by a suitably qualified ecologist prior to clearing commencing to reduce any impact on threatened species by the proposed repair and rehabilitation works.

9.9.6 Conclusion

Hunter Eco (2010) assessed two subsidence scenarios for potential ecological impacts, the predicted maximum scenario (up to 200mm subsidence) and the worst case 'plug failure' scenario. Overall, there were no significant impacts identified on vegetation communities, threatened flora and fauna, or to the connectivity of habitats (Hunter Eco, 2010).

The maximum impact of the unlikely worst case scenario ('plug failure') assessed would be low for the ecology of the affected area, even during a sustained impact (i.e. unremediated) (Hunter Eco, 2010). However, in such cases a failure would be immediately remediated (primarily for safety reasons) and so the event would not result in a sustained impact. Accordingly, the actual residual impact that would occur in such an event can be considered even lower.

As the potential impacts from the Project were identified and assessed to be low by the ecology impact assessment (Hunter Eco, 2010), no additional management or mitigation measures to the existing measures identified in Section 9.9.5 above have been required.

9.10 Waste Management

Waste generated at Awaba Colliery is managed generally in accordance with the relevant regulatory requirements including the *NSW Waste Classification Guidelines* (DECCW, 2009), the *NSW Waste Avoidance and Resource Recovery Act 2001* (WARR Act), and the *Protection of the Environment Operations (POEO) Act 1997* (including amendments in 2008 for *Scheduled Activities and Waste*) and its related regulations (*Protection of the Environment Operations (Waste) Regulation 2005)*.

The types of waste generated by the Awaba Colliery operation, and the management strategy for this waste, are outlined in Table 9.25 below. It is noted that there are no production wastes (i.e. coarse or fine rejects) generated by the Awaba Colliery CPP, and all processed materials are transported away from the Awaba Colliery.

Table 9.25 – Waste Sources at Awaba Colliery

Waste Type	Waste Management
General Wastes and Scrap Metal	All paper, cardboard, wooden pallets and other general wastes are disposed of in dedicated waste bins located adjacent to the various site buildings. Waste sorting is undertaken by Contractors onsite and is monitored via weekly environmental inspections to ensure its compliance within the POEO Act. Recyclable ferrous and non-ferrous metals are also collected for recycling on an 'as-needs' basis.
Waste Oils/Grease and Potential Hydrocarbon-Contaminated Water	Any hydrocarbon-contaminated water is collected in the oil/water separator. Consolidated oil from the separator is regularly removed from site by a licensed contractor. A contractor regularly services and maintains the oil water separator. Weekly inspections are also conducted on the oil water separators to ensure effective operation. Waste oil is also collected in several receptacles on the mine surface. A licensed contractor working within the waste tracking provisions of the POEO Act removes all waste oil and greases generated on the site.
Sewage	The treatment of sewage at Awaba Colliery is managed through both a surface and underground system, designed to be self-sustaining. Sewage from the surface buildings is treated through an on-site septic system located on the western side of the workshop while underground sewage is managed by air operated toilets.

The waste management systems currently employed at Awaba Colliery will continue to be utilised for the Project. The Project will not generate any new waste materials or additional waste volumes on an annual basis. Additional waste volume will be generated on a life of mine basis given the extended operational mine life, however this volume of waste will continue to be managed in accordance with current waste management strategies.

The supporting strategy for waste management will continue to be minimisation and segregation at source. Waste materials produced by the Project will be managed in accordance with the following principles of the 'Waste Hierarchy' in order of preference and resource conservation:

- Waste avoidance (source reduction);
- Waste re-use;
- Waste recycling/re-processing/treatment; and
- Waste removal and disposal.

9.11 Soils and Land Capability

9.11.1 Introduction

The Project BBRA considered the potential impact of surface activities, resulting in erosion and sedimentation, to be a *low risk*. It is noted that potential subsidence related impacts on soils were not considered for the BBRA due to limited surface disturbance predicted using the proposed mining method, however, an assessment of soils and land capability within Study Areas 2 and 3 has also been undertaken to assess the improbable worst case scenario.

A desktop review of existing soil information has been undertaken by GSSE to:

- Classify and determine the soil profile types of the Application Area;
- Identify pre and post-mining rural land capability and agricultural suitability classifications;
- Identify any potentially unfavourable soil material which may pose high environmental risks if disturbed; and
- Provide any relevant management and mitigation measures to minimise any potential impacts identified.

It is noted that Study Area 4 has not been included in this assessment as it was previously disturbed during the construction of the existing private haul road and, therefore, there are no soils present. Furthermore, disturbance in this area is not anticipated during the life of the Project, as such it has not been included in this assessment.

9.11.2 Existing Environment

9.11.2.1 Soils

Two (2) soil landscapes underlie the Application Area. These are the Awaba and Wyong soil landscape units as delineated by the "*Soil Landscapes of the Gosford-Lake Macquarie 1:100,000 Sheet*" (Murphy, 1993). It is noted that the Doyalson soil landscape unit also borders the Application Area. A description of the three (3) soil landscape units within and surrounding the Application Area is provided in Table 9.26.

Study Area 1

The existing quarry and PCD areas within Study Area 1 have been highly disturbed. The majority of Study Area 1 is dominated by the Awaba soil landscape, whilst a small portion of the alluvial Wyong soil landscape unit occurs toward the northern boundary of the Study Area.

Study Area 2 & 3

Study Area 2 and 3 comprises the Awaba soil landscape and a small portion of the Awaba variant landscape. Areas that include the Awaba variant are moderately inclined to steep slopes (>25%). Otherwise, this variant has similar features to the Awaba soil landscape.

Table 9.26 – Soil Landscape Units

Landscape Unit	Group	Typical Landform	Geology	Typical Soils	Limitations
Awaba	Erosional	Rolling low hills on predominately coarse-grained sediments of the Narrabeen group and Newcastle Coal Measures in the Awaba Hills. Local relief 20-80m and slope gradients usually 10-25%. Crests are relatively broad, Side slopes are short and become steeper down slope. Drainage lines are narrow.	Narrabeen Group – Munmorah Conglomerate Formation: conglomerate, pebbly sandstone, grey green and grey siltstone and claystone; and Newcastle Coal Measures – Moon Island, Boolaroo and Adamstown Subgroups: conglomerate, sandstone, tuff, siltstone and black coal.	Shallow (<50cm) Lithosols on steep slopes, shallow to moderately deep (50-150cm) Soloths and Yellow Podzolics Soils on gentler slopes with Soloths along drainage lines.	Very high erosion hazard, shallow soils, hard-setting soils, stoniness, occasionally shallow, strongly acid and with low fertility.
Wyong	Alluvial	Broad and poorly drained floodplains and alluvial flats of Quaternary sediments. Slope gradients <3%; local relief <10m.	Quaternary Sediments –sand, silt, gravel and clay.	Deep (>200cm) Yellow Podzolic Soils, Brown Podzolic Soils and Soloths.	Seasonal water logging, stream bank erosion, strongly acid, poorly drained and impermeable soils of low fertility with saline subsoils.
Doyalson	Erosional	Gently undulating rises on Munmorah Conglomerate. Slope gradients <10%; local relief to 30m. Broad crests and ridges and long gently inclined slopes.	Narrabeen Group – Clifton Subgroup-Munmorah Conglomerate Formation: conglomerate, pebbly sandstone, grey green and grey siltstone and claystone.	Moderately deep (50-150cm) Yellow Earths, Yellow Podzolic Soils and Soloths occur on sandstones and conglomerates; moderately deep (50-150cm) Yellow Podzolics, Soloths and	High erosion hazard, hard setting, stoniness, strongly acid soils of low fertility.

9.11.2.2 Land Capability and Agricultural Suitability

The pre-mining and post-mining rural land capability classification of the Application Area, in accordance with Department of Environment, Climate Change & Water (DECCW) mapping was reviewed as part of this assessment. In addition, pre and post mining agricultural land suitability classification of the Application Area has also been assessed in accordance with Industry and Investment (formerly DPI and NSW Agriculture & Fisheries) guidelines.

The pre-mining rural land capability and agricultural suitability of the Study Areas are described below.

Study Area 1 & 2

The rural land capability of Study Areas 1 and 2 is Class VI land. Class VI land is suited to grazing only provided structural soil conservation works are in place and managed to ensure ground cover is maintained.

Study Areas 1 and 2 have an agricultural suitability classification of Class 4. Class 4 lands are marginal lands not suitable for cultivation and with a low to very low productivity for grazing.

Study Area 3

Study Area 3 has a rural land capability class of Class VI and VII. Class VII land is land which, owing to its high soil erosion hazard and severe site limitations, should remain under green timber. It generally has severe to very severe site limitations for other land uses, but may be suitable for wood production. Limitations include; slope, terrain, soil erosion, shallow soils and stoniness and poor drainage.

The agricultural suitability classification of Study Areas 3 is classified as Class 4 and 5. Class 4 and 5 lands are marginal lands not suitable for cultivation and with a low to very low productivity for grazing.

9.11.3 Soil and Land Capability Impact Assessment

Study Area 1

The only disturbance within Study Area 1 involves the expansion of an existing Pollution Control Dam. The location of the dam has been deliberately located in a previously disturbed area where soil conditions are considered appropriate for the dam. No further clearing or topsoil stripping is required prior to the proposed expansion of the Pollution Control Dam in this area. During the construction of the Pollution Control Dam, a number of sediment and erosion control measures will be required (GHD, 2010a).

The existing quarry has also been considered for the Project in the water management assessment. While no changes are proposed for the existing quarry, the function of this facility is to provide material for on-site remedial works, as such, there is a potential for activities in this area to result in an increase in sediment laden water being discharged due to increased disturbance of the quarry base. The existing measures are not considered to be appropriate for the current form of the quarry (GHD, 2010a).

There are no further proposed activities that will occur in previously undisturbed areas within this Study Area.

Study Area 2 & 3

The soils within Study Area 2 and 3 are relatively stable. The maximum predicted subsidence in Study Area 2 and 3 has been assessed at 200mm. The associated tilts and strains would be very low. It is expected that soils will not be impacted by the predicted levels of subsidence in these areas. A worst case scenario has been assessed, although the mine plan has been designed to reduce the probability of such an event (as described in Section 9.4), which would involve the rapid collapse of the spanning conglomerate and the creation of a void sized cavity on the surface with approximately 2.5 metre high sheer edges. The potential impacts related to the worst case subsidence scenario may include:

- Topsoil loss or degradation, in areas of surface cracking;
- Exposure of unstable (sodic or saline) topsoils and subsoils, resulting in increased erosion potential;
- Increased potential for surface erosion due to localised changes in topography and surface hydrology; and
- Reduction in potential productivity of the land due to topsoil loss and modification of surface topography and hydrology.

9.11.3.1 Land Capability and Agricultural Suitability Impact Assessment

With appropriate management, the majority of the land within the study area will maintain the pre-mining land capability and agricultural suitability classification.

Provided that environmental controls (particularly relating to potential subsidence management and erosion and sediment controls) are in place and operating effectively during mining, there should be no adverse effects to land classification on the study area or surrounding land.

9.11.4 Consequences of Potential Soil and Land Capability Impacts

Study Area 1

The water management assessment identified that additional erosion and sediment control measures will be required during the construction of the proposed Pollution Control Dam and at the existing quarry location (GHD, 2010a). These recommendations have been included in Section 9.11.5. There were no further potential impacts identified in Study Area 1 during the GSSE review, and as such there are no anticipated consequences from the Project.

Study Area 2 & 3

It is noted that there were no potential impacts related to the maximum predicted subsidence levels and therefore no consequences for the Project. However, any subsidence beyond the predicted levels would be required to be inspected by Centennial staff and a suitably qualified specialist. Appropriate remediation measures (including erosion and sediment controls) would need to be developed once the extent of the impact has been assessed.

9.11.5 Management and Mitigation Measures

The Awaba Colliery identified a number of mitigation strategies that have been implemented to minimise and manage the impact from its operation upon soils and land capability. These include:

- Minimal additional construction activities (area of the PCD expansion only) and surface disturbances; and
- Existing erosion and sediment control structures.

Study Area 1

The following measures apply to lands within Study Area 1 of the Application Area (GHD, 2010a):

- Appropriate erosion and sediment control structures should be established prior to surface disturbance;
- Erosion and sediment controls should be developed in accordance with the recommendations of both *Managing Urban Stormwater: Soils and Construction (Vol 1)* and *Managing Urban Stormwater: Soils and Construction (Vol 2E)*;
- In particular, additional erosion and sediment control measures are required for:
  - The construction of the proposed Pollution Control Dam, which will be developed during the detailed design phase; and
  - The existing quarry, which includes shaping of the base of the quarry to enable the retention of dirty water runoff generated during rainfall events up to the 20 year ARI design event as well as installation of a sediment trap near the existing access track.
- Furthermore, the existing sediment and erosion control measures associated with the quarry are recommended to be monitored monthly to ensure their integrity and performance. Additional monitoring (i.e. weekly) may be undertaken during times when materials are being recovered from the quarry site.

Study Area 2 & 3

The following measures apply to all lands within Study Areas 2 and 3 of the Application Area:

- In the unlikely event of subsidence above the expected 200mm (such as plug failure), all areas affected would be inspected by Centennial staff and an appropriately qualified specialist. The existing Public Safety Management Plan and the Watercourse Management Plan would be referred to in such instances to provide mitigation measures that would be implemented (including remediation strategies); and
- Undertake pre-mining and post-mining inspections along creek lines.

9.11.6 Conclusion

Awaba Colliery has a number of existing and proposed mitigation measures in place in order to manage any potential impacts upon soil. These are considered appropriate for managing the minimal expected surface disturbances and impacts.

9.12 Hazards Management

9.12.1 Hazardous Material Management

"Chemwatch" is an electronic chemical, Material Safety Data Sheets (MSDS), and handling system utilised by the Awaba Colliery to assist in chemical management, and is used as a database of all MSDS's for chemicals brought to the Awaba Colliery. No hazardous material or waste is disposed of on site.

The condition of supply of goods incorporates the supply of MSDS by the product supplier/vendor. This is implemented by means of a condition placed on stores purchase order forms. The MSDS's are managed as per the Colliery Hazardous Substances Management System, with electronic copies available on Chemwatch.

A Hazardous Materials Assessment was completed at the Awaba Colliery in April 2009. This survey was used to locate all material found or assumed to contain asbestos at the Project site. Survey results are outlined in Appendix 3 of the Awaba Colliery Asbestos Management Plan. This plan outlines risk mitigation measures which are implemented at the site including; access restriction to areas containing friable asbestos; an asbestos register; education and awareness training for workers, contractors and others.

The proposed Project will not generate any further hazardous materials. All hazardous materials will be managed as per existing controls.

9.12.2 Spontaneous Combustion

There have been no recent occurrences of spontaneous combustion. A Spontaneous Combustion Management Plan has been prepared and was approved by the Director of Environmental Sustainability Branch of the then Department of Primary Industries in December 2007. A review of the Spontaneous Combustion Management Plan for the 3 North Area was submitted to the Department in 2009.

The proposed Project will access the same coal seam utilising the existing Spontaneous Combustion Management Plan, and spontaneous combustion is not expected to occur.

9.12.3 Bush Fire

The Awaba Colliery manages the potential risk for bush fires in accordance with the existing Bush Fire Management Plan (BMP). All Awaba Colliery surface structures have fire protection equipment installed around them and are compliant with the Coal Mines Health and Safety Act. A designated Fire Officer is in charge of maintaining the fire equipment on the surface and underground areas of the site.

Regular mowing of the lawns surrounding the building structures ensures fire fuel loading is well within acceptable limits.

The proposed Project is unlikely to result in an increased bushfire risk, with all current bushfire management controls, including the existing BMP, to remain in place.

9.12.4 Public Safety

Public safety is identified as a priority management aspect at Awaba Colliery, as detailed within the subsidence risk assessments for the Project area described in Section 7 of this report. In addition to the mine design excluding secondary extraction in areas potentially sensitive to subsidence (i.e. as not to cause 'plug failure' on existing tracks, etc) the Awaba Colliery also has an approved Public Safety Management Plan, which has been developed during previous SMP applications and updated where required. The Public Safety Management Plan summarises controls including:

- Awaba Colliery Pit Top is where practical surrounded by fencing, warning signage (mining area) and is patrolled by security staff on a regular basis;
- Visitor and contractor management systems are in place; and
- If any public safety issue is identified during inspections, actions will be completed as per the Trigger Action Response Plans (TARPs) in the Public Safety Management Plan. If subsidence poses a potential public safety risk warning signs will be erected, subsidence repairs will be completed as soon as practicable and site security will be reviewed.

The proposed Project is unlikely result in an increased public safety risk. Current controls will remain in place, and minimal subsidence is predicted.

9.12.5 Conclusion

The Awaba Colliery is currently implementing a variety of hazards management plans and systems which have been effective in mitigating any potential associated risk at the Awaba Colliery. As the proposed Project will not generate any further hazardous materials and existing infrastructure will be utilised no further mitigation measures are required.

10.0 STATEMENT OF COMMITMENTS

Centennial Newstan is committed to the appropriate identification, mitigation and management of potential risks from the continued operations of Awaba Colliery. In addition to a mine design dedicated to mitigating potential surface impacts from mining (refer Section 7.3), as a well-established operation that has been in place for a number of decades, several key management plans are already well developed and in place to manage and monitor performance of the Awaba Colliery. These include those listed in Table 10.1 below.

Table 10.1: Existing Management Plans for the Awaba Colliery

Title	Objective	Update Required following Project Approval
Awaba Colliery Operations		
Asbestos Management Plan	The Asbestos Management Plan has been developed to provide an overview of the responsibilities regarding asbestos containing material and to identify and assess the risk and management of these materials at Awaba Colliery.	No
Bushfire Management Plan	The objectives of the BMP include the following – • Protection of life and property in and immediately surrounding the Lease area. • Management of combustible fuel levels on the Lease. • Provision of access to the Lease area through a network of roads and trails to facilitate all fire and fuel mitigation works. • Minimisation of the potential for the spread of bushfires into, within and from the lease area. • Prescription of appropriate fire regimes in order to protect and enhance biodiversity of the Lease area. • Suppression of unplanned (wild) fire within the Lease area.	No
Air Quality Management Plan	This plan has been developed to monitor the dust emissions from the site. The plan outlines the air quality control measures and management strategies, and the monitoring system in place at Awaba.	No
Water Management Plan (in draft)	The objective of the water management plan is to detail water management strategies for discharge from site, in terms of volume and quality, to a level that is acceptable for environmental management and community expectations. This plan details the management strategies for the water system including; • Surface Water • Groundwater • Underground (Strata) Water	The Water Management Plan will be updated for the Project in consultation with DECCW and NOW as discussed in **Tables 10.2** and **10.3**
Spontaneous Combustion Management Plan	This plan was originally developed to meet the requirements of the SMP approval for the 3 North Area. Although this plan has been developed the the 3 North Area, the management strategies provided within are still relevant to existing mining operations, and are therefore implemented as such. Additionally, consultation with I&I identified concerns for the potential risk of underground workings being ignited as a result of bushfire. This matter is also addressed in this plan as far as practical.	No

Title	Objective	Update Required following Project Approval
Flora and Fauna Management Plan	The Flora and Fauna Management Plan has been developed to provide an overview of the existing characteristics and ecological values of ecosystems likely to be affected by the proposed mining operations. The management plan presents a number of potential strategies to provide increased security for existing habitats, communities and fauna including procedures for monitoring and maintenance of the various habitats.	No
Mining Operations – Study Area 2 (Main South Stage 2 and Revised Stage 3 Areas)[1]		
Subsidence Management Plan (SMP)	The prime objective of the SMP is to anticipate and monitor (through inspections) the effects of partial extraction within the **Main South Area** so as to prevent potential impacts (in particular to natural surface features, infrastructure and with respect to public safety). Where potential unacceptable effects are identified, the SMP aims to provide measures to mitigate or remediate.	A subsidence management plan (or equivalent) will be required for the East B Area as discussed in **Table 10.3**
Public Safety Management Plan	This plan has been developed to ensure the public safety in any surface areas that may be affected by the operations at Awaba Colliery and to comply with conditions that have been or may be imposed by existing or subsequent Subsidence Management Plan (SMP) approvals.	No
Watercourse Management Plan	The Watercourse Management Plan has been developed to provide guidance on the location of the Mine Plan for the Main South Area such that watercourses within the Area will experience minimal subsidence impact as well as manage the risks to creeks associated with surface subsidence caused by the mining at the Awaba Colliery.	No
Power Line Management Plan	The Powerline Management Plan has been developed to manage the risks to power poles associated with surface subsidence caused by the mining at the Awaba Colliery	No
Roads, Tracks and Trails Management Plan	The Roads Tracks and Trail Management Plan has been developed to manage the risks to roads, tracks and trails associated with surface subsidence caused by the mining at the Awaba Colliery.	No
Telstra Management Plan[2]	The objectives of the Telstra Management Plan in relation to Telstra's plant are to identify risks associated with the existing network within the **Main South Area (Revised Stage 3 Area)** and to provide a simple strategy to monitor this risk.	No

Note 1: A staged approach for SMP approvals was undertaken for the Main South Area, as such, there are specific management plans for both the separate Stage 2 and Revised Stage 3 Areas.

Note 2: The Telstra Management Plan was developed specifically for the Telstra owned infrastructure within the Main South Revised Stage 3 Area only (there is no Telstra infrastructure within the Main South Stage 2 Area).

Notwithstanding the above, the DGRs issued for the Project also require that the EA further includes a *Statement of Commitments* detailing the measures proposed for the environmental mitigation, management and monitoring of the Awaba Colliery. In addition to the above existing plans of management, Tables 10.2 and 10.3 detail the Statement of Commitments for the project that the Awaba Colliery is willing to adopt for implementation throughout the project development phase and through to the end of mine life respectively, should approval be granted under Part 3A of the EP&A Act.

Table 10.2 – Proposed Construction (Pollution Control Dam) – Statement of Commitments

Desired Outcome	Action
1. Pollution Control Dam	
All construction operations associated with the PCD are appropriately undertaken to minimise potential impacts to the environment and potential noise receptors.	1.1 Throughout the construction period of the Project, construction works will be limited to Monday to Friday: 7am to 6pm, Saturday: 8am to 1pm, No work Sundays or public holidays. 1.2 Appropriate erosion and sediment control measures required for construction of the PCD will be installed prior to commencement of disturbance activities, generally in accordance with the guidelines '*Managing Urban Stormwater – Soils and Construction, Volume 2E: Mines and Quarries'* (DECC 2008)..

Table 10.3 – Mining Operations – Statement of Commitments

Desired Outcome	Action
1. General	
All operations are undertaken in a manner that will minimise the environmental impacts associated with the Project.	1.1 Mining at the Awaba Colliery will be undertaken generally in accordance with the description provided in the environmental assessment dated September 2010.
2. Hours of Operation	
All operations are undertaken within the approved operating hours.	2.1 Mining and associated operations may be undertaken 24 hours a day 7 days a week.
3. Groundwater and Surface Water	
All surface water and groundwater managed such that water-related impacts are minimised to the greatest extent practicable.	**Surface Water:** 3.1 Within six months of Project Approval, the existing Water Management Plan will be updated to include erosion and sediment control measures required. 3.2 Within three months of Project Approval, a variation to EPL443 will be sought that incorporates a Pollution Reduction Program (PRP) for water quality monitoring for Awaba Colliery in accordance with ANZECC requirements. **Groundwater:** 3.3 Within six months of Project Approval a groundwater monitoring program for the 10 south bore will be developed in consultation with DECCW, NOW and DoP and continued in accordance with the existing Water Management Plan. 3.4 Any additional groundwater licenses required for the Project will be sought within three months of Project Approval, including 10 South bore. **3.5** Within three months of Project Approval, a variation to the existing Environment Protection License (EPL443) will be sought to include the 10 South bore.
4. Aboriginal Heritage Management	
Ensure that identified and unidentified Aboriginal sites are appropriately managed.	4.1 Within six months of Project Approval, an Aboriginal Cultural Heritage Management Plan (ACHMP) will be incorporated as part of the ongoing management of heritage within Awaba Colliery. The ACHMP will include strategies which address the identified areas of archaeological sensitivity within the Application Area, as well as, contingency strategies for any additional heritage issues which may arise.

Desired Outcome	Action
5. Traffic and Transport Management	
Project-related impacts on transportation and the road network surrounding the Awaba Colliery are limited.	5.1 Signage on Wilton Road approaching the Awaba Colliery will be improved within six months of Project Approval (as shown on **Figure 9.10**) in order to provide advanced warning to traffic of potential turning traffic in consultation with the LMCC.
6. Life of Mine Rehabilitation	
	6.1 All works associated with the decommissioning and rehabilitation of the Awaba Colliery is to be undertaken as prescribed in the approved Life of Mine Plan.
7. Subsidence Management	
Surface subsidence levels managed in accordance with predicted maximum levels	7.1 A 'Subsidence Management Plan', or equivalent document, which takes into account the existing information presented in this Environmental Assessment, will be developed for the proposed East B Area (Study Area 3) in consultation with the Department of Planning prior to expansion in East B Area.
8. European Heritage Management	
Ensure that identified and unidentified Archaeological sites are appropriately managed.	8.1 Prior to the decommissioning of any pit top buildings at the Awaba Colliery, buildings will be subject to a heritage assessment of significance.

11.0 JUSTIFICATION AND CONCLUSION

11.1 Environmental Impacts

As detailed in Section 8, the potential environmental impacts of the Project have been identified and assessed using a risk based process. The key issues identified were the subject of comprehensive specialist assessments, which are appended to this EA.

The potential environmental impacts of the Project have been kept to a minimum through:

- Negligible surface disturbance (the only construction proposed is an expansion to the existing Pollution Control Dam (PCD) which is located in an existing previously disturbed area) (see Section 4);
- A dedicated mine design with a successful and proven history in previously mined areas (including the recent 3 North Area and mined sections of Main South Area Stage 2) to eliminate or minimise potential surface subsidence impacts. This includes the following conservative measures in design (see Sections 4, 8.8);
    - providing for pillar supports to remain in place under surface infrastructure which occurs in Revised Stage 3 Area and the remaining Stage 2 Area (no infrastructure in East B Area);
    - no secondary extraction (buffer zones established) under creeks of 2nd order or higher;
    - providing minimum depths of cover exceeding 20 m (first workings) and 25 m (secondary workings) to avoid potential for surface impacts such as significant cracking or sink holes;
    - specialist subsidence assessment by Seedsman Geotechnics for the proposed mine designs
    - A risk-based approach to subsidence impact assessment and management including specialist environmental studies for key environmental aspects as outlined below.
- Obtaining a detailed understanding of the issues and potential impacts for the Project using a risk-based approach to appropriately identify and assess relevant environmental aspects (see Section 8). The multi-disciplinary assessment and consultation has been to a level of detail commensurate with the scale of the Project, industry standards and the legislative framework under which the Project is permitted;
- Implementation of the existing proactive strategies and management plans employed at the Awaba Colliery to avoid, minimise, mitigate, offset or manage potential impacts, with commitment to update those or develop new plans where required (including development of a dedicated Aboriginal and Cultural Heritage Management Plan for Awaba Colliery) (see Table 11.1 below and Section 10);
- Implementation of the Statement of Commitments (see Section 10).

While the information presented within Section 9 and appended to this EA should be read in its entirety, Table 11.1 provides a very broad overview of the key outcomes of the environmental assessment.

Table 11.1 – Broad Overview of Environmental Assessment Issues

Environmental Issue	Overview of Key Findings
Groundwater	• Awaba Colliery has been operating since 1947. Historical mining has resulted in the depressurisation of the main aquifers (coal seams) and mining experience has verified this, with very minor inflows observed during mining. • There were no predicted potential impacts upon registered groundwater users identified within a seven (7) kilometre radius of the Application Area, as groundwater is unlikely to be sourced from the Great Northern Seam. • Flow rates into the underground workings are not anticipated to substantially increase as a result of the Project. • De-watering of underground workings through the 10 South bore is not expected to pose a significant impact due to the minor contribution by Awaba Colliery to the overall inputs into the receiving Ash Dam.
Surface Water	• The expansion of the existing Pollution Control Dam (PCD) within an existing previously disturbed area will provide an increased capacity to cater for the 10 year, 24 hour design storm event, and reduce the potential for discharges through LDP009. The improved performance of the PCD is expected to further assist in reducing the potential for impact of Awaba Colliery on Stony Creek.
Socio-Economic	• Subject to actual mining conditions and relevant market drivers, the Project will enable operations to continue over a period of approximately five years or more. This will secure on-going employment opportunities and socio-economic flow-on benefits over this time for the local community and up to one hundred (100) staff and contractors. In accordance with the Life of Mine Plan for Awaba Colliery, the existing Stakeholder Engagement Plan will continue to be implemented to maintain consultation and communication with the workforce.
Aboriginal Heritage	• No Aboriginal sites requiring AHIMS registration were identified within the Application Area. • The proposed expansion of the Pollution Control Dam (PCD) lies within an existing previously disturbed area which was not identified as holding any archaeological significance. • There were five areas of archaeological sensitivity identified within Study Areas 2 and 3, requiring additional management (including inspections).
Traffic and Transport	• No additional traffic will be generated by the Project. • Interaction of coal haulage with traffic using public roads will be avoided by the continued use of the existing private haul roads, utilised to transport domestic coal to Newstan Colliery to the north or Eraring Power Station to the South. • Wilton Road and the Awaba Colliery access road intersection has adequate capacity to cope with the existing and projected traffic levels.
Subsidence	• The maximum predicted subsidence in the Application Area is 200 millimetres. This will be a function of the sag of the conglomerate (typically in the order of 10 to 100 millimetres for the panel widths utilised to date observed in adjacent mining areas) and the compression of the pillar system (typically in the order of 50 to 100 millimetres for the panel widths utilised to date observed in adjacent mining areas). • The mine design has conservatively incorporated a hierarchy of risk management controls (including engineering controls, elimination, substitution and administrative/monitoring controls) in order to maintain the overburden integrity and ensure high levels of safety underground and in doing so also protect the surface environment.

Environmental Issue	Overview of Key Findings
	• The unlikely 'worst-case' subsidence outcome would be the result of the spanning Teralba Conglomerate failing, causing a type of 'plug' subsidence (noting that this is not offered as a subsidence prediction and conservatively included as an absolute 'worst case' event). This type of subsidence would result in the formation of vertical faces of around 2.5 metres height at the edge of the extracted panels.
European Heritage	• No currently listed/registered heritage items were identified within the Application Area. • The buildings in the pit top area associated with Awaba State Mine have been identified in a previous heritage study for Lake Macquarie City Council (LMCC) as having local heritage significance in terms of representing extractive industries in the area, but are not currently listed within the current Local Environment Plan for LMCC. There are no proposed changes to historic pit top buildings or infrastructure. • The abandoned Awaba-Wangi rail line was identified as sharing its significance with the Awaba State Mine and the Wangi Power Station as examples of extractive industries within the Lake Macquarie LGA. It was assessed that, if deformation of the remaining components of the rail line occurs as a result of mining, this would not detract from the significance of the item.
Noise	• The results of the noise impact assessment indicate that operational noise levels are predicted to meet the project specific noise criteria established with reference to the DECCW Industrial Noise Policy (INP) at all considered residential locations under all modelled scenarios.
Air Quality	• Modelled predictions indicate acceptable air quality impact at all privately-owned residences throughout the life of the mine.
Greenhouse Gas Emissions	• The results of the greenhouse gas assessment indicate that the total emissions (Scope 1, 2, and 3) attributable to the project would equate to approximately 742,650 t CO_2-e/annum.
Flora and Fauna	• There were no significant impacts identified on vegetation communities, threatened flora and fauna, or to the connectivity of habitats for the Project. • The proposed expansion of the Pollution Control Dam (PCD) lies within an existing previously disturbed area.
Waste Management	• The Project will not generate any new waste materials or additional waste volumes on an annual basis, and all waste streams will continue to be managed in accordance with current waste management strategies successfully employed at the site.
Soil and Land Capability	• The only potential impacts upon soil are related to erosion and sediment control during minor surface disturbance, primarily associated with the expansion of the Pollution Control Dam.
Hazards Management	• Of the hazards assessed (including hazardous materials, asbestos, spontaneous combustion, bushfire and public safety) the proposed Project was not expected to result in an increased environmental or safety risk.

11.2 Project Benefits

The socio-economic assessment in Section 6.3.2 outlines a range of positive benefits that will accompany the Project at a local, regional and state level.

While the Project does not involve any significant change to employment, and only a slight increase in the coal production rate, it has been anticipated that the operations will extend the mine life over a period of approximately five years or more. This will in turn secure employment and associated flow on effects for the life of the project.

Notable benefits include, but are not limited to, the following:

- Continued direct employment (for approximately 100 personnel, including contractors) and indirect employment levels for up to an additional 5 years;
- Direct employment will result in gross annual wages totalling approximately $15.7 million;
- Continued opportunities for local residents in relation to employment, training and lifestyle;
- Continued community participation and support i.e. sporting group sponsorship, assistance to local schools and charities. This also strengthens social networks throughout the LGA and instils a sense of community among residents;
- Injection of approximately $40.5 million per year into the local, regional, state and national economies for the life of the Project. This expenditure is likely to generate additional economic activity and flow on effects, providing further employment opportunities;
- Optimal recovery of available coal resources prior to end of mine life (avoiding sterilisation of remaining resources at the existing mine);
- Provision of competitively priced, high quality coal for domestic and international customers to provide for the energy requirements of the people of NSW and elsewhere;
- Continued additional export income for Australia;
- Improved understanding of heritage significance of historical workings;
- Improved surface water and ground water understanding and management; and
- Provision of a formalised contemporary approval for the well-established mine which pre-dates the Environmental Planning and Assessment Act (EP&A Act), 1979.

11.3 Ecologically sustainable development (ESD)

Ecologically Sustainable Development (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) 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 natural resources. This ensures that ecological processes are maintained facilitating improved quality of life, now and into the future.

Awaba Colliery has shown a commitment to the principles of ESD and understands that social, economic and environmental objectives are interdependent. Awaba Colliery acknowledges that a well designed and effectively managed operation will avoid significant and/or costly environmental impact or degradation. The dedicated mine design and the suite of existing environmental management plans have been developed on a risk-basis to appropriately identify, mitigate and manage environmental risk. These demonstrate environmental due diligence and provide procedures for on-going management and monitoring of the operation in-line with the objectives of ESD.

11.3.1 The Precautionary Principle

The Precautionary Principle, in summary, holds that where there are threats of serious or irreversible environmental damage, the lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

A precautionary and conservative mine design is employed to prevent or minimise potential subsidence impacts to the surface environment and infrastructure, including the following:

- providing for pillar supports to remain in place under surface infrastructure which occurs in Revised Stage 3 Area and the remaining Stage 2 Area (no infrastructure in East B Area);
- no secondary extraction (buffer zones established) under creeks of 2nd order or higher;
- providing minimum depths of cover exceeding 20 m (first workings) and 25 m (secondary workings) to avoid potential for surface impacts such as significant cracking or sink holes;
- specialist subsidence assessment by Seedsman Geotechnics for the proposed mine designs
- A risk-based approach to subsidence impact assessment and management including specialist environmental studies for key environmental aspects as outlined below.

A detailed understanding of the issues and potential impacts associated with the Project has been obtained via consultation and assessment to a level of detail commensurate with the scale of the Project, industry standards and the legislative framework under which the Project is permitted. Specialist assessments, including the use of engineering and scientific modelling, have been undertaken for the design of the mine and for impacts relating to, groundwater, surface water, Aboriginal heritage, traffic and transport, subsidence, European heritage, noise, air quality (including greenhouse gas), and flora and fauna. Assessment has also been undertaken for other issues, including visual amenity, waste management, hazards (including public safety, bushfires and spontaneous combustion) and socio-economic considerations. To this end, there has been careful evaluation undertaken in order to avoid, where possible, serious or irreversible damage to the environment.

11.3.2 Social Equity, Inter-Generational Equity

Intergenerational Equity is centred on the concept 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. There is a moral obligation to ensure that today's economic progress, which will benefit both current and future generations, is not offset by environmental deterioration.

The proposed operations of the long-established Awaba Colliery will extract the last recoverable coal within the Great Northern Seam (this seam only) in Awaba's mining footprint within Consolidated Coal Lease CCL746. However it is unlikely that should current operations cease that the costs of re-establishing a mine for the small remaining reserves in this seam would be pursued at a later date, which would potentially sterilise those remaining resources. The utilisation of the remaining coal within this seam will be outweighed by the social and economic contribution of the continued operations, whilst maintaining minimal environmental impact via the conservative mine design.

The primary objective of the Project is to allow continued operations of the existing Awaba Colliery and maintain continuity of coal production from existing and proposed mining areas, optimising resource recovery for the life of mine in an environmentally and socially responsible manner. The various consultation activities that have been undertaken (see Section 6) and the engagement of suitably qualified and experienced consultants have ensured that the planning, design and environmental assessment phases of the Project have been transparent. The contents of this EA report (including appendices), combined with the consultation

activities, has enabled the Awaba Colliery to understand the potential implications of the Project, and therefore identify the required management strategies, mitigation measures and monitoring activities required to ensure potential for impact is appropriately minimised. It is noted that this includes obligations and requirements under the coal lease (CCL746) for the appropriate rehabilitation of the site at end of mine life which will be undertaken in accordance with the approved Life of Mine Plan.

The management strategies, mitigation measures and monitoring programs discussed in Section 9.4 and listed in Section 10.0 have been identified to minimise adverse impact upon the local environment and the nearby community of Awaba Village. Emphasis has been placed on anticipation and prevention of potential impacts, as opposed to undertaking later remedial action.

These actions and initiatives will assist in ensuring that current and future generations can enjoy equal and equitable access to social, environmental and economic resources through the maintenance of the health, diversity and production of the environment.

11.3.3 Conservation of Biological Diversity and Ecological Integrity

The principle of Conservation of Biological Diversity and Ecological Integrity holds that the conservation of biological diversity and ecological integrity should be a fundamental consideration for development proposals.

The potential environmental impacts of the Project, including upon ecological communities and habitat values, and measures to ameliorate these potential impacts are detailed within this EA. The Awaba Colliery has sought to avoid and minimise potential impacts on ecological values within the Project Site through a dedicated mine design that eliminates or minimises surface subsidence impacts on the surrounding ecology. This also includes buffer zones for exclusion of secondary extraction over 2nd order and higher creeks. A specialist ecological investigation was undertaken for the Project (including identification and assessment of any Endangered Ecological Communities (EEC)), which indicated that there were no significant impacts identified on vegetation communities, threatened flora and fauna, or to the connectivity of habitats (Hunter Eco, 2010).

Notwithstanding this, in accordance with obligations under the EPBC Act (Commonwealth legislation), species identified within the proposed East B Area (areas of new workings) will be referred to the federal Department of Environment, Water, Heritage, and the Arts (DEWHA) for determination.

11.3.4 Improved Valuation and Pricing of Environmental Resources

The principle of Improved Valuation, Pricing and Incentive Mechanisms deems that environmental factors should be included in the valuation of assets and services. The cost associated with using or impacting upon an environmental resource is seen as a cost incurred to protect that resource.

Whilst clear and widely accepted standards have not yet been established for the application of this principle (to date there are few widely accepted methods by which monetary values are attributed to environmental factors), Awaba Colliery acknowledges and accepts the financial costs associated with all the measures required for the mine to avoid, minimise, mitigate and manage potential environmental and social impacts for the Project.

Furthermore, if the additional two million tonnes of coal resources is not recovered by Awaba Colliery as part of the Project, the likelihood of the resource being extracted in the future is considered low. The high cost of re-establishing within the site, compared to the additional coal quantity, would likely result in that resource being isolated and sterilised. Centennial Newstan will optimise the valuation and pricing of the coal resources through continued use of existing infrastructure for the Project (including coal handling and preparation facilitates and existing transportation facilities to extract, process and transport additional coal resources to existing markets).

11.4 Conclusion

Awaba Colliery is a well established underground mine operating for over sixty years, with a well defined surface and mining environment. The mine's long history has provided a very good understanding of mine design requirements for the protection of surface features and appropriate management of potential environmental impacts, provided by a range of existing management plans and a conservative, proven mine design which has been successfully implemented in adjacent mining areas.

Mining operations commenced at the Awaba Colliery in 1947, prior to the commencement of any planning controls, and have continued without abandonment since that time. Consequently, the Awaba Colliery presently operates pursuant to section 109(1) of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) and clause 6B(1) of the *State Environmental Planning Policy (Major Development) 2005*. Key aspects of the Project (as described in Section 4) trigger the requirement for Part 3A approval beyond the current continuing use rights. The proposed Project will not significantly alter the nature of existing operations undertaken at the site, nor will it require significant modification to the existing infrastructure which supports the mining operation. The objectives of the Awaba Colliery Mining Project are to:

- Continue mining operations in the remaining areas of the Main South Area (Stage 2 and Revised Stage 3) and expand mining into the East B Area by undertaking bord and pillar development and pillar extraction within narrow panels using continuous miners. Mining operations will have a focus on:
  - Maximising resource recovery and maintaining continuity of coal production from the existing Awaba Colliery;
  - Maximising the use of existing infrastructure; and
  - Securing on-going employment opportunities and socio-economic flow-on benefits;
- Produce, handle and distribute up to 880,000 tonnes of Run of Mine coal per annum (financial year), using existing surface facilities, for competitive supply to domestic and export markets;
- Expand the existing Pollution Control Dam;
- Continue the delivery of coal to the Newstan Colliery and/or the Eraring Power Station using the existing private haul road/transport facilities; and
- Continue to conduct mining at the Awaba Colliery in an environmental responsible manner to ensure the potential for adverse impact is minimised. This has been demonstrated through the Environmental Assessment and specialist investigations taking into account the principles of Ecologically Sustainable Development.

The Project has been assessed using a risk-based approach to appropriately identify and assess environmental aspects relevant to the Project. The assessment has been multi-disciplinary and also involved consultation with various government agencies, as well as, Aboriginal and community groups. Emphasis has been placed on anticipation and prevention of potential environmental and social impacts, with management strategies, mitigation measures and monitoring activities identified to keep potential impacts to a minimum. This includes the continuation of an established and proven mine design at Awaba Colliery which eliminates or minimises potential impacts to key surface infrastructure and environmental features, including establishing buffer zones excluding secondary extraction from 2nd order and higher creeks and maintaining depths of cover above minimum levels in shallow areas.

The socio-economic output of the Project, particularly in terms of direct and indirect employment and flow-on benefits, is anticipated to make a positive contribution to Lake Macquarie LGA and the surrounding region, and as a *continuing* operation with minimal changes, the Project will not significantly influence social and community infrastructure requirements.

Accordingly, it is considered that the Project will meet environmental performance and socio-economic benefit requirements in order for the Project to be considered for approval.

12.0 REFERENCES

Australasian Groundwater & Environmental Consultants Pty Ltd. May 2008. *"Definition of Limit of the Stoney Creek Alluvium, Awaba Colliery".*

Centennial Awaba Pty Ltd, November 2008. *"Life of Mine Plan", as approved by I&I June 2009.*

Centennial Coal Pty Ltd, January 2010, *"Part 3A Broad Brush RA: General Introduction to Workshop Participants Presentation – by Roger Davis, Mine Manager".*

Centennial Coal Pty Ltd, February 2010. *"Stakeholder Engagement Plan, Awaba".*

Centennial Newstan Pty Ltd, March 2008*. "Stoney Creek Proposed Riparian Monitoring Transects."* (figure)

GSS Environmental, November 2008. "Awaba Colliery SMP Environmental Risk Assessment Workshop Presentation".

GSS Environmental, April 2009. *"Centennial Coal, Preliminary Environmental Assessment – Olstan Project".*

GSS Environmental, November 2008. *"SMP -3 North Risk Assessment Document, Awaba Colliery."*

GSS Environmental, December 2008. *"Awaba Colliery, Subsidence Management Plan Application – 3 North Area"*

GSS Environmental, December 2009. *"Awaba Colliery, Revised Stage 3 SMP Area - Subsidence Management Plan Application (including supporting specialist reports)".*

GSS Environmental, February 2010. *"Part 3A Broad Brush (Environmental) Risk Assessment Report, Awaba Colliery";*

GSS Environmental Pty Ltd, *February 2010 "Proposed East B Area – Risk Assessment for Mine Subsidence Impact and Management";*

Hansen Bailey, April 2007. *"Newstan Colliery Modifications to Development Consent".*

Hansen Bailey, March 2007*. "Mannering Colliery Continuation of Mining – Environmental Assessment".*

Hansen Consulting. March 2007. *"Mannering Colliery, Environmental Assessment – Appendix E – Stakeholder Consultation".*

Harper Somers O'Sullivan Pty Ltd, Australia. November 2008. *"SMP Archaeological Assessment & Revised Predictive Moderl for 3 North Area, Awaba East."*

HunterEco, 2009, "*Awaba East Stage 3 SMP: Ecology Assessment*".

HunterEco, November 2008, *"Awaba Underground Mine 3-North Outbye Project SMP – Ecology Assessment".*

HWR Pty Ltd, August 2007, "Flora and Fauna Assessment of Proposed Subsidence Monitoring Lines for Main South Area of Awaba Colliery".

HWR Pty Ltd, 2009, *"Ecological Monitoring of Riparian Vegetation Along Stony Creek at Awaba – 2009 Survey".*

HWR Pty Ltd, *2008, "Baseline Ecological Description of Riparian Vegetation Along Stony Creek at Awaba".*

Murphy C.L, 1993, *Soil Landscapes of the Gosford-Lake Macquarie 1:100 000 Sheet Report*, Department of Conservation and Land Management.

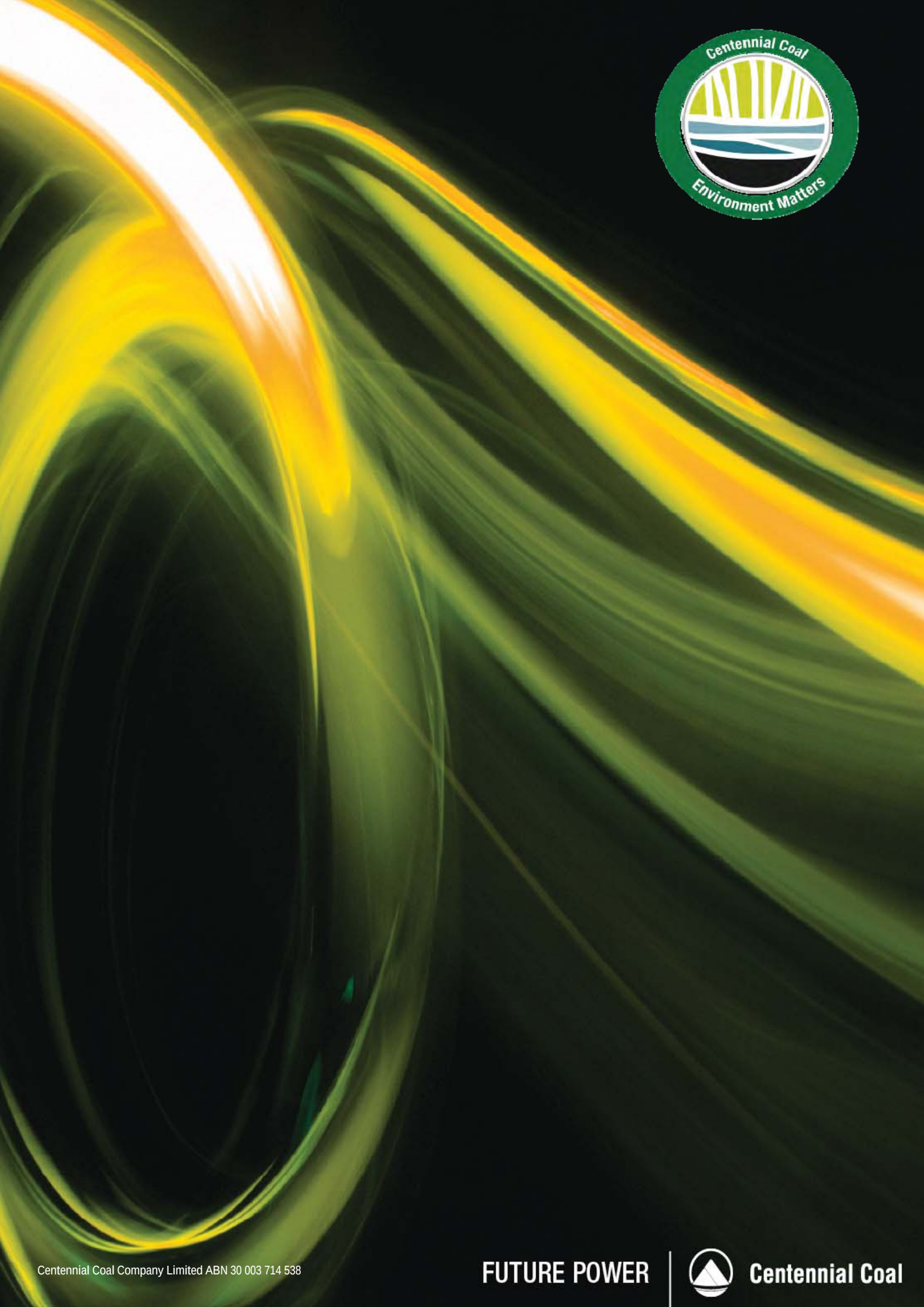
NSW Department of Planning, 2008. *Impacts of underground coal mining on natural features in the Southern Coalfield: strategic review.*

Seedsman Geotechnics Pty Ltd, November 2008, *"Extraction in 3 North Area – Subsidence".*

Seedsman Geotechnics Pty Ltd, November 2008, *"Audit Against SMP Guidelines (3 North Area)".*

Strata Engineering (Australia) Pty Ltd, 2005. *Long-Term Pillar Stability Assessment with Regard to Potential Secondary Extraction Opportunities*.

Umwelt, 1998, *Newstan Life Extension Area (LEA) Environmental Impact Statement (EIS)*.



Centennial Coal Company Limited ABN 30 003 714 538

FUTURE POWER | Centennial Coal