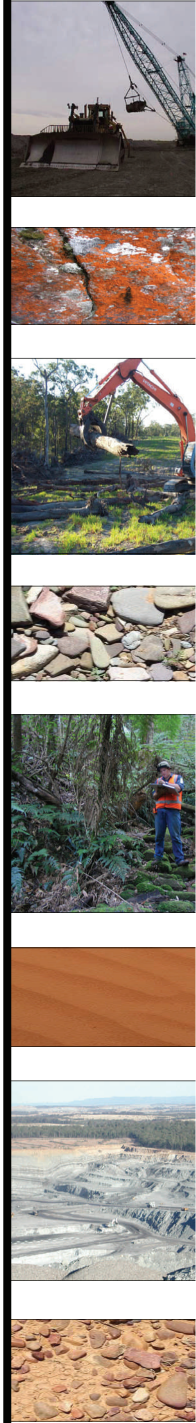
CENTENNIAL ENVIRONMENTAL POLICY



APPENDIX 1

Centennial Coal

Environment and Community Policy

Our Vision

To conduct our business in an efficient and environmentally responsible manner, that is compatible with the expectations of our shareholders, government, employees and the community.

Beliefs

Everyone has a responsibility for minimising impact to the environment

Environmental performance can always be improved

Respecting our stakeholders is essential to business success

Guiding Principles

P1 Appropriate decisions are made

P2 Risk management strategies are implemented based on clear science and valid data

P3 Stakeholders are identified and respected

P4 Environmental impacts are recognised and minimised

P5 Legal obligations are known and respected

P6 Environmental management is integrated into our business

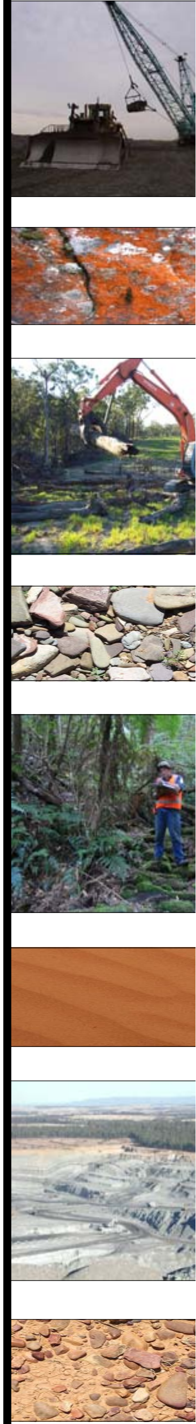
P7 Environmental performance is continually improved

P8 Natural resources are used efficiently

P9 Performance is assessed and reported

Catherine Brenner Director	Bob Cameron Managing Director	Ken Moss Chairman	Paul Moy Director
Richard Grellman Director	Bruce Allen Director	General Manager	Mine Manager

18 August 2009



CONSULTATION

INCLUDING:

AWABA COLLIERY PROJECT NEWSLETTER
LAKES MAIL – PEA ADVERTISEMENT
ENERGY AUSTRALIA LETTER
TELSTRA LETTER
DoP DIRECTOR-GENERAL'S REQUIREMENTS
HCRCMA DGR COMMENT
DECCW DGR COMMENT
NOW DGR COMMENT
I&I DGR COMMENT
LMCC DGR COMMENT
RTA DGR COMMENT

APPENDIX 2

AWABA COLLIERY

MINE LIFE CONTINUATION PROJECT

THE PROJECT

Awaba Colliery (Awaba) is a 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.

An application for a Part 3A Project Approval has been lodged by Centennial for the Awaba Colliery Continuation of Mining Project (the "Project"), which will seek approval from the Minister for Planning to allow ongoing underground mining and associated surface operations.

Whilst it is well known that Awaba has almost reached the end of its coal reserves and has been slated for closure, a development approval under Part 3A of the NSW EP&A Act (1979) is required. A renewal of the current planning consent will ensure Awaba is in a position to finalise its operations at the site in the most productive and effective manner.

With a history in the local area spanning over 75 years, Awaba is a small operation, with approximately 100 employees, producing approximately 850,000 tonnes of thermal coal annually.

ABOUT CENTENNIAL

Centennial is an Australian owned and operated coal mining and marketing company listed on the Australian stock exchange in 1994. Centennial supplies thermal coal to domestic and export markets.

As the major fuel supplier to the New South Wales energy industry, Centennial helps fuel approximately 46% of the State's coal-fired electricity.

Centennial is the largest underground coal producer in NSW, and has a workforce of 1,700 people with over 800 employees at the four Lake Macquarie operations (Mandalong, Mannering, Myuna and Awaba).

Centennial Coal

COMMUNITY SUPPORT

Centennial Coal supports activities, events and organisations in the communities where we operate.

Awaba recently worked with the local Awaba Public School to install a rainwater tank, construct a fenced in vegetable garden and establish a compost bin.

The school has planted tomatoes, corn, cucumbers, herbs, chillies and spinach. While they have become experts at growing herbs, they are still working toward a successful vegetable patch. The garden is used to teach the students the natural process of how plants grow, while the fruits of their labour are used in class to learn the benefits of eating healthy foods.

The compost bin is a practical tool teaching recycling and waste reduction with food scraps now being composted rather than being thrown in the rubbish. The installation of a water tank which collects rainwater from one of the buildings is being used in the garden rather than going to storm water.

Awaba Public School has 31 students who now have a school garden to learn the value of healthy food and recycling waste and water.

This project has given Awaba the opportunity to actively engage with the local school to deliver practical and tangible educational outcomes.

Awaba Public School's little green thumbs looking after their veggie gardens

For further information on this project please contact:

Jeff Dunwoodie
Environment and Community Co-ordinator
(02) 4956 0206

For information on Centennial Coal visit: **www.centennialcoal.com.au**

APPROVAL PROCESS

On the 4th of March 2010, Awaba submitted a Preliminary Environmental Assessment (PEA) to the Department of Planning seeking a continuation of mining and approval from the Minister of Planning under the provisions of Part 3A of the EP&A Act to:

- Undertake bord and pillar development and pillar extraction within the narrow panels by continuous miners within the proposed East B Area
- Produce approximately 880,000 tonnes of Run of Mine coal per annum (financial year)
- Expand the final pollution control dam

An Environmental Assessment (EA) is being prepared to support this application. The EA is being prepared by GSS Environmental and will include detailed environmental impact assessments from relevant specialists on surface and groundwater, air quality, traffic generation, subsidence, ecology, archaeology and heritage.

Detailed and conservative mine planning considerations have been undertaken in the preparation of mine designs including:

- Providing for pillar supports to remain in place under surface infrastructure
- No secondary extraction under creeks of 2nd order or higher
- Providing minimum depths of cover exceeding 20m (first workings) and 25m (secondary workings) to avoid potential for surface impacts
- Specialist subsidence assessment
- A risk-based approach to subsidence impact assessment and management

The PEA will be made available on the Department of Planning's website. The flow chart below provides a summary of the process.

Prepare community consultation strategy

Proponent lodges a project application
Commence community consultation

We are here

Director-General provides requirements to be addressed in an environmental assessment of the proposal

Preparation and submission of an environmental assessment

Public exhibition of environmental assessment

Review of environmental assessment and submissions

Minister decides to approve or disapprove the project

CONSULTATION

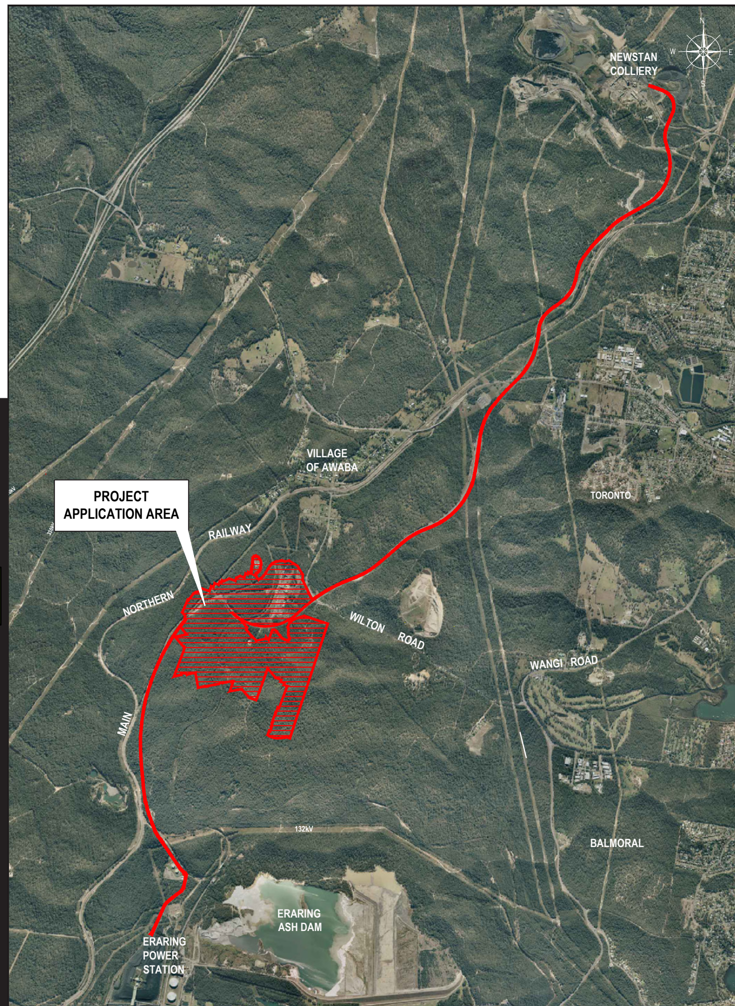
Centennial is committed to establishing and maintaining open and two-way communication with neighbours and stakeholders. There will be opportunities for the community to provide input into the Environmental Assessment (EA) process.

These opportunities include:

- Individual meetings with adjacent neighbours as required;
- 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.

A primary purpose of the community consultation is to provide the local community with an opportunity to comment on the proposal, so that Awaba can consider community opinions in the planning and assessment process.

LOCATION



CONTACT

For further information on this project further please contact:

Jeff Dunwoodie
Environment and Community Co-ordinator
(02) 4956 0206

Public Notice

Notice of Application for Project Approval under Part 3A of the Environmental Planning & Assessment Act 1979

by

Centennial Coal Company Limited

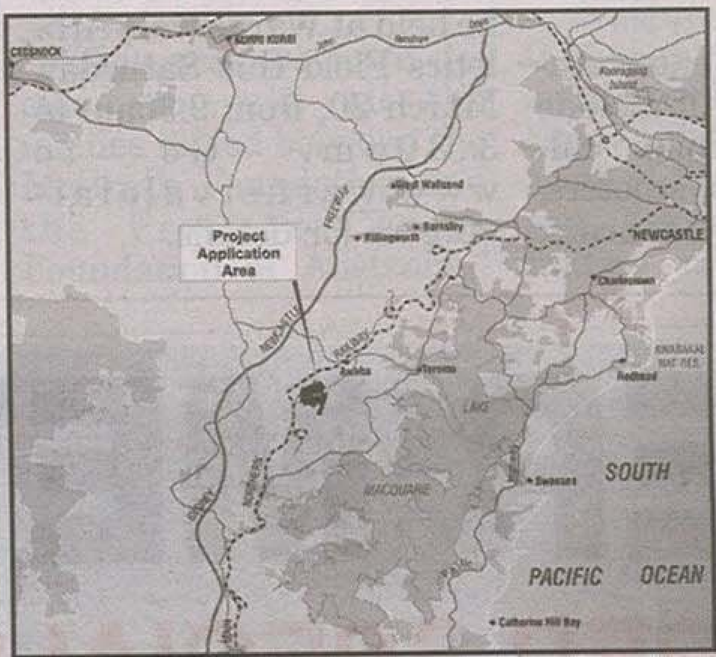
ABN 30003714538

for the Awaba Colliery Continuation of Mining Project

Centennial Coal Company Limited ("Centennial") has made an application for Project Approval under Part 3A of the Environmental Planning & Assessment Act 1979 (EP&A Act) to the Minister for Planning for the Awaba Colliery Continuation of Mining Project ("The Project").

Pursuant to clause 8F(3) of the EP&A Regulation 2000, Centennial hereby notifies that the Application has been made.

Site Description: The site of the proposed Project is located approximately one kilometre south of the Awaba township and five kilometers west of Toronto within the Lake Macquarie LGA.



Project Description: Awaba Colliery Continuation of Mining Project Environmental Assessment

The Project comprises the following elements:

- Undertaking bord and pillar development and pillar extraction within narrow panels by continuous miners within the East B Area
- Produce approximately 880,000 tonnes of run of mine coal per financial year
- Expand the final pollution control dam
- Include current mining and surface operations within the Part 3A approval

The Application for the Project may be inspected via:

1. the DoP website www.planning.nsw.gov.au; or
2. the Centennial Coal website www.centennialcoal.com.au
3. by contacting Awaba Colliery

The Project will be subject to an Environmental Assessment (EA) and public consultation requirements under Division 2, Part 3A of the EP&A Act.

Contact Details: Mary-Anne Crawford
Group Environment Manager
0400 403 550

7495-T41

Awaba Colliery

28 April 2010

BY MAIL

Mr David Eccles
Manager, Overhead Mains
Design Engineering Branch,
ET&T Division
Energy Australia
PO Box 1000
Toronto NSW, 2283

Dear David,

Re: Awaba Colliery Continuation of Mining Project

Background

Awaba Colliery is a small underground coal mine operated by Centennial Newstan Pty Limited ('Centennial'), a wholly owned subsidiary of Centennial Coal Company Limited. The mine is located within the Newcastle Coalfield, south of the Awaba village on the western side of Lake Macquarie.

Awaba Colliery is seeking a project approval from the Minister of Planning under the provisions of Part 3A of the Environmental Planning and Assessment Act 1979 for continued operations at the mine, and specifically to:

- Undertake bord and pillar development and pillar extraction within the proposed East B Area (note – there are **no** items of major infrastructure within this area, being predominantly bushland),
- Produce approximately 880,000 tonnes of run of mine coal per annum, and
- Expand the final pollution control dam located within the pit top area.

In addition, Awaba Colliery proposes to include its current mining and surface operations within the Part 3A approval.

Awaba Colliery has prepared and lodged a Project Application and a Preliminary Environmental Assessment (PEA) to the NSW Department of Planning. To support the application, Awaba Colliery is currently undertaking environmental investigations to support a complete Environmental Assessment (EA).

The Project Application Area and subsequent Study Areas are illustrated on the enclosed figures.

Stakeholder Consultation Process

In accordance with best practice, Centennial will be undertaking a comprehensive stakeholder engagement process for the EA. A Stakeholder Engagement Plan has been established for the project which will actively seek to identify and engage stakeholders for consultation regarding the project. This is done via correspondence to particular groups and generic media advertising including:

- Letters
- Newsletters
- Face to face meetings (including toolbox talks for employees)
- Local newspapers (Lakes Mail): and
- Centennial Coal website.

As you are aware, Centennial recently consulted with your organisation in late 2009 regarding a separate Subsidence Management Application under the NSW Mining Act (1992) to the Department of Industry & Investment (formerly DPI-MR) regarding an existing mining area known as Main South Area – Revised Stage 3 Area (illustrated on the enclosed figures), for which Centennial is currently awaiting approval . As mentioned earlier above, *existing* mining areas (including all remaining mining in the Main South Area) will be included in the project application for continued operations of Awaba Colliery. Accordingly, whilst there are no items of major infrastructure in the new mining area (and consultation was undertaken for all other existing mining areas where infrastructure does occur), as a previously registered stakeholder, Centennial is prudently writing to your organisation to inform you of the project and invite registration of any interest for further consultation for the EA or to confirm if existing consultation to date has been sufficient.

Centennial is seeking interested stakeholders to register their interest in the project by notifying the undersigned by Friday 14th May 2010;

Jeffrey Dunwoodie
Environment and Community Coordinator
Phone: (02) 4956 0206
Email: Jeffrey.Dunwoodie@centennialcoal.com.au

The following information has been provided to support this notification:

Attachment 1 – Map detailing the Awaba Colliery Continuation of Mining Project Application boundary (for consultation purposes during the Project)

Attachment 2 – Map showing project application study areas

Attachment 3 – Map showing detailed project application study areas

Yours sincerely

Grant Watson
Mine Manager, Awaba Colliery

Awaba Colliery

28 April 2010

BY MAIL

Mr Mark Schneider

Telstra Network Integrity Services

Level 9, 18 Smith St

Parramatta NSW, 2150

Dear Mark,

Re: Awaba Colliery Continuation of Mining Project

Background

Awaba Colliery is a small underground coal mine operated by Centennial Newstan Pty Limited ('Centennial'), a wholly owned subsidiary of Centennial Coal Company Limited. The mine is located within the Newcastle Coalfield, south of the Awaba village on the western side of Lake Macquarie.

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Jeffrey Dunwoodie
Environment and Community Coordinator
Phone: (02) 4956 0206
Email: Jeffrey.Dunwoodie@centennialcoal.com.au

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Attachment 3 – Map showing detailed project application study areas

Yours sincerely

Grant Watson
Mine Manager, Awaba Colliery

NSW GOVERNMENT | Planning

Major Projects Assessment
Mining & Industry Projects
Phone: 02 9228 6587
Fax: 02 9228 6466
Email: paul.freeman@planning.nsw.gov.au

Our Ref: 10/06672

Mr Steve Bracken
General Manager – Northern Operations
Centennial Newstan Pty Limited
242 Wilton Road
AWABA NSW 2283

Dear Mr Bracken,

Awaba Coal Project (10_0038)
Director-General's Requirements

The Department has received your application for the Awaba Coal Project.

The Director-General's requirements for the project are attached. These requirements have been prepared in consultation with relevant agencies, based on the information you have provided to date. I have also attached a copy of the agencies' comments for your information.

Please note that the Director-General may alter these requirements at any time.

If your proposal is likely to have a significant impact on matters of National Environmental Significance, it will require an approval under the Commonwealth *Environment Protection Biodiversity Conservation Act 1999* (EPBC Act). This approval is in addition to any approvals required under NSW legislation. It is your responsibility to contact the Department of Environment, Water, Heritage and the Arts in Canberra (6274 1111 or http://www.environment.gov.au) to determine if the proposal requires an approval under the EPBC Act. If it is subsequently determined that an approval is required under the EPBC Act, please contact the Department of Planning immediately as supplementary Director-General's requirements may need to be issued.

I would appreciate it if you would contact the Department at least two weeks before you propose to submit your EA for the project. This will enable the Department to:

- confirm the applicable fee (see Division 1A, Part 15 of the *Environmental Planning and Assessment Regulation 2000*); and
- determine the number of copies (hard-copy and CD-ROM) of the Environmental Assessment (EA) that will be required for exhibition purposes.

Once it receives the EA, the Department will review it in consultation with the relevant agencies to determine if it adequately addresses the Director-General's requirements, and may require you to revise it prior to public exhibition.

The Department is required to make all the relevant information associated with the project publicly available on its website. Consequently, I would appreciate it if you would ensure that all the documents you subsequently submit to the Department are in a suitable format for the web, and arrange for an electronic version of the EA to be hosted on a suitable website.

If you have any enquiries about these requirements, please contact Paul Freeman.

Yours sincerely

DKitto 22/4/10

David Kitto
Director
Mining & Industry Projects
As delegate for the Director-General

Director-General's Requirements

Section 75F of the *Environmental Planning and Assessment Act 1979*

Application Number	10_0038
Project	The Awaba Coal Project, including: • extending the life of the Awaba Colliery until 2015; • extracting coal from existing approved mining areas, extending the Stage 3 mining area and developing the East B mining area to produce up to a total of 880,000 tonnes of run-of-mine coal per annum; • continued coal delivery to the Eraring Power Station and Newstan Colliery; • continued use of the mine's surface infrastructure, including processing and transport systems; • expanding the mine's existing pollution control dam; and • rehabilitating the site.
Location	1.5 kilometres south of Awaba, in the Lake Macquarie City LGA
Proponent	Centennial Awaba Pty Limited
Date of Issue	22 April 2010
General Requirements	The Environmental Assessment of the project must include: • an executive summary; • a detailed description of the project, including: – need for the project; – 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; • 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, <u>using sufficient baseline data</u>; – 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 – 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; • 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 • a signed statement from the author of the Environmental Assessment, certifying that the information contained within the document is neither false nor misleading.
Key Issues	• **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; – 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 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: o the quality and quantity of existing surface water and groundwater resources; o groundwater dependent ecosystems; o affected licensed water users and basic landholder rights; and o 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. • **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. • **Noise & Vibration –** including a quantitative assessment of potential operational and transport noise impacts. • **Air Quality** – including a quantitative assessment of potential air quality impacts. • **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. • **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. • **Heritage** – both Aboriginal and non-Aboriginal; • **Greenhouse Gases** – including:

	– a quantitative assessment of the potential scope 1, 2 and 3 greenhouse gas emissions of the project; – 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. • **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. • **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.
References	The environmental assessment of the key issues listed above must take into account relevant guidelines, policies, and plans. While not exhaustive, the following attachment contains a list of some of the guidelines, policies, and plans that may be relevant to the environmental assessment of this project.
Consultation	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.
Deemed Refusal Period	90 days

Policies, Guidelines & Plans

Risk Assessment	
	AS/NZS 4360:2004 Risk Management (Standards Australia)
	HB 203: 203:2006 Environmental Risk Management – Principles & Process (Standards Australia)
Soil & Water	
Soil	Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites (ANZECC)
	Rural Land Capability Mapping (DLWC)
	Agricultural Land Classification (DPI)
Surface Water	National Water Quality Management Strategy: Australian Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ)
	National Water Quality Management Strategy: Australian Guidelines for Water Quality Monitoring and Reporting (ANZECC/ARMCANZ)
	National Water Quality Management Strategy: Guidelines for Sewerage Systems – Effluent Management (ARMCANZ/ANZECC)
	National Water Quality Management Strategy: Guidelines for Sewerage Systems – Use of Reclaimed Water (ARMCANZ/ANZECC)
	Using the ANZECC Guideline and Water Quality Objectives in NSW (DEC)
	State Water Management Outcomes Plan
	NSW Government Water Quality and River Flow Objectives (DECC)
	Approved Methods for the Sampling and Analysis of Water Pollutants in NSW (DEC)
	Hunter-Central Rivers Catchment Action Plan (Hunter-Central Rivers CMA)
	Managing Urban Stormwater: Soils & Construction (Landcom)
	Managing Urban Stormwater: Treatment Techniques (DECC)
	Managing Urban Stormwater: Source Control (DECC)
	A Rehabilitation Manual for Australian Streams (LWRRDC and CRCCH)
	Technical Guidelines: Bunding & Spill Management (DECC)
	Environmental Guidelines: Use of Effluent by Irrigation (DECC)
Groundwater	National Water Quality Management Strategy Guidelines for Groundwater Protection in Australia (ARMCANZ/ANZECC)
	NSW State Groundwater Policy Framework Document (DLWC, 1997)
	NSW State Groundwater Quality Protection Policy (DLWC, 1998)
	NSW State Groundwater Quantity Management Policy (DLWC, 1998)
	Guidelines for the Assessment & Management of Groundwater Contamination (DECC, 2007)
	Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009
Biodiversity	
	Draft Guidelines for Threatened Species Assessment under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act) (DEC)
	NSW State Groundwater Dependent Ecosystem Policy (DLWC)
	Policy & Guidelines - Aquatic Habitat Management and Fish Conservation (NSW Fisheries)
	Policy & Guidelines - Fish Friendly Waterway Crossings (NSW Fisheries)
	State Environmental Planning Policy No. 44 – Koala Habitat Protection
Noise & Vibration	
	NSW Industrial Noise Policy (DECC)
	Environmental Noise Management – Assessing Vibration: a technical guide (DEC)

	Environmental Criteria for Road Traffic Noise (NSW EPA)
	Interim Construction Noise Guideline (DECC)
	DIN 4150 Part 3 - Structural Vibration: effects of vibration on structures (ISO, 1999)
Air Quality	
	Protection of the Environment Operations (Clean Air) Regulation 2002
	Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (DEC)
	Approved Methods for the Sampling and Analysis of Air Pollutants in NSW (DEC)
Rehabilitation & Mine Closure	
	Mine Rehabilitation – Leading Practice Sustainable Development Program for the Mining Industry (Commonwealth of Australia)
	Mine Closure and Completion – Leading Practice Sustainable Development Program for the Mining Industry (Commonwealth of Australia)
	Strategic Framework for Mine Closure (ANZMEC-MCA)
Traffic & Transport	
	Guide to Traffic Generating Development (RTA)
Heritage	
Aboriginal	Draft Guidelines for Aboriginal Cultural Heritage Assessment and Community Consultation (DoP and DEC)
Non-Aboriginal	NSW Heritage Manual (NSW Heritage Office)
	The Burra Charter (The Australia ICOMOS charter for places of cultural significance)
Greenhouse Gases	
	National Greenhouse Accounts Factors (Australian Department of Climate Change (DCC))
	Guidelines for Energy Savings Action Plans (DEUS)
Hazards	
	State Environmental Planning Policy No. 33 – Hazardous and Offensive Development
	Applying SEPP 33 – Hazardous and Offensive Development Application Guidelines (DUAP)
	Hazardous Industry Planning Advisory Paper No. 6 – Guidelines for Hazard Analysis
Waste	
	Waste Classification Guidelines (DECC)
Social & Economic	
	Draft Economic Evaluation in Environmental Impact Assessment (DoP)
	Techniques for Effective Social Impact Assessment: A Practical Guide (Office of Social Policy, NSW Government Social Policy Directorate)

Hunter-Central Rivers
CMA CATCHMENT MANAGEMENT AUTHORITY

Contact: Anna Ferguson
Phone: 4337 1213
Fax: 4323 3960
Email: anna.ferguson@cma.nsw.gov.au

File: DGEARs Awaba Coal Project.doc

Howard Reed
Mining Projects
Department of Planning
GPO Box 39
SYDNEY NSW 2001

PCU003970

Your Ref: S04/01377
Our Ref: A351991

Dear Mr Reed

Subject: Request for provision of details of key issues and assessment requirements – Awaba Coal Project.

I refer to your request seeking endorsement or addition to the Director-General requirements for the full Environmental Assessment for the above project, under Part 3A of the *Environmental Planning and Assessment Act, 1979* (EP&A Act). The Hunter-Central Rivers Catchment Management Authority (CMA) has reviewed the preliminary environmental assessment and provides the following comments for consideration.

Biodiversity
Whilst it is acknowledged that there is not likely to be any significant impacts to native vegetation or fauna, the second point under "Biodiversity" could be expanded to read;
-' a detailed description of the measures that would be implemented to avoid or mitigate impacts on biodiversity, including a strategy to ensure that the project will maintain or improve the biodiversity conservation value of the region.'

Cultural Heritage
This section of the draft DGRs does not give a lot of detail. It is suggested that an assessment of cultural heritage be required including the potential impacts and avoidance and mitigation measures.

References
It is recommended that the Hunter-Central Rivers Catchment Action Plan (CAP) be included in the list of references. The CAP is a whole-of government approach to natural resource management which has been endorsed by the NSW Government. It is a regional plan that provides a roadmap to ensure that natural resources are protected and enhanced for the enjoyment and viability of future generations.

The CAP includes management targets and guiding principles. The guiding principles are statements that outline how natural resources should be managed in the Hunter-Central Rivers region. They provide direction for all natural resource managers to achieve ecologically sustainable development and allow organisations to align their activities so that they are compatible with the CAP. This will ensure that the whole community (including government) can work towards a common goal.

The CAP is available at http://www.hcr.cma.nsw.gov.au and can be referenced as

"Hunter-Central Rivers Catchment Action Plan, (2007), Hunter-Central Rivers Catchment Management Authority, Paterson."

The most relevant section of the CAP for this project the mining and extractive industries guiding principles (see page 68). The following is a list of those guiding principles with particular relevance to this proposal. These appear to be covered by the draft DGRs, and are included here for your information.

1. Every precaution should be taken to ensure that surface water flows are not lost or diverted due to subsidence or geological cracking caused by extraction. Where surface water is lost or diverted, offsets or mitigating actions should be provided.
2. A water management plan should be completed and approved before the commencement of mining operations. This plan should apply to the full lifespan of the mine including after closure. The plan would show how mining will be conducted so that water resources are managed sustainably. Development and approval of the water management plan should be open and transparent.
3. Monitoring should occur throughout the life of the project (planning, operation, and post closure). Environmental monitoring procedures should be open and transparent and reporting to the relevant stakeholders should be part of any extraction activity. Water management audits should be regularly undertaken and results made available to the community.
4. Rehabilitation of sites should occur progressively and before environmental degradation of temporary landforms develop, particularly with regard to stability and ability to intercept water (runoff and ground water) which can potentially impact on the volumes of salt transferred from sites to surface and ground water.
5. Current best practice of mine rehabilitation should ensure that land affected by mining is progressively returned to at least its former productive condition so that it can support appropriate vegetation cover. An appropriate balance of agricultural landuse, a healthy native vegetation community structure or a sustainable ecosystem that is consistent with pre-European historical vegetation in the area should be achieved.
6. Landscape plans (e.g. mine synoptic plans) should be used to guide rehabilitation of the biodiversity values and ecosystem services that can be provided by former mine sites.
7. Mining should be undertaken so as to minimise the destruction of culture and heritage sites and impacts on culturally significant landscapes.
8. Off-site impacts of the mining proposal should be considered in the environmental assessment and approval process.
9. Cumulative impact of mining should be considered during the approval processes.

If you require any further information please do not hesitate to contact Anna Ferguson, the CMA's Regional Catchment Coordinator on 4337 1213.

Yours faithfully

David Green
for Fiona Marshall
General Manager
26 March 2010

NSW GOVERNMENT | Environment, Climate Change & Water

Our reference: DOC09/52184; LIC09/28; Part 3A
Contact: Peter Hughes (02) 4908 6819

Mr Howard Reed
Manager – Mining Projects
NSW Department of Planning
GPO Box 39
SYDNEY NSW 2000

Attention: Mr Paul Freeman

Dear Mr Reed

**Proposed Awaba Coal Project (10_0038) –
Director General's Environmental Assessment Requirements**

Reference is made to the above proposal, and the request for the Department of Environment, Climate Change and Water's (DECCWs) Director-General's Environmental Assessment Requirements (DG EAR's) for preparation of the Environmental Assessment (EA).

DECCW has considered the details of the proposal as provided in the Preliminary Environmental Assessment and identified the information it requires to assess the proposal in Attachment A. The proponent should ensure that the EA is sufficiently comprehensive and detailed to allow DECCW to determine the extent of the impacts of the proposal. In particular, the requirements of Section 45 of the *Protection of the Environment Operations Act 1997* (POEO Act) must be addressed.

In summary, DECCW's key information requirements for the project are:

- the impacts on water quality;
- the impacts on quantity in water resources;
- subsidence impacts; and
- the impacts on threatened species and their habitat;

In carrying out the assessment the applicant should refer to the relevant guidelines in Attachment B and also any industry codes of practice and best environmental management practice guidelines. The proponent should be aware that any commitments made in the EA may be formalised as licence or approval conditions. Consequently, pollution control or conservation measures should not be proposed if they are impractical, unrealistic or beyond the financial viability of the development. It is important that all conclusions are supported by adequate data.

DECCW requests that the applicant provide three hard copies of the EA for review. These documents should be lodged with the Regional Manager – Hunter, Department of Environment, Climate Change and Water, PO Box 488G, Newcastle NSW 2300.

If you require any further information regarding this matter please contact Peter Hughes on (02) 4908 6819.

Yours sincerely

P. Jamieson 6-4-10

PETER JAMIESON
Head Regional Operations Unit Coastal
Environment Protection and Regulation

Encl: Attachment "A" – DECCW's Director-General Requirements; and
Attachment "B" – Guidance Material.

ATTACHMENT A - DECCW'S DIRECTOR-GENERAL REQUIREMENTS

Environmental Impacts of the Project

DECCW requires the following information to determine the extent of environmental impacts of the proposal. Impacts should be assessed in accordance with the relevant legislative requirements and guidelines listed in Attachment B.

1. The Proposal

The objectives of the proposal should be clearly stated and refer to:

- the size and type of the operation;
- the anticipated level of performance in meeting required environmental standards and cleaner production principles;
- the staging and timing of the proposal; and
- the proposal's relationship to any other industry or facility.

2. The Premises

The EA will need to fully identify all of the processes and activities intended for the site over the life of the development. This will include details of:

- The location of the proposed facility and details of the surrounding environment;
- The proposed layout of the site;
- Appropriate land use zoning;
- Ownership details of any residence and/or land likely to be affected by the proposed facility;
- Maps/diagrams showing the location of residences and properties likely to be affected and other industrial developments, conservation areas, wetlands, etc in the locality that may be affected by the facility;
- All equipment proposed for use at the site;
- Chemicals, including fuel, used on the site and proposed methods for their transportation, storage, use and emergency management;
- Waste generation and disposal;
- Methods to mitigate any expected environmental impacts of the development;
- Site rehabilitation following termination of the development.

3. Subsidence

The EA needs to assess and describe the predicted impacts of underground mining in detail. Particular emphasis should be given to sensitive areas such as Crown Lands, waterways, wetlands, threatened species and endangered ecological communities. The subsidence assessment should include, but be limited to, the following:

a. Review and assessment of the historical environmental impacts of subsidence from Awaba Colliery operations over the past 40 years. This review should include the impacts on water resource quality and quantity, groundwater systems, vegetation communities, landscape and habitat values;

b. Detailed assessment and prediction of subsidence impacts, including the cumulative impacts of past and proposed operations;

c. Detailed assessment of predicted subsidence impacts on all water resources. Likely and worst case scenario impacts should be detailed for all stream orders, including the potential impacts on water quality and quantity.

d. Detailed assessment of predicted subsidence impacts on all flora and fauna habitat values, threatened species, landscape values and ecological processes; and

e. Details of all proposals to mitigate the potential impacts of subsidence.

4. Air

The EA must include a detailed Air Quality Impact Assessment (AQIA). The AQIA must identify and describe in detail the significant sources of air pollution and activities/processes with the potential to cause fugitive dust emissions and odour emissions beyond the boundary of the development site. The AQIA should take into account cumulative impacts associated with existing developments and any developments having been granted development consent but which have not commenced.

The EA should demonstrate that the facility will operate within the DECCWs objectives which are to minimise adverse effects on the amenity of local residents and sensitive land uses and to limit the effects of emissions on local, regional and inter-regional air quality.

The AQIA must also include, but not be limited to, the following:

- Provide a description of existing air quality, using existing information and site representative ambient monitoring data. This description should include the following parameters:

  - dust deposition;

  - total suspended particulates;

  - PM_{10} particulate matter;

- Identification and location of all fixed and mobile sources of dust/air emissions from the development including rehabilitation. The location of all emission sources should be clearly marked on a plan for key years of the mine development. Identify all pollutants of concern and estimate emissions by quantity (and size for particles), source(s) and discharge point(s).

- Details of the project that are essential for predicting and assessing impacts on air quality including:

  - the quantity and physio-chemical characteristics of materials to be handled, stored or transported;

  - an outline of the procedures for material handling, storage and transport;

  - the management of activities and areas with potential for impacts on air quality.

  Note: emissions can be classed as either:

  - point (eg emissions from stack or vent) or

  - fugitive (from wind erosion, leakages or spillages associated with loading or unloading, crushing/screening, conveyors, storage facilities, plant and yard operation, vehicle movements (dust from road, exhausts, loss from load), land clearing and construction works).

- A description of the topography and surrounding land uses.

- Details of the exact locations of dwellings, schools and hospitals etc. Where appropriate provide a perspective view of the study area such as the terrain file used in dispersion and/or subsidence prediction models.

- Estimate the resulting ground level concentrations of all pollutants. Use an appropriate dispersion model to predict ambient TSP and PM_{10} dust concentrations and dust deposition levels. Refer to Appendix B for appropriate guidelines.

- A detailed description of the methodology used to assess the air quality impacts of the development. The use of a particular dispersion model and model parameters used should be justified and discussed. The dispersion model input/output files should be included.
- Air quality impact predictions should include plans showing projected incremental levels of 24-hour average PM_{10} concentrations, annual average dust deposition rates and annual average total suspended particulate concentrations throughout the life of the operation.
- An assessment of cumulative air quality impacts and a description of the methodology used.
- An assessment of the potential impacts on air quality other than by dust, for example nitrogen oxide emissions from diesel equipment and/or odour emissions arising from mine ventilation and/or spontaneous combustion.
- Describe the effects and significance of pollutant concentration on the environment, human health, amenity and regional ambient air quality standards or goals.
- Describe the contribution (if any) that the development will make to regional pollution, particularly in sensitive locations.
- Describe control measures to be implemented to minimise pollutants including dust generation during any construction activities, and coal handling and stockpiles.
- Outline specifications of pollution control equipment (including manufacturer's performance guarantees where available) and management protocols for both point and fugitive emissions. Where possible, this should include cleaner production processes.
- Include details of an air quality monitoring program to determine effectiveness of mitigation and to verify predictions, including provision for investigations in response to complaints.

5. Greenhouse gas emissions

The EA should include a comprehensive assessment of, and report on, the project's predicted greenhouse gas emissions (tCO2e). Emissions should be reported broken down by:

a) Direct emissions (scope 1 as defined by the Greenhouse Gas Protocol – see guidelines attached),
b) Indirect emissions from electricity (scope 2), and
c) Upstream and downstream emissions (scope 3).

before and after implementation of the project, including annual emissions for each year of the project (construction, operation and decommissioning).

If relevant, greenhouse emissions intensity (per unit of production) should be compared before and after the project. Emissions intensity should be compared with best practice if possible.

The emissions should be estimated using an appropriate methodology, in accordance with NSW, Australian and international guidelines (see attached).

The EA should identify which emissions would be covered by the Federal Government's proposed Carbon Pollution Reduction Scheme (CPRS) once commenced.

The proponent should also evaluate and report on the feasibility of measures to reduce greenhouse gas emissions associated with the project, concentrating on emissions not covered by the CPRS.

For emissions covered by the CPRS, any evaluation should include a consideration of expected price increases due to CPRS. This could include a consideration of energy efficiency opportunities or undertaking an energy use audit for the site.

The proponent should also identify if there are any cost-effective opportunities to reduce scope 3 emissions (eg by using different methods of supply or distribution).

6. Noise

The EA must include a comprehensive noise assessment of the existing environment, potential impacts and proposed noise amelioration measures in accordance with the guidelines and methodologies detailed in Appendix B. The EA must determine the rating background noise level and ambient ($L_{Aeq(period)}$) noise levels in accordance with the NSW Industrial Noise Policy.

The evaluation should take into account any construction and the operational phases of the development over the "operating" hours proposed and take into account adverse weather conditions including temperature inversions. The assessment must identify any noise sensitive locations likely to be affected by activities at the site, such as residential properties, schools, churches, and hospitals.

The project specific noise levels for the site must be determined. For each identified potentially affected receiver, this should include:

- determination of the intrusive criterion for each identified potentially affected receiver,
- selection and justification of the appropriate amenity category for each identified potentially affected receiver,
- determination of the amenity criterion for each receiver,
- determination of the appropriate sleep disturbance limit.

The noise and vibration levels likely to be received at the most sensitive locations (these may vary for different activities at each phase of the development) should be determined. Potential impacts should be determined for any identified significant adverse meteorological conditions. Predicted noise levels under calm conditions may also aid in quantifying the extent of impact where this is not the most adverse condition.

The EA should include an assessment of cumulative noise impacts, having regard to existing developments and developments which have received development consent in the area but which have not commenced.

The EA should include noise amelioration measures proposed to address any noise issues identified.

6. Water

The EA must provide sufficient information to demonstrate that the proposed development can be operated whilst complying with the *Protection of the Environment Operations (POEO) Act* 1997, in particular, the protection of water quality, including ground water, during operation and following mine closure.

Potential impacts on water quality and quantity must be assessed, and mitigating measures proposed, for all on site water resources, all receiving waters downstream, and Lake Macquarie. The EA must assess:

- Details of all proposed water discharges including locations, water volumes, water quality and under what conditions;
- The expected water quality of all proposed discharges assessed in accordance with the Guidelines for Fresh and Marine Water Quality (ANZECC 2000);
- DECCW is especially concerned with heavy metal and salt discharges from the premises. The concentrations of metals and salinity in discharge waters should be directly compared with those in the receiving waters and Lake Macquarie using the Guidelines for Fresh and Marine Water Quality (ANZECC 2000). All impacts on receiving waters should then be assessed;
- Quality of runoff from exposed soils, roads and coal handling areas;

- Design and location of all sediment and erosion control structures;
- Methods proposed to deal with pollutants other than sediments that may be in the water;
- Spillage controls and bunding;
- Sealing, kerbing and guttering of trafficable areas;
- Provision of truck washing facilities capable of washing wheels and under body of vehicles leaving the premises;
- Potential impacts on water quality and quantity for receiving waters downstream of the mine; and
- Potential long terms impacts on Lake Macquarie and its tributaries.

The methodology, data and assumptions used to design any pollution control works and assess the potential impact of the proposal on water quality, must be fully documented and justified.

The EA must include a detailed Water Management Plan and site water balance which includes cumulative water balance modelling and assessment incorporating the following matters:

- Maximum on-site reuse of wastewater together with adequate water storages to minimise discharge of pollutants from the premises at any time. This must include correct installation and sizing of the wastewater collection and recycling systems;
- Details of all measures employed to minimise all water discharges from the premises at all times;
- Prevention of wet weather overflows of contaminated stormwater by collection and reuse or treatment of contaminated first flush stormwater;
- Segregation of contaminated from non-contaminated water to minimise the volume of polluted water to be dealt with;
- Management of groundwater and surface waters; and
- Detailed design and management of all proposed water storages.

7. Waste and Chemicals

The EA should provide full details and classification of wastes generated from the process and their disposal options.

The EA must identify any fuel or chemical storage areas on the site/s and describe the measures proposed to minimise the potential for leakage or the migration of pollutants into the soil/waters or from the site.

8. Monitoring Programs

The EA should include a detailed assessment of any noise, air quality, water quality or waste monitoring required during the operation of the facility to ensure that the development achieves a satisfactory level of environmental performance. The evaluation should include a detailed description of the monitoring locations, sample analysis methods and the level of reporting proposed.

9. Threatened Species, Populations and Ecological Communities (including their Habitat)

The EA must:

- document all the known and likely threatened species, their habitats, populations and ecological communities of the site / study area (including any adjacent areas that may be indirectly impacted upon by the proposal). The accompanying report must provide details of the survey methodologies used (both flora and fauna) and / or techniques utilised;
- provide a detailed assessment of the direct and indirect impacts (e.g. subsidence, changes to hydrology, fragmentation etc) of the proposal, including any impacts associated with ancillary activities, such as asset protection zones (APZ) on such species, habitats, populations and ecological communities;
- provide a general baseline flora and fauna survey for the subject site, describing the vegetation communities, habitat types and species assemblages present;
- detail the actions that will be taken to avoid or mitigate impacts on threatened species, their habitats, populations and ecological communities; and in instances where impacts can not be avoided provide appropriate details on offset / compensatory habitat packages or strategies; and
- detail any impacts on adjacent or nearby DECCW conservation estate and provide mitigation or avoidance measures for any adverse impacts.

To address likely impacts (both direct and indirect) on threatened species, populations and ecological communities (including their habitat), the proponent will need to engage a qualified and experienced environmental consultant to conduct an appropriate flora and fauna survey of the subject site / study area, and provide an assessment report.

<u>Surveys</u>

Survey procedures and assessment of results should be consistent with those procedures and assessment approaches contained within the DECCW publications shown at Attachment B.

A general baseline fauna and flora survey must be conducted on the subject site and/or study area to provide details of the vegetation communities, habitat types and species assemblages present. Additional targeted surveys will be required for all likely threatened species, populations and/or communities that are not easily detected using general survey methodologies.

Surveys must be undertaken at the time of year when the subject species are most likely to be detected (e.g. targeted threatened flora should be carried out when a species is flowering and/or fruiting, as these features are typically required to positively identify species).

If a proposed survey methodology is likely to vary significantly from widely accepted methods, the proponent should discuss the proposed methodology with the DECCW prior to undertaking the EA, to determine whether DECCW considers that it is appropriate.

<u>Previous Surveys</u>

Recent (less than 5 years old) surveys and assessments may be used. However, previous surveys should not be used if they have:

- been undertaken in seasons, weather conditions or following extensive disturbance events when the target subject species are unlikely to be detected or present (e.g. outside known flowering / fruiting periods, adverse drought conditions, flooding , bushfire, slashing and overgrazing etc.); or
- utilised methodologies, survey sampling intensities, timeframes or baits that are not the most appropriate ones for detecting the target subject species;

unless these differences can be clearly demonstrated to have had an insignificant impact upon the outcomes of the surveys.

<u>Biobanking Assessment Methodology</u>

If the proponent is proposing to conduct a biodiversity assessment using BioBanking Assessment Methodology, as outlined in the '<u>*BioBanking Assessment Methodology and Credit Calculator*</u>

Operational Manual (DECC 2009b), then it is advantageous that during the survey component of the EA that the relevant data is collected in the appropriate format for the Biometric tool (i.e. BioBanking Credit Calculator) (*Note: this may reduce duplication or further surveying at a later date). Under this scenario all vegetation types in the study area should be identified and matched to a DECCW BioMetric vegetation type. Please note there is no formal requirement to use BioBanking under Part 3A of the *EP&A Act 1979*, but the process can, if the proponent wishes, provide guidance in determining the level and adequacy of an offset required to compensate the loss of vegetation / habitat. Furthermore, conducting a biodiversity assessment does not negate the need to comply with the full survey requirements.

For details on the use of Biometric, see http://www.environment.nsw.gov.au/biobanking/

Subject Species

In determining potential threatened species (the subject species) for the site, consideration shall be given to the habitat types present within the study area, recent and historic records of threatened species or populations in the locality and the known distribution of threatened species.

Databases such as DECCW *Atlas of NSW Wildlife, BioBanking Credit Calculator, Australian Museum and Royal Botanic Gardens* should be consulted to assist in compiling the list. Other databases must also be consulted to create a comprehensive list of subject species.

DECCW notes the following known threatened species, populations and ecological communities (based on DECCW *Atlas of NSW Wildlife* database), which have broad habitat matches to that of the site occur on or nearby (10 km radius) to the proposal and these should be targeted during surveying (but not be limited to just these):

Flora:
Bynoe's Wattle (*Acacia byoneana*)*
Charmhaven Apple (*Angophora inopina*)*
Netted Bottle Brush (*Callistemon linearifolius*)
Leafless Tongue Orchid (*Cryptostylis hunteriana*)*
Small-flowered Grevillea (*Grevillea parviflora* subsp. *parviflora*)*
Biconvex Paperbark (*Melaleuca biconvexa*)*
Heath Wrinklewort (*Rutidosis heterogama*)*
Black-eyed Susan (*Tetratheca juncea*)*

Fauna:

Amphibians:
Wallum Froglet (*Crinia tinnula*)
Giant Burrowing Frog (*Heleioporus australiacus*)*
Green And Golden Bell Frog (*Litoria aurea*)*
Green-thighed Frog (*Litoria brevipalmata*)
Stuttering Barred Frog (*Mixophyes balbus*)*
Giant Barred Frog (*Mixophyes iteratus*)*
Red-crowned Toadlet (*Pseudophryne australis*)

Reptiles:
Pale-headed Snake (*Hoplocephalus bitorquatus*)
Stephen's Banded Snake (*Hoplocephalus stephensii*)
Rosenberg's Goanna (*Varanus rosenbergi*)

Birds:
Australian Bittern (*Botaurus poiciloptilus*)
Bush Stone-curlew (*Burhinus grallarius*)
Gang-gang Cockatoo (*Callocephalon fimbriatum*)
Glossy Black Cockatoo (*Calyptorhynchus lathami*)
Brown Treecreeper (*Climacteris picumnus* ssp. *victoriae*)
Varied Sittella (*Daphoenositta chrysoptera*)

Black-necked Stork (*Ephipporhynchus asiaticus*)
Little Lorikeet (*Glossopsitta pusilla*)
Black Bittern (*Ixobrychus flavicollis*)
Comb-crested Jacana (*Irediparra gallinacea*)
Swift Parrot (*Lathamus discolor*)*
Square-tailed Kite (*Lophoictinia isura*)
Black-chinned Honeyeater (eastern subspecies) (*Melithreptus gularis* ssp. *gularis*)
Powerful Owl (*Ninox strenua*)
Osprey (*Pandion haliaetus*)
Grey-crowned Babbler (eastern subspecies) (*Pomatostomus temporalis* ssp. *temporalis*)
Superb Fruit-dove (*Ptilinopus superbus*)
Speckled Warbler (*Pyrrholaemus saggitatus*)
Masked Owl (*Tyto novaehollandiae*)
Sooty Owl (*Tyto tenebricosa*)
Regent Honeyeater (*Xanthomyza phrygia*)*

Mammals:
Eastern Pygmy-possum (*Cercartetus nanus*)
Large-eared Pied Bat (*Chalinolobus dwyeri*)*
Spotted-tailed Quoll (*Dasyurus maculatus*) *
Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)
Golden-tipped Bat (*Kerivoula papuensis*)
Parma Wallaby (*Macropus parma*)
Little Bentwing-bat (*Miniopterus australis*)
Eastern Bent-wing Bat (*Miniopterus schreibersii* subsp. *oceanensis*)
Eastern Freetail bat (*Mormopterus norfolkensis*)
Large-footed Myotis (*Myotis adversus*)
Squirrel Glider (*Petaurus norfolcensis*)
Koala (*Phascolarctos cinereus*)
Yellow-bellied Glider (*Petaurus australis*)
Brush-tailed Rock-wallaby (*Petrogale penicillata*)*
Long-nosed Potoroo (*Potorous tridactylus*)*
Grey-headed Flying-fox (*Pteropus poliocephalus*)*
Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*)
Greater Broad-nosed Bat (*Scoteanax rueppellii*)
Eastern Cave Bat (*Vespadelus troughtoni*)

Endangered Populations
- *Eucalyptus parramattensis* subsp. *parramattensis* population in the Wyong and Lake Macquarie LGAs.

Endangered Ecological Communities
- Freshwater wetlands on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions.
- Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions.
- Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion.
- Lowland Rainforest in NSW North Coast and Sydney Basin Bioregion.
- River-flat eucalypt forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions.
- Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions.
- Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions.

* indicates species that are listed on the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

<u>Habitat Corridors</u>

The potential fragmentation of and/or indirect impacts on the various corridor links in which the proposal lies or is within close proximity to, needs to be assessed. These corridors include the following 'Regional Corridors':

- Awaba 2
- Eungala
- Lord's Creek
- Wangi Wangi Bay

Regional Corridors are landscape corridors designed to provide potential residential and dispersal habitat for threatened faunal assemblages (as described in Scotts 2003), and supplementary habitat for other taxa. Typically corridors are in the order of kilometres wide to maintain habitat and to facilitate movement between areas of significant intact habitat. Although they may be discontinuous, due to fragmentation by clearing or degraded through logging and/or agricultural activities, they must still maintain their overall landscape connectivity. DECCW is of the opinion regardless of the patchiness and discontinuous nature associated with parts of these corridors, they still represent an important habitat, nodes and movement linkage for locally occurring threatened species, of which some are highly mobile and can move across gaps in habitat. Fragmentation may impede the movement opportunities for some of the known threatened species of the subject site, and hence impacts on such corridors need to be carefully assessed and documented in the EA.

<u>Compensatory strategies</u>

DECCW's 'offset provision' principles state that impacts must be avoided first by using prevention and mitigation measures (DECC 2007). Where significant modification of the proposal to minimise impacts is not possible then compensatory strategies should be considered. These should include on or offsite proposals that contribute to long term conservation of affected threatened species, populations or ecological communities. If compensatory habitat is not considered appropriate, justification must be provided. Where a proposal involves the clearing of threatened species habitat then appropriate offsets which compensate for the clearing of the habitat should be provided.

Justification for any area(s) proposed as compensatory habitat / offsets must include an assessment of the threatened species / biodiversity values impacted on by the proposed works (i.e. those of the subject site) and a comparison of whether the proposed offset area(s) provides equivalent or greater values – "improve or maintain important biodiversity values".

Offsets must be considered for both direct and indirect impacts. In instances where an impact can not be conclusively ruled out (e.g. subsidence) an appropriate offset package must be provided in accordance with DECCW guidelines. DECCW notes that the EA states that subsidence is predicted or may occur. Under this scenario, DECCW would expect an appropriate offset / compensatory habitat package be provided for the indirect impacts of subsidence which damage vegetated landscapes and/or habitats. DECCW is unlikely to support significant indirect impact of subsidence to DECCW Estate, such as Sugarloaf State Conservation Area.

To determine the adequate biodiversity offset either one of the following methodologies are to be used as a guide:

- DECCW 'offsetting principles', as outlined in Appendix 2 – Principles for the use of biodiversity offsets in NSW *Draft Guidelines for Biodiversity Certification of Environmental Planning Instruments* (DECC 2007),
- '<u>*BioBanking Assessment Methodology and Credit Calculator Operational Manual*</u>' (DECC 2009b). Please note that the use of Biobanking is voluntary.

Offsets will require the proponent to consider adequate conservation in perpetuity, appropriate management regimes, and financial security with respect to ongoing management.

DECCW would typically consider suitable measures to ensure conservation in perpetuity, such as (but not limited to) a Conservation Agreement under the *National Parks and Wildlife (NP&W) Act 1974*, a bio-banking agreement under the *Threatened Species Conservation Act 1995*, reservation of land under Part 4 of the *NP&W Act 1974*, and/or Section 88B-E covenant of the *Conveyancing Act 1919* (Note: that a covenant under the *Conveyancing Act 1919* will require such an instrument to be lodged for registration under a new deposited plan or a plan of survey [refer to: http://rgdirections.lands.nsw.gov.au/plans/easementsandcovenants).

To appropriately manage any proposed compensatory offsets, DECCW will require that an appropriate Management Plan (such as vegetation or habitat) be developed. These plans should be prepared prior to any potential approval of the development. Management plans should clearly document how any retained vegetated areas or habitat features will be managed with respect to long-term conservation and viability, including clear details on how they will be funded. They should cover, but not be limited to, the following issues:

- weed management (both control and suppression) and monitoring,
- management of retained native vegetation and habitat (including buffer zones),
- feral animal control,
- fire management (including asset protection zones [APZs]),
- public access (including increased traffic, and associated impacts, such as increased refuse and pets),
- minimisation of edge effects and fragmentation,
- stormwater control and changes to hydrology (including stormwater / runoff control and sediment / erosion control measures),
- management of specific habitat enhancement measures (e.g. hollow / habitat trees, animal fencing to facilitate movement [e.g. Koala 'floppy-top fencing'], artificial hollows and nest boxes etc.),
- fauna displacement and if appropriate translocation (including any licence requirements),
- proposed surveys, such as pre-extraction baseline, pre-clearance and rehabilitation surveys,
- details of long-term monitoring (including proposed timing),
- details of any rehabilitation program, including details of timing (including proposed staging details), rehabilitation measures (including details of proposed revegetation and species mix), and post-rehabilitation monitoring,
- measures to ensure conservation in perpetuity (e.g. transfer to DECCW estate, conservation agreements or covenants), and
- funding details of long-term financial commitment to any proposed conservation measures, including any mechanisms to be implemented to achieve this.

DECCW Conservation Estate

Likely impacts on any adjoining and/or nearby DECCW estate under the *National Parks and Wildlife Act 1974* must be assessed, evaluated and reported on. DECCW notes that Sugarloaf State Conservation Area occurs within the vicinity of the proposal.

The assessment should focus on impacts on threatened species, biodiversity in general and landscape / amenity values, but include indirect impacts such as subsidence, increased surface runoff, changes to hydrology, increased refuse, bushfire implications / management, fragmentation, loss of connectivity, and weed infestation, but not be limited to these.

The EA should describe mitigation and management options that will be used to prevent the identified impacts associated with the project. This should include an assessment of the effectiveness and reliability of the measures and any residual impacts after these measures are implemented.

Report

The general report structure should be consistent with the information presented in Table 3.4 of DEC (2004). In addition the following is required:

- a geo-referenced map / aerial photograph (or equivalent) of the subject site and study area indicating their location and regional context;

- a detailed description of all vegetation communities / types (both undisturbed and disturbed) on the site and study area (and if applicable DECCW BioMetric vegetation types), including a geo-referenced map / aerial photograph (or equivalent) showing their location. The descriptions should include: a general description, characteristic features (e.g. lacks a mid-storey, restricted to a particular geomorphic / edaphic feature etc.), their distribution and size, their vegetation structure (including cover), their condition, key diagnostic species, relationship to other communities, species richness and any significant species present (e.g. threatened species, ROTAP [Briggs & Leigh 1996], regionally significant taxa);
- identification of the classification system used in the vegetation descriptions (e.g. Specht *et.al.* 1974, Walker & Hopkins 1998 [Note: the classification must have regard to both structural and floristic elements]),
- details of how the vegetation classification for the site was developed, including details and associated products (e.g. dendrogams / two-way tables) of any analyses used;
- a full floristic list in tabular format of all taxa (both native and exotic) recorded on the subject site, indicating which vegetation communities they occur in, their cover / abundance, and conservation (including taxa of conservation significance);
- a full list of fauna (both native and exotic) in tabular format recorded on the subject site, indicating which vegetation communities / habitat types they occurred in;
- a geo-referenced map / aerial photograph (or equivalent) showing all threatened species, populations and ecological communities recorded on the site during surveying (*Note: records obtained from the "*Atlas of NSW Wildlife*" database can be used in determining likely habitat, but they are not to be schematically mapped in the EA, as this is considered a breach of licence conditions for such records);
- all habitat features / types should be detailed and mapped (where appropriate), such as frequency and location of stags, hollow bearing trees (including size), mature / old growth trees, culverts, rock shelters, rock outcrops, presence of feed tree / shrub / groundcover species (e.g. winter-flowering eucalypts, *Acacia* and *Banksia* trees, *Casuarina* / *Allocasuarina* and areas of native grasses], crevices, caves, drainage lines, soaks etc; and
- details of how the proposal will impact (both directly and indirectly) and affect known and potential threatened species, populations an ecological communities (including their habitat), including any assessment of significance.

References

Briggs, J.D. and Leigh, J.H. (1996) *Rare or Threatened Australian Plants.* 5th Revised Edition. Australian Nature Conservation Agency / CSIRO Publishing, Collingwood.

DEC (2004) *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities.* Working Draft. November 2004. Department of Environment and Conservation (NSW)

DECC (2007) *Biodiversity Certification of Environmental Planning Instruments: Working Draft.* April 2007. Department of Environment and Climate Change (NSW).

DECC (2009a) *Threatened Species Survey and Assessment Guidelines: Field Survey Methods for Fauna – Amphibians.* April 2009. Department of Environment and Climate Change (NSW), Goulburn Street, Sydney.

DECC (2009b) *BioBanking Assessment Methodology and Credit Calculator Operational Manual*. Department of Environment and Climate Change NSW, Sydney.

Scotts, D. (2003) *Key Habitats and Corridors for Forest Fauna.* NPWS Occasional Paper 32, National Parks and Wildlife Service, Hurstville, NSW.

Specht, R.L., Roe, E.M., and Boughton, V.H. (1974) Conservation of major plant communities in Australia and Papua New Guinea. *Australian Journal of Botany.* Supplementary Series No. 7.

Walker, J. and Hopkins, M. S. (1998) Vegetation. In R. C. McDonald, R. F. Isbell, J. G. Speight, J. Walker, and M. S. Hopkins (eds.) *Australian Soil and Land Survey Field Handbook Second Edition.* Inkata Press, Melbourne.

10. Aboriginal Cultural Heritage Values

DECCW notes the existence of numerous registered Aboriginal sites in the immediate locality. These include open camp sites, artefact sites, axe grinding grooves, and a potential archaeological deposit (PAD). We recommend the proponent consider any potential impacts of the proposal on these known sites, the sensitivity and significance of these sites to the traditional Aboriginal custodians and any relationship that may exist between these sites and any Aboriginal cultural values of the project area.

Impacts of the project on Aboriginal Cultural Heritage values

Standard requirements

1. The Environmental Assessment (EA) should address and document the information requirements set out in the draft "*Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation'* (Department of Environment and Conservation 2005). This document is available from the DECCW and the Department of Planning upon request.

2. The EA should include surveys by suitably qualified archaeological consultants in consultation with traditional Aboriginal custodians.

3. The EA should identify the nature and extent of impacts on Aboriginal Cultural Heritage values across the project area and the strategies proposed to avoid / minimise these impacts. If impacts are proposed as part of the final development, clear justification for such impacts should be provided.

4. The EA should assess the archaeological and Aboriginal significance of the site's Aboriginal Cultural Heritage values.

5. Describe the actions that will be taken to avoid or mitigate impacts of the project on Aboriginal Cultural Heritage values. This should include an assessment of the effectiveness and reliability of the measures and any residual impacts after these measures are implemented.

6. The EA needs to clearly demonstrate that effective community consultation with Aboriginal communities has been undertaken in assessing impacts, developing options and making final recommendations. DECCW supports broad-based Aboriginal community consultation and as a guide the '*Interim Community Consultation Requirements for Applicants* (DECCW 2005)' provides a useful model to follow.

7. If impacts on Aboriginal cultural values are proposed as part of the final development, an assessment of the regional significance of the values to be impacted, the extent to which these values are protected elsewhere in the landscape and consideration of the proposed impacts in the context of 'inter generational equity' should be undertaken.

Note: If the EA is relying on past surveys it is critical to confirm that the surveys are consistent with the requirements of the above Part 3A guidelines. Furthermore, if any new sites or objects are located, they should be recorded on NPWS site cards and registered on DECCW's Aboriginal Heritage Information Management System (AHIMS). AHIMS contact details: Phone: (02) 9585 6470, address: Lvl 6, 43 Bridge Street, Hurstville, NSW, 2220, e-mail: ahims@environment.nsw.gov.au.

Department of Environment, Climate Change and Water (DECCW)
April 2010

ATTACHMENT B: GUIDANCE MATERIAL

Assessing Environmental Impacts

Information requirements described in **Attachment A** should be assessed in accordance with the following legislative requirements and guidelines. In particular the requirements of Section 45 of the *Protection of the Environment Operations Act 1997* should be addressed.

Air Quality

- Protection of the Environment Operations (Clean Air) Regulation 2002.
- Approved Methods for the Sampling and Analysis of Air Pollutants in NSW (2006).
- Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (2005).
- Assessment and Management of Odour from Stationery Sources in NSW (November, 2006).

Impacts on Greenhouse Gas Emissions

- The Greenhouse Gas Protocol: Corporate Standard, World Council for Sustainable Business Development & World Resources Institute.
  http://www.ghgprotocol.org/standards/corporate-standard
- National Greenhouse Accounts (NGA) Factors, Australian Department of Climate Change, 2008.
  http://climatechange.gov.au/workbook/index.html
- Australia's Low Pollution Future: The Economics of Climate Change Mitigation, Australian Treasury, 2008.
  http://www.treasury.gov.au/lowpollutionfuture/
- Carbon Pollution Reduction Scheme: Australia's Low Pollution Future, White Paper, Australian Department of Climate Change, 2008, Chapter 12: Assistance to emissions-intensive trade-exposed industries.
  http://www.climatechange.gov.au/whitepaper/report/index.html

Noise and Vibration

- Construction noise should be assessed using DECCW's "Interim Construction Noise Guideline" available electronically at http://www.environment.nsw.gov.au/noise/constructnoise.htm
- Operational noise should be assessed in accordance with the *NSW Industrial Noise Policy (EPA, 2000)* and *Industrial Noise Policy Application Notes.*
  http://www.environment.nsw.gov.au/noise/industrial.htm
- Operational vibration should be assessed in accordance with *DECCW's Environmental Noise Management – Assessing Vibration: a technical guideline (DEC, 2006).*
  http://www.environment.nsw.gov.au/noise/vibrationguide.htm
- Traffic noise should be assessing using the *Environmental Criteria for Road Traffic Noise* (EPA, 1999) http://www.environment.nsw.gov.au/noise/traffic.htm
- If blasting is required for any reasons, blast impacts should be demonstrated to be capable of complying with the guidelines contained in "*Australian and New Zealand Environment Council – Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration*" (ANZEC 1990). (http://www.environment.nsw.gov.au/noise/blasting.htm

Water

Water Quality

- National Water Quality Management Strategy: Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC 2000).
- NWQMS Australian Guidelines for Water Quality Monitoring and Reporting (ANZECC 2000).

Stormwater

- Managing Urban Stormwater: Soils and Construction (Landcom, 2004).

- Managing Urban Stormwater: Source Control (EPA 1998).
- Managing Urban Stormwater: Treatment Techniques (EPA 1998).

Groundwater

- State Groundwater Policy Framework Document (DLWC 1997).
- NSW State Groundwater Quality Protection Policy (DLWC 1998).
- (Draft) NSW State Groundwater Quantity Management Policy.
- NSW State Groundwater Dependent Ecosystems Policy (DLWC, 2002).
- National Water Quality Management Strategy Guidelines for Groundwater Protection in Australia (ARMCANZ & ANZECC, 1995).

Waste Water

- National Water Quality Management Strategy: Guidelines for Sewerage Systems - Effluent Management (ARMCANZ/ANZECC 1997).
- National Water Quality Management Strategy: Guidelines for Sewerage Systems – Use of Reclaimed Water (ARMCANZ/ANZECC 2000).
- Environmental Guidelines for the Utilisation of Treated Effluent by Irrigation (NSW DEC 2004).

Waste and Chemicals

- Protection of the Environment Operations Act 1997 – Schedule 1
- Waste Classification Guidelines, Part 1: Classification of Waste (DECC, 2008)
- Environmental Compliance Report: Liquid Chemical Storage, Handling and Spill Management Part B Review of Best Practice and Regulation (DEC, 2005) http://www.environment.nsw.gov.au/resources/licensing/ecrchemicalsb05590.pdf
- Storing and Handling Liquids: Environmental Protection Participants Manual (DECC, 2007) http://www.environment.nsw.gov.au/resources/sustainbus/2007210liquidsManual.pdf
- Waste Exemption Guidelines http://www.environment.nsw.gov.au/waste/RegulateWaste.htm

Contaminated Land

- Contaminated Sites - Guidelines for Consultants Reporting on Contaminated Sites (EPA 1997);
- Contaminated Sites - Guidelines for the NSW Site Auditor Scheme (EPA 1998); and
- Contaminated Sites - Sampling Design Guidelines (EPA 1995).

Aboriginal Cultural Heritage Impacts

- Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation – (DEC, 2005) Available from the Department of Planning website.
- Part 3A EP&A Act Guidelines for Aboriginal Cultural Heritage Assessment and Community Consultation' (Department of Planning and DEC 2007). Available from DECC and Department of Planning on request.
- Interim Community Consultation Requirements for Applicants (DECC 2005)

Threatened Species Impacts

- Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (DEC November 2004) http://www.environment.nsw.gov.au/resources/nature/TBSAGuidelinesDraft.pdf).

(Note: Section 6.1 *Assessment of Significance* has now been amended by DECC 2007 and NSW DPI 2008)

- Threatened species survey and assessment guidelines: field survey methods for fauna – Amphibians (DECC April 2009) http://www.environment.nsw.gov.au/resources/threatenedspecies/09213amphibians.pdf

(Note: DECC has recently produced new survey guidelines to cover Amphibians (frogs), which replaces the amphibian section in the DEC (2004) guidelines. However, the survey requirements for all other species (flora and fauna) are still found in the DEC (2004) guidelines).

- Threatened Species Assessment Guidelines – The Assessment of Significance (DECC 2007 and NSW DPI 2008)
- Principles for the use of Biodiversity Offsets in NSW (DECC October 2008). http://www.environment.nsw.gov.au/biocertification/offsets.htm
- The BioBanking Assessment Methodology. Further information can be found on the DECC website at: http://www.environment.nsw.gov.au/biobanking/assessmethodology.htm.
- Consideration for assessment of the proposal through the NSW Government's Biodiversity Banking and Offset Scheme (BioBanking). BioBanking is a voluntary process which provides a systematic and consistent framework for counterbalancing (offsetting) the impacts of development to achieve an improve or maintain outcome for biodiversity values. Further information is available at: http://www.environment.nsw.gov.au/biobanking/index.htm

NSW GOVERNMENT | Office of Water

Director – Major Projects Assessments
Department of Planning
GPO Box 39
SYDNEY NSW 2001

Contact: Fergus Hancock
Phone: 02 4904 2532
Fax: 02 4904 2503
Email: Fergus.Hancock@dnr.nsw.gov.au

Attention Paul Freeman

19 April 2010

Our ref: ER20959
Your ref: S04/01377

Dear Paul

Subject: Awaba Coal life extension

I refer to your letter dated 19 March 2010, requesting input from the Department of Environment, Climate Change and Water, NSW Office of Water (NOW) on the proposed Awaba Coal life extension. NOW has reviewed the Preliminary Environmental Assessment (EA) for the proposal and identified a number of statutory issues that require consideration as part of Director General's Requirements to the proposal. NOW requires the following outcomes to be achieved for the project proposal:

- no hydraulic connection between the mining operation and surface water sources, including connected alluvium
- no impact on adjacent licensed water users, basic landholder rights, or minimum base flows in Stony or Kilaben Creeks, or groundwater-dependent ecosystems
- finalisation of mine operations which prevents ingress of surface water flows to mine workings

Assessment requirements for inclusion in the EA are included at Attachment A.

If you require any further information or clarification of information provided in this submission, please contact Fergus Hancock on (02) 4904 2532.

Yours sincerely

f/ Mark Mignanelli
Manager, Major Projects Assessments
NSW Office of Water

Department of
Environment, Climate Change and Water NSW

ATTACHMENT A
19 April 2010

NSW Office of Water

General Assessment Requirements for Major Project Proposals Under Part 3A of *Environmental Planning & Assessment Act 1979*

The NSW Office of Water (NOW) provides the following advice for consideration:

Relevant Legislation

The assessment is required to take into account the requirements of the following legislation (administered by NOW), as applicable:

- *Water Act 1912*
- *Water Management Act 2000 (WMA)*

In particular, proposals and management plans should be consistent with the Objects (s.3) and Water Management Principles (s.5) of the *WMA*.

Water Sharing Plans

Gazetted Water Sharing Plans (WSPs) prepared under the provisions of the *WMA* establish rules for access to, and the sharing of water between the environmental needs of the surface or groundwater source and water users. The Hunter Unregulated rivers and Alluvial Water Sharing Plan 2009 (HURAWSP) was proclaimed on 1 August 2009, and regulates access to, and flow management within, rivers and connected alluvial groundwaters within the Plan boundaries. As the proposal is within a gazetted WSP area the assessment is required to demonstrate consistency with the rules of the WSP.
Refer to: http://www.water.nsw.gov.au/Water-Management/Water-sharing/default.aspx

NOW requires the EA to include a template of regulatory limitations to mining access to and interference with flows within Stony and Kilaben Creeks, which are comprised within the Lake Macquarie Management Unit of the HURAWSP. This must include current levels of access to these watercourses both within and downstream of the proposal site, and any identified levels of environmental dependence, including any groundwater dependent ecosystems associated with them.

The EA must identify the location(s) and extent of alluvial deposits associated with either of these rivers, and the extent to which they contribute to maintenance of minimum baseflows. Any risk assessment for the proposal must address statutory obligations to avoid impacts exceeding minimal harm to any rivers or associated alluvial deposits. The EA must clearly demonstrate that the proposal will not lead to impacts on any rivers which interrupt or capture or divert minimum baseflows, or interrupt alluvial groundwater transmission to rivers.

Relevant Policies

The assessment is required to take into account the following NSW Government policies, as applicable:

- *NSW Groundwater Policy Framework Document - General*
- *NSW Groundwater Quantity Management Policy*
- *NSW Groundwater Quality Protection Policy*
- *NSW State Groundwater Dependent Ecosystem Policy*
- *NSW State Rivers and Estuaries Policy*
- *NSW Sand and Gravel Extraction Policy for Non-Tidal Rivers*
- *NSW Wetlands Management Policy*
- *NSW Farm Dams Policy*
- *NSW Weirs Policy*
- *NSW Coastal Policy*

In addition assessments should consider the following strategies:

- *NSW Salinity Strategy*
- *NSW Water Conservation Strategy*

The majority of these documents can be found at:
http://www.water.nsw.gov.au/Water-Management/Law-and-Policy/Key-policies/default.aspx

Guidelines
The assessment is required to take into account the following NOW Guidelines for Controlled Activities (February 2008), as applicable:

- Riparian corridors (and associated Vegetation Management Plans)
- Watercourse crossings
- Laying pipes and cables in watercourses
- Outlet structures
- In-stream works

Refer to: http://www.water.nsw.gov.au/Water-Licensing/Approvals/Controlled-activities/default.aspx

Groundwater
NOW is responsible for the management of groundwater resources so they can sustain environmental, social and economic uses for the people of New South Wales.

Groundwater Source
The assessment is required to identify groundwater issues and potential degradation to the groundwater source and provide the following:

- Details of any works likely to intercept, connect with or infiltrate the groundwater sources.
- Details of any proposed groundwater extraction, including purpose, location and construction details of all proposed bores and expected annual extraction volumes.
- Describe the flow directions and rates and the physical and chemical characteristics of the groundwater source.
- Details of the predicted impacts of any final landform on the groundwater regime.
- Details of the existing groundwater users within the area (including the environment) and include details of any potential impacts on these users.
- Assessment of the quality of the groundwater for the local groundwater catchment.
- Details of how the proposed development will not potentially diminish the current quality of groundwater, both in the short and long term.
- Details on preventing groundwater pollution so that remediation is not required.
- Details on protective measures for any groundwater dependent ecosystems (GDEs).
- Details of proposed methods of the disposal of waste water and approval from the relevant authority.
- Assessment of the potential for saline intrusion of any alluvial groundwaters and measures to prevent such intrusion into ay alluvial aquifer.
- Details of the results of any models or predictive tools used.

Where potential impact/s are identified the assessment will need to identify limits to the level of impact and contingency measures that would remediate, reduce or manage potential impacts to the existing groundwater resource and any dependent groundwater environment or water users, including information on:

- Details of any proposed monitoring programs, including water levels and quality data.
- Reporting procedures for any monitoring program including mechanism for transfer of information.
- An assessment of any groundwater source/aquifer that may be sterilised as a consequence of the proposal.
- Identification of any nominal thresholds as to the level of impact beyond which remedial measures or contingency plans would be initiated (this may entail water level triggers or a

beneficial use category).
- Description of the remedial measures or contingency plans proposed.
- Any funding assurances covering the anticipated post development maintenance cost, for example on-going groundwater monitoring for the nominated period.

Licensing
All proposed groundwater works, including bores for the purpose of investigation, extraction, dewatering, testing or monitoring must be identified in the proposal and an approval obtained from NOW prior to their installation.

Groundwater Dependent Ecosystems (GDEs)
The assessment is required to identify any impacts on GDEs. GDEs are ecosystems which have their species composition and natural ecological processes wholly or partially determined by groundwater. GDEs represent a vital component of the natural environment. GDEs can vary dramatically in how they depend on groundwater from having occasional or no apparent dependence through to being entirely dependent. GDEs occur across both the surface and subsurface landscapes ranging in area from a few metres to many kilometres. Increasingly, it is being recognised that surface and groundwaters are often interlinked and aquatic ecosystems may have a dependence on both.

Ecosystems that can depend on groundwater and that may support threatened or endangered species, communities and populations, include:
- Terrestrial vegetation that show seasonal or episodic reliance on groundwater.
- River base flow systems which are aquatic and riparian ecosystems in or adjacent to streams/rivers dependent on the input of groundwater to base flows.
- Aquifer and cave ecosystems.
- Wetlands.
- Estuarine and near-shore marine discharge ecosystems.
- Fauna which directly depend on groundwater as a source of drinking water or that live within water which provide a source.

The *NSW Groundwater Dependent Ecosystem Policy* provides guidance on the protection and management of GDEs. It sets out management objectives and principles to:
- Ensure the most vulnerable and valuable ecosystems are protected.
- Manage groundwater extraction within defined limits thereby providing flow sufficient to sustain ecological processes and maintain biodiversity.
- Ensure sufficient groundwater of suitable quality is available to ecosystems when needed.
- Ensure the *precautionary principle* is applied to protect GDEs, particularly the dynamics of flow and availability and the species reliant on these attributes.

A number of gazetted WSP list and map priority GDEs and set out the management strategies and actions for sharing and protecting groundwater quality, quantity and dependent ecosystems.

Surface Water
NOW is responsible for the sustainable management of rivers, estuaries, wetlands and adjacent riverine plains.

Watercourse/Riparian
The assessment is required to consider the impact of the proposal on the watercourses an associated riparian vegetation within the proposal footprint and provide the following:
- Identify the sources of surface water.
- Details of stream order (using the Strahler System).
- Details of any proposed surface water extraction, including purpose, location of existing pumps, dams, diversions, cuttings and levees.
- Detailed description of any proposed development or diversion works including all construction, clearing, draining, excavation and filling.

- An evaluation of the proposed methods of excavation, construction and material placement.
- A detailed description of all potential environmental impacts of any proposed development in terms of vegetation, sediment movement, water quality and hydraulic regime.
- A description of the design features and measures to be incorporated into any proposed development to guard against long term actual and potential environmental disturbances, particularly in respect of maintaining the natural hydrological regime and sediment movement patterns and the identification of riparian buffers. (See note below)
- Details of the impact on water quality and remedial measures proposed to address any possible adverse effects.

<u>Water Management Structures/Dams</u>
NOW is responsible for the management and licensing of these structures under water legislation. If the proposal includes existing or proposed water management structures/dams, the assessment is required to provide information on the following:

- Date of construction (for existing structure/s).
- Details of the legal status/approval for existing structure/s.
- Details of any proposal to change the purpose of existing structure/s.
- Details if any remedial work is required to maintain the integrity of the existing structure/s.
- Clarification if the structure/s is on a watercourse.
- Details of the purpose, location and design specifications for the structure/s.
- Size and storage capacity of the structure/s.
- Calculation of the Maximum Harvestable Right Dam Capacity (MHRDC).
- Details if the structure/s is affected by flood flows.
- Details of any proposal for shared use, rights and entitlement of the structure/s.
- Details if the proposed development/subdivision has the potential to bisect the structure/s.

NOW's Farm Dams Assessment Guide provides details on harvestable rights and the calculation of the MHRDC. Refer to: *<u>http://www.water.nsw.gov.au/Water-Licensing/Basic-water-rights/Harvesting-runoff/Harvesting-runoff/default.aspx</u>*

Sustainable Water Supply
Many gazetted WSPs to-date have identified particular surface and groundwater systems that are currently over-allocated (that is, water licence volumes issued to landholders operating in these catchments exceed the sustainable volumes/flows within these systems). In the case of over-allocation, the systems have subsequently been embargoed and no new water licences are to be issued within these catchments. Any new or expanded development within such catchments will therefore be unable to obtain any new water entitlements directly and will have to enter the water trading market (if available within that catchment) to seek additional water. Therefore, there can be no guarantees of obtaining additional water via this mechanism and there is the potential of restrictions on further development within such catchments. Whilst there is provision in the *WMA* to allow for limited growth in Town Water Supplies (TWS) this could still impact subsequently on other water users.

The assessment is required to address the issue of provision of a sustainable water supply for any project proposal. The assessment should include Water Management Plans detailing how a sustainable and efficient water supply can be sourced and implemented with minimal reliance on accessing valuable surface and groundwater resources. Through the implementation of BASIX, Integrated Water Cycle Management and Water Sensitive Urban Design, any proposed development must also be able to exhibit high water use efficiency.

NSW GOVERNMENT | Industry & Investment

OUT10/4885
9 April 2010

Mr Howard Reed
Manager Mining
Department of Planning
GPO Box 39
SYDNEY NSW 2001

Dear Mr Reed

Awaba Coal Project (10_0038)
Director General Requirements for EA

I refer to your letter dated 18 March 2010 requesting input into the Director General Requirements (DGRs) for the above project.

Industry & Investment NSW (I&I NSW) provide the following comments which are directed at specific areas of responsibility to assist in the framing of Director-General's requirements for an Environmental Assessment report (EA) for this proposal.

MINING TITLES

As coal is a prescribed mineral under the *Mining Act 1992*, the proponent is required to hold appropriate mining titles from I&I NSW in order to mine this mineral. I&I NSW understand that the project proposal is within existing coal titles held by the proponent.

REHABILITATION, SUBSIDENCE MANAGEMENT, MINE WATER MANAGEMENT AND MINE CLOSURE

The proponent has referred to rehabilitation systems and procedures that currently apply to the Awaba mine and current I&I NSW approvals for Subsidence Management Plan (SMP) and Mining Operation Plan (MOP).

The project is generally consistent with I&I NSW expectations of the Awaba mine development and rehabilitation in current MOP and SMP approvals, however I&I NSW recommends the following issues require clarification in any DGRs issues for the project:

<u>Proposed East B mining area</u>:

I&I NSW has identified particular constraints to secondary extraction development in this area including; decreasing shallow cover < 30m in parts, thinning of the Great Northern seam, and potentially deteriorating mining conditions in previously unmined area with little geological / geotechnical information. These mining constraints may require further preliminary assessment of subsidence predictions and surface impacts prior to I&I NSW

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supporting the Conceptual Mine Development as outlined in the Preliminary Environmental Assessment (PEA) for this area. Further consultation with the proponent is requested on this matter.

General Requirements:
I&I NSW recommend that the DGRs specifically seek a statement of commitment for subsidence monitoring and rehabilitation post mining under the I&I NSW MOP and SMP approvals process or equivalents.

Key issues:

Subsidence Prediction, Management and Mitigation of Impacts.

I&I NSW has in current Awaba SMP approvals conditionally required avoidance and mitigation of subsidence impacts upon 2nd & 3rd order streams due to shallow cover. I&I NSW have in current Awaba SMP approvals conditionally required preparation of a Spontaneous Combustion Management Plan arising from the risk of subsidence cracking in shallow cover. These matters should specifically feature in the DGRs.

Rehabilitation.

The proponent anticipates completion of mining within 5 years therefore I&I NSW requires that mine closure planning must be at an advanced stage. However, the PEA states in Sections 4.7 & 4.8 states that Awaba mine will be placed into care and maintenance and that mine closure documentation will be deferred until mining is completed. The EA should include post mining land use and landforms, rehabilitation objectives based upon operational domains and mine closure completion criteria consistent with the MOP requirements of the mining lease (CCL746). Attached for information is a copy of I&I NSW approval for Awaba's Mine Closure Plan dated June 2008 and I&I NSW response to Awaba's AEMR dated June 2009.

I&I NSW request the following specific information be addressed in the EA;

- Decommissioning and management of pit top buildings which may potentially be listed as having local heritage significance. This requires further stakeholder consultation (Department of Planning, I&I NSW, Lake Macquarie Council, Community),
- Documentation of site contamination assessment and remediation according to Department of Environment, Climate Change and Water (DECCW) standards, particularly assessment of Awaba's underground fuel tank,
- A Gantt chart of mine closure activities for Awaba mine,
- Subsidence management commitments post closure (monitoring, inspection and remediation) documented as a matrix of SMP condition requirements.

Water.
I&I NSW acknowledge that the proposed expansion of the Pollution Control Dam will improve water management and is to be included in the EA. I&I NSW notes however that Awaba's water management infrastructure includes six underground dewatering bores located within the colliery but outside the Project Application Area. The management of such facilities during mine life and decommissioning at mine closure must be addressed in the EA and the approval process.

Consultation requirements:
The proponent has to date initiated no specific consultation with I&I NSW for this project. Such consultation is requested prior to the completion of the EA.

Should you have any enquires regarding this matter please contact Julie Moloney, Principal Adviser, Development Coordination on (02) 4931 6549.

Yours sincerely

JMoloney

for **William Hughes**
Director
Industry Coordination

NSW DEPARTMENT OF
PRIMARY INDUSTRIES

9 June 2009

Mr Roger Davis
The Mine Manager
Awaba Colliery
Wilton Rd
AWABA NSW 2283

Our Ref: M76/1782

AWABA COLLIERY MINE CLOSURE PLAN

Dear Sir,

I refer to your letter of 28 November 2008 to the Department of Primary Industries (DPI) presenting the Colliery's Mine Closure Plan.

I attended a meeting with yourself and Jeff Dunwoodie on 3 June 2009 to review the document and plans. It is noted that mine planning at Awaba anticipates mining within approved SMP areas until late 2010 when all available resources have been exhausted. It is also noted that Centennial Coal will during this time review potential for Awaba mine infrastructure to be applied to future coal projects within the Newstan colliery holdings.

The Mine Closure Plan's documented objectives, staged rehabilitation and decommissioning actions are accepted as preliminary planning for closure. The Mine Closure Plan is hereby conditionally approved subject to the provision of the following supplementary information / plans;

1) Management of buildings which may be potentially LEP listed as local heritage significance. This is to be subject to further stakeholder consultation (DPI, Lake Macquarie Council, Community),
2) The documentation of site contamination assessment and remediation according to DEC standards, particularly assessment of Awaba's underground fuel tank,
3) A Gant chart of mine closure activities for Awaba mine,
4) Subsidence management commitments post closure (monitoring, inspection, remediation) documented as a matrix of SMP condition requirements,
5) The Awaba Mine Record Tracing with the notation of mine entry seals and borehole seals,
6) These items 1 to 5 are to be presented as annexure after the cessation of mining at Awaba.

For clarification or further information on any matter, please contact me at the Department on (02) 49316705. Enclosed for retention is an endorsed copy of the approved Plan; ***Centennial Awaba Mine Closure Plan, December 2008.***

Yours faithfully

G. SUMMERHAYES
Principal Environmental Officer, Manager Northern Region
Environmental Sustainability Branch

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NSW DEPARTMENT OF
PRIMARY INDUSTRIES

10 June 2009

Mr Roger Davis
The Mine Manager
Awaba Colliery
Wilton Rd
AWABA NSW 2283

Our Ref: M76/1782

Attention: Jeff Dunwoodie

Dear Sir,

AWABA COLLIERY - AEMR 2008

I refer to Awaba's AEMR for the period January 2008 to December 2008 presented to DPI in May 2009.

The AEMR has been assessed by DPI's Environmental Sustainability Branch which included a mine site inspection on 3 June 2009. The mine pit top inspection was attended by Awaba's Roger Davis, Jeff Dunwoodie and Veronica Waite. The AEMR has been prepared generally in accordance with the DPI current '*Guidelines to the Mining, Rehabilitation and Environmental Management Process*' EDG03. The AEMR 2008 is accepted. The issues / observations listed in the following action plan require management and review in the next AEMR.

ACTION PLAN

No	Issue / Observation	Action	Responsibility	Due
1.	Location of licensed water discharge points	Provide a plan to DPI identifying the location of Awaba's licensed water discharge points.	Awaba	Within 30 days
		The next AEMR requires a plan showing the location of all environmental monitoring points.	Awaba	Next AEMR
2.	Contamination assessment	Noted that a Phase 1 assessment completed. A summary of results and Phase 2 actions to be reported next AEMR	Awaba	Next AEMR
3.	Subsidence sinkholes	Two incidences of subsidence sinkholes documented in the AEMR. Sinkhole remediation was inspected. It is requested that in future such incidents are promptly reported to DPI.	Awaba	As incidents occur

ENVIRONMENTAL SUSTAINABILITY BRANCH

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4.	SMP environmental reporting	SMP environmental monitoring results are to be presented in AEMRs – documented as a matrix of SMP condition requirements – eg flora & fauna surveys.	Awaba	next AEMR
5.	Hydrocarbon management	Noted on inspection that the pit top primary oil separator was upgraded / installed. Such improvement initiatives arising from Awaba's hydrocarbon audit be reported in AEMR	Awaba	next AEMR

For clarification or further information on the above actions, please contact the undersigned on 49316705.

Yours faithfully

GREG SUMMERHAYES
Principal Environmental Officer, Manager Northern Region
Environmental Sustainability Branch

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29 March 2010
NSW Department of Planning
Major Projects Assessment

Mining & Industry Projects

PO Box 39
SYDNEY NSW 2001
Attention: Mr Paul Freeman

Dear Sir,

Subject: Awaba Coal Project (Your Ref 10_0038)

Request for Council Comments on Draft Director General's Requirements

In response to your correspondence dated 18 March 2010 seeking Council input for the preparation of the Director General's Requirements (DGRs) for the proposed Awaba Coal Project, the following information is provided.

Council thanks the Department for the opportunity to provide comment on Draft DGRs. In addition to those matters identified in the Draft DGRs, Council submits that the following be included:

Planning Considerations

The Environmental Assessment shall consider the following planning documents:

Lower Hunter Regional Strategy 2006.
the Draft Newcastle- Lake Macquarie Western Corridor Planning Strategy.
the Draft Lake Macquarie Aboriginal Heritage Management Strategy.
Lake Macquarie City Council's Lifestyle 2020 Strategy.
Lake Macquarie Local Environmental Plan 2004.
Lake Macquarie Development Control Plan No. 1 – Principles of Development.
Lake Macquarie Guidelines Supporting Development Control Plan No. 1 – Principles of Development.
City of Lake Macquarie Heritage Study 1993.

Flora and Fauna Considerations

A flora and fauna survey and associated impact assessment shall be undertaken, having regard to the following:

The Lake Macquarie Flora and Fauna Survey Guideline;
The Lake Macquarie *Tetratheca juncea* Management Plan;
The Lake Macquarie Native Vegetation and Corridors Mapping;
The Lake Macquarie City Council Guidelines for Vegetation Management Plans and
Councils preferred approach to amelioration and offsetting as outlined in the Lake Macquarie Council Planning Policy & Guideline for LEP Rezonings.

Creeks and Watercourses

No additional DGRs are required with regard to creeks and watercourses, however it is requested that the 'sensitive receptors' referred to under the subsidence requirements include watercourses and drainage lines.

Greenhouse Gases

At present the DGRs require a qualitative assessment of greenhouse gases, however this assessment should be a quantitative in nature.

Heritage Conservation

Both impact on Aboriginal and non Aboriginal Heritage is required to be assessed.

The Preliminary Environmental Assessment correctly identifies provisional heritage item AW-07 Awaba Site Mine in the City of Lake Macquarie Heritage Study 1993.

Additional to the polices, guidelines and plans called for consideration in the Draft DGRs, the following additional planning documents relating to heritage need to be considered and should be used as a reference for this proposal:

Statements of Heritage Impact, Heritage Office and Department of Urban Affairs & Planning 1996, revised 2002
Assessing Heritage Significance, Heritage Office 2001
Heritage Interpretation Policy, Heritage Office, 2005
Interpreting Heritage Places and Items, Heritage Office, 2005
The above comments are made without the benefit of a detailed review of the Preliminary Environmental Assessment as this document was not received early enough to allow Council both to review the document and to respond to the Department in the allowed timeframe.

Council looks forward to the referral of any formal Part 3A application to enable input into the assessment of the proposal, at the local level.

Should you require further information, please contact the undersigned on 4921 0311 or by e-mail on cbdwyer@lakemac.nsw.gov.au.

Yours faithfully

Chris Dwyer
Principal Development Planner
Lake Macquarie City Council

252DA241; 1
10/483, 10/481
AT

Director, Major Development Assessment
Mining and Extractive Industries
Department of Planning
GPO Box 39
SYDNEY NSW 2001

COPY

Howard

Attention: Mr ~~Harold~~ Reed

AWABA COAL PROJECT (10_0038) - DIRECTOR GENERAL'S REQUIREMENTS

Dear Mr Reed

I refer to your letter of 18 March 2010 (Your reference: S04/01377) regarding the subject proposal and the Department's request for key issues and environmental assessment requirements.

The Environmental Impact Assessment (EIA) should refer to the following guidelines with regard to the traffic impact of the proposed development:

- Roads and Traffic Authority's *Guide to Traffic Generating Developments*
  - *Section 2 Traffic Impact Studies*

The traffic study shall be prepared in accordance with the RTA's Guide to Traffic Generating Developments and is to include (but not limited to) the following:

- Assessment of all relevant vehicular traffic routes and intersections for access to/from the subject area during the construction and operational phases.

- Current traffic counts for all of the traffic routes and intersections.

- The anticipated additional vehicular traffic generated from the proposed development and associated trip distribution on the road network during both the construction and operational phases.

- Consideration of the traffic impacts on existing and proposed intersections and the capacity of the local and classified road network to safely and efficiently cater for the additional vehicular traffic generated by the proposed development. The traffic impact shall also include the cumulative traffic impact of other proposed developments in the area.

- Identify the necessary road network infrastructure upgrades that are required to maintain existing levels of service on both the local and classified road network. In this regard, concept drawings shall be submitted with the EIA for any identified road infrastructure upgrades. However, it should be noted that any identified road infrastructure upgrades will need to be to the satisfaction of Council/RTA.

- Intersection analysis (such as SIDRA) shall be submitted to determine the need for intersection and road capacity upgrades. The intersection analysis shall include (but not limited to) the following:

    - Current traffic counts and 10 year traffic growth projections
    - 95th percentile back of queue lengths
    - Delays and level of service on all legs for the relevant intersections
    - Electronic SIDRA files for RTA review.

- Impact of construction traffic on the road network in the vicinity of the development and measures to minimise any identified impact

Lake Macquarie City Council should also be consulted regarding requirements for assessment of traffic and transport requirements.

Should you require any further advice, please contact me on 4924 0420.

Yours sincerely

David Young
Manager, Land Use Development
Hunter Operations & Engineering Services

9 April 2010

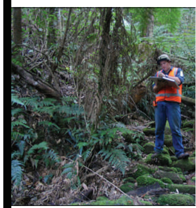
CC Peter Mc Murray
Lake Macquarie City Council

CC Grant Watson
Awaba Colliery

SOCIAL IMPACT ASSESSMENT








APPENDIX 3

Centennial Coal

Awaba Colliery

Social Impact Assessment

August 2010

FUTURE POWER | Centennial Coal

Table of Contents

Abbreviations

ACHCR	Aboriginal Cultural Heritage Consultation Requirements
ADTOAC	Awabakal Descendants Traditional Owners Aboriginal Corporation
BBRA	Broad Brush Risk Assessment
CCC	Community Consultation Committee
DECCW	NSW Department of Environment, Climate Change and Water
DGRs	Director General's Requirements
DoP	NSW Department of Planning
EA	Environmental Assessment
ECD	Environment and Community Database
EP&A Act	Environmental Planning and Assessment Act 1979
HCRCMA	Hunter-Central Rivers Catchment Management Authority
ICCGs	Interim Community Consultation Guidelines
ICCRs	Interim Community Consultation Requirements
I&I	Industry and Investment, NSW
ILUA	Indigenous Land Use Agreement
KLALC	Koompahtoo Local Aboriginal Lands Council
LMCC	Lake Macquarie City Council
NOW	NSW Office of Water
NSW	New South Wales
NTA	Native Title Act 1993
PEA	Preliminary Environmental Assessment
RTA	Roads and Traffic Authority
SEP	Stakeholder Engagement Plan
SIA	Social Impact Assessment
SMP	Subsidence Management Plan
WNAC	Wonnarua Nation Aboriginal Corporation

1 INTRODUCTION

1.1 BACKGROUND

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 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 site is situated on crown land under lease to Centennial for the purpose of mining under Consolidated Coal Lease CCL746, and is adjacent to the Newstan-Eraring haul road owned by Eraring Energy. The locality of the mine is illustrated on **Figure 1**.

Awaba Colliery is a small operation with approximately 100 employees and contractors, 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.

A form of pillar extraction of narrow panels is used to recover coal in pillars developed previously by bord and pillar methods. 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 has been developed in consultation with the Department of Primary Industries – Mineral Resources (now known as Industry and Investment, NSW (I&I)) and has been used successfully to date, and is proposed to be continued for the Project.

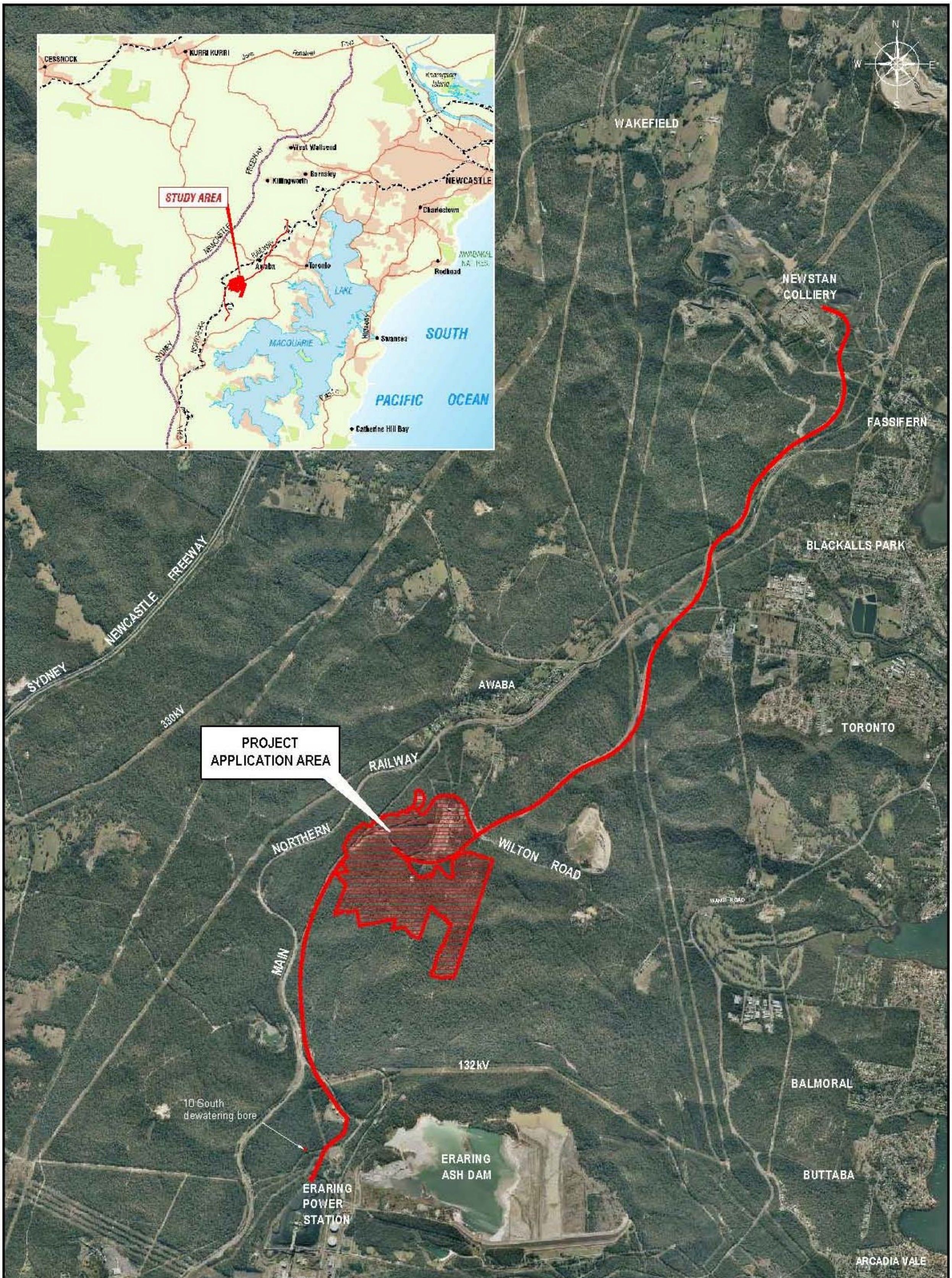
Mining operations commenced at the Awaba Colliery in 1947, prior to the commencement of any planning controls, and have continued without abandonment since that time. Consequently, the Awaba Colliery presently operates pursuant to section 109(1) of the NSW *Environmental Planning and Assessment Act 1979* (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. A detailed description of the Project and the **Project Application Area (*the "Application Area"*)** (including focus study areas) is detailed further in **Sections 1.2** and **1.3** below.

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 outlined in **Sections 1.2** and **1.3** below.

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 (refer **Section 1.2.1**) over a period of approximately five years or more, depending on actual mining conditions and relevant market drivers.

The application for the proposed Project is supported by an Environmental Assessment ("EA").

Figure 1 – Location Plan



1.2 PROJECT APPLICATION AREA

The **Project Application Area** (the "Application Area") is illustrated on **Figure 1**. 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 1.2.1**. 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.

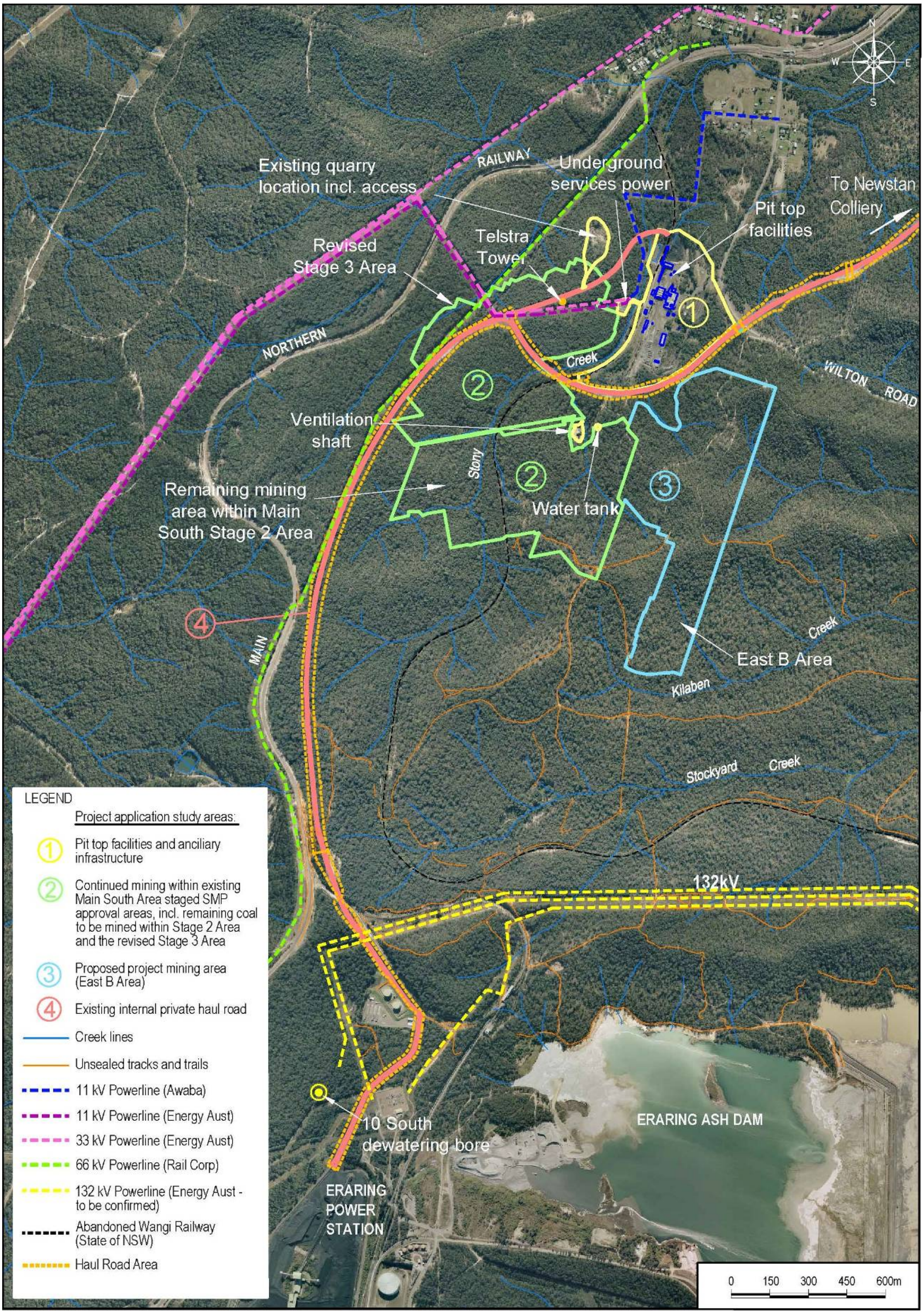
1.2.1 Study Areas

The Study Areas that have been assessed as part of this EA are shown on **Figure 2** 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 (as shown on **Figure 2**); 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 Section 96(1A) of 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 will also be addressed in the EA.

Figure 2 – Project Application Study Areas



1.3 PROJECT DESCRIPTION

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 final 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 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 **Figure 2**.

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 **Figure 2**:

- **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).

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**) 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 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 NSW in 2009, until such time that a final Detailed Life of Mine Strategy has been developed.

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

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

Existing mining areas, will continue to be utilised for ongoing mining operations including (but not limited to) mine access, emergency management and underground services and infrastructure.

Continuing Mine Operations:

For the purposes of environmental assessment, further to the information above regarding continued mining areas, it is noted that the following aspects of mine operations are proposed to continue and remain unchanged. Existing mining operations are presented in detail in Section 3 of the *Environmental Assessment (EA)* and, where relevant, components are discussed further in this specialist report.

- **Coal Handling, preparation and stockpiles** – No changes are proposed to the current coal handling, preparation or stockpile procedures to the existing operations;

- **Mine support facilities and site access** – No changes are proposed to the current infrastructure and facilities, with the only exclusion being the expansion of the Pollution Control Dam (PCD) mentioned earlier above, with related water management considerations. Mine access from Wilton Road will continue to be utilised and no significant change is anticipated from current use;

- **Plant and equipment** – No changes are proposed to the typical plant and equipment used at the Awaba Colliery;

- **Transportation procedures** – 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;

- **Mining methodology** – There will be no significant changes to current mining methods 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 (financial year), depending on mining efficiency and market demands;

- **Operational water management** – 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;

Mine dewatering procedures – the10 South Bore will continue to be used for groundwater management and dewatering during both continued operation and care and maintenance conditions.

1.4 REPORT OBJECTIVES

Existing operations/activities and any potential impacts have been considered in the Broad Brush Risk Assessment (BBRA) undertaken for the Project. 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 which 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 for the Project.

The role of this SIA is to evaluate the current socio-economic impacts of the Project on surrounding communities and to anticipate future requirements and concerns of those communities and relevant stakeholders. The SIA aims to:

- Identify the potential impacts and concerns of the community and stakeholders and how the potential 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.

1.5 METHODOLOGY

1.5.1 Principles of Social Impact Assessment

The framework used to assess the potential socio-economic impacts for the Project, within this SIA, comprised the following activities as defined in SIA Principles (Vanclay, 2003):

- Identification of interested and affected peoples (**Section 2** - Stakeholder Identification);
- Facilitates and coordinates the participation of stakeholders (**Section 3** - Consultation Undertaken);
- Identifies and describes activities which are likely to cause impacts (**Section 4** - Identification of potential impacts and responses);
- Analysis of the indentified potential impacts (**Section 5** - Assessment of Potential Issues); and
- Recommends mitigation measures (**Section 6** - Mitigation & Management Measures).

1.5.2 Consultation Strategy

The key consultation actions implemented by Awaba Colliery during the Project are detailed in **Table 1** below. It is also noted that Awaba Colliery has maintained a consultative approach during the preparation and implementation of previous Subsidence Management Plans (including for the Main South Stage 2 and Revised Stage 3 Areas i.e. Study Area 2), and while these have not been included in the consultation strategy for this Project they have been discussed in further detail in **Appendix 4** of the EA.

Table 1 – Stakeholder Consultation Strategy

Key Consultation Actions	Mode of Consultation
Develop a Stakeholder Engagement Plan to provide a strategy to manage consultation for the Project.	-
Update the Awaba Colliery stakeholder database to include relevant stakeholders, and those stakeholders known from previous consultation.	-
Prepare a Preliminary Environmental Assessment and make publicly available following submission to the Department of Planning.	Website, CD, hardcopy
Advertise to the community to make them aware of the Project.	Newspaper (Lakes Mail), newsletter (Awaba residents and the Awaba representative on the Newstan Community Consultation Committee (CCC).
Hold one-on-one consultations, site inspections and further discussions with key stakeholders/authorities, providing additional information if/where required to address any issues.	Meetings/presentation, site inspections, phone calls and other correspondence
Conduct specific consultation with the Aboriginal Community in accordance with the DECCW *Interim Community Consultation Requirements* (ICCRs) (2004).	Letters, surveys, phone calls and other correspondence. See **Section 9.2.2** of the EA for details
Address any feedback received following consultation within the Project.	Feedback has been considered and, where appropriate, addressed within this Environmental Assessment (including within supporting appended specialists assessments)
Submit Environmental Assessment for adequacy review by Department of Planning and address any concerns (if required).	CD, hardcopy, phone calls and other correspondence
Submit final Environmental Assessment and make publicly available following submission to the Department of Planning.	Website, CD, hardcopy
Responded to any submissions once the Environmental Assessment is available for stakeholder comment.	Response to Submissions provided to the Department of Planning

2 STAKEHOLDER IDENTIFICATION

All consultation has been undertaken in accordance with a Stakeholder Engagement Plan (SEP), which was specifically developed for the Project.

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).

Awaba Colliery has identified stakeholders for inclusion in the consultation process in accordance with the SEP. This process will allow for Awaba Colliery to effectively maintain and continue to develop trust through comprehensive and well timed engagement and communication; contribute to good working relationships by proactively anticipating and addressing concerns about the Project; and to 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.

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 potential issues for the Project is included in **Section 3.2**. 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.

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 also 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 3.3**.

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** (see **Section 2.3** of the EA). 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 3.4** 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 3.4**.

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 3.5.** This is discussed in further detail in **Section 9.2.2** and **Appendix 6** of the EA**.**

3 CONSULTATION UNDERTAKEN

3.1 INTRODUCTION

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).

Table 2 provides a summary of all stakeholder consultation in relation to the Project (including relevant consultation undertaken during the SMP application process) and identifies the method of engagement, the date of the engagement and the issues raised or comments made regarding the Project. Further detail regarding the specific consultation is provided below in **Sections 3.2 to 3.5**.

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** of the EA.

Table 2 – Summary of Stakeholder Consultation

Stakeholder	Method of Engagement	Date	Issues Raised/Comments	Section Addressed
Department of Planning	Letters, meetings, phone calls, Preliminary Environmental Assessment	03/03/10 - present	Director General Requirements for the Project were issued on the 22/04/10	These have been discussed in **Section 1.6** of the EA and were addressed throughout the EA.
Industry and Investment	Letters, phone call, meeting	18/03/10 - present	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** of the EA. In addition, a Life of Mine Plan has been developed to encompass these requirements.
Department of Environment, Climate Change and Water	Letters, phone call	18/03/10 - present	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** of the EA.
NSW Office of Water	Letters, phone call, meeting	18/03/10 - present	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** of the EA.
Hunter-Central Rivers Catchment Management Authority	Letters, phone call	18/03/10 - present	***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.	

Stakeholder	Method of Engagement	Date	Issues Raised/Comments	Section Addressed
Roads and Traffic Authority	Letters, phone call	18/03/10 - present	***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 (LMCC) 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** of the EA, while consultation with the RTA and LMCC is discussed in **Appendix 2** of the EA.
Lake Macquarie City Council	Letters, phone calls, site visit and presentation,	18/03/10 - present	***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.	These have been considered in the preparation of the relevant key specialist reports and the EA.
Energy Australia	Letters, risk assessment workshop attendance	11/09/09 – 29/04/10	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	Letters, emails, phone calls	06/11/09 – Dec 2009	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	Letters, risk assessment workshop attendance, emails		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	Letters, risk assessment workshop attendance	11/09/09 – Dec 2009	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 are aware of the bore and its input into the Eraring Ash Dam. ***No initial issues were identified and consultation is ongoing.***	**N/A**

Stakeholder	Method of Engagement	Date	Issues Raised/Comments	Section Addressed
Mine Subsidence Board	Site inspection and presentation	23/10/09	Presentation by Awaba Colliery 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**
Aboriginal and other Interested Groups	Letters	12/09/05 - present	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 9.2.2** of the EA
Awaba Colliery Employees	Meetings (including toolbox talks), newsletters		***No issues were raised***.	**N/A**
Newstan Community Consultation Committee	Newsletter provided to Awaba resident on Newstan CCC		***No issues were raised***.	**N/A**
General public responses to advertisement/PEA exhibition	Newsletter, Advertisement within the Lakes Mail, Centennial website		***No issues were raised***.	**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).

3.2 GOVERNMENT AGENCY CONSULTATION

3.2.1 NSW Department of Planning

The consultation for the Project involved the preparation of a Preliminary Environmental Assessment (PEA) that was submitted to the NSW Department of Planning (DoP) on the **3rd March 2010** 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. All of the required agencies were provided a copy of the PEA on the **18th March 2010** this included:

- Industry and Investment (I&I);
- Department of Environment, Climate Change and Water (DECCW);
- NSW Office of Water (NOW);
- Hunter-Central Rivers Catchment Management Authority (HCRCMA);
- Roads and Traffic Authority (RTA); and
- Lake Macquarie City Council (LMCC).

Centennial also contacted these agencies by phone notifying them of the provision of the PEA, and also to offer each of the agencies the chance to meet with Centennial and view a presentation of the Project and discuss any potential issues. This offer was accepted by I&I, NOW and LMCC. All other government agencies declined this opportunity.

The DGRs for the Project were received from DoP on the **22nd April 2010**. A summary of DGRs relevant to the SIA have been presented in **Table 3.** A complete list of the DGRs has been presented in **Table 1.1** of the EA.

Table 3 – Director General Requirements for the SIA

Director General Requirements	Section Where Addressed
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** of the EA
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** of the EA

3.2.2 NSW Industry and Investment

As mentioned in **Section 3.2.1**, a copy of the PEA was provided to NSW Industry and Investment (I&I) on the **18th March 2010**. I&I responded to DoP on the **9th April 2010** (via letter) and provided comments on the PEA for consideration into the DGRs for the Environmental Assessment. A copy of the letter from I&I is included in **Appendix 2** of the EA.

Additionally, a meeting was held with I&I in Maitland on the **15th June 2010** which was attended by Greg Summerhayes, Ray Ramage and Elizabeth Laidlaw. During this meeting, Centennial presented an overview of the Project including; definition of the Project, relevant legislation and approvals relating to the Project, mine design, management of existing workings (existing and future), study areas and consultation. Following this there was a discussion with I&I regarding key issues to be addressed with the Environmental Assessment.

Additional comments from I&I that were not included within the DGRs, including those discussed during the meeting, have been incorporated into this Environmental Assessment, or, are being addressed in separate processes. This has included providing a commitment for subsidence monitoring and rehabilitation post mining and updating the existing *Life of Mine Plan* for Awaba Colliery to include more detailed commitments for mine closure in consultation with relevant agencies (i.e. LMCC and I&I).
Of note, the Environmental Assessment has also addressed the following comments from I&I:

- Management of subsidence within historical workings areas (**Section 9.4 – Life of Mine Rehabilitation**);
- Mine design and depth of cover restrictions (**Section 7 – Mine Induced Subsidence**); and
- Spontaneous combustion (**Section 9.12 – Hazards Management**).

3.2.3 Department of Environment, Climate Change and Water

A copy of the PEA was provided the Department of Environment, Climate Change and Water (DECCW) on the **18th March 2010**. DECCW responded to DoP on the **6th April 2010** (via letter) which identified the information required by DECCW to assess the proposal. These requirements are outlined in the letter from DECCW included in **Appendix 2** of the EA. A summary of the key information requirements was provided by DECCW and included:

- Impacts on water quality;
- Impacts on quantity in water resources;
- Subsidence impacts; and
- Impacts of threatened species and their habitat.

All specialist studies for the Project have been prepared in consideration of the DECCW comments for the DGRs. In particular, to address the above key information requirements, the following were undertaken (and discussed within the EA):

- Impacts on water quality and quantity was assessed by GHD (**Section 9.1**)
- Subsidence impacts were assessed by Seedsman Geotechnics (**Section 7**); and
- Threatened species were assessed by Hunter Eco (**Section 9.9**). It is noted that the assessment for threatened species also included a referral under the *Environment Protect and Biodiversity Conservation Act* (1999) to the Australian Federal Department of Environment, Water, Heritage and the Arts.

During the consultation for the Aboriginal Heritage Impact Assessment for the Project, RPS contacted the DECCW – Aboriginal Heritage Unit on **15th April 2010**, to discuss the correct consultation guidelines to be followed for the Project. DECCW advised that the wording of ‘meeting’ in the transitional guidelines refers to the ‘presentation’ of information under Stage 2 of the *Aboriginal Cultural Heritage Consultation Requirements* (ACHCR), which may be provided in person, or verbally. The consultation log for the Project by this date showed that information had been provided and registered parties were verbally contacted and thus consultation should continue under the *Interim Community Consultation Guidelines* (ICCGs).

3.2.4 NSW Office of Water

On the **18th March 2010** the NSW Office of Water (NOW) were provided with a copy of the PEA. Following this on the **23rd March 2010** Centennial contacted Fergus Hancock (of NOW) and discussed the Project, particularly with regard to Awaba Colliery and potential water licensing issues. NOW provided a letter to DoP on the **19th April 2010** to provide comments to be considered for the DGRs.

A copy of the letter provided by NOW is included in **Appendix 2** of the EA. A surface and groundwater assessment for the Project was undertaken by GHD, the results from this assessment are discussed in **Section 9.1**.

A meeting was held at Centennial Newstan on the **11th May 2010** which was attended by Fergus Hancock. This meeting discussed the Project and water licensing issues for both Awaba and Newstan Collieries. It was agreed at this meeting that Awaba Colliery would apply to license water extraction and monitoring bores following approval for the proposed Project.

3.2.5 Hunter-Central Rivers Catchment Management Authority

A copy of the PEA was provided to Hunter-Central Rivers Catchment Management Authority (HCRCMA) on the **18th March 2010**. HCRCMA responded to DoP regarding the Project on the **26th March 2010**. There were no major issues with DGRs provided by DoP for comment, however, HCRCMA did propose minor amendments for biodiversity, cultural heritage and the reference list. A copy of the letter provided by HCRCMA is included in **Appendix 2** of the EA.

It is noted that while HCRCMA proposed the inclusion of the *Hunter-Central Rivers Catchment Action Plan* into the reference list, they recognised that the most relevant guiding principles from the *Hunter-Central Rivers Catchment Action Plan* were already addressed by the DGRs. No further comments were received from HCRCMA.

3.2.6 Roads and Traffic Authority

A copy of the PEA was provided to the Roads and Traffic Authority (RTA) on the **18th March 2010**. RTA responded to DoP regarding the Project on the **9th April 2010**. A copy of the letter provided by RTA is included in **Appendix 2** of the EA. RTA suggested that the traffic assessment for the Project be undertaken in accordance with the *Roads and Traffic Authority's Guide to Traffic Generating Developments*. These guidelines were addressed in the traffic assessment for the Project as detailed in **Section 9.3**.

It is also noted that RTA were provided a copy of the draft traffic assessment for the Project, and offered the opportunity to meet and discuss the report with Centennial and GHD. It was decided by RTA that due to the road being managed by the Lake Macquarie City Council a meeting was not necessary, and the council should be consulted.

3.2.7 Lake Macquarie City Council

Following the provision of a copy of the PEA on the **18th March 2010**, the Awaba Colliery was contacted by the Lake Macquarie City Council (LMCC) Principal Development Planner on the **24th March 2010** requesting a site visit for several LMCC staff. On the **29th March 2010**, LMCC provided a letter to DoP to provide comment on the DGRs for the Project. It should be noted that this letter provided no major issues with the DGRs, however, did provide a list of references to be used for the Project.

On the **19th April 2010**, seven (7) employees from LMCC visited the Awaba Colliery. A Project presentation was provided by Centennial followed by a site tour. No issues were raised by LMCC during this visit.

During the preparation of the traffic assessment for the Project LMCC were contacted by GHD to discuss the site access for the Awaba Colliery on Wilton Road. On the **25th May 2010**, LMCC suggested, considering there are less than 250 car parking spaces at the Awaba Colliery, the site access be treated as a driveway access, and should allow sight distances accordingly. It is noted that these sight distances already exist. However, LMCC also expressed concern about the lack of signage on the approach to Awaba Colliery. These concerns have been addressed within the recommendations of the traffic assessment and the statement of commitments for the Project (**Section 9.3** and **Section 10** of the EA respectively). There were no other comments regarding the condition of the road.

LMCC were provided a copy of the draft traffic assessment for the Project, and offered the opportunity to meet and discuss the report with Centennial and GHD. It was decided by LMCC that the traffic assessment was adequate and a meeting was not necessary.

3.3 COMMUNITY CONSULTATION

Community consultation for the Project was undertaken by Centennial in accordance with the SEP. The SEP provides the consultation strategy to be implemented and also identifies the relevant stakeholders for the Project. On the **18th March 2010** an article regarding the Project was published in the Lakes Mail formally notifying the community of the Project. Additionally residents of the Awaba village and a member of the Newstan Colliery Community Consultation Committee, whom resides in Awaba, were provided with a newsletter with details of the Project on the **29th March 2010**. A copy of the newsletter was also made available for download from the Centennial website - http://www.centennialcoal.com.au/.

Copies of the Lakes Mail article and the newsletter are provided in **Appendix 2** of the EA.

Copies of the PEA have been made available on the DoP and Centennial websites.

In addition, the community are able to pose questions, request information or make complaints about the operation via a dedicated phone line. **The Awaba Colliery Community Information Line is (02) 4950 3435**.

There have been no inquiries, or comments from the community regarding the Project to date.

3.4 OTHER RELEVANT STAKEHOLDER CONSULTATION

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 and Revised Stage 3 Areas. These relate 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 have previously 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 not include these stakeholders. Details of the consultation undertaken for the previous SMP applications are provided in the SMP written reports for both Main South Area Stage 2 and Revised Stage 3.

The previous SMP applications and accompanying management plans, for both Main South Area Stage 2 and Revised Stage 3, are available for download from the Centennial website - http://www.centennialcoal.com.au/.

It is noted, however, that contact was made with Eraring Energy on **20th August 2010** regarding the ongoing use of the 10 South de-watering bore for the Project. Eraring Energy indicated they were aware of the bore and its input into the Eraring Ash Dam. No initial issues have been identified and consultation is ongoing.
In addition, a letter describing the Project was sent to Telstra and Energy Australia on the **28th April 2010**. No comments were received regarding the Project.

3.5 ABORIGINAL COMMUNITY CONSULTATION

3.5.1 Introduction

The purpose of Aboriginal community consultation is to provide an opportunity for the relevant Aboriginal stakeholders to have input into the heritage management process. Aboriginal community consultation for surveys within the Application Area has been ongoing since 2005. **Section 3.5.2** provides a brief description of the Aboriginal community consultation undertaken previously for the Awaba Colliery, while **Section 3.5.3** details the consultation undertaken specifically relating to this Environment Assessment. In addition, part of the Application Area is covered by an Indigenous Land Use Agreement (ILUA), this is described in **Section 3.5.4**.

3.5.2 Previous Aboriginal Consultation

Awaba Colliery has undertaken a number of heritage assessments which have involved consultation with the Aboriginal community for various portions of land within the Application Area (ERM 2005; Indigenous Outcomes Pty Ltd 2007; RPS 2009; RPS 2010a as cited in RPS 2010b). 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 undertaken for each of these assessments has been detailed within the respective reports. These have been included as appendices to the Aboriginal Heritage Impact Assessment for the Project (**Appendix 7** of the EA).

In addition to the consultation process undertaken for the above heritage assessments, these also typically involved the participation of the Aboriginal community in the completion of a field survey. **Table 4** provides a summary of the previous surveys undertaken within the Application Area.

Table 4 – Previous Surveys Undertaken within the Application Area

Survey Area	Participants[1]	Date	Source	Comment
Study Area 1 – portion of (i.e. quarry area)	KLALC & ADTOAC	23rd Feb, 2007	Indigenous Outcomes Pty Ltd (2007)	This survey was undertaken by seven participants from two interested Aboriginal Groups (including six from KLALC and one from ADTOAC)
Study Area 2 - (Main South Area[2])	WNAC	12th & 13th Sep, 2005	ERM (2005)	Survey undertaken as part of a Subsidence Management Plan application. This survey also covered areas not within the Application Area for the Project
Study Area 2 - northern portion (i.e. Revised Stage 3 Area)	WNAC & KLALC	7th & 13th Oct, 2009	RPS (2009)	Survey undertaken as part of a Subsidence Management Plan application submitted to I&I in Dec, 2009.
Study Area 3 - East B Area	WNAC, KLALC & ADTOAC	7th & 13th Oct, 2009 and 16th Apr, 2010	RPS (2010a)	The survey for Study Area 3 was undertaken in two parts. The northern portion was surveyed in October 2009, and following an extension of the area to the south a second survey was undertaken in April 2010.
Note 1: WNAC = Wonnarua Nation Aboriginal Corporation; KLALC = Koompahtoo Local Aboriginal Land Council; and ADTOAC = Awabakal Descendants Traditional Owners Aboriginal Corporation.				
Note 2: Original survey included entire Main South Area, which was approved in stages (i.e. Stage 1, Stage 2 and the 'Revised' Stage 3 Areas). As the Stage 3 Area had been 'Revised' a separate survey was undertaken within the Revised Stage 3 Area.				

3.5.3 Aboriginal Consultation for the Project

The consultation process with local Aboriginal stakeholders 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.

New consultation guidelines, *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (2010) were released in April 2010. However, as discussed in **Section 3.2.3**, DECCW has advised that consultation commenced for projects prior to the 12 April 2010 can continue under the ICCR process. In these circumstances the proponent is not required to recommence consultation under the new 2010 guidelines. Consultation for the Project under the ICCR guidelines was commenced in March 2010.

Stage 1 of the ICCR process (notification of stakeholders) was undertaken by contacting the relevant authorities regarding potential Aboriginal stakeholders for the study area (Local Aboriginal Land Council, Registrar of Aboriginal Owners, Native Title Services, Local Councils and DECCW) and an advertisement placed in a local print media. The 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. The registered groups and / or individuals are shown in **Table 5**.

Table 5 – List of Registered Aboriginal Stakeholders for the Project

Aboriginal Stakeholder	Date Expression of Interest Received
Awabakal Traditional Owners Aboriginal Corporation	30-Mar-2010
Daniella Chedzey	31-Mar-2010
Wonn1 Contracting	31-Mar-2010
Awabakal Descendants Traditional Owners Aboriginal Corporation	1-Apr-2010
Gidawaa Walang Cultural Heritage Consultancy	7-Apr-2010
Wonnarua Nation Aboriginal Corporation	8-Apr-2010
NSW Aboriginal Land Council acting on behalf of Koompahtoo Local Aboriginal Land Council	14-Apr-2010

Stage 2 ICCR letters were sent to the registered stakeholders detailing the methodology for the assessment. No comments regarding Stage 2 of the ICCRs were received.

A copy of the Aboriginal Heritage Impact Assessment was forwarded to the seven (7) registered groups for comment in April 2010. The responses indicate that there is in principle agreement with the report and that an Aboriginal Cultural Heritage Management Plan (ACHMP) should be prepared as part of the ongoing management for the Awaba Colliery. The preparation of an ACHMP is discussed in **Sections 9.2** and **10**.

3.5.4 Indigenous Land Use Agreement Consultation

The *Native Title Act 1993* (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.

Centennial (and formerly Powercoal) has undertaken extensive consultation with the Aboriginal community over a number of years for lands within the Application Area. Aboriginal consultation in the 1990s 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.

3.6 CONSULTATION OUTCOMES

The goal of the Awaba Colliery SEP was to establish a set of guidelines to effectively engage with stakeholders and to fulfil the commitment by Centennial to openly communicate with stakeholders about Awaba Colliery and the Project. This was communicated with local and state government authorities, Aboriginal groups and other relevant stakeholders for this Project. A number of strategies were implemented by Awaba Colliery to portray the relevant information to each of the stakeholders as detailed in the preceding sections.

Through the process of providing relevant information and engaging in one-on-one meetings and further discussions with interested groups Awaba Colliery has effectively resolved and addressed any issues raised regarding the Project. There were no further outstanding issues identified through this consultation process that are required to be addressed.

4 IDENTIFICATION OF POTENTIAL IMPACTS AND RESPONSES

A variety of potential issues were raised throughout the consultation process as demonstrated in **Table 6**. All identified issues with the exception of infrastructure have been adequately addressed through the completion of speciality reports. A summary of relevant mitigation measures shall be provided in **Section 6** of this report. Infrastructure and associated impacts shall be discussed in detail in **Section 5.1**.

Table 6 - Issues identified through the consultation process and response for the Project

Potential Issue	Response
Subsidence impacts	Specialist report by GHD; Subsidence Assessment Report , Subsidence Risk Assessment (see **Appendix 4** of the EA), and Mine Subsidence (see **Section 7** of the EA)
Rehabilitation	Mine Closure Plan (Centennial, 2008), and Life of Mine and Rehabilitation (see **Section 9.4** of the EA)
Water quality and quantity	Specialist reports by GHD; Water Management Assessment, Water Balance Assessment (see **Appendix 4a & 4b** of the EA), Watercourse Management Plan, Water Management Plan (in draft), and Water Management (see **Section 9.1** of the EA)
Threatened species and habitat	Specialist report by Hunter Eco Pty Ltd; Ecology Assessment (see **Appendix 11** of the EA), and Ecology (see **Section 9.9** of the EA)
Hydrology	Specialist reports by GHD; Water Management Assessment, Watercourse Management Plan, Water Management Plan (in draft), Water Balance Assessment (see **Appendix 4a & 4b** of the EA), and Water Management (see **Section 9.1** of the EA)
Landholder rights (water access)	Specialist reports by GHD; Water Management Assessment, Watercourse Management Plan, Water Management Plan (in draft), Water Balance Assessment (see **Appendix 4a & 4b** of the EA), and Water Management (see **Section 9.1** of the EA)
Social Infrastructure	This was identified by the SIA and has been discussed below in **Section 5.1**
Aboriginal heritage	Specialist report by RPS; Cultural Heritage Impact Assessment (see **Appendix 5** of the EA), and Aboriginal Heritage (see **Section 9.2** of the EA)

In addition, Awaba Colliery has identified a range of potential socio-economic impacts associated with the Project (see **Table 7**). These will be discussed in order to effectively assess the potential impacts of the Project.

Socio-economic impacts associated with the Project have been addressed by specialty reports with the exception of economic contributions and employment (see **Table 7**). Relevant mitigation measures that have been recommended by these reports shall be provided in Section 6 of this report. Economic contributions and employment shall be discussed in detail in **Section 5.2**.

Table 7 Socio-economic impacts and response for the Project

Socio-Economic Impact	Response
Economic contributions	This was identified by the SIA and has been discussed in **Section 6.3.2.1** of the EA.
Traffic	Specialist report by GHD; Traffic Assessment, and Traffic and Transport (see **Section 9.3** of the EA)
Hazards	Hazardous Substances Management System, Asbestos Management Plan, Bushfire Management Plan, Public Safety Management Plan, Spontaneous Combustion Management Plan and Hazards Management (see **Section 9.12** of the EA)
Aboriginal & European Heritage	Specialist report by RPS; Cultural Heritage Impact Assessment (see **Appendix 7** of the EA), Aboriginal Heritage and European Heritage (see **Sections 9.2** and **9.5** of the EA)
Employment	This was identified by the SIA and has been discussed in **Section 6.3.2.2**.
Environment	Specialist reports; Air Quality Impact Assessment by Heggies and Air Quality Management (see **Appendix 9** and **Section 9.7** of the EA**)**; Water Management Assessment, Water Balance Assessment by GHD (see **Appendices 4a & 4b** of the EA), Water Management Plan (in draft), Watercourse Management Plan and Water Management (see **Section 9.1** of the EA); Environmental Noise Impact Assessment by Heggies and Noise Management (see **Appendix 8** and **Section 9.6** of the EA**)**; and Ecology Assessment, by Heggies and Ecology (see **Appendix XX** and **Section 9.9** of the EA)

5 ASSESSMENT OF POTENTIAL ISSUES

5.1 IDENTIFIED IMPACTS

5.1.1 Social Infrastructure

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** of the EA).

5.2 SOCIO-ECONOMIC IMPACTS

5.2.1 Economic Contributions

The Awaba Colliery currently makes annual economic contributions of **$40.5 million** (see **Table 8**). 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 also 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 8 – 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 8** 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.

5.2.2 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 9** and **Figure 3**)(Australian Bureau of Statistics, 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% (see **Figure 3**) (Australian Bureau of Statistics, 2006). The 100 people employed by the Awaba Colliery (see **Table 10**) equate to 6% of the total people employed in the mining industry within the Lake Macquarie LGA.

Table 9 – 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						

Figure 3 – Employment by Industry as a percentage in Lake Macquarie LGA, Wyong LGA and NSW

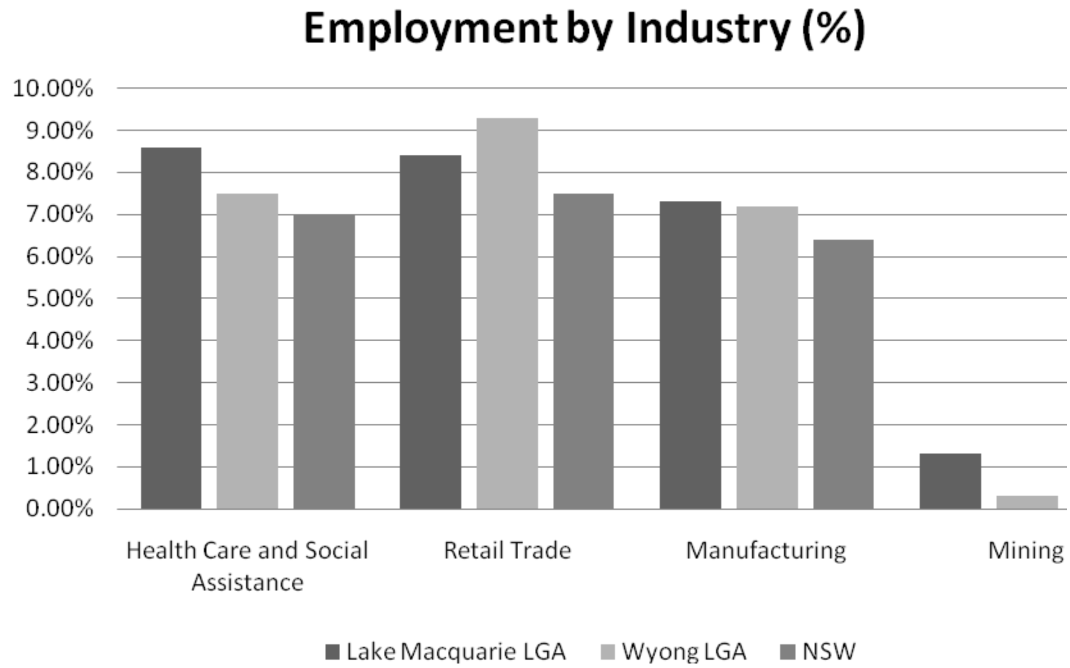


Table 10 – Working Arrangement

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 11**), 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 11 – Workforce Residential Location

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

6 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** and **7**, and discussed in **Section 9** of the EA. 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.

7 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 also 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 as a result 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.

8 REFERENCES

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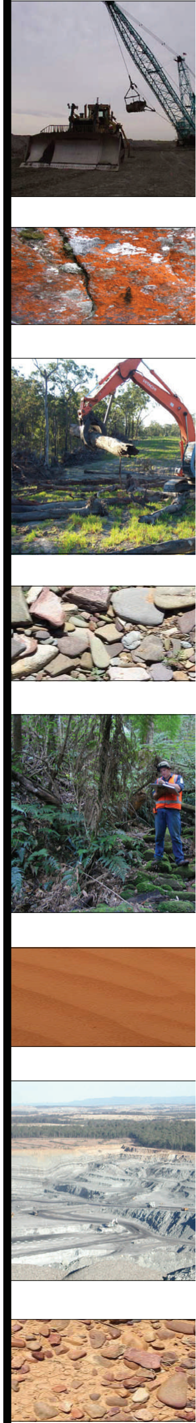


SUBSIDENCE IMPACT ASSESSMENT

APPENDIX 4

SEEDSMAN GEOTECHNICS PTY LTD
ACN 082 109 082

285 Cordeaux Road, Mt Kembla NSW 2526
Telephone 0417279556
Facsimile 0242712220

CENTENNIAL AWABA PTY LTD

SUBSIDENCE ASSESSMENT

PART 3A SUBMISSION

Awaba-30 SEPTEMBER 2010

SEEDSMAN GEOTECHNICS PTY LTD
ACN 082 109 082

285 Cordeaux Road, Mt Kembla NSW 2526
Telephone 0417279556
Facsimile 0242712220

Tuesday, 07 September 2010

Ref: Awaba-30

Mr G Watson
Manager – Awaba Colliery
PO Box 1000
Toronto NSW

Dear Grant,

Re: Subsidence assessment

We are pleased to submit this report that examines the subsidence implications of the layout being proposed for Study Areas 2 and 3 at Awaba Colliery.

Please contact the undersigned if you require further information.

Yours truly,

Ross Seedsman

EXECUTIVE SUMMARY

The mining layout for second workings at Awaba Colliery involves pillar stripping is conducted within panels that are less than 100m wide. This layout reduces the likelihood of rapid uncontrolled collapse of the Teralba Conglomerate while maintaining acceptable levels of coal recovery.

Previous mining immediately adjacent to the rail barrier has been reviewed. Subsidence at the rail lines has been less than 20mm and there has been no measured impact on the rail of the subsidence/floor heave events.

A model for subsidence/floor heave events has been developed and related to possible low strength horizons in the Awaba Tuff. Recent coring of the floor and a review of previous drilling at Awaba and Newstan Collieries indicates that such low strength layers have not been present in the area to the east of the rail line.

Subsidence levels of approximately 100mm are predicted above the pillars with an additional 100mm above the extraction panels. There may be some plug collapses activated during heavy rainfall events. No long-term additional subsidence events are predicted when the mine is flooded.

The predicted maximum subsidence is 200mm and the associated tilts and strains will not be measurable with standard survey tools. A plug collapse geometry, which has a negligible likelihood of developing is also provided as the basis for a risk assessment.

TABLE OF CONTENTS

List of Tables

List of Figures

1 INTRODUCTION

This introduction was provided by GSS and is reproduced in full, with the only change being the figure numbering to be compatible with this report.

1.1 Background

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 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 site is situated on crown land under lease to Centennial for the purpose of mining under Consolidated Coal Lease CCL746, and is adjacent to the Newstan-Eraring haul road owned by Eraring Energy. The locality of the mine is illustrated on Figure 1.

Awaba Colliery is a small operation with approximately 100 employees and contractors, 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.

A form of pillar extraction of narrow panels is used to recover coal in pillars developed previously by bord and pillar methods. 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 has been developed in consultation with the Department of Primary Industries – Mineral Resources (now known as Industry and Investment, NSW (I&I)) and has been used successfully to date, and is proposed to be continued for the Project.

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. A detailed description of the Project and the **Project Application Area (*the "Application Area"*)** (including focus study areas) is detailed further in **Sections 1.2 and 1.3** below.

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 outlined in **Sections 1.2** and **1.3** below.

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 (refer **Section 1.2.1**) over a period of approximately five years or more, depending on actual mining conditions and relevant market drivers.

The application for the proposed Project is supported by an Environmental Assessment ("EA").

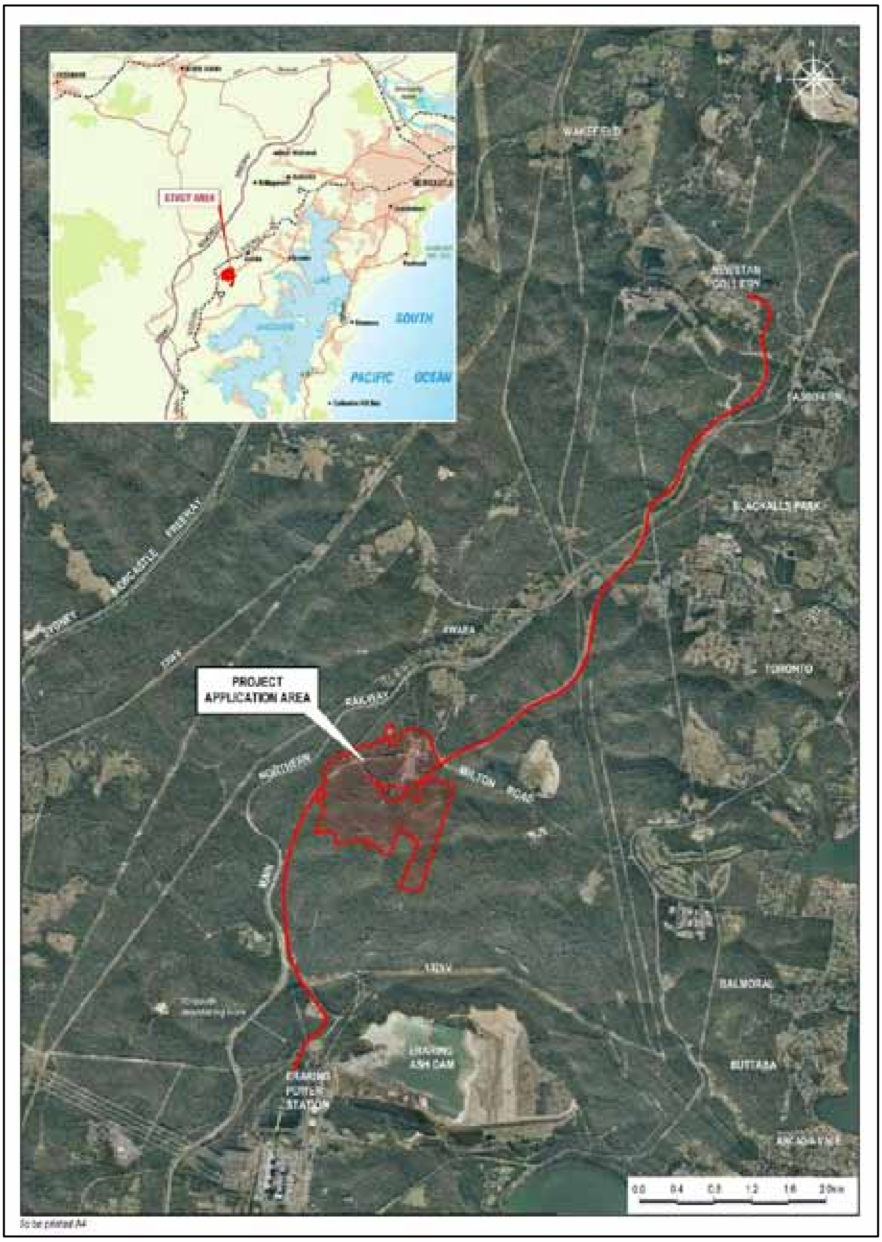


Figure 1 Locality plan (supplied by GSS Environmental)

1.2 Project Application Area

The **Project Application Area** (the “Application Area”) is illustrated on Figure 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 1.2.1**. 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.

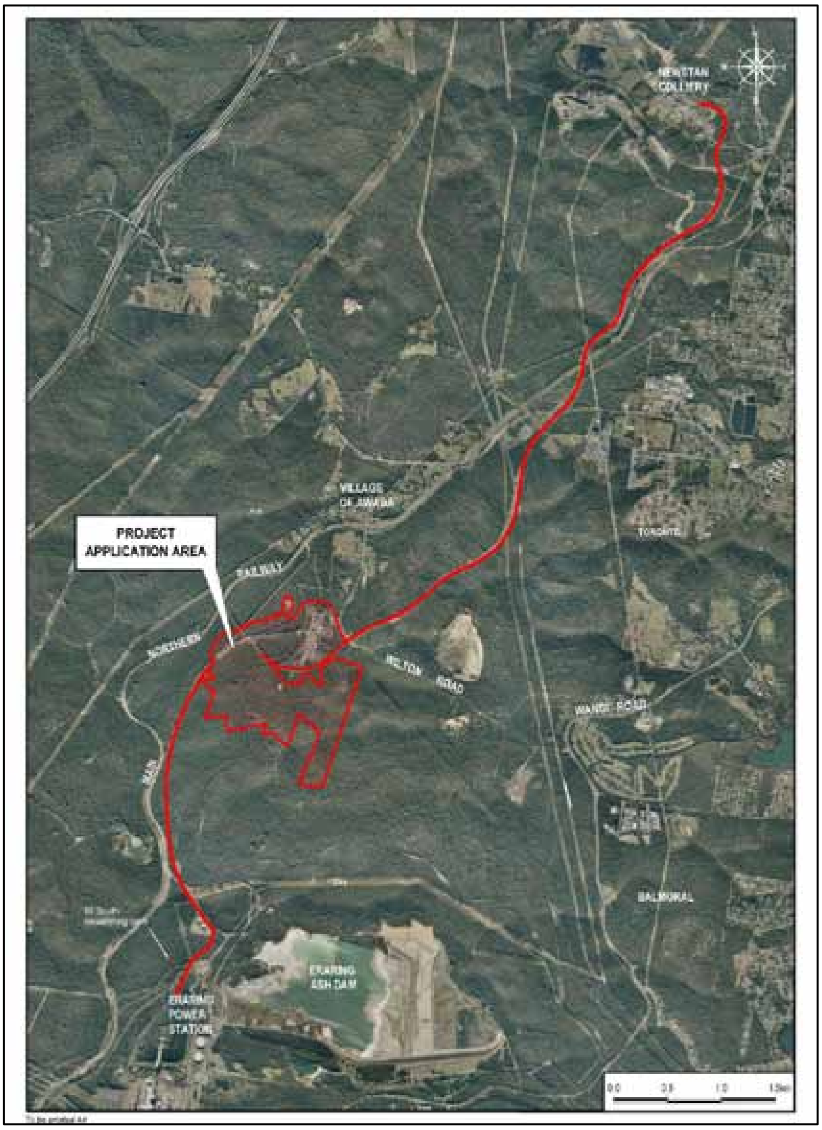


Figure 2 Project Application Area (supplied by GSS Environmental)

1.2.1 Study Areas

The Study Areas that have been assessed as part of this EA are shown on **Figures 3** and **4** 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 4**); 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 Section 96(1A) of 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 will also be addressed in the EA.

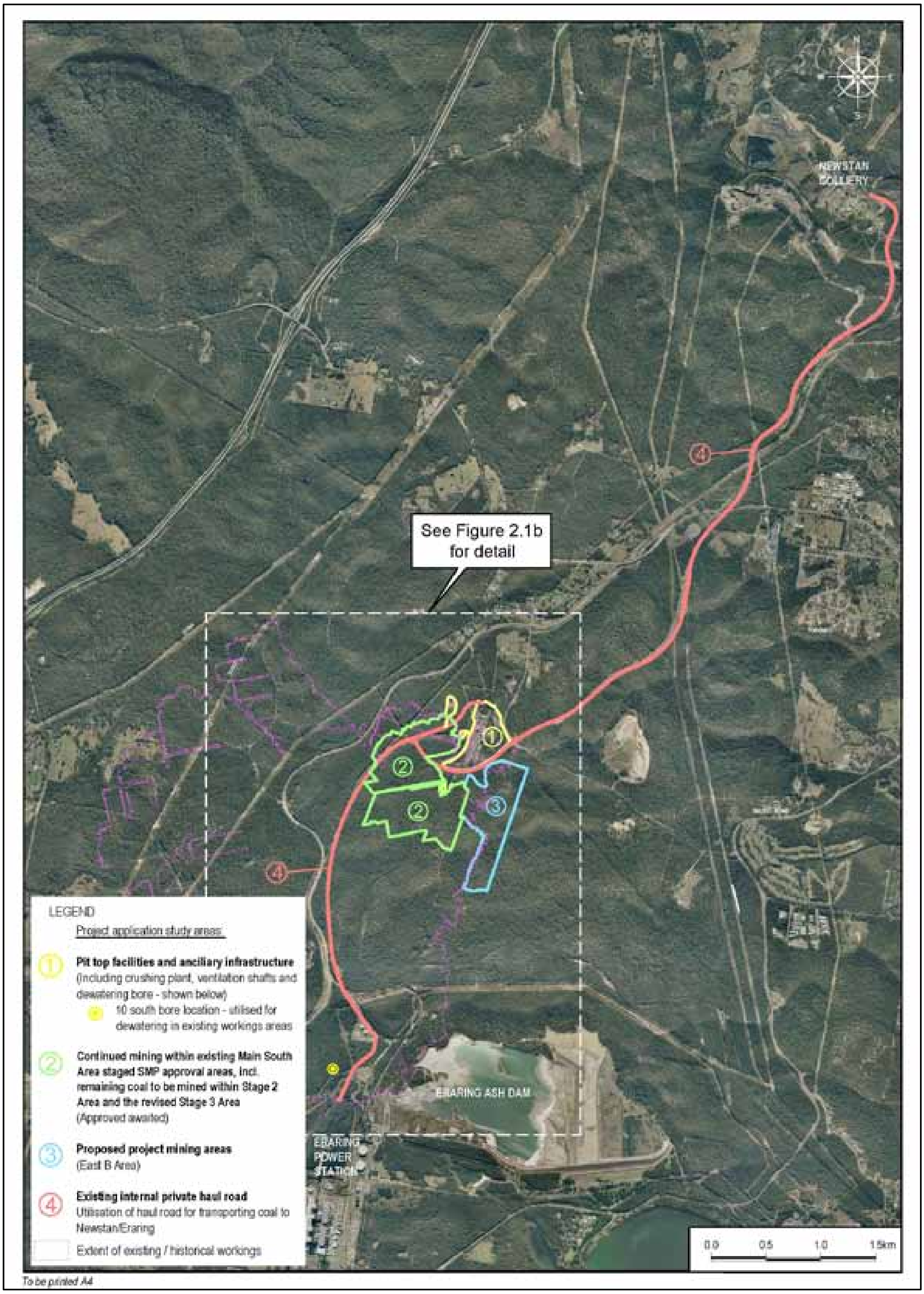


Figure 3 Study areas (supplied by GSS Environmental)

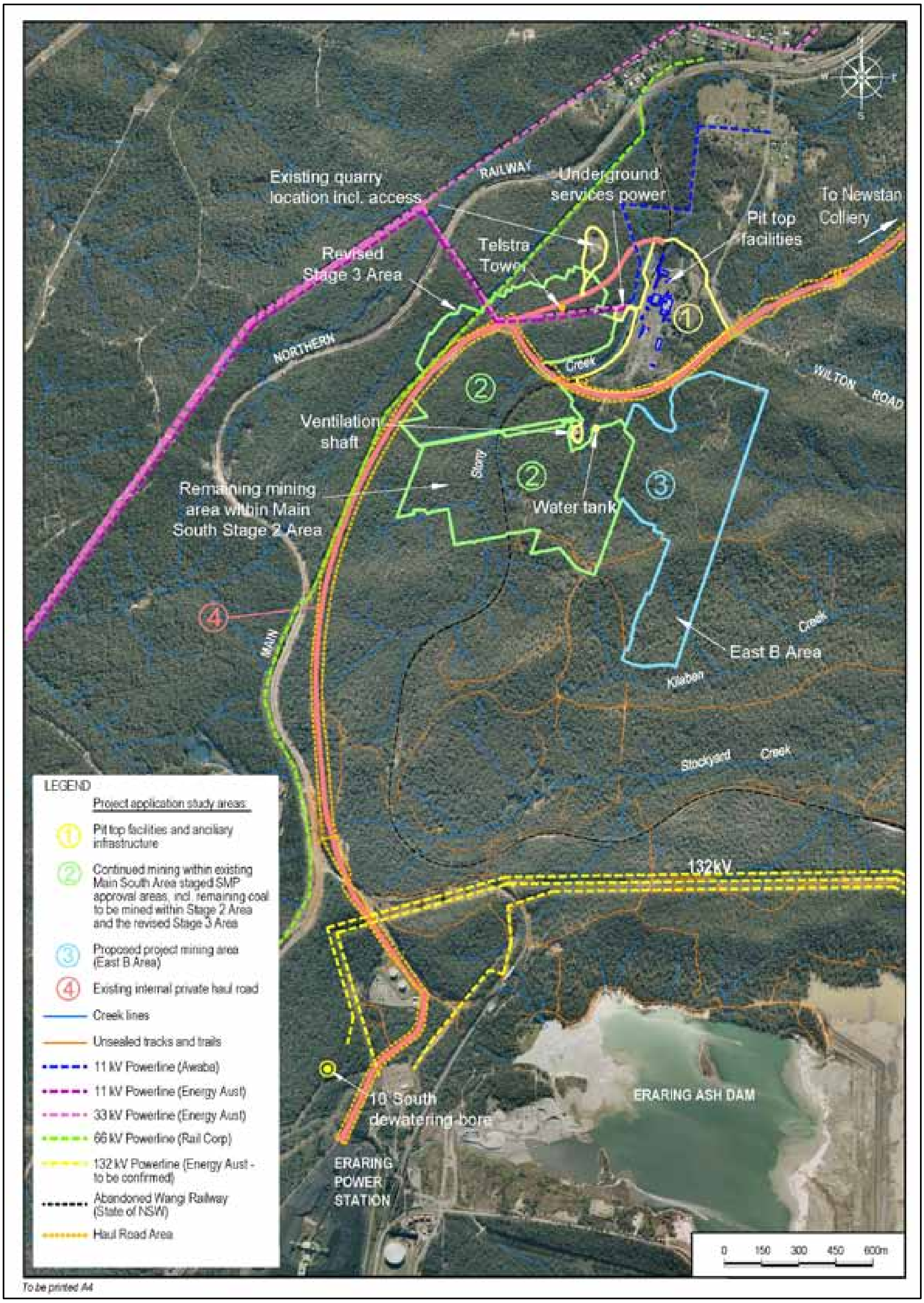


Figure 4 Detail of study areas (supplied by GSS Environmental)

1.3 Project Description

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) utilising existing surface facilities;

- Continue the use of existing ancillary surface facilities (all **Study Areas**);

- Expand the existing final Pollution Control Dam (refer **Study Area 1**);

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

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 3 and 4.

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 3 and 4:

- **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).

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 4) 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 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 NSW in 2009, until such time that a final Detailed Life of Mine Strategy has been developed.

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

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
Existing mining areas, will continue to be utilised for ongoing mining operations including (but not limited to) mine access, emergency management and underground services and infrastructure.

Continuing Mine Operations:

For the purposes of environmental assessment, further to the information above regarding continued mining areas, it is noted that the following aspects of mine operations are proposed to continue and remain <u>unchanged</u>. Existing mining operations are presented in detail in Section 3 of the *Environmental Assessment (EA)* and, where relevant, components are discussed further in this specialist report.

- **Coal Handling, preparation and stockpiles –** No changes are proposed to the current coal handling, preparation or stockpile procedures to the existing operations;

- **Mine support facilities and site access –** No changes are proposed to the current infrastructure and facilities, with the only exclusion being the expansion of the Pollution Control Dam (PCD) mentioned earlier above, with related water management considerations. Mine access from Wilton Road will continue to be utilised and no significant change is anticipated from current use;

- **Plant and equipment –** No changes are proposed to the typical plant and equipment used at the Awaba Colliery;

- **Transportation procedures –** 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;

- **Mining methodology –** There will be no significant changes to current mining methods 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 (financial year), depending on mining efficiency and market demands;

- **Operational water management –** 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;

- **Mine dewatering procedures –** the10 South Bore will continue to be used for groundwater management and dewatering during both continued operation and care and maintenance conditions.

2 DEVELOPMENT OF THE RECENT MINING STRAGEGY

2.1 Background

As a result of difficulties in obtaining approval for an extraction strategy based on stripping one side of the current standing pillars, as well as a review of the layout subsequent to a floor heave and subsidence event in late 2006, a new mine plan was formulated. This layout involves the taking of more coal from selected standing pillars but with panels that are no more than 100m wide, and has been applied since mid 2007. The dark shaded areas in Figure 5 show where this extraction has been conducted up to February 2010.

Awaba Colliery has large expanses of first working pillars that have typical minimum pillar centres of 21m to 23m with roadways of nominal 5.5m width (Figure 5). Typically, 5 to 7 rows of pillars define panels that are identified by name. Study Area 2 is such an area of standing first working pillars. New first workings are proposed for much of Study Area 3.

The proposed second workings at Awaba are based on exploiting the spanning capabilities of the Teralba Conglomerate that lies above the Great Northern Seam. The layout is referred to as the “bridging layout” to contrast it to the stripping layout previously considered. In general, pillars within panels that are no more than 100m wide are stripped by a maximum of 15m thus leaving small stooks that should manage any 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. The pillar design does not necessarily produce long-tem stable pillars.

The stability of the pillar/floor system will vary depending on the nature of the Awaba Tuff in the floor. It is recognized 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. A key aspect of the planning for the layout is that floor failure does not result in rapid and uncontrolled collapse of the strata above the extraction panels.

The implementation of the bridging layout recognizes the agreement with Rail Corp that the requirements of the Department of Primary Industry be adopted. Thus no second workings are to be conducted within a protection zone defined as the sum of 20m from the nearest rail, a step out distance defined by a 35^{o} angle of draw, and an additional distance of 100m. Furthermore, there have been requirements not to extract pillars under certain creek lines.

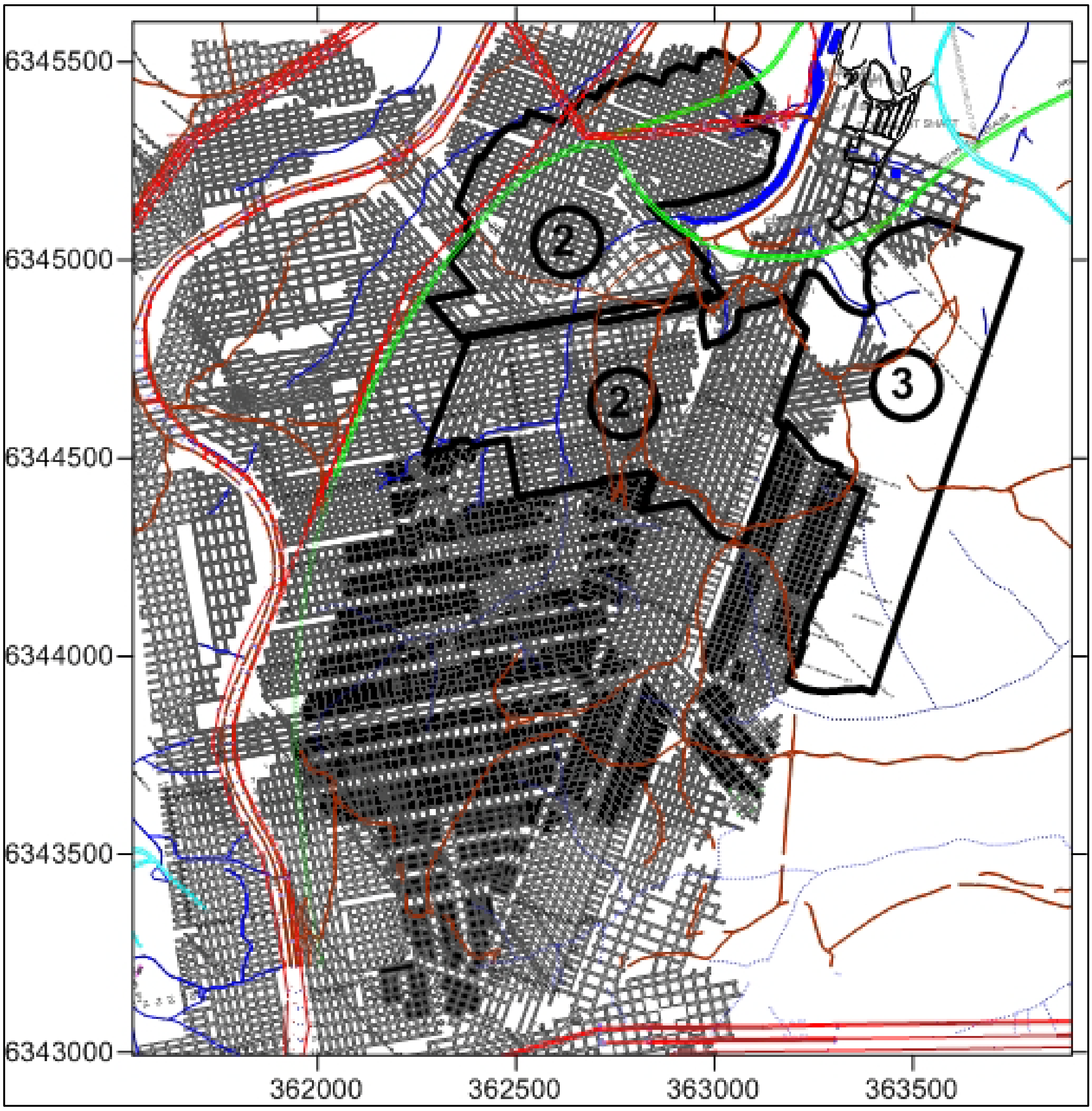


Figure 5 Indication of the extent of first working pillars and the area over which new mining system has been applied up to February 2010.

2.2 Previous mining

Awaba Colliery has experienced a number of events in which there was rapid subsidence of the surface and the onset of floor heave in working panels. The pillars involved had been formed on 20m centres and at depths from 25m to 80m such that the pillars themselves have had very high factors of safety. There have also been reports of wind rush events in association with the failures. It is important to note that such events did not always develop with pillars of these dimensions – there are many areas of Awaba still standing with pillars formed on 20m centres.

The term "creep" has been used for these events. Creep is informally defined as a progressive pillar collapse and hence may not be the ideal terminology for these events as they happen very quickly and do not involve the failure of the coal pillar themselves. It would be better to refer to them as floor heave/subsidence events. Neither the floor heave/subsidence events nor other mining have had an adverse impact on the railway barrier as there are no reports of any closing of the rail line.

2.2.1 Subsidence along the rail barrier

The rail line was monitored during the extraction of 4 South, 9 West, 2 East, and 15 West (Figure 6) in the early 1980s. The depth of cover in this area is about 50m. The results of the survey along the rail line are shown in Figure 7, and for the 9 West line in Figure 8.

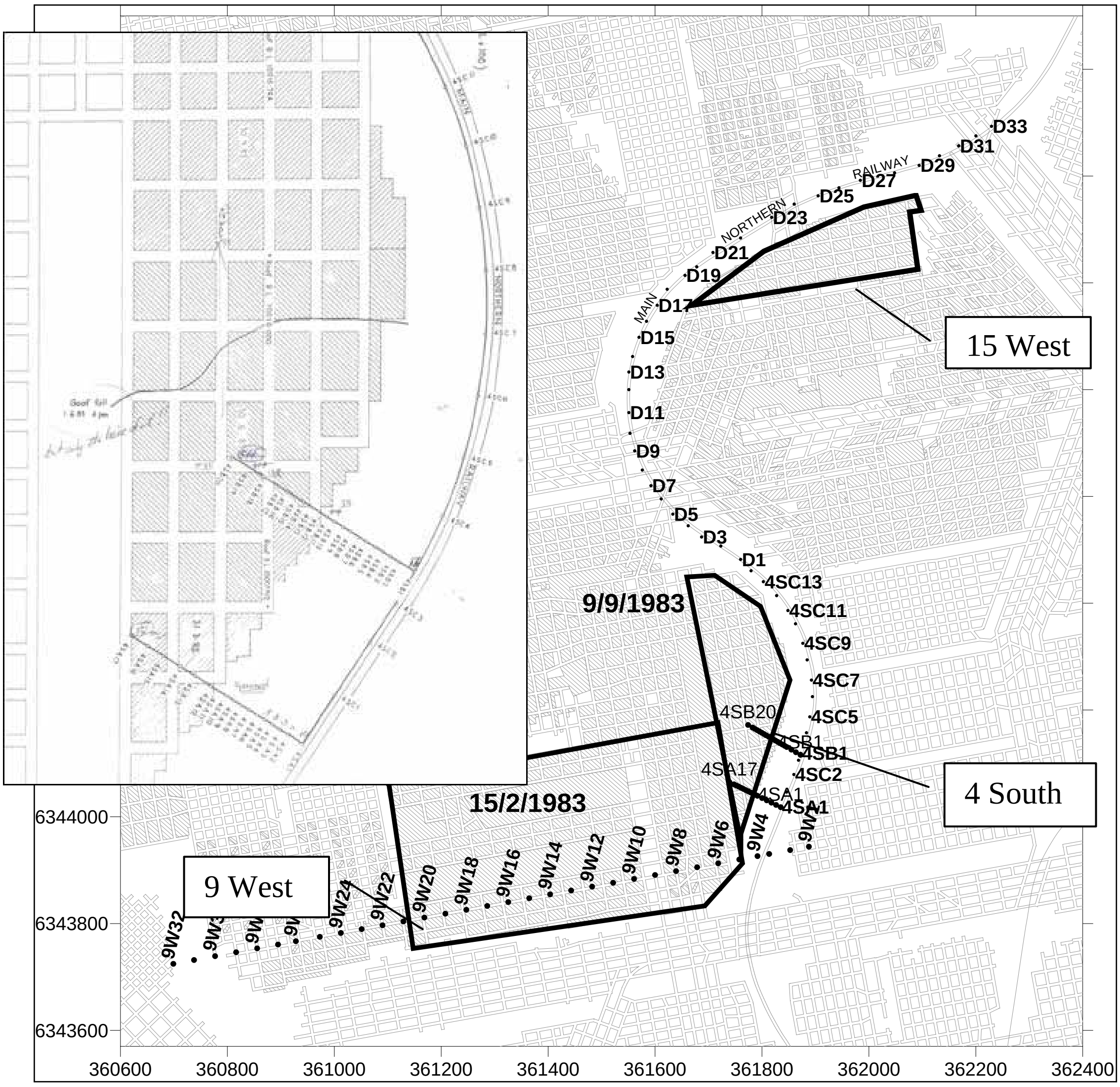


Figure 6 Survey points along rail and along 9 West, also showing dates of pillar extraction

Maximum subsidence at the rail was 32mm and this occurred when there was pillar extraction on both sides of the railway zone (Figure 6). With first workings on one side and extraction on the other side, the measured movements were less than 20mm.

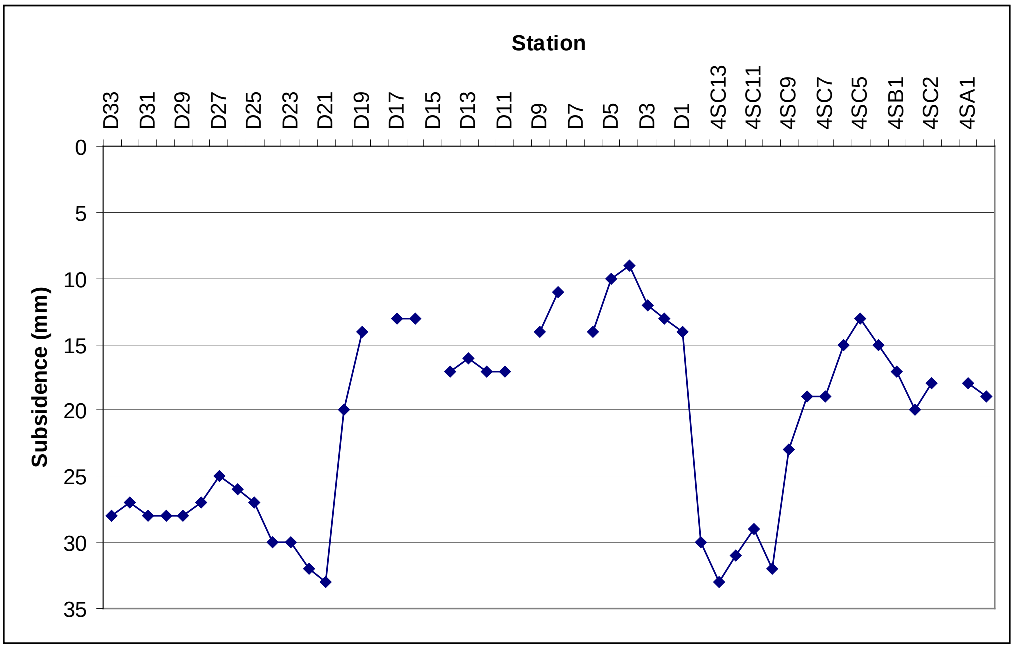


Figure 7 Compilation of vertical subsidence along D and 4SC lines (Drawings HA-536 and HA-437, end 1985)

During the extraction of 9 West, the goaf edge subsided by approximately 40mm, and the 20mm subsidence level was measured at station 9W4, approximately 55m from the goaf edge.

Figure 8 Vertical subsidence above 9 West (Drawing HA-338/1 - December 1985)

The extraction of 4 South was monitored with 2 cross lines (Figure 9). Crossline 4SA suggests that the conglomerate roof did not fully cave, and that there was approximately

26mm of subsidence at the goaf edge. Crossline 4B suggests that there was incomplete subsidence of the conglomerate and that the 20mm subsidence level was about 15m from the goaf edge.

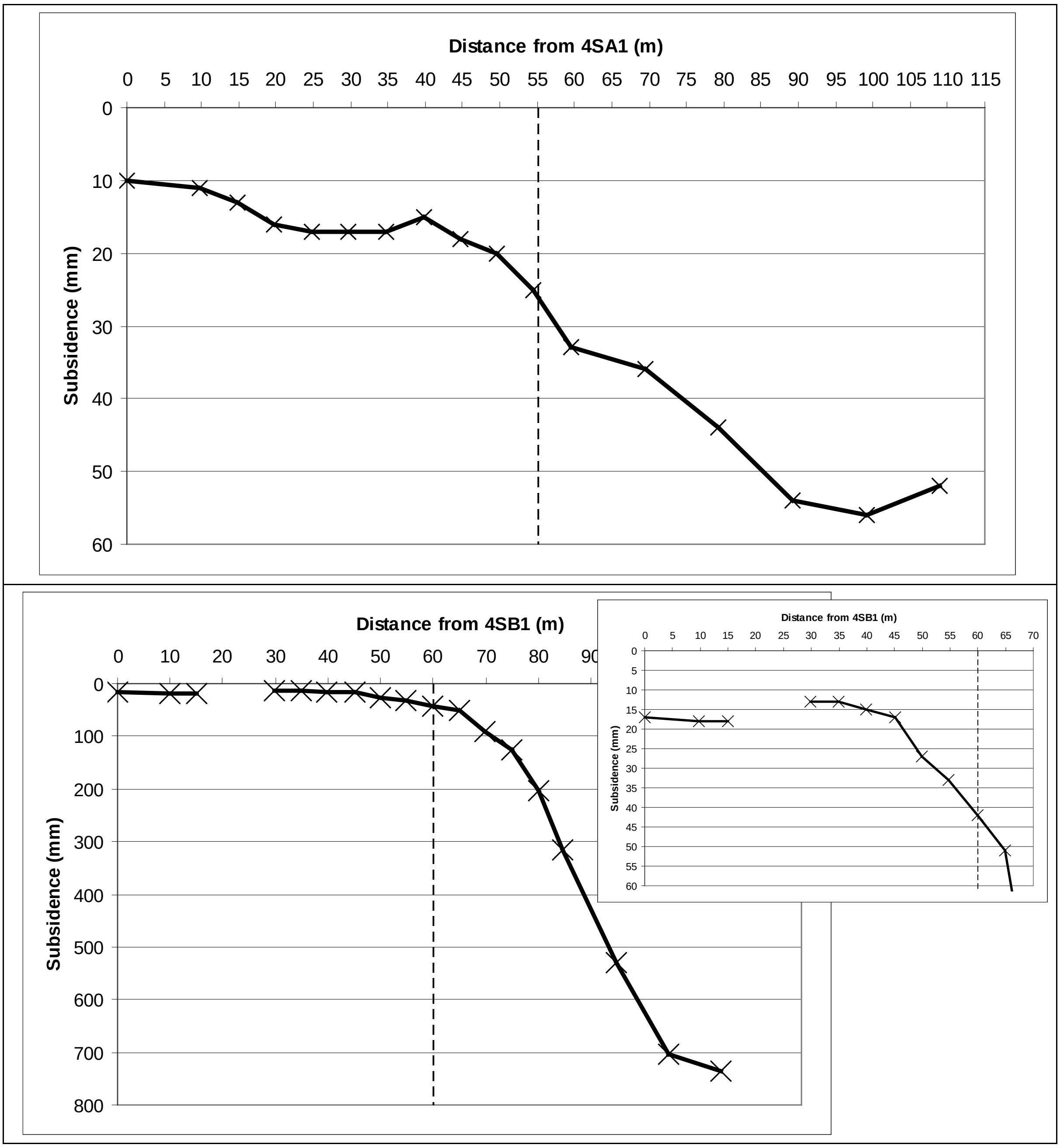


Figure 9 Vertical subsidence above 4 South (Drawing HA-338/2 – December 1985)

2.2.2 Location of floor heave/subsidence events

The location of known floor heave/subsidence events is shown in Figure 10. All events have occurred on the west and north side of the railway, and at depths between 25m and 80m.

there have been no heave events to the east of the railway line. The information in Figure 10 is drawn from colliery plan AW1253 which was created in November 2003 based on personal recollections from the 1980s. The plan identifies the panels that experienced floor heave/subsidence events, but not exactly which parts of the panels did. The plan does not show the status of the adjacent layout when the panels collapsed.

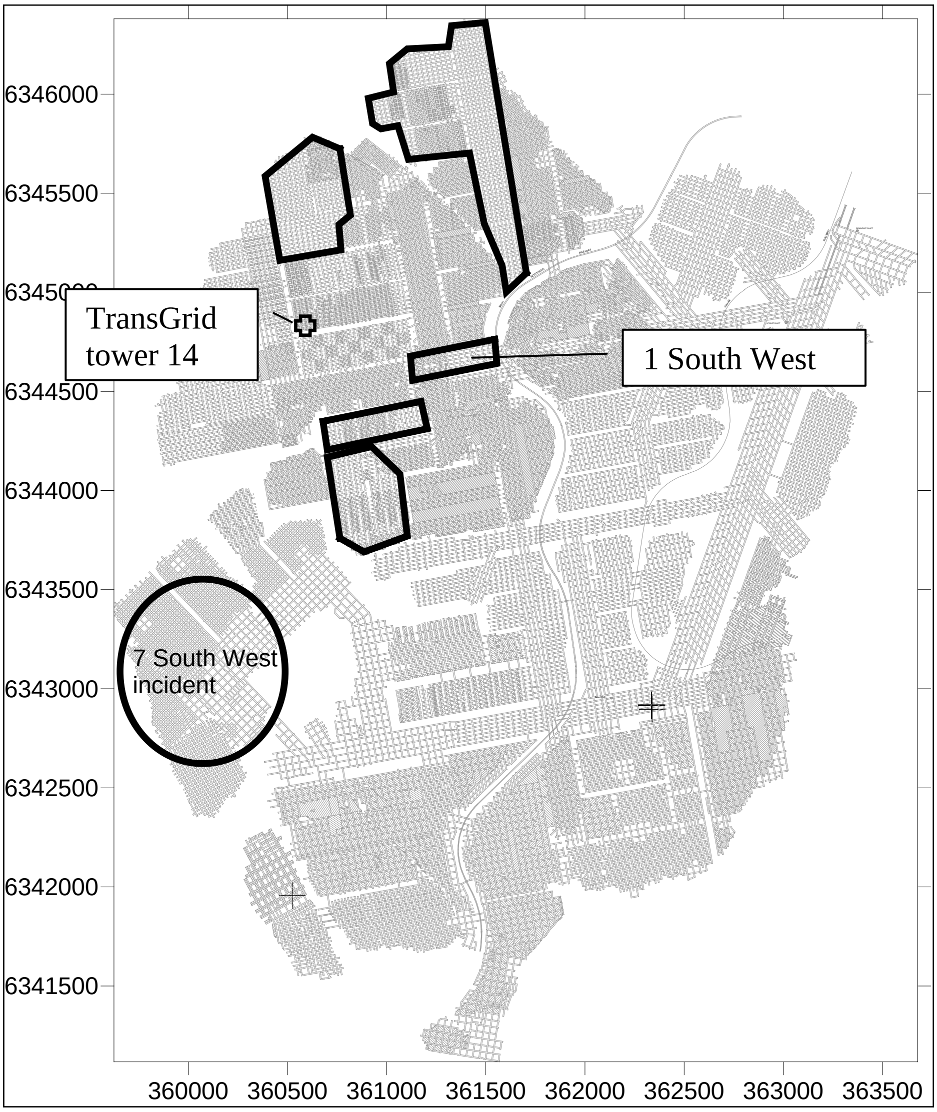


Figure 10 Location of floor heave/subsidence events and previous subsidence lines

It is understood that the 2 events that were immediately adjacent to the railway did not result in adverse impacts to the function of the rail.

The 7 South West event occurred on the morning of 13 September 2006. The pillars were originally formed on 33m centres at a depth of 60m, increasing to 36m centres for a depth of 80m. The pillars were then quartered on retreat leaving pillars on 16m centres (nominally 10.5 wide with 5.5m roads).

The event was characterised by rapid floor heave, a dust cloud, and surface subsidence. There was no significant additional rib spall. Operators reported that the event was complete within 15-40 seconds.

Floor heave was present in old roadways in the panel but there was no active heave in the newly formed roadways prior to the event. Typically 0.5m to 1.0m of floor coal had been left in the new roadways and this was taken during the quartering.

Analysis by others indicated factors of safety for the coal in the pillars was greater than 1.5 with the worse case assumption of 7.5m wide roadways. No testing of the Awaba Tuff was conducted prior to the panel design or subsequently in the area of interest. Testing immediately outbye suggested floor strengths of 1.5 MPa to 6.5 MPa. It was concluded that a failure of the floor was more likely than a coal pillar failure.

It is important to note that none of the rapid collapses extended throughout the mine, indicating that either the geotechnical conditions were not similar, or that larger pillars or unmined coal stopped the progression. In fact, this argument can be taken further to suggest that if there are standing pillars in panels more than 150m wide, this is evidence that the floor is adequately strong to prevent failure.

2.2.3 Models for floor heave

The floor heave/subsidence events have not been formally or exhaustively studied. There appears to be 2 models proposed.

One model proposes that abutment stresses around an extraction panel generate failure in relatively large pillars and that this propagates through the first workings. This model requires elevated vertical stresses that are well in excess of tributary area loading and that these persist over large areas.

The adopted model is that the pillar floor foundations are unstable and that these will collapse once the panel is wide enough so that full loading is applied (Figure 11). Because of the presence of low strength floor horizons, the bearing strength of the pillar foundation is significantly less than the strength of the coal component. The bearing strength is a function of the width of the pillar compared to the thickness of the low strength layer, so wider pillars have higher bearing strength. The massive conglomerate roof means that it can bridge across narrow panels and transfer more of the vertical stress to the abutments. As the panel increases in width, a condition develops where the conglomerate cannot span – the conglomerate then collapses and loads the pillars directly and the foundations fail; at the same time loads are reduced on the abutments. An implication of this model is that until the conglomerate beam fails there may be no indication of floor heave or other evidence of low strength floors.

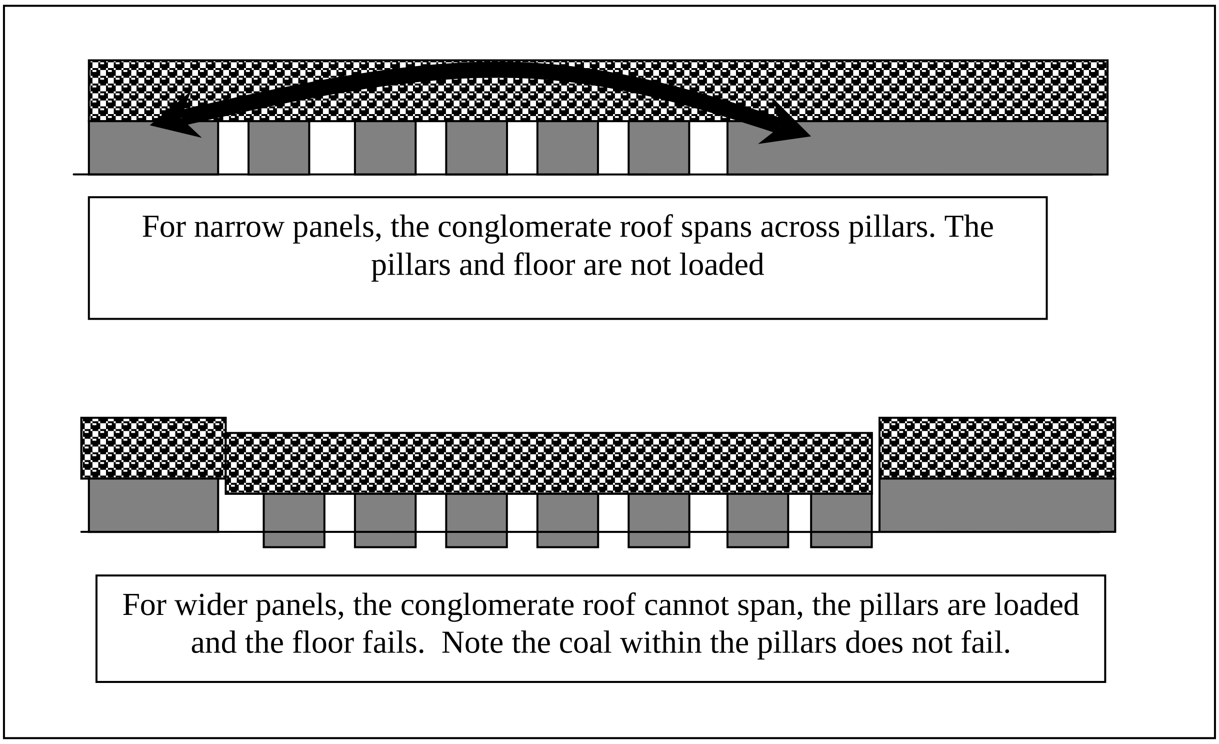


Figure 11 Model for the development of previous floor heave and wind rush events

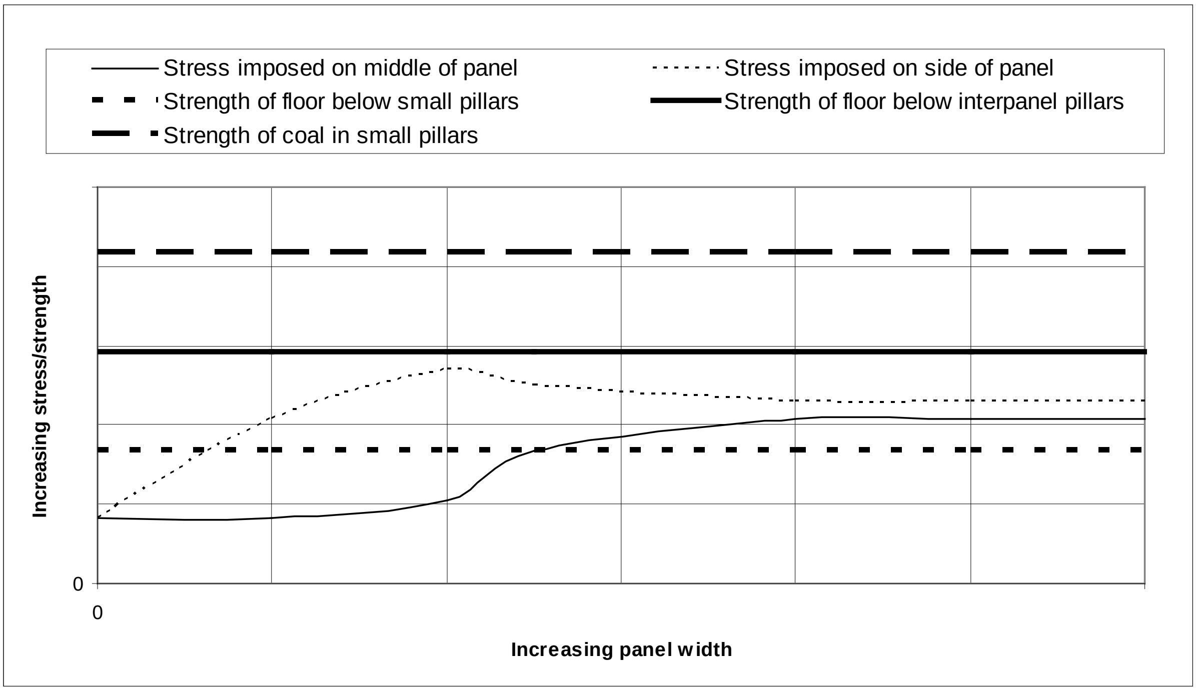


Figure 12 Conceptual model of stresses and strength involved in pillar extraction at Awaba

Key mechanisms are collapse of the conglomerate roof and the collapse of the floor. These can be analysed using standard engineering methods – voussoir beams and foundation engineering. Both of these are application of standard physical laws and elastic theory.

Voussoir beam theory was originally developed in the UK coal mining industry and developed further in several mining text books and mining journals. It has been adopted by civil engineers working in stratified rock masses (e.g. Sydney tunnels) and also for coal mine design (Mandalong). Foundation engineering concepts have been applied to mine pillars extensively in the past and are included in standard text books.

2.3 Geotechnical Conditions

Having identified the failure mechanism the mine design exercise is to prevent this from happening. The direction given by Centennial is that this collapse must not occur during the mining of the panel as the safety implications are not acceptable.

The engineering analyses require an understanding of pillar stress and the strength of the floor and the conglomerate in the overburden.

2.3.1 Vertical stresses

Awaba Colliery mines the Great Northern Seam and in the area of interest the depth ranges between 20m and 60m (Figure 13). It is appropriate to assume an average overburden density of 2.5 t/m3, and since the mine design is based on the overburden units spanning across the extraction a derivative of the tributary area loading model can be used.

2.3.2 Pillar height

The full thickness of the Great Northern Seam is in the range of 2.5m to 3.8m depending on the location.

2.3.3 Floor conditions

The floor of the Great Northern Seam is the Awaba Tuff, which in this area is 2.7m to 4.5m in thickness, and this overlies the Fassifern Seam.

ADC27, drilled in 1961 and located near the railway and one of the floor heave events (1 South West, Figure 10) includes the following description:

> SILTSTONE (?TUFF) very friable and easily powdered between fingers. 3’1” (0.94m). With modern logging definitions, this would have a UCS of 150-700 kPa.

Logging of other holes in the 1980 makes reference to moderately soft and soft strengths with no definitions of the terms provided.

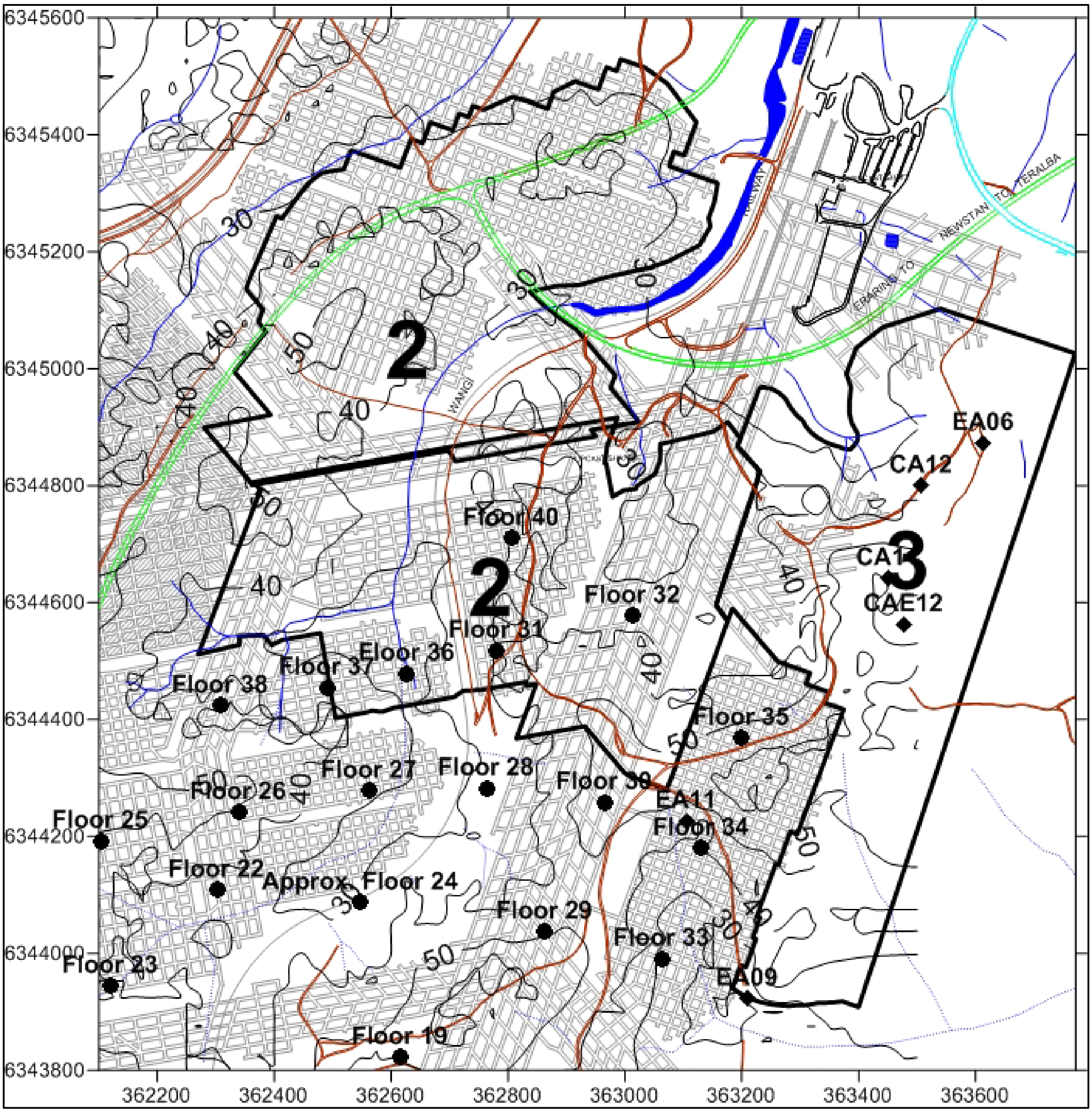


Figure 13 Depth of cover to Great Northern Seam and location of floor and overburden holes

Cores of the Awaba Tuff drilled recently (Figure 13) have included visual and tactile strength assessments (Table 1). It will be suggested below that the materials with 500 kPa strengths are probably associated with the collapse of the pillars.

The fact that much of the Awaba Tuff has strengths of less than say 10 MPa to 20 MPa is significant in itself, as materials of these strengths can swell when exposed to water. Free swell values of up to 30%-40% have been measured on similar Awaba Tuff from Cooranbong Colliery. It is assessed that the floor heave that is seen in old roadways at Awaba is caused by the swelling of the Awaba Tuff in the floor of the roadways. This is the reason why hole Floor 7 reported lower strengths – it was drilled vertically into the roadway floor and not at an angle under the pillars. Note that such swelling and associated strength loss does not develop in the Awaba Tuff below the pillars that, by definition, is under higher stress following mining than in the recent geological past.

Table 1 Visual and tactile tests

Symbol	Term	Visual and tactile	Approx strength
S4	Hard soil	Cannot be moulded, readily crumbled	150-700 kPa
S5	Transitional soil/rock	Readily trimmed, thumbnail easily scratches core	0.7-1.5 MPa
R1	Very low strength rock	Peeled with moderate effort, G pick leaves deep impression	1.5 – 3.0MPa
R2	Low strength rock	Peeled with difficulty, G pick leaves minor impression	3.0 – 10 MPa
R3	Medium strength rock	Barely shows mark when attempted to be peeled. Blow by G pick leaves minimal impression	10 – 25 MPa

Table 2 Summary of low strength (S4-R2) layers in floor

Easting	Northing	Hole	Thickness	Strength
362616	6343823	Floor 19	None	
362626	6343422	Floor 20	None	
362735	6343728	Floor 21	None	
362302.2	6344108	Floor 22	0.14	S5
362120.6	6343945	Floor 23	0.07	S5
362548	6344087	. Floor 24	0.26	R2
362103.5	6344192	Floor 25	0.35	R2
362339.2	6344242	Floor 26	0.4	S5
362563.2	6344278	Floor 27	0.1	S4
362763.2	6344282	Floor 28	None	
362863.5	6344038	Floor 29	None	
362965.5	6344259	Floor 30	None	
362781.4	6344517	Floor 31	0.2	5
363013.7	6344577	Floor 32	0.02	R1
363063.8	6343991	Floor 33	None	
363131.4	6344180	Floor 34	None	
363200	6344369	Floor 35	None	
362627.6	6344479	Floor 36	0.1	S4
362491.7	6344455	Floor 37	0.33	R2
362308.5	6344424	Floor 38	0.44	S5
363065.9	6343760	Floor 39	0.39	R2
362806.5	6344710	Floor 40	0.02	S5

Investigation at Newstan Colliery in 2004 included some core drilling of the Awaba Tuff near TransGrid Tower #14 (Figure 10). Based on the core and the sonic logging conducted in the hole, it was concluded that there may be 1m of 0.5 MPa material present in the floor under the barrier pillar. The coincidence with the logging of ADC27 is noteworthy.

2.3.4 Teralba Conglomerate

The stratigraphic unit above the Great Northern Seam is the Teralba Conglomerate and this extends all the way to the surface.

There are 6 boreholes in the area that have been used to define the geological model for Stage 3. There are useful geotechnical data from 4 holes (Table 3), including 3 ELCOM Awaba (EA) holes and a more recent Centennial hole (CAE12). Table 1 presents data on the thickest continuous unit within the Teralba Conglomerate stratigraphic unit that comprises the overburden. In the geophysical log of CAE12, the unit was defined according to the gamma log signature.

Compared to EA11 above early panel and pillar layouts, the other holes reveal a thinning of the conglomerate unit that is relied on in the panel design.

Table 3 Conglomerate unit above the Great Northern Seam

Hole	Great Northern depth (m)	Conglomerate thickness (m)	Depth to top of unit(m)	Maximum indicate panel width (m) – Figure 4
EA6	44.69	12.73	31.96	82
EA11	44.24	18.393	25.84	119
CAE12	78.8	15.46	63.34	76
EA9	17.61	8.607	7.5	89

Based on previous studies of the Teralba Conglomerate at Newstan Colliery, it is considered that the Teralba Conglomerate has an unconfined compressive strength of 65 MPa and a Youngs Modulus of 20 GPa.

2.3.5 Faults

The geological plan attached to the 2005 SMP application shows a series of normal faults occurring in swarms of 3 or 4, and about 500m apart. Throws are indicated to be 0.5m-1.5m. Such normal faults have not been shown to be implemented in unexpected subsidence events with the Teralba Conglomerate.

2.4 Analysis of Floor Heave/Subsidence Events

The geotechnical data presented in the previous section allows the analysis of various behaviours to assist in assessing the likely contributors to the floor heave/subsidence events.

2.4.1 Collapse of Teralba Conglomerate

The relationship between the span and thickness at which the Teralba Conglomerate could collapse is shown in Figure 14. For 20m thick layers of conglomerate the critical span is shown to be in the order of 150m to 200m. It is noted that this is in agreement with the observations at 4 South and other extraction panels at Awaba. Reducing the panel width to 100m or less, the required thickness of conglomerate is in the order of 10m, which is significantly less than the layering that is seen in most holes.

The deflections at failure shown in Figure 15 are of interest – the analyses suggest that there can be 2m to 3m of surface subsidence without collapse of the beam. For panels of less than 100m, the deflections are predicted to be less than 200mm.

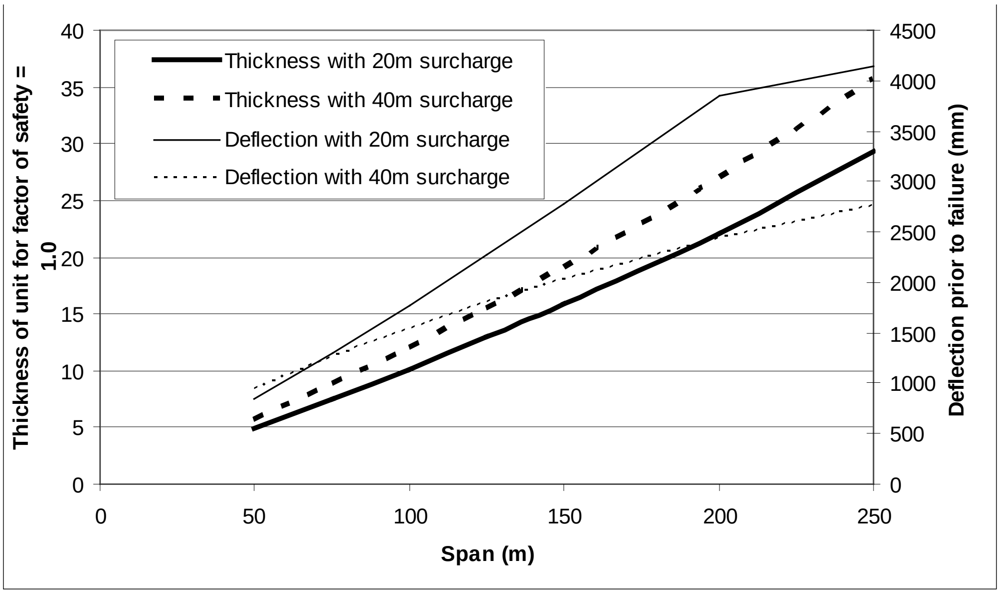


Figure 14 Collapse of Teralba Conglomerate (compressive failure, Factor of safety = 1.0)

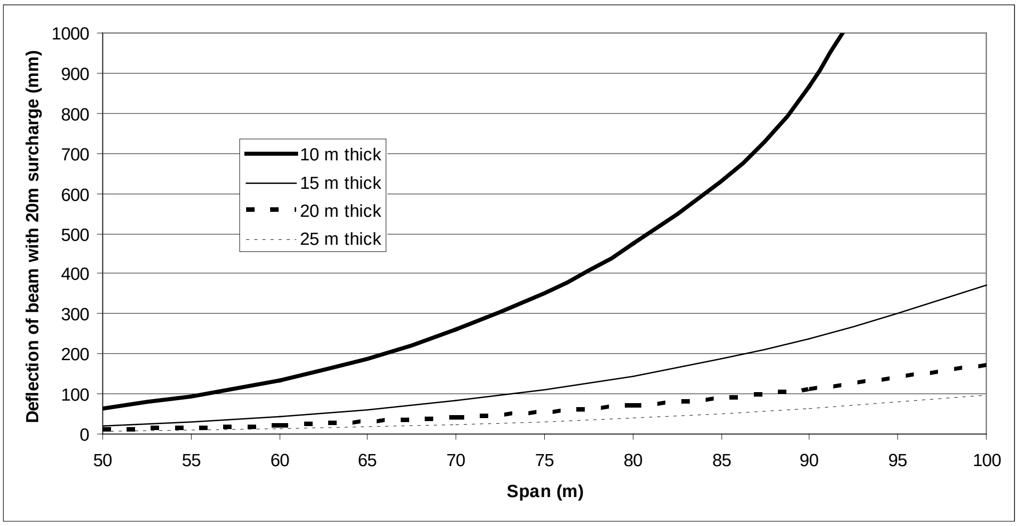


Figure 15 Deflection of Teralba Conglomerate

2.4.2 Back analyses of floor failure

In the past, one of the difficulties when analyzing the floor failure was that the floor strength was not known. However, hole ADC27 is adjacent to the 1 South West event and the logging can be used to estimate the floor strength. It is encouraging that the strength of the floor in this area is similar to an independent estimate of the floor in the vicinity of TransGrid Tower 14.

Figure 16 presents the allowable bearing stress on a 1m thick layer of 500 kPa strength assuming a factor of safety of 2.5 and compares it with pillar stresses based on tributary area loading. It can be seen that at 40m depth of cover, pillar stresses are in excess of the bearing capacity for pillar widths less than about 23m, and at 60m depth for pillars with widths less than 32m. The figure suggests that the progression of floor heave/subsidence events could have been stopped by pillars of the order of 25m in width – it is understood that this was the basis of successful management strategies at the mine in the later 1980s.

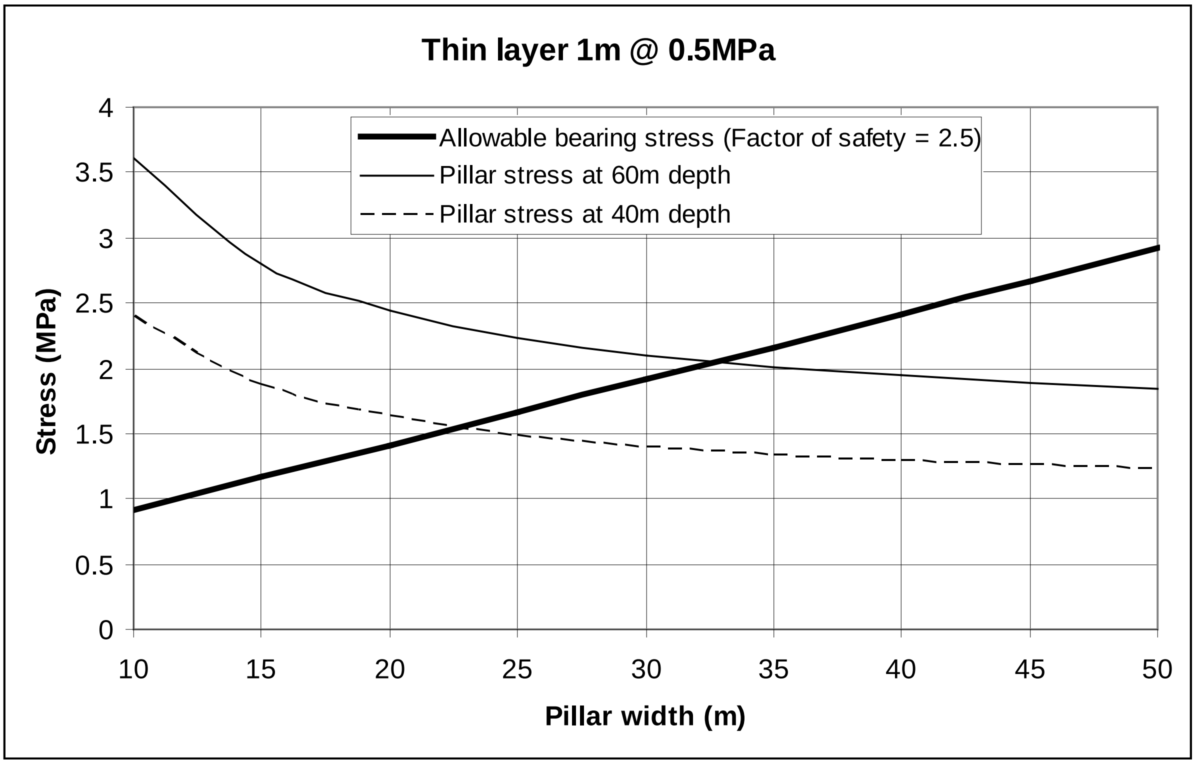


Figure 16 Analysis of bearing strength of thin layer of material

2.4.3 Lateral extent of vertical subsidence

Elastic analyses using a simple displacement discontinuity code (Examine TAB) with modified parameters to simulate the conglomerate and the pillar/floor system suggest that 20mm subsidence line would be located about 50m from the side of the panels and 25m from the end of the panels for the case of 100mm of vertical subsidence (Figure 17). The similarity to 4 South is noteworthy. This set of subsidence analyses are only made for cases where there is no failure of the floor. The mechanics of the massive beam may meant that the 20mm deformation line may extend further out for greater values of the vertical deformation of conglomerate beam. It is important to note that the traditional understanding of angles of draw may need to be modified for this type of subsidence behavour.

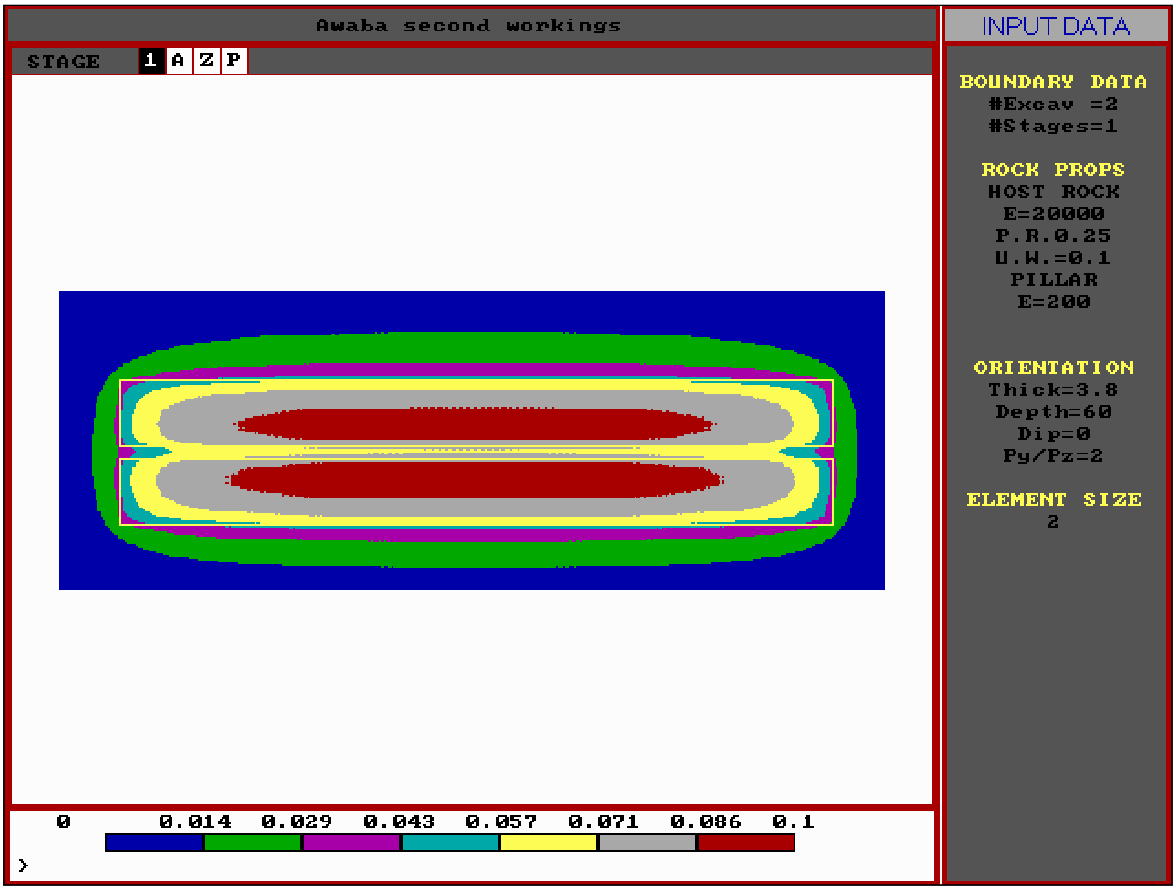


Figure 17 Displacement discontinuity analysis of the displacement (mm) above 2 bridging panels each of 100m width

3 MINING SINCE 2008

3.1 Survey results

Figure 18 presents a contour plan of the subsidence recorded up to December 2009 at Awaba with the extraction design applied to pillars that were formed some 50 years ago. The maximum vertical subsidence associated with the extraction is 125mm. The 20mm subsidence line is shown to be between 0m and 100m from the end of the panels.

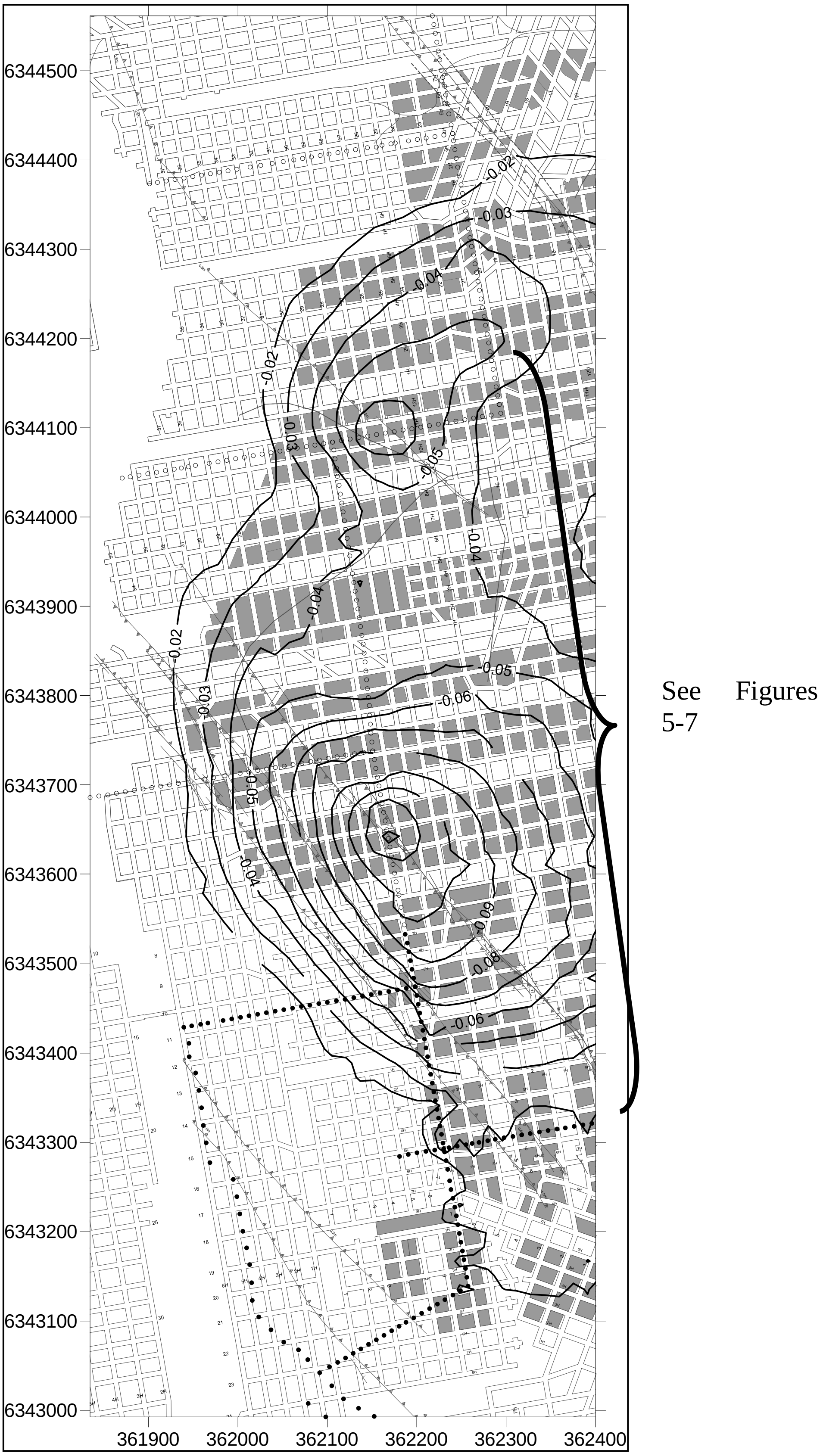


Figure 18 Interpreted vertical subsidence contours to date (grey areas are extracted pillars)

A typical survey line is shown in Figure 19. As the extraction progressed, the vertical subsidence has increased to about 125mm. The associated tilts for the last survey (Figure 20) show a large degree of noise (related to survey precision with such low absolute values) and the real values for tilt are assessed to be less than 1 mm/m.

Strains were measured during some of the initial extraction. When the maximum vertical subsidence was less than about 30mm, the strains were less than about 0.5mm/m (Figure 21).

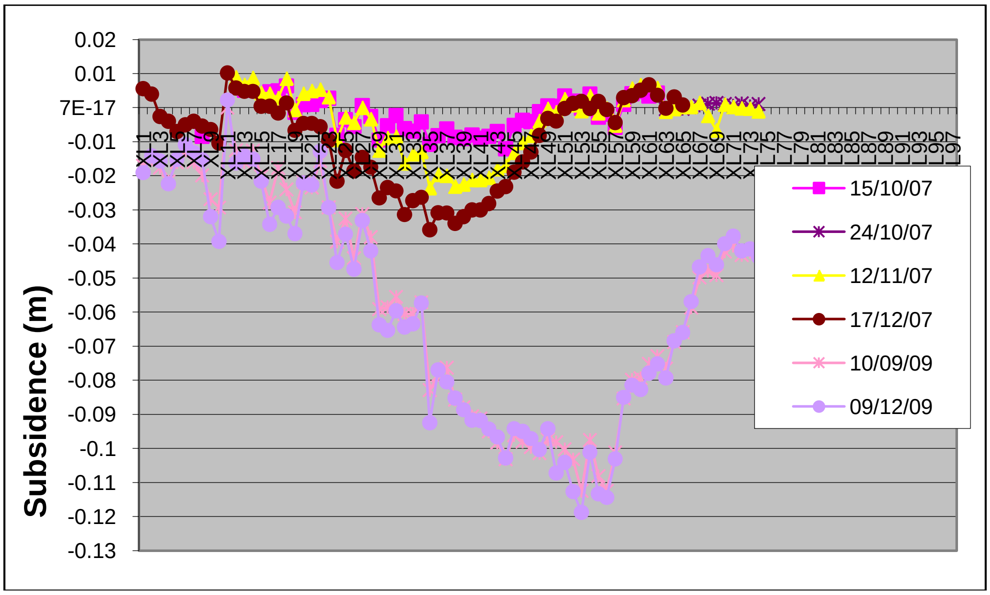


Figure 19 Progressive vertical subsidence movement as pillar extraction progressed

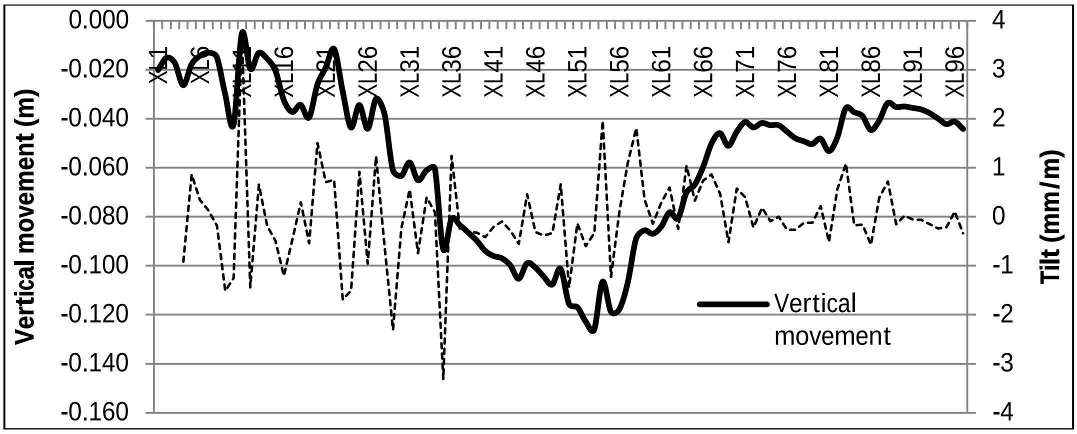


Figure 20 Vertical movement and associated tilts for the last survey

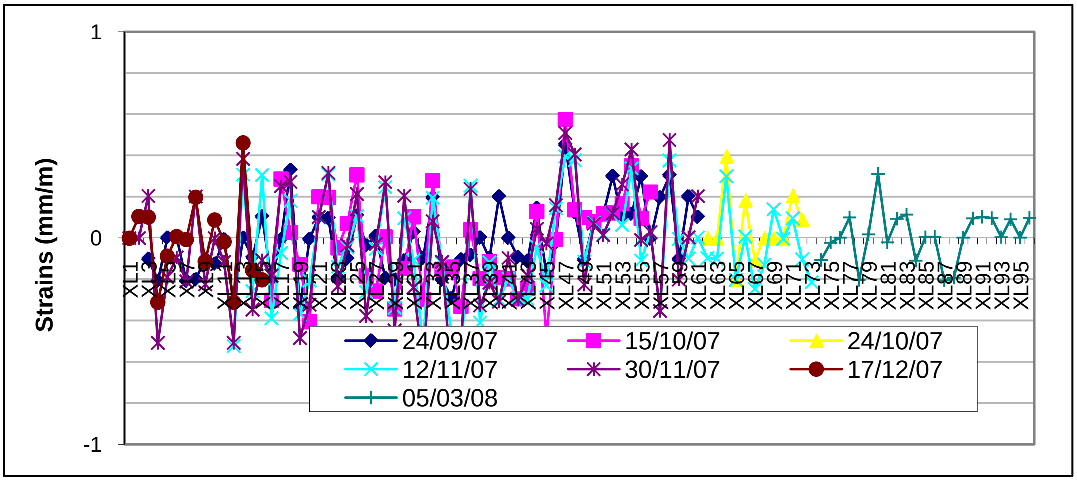


Figure 21 Strain measurement up to March 2008

3.2 Analysis

3.2.1 Pillar compression

There needs to be a wide expanse of extraction to achieve full subsidence, and this is assessed to be related to the arching of the Teralba Conglomerate. The maximum subsidence directly above a pillar is in the order of 80mm. A back analysis of this subsidence has been conducted assuming full tributary area loading, elastic compression of the pillars and a layer of low strength Awaba Tuff, and compression of the roof and floor strata assuming elastic deformations under a footing. Floor hole 17 (Figure 22) is relatively close to the peg 48 where the maximum subsidence has developed.

Table 4 presents the results of a back analysis conducted using presumed values for the deformation modulus of intact samples and the Geological Strength Index (so as to determine the sample-mass reduction). The values are consistent with our experiences at Mandalong. It is noted that the floor modulus value is relatively low to account for the presence of the Fassifern Seam as well as the high strength Awaba Tuff. This set of parameters implies that the majority of the surface subsidence is generated by compression of the floor units (55mm, Figure 23).

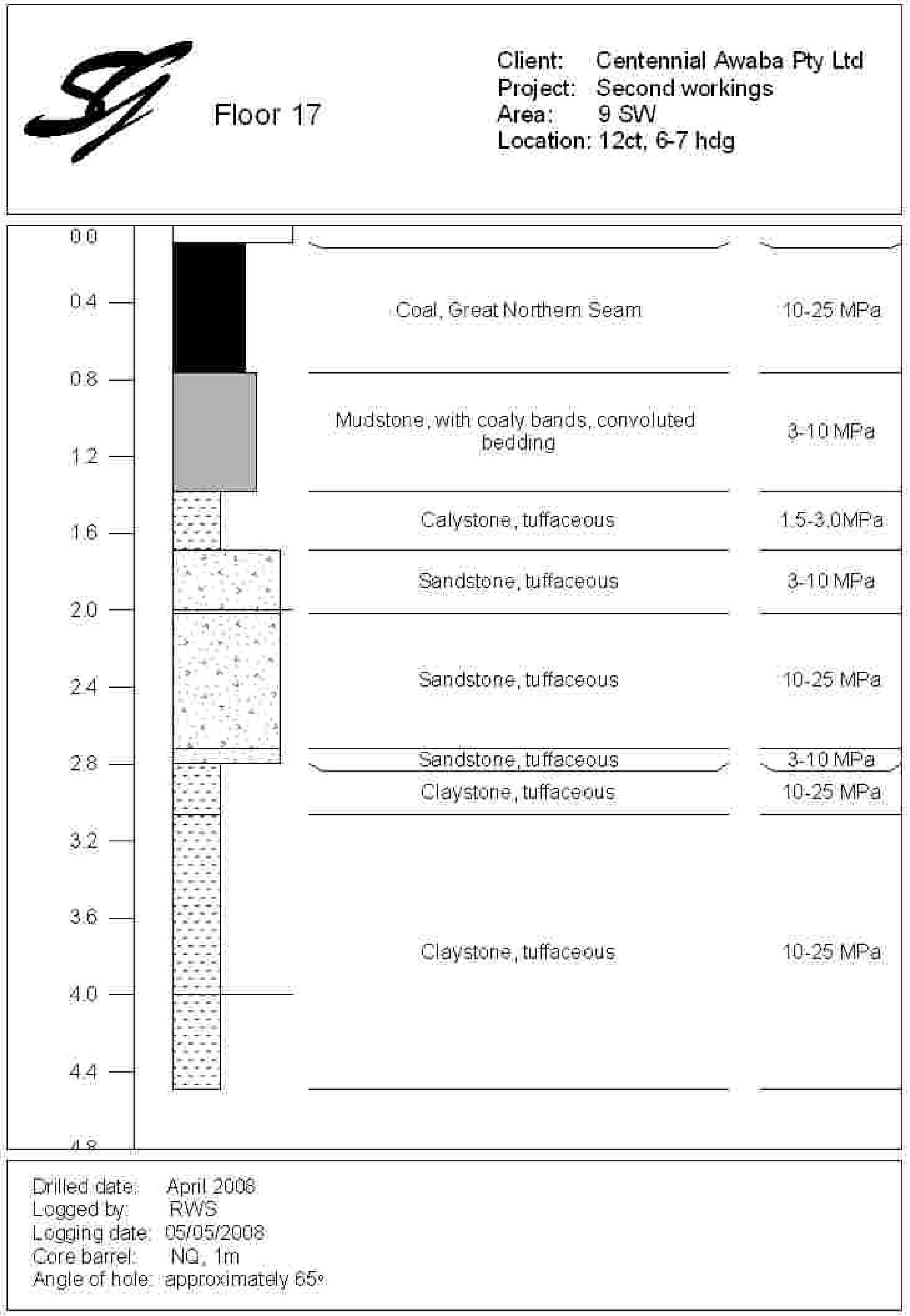


Figure 22 Logging from holes Floor 17

Table 4 Back analysed values for pillar subsidence

Parameter	Value
Thin layer UCS (MPa)	4
Thin layer thickness (m)	1
Thin layer sample modulus (MPa)	1000
Coal sample modulus (MPa)	2500
Coal Geological Strength Index	60
Roof sample modulus (MPa)	12500
Roof Geological Strength Index	95
Floor sample modulus (MPa)	5000
Floor Geological Strength Index	50
COAL MODULUS	1250
ROOF MODULUS	12000
FLOOR MODULUS	1435

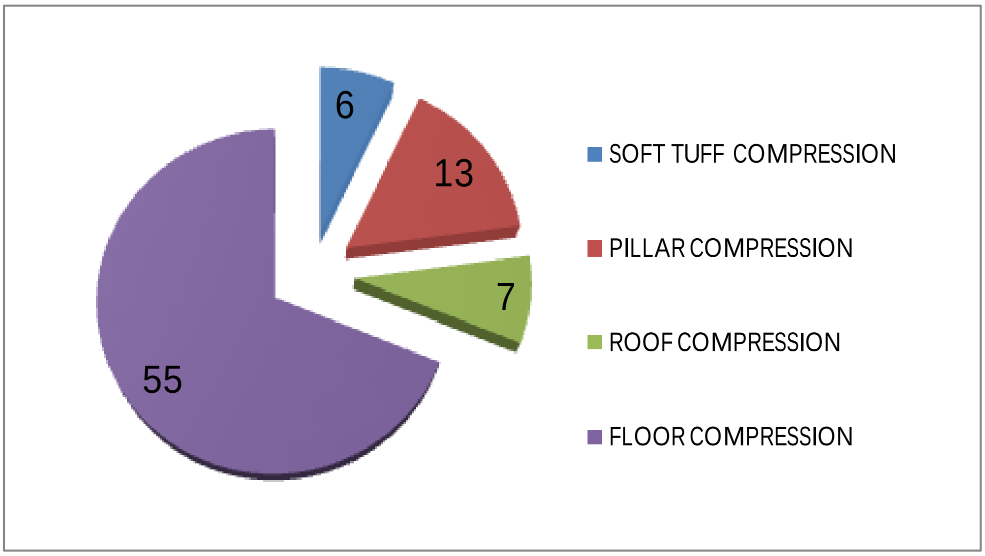


Figure 23 Components of subsidence (mm)

3.2.2 Panel sag

From Figure 19, it is possible to extract data on the sag between the pillars. These sag values are compared to the associated panel sag in Figure 24. The sag values are relatively small and it is difficult to resolve any trend from the survey noise.

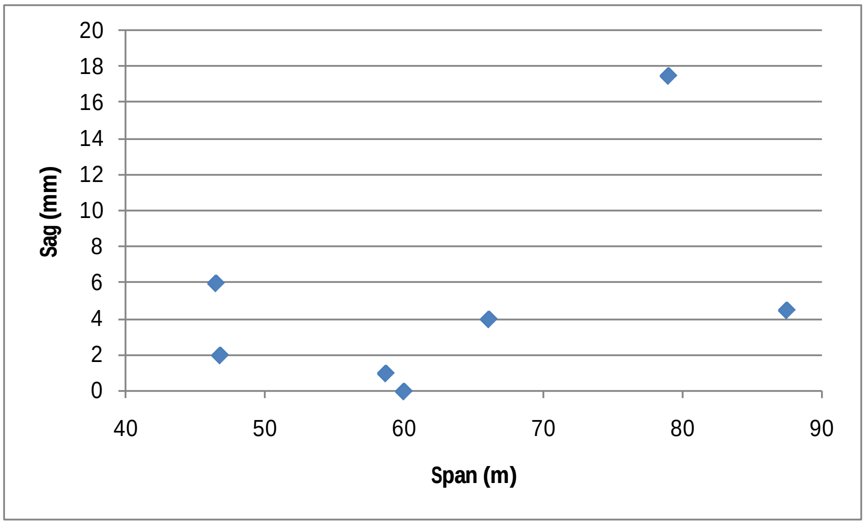


Figure 24 Sag above extraction panels

To some degree, the low sag values are indicative of the high levels of stability. Assuming rational values for the strength and deformation modulus of the Teralba Conglomerate, it is possible to use the sag values to determine the active thickness of the conglomerate (Figure 25). This analysis suggests very high values of the stability index for a beam thickness of 41m across a 90m panel. It is noted that there are not sufficient data on the performance of these rock beams to set a minimum value for the stability index.

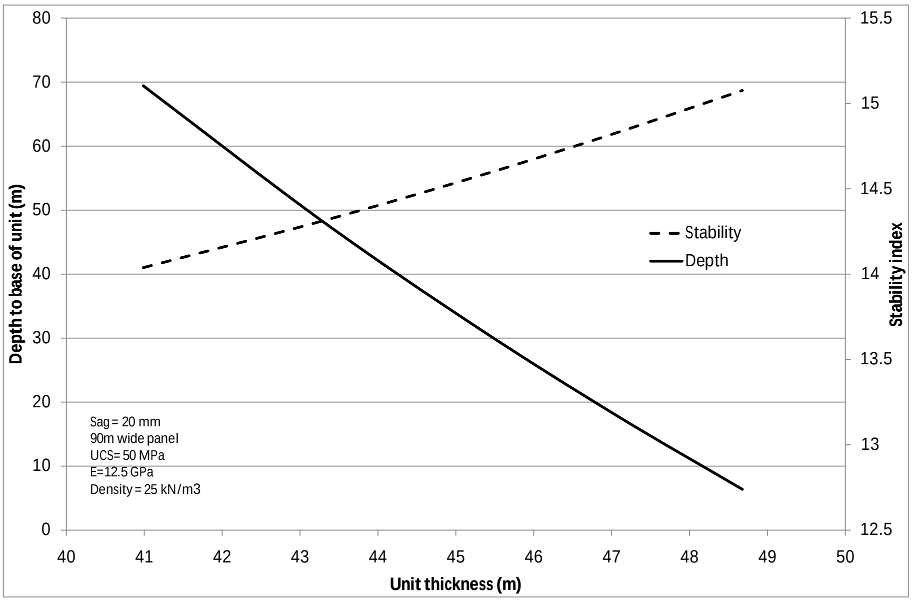


Figure 25 Geometries that give 20mm of beam sag

The analysis can be extended to assess the span required to generate failure of a 41m thick beam (Figure 26). It would appear that spans in excess of 250m would be required.

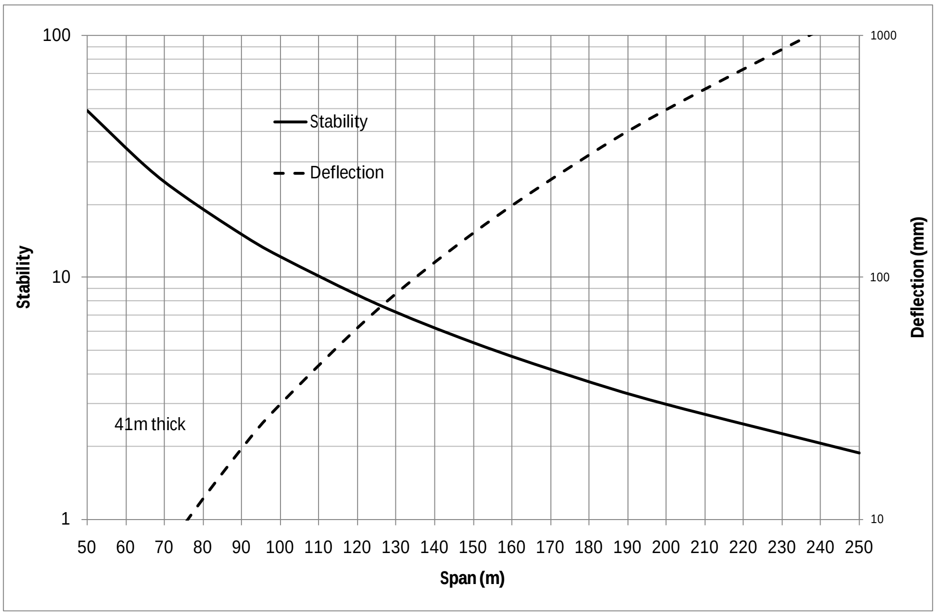


Figure 26 Stability and deflection of wide spans of a 41m thick conglomerate.

It is of value to compare the sag values in Figure 24 with the empirical Holla database for subsidence in the Newcastle coalfield. Normalised to the seam thickness the Smax/T values are 0.003 while the panel width/depth ratios have been within the range of 1.0-1.5. It can be seen that these outcomes are substantially less than in the database (Figure 27).

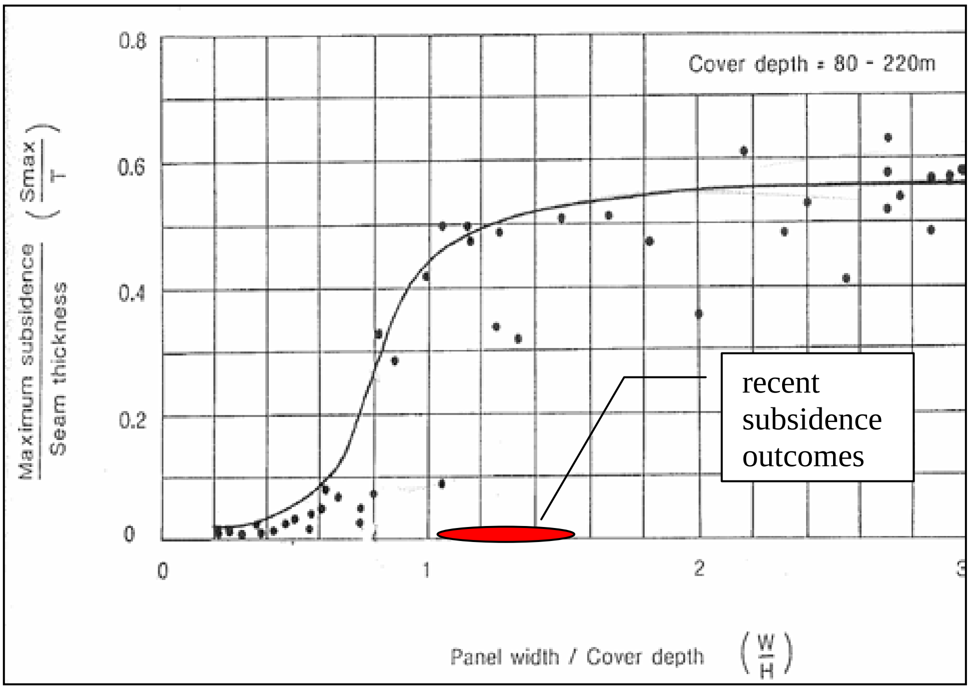


Figure 27 Recent subsidence outcomes compared to Holla Newcastle database

4 STUDY AREA 2

4.1 Layout

The layout for the extraction of Great Northern Coal in the Study Area 2 (Figure28) using the same panel and pillar concept as developed in recent years.

The standing pillars were originally formed on nominal minimum 20m centres with 5.5m wide roads. The proposal is to extract pillars in a somewhat staggered pattern so as to not extract under the haul roads and power lines on the surface. No extraction is proposed under the identified stream and water courses. The resulting voids will be in the order of 60m to 80m wide. The seam is 3.5m thick and the depth ranges between 30m and 50m.

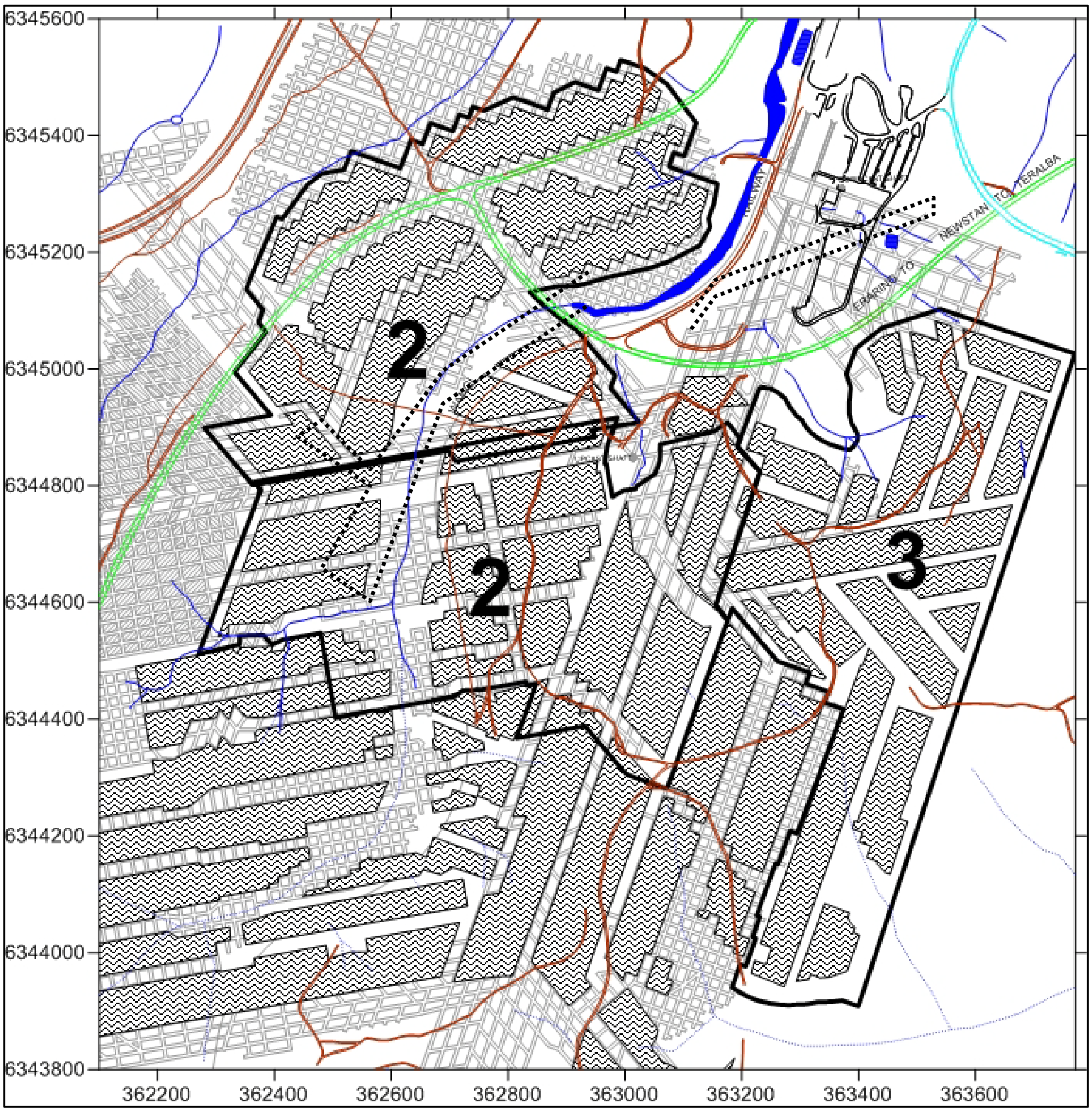


Figure 28 Proposed layout for Study Areas 2 and 3

The panel and pillar layout is based on total extraction within narrow panels such that the Teralba Conglomerate can span. It is understood that there will be a management plan that seeks to characterise the strength of the Awaba Tuff in the floor, as has been utilised in previous applications of this method. Geotechnically, the layout addresses the hazards presented by both weak floors and massive conglomerates.

The layout shown in Figure 28 includes 2 types of "pillars":

- In-panel pillars – mostly a single row of pillars between the panels – these are required for underground safety considerations
- Barrier pillars – mostly 3 rows of pillars left under surface infrastructure so that the risk of adverse subsidence deformations is effectively zero.

The layout is not a "zero" subsidence plan. To prevent the uncontrollable collapse of the goaf the panel width is designed so that the conglomerate can span –it will still deflect. Relatively high loads are placed on the in-panel pillars and this means that the compression of the roof/pillar/floor system will exceed the 20mm subsidence threshold defined in the SMP guidelines (in fact up to 90mm has been recorded in similar layouts). In addition, the in-panel pillars have factors of safety of less than the long-term stable threshold. The barrier pillars are long term sable, and the subsidence above the central line pillars will be less than 60mm.

4.2 Subsidence Assessment

The proposed layout for Study Area 2 incorporates a hierarchy of risk management controls.

4.2.1 Elimination

Pillar extraction has been eliminated in the following areas:

1. Within a nominal 125m from the Rail boundary. 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 this barrier has performed adequately; in fact there has been no recorded instance of the "pillar run" or even anomalous subsidence for which the PSE has concerns at either Awaba or at the adjacent Newstan when similar pillars have been undermined by longwall extraction.
2. No extraction under the haul roads and the associated infrastructure or the identified water courses.
3. There is no extraction planned for less than 25m depth and only a very limited amount at less than 30m depth.

4.2.2 Substitution

The narrow panel and pillar layout represent "substitution" compared to the alternatives of very wide full extraction or the stripping of the pillars over a wide expanse. The layout has been adopted for a number of underground workplace safety considerations. An upshot of layout is that the subsidence is significantly lower than the alternatives.

4.2.3 Engineering controls

The layout continues with the same panel and pillars concept as used previously at the mine and the spans are no greater. At this time, it is reasonable to assume that the spans will be stable and that any sag will be less than 10mm.

In the Study Area 2 the maximum depth of cover is approximately 50m. Assuming a 14.5m wide in-pillar and two 80m wide extraction panels, the pillar stress can be calculated to be 7.9 MPa (full tributary area, plane strain). Recalling the full subsidence required extraction areas of about 550m width, full tributary area loading is considered appropriate given all the earlier extraction. For a 3.5m high pillar, the width to height ratio is 4.3, and the pillar strength can be estimated to be in the range of 11 MPa to 13 MPa based on a number of strength equations using minimum width. The factor of safety for pillar failure is between 1.4 and 1.7. This is assessed as adequate for the mining system being used in this seam.

The geographic proximity to the other extraction areas would suggest that the roof and floor materials should be similar. It is understood that you will have a management plan to confirm the floor strengths.

4.2.4 Administrative controls

The key administrative control will come from the workplace safety requirement to test the floor to identify the presence of low strength floor units. This will have advantages to the subsidence concerns as extraction will not be recommended in such areas.

Should the plug subsidence develop, the onset will be rapid and hence not amenable to control using the Observational Method.

A survey line along one of the haul roads would produce valuable information for the calibration of the prediction method – this line can be a simple pre-mining and post-mining survey of vertical movements.

4.2.5 Subsidence deformations

The following represents an appropriate estimate of the subsidence deformation on which the hazards and risks can be assessed.

4.2.5.1 During mining

The predicted maximum vertical subsidence is of the order of 200mm, and extending out to a 20mm level within a 45^{o} angle of draw.

The vertical subsidence will develop over a width of approximately 200m (2 panels and 1 pillar row), so the associated tilts and strains will be very low – for risk assessment purposes, values of 1 mm/m should be used for these vertical subsidence predictions.

A visualisation of the likely subsidence (Figure 29) has been conducted based on a set of arbitrary parameters and calibration to the maximum subsidence recorded to date above the previous area. The visualisation cannot incorporate the upsidence that has been measured. In addition, the visualised subsidence at the panel edges is greater than that measured. The maximum subsidence along the haul roads is likely to be in the order of 50mm-100mm with maximum strains and tilts less than 0.5mm/m.

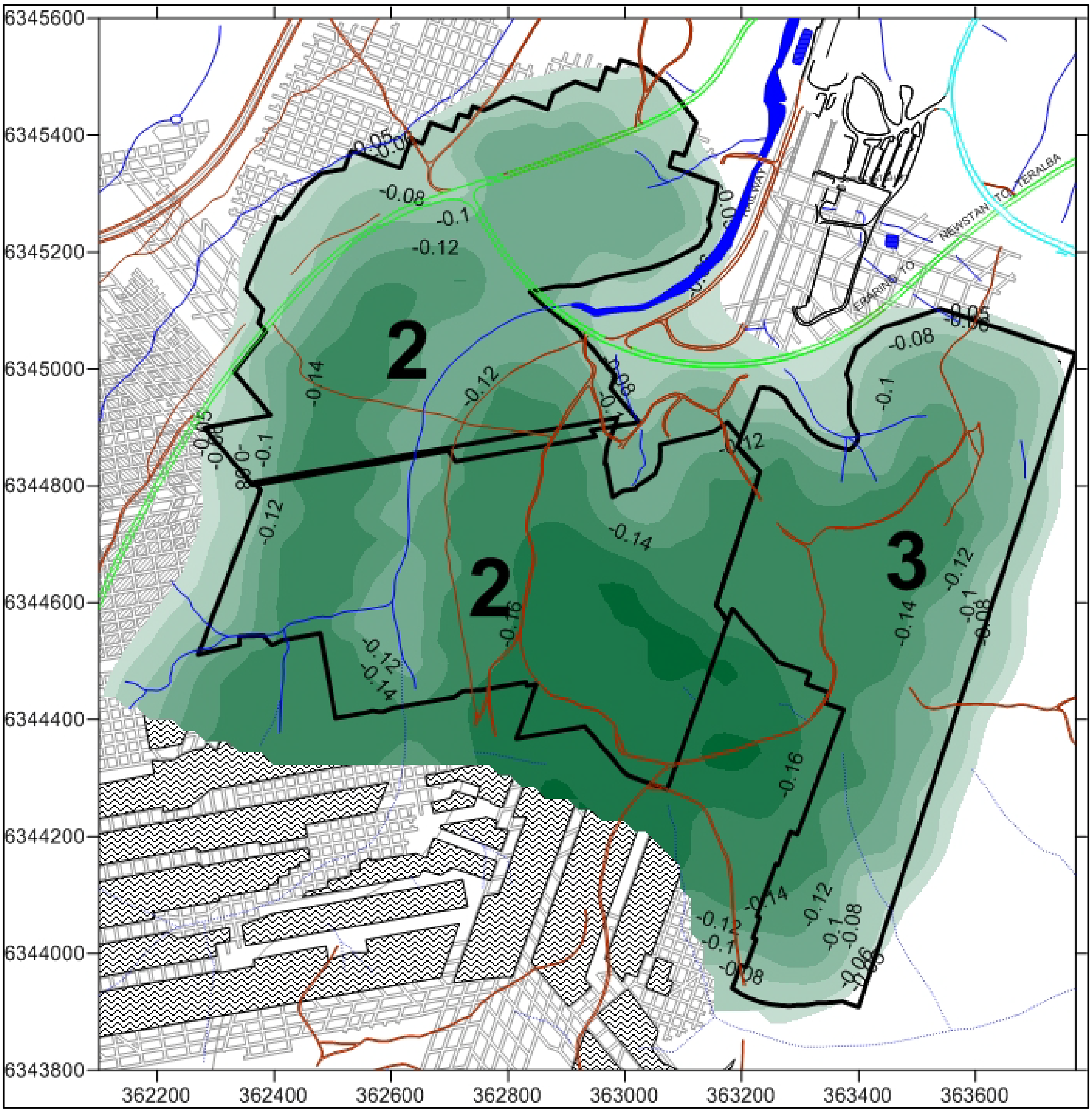


Figure 29 Visualisation of subsidence above Study Area 2 and its relationship to Study Area 3.

4.2.5.2 Subsidence over the longer term

The "unstable" behaviour of the floor is related to the immediate loading of the Awaba Tuff claystone and the associated rises in pore pressures (undrained state in soil mechanics). It follows that over time the stability of the pillars foundations will increase as the floor under the pillars consolidates. It is noted that the floor heave/subsidence events at Awaba happened during active mining and not sometime later. There would be further increases in stability if the mine floods as this reduces pillar loads by introducing buoyancy effects. A corollary of this would be a slight reduction in subsidence.

As is the case for other areas of Awaba, shallow mining introduces the risk of plug collapses above the voids. This behaviour should be restricted to periods of high rainfall and only in drainage channels.

4.2.5.3 Extreme subsidence outcome

There are a number of possibilities whereby the subsidence levels will be in excess of predictions.

- Lack of knowledge of the floor leading ultimately to the collapse of the pillars. This hazard could lead to increased subsidence and also loss of coal reserves and the onset of poor goaf edge conditions underground. We recommend progressive coring or other testing of the floor in extraction areas and adjacent to rail prior to second workings.
- Plug collapse. This can lead to formation of large cracks and steps at the surface and inflow of water into the mine. We recommend regular inspections of any water courses especially after heavy rainfall.
- In common with all geotechnical ventures, there is uncertainty about the selection of parameters for the design calculations. We recommend subsidence cross line(s) to check pillar compression and sag predictions.

The worst-case subsidence outcome would be if the conglomerate fails – this will result in a type of plug subsidence, with the formation of vertical faces of say 2.5m height at the edge of the panels (Figure 30). Because of the serious threat such a collapse would pose to the underground workforce, the mine design process is focussed on seeking to eliminate this hazard through a series of engineering controls. There are no administrative controls that can be applied to this event

It is stressed that this is not offered as a prediction as the mine layout has been specifically designed to avoid such an outcome. In the context of a subsidence risk assessment, it is recommended that this plug subsidence should be used and, if the impacts are manageable, it will follow that the impacts at the predicted levels will also be acceptable. It is noted that if plug subsidence does develop, there will be no cracking within the barrier pillars and the subsidence along the haul roads will decrease as a consequence of the spanning loads being removed.

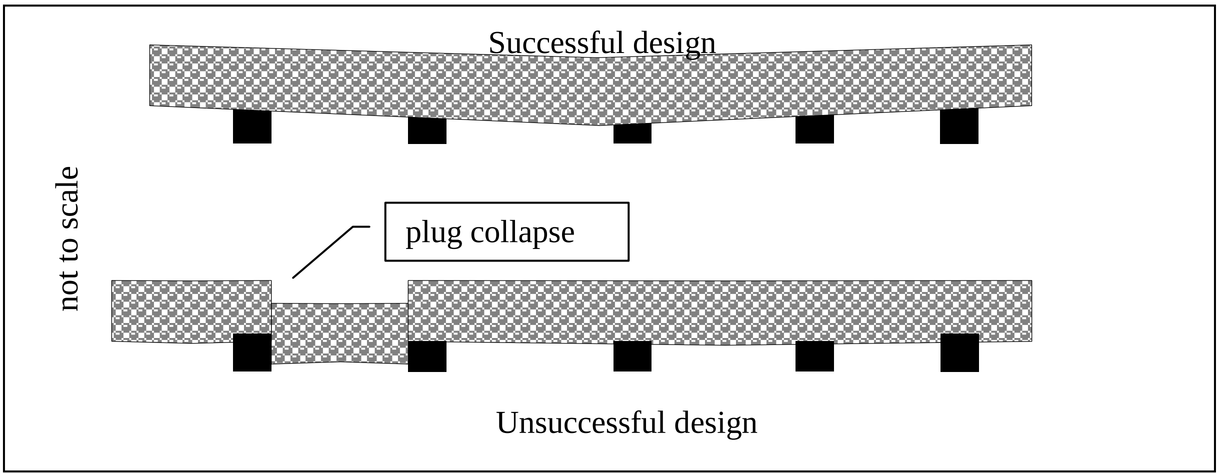


Figure 30 Cartoon defining a plug collapse in an unsuccessful design

5 STUDY AREA 3

5.1 Layout

Area 3 is an area of mainly undeveloped coal that lies to the east of the South Headings Mains (Figure 28). It differs from recent mining at Awaba as the area needs to be developed with first workings prior to extraction. It is bounded to the east by a thinning of the Great Northern Seam. The depth of cover ranges from less than 20m to approximately 80m. The seam thickness is in the range of 3.0m and 2.0m.

The mining proposal is to first develop the area with bord and pillar mining at depths greater than 20m, and then to extract selected pillars to form a panel and pillar layout similar to that adopted recently at the mine. Following earlier discussions with you, the width of the extraction panels will vary between 46m to 85m. There is to be no extraction of pillars at depths less than 25m.

The geotechnical design approach identifies the thickness of units within the Teralba Conglomerate forming the immediate roof of the Great Northern Seam. The thickness of the conglomerate, along with the relative shallow depth of cover, can allow the overburden to span across properly designed extraction panels. The approach also recognises the hazard of the possible presence of low strength Awaba Tuff in the floor of the Great Northern Seam. A management plan requires the floor conditions to be determined with coring and testing followed by a geotechnical assessment – if weak floor is present the initial response is to not conduct pillar extraction.

5.2 Subsidence Assessment

The key driver in the development of the layout is to maintain high levels of safety underground. This requires that the overburden does not collapse. The proposed layout for Study Area 3 incorporates a hierarchy of risk management controls.

5.2.1 Elimination

Pillar extraction has been eliminated for less than 25m depth and only a very limited amount at less than 30m depth.

5.2.2 Substitution

The narrow panel and pillar layout represent "substitution" compared to the alternatives of very wide full extraction or the stripping of the pillars over a wide expanse. The layout has been adopted for a number of underground workplace safety considerations. An upshot of layout is that the subsidence is significantly lower than the alternatives.

5.2.3 Engineering controls

Panel widths are specified with a nominal factor of safety greater than 2.0 against compressive failure of the spanning Teralba Conglomerate and the pillars have factors of safety against failure of greater than 1.6.

The proposed layout minimizes the risk of rapid collapse of the conglomerate by keeping spans to less than 85m. There is a high level of confidence in this part of the design because the Teralba Conglomerate is known to be a relatively consistent unit across the mining area.

The stability of the coal component of the pillar/floor system, as measured by the pillar factor of safety using the University of NSW method and assuming complete spanning of the conglomerate, is greater than 1.55 for the geometries examined. This would indicate that the pillars themselves will not fail.

The stability of the pillar foundations will depend on the presence or absence of low strength horizons – the distribution of which is not known at this time. Potentially problematic floor can be readily identified from drilling. The lack of floor heave in old workings would also be a very good sign as it suggests that no material with strength less than about 20 MPa.

5.2.4 Administative controls

There are a number of possibilities whereby the subsidence levels will be in excess of predictions.

- Lack of knowledge of the floor leading ultimately to the collapse of the pillars. This hazard could lead to increased subsidence and also loss of coal reserves and the onset of poor goaf edge conditions underground. We recommend progressive coring or other testing of the floor in extraction areas and adjacent to rail prior to second workings.
- Plug collapse. This can lead to formation of large cracks and steps at the surface and inflow of water into the mine. We recommend regular inspections of any water courses especially after heavy rainfall.

- In common with all geotechnical ventures, there is uncertainty about the selection of parameters for the design calculations. We recommend subsidence cross line(s) to check pillar compression and sag predictions.

5.2.5 Subsidence deformations

The following represents an appropriate estimate of the subsidence deformation on which the hazards and risks can be assessed.

5.2.5.1 During mining

The vertical subsidence is a function of the sag of the conglomerate (in the order of 10mm to 100mm for the panel widths utilised to date) and the compression of the pillar system (in the order of 50mm to 100mm for the panel widths utilised to date.). The 20mm subsidence limit is predicted to be within 50m of the end of the extraction panels.

A visualisation of the likely subsidence (Figure 31) has been conducted based on a set of arbitrary parameters and calibration to the maximum subsidence recorded to date above the previous area. The visualisation cannot incorporate the upsidence that has been measured. In addition, the visualised subsidence at the panel edges is greater than that measured.

5.2.5.2 Subsidence over the longer term

The "unstable" behaviour of the floor is related to the immediate loading of the Awaba Tuff claystone and the associated rises in pore pressures (undrained state in soil mechanics). It follows that over time the stability of the pillars foundations will increase as the floor under the pillars consolidates. It is noted that the floor heave/subsidence events at Awaba happened during active mining and not sometime later. There would be further increases in stability if the mine floods as this reduces pillar loads by introducing buoyancy effects. A corollary of this would be a slight reduction in subsidence.

As is the case for other areas of Awaba, shallow mining introduces the risk of plug collapses above the voids. This behaviour should be restricted to periods of high rainfall and only in drainage channels.

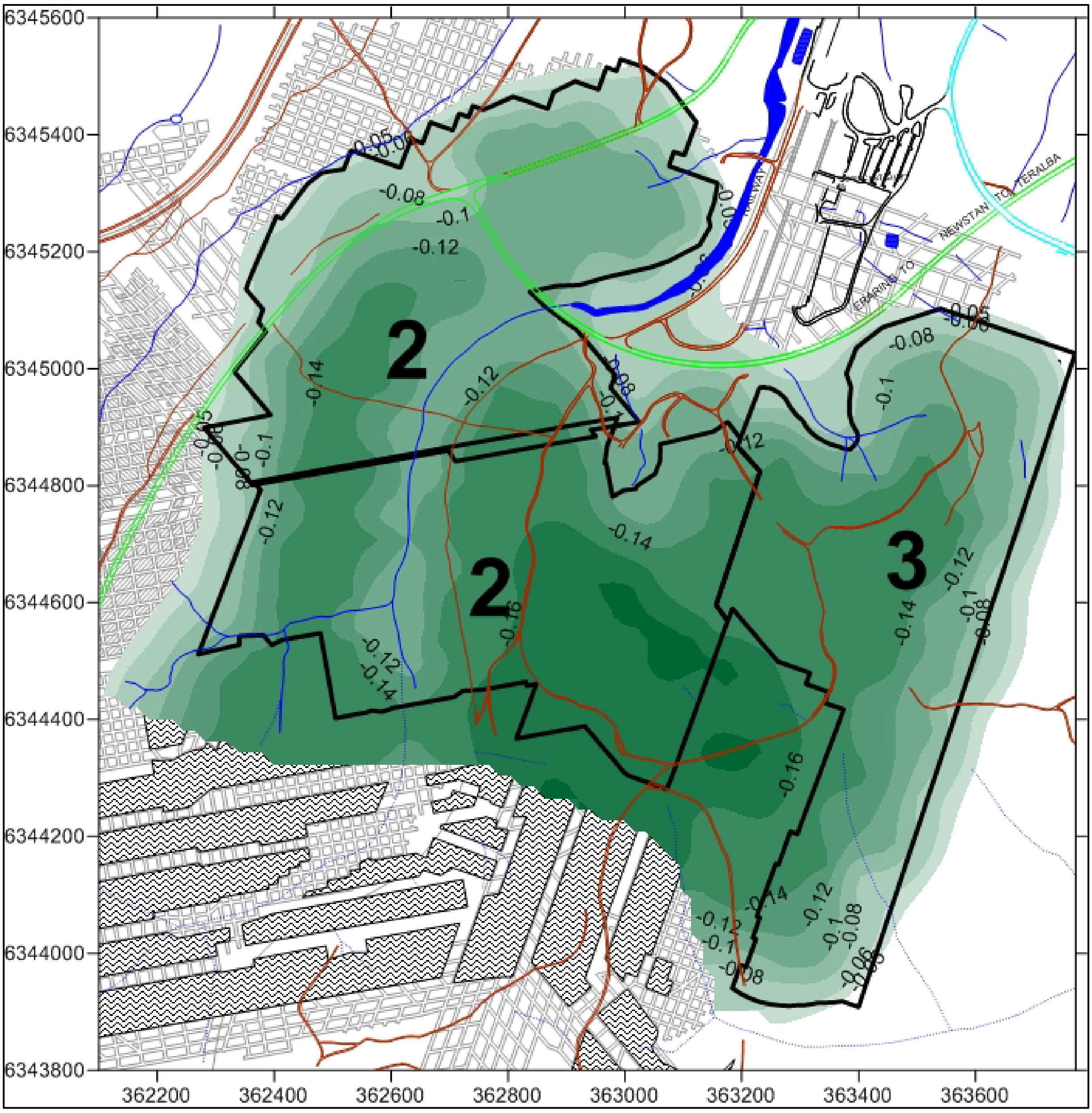


Figure 31 Visualisation of possible subsidence above Study Area 3 and its relationship to Study Area 2

5.2.5.3 Extreme subsidence outcome

There are a number of possibilities whereby the subsidence levels will be in excess of predictions.

- Lack of knowledge of the floor leading ultimately to the collapse of the pillars. This hazard could lead to increased subsidence and also loss of coal reserves and the onset of poor goaf edge conditions underground. We recommend progressive coring or other testing of the floor in extraction areas and adjacent to rail prior to second workings.

- Plug collapse. This can lead to formation of large cracks and steps at the surface and inflow of water into the mine. We recommend regular inspections of any water courses especially after heavy rainfall.
- In common with all geotechnical ventures, there is uncertainty about the selection of parameters for the design calculations. We recommend subsidence cross line(s) to check pillar compression and sag predictions.

The worst-case subsidence outcome would be if the conglomerate fails – this will result in a type of plug subsidence, with the formation of vertical faces of say 2.5m height at the edge of the panels (Figure 32). Because of the serious threat such a collapse would pose to the underground workforce, the mine design process is focussed on seeking to eliminate this hazard through a series of engineering controls. There are no administrative controls that can be applied to this event

It is stressed that this is not offered as a prediction as the mine layout has been specifically designed to avoid such an outcome. In the context of a subsidence risk assessment, it is recommended that this plug subsidence should be used and, if the impacts are manageable, it will follow that the impacts at the predicted levels will also be acceptable. It is noted that if plug subsidence does develop, there will be no cracking within the barrier pillars and the subsidence along the haul roads will decrease as a consequence of the spanning loads being removed.

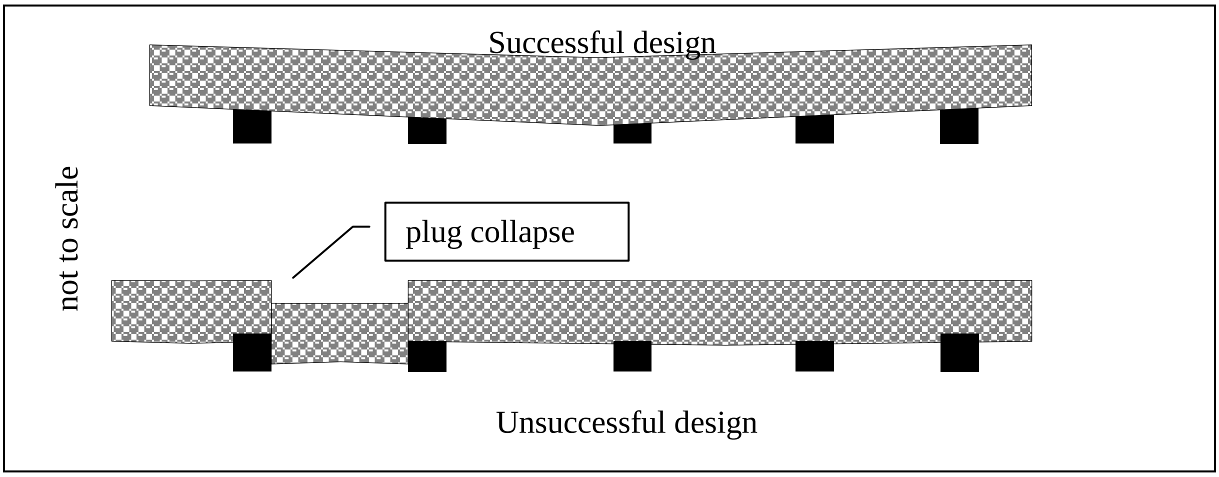


Figure 32 Cartoon defining a plug collapse in an unsuccessful design

6 CONCLUSION

The mine layout proposed for Awaba is based on the application of well-established rock mechanics principles that are applied conservatively. Pillar extraction is conducted only after a number of engineering and administrative controls are applied. This mans that the final location of extraction voids is an outcome of a comprehensive management plan that not only provides a safe ad productive workplace but also results in acceptable subsidence outcomes.

The engineering analyses are applied in parallel with back analysis of previous behaviours at the site and ongoing monitoring.

Risk management is an integral part of the mine planning and operational process. The same approach is applied to assessing a range of subsidence outcomes to provide a number of hazards for input to subsidence risk assessment.

7 GLOSSARY OF TERMS

Angle of Draw (AoD)	The angle to the vertical from the sides or ends of an extracted longwall block and the line drawn from the limits of extraction at seam level to the 20 mm subsidence contour at the surface. The 20 mm subsidence contour is an industry defined limit and represents the practical measurable limit of subsidence.
Bord	
Compressive Strain	A decrease in the distance between two points on the surface. Compressive strains may cause shear cracking or steps at the surface if > 3 mm/m and are usually associated with concave curvatures near the middle of the panels.
Cover Depth	The depth from the surface to the mine workings.
Factor of Safety (FoS)	The ratio between the strength of a structure divided by the load applied to the structure. Commonly used to design underground coal mine pillars.
First Workings	The tunnels or roadways driven by a continuous mining machine to provide access to the longwall panels in a mine (i.e. main headings and gate roads). The roof of the roadways is generally supported by high strength steel rock bolts encapsulated in chemical resin. Subsidence above first workings pillars and roadways is generally < 20 mm.
Mining Height	Refers to the height or thickness of coal extracted.
Outbye	An underground coal mining term used to describe the relative position of some feature or location in the mine that is closer to the mine entry point than the reference location.
Panel Width	The width of an extracted area between chain pillars.
Pillar	
Strain	The change in horizontal distance between two points at the surface after mining, divided by the pre-mining distance between the points. i.e. Strain = ((post-mining distance between A and B) - (pre-mining distance between A and B))/(pre-mining distance between A and B) and is usually expressed in mm/m.
Study Area	The area which may be influenced by mine subsidence
Subsidence	The difference between the pre-mining surface level and the post-mining surface level at a point, after it settles above an underground mining area.

Tilt	The rate of change of subsidence between two points (A and B), measured at set distances apart (usually 10 m). Tilt is plotted at the mid-point between the points and is a measure of the amount of differential subsidence. i.e. Tilt = (subsidence at point A - subsidence at point B)/(distance between the points) and is usually expressed in mm/m.
Tensile Strain	An increase in the distance between two points on the surface.

THE AWABA COLLIERY MINING PROJECT BROAD BRUSH RISK ASSESSMENT

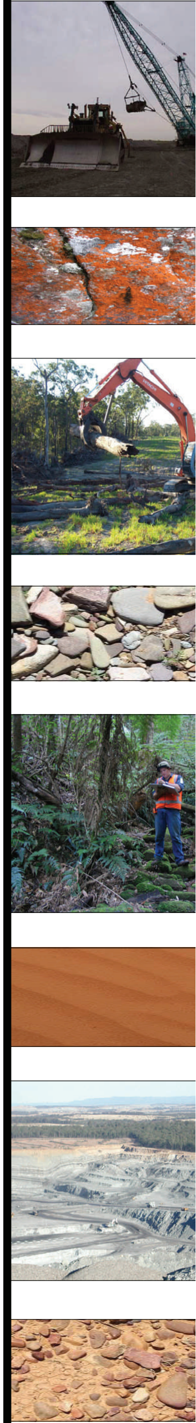
INCLUDING:

APPENDIX A: PART 3A BROADBRUSH RISK ASSESSMENT WORKSHOP

APPENNDIX B: SMP RISK ASSESSMENT - REVISED STAGE 3

APPENDIX C: SMP RISK ASSESSMENT - EAST B AREA

APPENDIX D: SMP RISK ASSESSMENT - MAIN SOUTH AREA



APPENDIX 5

Centennial Coal
Awaba

Risk Assessment Document

Awaba Colliery

Part 3A Environmental Assessment - Awaba Colliery

Broad Brush Risk Assessment No.: 20100113

1. INTRODUCTION

Background:

Awaba Colliery is a small underground coalmine 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. Awaba Colliery is a small operation with approximately 100 employees and contractors, historically producing approximately 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.

This Broad Brush Risk Assessment (BBRA) has been prepared by GSS Environmental (GSSE) to assess the key environmental issues relating to a proposal by Centennial for continued operations at Awaba Colliery. An application for a Part 3A Project Approval will be lodged by Centennial for the ***Awaba Colliery Mining Project*** (the "Project"), which will seek approval from the Minister for Planning to allow an extension of underground mining (East B Area) and the ongoing use of associated surface operations. 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 (refer Section 4) over a period of approximately five years or more, depending on actual mining conditions and relevant market drivers. To allow for potential productivity improvements, approval will be sought for approximately 880,000 tonnes per financial year. An Environmental Assessment ("EA") that will assess the key environmental issues as considered by this BBRA will support the application for the proposed Project.

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 outlined in Sections 1.2 and 1.3 below.

***Context of the BBRA*:**

Subsidence impacts from the proposed mining areas for the Project have been dealt with in separate specific risk assessments attached as Appendix B (Revised Stage 3 Area), Appendix C (East B Area) and Appendix D (Main South Stage 2 Area). This Broad Brush Risk Assessment should consider the environmental risks posed by the entire Project as required for a Part 3A Environmental Assessment, excluding subsidence-related environmental impact risks dealt with in the specific Risk Assessments completed for each of the mining areas. The scope of this BBRA is outlined in **Section 4** (Risk Assessment Boundary Definition).

Presentation to the Risk Team During the BBRA Workshop:

A project background presentation (powerpoint) for the Part 3A Environmental Assessment - Awaba Colliery was presented to the risk team by GSSE at the risk assessment workshop (see **Appendix A** and further detail in **Section 7**). This provided an overview of the Part 3A process, as well as providing background to the mining areas including previous history, natural and man-made features and expected subsidence behavior, which differ significantly for the three proposed mining areas. The presentations also outlined the mining method and explained subsidence controls.

2. Objective:

The following Hierarchy of Controls offers a framework for considering the effectiveness of controls. Note that the effectiveness of a control that is intended to reduce a risk decreases from top to bottom of the list. In other words, the closer the control type is to the top of the hierarchy, the more potentially effective the control.

·Eliminate the hazard or energy source (do not use the energy)
·Minimise or replace the hazard or energy source (reduce the amount of energy to a less damaging level or replace the energy with another hat has less potential negative consequences)
·Control the hazard or energy using engineered devices (ex. Lock outs, chemical containers, mechanical roof support, gas monitors, etc.)
·Control the hazard or energy by using physical barriers (ex. machine guarding, warning signs, etc.)
·Control the hazard or energy with procedures (ex. Isolation procedures, standard operating procedures, etc.)
·Control the hazard or energy with personal protective equipment (ex. hard hats, boots with toe caps, gloves, safety glasses, welding gear, etc.)
·Control the hazard or energy with warnings and awareness (ex. posters, labels, stickers, verbal warnings, etc.)

The following **key objectives** of this preliminary Broad Brush Risk Assessment (BBRA) for the **Part 3A Environmental Assessment - Awaba Colliery** include:

- To establish an appropriate risk assessment team of suitably qualified and experienced Centennial staff, specialist consultants and key stakeholders;
- Discuss and review existing information known for the Study Areas and experience in adjacent mining areas;
- To provide the basis for the development of a priority action plan which identifies the various key potentially high risk issues relating to the project (including where this is due to further investigation or information being required to better assess environmental risk). This is to be used to ensure the potentially high risk aspects are adequately investigated and addressed in the Environmental Assessment work and are included in further consideration during the environmental impact assessment phase of project;
- To establish a Draft Risk Register (WRAC Worksheet) and risk report for the Project for review and comment by the risk team;
- The identification of additional controls required (including with respect to any need for updating Centennial management plans); and
- To produce a Project Broad Brush Risk Assessment Report (including Risk Register/WRAC Worksheet) for the Environmental Assessment to the DoP.

The aim is to provide the basis for identifying issues prior to the commencement of the environmental impact assessment phase of the project. It is intended that this BBRA would be used in the preparation of an Environmental Assessment (EA) to be submitted to the Department of Planning (DoP) under Part 3A of the Environmental Planning and Assessment Act and form part of the “risk based” justification for the level of assessment for the various aspects of the project.

The Centennial risk assessment standard lists the following Hierarchy of Controls and was followed in undertaking this risk assessment. Note that the effectiveness of a control that is intended to reduce as a risk decreases from top to bottom of the list. Which in other words, the closer the control type is to the top of the hierarchy, the more potentially effective the control.

3. Potential Hazards:

Potential hazards for the Project were considered within the context of risks discussed and assessed by the risk team (as a minimum) for the following environmental related hazard categories/aspects:

- Community Consultation;
- Soils and Land Capability;
- Flora and Fauna;
- Heritage (indigenous and Non-Indigenous);
- Air Quality and Greenhouse Gas;
- Surface Water;
- Groundwater;
- Subsidence;
- Traffic and Transport;
- Visual Amenity;
- Site Services;
- Waste Management;
- Closure and Rehabilitation;
- Land Ownership;
- Contaminated Land;
- Socio-Economic; and
- Noise and Vibration.

4. Risk Assessment Boundary Definition:

The **boundary** of this BBRA is formed by the Project Application Area for the Environmental Assessment, which is comprised of four (4) key study areas for consideration in this risk assessment. This includes the following areas:

- **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;
- **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); and
- **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 development consent DA 73-11-98) 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 Section 96(1A) of the EP&A Act to allow for the preparation of coal sourced from the Awaba Colliery using the existing Newstan Colliery infrastructure.

Further, the **scope** of the risk assessment for the ***Awaba Colliery Continuation of Mining Project*** included:

- Consideration of the three (3) Mining Areas – Remaining Mining within the SMP Approved Main South Area (Stages 2 and revised Stage 3), and the proposed East B Area, each defined as the proposed workings plus 26.5 degree angle of draw (i.e. as per SMP Guidelines), excluding **subsidence-related impacts** which have already been addressed in specific Subsidence risk assessments completed for those areas. Cross-reference to the highest potential risks within each of these risk assessments has been made within this BBRA;
- The Awaba pit top facilities (Surface Operations) associated with the crushing and loading of coal to trucks for transport to Centennial Newstan or Eraring Power Station by internal private Haul Road;
- Transport of coal along the internal haul road to either of the Newstan or Eraring receival facilities;
- The use of an existing quarry on a campaign basis with material used for construction, road building and related purposes. It should be noted that there is no further disturbance proposed for the Project and will only involve the removal of stockpiled material;
- All potential environmental impacts associated with mine access, ventilation, water management and other services provided through the existing workings areas to the active and proposed mining areas.

5. Risk Assessment Methods:

Yes/No	Method
	PROACTIVE TOOLS
Yes	Workplace Risk Assessment and Control (WRAC) – including a ‘worst case’ failure scenario
	Fault Tree Analysis (FTA)
	SIL Analysis to Australian Standard 61508 - Under Development
	Bow Tie Analysis (BTA)
	Failure Modes and Effects Analysis (FMEA)
	REACTIVE TOOLS:
	Root Cause Analysis (RCA) - Under Development

6. Previous Risk Assessment and other documents to be used and/or referenced:

Title	Author	Version	Referenced Document Date
Revised Stage 3 SMP Area – SMP Application	GSS Environmental	Final	01-Dec-2009
Revised Stage 3 SMP Area – Risk Assessment	GSS Environmental	Final	11-Sep-2009
3 North SMP Area Risk Assessment	GSS Environmental	Final	07-Nov-2008
Awaba East Exploration Risk Assessment	GSS Environmental	Final	04-Apr-2008
SMP Risk Assessment for Main South Area (incl Stage 2 Area)	Environmental Resource Management	Final	10-Jan-2005
3 North Area – SMP Application	GSS Environmental	Final	01-Dec-2008
Awaba East Exploration Review of Environmental Factors (REF), including environmental risk mapping and specialist reports for ecology & Aboriginal heritage	GSS Environmental	Final	04-Aug-2008
2005 SMP Application - Main South Area	Environmental Resource Management	Final	05-Dec-2005
DPI Staged Approval Conditions for Main South Area and 3 North Area	DPI-MR	Final	Stage 1 – Sep-2007 Stage 1 variation – Aug-2008 Stage 2 – Sep-2008 3 North – Mar-2009
Environmental Monitoring Program (*incorporating Public Safety MP & Watercourse MP*), Subsidence Monitoring Plan	Various		
Alluvium Groundwater study	Australasian Groundwater and Environmental Consultants	Final	
Review of Panel & Pillar Layout	Seedsman Geotechnics	Final	04-Aug-2008

7. Information Required for Risk Assessment:

Presentations were made by the Centennial Mine Manager and GSS Environmental to the risk assessment team at the start of the risk assessment workshop (refer **Appendix A** – *Risk Assessment Presentations – GSSE and Centennial*), which provided an overview of the key characteristics of the Project study areas, and aspects required for discussion and assessment during the risk assessment. The presentations illustrated the study areas, outlined the mining method, predicted subsidence behavior and history of mining and subsidence in the area. The risk assessment team was given the opportunity to comment on the material in each presentation.

Following the initial presentation provided at the risk assessment workshop the scope of the Part 3A application was updated. These changes in scope have been incorporated into this Risk Assessment report and were communicated to the risk team who were then given the opportunity to comment on the risk assessment in light of the revised scope.

Preliminary mapping/figures were presented for natural and constructed surface features and land ownership within the Study Area. Comment was provided on each relevant aspect by the specialists present at the risk assessment meeting for ecology, archaeology/Aboriginal heritage, noise, air quality, surface water and mine subsidence.

8. Venue and Time:

Date	Description	Location	Start Time	End Time	Comment
1. 13-Jan-2010	Scoping	Awaba Colliery	9:00 AM	10:30 AM	Completion of presentations. Discussions with stakeholders regarding mining method & controls to minimise subsidence
2. 13-Jan-2010	Assessment	Awaba Colliery	10:30 AM	2:00 PM	Completion of RA
3. 21-Jan-2010	Review	Various Locations (emailed to risk team)	21/01/10	27/01/10	Draft risk assessment report sent to risk team for review and comment before finalisation
4. 19-Feb-2010	Review	Various Locations (emailed to risk team)	19/02/10	22/02/10	Draft risk assessment report updated with revised scope to include aspects such as the private haul road use and the existing quarry, etc. then sent to risk team for review and comment before finalisation

9. Risk Assessment Team Selection

Name	Title	Company	Yrs. of Exp.	E-Mail Address
Roger Davis	(former) Mine Manager	Awaba Colliery (now Myuna Colliery)	32	roger.davis@centennialcoal.com.au
Grant Watson*	(new) Mine Manager	Awaba Colliery	19	grant.watson@centennialcoal.com.au
Craig Cluderay	Surveyor	Awaba Colliery	26	craig.cluderay@centennialcoal.com.au
Mary-Anne Crawford	Group Environment Manager	Centennial Coal	15	maryanne.crawford@centennialcoal.com.au
Jeff Dunwoodie	Environmental Coordinator	Newstan/Awaba Colliery	7	jeffrey.dunwoodie@centennialcoal.com.au
Craig Bagnall	Project Manager	GSS Environmental	16	bagnell@gssenvironmental.com
Eryn Bath	Project Manager	GSS Environmental	10	bath@gssenvironmental.com
Anthony Reid	Environmental Scientist	GSS Environmental	2	reid@gssenvironmental.com
Colin Driscoll	Environmental Biologist	Hunter Eco	30	cd_enviro@bigpond.com
Lisa-Maree Campbell	Archaeologist	RPS HSO	5	lisa-maree@rpshso.com.au
Ian Joliffe	Principal Water Engineer	GHD	30	ian.joliffe@ghd.com
Katie Teyhan	Noise Consultant	Heggies	7	katie.teyhan@heggies.com
Jason Watson*	Air Quality / GHG Consultant	Heggies	12	jason.watson@heggies.com
Veronica Warren	Environmental Officer	Newstan/Awaba Colliery	2	Veronica.warren@centennialcoal.com.au
Lee-Ann Snowden	Commercial Support Officer	Centennial Coal	28	leeann.snowden@centenninalcoal.com.au

** Reviewed Risk Report and Risk Register including risk workshop presentations, did not attend workshop.*

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WRAC Analysis Worksheet

L= Likelihood; MRC= Maximum Reasonable Consequence; RR= Risk Rank

Step	Potential Incident	Current Controls	L	MRC	RR	Recommended Control
1. Stakeholder Consultation	There is a risk to Awaba from ::: Part 3A Project application ::: Caused by: Lack of adequate/appropriate consultation or Objections received during exhibition period Resulting in: Delays to project approval.	1.1.a. Centennial Corporate Community Consultation Procedures and experience. 1.1.b. Stakeholder Engagement Plan. 1.1.c. Stakeholder (including Aboriginal and infrastructure) consultation undertaken for revised Stage 3 mining area SMP (2009). 1.1.d. Stakeholder (including Aboriginal) consultation undertaken for preliminary East B mining area (2009).	**C** (Pb)	3 (F)	13 (S)	1. Complete consultation for finalised East B mining area. 2. Consultation log to be developed for Part 3A application consultation process.
2. Soils	There is a risk to Awaba from ::: Surface operations ::: Caused by: Surface disturbance Resulting in: Erosion and sedimentation.	2.1.a. Minimal additional construction activities and surface disturbances. 2.1.b. Erosion sediment control installed for any surface disturbance. 2.1.c. PCD.	**D** (Pb)	4 (E)	21 (L)	
3. Flora and Fauna	There is a risk to Awaba from ::: Surface operations ::: Caused by: Surface disturbance Resulting in: Disturbance to threatened species and/or endangered communities.	3.1.a. Minimal additional construction activities and surface disturbances. 3.1.b. Flora and Fauna Management Plan including permit to clear. 3.1.c. Area proposed for new dam is already disturbed.	**D** (Pb)	4 (E)	21 (L)	3. Specialist ecology assessment including cumulative impacts required for Part 3A application including any required mitigation measures.
	There is a risk to Awaba from ::: Underground operations ::: Caused by: Underground mining subsidence (plug failure) Resulting in: Disturbance to threatened species	3.2.a. Mine design (extraction only in areas of adequate depth of cover). 3.2.b. Specialist Ecological Assessment undertaken for revised Stage 3 Area SMP 2009.	**D** (Pb)	4 (E)	21 (L)	4. Specialist ecology assessment including cumulative impacts required for Part 3A application including any required mitigation measures.

WRAC Analysis Worksheet

L= Likelihood; MRC= Maximum Reasonable Consequence; RR= Risk Rank

Step	Potential Incident	Current Controls	L	MRC	RR	Recommended Control
	and/or endangered communities including GDE.					
	There is a risk to Awaba from ::: Potential to trigger detailed requirements (incl. consultations) of the federal Environment Protection & Biodiversity Conservation (EPBC) Act ::: Caused by: Federally listed Threatened Species being disturbed within the project area Resulting in: Breach of the EPBC Act, potential delays in project or failure to receive approval.	3.1.a. Flora and Fauna Management Plan including permit to clear. 3.1.b. Specialist Ecological Assessment undertaken for Revised Stage 3 Area SMP 2009.	**D** (Pb)	4 (E)	21 (L)	5. a) Specialist ecology assessment including cumulative impacts required for Part 3A application including any required mitigation measures. 5.b) Submit formal referral to DEWHA for instruction.
4. Heritage (indigenous and Non-Indigenous)	There is a risk to Awaba from ::: Surface operations ::: Caused by: Surface disturbance Resulting in: Disturbance to Aboriginal sites.	4.1.a. Minimal additional construction activities and surface disturbances. 4.1.b. Specialist archaeological assessment and Aboriginal community consultation for revised Stage 3 Area and preliminary East B area. 4.1.c. Area proposed for new dam is already disturbed but still to be assessed by archaeologist. 4.1.d. Centennial procedure requires Permit to Clear for all surface disturbances.	**C** (Pb)	3 (E)	13 (S)	6. Specialist archaeology assessment required for Part 3A application including any required mitigation measures. 7. Commence additional Aboriginal Community Consultation. 8. Review Newstan Colliery Holding Aboriginal Heritage Management Plan and update as required.
	There is a risk to Awaba from ::: Surface operations ::: Caused by: Surface disturbance Resulting in: Disturbance to European Heritage items.	4.2.a. Minimal additional construction activities and surface disturbances. 4.2.b. Specialist archaeological assessment for revised Stage 3 Area and preliminary East B area. 4.2.c. Centennial procedure requires Permit to Clear for all surface disturbances.	**D** (Pb)	3 (L)	17 (M)	9. Specialist archaeology assessment required for Part 3A application including any required mitigation measures.

Centennial Coal
Awaba

WRAC Analysis Worksheet

L= Likelihood; MRC= Maximum Reasonable Consequence; RR= Risk Rank

Step	Potential Incident	Current Controls	L	MRC	RR	Recommended Control
	There is a risk to Awaba from ::: Underground operations ::: Caused by: Underground mining subsidence (plug failure) Resulting in: Disturbance to Aboriginal sites. or Disturbance to European Heritage items.	4.3.a. Mine design (extraction only in areas of adequate depth of cover). 4.3.b. Specialist Aboriginal and European archaeological assessment for revised Stage 3 Area and preliminary East B area.	**D** (Pb)	3 (E)	17 (M)	10. Specialist archaeology assessment required for Part 3A application including any required mitigation measures.
5. Air Quality	There is a risk to Awaba from ::: Surface operations ::: Caused by: Plant and machinery (fixed and mobile) Resulting in: Exceedance of relevant DECCW criteria.	5.1.a. No additional operational activities or significant increase in production. 5.1.b. Minimal additional construction activities and surface disturbances. 5.1.c. Dust Management Plan including onsite controls. 5.1.d. Monthly dust monitoring.	**C** (IF)	4 (E)	18 (M)	11. Specialist air quality assessment including cumulative impacts required for Part 3A application including any required mitigation measures.
	There is a risk to Awaba from :::Dust emissions::: Caused by: Transport of coal by trucks to either Newstan or Eraring on private haul road Resulting in: Exceedance of relevant DECCW criteria and/or receipt of complaints at residences.	5.2.a. Coal transport trucks have loads covered 5.2.b. No additional operational activities or significant increase in production 5.2.c. Dust Management Plan including onsite controls. 5.2.d. Monthly dust monitoring.	**D** (Pb)	4 (E)	21 (L)	12. Specialist air quality assessment including cumulative impacts required for Part 3A application including any required mitigation measures.
6. Greenhouse Gas	There is a risk to Awaba from ::: Mine operations ::: Caused by: Plant and machinery (fixed and mobile), transportation, fugitive emissions, power consumption, additional burning of coal (all scope 1 and 2 emissions - NGERS)	6.1.a. No additional operational activities or significant increase in production. 6.1.b. Awaba Colliery has historically had very low methane emissions. 6.1.c. Awaba emissions currently below 25,000 tonnes CO2 NPI trigger level.	**D** (Pb)	4 (E)	21 (L)	13. Greenhouse Gas impacts to be assessed as part of the Part 3 A application.

WRAC Analysis Worksheet

L= Likelihood; MRC= Maximum Reasonable Consequence; RR= Risk Rank

Step	Potential Incident	Current Controls	L	MRC	RR	Recommended Control
	Resulting in: Significant increase in greenhouse gas emissions and associated impacts.	6.1.d. Existing monthly audited assessments. 6.1.e. Annual Reports to NGERS.				
7. Surface Water	There is a risk to Awaba from ::: Pit top dirty water ::: Caused by: Rainfall and failure of stormwater drainage system Resulting in: Unintended discharge from the LDP009 (non compliance with EPL quality criteria).	7.1.a. No additional operational activities or significant increase in surface water management requirements from existing operations. 7.1.b. Existing pollution control dam (PCD). 7.1.c. Existing oil water separator. 7.1.d. Separation of clean and dirty waters (diversions, piping etc). 7.1.e. Ability to pump water underground (from PCD). 7.1.f. Routine monitoring and level alarms. 7.1.g. EPL licence discharge. 7.1.h. Staff training and equipment for spill response. 7.1.i. Bunded storage areas, eg diesel.	**B** (Op)	3 (L)	9 (H)	14. Specialist surface water assessment including cumulative impacts required for Part 3A application including any required mitigation measures. 15. Proposed additional dam capacity budgeted. 16. Annual water balance to quantify site water usage.
	There is a risk to Awaba from ::: Pit top clean water ::: Caused by: Spill or failure of the bunded storage area introducing pollutants into clean water system Resulting in: Discharge of polluted water.	7.2.a. No additional operational activities or significant increase in surface water management requirements from existing operations. 7.2.b. Separation of clean and dirty waters (diversions, piping etc). 7.2.c. Staff training and equipment for spill response. 7.2.d. Bunded storage areas, eg diesel.	**D** (Pb)	4 (E)	21 (L)	17. Specialist surface water assessment including cumulative impacts required for Part 3A application including any required mitigation measures.
	There is a risk to Awaba from ::: Surface Cracking in the **Revised Stage 3 Area** ::: Caused by: Mining operations	7.3.a. No secondary extraction under second or third order creeks or their alluvial deposits 7.3.b. Mine design (extraction only in areas of adequate depth of cover). 7.3.c. Flow path analysis assessment completed by HunterEco for the Revised Stage 3 Area	**E** (Pb)	4 (R)	23 (L)	18. Review of SMP investigations and assessments (including cumulative impacts) required for Part 3A application (EA) including any additional required mitigation measures.

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WRAC Analysis Worksheet

L= Likelihood; MRC= Maximum Reasonable Consequence; RR= Risk Rank

Step	Potential Incident	Current Controls	L	MRC	RR	Recommended Control
	Resulting in: Cracking of banks and first order tributaries of creek beds, loss of water flows, iron deposits, increased sediment in drainage lines, loss of aquatic habitat.	7.3.d. Watercourse Management Plan				
	There is a risk to Awaba from ::: Surface Cracking in the **East B Area** ::: Caused by: Mining operations Resulting in: Cracking of banks and first order tributaries of creek beds, loss of water flows, iron deposits, increased sediment in drainage lines, loss of aquatic habitat.	7.4.a No second order or higher creek sections within the East B Area 7.4.b. Mine design (extraction only in areas of adequate depth of cover). 7.4.c. Surface Water Management Plan 7.4.d. Watercourse assessment was carried out for Awaba East Stage 1 Exploration REF study area.	**E** (Pb)	4 (R)	23 (L)	19. Review of SMP investigations and assessments (including cumulative impacts) required for Part 3A application (EA) including any additional required mitigation measures. 20. Surface water flow path analysis recommended assessing downstream impacts in the event of worst case ('plug failure') scenario.
	There is a risk to Awaba from ::: Surface Cracking in the **Main South Stage 2 Area** ::: Caused by: Mining operations Resulting in: Cracking of banks and first order tributaries of creek beds, loss of water flows, iron deposits, increased sediment in drainage lines, loss of aquatic habitat.	7.5.a No secondary extraction including prescribed buffer zones under second or third order creeks or their alluvial deposits 7.5.b. Mine design (extraction only in areas of adequate depth of cover). 7.5.c. Approved Subsidence Management Plan including risk assessment for subsidence impacts 7.5.d. Watercourse Management Plan 7.5.e. Surface water assessment was carried out for Awaba East Stage 1 Exploration REF study area.	**E** (Pb)	4 (R)	23 (L)	21. Review of SMP investigations and assessments (including cumulative impacts) required for Part 3A application (EA) including any additional required mitigation measures. 22. Surface water flow path analysis recommended assessing downstream impacts in the event of worst case ('plug failure') scenario.

WRAC Analysis Worksheet

L= Likelihood; MRC= Maximum Reasonable Consequence; RR= Risk Rank

Step	Potential Incident	Current Controls	L	MRC	RR	Recommended Control
8. Groundwater	There is a risk to Awaba from ::: Mine operations - coal seam aquifers ::: Caused by: Underground mining Resulting in: Ground water system impacts or Inflow of ground water to underground workings.	8.1.a. Historical underground workings since 1947 have depressurised the aquifer. 8.1.b. Historical minimum water observed from coal seam (dry seam). 8.1.c. Routine mine inspections. 8.1.d. AGEC Groundwater Investigations - 2008.	**D** (IF)	4 (E)	21 (L)	
	There is a risk to Awaba from ::: Mine operations - shallow aquifers ::: Caused by: Underground mining subsidence (plug failure) Resulting in: Impact on ground water dependent ecosystems.	8.2.a. AGEC Groundwater Investigations - 2008. 8.2.b. Mine design (extraction only in areas of adequate depth of cover). 8.2.c. Mining extraction barriers around second and third order streams.	**D** (Pb)	4 (E)	21 (L)	
	There is a risk to Awaba from ::: Groundwater Infill of Mine Workings ::: Caused by: Inadequate post closure (long-term) groundwater strategy Resulting in: Impacts (including seepage) upon infrastructure or lands not owned by Centennial.	8.3a. Awaba Part 3A BBRA (2010) 8.3.b Existing Licenced Discharge Points (LDPs) under the site's EPL with volumetric discharge limits 8.3 c Surface inspections for subsidence cracking and appropriate rehabilitation where required prior to closure (wrt cracks as potential long term water egress points)	B (Pb)	3 (E)	9 (H)	23. Creation of a hydro-geological model for the Awaba Colliery based on Centennial Newstan.
	There is a risk to Awaba from ::: Groundwater management::: Caused by: Mine Dewatering	8.4.a. Groundwater pumped through LDP (Barnes Dam) in accordance with Awaba's EPL 8.4.b. Discharge of mine water via 10 South Bore to Eraring Ash Dam (in accordance with agreements with	B (Pb)	3 (L)	9 (H)	24. 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). Includes consideration of the hydrogeological model being developed (see above).

WRAC Analysis Worksheet

L= Likelihood; MRC= Maximum Reasonable Consequence; RR= Risk Rank

Step	Potential Incident	Current Controls	L	MRC	RR	Recommended Control
	Resulting in: Breach of applicable regulatory requirements relating to discharge (including quality and quantity).	Eraring Energy).				
9. Subsidence	There is a risk to Awaba from ::: Subsidence::: Caused by: Underground Mining Resulting in: Subsidence impacts upon public safety, natural and man-made surface features, including areas of environmental significance (as per SMP Guidelines, 2003).	9.1.a. ***Main South Area*** Subsidence Risk Assessment (**Appendix B**) *note highest risk within RA was to public safety ("plug" failure resulting in risk of accident to truck drivers) ** this risk was ranked ***without*** considering controls which include no secondary extraction under roads and limits for mining at particular depths of cover	D (Op)	1 (PI)	7** (H)	25 Specialists studies will review previous investigations for the Main South Area SMP 2005/2007 and the adequacy of these controls for the proposed mining method and mine layout for the remaining areas with Main South Stage 2 Area. Refer **Appendix B** for full copy of the subsidence risk assessment for Main South Area (incl Stage 2).
		9.1.b. ***East B Area*** Subsidence Risk Assessment (**Appendix C**) *note: highest risk within RA was to public safety ("plug" failure resulting in personal injury, vehicle damage & vegetation instability) and Archaeology (various aspects). **this risk was ranked considering current controls implemented.	**D** (IF)	3 (PI)	17 (M)	26. Controls recommended within the East B Area subsidence risk assessment are considered adequate for this Project. Noted that East B area has **no surface infrastructure** (unlike other areas). Refer **Appendix C** for full copy of the subsidence risk assessment for East B Area.
		9.1.c. ***Revised Stage 3 Area*** Subsidence Risk Assessment (**Appendix D**) *note highest risk within RA was to public safety ("plug" failure resulting in risk of accident to truck drivers). **this risk was ranked considering current controls implemented.	E (Op)	3 (PI)	20 (L)	27. Controls recommended within the Revised Stage 3 Area subsidence risk assessment are considered adequate for this Project. Refer **Appendix D** for full copy of the subsidence risk assessment for Revised Stage 3 Area.
10. Traffic and Transport	There is a risk to Awaba from ::: Mine operations ::: Caused by: Employee/contractor movements to and from site, deliveries, off site maintenance Resulting in:	10.1.a. No additional operational activities or personnel proposed under Part 3A (continuing existing operations). 10.1.b. Majority of vehicles entering and exiting are light vehicles. 10.1.c. Mine entrance has good visibility and is a low traffic density road. 10.1.d. Mine's projected cessation is late	**D** (IF)	3 (PI)	17 (M)	28. Undertake consultation with DoP and Council/RTA to determine their EA requirements.

WRAC Analysis Worksheet

L= Likelihood; MRC= Maximum Reasonable Consequence; RR= Risk Rank

Step	Potential Incident	Current Controls	L	MRC	RR	Recommended Control
	Interaction and public safety risks.	2011.				
	There is a risk to Awaba from ::: Transport of coal ::: Caused by: Truck movements Resulting in: Interaction and public safety risks.	10.2.a. No additional operational activities or significant increase in production. 10.2.b. All coal transported on private haul road (no transport on public roads). 10.2.c. Fencing, gate and signage to prevent public access to haul road.	**E** (IF)	3 (PI)	20 (L)	
11. Visual Amenity	There is a risk to Awaba from ::: Surface operations ::: Caused by: Surface infrastructure Resulting in: Unacceptable visual impacts.	11.1.a. Minimal additional construction (no additional operational activities) 11.1.b. Natural topographical and vegetation screening. 11.1.c. Low density of surrounding residential receptors. 11.1.d. Complaints Register kept (no complaints to date).	**E** (Pb)	4 (R)	23 (L)	
12. Site Services	There is a risk to Awaba from ::: Not Applicable ::: Caused by: Resulting in: Not applicable.	12.1.a. No additional operational activities, site services or personnel proposed under Part 3A (continuing existing operations).				
13. Waste Management	There is a risk to Awaba from ::: Domestic waste water management ::: Caused by: Operation of surface facilities Resulting in: Discharge of water beyond licence requirements.	13.1.a. No additional operational activities or personnel proposed under Part 3A (continuing existing operations). 13.1.b. Monthly water quality monitoring. 13.1.c. Weekly inspections of irrigation system 13.1.d. EPL licence discharge.	**D** (Pb)	4 (E)	21 (L)	
	There is a risk to Awaba from	13.2.a. No additional operational activities or personnel proposed under Part	**D** (Pb)	4 (E)	21 (L)	

WRAC Analysis Worksheet

L= Likelihood; MRC= Maximum Reasonable Consequence; RR= Risk Rank

Step	Potential Incident	Current Controls	L	MRC	RR	Recommended Control
	::: Solid general waste ::: Caused by: Mining operations Resulting in: Pollution due to incorrect disposal and inefficient use of resources.	3A (continuing existing operations). 13.2.b. Waste contract. 13.2.c. Recycling and waste sorting program.				
14. Closure and Rehabilitation	There is a risk to Awaba from ::: Inadequate closure and rehabilitation ::: Caused by: Poor planning Resulting in: Failure to meet mine closure criteria (including environmental) and reclaim mine security deposit from the DII.	14.1.a. Approved Mine Closure Plan. 14.1.b. Security deposit. 14.1.c. Successful corporate experience in mine closure and site rehabilitation.	**D** (Pb)	3 (E)	17 (M)	29. Mine Closure and Rehabilitation Risk Assessment to be conducted prior to commencement of closure works.
15. Land Ownership	There is a risk to Awaba from ::: Not Applicable ::: Caused by: Resulting in: Not applicable.	15.1.a. Entire Project area is Crown Land - Held by Centennial Newstan Pty Ltd (CCL746).				
16. Socio-Economic	There is a risk to Awaba from ::: Failure to attain project approval under Part 3A ::: Caused by: Application refusal Resulting in: Adverse socio economic impact, ie loss of jobs and flow on effects or Loss of revenue from coal sales.	16.1.a. Commenced development approval process.	**D** (Pb)	2 (F)	12 (S)	30. Commence and continue consultation with DoP and Stakeholders.

WRAC Analysis Worksheet

L= Likelihood; MRC= Maximum Reasonable Consequence; RR= Risk Rank

Step	Potential Incident	Current Controls	L	MRC	RR	Recommended Control
17. Noise and Vibration	There is a risk to Awaba from ::: Surface operations ::: Caused by: Plant and machinery (fixed and mobile) Resulting in: Exceedance of Industrial Noise Policy criteria.	17.1.a. No additional operational activities proposed under Part 3A. 17.1.b. Minimal additional construction activities and surface disturbances. 17.1.c. Partially enclosed plant. 17.1.d. Limited trucking operations between 12am and 6am. 17.1.e. Low density of surround residential receptors. 17.1.f. Natural topographical and vegetational screening. 17.1.g. Scheduled maintenance of surface vehicles and plant. 17.1.h. Operational controls in CP to minimise noise.	**C** (D)	4 (E)	18 (M)	31. Specialist noise assessment including cumulative impact required for Part 3A application including any required mitigation measures.
	There is a risk to Awaba from ::: Underground operations ::: Caused by: Blasting Resulting in: Exceedance of relevant DECCW criteria.	17.2.a. No blasting is proposed under the Part 3A. 17.2.b. No blasting undertaken at Awaba for approximately the past 20 years.	**E** (Pb)	4 (L)	23 (L)	
	There is a risk to Awaba from :::noise emissions::: Caused by: Transport of coal by trucks to either Newstan or Eraring by private haul road Resulting in: Exceedance of relevant DECCW criteria.	17.3.a. No significant change to operational activities proposed under Part 3A (continuation of existing operations/"business as usual"). 17.3.b. No noise complaints to date regarding haulage 17.3.c. Limited trucking operations between 12am and 6am. 17.3.d. Low density of surround residential receptors. 17.3.e. Natural topographical and vegetational screening.	**D** (If)	4 (E)	21 (L)	32. Specialist noise assessment including cumulative impact required for Part 3A application including any required mitigation measures.

WRAC Analysis Worksheet

L= Likelihood; MRC= Maximum Reasonable Consequence; RR= Risk Rank

Step	Potential Incident	Current Controls	L	MRC	RR	Recommended Control
		17.3.f. Scheduled maintenance of surface vehicles and plant.				
18. Contaminated Land	There is a risk to Awaba from ::: Mining and Surface operations ::: Caused by: Spills and/or leakage in storage and refueling areas Resulting in: Contamination of soil and groundwater exceeding relevant DECCW criteria.	18.1.a. Phase 1 Contamination Study completed to identify potential contaminants 18.1.b. Designated storage areas for hydrocarbons and other contaminants	**C** (Pb)	4 (E)	18 (M)	33. Review the Phase 1 Assessment to determine if there are any reporting requirements to the DECCW.

RISK MANAGEMENT STANDARD **Management Standard-004**

CENTENNIAL RISK MATRIX

Consequence

Note: Consequence may result from a single event or may represent a cumulative impact over a period of 12 months. Use the worst case reasonable consequence if there is more than one.

Likelihood

Description (D)	A Certain	B Probable	C Possible	D Remote	E Improbable
Probability (Pb)	Common"	Has Happened within Centennial"	"Could Happen & has happened in non-CEY operations	Not Likely	"Practically impossible
Incident Frequency (IF)	Frequent incidents	Regular incidents	Infrequent incidents	Unlikely to occur. Very few recorded or known incidents	May occur in exceptional circumstances. Almost no recorded incidents.
Operations (Op)	Operations – within 3 months	Operations – within 2 years	Operations – within 5 years	Operations – within 10 years	Operations – within 30 years
Project (Pr)	Project – Every project	Project – Every 2 projects	Project – Every 5 projects	Project – Every 10 projects	Project – Every 30 projects

Rating	Impact to Annual Business Plan (F)	Personal Injury (PI)	Business Interruption (BI)	Legal (L)	Reputation (R)	Environment (E)	A Certain	B Probable	C Possible	D Remote	E Improbable
1. Catastrophic	>$50m	Multiple Fatalities	> 1month	Prolonged litigation, heavy fines, potential jail term	Prolonged International media attention	Long term impairment habitats/ ecosystem	1 (E)	2 (E)	5 (H)	7 (H)	11 (S)
2. Major	$10m - $50m	Single Fatality	1 week to 1 month	Major breach/ major litigation	International media attention	Long term effects of ecosystem	3 (E)	4 (E)	8 (H)	12 (S)	16 (M)
3. Moderate	$1m - $10m	Serious/ Disabling Injury	1 day to 1 week	Serious breach of regulation. prosecution/ fine	National media attention	Serious medium term environmental effects	6 (H)	9 (H)	13 (S)	17 (M)	20 (L)
4. Minor	$100k - $1m	Lost Time Injury	12 hrs to 1 day	Non-compliance, breaches in regulation	Adverse local public attention	Minor effects to physical environment	10 (S)	14 (S)	18 (M)	21 (L)	23 (L)
5. Insignificant	<$100k	First Aid Treatment Only	< 12 hrs	Low level compliance issue	Local complaints	Limited physical damage	15 (S)	19 (M)	22 (L)	24 (L)	25 (L)

Risk Rating	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 a lower level by the introduction of control measures. Management planning required at senior levels
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 where practicable

Part 3A Broad Brush RA General Introduction to Workshop Participants

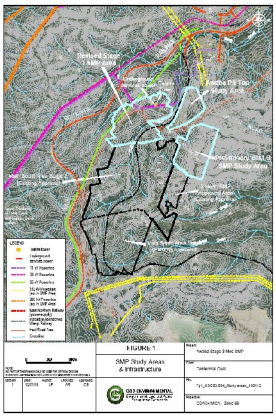
Awaba Colliery Conference Room

13 January 2010

Mine Manager - Roger Davis

Study Area

- 2 Continuous Miner Units
- Bord & Pillar and Partial Pillar Extraction
- Approx. 800 000 Tpa
- Bord & Pillar and Partial Pillar Extraction
- Recover remaining final reserves in 18 months
- Expected completion Dec. 2011
- Mostly Crown Land
- Mining title which includes the surface over the majority of the lease.
- Predominately undulating bush land



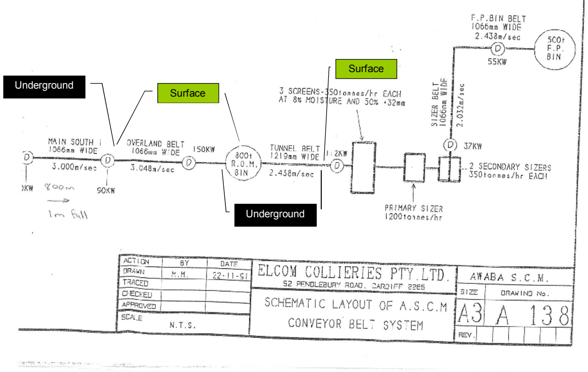
Description of Proposal

- Proposed Application Area consists of existing first workings developed from 1947.
- Partial extraction mining method chosen to satisfy mine safety, resource recovery, surface subsidence and production requirements.
- Pillar and barrier design evaluated by Seedsman.

Natural Features

Typical Bushland

Coal Processing flow diagram



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Risk Assessment Document

Awaba

SMP - Revised Stage 3 SMP Area

Risk Assessment No.: **20090911**

1. Background:

Centennial Newstan - Awaba Colliery are proposing to undertake pillar extraction within narrow panels in an area known as the "Revised Stage 3 SMP Area". The process is known as partial pillar extraction and involves extracting rows of pillars (void) and leaving rows remaining as support (pillars). The entire "Revised Stage 3 SMP Area" has been previously undermined by Awaba, through bord and pillar mining.

In 2005, Awaba Colliery submitted a SMP Application for the entire Main South Area, which consisted of 3 stages (starting south to north). However, NSW Department of Industry and Investment -DII (formally DPI) adopted a 'progressive/staged' approach to issuing approvals for the overall Main South Area, and as such approval for Stage 3 was not granted at this time. As part of the 2005 SMP application, a large section of the Revised Stage 3 SMP Area was studied at this time. An additional area, north east of the original 2005 SMP Area will now be also assessed for this SMP Application. This section of the Revised Stage 3 SMP Area was not studied for the 2005 SMP, with field assessments now required for this SMP Application.

A new SMP Application is required for the Revised Stage 3 SMP Area which is to be submitted to NSW DII for determination. In accordance with the NSW Department of Primary Industries – Mineral Resources (DPI-MR) *Guideline for Applications for Subsidence Management Approvals* (2003), a risk based process and assessment is required for the application. Specifically, risk aspects are to be considered in accordance with the requirements of sections s6.10.2 and s6.10.3 of the guidelines.

Two project background presentations (powerpoint) for the Revised Stage 3 SMP Area were presented to the risk team by the Awaba mine manager and subsidence consultant at the risk assessment workshop (see **Appendix 1 and 2** and further detail in Section 7). This provided an overview of the key natural and manmade features within the SMP area, as well as outlining the mining method, expected subsidence behavior and subsidence controls. The presentations also outlined the mining method and explained subsidence controls.

2. Objective:

The following key objectives of the risk assessment for the **Revised Stage 3 SMP Area** include:

- To establish an appropriate SMP risk assessment team of suitably qualified and experienced Centennial staff, specialist consultants and key stakeholders;
- Discuss and review existing information known for the Revised Stage 3 SMP Area and experience in adjacent mining areas;
- Identify, assess & evaluate potential subsidence impacts to surface and subsurface features (natural & man-made) for the aspects required by the DPI-MR *Guideline for Applications for Subsidence Management Approvals* (2003), and in accordance with the Centennial Risk Management Standard (004) using the Centennial Risk Matrix (probability matrix of consequence and likelihood), with a focus on identifying and addressing potentially high risks or potentially severe consequences. This will consider both expected/predicted maximum subsidence, and higher than predicted subsidence (worst case) scenario of 'plug failure';
- To establish a Draft SMP Risk Register (WRAC Worksheet) and risk report for the Revised Stage 3 SMP Area for review and comment by the risk team;
- The identification of additional controls required (including with respect to updating Centennial management plans for the SMP application); and
- To produce a Final SMP Risk Assessment Report (including the SMP Risk Register/WRAC Worksheet) for the Revised Stage 3 SMP Area Application to DPI-MR.

The Centennial risk assessment standard lists the following Hierarchy of Controls and was followed in undertaking this risk assessment. Note that the effectiveness of a control that is intended to reduce as a risk decreases from top to bottom of the list. Which in other words, the closer the control type is to the top of the hierarchy, the more potentially effective the control.

·Eliminate the hazard or energy source (do not use the energy);
·Minimise or replace the hazard or energy source (reduce the amount of energy to a less damaging level or replace the energy with another that has less potential negative consequences);
·Control the hazard or energy using engineered devices (ex. Lock outs, chemical containers, mechanical roof support, gas monitors, etc);
·Control the hazard or energy by using physical barriers (ex. machine guarding, warning signs, etc);
·Control the hazard or energy with procedures (ex. Isolation procedures, standard operating procedures, etc);
·Control the hazard or energy with personal protective equipment (ex. hard hats, boots with toe caps, gloves, safety glasses, welding gear, etc); and
·Control the hazard or energy with warnings and awareness (ex. posters, labels, stickers, verbal warnings, etc).

3. Potential Hazards:

The primary hazard assessed was surface cracking and deformation resulting from subsidence. This potential hazard was risk assessed for all the aspects listed in Section 4.

During the risk assessment, some stakeholders discussed the potential risk of pillar run. Concern was raised in that the unlikely event of a plug failure, subsidence impacts would spread and result in potential impact to the main northern railway which is approximately 100m from the closest proposed point of mining. This issue was addressed by the subsidence consultant, who responded saying that even in the unlikely event of plug failure, far field impacts would not occur. This will be further addressed in the specialist subsidence report.

4a. Risk Assessment Boundary Definition:

The scope of the risk assessment for the Revised Stage 3 SMP Area included:

- Consideration of the Revised Stage 3 SMP Area defined as the proposed workings plus 26.5 degree angle of draw;
- The risk assessment considered the potential subsidence impacts to surface and subsurface features (natural and man-made) for the worst case scenario of plug failure (2m shear failure of the Teralba conglomerate spanned (unsupported) roof areas). If a risk was determined to be medium or high for the plug failure scenario, the risk assessment team would assess the same risk under the predicted mining subsidence scenario (subsidence of approximately 90-135mm which was conservatively risk assessed up to 200mm, and negligible tilt or strain). However, the risk assessment team did not assess the predicted mining subsidence scenario as no risks were determined to be medium or high during the plug failure scenario.

The undertaking of the worst case scenario assessment first allowed focus on key risk aspects if identified and, subsequently, consideration under the base case scenario (expected mining predicted subsidence scenario) of whether the identified risks and controls required further consideration and assessment.

In accordance with DPI-MR *Guideline for Applications for Subsidence Management Approvals* (2003), the following subsidence and environmental related hazard categories/aspects were considered within the context of risks discussed and assessed by the risk team (as a minimum):

- Public Safety;
- Areas of high environmental, heritage or archaeological significance;
- Wetlands, swamps and water related ecosystems;
- Catchment Areas causing or exacerbating erosion and drainage pattern changes;
- Significant water courses including surface flows, water quantity and quality, and ecological integrity;
- Significant groundwater resources including levels and quality;
- Threatened & protected species under TSC Act 1995;
- Stability of escarpments & significant clifflines, pagodas or steep slopes;
- The serviceability of major public utilities and/or amenities;
- Surface improvements (including roads) causing damage beyond safety, serviceability and reparability;
- Agricultural suitability or productivity;
- Industrial, commercial and business establishments;
- Foreshores and land prone to flooding or inundation;
- Prescribed Dams or structures under the Dam Safety Act 1978; and
- Any other areas or features causing significant concern to the community, local and state government agencies.

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5. Risk Assessment Methods:

Yes/No	Method
	PROACTIVE TOOLS
Yes	WRAC
	Fault Tree Analysis (FTA)
	SIL Analysis to Australian Standard 61508 - Under Development
	Bowtie Analysis - Under Development
	Failure Modes and Effects Analysis (FMEA)
	[redacted]
	REACTIVE TOOLS:
	Root Cause Analysis (RCA) - Under Development

6. Previous Risk Assessment and other documents to be used and/or referenced

Title	Version	Referenced Document Date
2008 3 North SMP Area Risk Assessment	Initial	7 November 2008
2008 Awaba East Exploration Risk Assessment	Initial	4th April 2008
2005 SMP Risk Assessment for Main South Area	initial	2005
2008 SMP Application – 3 North Area	Initial	December 2008
2008 Awaba East Exploration Review of Environmental Factors (REF), including environmental risk mapping and specialist reports for ecology & Aboriginal heritage	Initial	August 2008
2005 SMP Application - Main South Area	initial	December 2005
DPI Staged Approval Conditions for Main South Area		*Stage 1 Sep 2007, Stage 1 variation Aug 2008, Stage 2 Sep 2008*
Documents developed for SMP Approval Compliance		
Environmental Monitoring Program *(incorporating Public Safety MP & Watercourse MP),* Subsidence Monitoring Plan		
Alluvium Groundwater study (AGEC)		2008
Review of Panel & Pillar Layout *(Seedsman Geotechnics)*		August 2008

7. Information Required for Risk Assessment:

Two presentations were viewed and discussed by the risk assessment team at the start of the risk assessment workshop (refer **Appendix 1**- *Photos of SMP Area and **Appendix 2** – Subsidence Presentation*), which provided an overview of the key characteristics of the Revised Stage 3 SMP Area, and aspects required for discussion and assessment during the risk assessment. The first presentation illustrated photos of the natural and manmade features within the SMP Area. The second presentation outlined the mining method of partial pillar extraction, predicted subsidence behavior and history of mining and subsidence in the area. Stakeholders were given the opportunity to comment on the material in each presentation.

Preliminary mapping/figures were presented for natural and constructed surface features and land ownership within the SMP Area. Comment was provided on each relevant aspect by the specialists present at the risk assessment meeting for ecology, archaeology/Aboriginal heritage and mine subsidence.

8. Venue and Time

Date	Description	Location	Start Time	End Time	Comment
1. 11-Sep-2009	Scoping	Awaba Colliery	9:00 AM	10:30 AM	Completion of presentations. Discussions with stakeholders regarding mining method and controls to minimise subsidence.
2. 11-Sep-2009	Assessment	Awaba Colliery	10:30 AM	2:00 PM	Completion of risk assessment

9. Risk Assessment Team Selection

Name	Title	Company	E-Mail Address	Role
Roger Davis	Mine Manager	Awaba Colliery	roger.davis@centennialcoal.com.au	Risk Assessment Owner (Awaba representative)
Craig Cluderay	Mine Surveyor	Awaba Colliery	craig.cluderay@centennialcoal.com.au	Awaba representative
Jeff Dunwoodie	Environmental Coordinator	Awaba Colliery	jeffrey.dunwoodie@centennialcoal.com.au	Awaba representative
Dr Ross Seedsman	Director	Seedsman Geotechnics Pty Ltd	sgplross@bigpond.com	Specialist subsidence consultant
Colin Driscoll	Environmental Biologist	Hunter Eco	cd_enviro@bigpond.com	Specialist ecological consultant
Chris Jones	Environmental Scientist	GSS Environmental	jones@gssenvironmental.com	Assisting in facilitating of workshop
Darrell Rigby	Archaeology Manager	RPS HSO	darrell@rpshso.com.au	Specialist Archaeological consultant
Nicole Armit	Environmental Engineer	GSS Environmental	armit@gssenvironmental.com	Risk Assessment Facilitator
Sandy Pfeiffer	Senior Engineering Geologist	RailCorp	sandy.pfeiffer@railcorp.nsw.gov.au	Representing Infrastructure owner
David Eccles	Overhead Mains Design Manager	Energy Australia	deccles@energy.com.au	Representing Infrastructure owner
Richard Grant	Rail Corridor Management Group - Metro North Coordinator	RailCorp	Richard.Grant@railcorp.nsw.gov.au	Representing Infrastructure owner
Eddie Blackwell	External Interface Manager	RailCorp	eddie.blackwell@railcorp.nsw.gov.au	Representing Infrastructure owner
Kate Hendrikson	External Party Works Manager - North District	RailCorp	kate.hendrikson@railcorp.nsw.gov.au	Representing Infrastructure owner
Geoff Byrnes	Fuel Manager	Eraring Energy	geoff.byrnes@eraring-energy.com.au	Representing Infrastructure owner

Centennial Coal Awaba

WRAC Analysis Worksheet

L= Likelihood; MRC= Maximum Reasonable Consequence; RR= Risk Rank

Step	Potential Incident	Current Controls	L	MRC	RR	Recommended Control
1. Public safety	There is a risk to Awaba from ::: Surface cracking ::: Caused by: Mining operations Resulting in: Personnel injury, vehicle damage & vegetation instability.	1.1.a. Inspections of access tracks 1.1.b. Public Safety Management Plan signed off 1.1.c. Signage 1.1.d. Underground conditions	**E** (Op)	3 ()	20 (L)	1. Erect signage in potential subsidence access zones.
2. Areas of high Environmental, Heritage or Archaeological Significance	There is a risk to Awaba from ::: Aboriginal heritage beliefs ::: Caused by: Mining operations Resulting in: Damage to Aboriginal heritage material along ridge and drainage landforms.	2.1.a. Heritage assessment undertaken for Awaba East Stage 1 Exploration REF 2.1.b. RPS HSO completed Archaeological field assessment for the previous SMP area (no artefacts found) 2.1.c. Sensitivity risk mapping for this area has been performed and found to be low for majority of area. 2.1.d. Newstan Archaeological Management Plan	**D** (Op)	4 ()	21 (L)	
	There is a risk to Awaba from ::: Surface cracking :::	2.2.a. Subsidence is predicted as minimal 2.2.b. Locations of sites at	**E** (Op)	4 ()	23 (L)	2. Field survey to be conducted.

Centennial Coal
Awaba

WRAC Analysis Worksheet

L= Likelihood; MRC= Maximum Reasonable Consequence; RR= Risk Rank

Step	Potential Incident	Current Controls	L	MRC	RR	Recommended Control
	Caused by: Mining operations Resulting in: Changes to surface drainage lines & displacing of surface arefacts.	Awaba mapped for previous Awaba East Stage 1 Exploration REF and for SMP area 2.2.c. Sensitivity risk mapping for this area has been performed and found to be low for majority of area 2.2.d. Newstan Archaeological Management Plan				
	There is a risk to Awaba from ::: Indigenous land agreement ::: Caused by: Mining operations Resulting in: Non compliance with current Indigenous Land Use Agreement/Native Title.	2.3.a. ILUA/ NTA applies to a very small area in north east of SMP area 2.3.b. Landform risk mapping undertaken for Awaba East Stage 1 Exploration REF. 2.3.c. Newstan Archaeological Management Plan	**E** (Op)	4 ()	23 (L)	
	There is a risk to Awaba from ::: Surface cracking ::: Caused by: Mining operations Resulting in: Earthworks required to fill in surface cracking exposes or	2.4.a. Sensitivity risk mapping for this area has been performed and found to be low for majority of area 2.4.b. Considered unlikely that earthworks will be required. 2.4.c. Newstan Archaeological	**E** (Op)	4 ()	23 (L)	

WRAC Analysis Worksheet

L= Likelihood; MRC= Maximum Reasonable Consequence; RR= Risk Rank

Step	Potential Incident	Current Controls	L	MRC	RR	Recommended Control
	displaces surface artefacts.	Management Plan				
	There is a risk to Awaba from ::: Surface cracking ::: Caused by: Mining operations Resulting in: Impact on European heritage with SMP Area.	2.5.a. Abandoned Wangi Railway Line present in SMP area however no extraction planned in this area	**E** (Op)	5 ()	25 (L)	
3. Wetlands, swamps and water related ecosystems	There is a risk to Awaba from ::: Not Applicable ::: Caused by: Resulting in: Not applicable.	3.1.a. Not applicable	(Op)	()		
4. Catchment areas	There is a risk to Awaba from ::: Subsidence ::: Caused by: Mining operations Resulting in: Erosion within stream bed and bank during re- establishment of creek grades.	4.1.a. Not mining under Stony Creek	**E** (Op)	4 ()	23 (L)	
	There is a risk to Awaba from	4.2.a. Newstan/Awaba Water	**E**	3	20	

Centennial Coal
Awaba

WRAC Analysis Worksheet

L= Likelihood; MRC= Maximum Reasonable Consequence; RR= Risk Rank

Step	Potential Incident	Current Controls	L	MRC	RR	Recommended Control
	::: Subsidence ::: Caused by: Mining operations Resulting in: Temporary ponding & reduction in surface water flows in creeks crossing the SMP study area.	Management Plan 4.2.b. Any subsidence will be remediated to reduce long term impact	(Op)	()	(L)	
	There is a risk to Awaba from ::: Surface cracking ::: Caused by: Mining operations Resulting in: Loss of water into overburden strata resulting in reduced surface flows.	4.3.a. No routine surface flows (ephemeral) 4.3.b. Extraction depth is greater than 25m 4.3.c. Inspections 4.3.d. Timely response for surface rehabilitation 4.3.e. Demonstrated successful rehabilitation strategies.	**E** (Op)	3 ()	20 (L)	
5. Surface Water - Significant water courses	There is a risk to Awaba from ::: Surface cracking ::: Caused by: Mining operations Resulting in: Cracking of banks & first order tributaries of creek bed, loss of water flows, iron deposits,	5.1.a. Surface Water Management Plan 5.1.b. No extraction under second or third order creeks or their alluvial deposits	**E** (Op)	4 ()	23 (L)	

WRAC Analysis Worksheet

L= Likelihood; MRC= Maximum Reasonable Consequence; RR= Risk Rank

Step	Potential Incident	Current Controls	L	MRC	RR	Recommended Control
	increased sediment in drainage lines &loss of aquatic habitat.					
6. Groundwater - Significant groundwater resources including groundwater level and quality	There is a risk to Awaba from ::: Surface cracking ::: Caused by: Mining operations Resulting in: Aquifer cracked leading to loss of ground water or Impact on third party user outside SMP area or Inflow of ground water into underground working.	6.1.a. Water Management Plan 6.1.b. Extensive groundwater monitoring program	**E** (Op)	4 ()	23 (L)	3. Confirm no registered ground water users.
7. Flora & Fauna - Threatened and protected species under the Threatened Species Conservation Act (1995)	There is a risk to Awaba from ::: Subsidence ::: Caused by: Mining operations Resulting in: Changes to water courses including stream bed and banks or Destruction or damage to habitat impacting in species population decline.	7.1.a. Newstan/Awaba Water Mgt Plan 7.1.b. Partially completed Ground Survey undertaken and risk mapping developed for threatened species 7.1.c. Rehab works will be carried out per Centennial's Environmental Management Plan	**E** (Op)	5 ()	25 (L)	11. Ground survey undertaken for subsidence line installation. 2. Field survey to be conducted.
8. Groundwater Dependent Ecosystems	There is a risk to Awaba from ::: Surface cracking :::	8.1.a. Only the very upper sections of first order tributaries occur within SMP Area and that cover	**E** (Op)	5 ()	25 (L)	13. 8.1.a. Ecologist to assess potential impact of potential groundwater dependant ecosystems.

WRAC Analysis Worksheet

L= Likelihood; MRC= Maximum Reasonable Consequence; RR= Risk Rank

Step	Potential Incident	Current Controls	L	MRC	RR	Recommended Control
	Caused by: Mining operations Resulting in: Groundwater loss or inflow impacting on Groundwater dependant ecosystems.	depths maintained >25m 8.1.b. No extraction under second or third order creeks or their alluvial deposits				14. Complete catchment analysis.
9. Public and Private Utilities and other Infrastructure (including roads)	There is a risk to Awaba from ::: Surface cracking ::: Caused by: Mining operations Resulting in: Damage to power poles (RailCorp, Energy Australia &Centennial Awaba) or Damage to Telstra Tower (and associated fiber optic cable) or Loss of power and possible injury to personnel.	9.1.a. Inspections of surface 9.1.b. Public Safety Management Plan 9.1.c. Pillars under poles and Telstra fiber optic cable are not extracted 9.1.d. 20m buffer around poles	**E** (Op)	4 ()	23 (L)	4. Confirm buffer around each pole is sufficient. 5. Consultation with Telstra regarding Telstra Tower and fiber optic cable (Telstra to complete Management Plan). 7. RailCorp to check mine induction knowledge and reporting structure of surface cracking etc. 8. Mine to notify infrastructure owners at commencement of mining extraction. 10. Installation of subsidence monitoring line across closest point to rail line.
	There is a risk to Awaba from ::: Surface cracking ::: Caused by: Mining operations Resulting in: Damage to fire trails or Personnel injury.	9.2.a. Inspections of surface 9.2.b. Public Safety Management Plan	**E** (Op)	4 ()	23 (L)	8. Mine to notify infrastructure owners at commencement of mining extraction.
	There is a risk to Awaba from	9.3.a. Inspections of surface by	(Op)	()		9. The group considered the scenario and is not applicable

WRAC Analysis Worksheet

L= Likelihood; MRC= Maximum Reasonable Consequence; RR= Risk Rank

Step	Potential Incident	Current Controls	L	MRC	RR	Recommended Control
	::: Surface cracking ::: Caused by: Mining operations Resulting in: Damage to Haul Road or Personnel injury to operators.	Centennial 9.3.b. No extraction underneath haul road (20m barrier either side of edge of road) 9.3.c. Public Safety Management Plan 9.3.d. Regular inspections of haul road by Eraring Energy 9.3.e. Reporting of abnormalities by truck operators				due to 9.3.b
10. Surface improvements causing damage beyond safety, serviceability and reparability	There is a risk to Awaba from ::: Not Applicable ::: Caused by: Not applicable Resulting in: Not applicable.	10.1.a. Not applicable	(Op)	()		
11. Agricultural suitability and productivity	There is a risk to Awaba from ::: Not Applicable ::: Caused by: Not applicable Resulting in: Not applicable.	11.1.a. Not applicable	(Op)	()		

Centennial Coal
Awaba

WRAC Analysis Worksheet

L= Likelihood; MRC= Maximum Reasonable Consequence; RR= Risk Rank

Step	Potential Incident	Current Controls	L	MRC	RR	Recommended Control
12. Industrial, commercial and business establishments	There is a risk to Awaba from ::: Not Applicable ::: Caused by: Not applicable Resulting in: Not applicable.	12.1.a. Not applicable	(Op)	()		
13. Foreshores and land prone to flooding or inundation	There is a risk to Awaba from ::: Not Applicable ::: Caused by: Not applicable Resulting in: Not applicable.	13.1.a. Not applicable	(Op)	()		
14. Prescribed Dams (including stored waters and reservoirs) and / or structures Awaba East Stage 1 Exploration Referred to by the Dam Safety Act (1978)	There is a risk to Awaba from ::: Not Applicable ::: Caused by: Not applicable Resulting in: Not applicable.	14.1.a. Not applicable	(Op)	()		
15. Other (Underground Fire)	There is a risk to Awaba from ::: Surface cracking :::	15.1.a. Inspections 15.1.b. Timely response for surface rehabilitation 15.1.c. Spontaneous	**D** (Op)	4 ()	21 (L)	

WRAC Analysis Worksheet

L= Likelihood; MRC= Maximum Reasonable Consequence; RR= Risk Rank

Step	Potential Incident	Current Controls	L	MRC	RR	Recommended Control
	Caused by: Mining operations Resulting in: A surface fire spreading into the underground workings. or Spontaneous combustion underground.	Management Plan. (SMP version) 15.1.d. Spontaneous Management Plan				

Recommended Controls

Recommended Controls Do NOT enter additional Recommended Controls on this sheet.	Place(s) Used	Allocated To	Required By Date	Pulse User No.
1. Erect signage in potential subsidence access zones.	Potential Incident Builder: 1.1	Awaba		
2. Flora and fauna field survey to be conducted	Potential Incident Builder: 2.2, 7.1	Awaba/ Ecologist		
3. Confirm no registered ground water users.	Potential Incident Builder: 6.1	Awaba		
4. Confirm buffer around each pole is sufficient.	Potential Incident Builder: 9.1	Awaba		
5. Consultation with Telstra regarding Telstra Tower and fiber optic cable (Telstra to complete Management Plan).	Potential Incident Builder: 9.1	Awaba		
6. RailCorp to check mine induction knowledge and reporting structure of surface cracking etc.	Potential Incident Builder: 9.1	RailCorp		
7. Mine to notify infrastructure owners at commencement of mining extraction.	Potential Incident Builder: 9.1, 9.2	Awaba		
8. Installation of subsidence monitoring line across closest point to rail line.	Potential Incident Builder: 9.1	Awaba		
9. Ground survey undertaken for subsidence line installation.	Potential Incident Builder: 7.1	Awaba		
10. Ecologist to assess potential impact of potential groundwater dependant ecosystems.	Potential Incident Builder: 8.1	Awaba/ Ecologist		
11. Complete catchment analysis.	Potential Incident Builder: 8.1	Awaba/ Ecologist		

CENTENNIAL RISK MATRIX

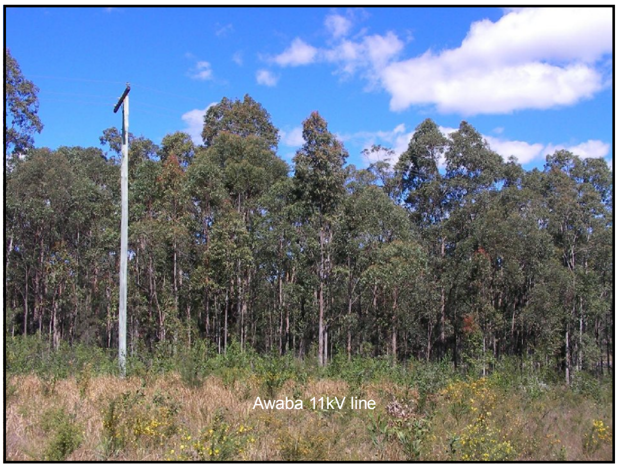
Rating	Consequence Note: Consequence may consist of a single event or may represent a cumulative impact over a period of 12 months. Use the worst case consequence if there are more than one.						Likelihood				
	Impact to Annual Business Plan (F)	Personal Injury (PI)	Business Interruption (BI)	Legal (L)	Reputation (R)	Environment (E)	A Certain "Common" Frequent incidents Operations – within 3 months Project – Every project	B Probable "Has Happened within Centennial" Regular incidents Operations – within 2 years Project – Every 2 projects	C Possible "Could Happen & has happened in non-CEY operations" Infrequent incidents Operations – within 5 years Project – Every 5 projects	D Remote "Not Likely" Unlikely to occur. Very few recorded or known incidents. Operations – within 10 years Project – Every 10 projects	E Improbable "Practically impossible" May occur in exceptional circumstances. Almost no recorded incidents. Operations – within 30 years Project – Every 30 projects
1. Catastrophic	>$50m	Multiple Fatalities	> 1month	Prolonged litigation, heavy fines, potential jail term	Prolonged International media attention	Long term impairment habitats/ ecosystem	1 (E)	2 (E)	5 (H)	7 (H)	11 (S)
2. Major	$10m - $50m	Single Fatality	1 week to 1 month	Major breach/ major litigation	International media attention	Long term effects of ecosystem	3 (E)	4 (E)	8 (H)	12 (S)	16 (M)
3. Moderate	$1m- $10m	Serious/ Disabling Injury	1 day to 1 week	Serious breach of regulation. prosecution/ fine	National media attention	Serious medium term environmental effects	6 (H)	9 (H)	13 (S)	17 (M)	20 (L)
4. Minor	$100k - $1m	Lost Time Injury	12 hrs to 1 day	Non-compliance, breaches in regulation	Adverse local public attention	Minor effects to physical environment	10 (S)	14 (S)	18 (M)	21 (L)	23 (L)
5. Insignificant	<$100k	First Aid Treatment Only	< 12 hrs	Low level compliance issue	Local complaints	Limited physical damage	15 (S)	19 (M)	22 (L)	24 (L)	25 (L)

Risk Rating	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 a lower level by the introduction of control measures. Management planning required at senior levels
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 where practicable

Appendix 1 – Photos of SMP Area

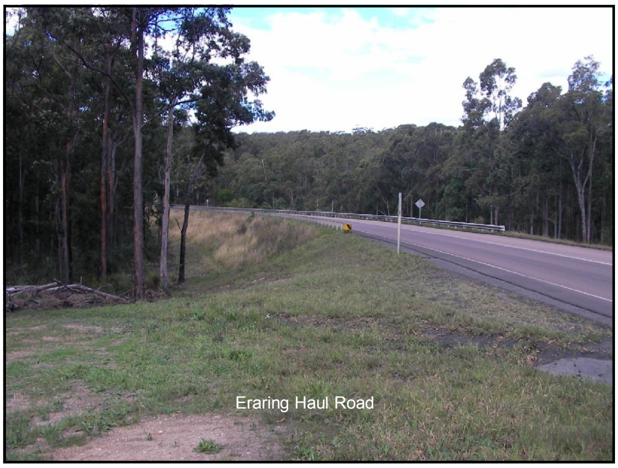
Bushland east of Haul Road

Energy Aust 33 kV line
Haul Road Intersection



Awaba 11kV line


Awaba /Energy Aust lines (Turn point)


Eraring Haul Road


Eraring Haul Road


RailCorp

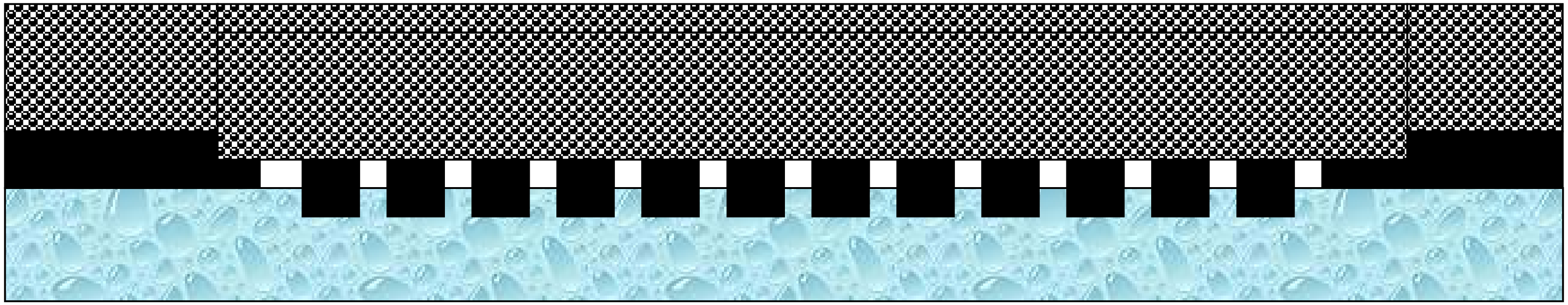

RailCorp


RailCorp


Telstra Tower

Appendix 2 – Subsidence Presentation

The problem is wide spans on pillars with weak foundations



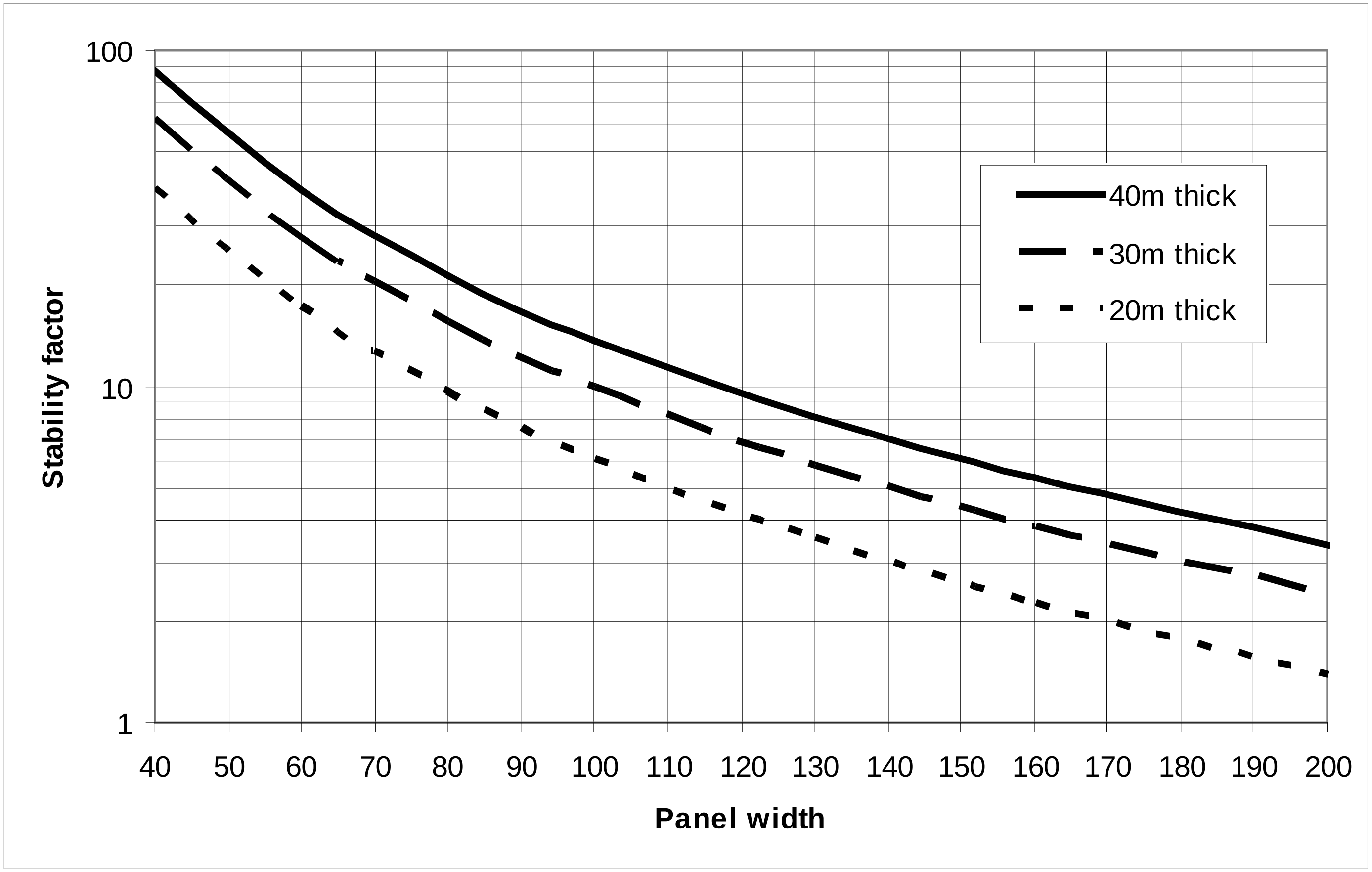
Constraints

- No collapse of the Teralba Conglomerate
- Manage the wind blast hazard
- Extract standing pillars
- Inability to <u>fully</u> characterize floor
- Remote control miners
- Breaker line supports
- Maximum cutout of 15m when stripping
- Depths of 40m-60m
- Maximum extraction height of 3.8m
- 100m stand-off from proven rail barrier

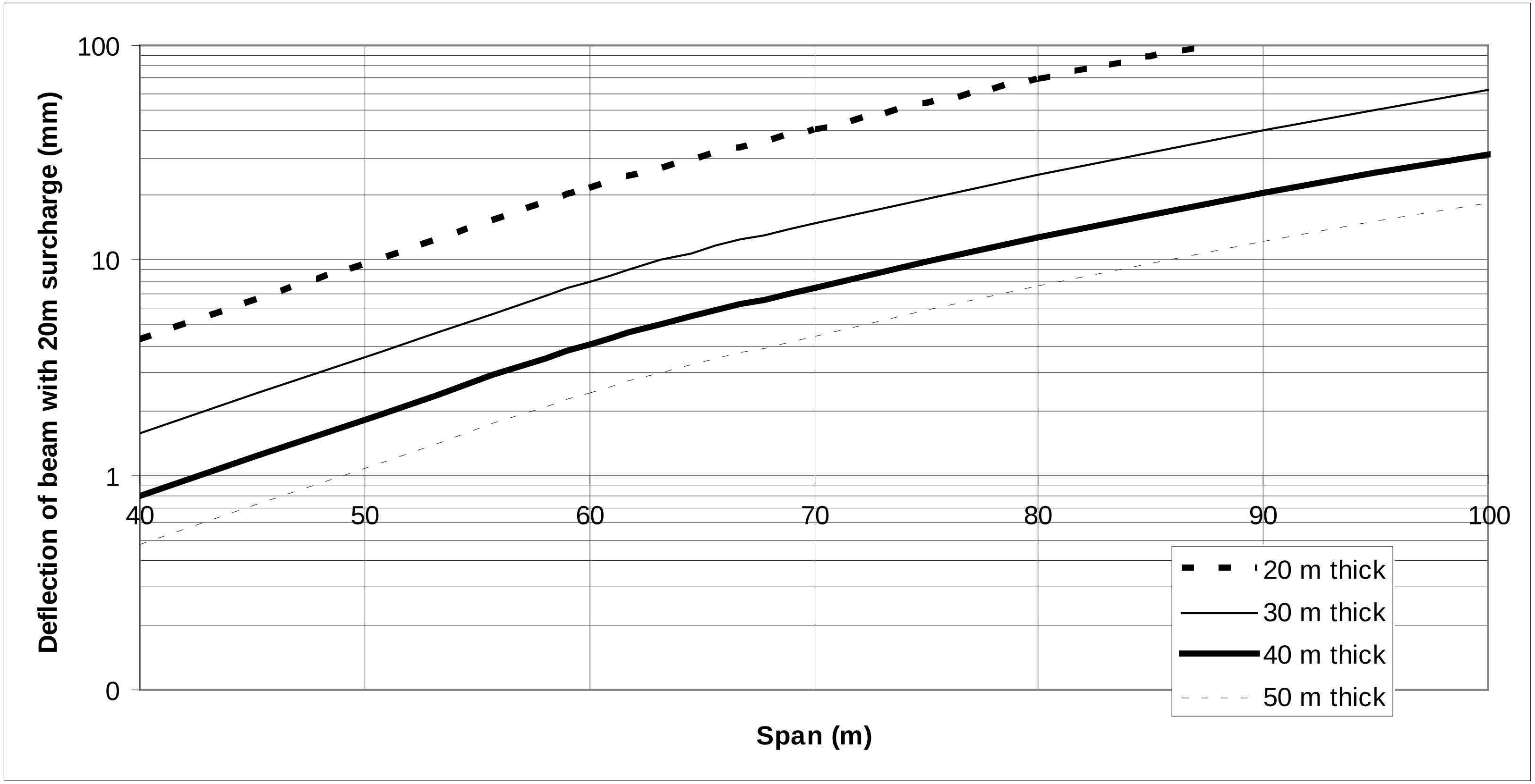
Some things on our side

- No rapid floor heave/subsidence event at widths less than 150m
- Old standing pillars gives the ability to core the floor in selected places prior to second workings
- Validated analytical method with back analysis
- Teralba Conglomerate is very consistent

Confidence in the span

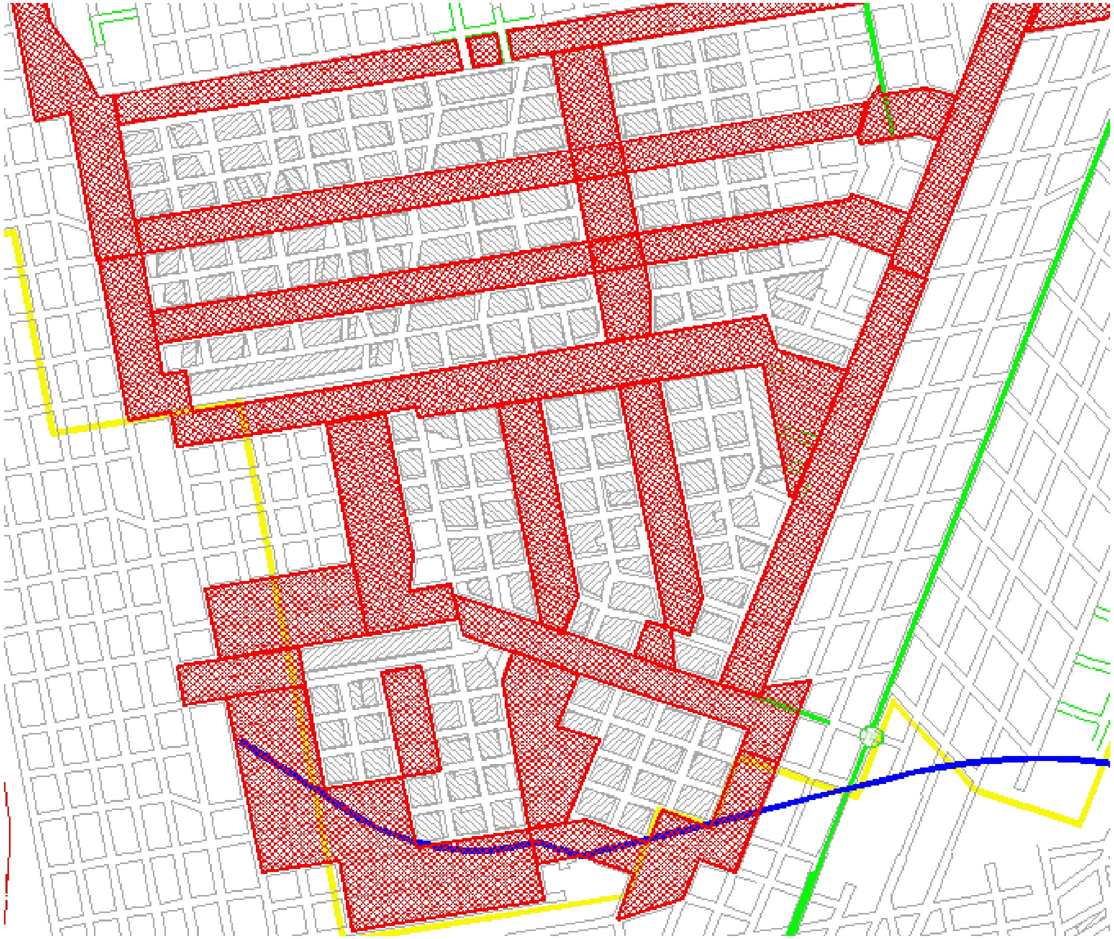


Deflection of conglomerate



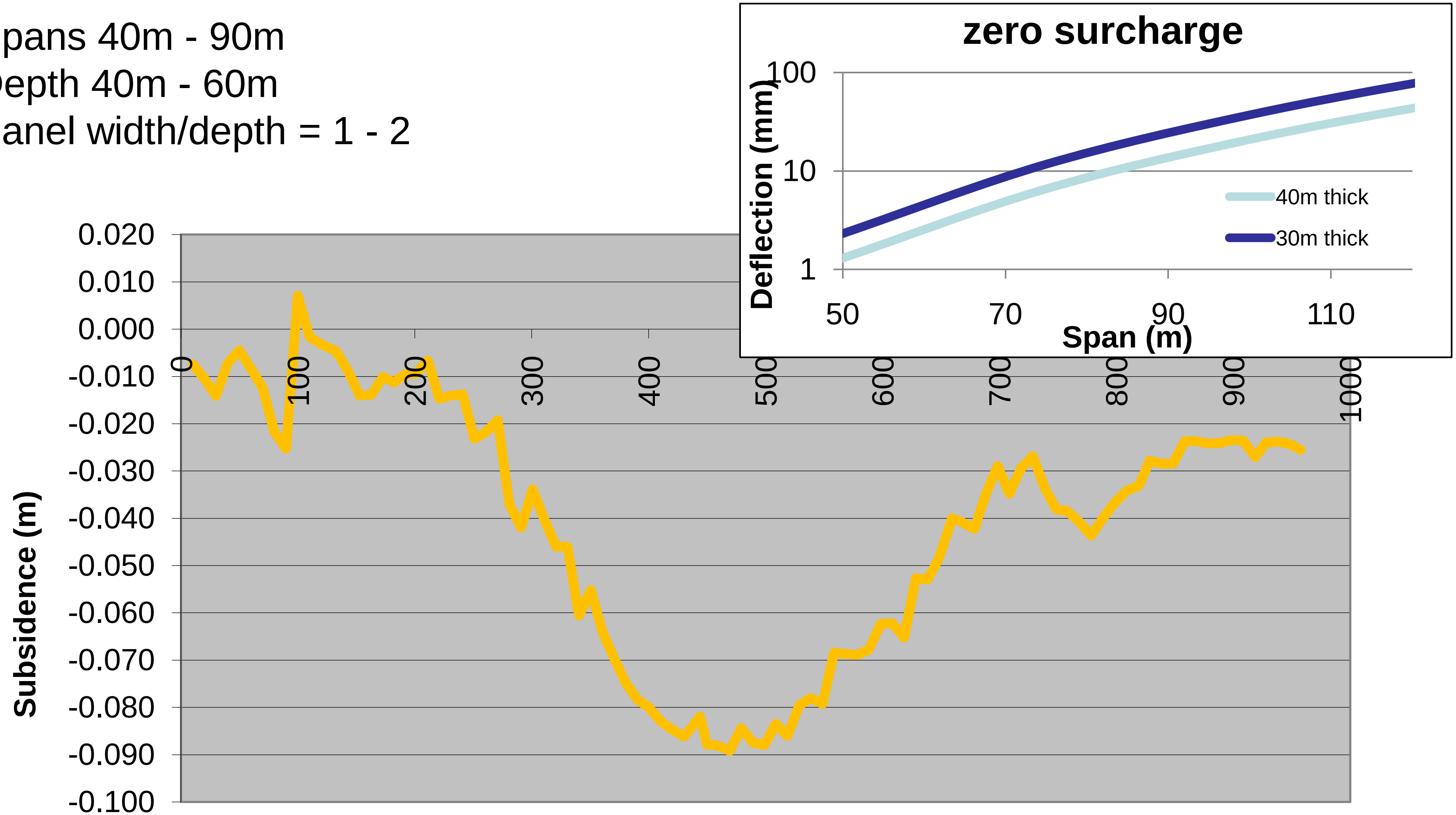
By comparison, the compression of the pillar/roof/floor system is estimated to be about 100mm

Take 2-3 rows, leave 1 row

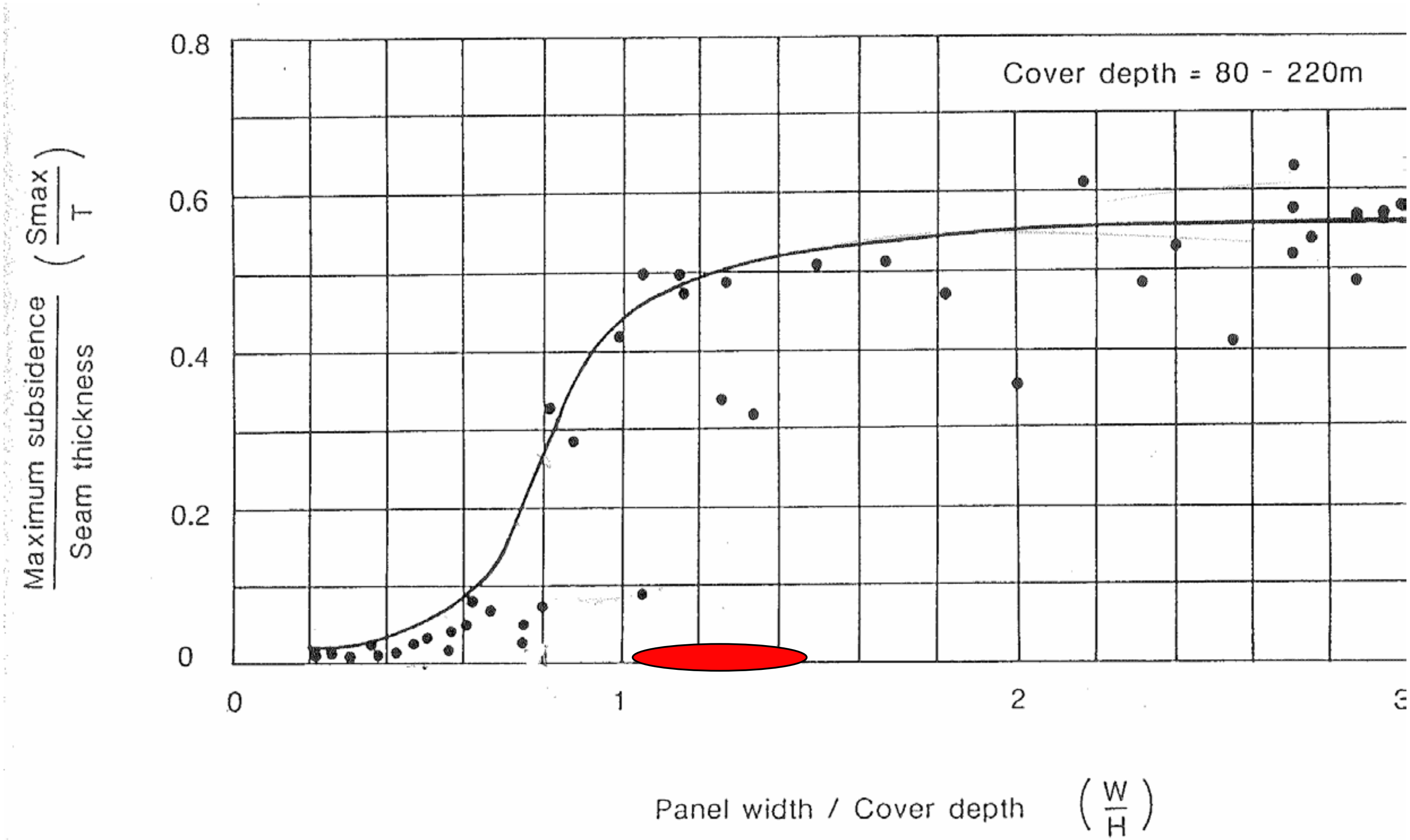


Case study 1 - Awaba

Spans 40m - 90m
Depth 40m - 60m
Panel width/depth = 1 - 2



Where we sit on the Holla plot



Risk Assessment Document

Awaba Colliery

Proposed East B Area – Risk Assessment For Mine Subsidence Impact and Management

Risk Assessment No.: 20100120

1. Background:

Awaba Colliery is located on the western side of Lake Macquarie, near Newcastle NSW. The mine is operated by Centennial Newstan – Awaba Colliery (Awaba Colliery), and is a small operation with approximately 100 employees and contractors, historically producing approximately 800,000 tonnes of thermal coal annually, which first started producing coal by bord and pillar methods in 1947. The current mining method within the old existing workings using modern continuous miners is extending the mine life.

The proposed *"East B"* mining area *('**East B Area**')* is located east of the larger Main South Area. The East B Area comprises one of the study areas of a broader *Environmental Assessment (EA)* for a Part 3A Project Approval being prepared and sought for Awaba Colliery Continued Operations. This specific risk assessment focusing on subsidence impact assessment and management for the proposed East B Area supports a separate (but related) *Broad Brush Risk Assessment (BBRA)* which was undertaken for the broader Environmental Assessment (GSSE, 2010). It is noted that non-mine subsidence related risks are discussed within that broader BBRA.

The East B Area consists of some areas of previously mined workings (first workings) and predominantly new mining areas. Extraction within the East B Area will occur via bord and pillar development followed by pillar extraction within narrow panels using continuous miners. This method was developed in consultation with NSW Industry & Investment (I&I) and has been successfully used since 2007 in the Main South Area and 3 North Area. The process involves extracting rows of pillars (void) and leaving rows as support (pillars).

The whole of the East B Area is within crown lands leased by Centennial. Specialist studies for ecology and archaeology have been partially completed for the East B Area. The East B Area is bordered to the east by Aboriginal owned lands (Kommpahtoo Local Aboriginal Land Council).

A new approval for mining and subsidence management is required for the East B Area, which is to be submitted to government for determination. A risk based process and assessment is required for the approval process. Prudently, risk aspects considered will include those required in sections s6.10.2 and s6.10.3 of the DPI-MR SMP Guidelines (Dec 2003).

A project background presentation (powerpoint) for the broader Part 3A Environmental Assessment, which included a focus on East B Area, was presented to the risk team at the risk assessment workshop held on Wednesday 13th January 2010 at Awaba Colliery (further detail in Section 7). This included historical mining and subsidence information, lists of previous related studies and risk assessments, preliminary figures/mapping showing natural and constructed surface features, photos of the area, and expected subsidence behaviour based on previous experience. Specialists attending the risk assessment contributed brief discussion and overview on each of their relevant aspects for the presentation. Being located immediately adjacent the 3 North Area, with similar environment, similar mine design and similar expected subsidence behaviour, it was recognised that the existing 3 North Risk Assessment (2008) could be used as a *basis* for the risk assessment for East B Area. Subsequently, the risk register for 3 North Area SMP (Dec 2008) has been used as a base platform for consideration by the risk team, with any additional specific aspects modified (eg for Native Title/ILUA triggers), and circulated for comment and review by the risk team. Majority consensus for risk rankings for the identified risk hazards for the East B Area was then adopted accordingly.

2. Objective:

The following key objectives of the risk assessment for the **East B Area** include:

- To establish an appropriate risk assessment team of suitably qualified and experienced Centennial staff and specialist consultants;
- Discuss and review existing information known for the East B Area and experience in adjacent mining areas;
- Identify, assess & evaluate potential subsidence impacts to the surface and subsurface features (natural & man-made) for the aspects typically required by government regulators for subsidence impact assessment and management (eg the NSW DPI-MR *Guidelines for Subsidence Management Applications* (2003)), and in accordance with the Centennial Risk Management Standard (004) using the Centennial Risk Matrix (probability matrix of consequence and likelihood).
- To focus on identifying and addressing *potentially* high risks or potentially severe consequences (including where lack of current information may present potential risk). This will consider both expected/predicted maximum subsidence, and higher than predicted subsidence (worst case) scenario of 'plug failure';
- To establish a Draft Risk Register (WRAC Worksheet) and risk report for the East B Area for review and comment by the risk team;
- The identification of additional controls required (including with respect to updating Centennial management plans);
- To produce a Final Risk Assessment Report (including the Risk Register/WRAC Worksheet) for the East B Area suitable to accompany the Environmental Assessment and provide a complementary risk assessment to the over-arching BBRA for the Environmental Assessment.

The following Hierarchy of Controls offers a framework for considering the effectiveness of controls. Note that the effectiveness of a control that is intended to reduce a risk decreases from top to bottom of the list. In other words, the closer the control type is to the top of the hierarchy, the more potentially effective the control.

- Eliminate the risk hazard;
- Minimise or replace the risk hazard (reduce to a less damaging level or replace with another that has less potential negative consequences);
- Control the risk hazard using hard controls (eg engineered controls);
- Control the risk hazard or energy by using physical barriers (exclusion areas, fencing, warning signs, etc.)
- Control the risk hazard with procedures (eg. standard operating procedures, etc.)
- Control the risk hazard with personal protective equipment (ex. hard hats, boots with toecaps, gloves, safety glasses, welding gear, etc.)
- Control the risk hazard with warnings and awareness

3. Potential Hazards:

In accordance with DPI-MR '*Guidelines for Subsidence Management Applications*' (2003), the following subsidence and environmental related hazard categories/aspects were considered within the context of risks discussed and assessed by the risk team (as a minimum):

- Public Safety
- Areas of high environmental, heritage or archaeological significance
- Wetlands, swamps and water related ecosystems
- Catchment Areas causing or exacerbating erosion and drainage pattern changes
- Significant water courses including surface flows, water quantity and quality, and ecological integrity
- Significant groundwater resources including levels and quality
- Threatened & protected species under TSC Act 1995
- Stability of escarpments & significant cliff lines, pagodas or steep slopes
- The serviceability of major public utilities and/or amenities
- Surface improvements (including roads) causing damage beyond safety, serviceability and reparability
- Agricultural suitability or productivity
- Industrial, commercial and business establishments
- Foreshores and land prone to flooding or inundation
- Prescribed Dams or structures under the Dam Safety Act 1978; and
- Any other areas or features causing significant concern to the community, local and state government agencies.

4a. Risk Assessment Boundary Definition:

The scope of the risk assessment for the East B Area included:

- Consideration of the East B Area defined as the proposed workings plus 26.5 degree angle of draw. It is noted that East B Area extraction connects in the west to the existing Main South Area Stage 2 and 3 North Area approved SMP Areas;
- The risk assessment considered the potential subsidence impacts to surface and subsurface features (natural and man-made) for two scenarios:
  - Firstly, a higher than predicted subsidence scenario (worst case scenario) - represented as a 'Plug Failure' scenario of approximately 2m shear failure of the Teralba conglomerate spanned (unsupported) roof areas, and;
  - Secondly, the base case (expected maximum mining subsidence scenario) - with maximum expected vertical subsidence in the order of approximately 90-135mm (based on previous mine experience in adjacent areas) which was conservatively risk assessed up to 200mm, and negligible tilt or strain.

The undertaking of the worst case scenario assessment first allowed focus on key risk aspects if identified and, subsequently, consideration under the base case scenario (expected mining maximum subsidence scenario) of whether the identified risks and controls required further consideration and assessment.

5. Risk Assessment Methods:

Yes/No	Method
	PROACTIVE TOOLS
Yes	WRAC (Workplace Risk Assessment & Control)
	Fault Tree Analysis (FTA)
	SIL Analysis to Australian Standard 61508 - Under Development
	Bowtie Analysis - Under Development
	Failure Modes and Effects Analysis (FMEA)
	[redacted]
	REACTIVE TOOLS:
	Root Cause Analysis (RCA) - Under Development

6. Previous Risk Assessment and other documents to be used and/or referenced:

Title	Version	Referenced Document Date
2008 3 North SMP Area Risk Assessment	Final	07-Nov-2008
2009 SMP Application – Revised Stage 3 SMP Area	Final	December 2009
2009 Revised Stage 3 SMP Area – Risk Assessment	Final	11 September 2009
2008 Awaba East Exploration Risk Assessment	Final	4th April, 2008
2008 SMP Application – 3 North Area	Final	December 2008
2008 Awaba East Exploration Review of Environmental Factors (REF), including environmental risk mapping and specialist reports for ecology & Aboriginal heritage	Final	August 2008
Alluvium Groundwater study (AGEC)	Final	2008
Subsidence Assessment for Awaba Stage 3 *(Seedsman Geotechnics)*	Final	November 2009
Review of Panel & Pillar Layout – 3 North Area *(Seedsman Geotechnics)*	Final	August 2008

7. Information Required for Risk Assessment:

A presentation was viewed and discussed by the risk team at start of the risk assessment workshop (refer Appendix A of the BBRA (GSSE, 2010) – *Risk Assessment Presentations – GSSE and Centennial*), which provided an overview of key characteristics known for the East B SMP Area and aspects required for discussion and assessment during the risk assessment. This included:

- Key Objectives
- Background to the East B SMP Area
  - Historical & Proposed Mining
  - Natural Surface & Sub-surface Features - ecology (Flora & fauna), Aboriginal Heritage/Native Title, rock formations/outcropping, surface and ground water
  - Land Ownership
  - Constructed (man-made) Surface Features - Non Centennial infrastructure & Centennial owned infrastructure
  - Expected Subsidence Behaviour
  - Previous Studies and Available Info
- Centennial Risk Standard & Risk Matrix
- East B Area Risk Register / WRAC Worksheet.

Preliminary mapping/figures were presented for natural and constructed surface features, cover depths, land ownership and mining titles. Photos of the SMP Area for various aspects were shown.

8. Venue and Time:

Date	Description	Location	Start Time	End Time	Comment
1. 13-Jan-2010	Scoping during related Part 3 A BBRA Workshop	Awaba Colliery	8:00 AM	9:30 AM	Scoping for this risk assessment was completed within the presentation for the Awaba Part 3A BBRA and risk assessment workshop. Risk ranking and the report were completed in the following weeks (Feb 2010) as per below.
2. 11-Feb-2010	Assessment and Risk Ranking	Various (Risk Assessment including figures showing proposed extraction plan emailed to risk team with draft risk rankings for review and comment)	11-Feb-2010	12-Feb-2010	Risk ranking completed by risk team using base model for adjacent and similar 3 North Area risk assessment, modified accordingly for East B area where required (eg Aboriginal Heritage for Native Title/ILUA).

9. Risk Assessment Team Selection

Name	Title	Company	Yrs. of Exp.	E-Mail Address
Grant Watson	Mine Manager	Awaba Colliery	19	roger.davis@centennialcoal.com.au
Craig Cluderay	Mine Surveyor	Awaba Colliery	26	craig.cluderay@centennialcoal.com.au
Mary-Anne Crawford	Group Environment Manager	Centennial Coal	15	maryanne.crawford@centennialcoal.com.au
Jeff Dunwoodie	Environmental Coordinator	Newstan/Awaba Colliery	7	jeffrey.dunwoodie@centennialcoal.com.au
Craig Bagnall	Project Manager / Environ. Engineer	GSS Environmental	16	bagnell@gssenvironmental.com
Eryn Bath	Project Manager / Environ. Planner	GSS Environmental	10	bath@gssenvironmental.com
Anthony Reid	Environmental Scientist	GSS Environmental	2	reid@gssenvironmental.com
Colin Driscoll	Environmental Biologist	Hunter Eco	30	cd_enviro@bigpond.com
Lisa-Maree Campbell	Archaeologist	RPS HSO	5	lisa-maree@rpshso.com.au
Veronica Warren	Environmental Officer	Newstan/Awaba Colliery	2	Veronica.warren@centennialcoal.com.au
Lee-Ann Snowden	Commercial Support Officer	Centennial Coal	28	leeann.snowden@centenninalcoal.com.au

WRAC Worksheet (East B Area Risk Register)

L= Likelihood; MRC= Maximum Reasonable Consequence; RR= Risk Rank

Step	Potential Incident	Current Controls	L	MRC	RR	Recommended Control
1. **Public safety** (*Centennial Coal is responsible for the health and safety of all persons whilst on Centennial owned lands (including non-staff and general public. This also relates to land that has been leased by Centennial.)*)	There is a risk to Awaba from ::: Surface cracking ::: Caused by: Mining operations. Resulting in: Personal injury or vehicle damage.	1.1.a. Inspections of access tracks 1.1.b. Public Safety Management Plan (existing) 1.1 c. Timely response for surface rehabilitation works.	**D** **(IF)**	3 (PI)	17 (M)	1. Update the Public Safety Management Plan to include East B Area with specific TARP controls (including specific additional controls where required). 2. Update the Public Safety MP to include the following for East B Area: Temporarily close tracks and trails, erect appropriate warning signs, and remediate as soon as practicable in accordance with required environmental protocols for any disturbance works required (see TARPs for details).
2. **Areas of high Environmental, Heritage or Archaeological Significance** *(No heritage or archaeological surface sites identified during field survey. Sub-surface unknown)*	There is a risk to Awaba from ::: Surface cracking ::: Caused by: Mining operations. Resulting in: Damage/impact of Aboriginal Cultural Heritage material along ridge and drainage landforms (high sensitivity), sloped landforms (moderate sensitivity).	2.1.a. Sensitivity risk mapping for this area has been performed and found to be low for majority of area. 2.1.b. RPS HSO completed Archaeological field assessment for adjacent and similar 3 North area (no artefacts found) 2.1.c. Heritage assessment undertaken for Awaba East Stage 1 Exploration REF 2.1.d. RPS HSO commenced Archaeological field assessment for the East B Area 2.1.e. Newstan Archaeological Management Plan	**D** **(Pb)**	3 (E)	17 (M)	3. Specialist archaeology assessment required for Part 3A application for East B Area including any required mitigation measures. 4. Commence additional Aboriginal Community Consultation. 5. Review Newstan Colliery Holding Aboriginal Heritage Management Plan and update as required.

WRAC Worksheet (East B Area Risk Register)

L= Likelihood; MRC= Maximum Reasonable Consequence; RR= Risk Rank

Step	Potential Incident	Current Controls	L	MRC	RR	Recommended Control
	There is a risk to Awaba from ::: Surface cracking ::: Caused by: Mining operations. Resulting in: Changes to surface drainage lines and displacing of surface artefacts.	2.2.a. Subsidence is predicted as minimal <200mm, typically 90-135mm. 2.2.b. Locations of sites at Awaba mapped for previous Awaba East Stage 1 Exploration REF and for SMP area	**D (Pb)**	4 (E)	21 (L)	6. Specialist archaeology assessment required for Part 3A application for East B Area including any required mitigation measures.
	There is a risk to Awaba from ::: Surface cracking ::: Caused by: Mining operations. Resulting in: Impact to Neighbouring Aboriginal-owned land (KLALC).	2.3.a. Review of Aboriginal ownership documents and areas for previous assessments. 2.3.b. Mapping of Land ownership completed 2.3.c. East B Area subsidence impact zone is conservative and borders but does not enter KLALC Lands	**D (IF)**	3 (L)	17 (M)	7. Commence additional Aboriginal Community Consultation in accordance with *Awaba Colliery Stakeholder Engagement Plan* and DECCW ICCG's.
	There is a risk to Awaba from ::: Indigenous Land Use Agreement (ILUA) (Native Title):::	2.4.a. Landform risk mapping undertaken for Awaba Colliery Area (including mapping of previously unmined and unsurveyed areas for Aboriginal heritage).	**D (IF)**	3 (L)	17 (M)	8. Specialist archaeology assessment required for Part 3A application for East B Area including any required mitigation measures. 9. Commence additional Aboriginal Community Consultation and involvement (eg for surveys) in accordance with ILUA requirements and

WRAC Worksheet (East B Area Risk Register)

L= Likelihood; MRC= Maximum Reasonable Consequence; RR= Risk Rank

Step	Potential Incident	Current Controls	L	MRC	RR	Recommended Control
	Caused by: Mining operations. Resulting in: Non-compliance with Indigenous Land Use Agreement (ILUA)/ Native Title Agreement Centennial holds with Aboriginal groups for the broader area.	2.4.b. Established ILUA trigger protocols for new mining areas for Awaba Colliery (ie known actions and requirements to be implemented).				established trigger protocols.
	There is a risk to Awaba from ::: Surface cracking ::: Caused by: Mining operations. Resulting in: Remedial earthworks required following subsidence exposing or displacing surface artefacts	2.5.a. Considered unlikely that earthworks will be required. 2.5 b. 'Permit to Clear' process (signed off by Environ. Coordinator)	**D (Pb)**	4 (E)	21 (L)	10. Prior to any ground disturbance works for remediation, an inspection for due diligence during Permit to Clear process is to be carried out by the Environmental Coordinator.
	There is a risk to Awaba from ::: Surface cracking ::: Caused by: Mining operations. Resulting in:	2.6.a. No European heritage sites found for Awaba East Stage 1 Exploration REF 2.6.b. There are no known significant heritage items perceived to be within the study area	**D (Pb)**	4 (E)	21 (L)	

WRAC Worksheet (East B Area Risk Register)

L= Likelihood; MRC= Maximum Reasonable Consequence; RR= Risk Rank

Step	Potential Incident	Current Controls	L	MRC	RR	Recommended Control
	Impact on European Heritage within the area.					
3. **Wetlands, swamps and water related ecosystems** *(Not Applicable)*	There is a risk to Awaba from ::: Not Applicable ::: Caused by: Resulting in: Not Applicable.					
4. **Catchment areas causing or exacerbating erosion of drainage lines.** *(There are several ephemeral watercourses schedule 1 watercourses within the SMP area.)*	There is a risk to Awaba from ::: Subsidence ::: Caused by: Mining operations. Resulting in: Erosion within streambed and bank during re-establishment of creek grades following subsidence.	4.1.b. Surface Water Assessment carried out for Awaba East Stage 1 Exploration REF and proposed for SMP area 4.1.c. Mine plan has no extraction for cover < 25 metres of cover. This minimise the impacts on the surface drainage. 4.1.d. Water course management plan (existing)	**D (Pb)**	4 (E)	21 (L)	11. Update Watercourse Management Plan for East B Area aspects.
	There is a risk to Awaba from ::: Subsidence ::: Caused by: Mining operations.	4.2.a. Watercourse Management Plan 4.2 b – Mine design avoids extraction within below 2nd order creeks and higher (avoids impacts to creek line)	**D (Pb)**	5 (E)	24 (L)	11. Update Watercourse Management Plan for East B Area aspects.

WRAC Worksheet (East B Area Risk Register)

L= Likelihood; MRC= Maximum Reasonable Consequence; RR= Risk Rank

Step	Potential Incident	Current Controls	L	MRC	RR	Recommended Control
	Resulting in: Temporary ponding and reduction in surface water flows in the creeks (all ephemeral) crossing the Study Area.	4.2 c Mine design maintains adequate depth of cover (20m for first workings and 25m for secondary extraction areas) to minimise surface impacts (successfully used at Awaba).				
	There is a risk to Awaba from ::: Subsidence ::: Caused by: Mining operations. Resulting in: Loss of water into overburden strata through surface cracks, with subsequent reduction in surface flows.	4.3.a. Upper drainage lines of 1st order ephemeral creeks within SMP area only. No routine surface flows. 4.3.b. Mine plan allows Depth of cover maintained to protect surface (20m for 1st workings, 25m for secondary extraction). 4.3.c. Inspections 4.3.d. Timely response for surface rehabilitation 4.3 e Watercourse Management Plan (existing) 4.3.f. Demonstrated successful rehabilitation strategies.	**D (Pb)**	5 (E)	24 (L)	12. For completeness, specialist surface water assessment to be undertaken including cumulative impacts required for Part 3A application for East B Area including any required mitigation measures. 13. Surface water catchment flow path analysis will be undertaken within the ecology report for the Part 3A application to assess downstream impacts in the event of worst case ('plug failure') scenario and confirm risk rankings. 11. Update Watercourse Management Plan for East B Area aspects..
5. **Surface Water - Significant water courses** *(Relevance: 1st Order Tributaries of Kilaben Creek (the major catchment within the SMP Area) and Stony Creek (minor catchment within the SMP Area*	There is a risk to Awaba from ::: Surface Cracking ::: Caused by: Mining operations. Resulting in:	5.1.a No second order or higher creek sections within the East B Area 5.1.b. Mine design (extraction only in areas of adequate depth of cover). 5.1.c. Watercourse Management Plan (existing)	**E (Pb)**	4 (E)	23 (L)	12 . For completeness, specialist surface water assessment to be undertaken including cumulative impacts required for Part 3A application for East B Area including any required mitigation measures. 13. Surface water catchment flow path analysis will be undertaken within the ecology report for the Part 3A application to assess downstream impacts in the event of worst case ('plug failure')

WRAC Worksheet (East B Area Risk Register)

L= Likelihood; MRC= Maximum Reasonable Consequence; RR= Risk Rank

Step	Potential Incident	Current Controls	L	MRC	RR	Recommended Control
	Cracking of banks and first order tributaries of creek beds, loss of water flows, iron deposits, increased sediment in drainage lines, loss of aquatic habitat.	5.1.d. Surface water assessment was carried out for Awaba East Stage 1 Exploration REF study area.				scenario and confirm risk rankings. 11. Update Watercourse Management Plan for East B Area aspects..
6. **Groundwater - Significant groundwater resources including groundwater level and quality** . *(Relevance: AGEC groundwater investigations (2008) states there are three (3) main hydrogeological units (aquifers) at Awaba Colliery: Alluvium Aquifers, Shallow Weathered Zone Aquifers, and Triassic & Permian Strata (Bedrock) Aquifers. None of these is noted by the study as regionally significant groundwater resources. No nearby private extraction bores (users) are currently known. See background AEGC report and SMP RA workshop background presentation for further detail.*	There is a risk to Awaba from ::: Subsidence ::: Caused by: Mining operations. Resulting in: Cracking of aquifer leading to loss of groundwater.	6.1.a. Water Management Plan 6.1.b. Extensive regional groundwater monitoring program 6.1.c AGEC Groundwater Investigation 2008 (Definition of Stony Ck Alluvium)	D **(Pb)**	4 (E)	21 (L)	
	There is a risk to Awaba from ::: Surface Cracking ::: Caused by: Mining operations. Resulting in: Inflow of groundwater into underground workings.	6.2.a. Watercourse Management Plan 6.2b Conservative mine plan (no mining within buffer zones for 2nd order and higher creeks) 6.2.c Minimum Depth of Cover maintained in mine design 6.2 d Surface inspections for subsidence cracking 6.2 e Appropriate rehabilitation of subsidence cracking 6.2.b. Extensive groundwater monitoring program	**D** **(Op)**	**4** **(E)**	21 (L)	11. Update Watercourse Management Plan for East B Area aspects.

WRAC Worksheet (East B Area Risk Register)

L= Likelihood; MRC= Maximum Reasonable Consequence; RR= Risk Rank

Step	Potential Incident	Current Controls	L	MRC	RR	Recommended Control
	There is a risk to Awaba from ::: Subsidence ::: Caused by: Mining operations. Resulting in: Impact to a third party user outside the SMP area.	6.3.a Well-established mine (1947), no 3rd party users nearby currently known, has not presented any issues in neighbouring existing mining areas at Awaba Colliery.	**E (Op)**	**5 (L)**	25 (L)	
		6.3.b Extensive regional groundwater monitoring program				
		6.3.c AGEC Groundwater Investigation 2008 (Definition of Stony Ck Alluvium)				
		6.4.d DWE Licensed Bores register checks for private bores as part of SMP Process (none known in near proximity).				
7. **Flora & Fauna - Threatened and protected species under the Threatened Species Conservation Act (1995)** (*<u>Relevance:</u>* *<u>Flora</u>: Tetratheca juncea, Grevillea parviflora, associated with vegetation communities MU30 and MU31* *<u>Fauna</u>: Powerful owl, Masked Owl, Microchiropteran Bats.* *The site contains some ephemeral streams and drainage lines.)*	There is a risk to Awaba from ::: Subsidence ::: Caused by: Mining operations. Resulting in: Destruction or damage to habitat resulting in species population decline.	7.1.a. Newstan/Awaba Flora and Fauna Mgt Plan	**D (Pb)**	5 (E)	24 (L)	
		7.1.b. A consolidated Flora and Fauna Assessment *(based on several past assessments covering/relevant to the SMP Area)* was carried out for the Awaba East Stage 1 Exploration REF Study area				
		7.1.c. Ground survey undertaken and risk mapping developed for threatened species				
	There is a risk to Awaba from	7.2.a. Watercourse Mgt Plan (existing)	**D (Pb)**	5 (E)	24 (L)	11. Update Watercourse Management Plan for East B Area aspects.

Centennial Coal
Awaba

WRAC Worksheet (East B Area Risk Register)

L= Likelihood; MRC= Maximum Reasonable Consequence; RR= Risk Rank

Step	Potential Incident	Current Controls	L	MRC	RR	Recommended Control
	::: Subsidence (or erosion due to subsidence) ::: Caused by: Mining operations. Resulting in: Changes to watercourses including streambed and banks.	7.2.b. Surface water assessment was carried out for Awaba East Stage 1 Exploration REF study area 7.2 c Conservative mine plan – no secondary extraction below 2^{nd} order creek sections 7.2d Conservative mine planning – cover depths maintained above 20m for 1^{st} workings and 25m for extraction areas (historically shown to prevent significant surface cracking / sink holes). 7.2.e. Ground survey undertaken and risk mapping developed for GDE's/threatened species				
8. **Groundwater Dependant Ecosystems** *(Relevance: Ecological field surveys indicate no presence of GDE's within SMP Area)*	There is a risk to Awaba from ::: Subsidence ::: Caused by: Mining operations. Resulting in: Groundwater loss or inflow impacting upon Groundwater dependent ecosystems.	8.1.a. Ecologist has assessed potential impact of potential groundwater dependent ecosystems 8.1 b Conservative mine planning – cover depths maintained above 20m for 1^{st} workings development, and 25m for secondary extraction areas (historically shown to minimise significant cracking / sink holes) 8.1.b. Conservative mine plan (no secondary extraction under 2^{nd} order or higher creeks) - only the very upper sections of first order tributaries	**D (Pb)**	5 (E)	24 (L)	

WRAC Worksheet (East B Area Risk Register)

L= Likelihood; MRC= Maximum Reasonable Consequence; RR= Risk Rank

Step	Potential Incident	Current Controls	L	MRC	RR	Recommended Control
		occur within SMP Area				
9. **Public and Private Utilities and other Infrastructure - NO public utilities and/ or amenities** *(Access to fire Tracks)*	There is a risk to Awaba from ::: Surface Cracks ::: Caused by: Mining operations. Resulting in: Cracking to fire tracks.	9.1.a. Public Safety Management Plan 9.1.b. Inspections of tracks 9.1.c. All Crown Land leased by Centennial Coal 9.1.d. No utilities are known to occur in the area	**D (Pb)**	5 (PI)	24 (L)	
10. **Surface improvements causing damage beyond safety, serviceability and reparability** *(Not Applicable)*	There is a risk to Awaba from ::: Not Applicable ::: Caused by: Resulting in: Not Applicable.					
11. **Agricultural suitability and productivity (***Not Applicable)*	There is a risk to Awaba from ::: Not Applicable ::: Caused by: Resulting in: Not Applicable.					
12. **Industrial, commercial and business establishments (***Not Applicable)*	There is a risk to Awaba from ::: Not Applicable :::					

WRAC Worksheet (East B Area Risk Register)

L= Likelihood; MRC= Maximum Reasonable Consequence; RR= Risk Rank

Step	Potential Incident	Current Controls	L	MRC	RR	Recommended Control
	Caused by: Resulting in: Not Applicable.					
13. **Foreshores and land prone to flooding or inundation** ***(****Not Applicable)*	There is a risk to Awaba from ::: Not Applicable ::: Caused by: Resulting in: Not Applicable.					
14. **Prescribed Dams (including stored waters and reservoirs) and / or structures Awaba East Stage 1 Exploration Referred to by the Dam Safety Act (1978)** ***(****Not Applicable)*	There is a risk to Awaba from ::: Not Applicable ::: Caused by: Resulting in: Not Applicable.					
15. Underground Fire	There is a risk to Awaba from ::: Surface Cracking ::: Caused by: Mining operations. Resulting in:	15.1.a. Inspections 15.1.b. Timely response for surface rehabilitation 15.1.c. Spontaneous Combustion Management Plan. (SMP version)	**E (Op)**	4 (PI)	23 (L)	

WRAC Worksheet (East B Area Risk Register)

L= Likelihood; MRC= Maximum Reasonable Consequence; RR= Risk Rank

Step	Potential Incident	Current Controls	L	MRC	RR	Recommended Control
	A surface fire spreading into the underground workings.					
	There is a risk to Awaba from ::: Surface Cracking ::: Caused by: Mining operations. Resulting in: Spontaneous combustion underground.	15.2.a. Spontaneous Combustion Management Plan.	**D (Op)**	5 (PI)	24 (L)	

RISK MANAGEMENT STANDARD **Management Standard-004**

CENTENNIAL RISK MATRIX							Likelihood					
							A Certain	B Probable	C Possible	D Remote	E Improbable	Description (D)
	Consequence Note: Consequence may result from a single event or may represent a cumulative impact over a period of 12 months. Use the worst case reasonable consequence if there is more than one.						Common"	Has Happened within Centennial"	"Could Happen & has happened in non-CEY operations	Not Likely	"Practically impossible	Probability (Pb)
Rating	Impact to Annual Business Plan (F)	Personal Injury (PI)	Business Interruption (BI)	Legal (L)	Reputation (R)	Environment (E)	Frequent incidents	Regular incidents	Infrequent incidents	Unlikely to occur. Very few recorded or known incidents	May occur in exceptional circumstances. Almost no recorded incidents.	Incident Frequency (IF)
							Operations – within 3 months	Operations – within 2 years	Operations – within 5 years	Operations – within 10 years	Operations – within 30 years	Operations (Op)
							Project – Every project	Project – Every 2 projects	Project – Every 5 projects	Project – Every 10 projects	Project – Every 30 projects	Project (Pr)
1. Catastrophic	>$50m	Multiple Fatalities	> 1month	Prolonged litigation, heavy fines, potential jail term	Prolonged International media attention	Long term impairment habitats/ ecosystem	1 (E)	2 (E)	5 (H)	7 (H)	11 (S)	
2. Major	$10m - $50m	Single Fatality	1 week to 1 month	Major breach/ major litigation	International media attention	Long term effects of ecosystem	3 (E)	4 (E)	8 (H)	12 (S)	16 (M)	
3. Moderate	$1m - $10m	Serious/ Disabling Injury	1 day to 1 week	Serious breach of regulation. prosecution/ fine	National media attention	Serious medium term environmental effects	6 (H)	9 (H)	13 (S)	17 (M)	20 (L)	
4. Minor	$100k - $1m	Lost Time Injury	12 hrs to 1 day	Non-compliance, breaches in regulation	Adverse local public attention	Minor effects to physical environment	10 (S)	14 (S)	18 (M)	21 (L)	23 (L)	
5. Insignificant	<$100k	First Aid Treatment Only	< 12 hrs	Low level compliance issue	Local complaints	Limited physical damage	15 (S)	19 (M)	22 (L)	24 (L)	25 (L)	

Risk Rating	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 a lower level by the introduction of control measures. Management planning required at senior levels
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 where practicable

AWABA COLLIERY

SECONDARY PARTIAL PILLAR EXTRACTION
SURFACE SUBSIDENCE
MAIN SOUTH AREA

RISK ASSESSMENT

OCTOBER, 2005

FINAL REPORT

ISSUE DATE 16.11.05
VERSON NO.: 04

Prepared by: Jim Knowles Group

APPENDICES ONLY

APPENDIX 'A'

Team Member Resumés

Eddie Blackwell - External Works Manager, RailCorp

Qualifications:
- ◇ Carpentry Trades
- ◇ Building Foreman certificate of Works
- ◇ Project management

Experience:
- ◇ 3 years in present position
- ◇ 20 years as Senior Project Manager in building construction industry
- ◇ 27 years in total, experience in building construction in a rail environment

Geoff Byrnes - Manager - Fuel, Eraring Energy

Qualifications:
- ◇ Bachelor Engineering
- ◇ Master Engineering Science

Experience:
- ◇ 3 years in present position
- ◇ (other experience not listed)

Phil Enright - Mine Surveyor, Centennial Newstan - Awaba Colliery

Qualifications:
- ◇ Surveyor's Certificate of Competency
- ◇ Undermanager's Certificate of Competency
- ◇ Registered Mining Surveyor (BOSS 1)

Experience:
- ◇ 23 years underground mining experience including:
  - o 20 years at Awaba - 13 years as Mine Surveyor and 2 years as Undermanager
  - o 7 years at Newstan (some concurrent with Awaba)

APPENDIX 'A'

Vanessa Garling - Mining Engineer, Centennial Newstan - Awaba Colliery

Qualifications:

- Bachelor Engineering (Mining)
- MCom (Strategic Value Management)

Experience:

- 4 years mining experience at Centennial mines, including:
  - Clarence
  - Charbon
  - Myuna
  - Newstan
  - Munmorah
  - Mannering
  - Awaba

Richard Grant - Project Co-ordinator (Metro North), RailCorp - Rail Corridor Management Group

Qualifications:

- Electrical Trades certificate
- Joinery Trades certificate
- Track Awareness certificate
- Telecommunications qualifications

Experience:

- 1 year in current position
- 4 years in RailCorp as Senior Accounts Manager

David Hill - Principal Engineer- Strata Engineering

Qualifications:

- BSc (Hons) Mining Engineering
- Grad Dip Economics (Wits)
- CoMSA Certificate in Coal Mine Strata Control

Experience:

- 25 years coal mining experience (UK, South Africa and Australia) including production, planning and technical roles. Primarily involved in the field of underground geotechnical engineering for last 18 years.

APPENDIX 'A'

Andrew Hutton - Principal Environmental Consultant, GSS Environmental

Qualifications:

- ◇ Bachelor Natural Resources (UNE)
- ◇ Masters Business & Environmental Management (Newcastle)

Experience:

- ◇ 4 years as Environmental Officer for BHP Coal Operations, Central Queensland
- ◇ I year as Operations Manager for IESA Environmental Consultants
- ◇ 3 years as Environmental Manager, Donaldson coal Mine, Beresfield
- ◇ Last 2 years in current position

Sandy Pfeiffer - Senior Engineering Geologist, RailCorp

Qualifications:

- ◇ Bachelor of Applied Science (Hons)

Experience:

- ◇ 27 years with RailCorp

Sally McPhee - Senior Consultant, Jim Knowles Group

Qualifications:

- ◇ Bachelor Building (UNSW, Kensington)
- ◇ Graduate Diploma in OH&S
- ◇ OH&S Systems Auditor Accreditation

Experience:

- ◇ 20 years of experience in the building construction field. She has been involved at site and senior management level in commercial and industrial building as well as civil engineering projects.
- ◇ Over the past ten years, she has been involved with and facilitated Operational and Design Risk Assessment Workshops in the coal mining and construction industries in Australia and overseas as well as commercial Risk Reviews for corporate and insurance industry clients.

APPENDIX 'B'

Scoping Meeting Notes

Scoping Meeting for
Risk Assessment of Partial Secondary Pillar Extraction in the Great Northern Seam
Surface Subsidence

Held 10.30am Tuesday 27th September, 2005
(Revised)

GENERAL

Centennial Coal's Awaba Colliery is proposing to conduct partial secondary extraction in a section of first workings in the Great Northern Seam (GNS) of the Mine. The area was first worked from around 1955 to the early 1960's leaving a considerable coal resource in the pillars. There has been no recorded subsidence of the workings in the intervening years and all roadways are still open and accessible.

The mine plan is been deliberately conservative to expedite the progress of the project. Maximising recovery of the coal resource while maintaining a safe method of work was also a consideration when developing the plan. Due to other mining activities in the area, the window of opportunity to recover the coal resource from these first workings, is time limited.

The proposed extraction method will result in a predicted subsidence up to 115mm across the mining area. There is a long history of mining in the area both at Awaba and nearby mines and subsidence monitoring data from these as well as world wide empirical information, has been used to assist with the predictions. There is a possibility of failures such as pillar and plug failure, all of which have occurred at Awaba , the subsidence from which has been managed over a number of years.

To support Awaba's application to mine the subject area, a Subsidence Management Plan (SMP) is being prepared and will be submitted to the DPI-Mineral Resources. SMP guidelines require that a risk assessment be conducted to identify potential hazards and to help formulate controls and management plans for those hazards. This scoping session was convened to bring together all interested parties to define the scope, resources, method and required outcomes for the risk assessment that may be used to formulate specific Management Plans.

Community consultation and consultation with surface user stakeholders - Railcorp, Eraring Energy, Xstrata and Energy Australia - has already occurred. All have been invited to attend the risk assessment, however only Railcorp and Eraring Energy have expressed a desire to attend. Other stakeholders will be advised of the results of the risk assessment.

SCOPE OF THE REVIEW

The risk assessment will examine the subsidence effects with the mining area as a result of the proposed partial secondary pillar extraction within the application area. Risks to personal safety of the public and other persons and business interruption to surface users, may all be considered when identifying hazards and loss scenarios.

Inclusions:

- Proposed area for secondary pillar extraction plus 'buffer' area to be defined
- All surface facilities within the defined area and 'buffer' zone which may be affected by subsidence or ground movement (lateral)
- Different cases for subsidence, that is
  - → predicted subsidence to a maximum of 115mm
  - → twice the predicted subsidence (250mm)
  - → ten times predicted - 1.1m (pillar failure)
  - → plug failure

* Surface Features:
  - → Natural bush Crown Land including public access trails / tracks
  - → Two water courses
  - → Rail lines - adjacent Main Northern, adjacent Ulan loop, overlying abandoned Railcorp Wangi line
  - → Eraring haul road
  - → Power lines - Railcorp, Energy Australia and Awaba

Exclusions:
* Future proposed Newstan undermining of Awaba workings - covered under a separate application and risk assessment
* Eraring ash dam (outside of notification area)
* Catastrophic events such as earthquakes

INFORMATION TO BE AVAILABLE FOR THE REVIEW WORKSHOP

(a) Mine plans

(b) Geotechnical information and subsidence predictions

(c) Historical data on actual subsidence from other mines such as
  - o Awaba
  - o Newstan
  - o Cooranbong
  - o any other relevant mines

ISSUES TO BE CONSIDERED

* Subsidence is not as predicted - failures such as plug failure
* Issues for the public and other users on the surface
* Subsidence effects on surface environment
  - safety
  - environment
  - business interruption (surface business operations)
* Short term immediate subsidence (expected to be 90% of final)
* Long term subsidence effects e.g.
  - plug failure
  - pillar creep
  - pillar failure

OBJECTIVES OF THE REVIEW:

The results of the risk assessment will be used to help define actions and trigger levels for the Awaba Subsidence Management Plan to be included with the application to mine in the proposed area.

PERSONS PRESENT AT SCOPING MEETING:

Neil Alston	Centennial Coal	neil.alston@centennialcoal.com.au
Phil Enright	Centennial Awaba	phil.enright@centennialcoal.com.au
Vanessa Garling	Centennial Awaba	vanessa.garling@centennialcoal.com.au
Paul Williams	Centennial Awaba	paul.Williams@centennialcoal.com.au
Ray Ramage	DPI-MR	ray.ramage@minerals.nsw.gov.au
Sally McPhee	Jim Knowles Group	sally.mcphee@jkgroup.com.au

REVIEW WORKSHOP DATE

The review workshop has been rescheduled for one day on Friday 14th October, 2005, commencing at 8.00am at the Awaba Mine offices. (First proposed date of 6th October, postponed)

TEAM MEMBERS

The composition of the team was discussed and the proposed team members are as follows:

Phil Enright	Surveyor / Systems Superintendent
Vanessa Garling	Mining Engineer
Paul Williams	Environmental Officer
Railcorp representative	
Eraring Energy representative	
David Hill	Geotechnical Consultant (Strata Engineering Australia)
Andrew Hutton	Environmental Consultant (GSS Environmental)
Sally McPhee	Facilitator - Jim Knowles Group
Carolyn Gowdy	Facilitation Support– Jim Knowles Group

RISK ASSESSMENT METHOD

The risk assessment will use the standard Centennial Coal risk assessment and ranking method, which is a variation of the WRAC system. in this case, the team will assess each of the four different subsidence cases (see scope) as it applies to each different location and surface feature.

The team may use the following risk ranking criteria. The risk assessment team will discuss these at the workshop and change them as considered necessary to the subject under review.

Consequences

	Descriptor	People	Business Interruption
1	*Catastrophic*	Fatality	> 1 month
2	*Major*	Serious injury / Permanent disability	~ 1week
3	*Moderate*	Lost Time Injury	~ 1 day
4	*Minor*	Medical treatment	~ 1 shift
5	*Insignificant*	First Aid	< ~ 1 hour

Probability

	Descriptor	
A	*Highly likely*	**Common** occurrence
B	*Likely*	**Likely** - has happened
C	*Possible*	**Moderate** – could happen / possible
D	*Unlikely*	**Unlikely** - not likely to happen
E	*Highly unlikely*	**Rare** - Practically impossible

		1	2	4	7	11
	2	3	5	8	12	16
Consequences	3	6	9	13	17	20
	4	10	14	18	21	23
	5	15	19	22	24	25

Note that a Risk Ranking of 1 represents the highest risk or the worst case.

As a general rule, High Risks ranked from 1 to 6 require action (two hard barriers or the equivalent) that will reduce the risk to an acceptable level for everyday operation. Hazards ranked 7 to 15 are judged medium risks, those ranked from 16 to 25 are deemed to be low or acceptable risks.

These notes were prepared by Sally McPhee of the Jim Knowles Group and will be forwarded to Vanessa Garling for further distribution as necessary.

Sally McPhee
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APPENDIX 'C'

Results of the Review

Centennial Newstan

AWABA COLLIERY

Awaba, NSW

Risk Assessment of

Secondary Partial Pillar Extraction
Surface Subsidence
Main South Area

Table of Results

REPORT APPENDIX 'C'

October, 2005

JIM KNOWLES GROUP

Consultants in Occupational Health, Safety and Risk Management

1

Railcorp Main Northern Line – nearest points to Mining Application Area		
Mine Area	**Closest Point to Rail Line**	**Depth of Cover**
Location 1 (2NW Panel)	51m	30m
Location 2 (7S Panel)	72m	50m

	Subsidence within mine area	**Consequences to rail line / Rail Corridor**		**Comments**
		Location 1	**Location 2**	
Case 1	As predicted – to a maximum of 115mm (expected < 75mm)	Negligible* impact to rail line	Negligible* impact to rail line	Impact to rail line was assessed on potential vertical as well as horizontal movement
Case 2	Twice predicted – that is to a maximum of 250mm	Negligible* impact to rail line	Negligible* impact to rail line	
Case 3	Ten Times predicted – that is in effect, pillar failure – 1.1m to 1.5m	Negligible* impact to rail line	Negligible* impact to rail line	* Negligible is 'unmeasurable' or < 10mm
Case 4	Plug failure	Nil impact to rail line (no possibility of plug failure under rail line from this mining activity)	Nil impact to rail line (no possibility of plug failure under rail line from this mining activity)	

No adverse consequences to rail line from any of the predicted or unpredicted subsidence scenarios, therefore no requirement to assess risk

2. Eraring Energy Haul Road – Locations where road crosses Mining Application Area		
Mine Area	**Type of Partial Pillar Extraction**	**Depth of Cover**
Location 1 - 7S	Single sided	50-60m
Location 2 - 4NW	Single sided	40-45m
Location 3 – 5SW	Single sided	55m
Location 4a – 2NW	Double sided	40-45m
Location 4b – 4N	Single sided	35-40m
Location 5 – 1NW	Double sided*	25-30m
Location 6 – 2SW	Double sided	55m

* Based on reports from Strata Engineering Australia, no extraction will occur where depth of cover is less than 35m beneath sensitive features. In this case, the pillars beneath the haul road will not be stripped.

2	Eraring Energy Haul Road – Locations where road crosses Mining Application Area			
		Single sided Lifting in Locations 1, 2, 3 and 4b	Double sided lifting in locations 4a, 5, and 6	
	Subsidence within mine area	**Consequences to rail line / Rail Corridor**		**Comments**
Case 1	As predicted – to a maximum of 75mm with single sided lifting and 115mm with double sided lifting (expected subsidence is considerably less)	Negligible to nil impact on haul road	Negligible to nil impact on haul road	
Case 2	Twice predicted – that is to a maximum of 150mm with single sided lifting and 250mm with double sided lifting	Negligible to nil impact on haul road	Consequence to haul road includes minor surface cracking.	In the past the Eraring Energy Haul road has been fully undermined using full extraction (subsidence up to 1.5m) and also partial extraction – the results of the subsidence during those events was easily managed and is well understood
Case 3	Ten Times predicted – that is in effect, pillar failure – 1.1m to 1.5m	Expected consequence to haul road could include road cracking and localised dipping. Pillar failure develops over 2 to 3 days		
Case 4	Plug failure	Practically impossible due to depth of cover (>35m)	Theoretically possible in 2NW double sided lifting (Location 4a). Localised sink hole up to 1m deep.	

2 Eraring Energy Haul Road

No	Type of Subsidence	Consequence	P	C	R	Loss	No	Threats	Control Measures	Action By	Date
2.1	Double predicted subsidence – 250mm	Minor surface cracking – • break up integrity of road surface • additional maintenance cost and business interruption	D	4	21	C	2.1.1	Geotechnical information/ predictions are incorrect	▪ Predictions are based on extensive historical data – local and international ▪ Provided by expert Geotechnical consultants		
							2.1.2	Mine design is compromised	▪ Awaba will strictly adhere to Mining Plan using - mining plan - supervision - audits • Track, Trail, and Haul Road Safety Management Plan to address variation from mining sequence ▪ Design is deliberately conservative with factors of safety		
2.2	Pillar failure (all areas) – subsidence up to 1.5m	Road cracking and localised dipping or small steps (<100mm) Truck may become destabilised	E	1	11	S	2.2.1	Mine design is compromised – excess extraction reduces pillar size and therefore stability	▪ Awaba will strictly adhere to Mining Plan using - mining plan - supervision - audits • Track, Trail, and Haul Road Safety Management Plan to address variation from mining sequence • Design is deliberately conservative with factors of safety		

2 Eraring Energy Haul Road

No	Type of Subsidence	Consequence	P	C	R	Loss	No	Threats	Control Measures	Action By	Date
2.3	Plug failure – double sided lifting particularly at 1NW where cover is 25m	Could result in large step in roadway • Risk of accident to truck drivers	D	1	7	S	2.3.1	Increased risk with decreased cover – can be exacerbated by geological anomalies	▪ Secondary extraction will not occur in 1NW panel under roadway, that is less than or equal to 35m cover ▪ Single sided lifting only where cover is 35-45m directly under roadway		
2.3	Plug failure – double sided lifting particularly at 1NW where cover is 25m	Could result in large step in roadway • Risk of accident to truck drivers	D	1	7	S	2.3.2	Mine design not followed	▪ Awaba will strictly adhere to Mining Plan using - mining plan - supervision - audits - Track, Trail, and Haul Road Safety Management Plan to address variation from mining sequence ▪ Design is deliberately conservative with factors of safety		

3

Railcorp Power Transmission Poles – 5 identified poles within the Application Area		
Mine Area	**Type of Pillar Extraction**	**Depth of Cover**
Location 1 (2NW Panel - 1 pole)	Double sided lifting	35-40m
Location 2 (4N Panel - 4 poles)	Single sided lifting	20-45m

	Subsidence within mine area	Consequences to Timber Power transmission poles	Comments
		All Locations	
Case 1	As predicted – to a maximum of 115mm (expected < 75mm)	maximum 30mm movement at top of pole (any direction)	
Case 2	Twice predicted – that is to a maximum of 250mm	maximum 45mm movement at top of pole (any direction)	
Case 3	Ten Times predicted – that is in effect, pillar failure – 1.1m to 1.5m	Individual pole could drop maximum of 1.1m	
Case 4	Plug failure	Plug failure under pole - could destabilise poles and bring down or break conductors	

No	Type of Pole Movement from Subsidence	Consequence	P	C	R	Loss	No	Threats	Control Measures	Action By	Date
3	**Railcorp Power Transmission Poles**										
3.1	Predicted Subsidence - 30mm movement at top of pole	Believed to be no adverse consequences. Any deviation would be within acceptable/ manageable limits							▪ Railcorp to check this		
3.2	Twice predicted subsidence - 45mm movement at top of pole	Believed to be no adverse consequences. Any deviation would be within acceptable/ manageable limits							▪ Railcorp to check this		
3.3	Pillar failure - up to 1.1 or 1.5m subsidence under poles	Possible over-stretch of conductors						*Where this has occurred in the past (under full pillar extraction) there has been no adverse impacts*	▪ Railcorp to check this ▪ This is not expected and mine planning will preclude this ▪ Option to change mine sequencing to protect surface feature (pole)		

3 Railcorp Power Transmission Poles

No	Type of Pole Movement from Subsidence	Consequence	P	C	R	Loss	No	Threats	Control Measures	Action By	Date
3.4	Plug failure under pole - up to 1m drop - destabilisation of pole	Break of conductor - • business interruption to RailCorp • Fire • Public safety (pole falls over)	D	1	7		S	▪ Failure to follow mine plan	▪ Mine sequence can be altered to protect surface features eg. poles ▪ Review of subsidence monitoring data collected over the life of the project conducted prior to mining affected area. Consult with RailCorp at that time. ▪ Monitoring ▪ Transmission Pole Safety Management Plan		

4 Energy Australia Power Transmission Poles – 6 identified poles within the Application Area - 3 x 33kv and 3 x 11kv

Mine Area	Type of Pillar Extraction	Depth of Cover
Location (4N Panel - 6 poles)	Single sided lifting	25m-30m

Comments / Controls

Management for all Energy Australia poles will be the same as for Railcorp poles

NOTE: Awaba has long history of successful management of these types of surface infrastructure over full pillar extraction areas

5. General Environment Above Mining Application Area				
Feature	**Predicted - up to 115mm**	**Twice Predicted - up to 250mm**	**Ten Times - Pillar failure**	**Plug Failure**
Bushland	Insignificant effect	Insignificant effect	Insignificant effect	Localised sink hole
Tracks/ trails	Insignificant effect	Insignificant effect	Disruption to tracks or trails	Localised sink hole
Heritage features (Wangi Wangi rail line)	Insignificant effect	Insignificant effect	Insignificant effect	Localised sink hole
Water courses	Insignificant effect	Insignificant effect	Disruption to water flow	Localised sink hole
Aboriginal Heritage	No Aboriginal heritage areas identified			
Threatened Flora & Fauna (permanent water hole/ riparian vegetation)	Insignificant effect	Insignificant effect	Disruption to water habitats	Localised sink hole

No	Subsidence Affect	Consequence	P	C	R	Loss	Threats	Control Measures	Action By	Date
5	**General Environment**									
5.1	Plug failure produces sink hole in bushland	Hazard to public walking in area	E	2	16	S	Mining plan not followed - areas of very low cover (< 25m) have partial pillar extraction - may produce unstable intersections *NOTE: only instance of plug failure occurred (in first workings) at depth <20m under creek (bord and pillar workings)*	▪ Mine design has identified areas at risk – design 'precludes' possibility of failure under sensitive surface feature – - conservative pillar design ▪ Mine operations will be supervised and monitored to ensure mine plan adhered to ▪ Mining sequence can be varied to accommodate sensitive surface features (preclude probability of event) (TARP to be developed cover etc) ▪ Awaba management plans for surface subsidence monitoring and rectification to include: - Public safety - Track, trail and haul road - watercourses		
		Damage to environment while repairing sink hole (dozing)	E	3	20	E				
5.2	Plug failure - sink hole in riding trail	Trail bike rider drives into sink hole	E	1	11	S				
5.3	Plug failure - sink hole in Stakeholders access to infrastructure	Maintenance personnel drive / walk into hole	E	2	16	S				
5.4	Plug failure sink hole under abandoned rail corridor	Damage to surface heritage feature (Wangi line)	E	4	23	E				
5.5	Plug failure under water course	Flooding of mine and loss of creek environment (flora and fauna etc)	E	2	16	PE				
5.6	Plug failure	Protected flora damaged by plug failure / sink hole	E	3	20	E				

5	General Environment									
No	Hazard	Consequence	P	C	R	Loss	Threats	Control Measures	Action By	Date
5.7	Pillar failure - Tracks or trails disrupted	▪ Minor surface steps ▪ Trip hazard	E	4	23	S	Mining plan not followed - produces pillar instability	▪ Mine plan is designed to maintain pillar stability ▪ (see 2, 4 in environmental plug failure) ▪ TARP to be developed to identify areas of particular risk related to - depth of cover - system of mining - location within catchment		
5.8	Pillar failure, Watercourses disrupted	▪ Diversion of waters (surface cracking and vertical movement) ▪ Affect on riparian communities	E	2	16	E				

6. Catastrophic / Emergency Events

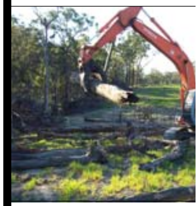
1. Fire/ spon comb - Covered by Underground Emergency Management Plan. Also covered by Railcorp procedures. No history of sponcom at Awaba and proposed method of mining is not significantly different to previous methods of mining undertaken at Awaba, therefore no increased risk of spontaneous combustion. Fire and Emergency Management Plan includes notification of surface stakeholders. Short and long term effects on Railcorp effects are nil (subsidence)

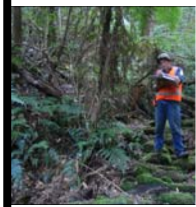
2. Mine explosion – Same as above

3. Earthquake – Covered by Underground Emergency Management Plan and Fire and Emergency Management Plan. Also covered by Railcorp procedures.

4. Other Issues
   - Fault lines – considered fault lines adjacent to corridor:
     - Solid coal (no voids) under rail-lines with faults which run at high angles relative to the rail line and mine workings.
     - Partial extraction includes 'buffer zone' pillars and conservative large pillar design with high factors of safety.
     - Failure of all of above would result in maximum of 1.5m of subsidence (total extraction effect)








WATER MANAGEMENT ASSESSMENT

INCLUDING:

APPENDIX A: POLLUTION CONTROL DAM ASSESSMENT

APPENDIX B: WATER BALANCE

APPENDIX C: WATER QUALITY

APPENDIX 6

Centennial Newstan Pty Ltd

Awaba Colliery
Water Management Assessment
May 2010

FUTURE POWER | Centennial Coal

Contents

Table Index

Figure Index

Appendices

Glossary

Aquifer	Underground water storage within either disturbed or undisturbed strata.
Average Recurrence Interval	A statistical estimate of the average period in years between the occurrence of a flood of a given size or larger, eg. floods with a discharge as big as, or larger than, the 100-year ARI flood event will occur on average once every 100 years. ARI is equal to the reciprocal of annual flood risk, e.g. an annual flood risk of 1/100 has an ARI of 100 years.
Barnes Dam	An underground water storage location. Discharges from Barnes Dam are via LDP005.
Boot Wash	Location where personnel can wash their safety boots.
Bord and Pillar	A mining system whereby coal is extracted leaving 'pillars' of untouched coal to support the strata above.
Bore	A constructed connection between the surface and a source of underground water that enables the underground water to be transferred to the surface either naturally or through artificial means
Clean catchment areas	Catchments in which there are no exposed surfaces containing coal or mined carbonaceous material.
Clean water	Waters on the premises that have not come into physical contact with coal, or mined carbonaceous material.
Coal Handling Plant	A facility where coal is screened and prepared for transport off-site.
Dewatering	Transfer of water from underground workings to the surface.
Dirty catchment areas	Catchments in which coal mined carbonaceous materials are present or areas where the topsoil has been disturbed.
Dirty water	Water on the premises that has come into physical contact with coal, mined carbonaceous materials or otherwise contains elevated sediment load.
Electrical Conductivity	A measure of concentration of dissolved salts in water.
Fish Tank	Underground water storage tank located in the proximity of Barnes Dam.
Fractures	Cracks within the strata either natural or resulting from underground works.
Groundwater	Water held in strata that is not overlying the strata of the coal seam, or within the coal seam.

Infiltration	Natural flow of surface water through ground surfaces as a result of rainfall events.
Inbye	Direction towards the mining face of the coal seam.
In-Seam Coal Storage Bin	Coal Storage Bin located at the end of the coal conveyor south of the workshop.
Interburden	The strata between coal seams.
Licensed Discharge Point	A location where Awaba Colliery discharges water in accordance with conditions stipulated within the site Environment Protection License.
Net extraction	Difference between water transferred to, and from, the underground water storage.
Oil Water Separator	Device designed to separate oil and suspended solids from water.
Overburden	The strata between the recoverable topsoil and the upper coal seam.
pH	A measure of the acidity / alkalinity or water as a result of potential hydrogen ion concentration.
Pollution Control Dam	A dam located downstream of the pit top facilities. LDP009 is located on the spillway of this dam.
Recharge	Inflow of water from surrounding strata into underground workings through infiltration. This can be as a result of rainfall events or from surrounding aquifers.
Sediment-laden water	Water that has a high level of suspended solids.
Steady state condition	A condition in which the system has achieved equilibrium.
Surface Water	Water that is derived from precipitation or pumped from underground and may be stored in dams, rivers, creeks and drainage lines.
Temporary storage	Volume of storage available within a dam between the permanent water level and the overflow level.
Total Suspended Solids	Particles that are suspended in a measured volume of water.
Turbidity	A measure of water cloudiness caused by the amount of suspended matter in the water.
Underground water	Water stored in underground aquifers. During the mining process a proportion of this water is released and managed by the underground settling and pumping system.

Abbreviations

AEMR	Annual Environmental Management Report
AHD	Australian Height Datum
ARI	Average Recurrence Interval
CHP	Coal Handling Plant
DECCW	Department of Environment, Climate Change and Water
DOP	Department of Planning
EA	Environmental Assessment
EC	Electrical Conductivity
EP&A Act	Environmental Planning and Assessment Act 1979
EPL	Environment Protection Licence
kL	Kilolitres
LDP	Licensed Discharge Point
m	Metres
MB	Monitoring bore
ML	Megalitres
MTpa	Million Tonnes per annum
NOW	New South Wales Office of Water
NMQMS	National Water Quality Management Strategy
PA	Project Approval
POEO Act	Protection of the Environment Operations Act 1997
ROM	Run of Mine
STP	Sewage Treatment Plant
T	Tonnes
TSS	Total Suspended Solids
WMAct	Water Management Act 2000

Executive Summary

The operation owned by Centennial Newstan at Awaba Colliery is an underground operation for which the management of both surface and underground water is an important issue.

The objective of this water management assessment was to assess the existing conditions with respect to both surface and groundwater and to determine the potential impact of the proposed operations on current and proposed water management systems.

The aspects of the water system that were investigated included:

- Clean water management.
- Dirty water management.
- Underground water management.
- Overall site water balance.
- Water quality.

The key component of the Project that would potentially impact water management was determined to be the construction of additional storage associated with the Pollution Control Dam. It was determined that the construction of this facility will reduce the number of discharges through LDP009 from an average annual rate of 1.0 ML/year to 0.2 ML/year.

It was determined that the removal of Barnes Dam (and LDP005) would also have an impact on water management but to a lesser extent. As a result of the removal of this dam, discharges through 10 South to the Eraring Ash Dam would increase from an average annual of 82 ML/year to 173.6 ML/year. A review of inflows to the Ash Dam indicated that the impact of Awaba Colliery would increase from approximately 2% to 3% of the total daily inflows. Therefore it was considered that changes to the water management system at Awaba Colliery would have minimal impact on the Ash Dam.

To provide greater flexibility for Awaba Colliery in maintaining an underground water level of -2 m AHD, an increased pumping capacity of 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.

1. Introduction

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 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, near Newcastle NSW.

Awaba Colliery has been producing coal by bord and pillar method since 1947. The site is situated on crown land under lease to Centennial for the purpose of mining under Consolidated Coal Lease CCL746, and is adjacent to the Newstan-Eraring haul road owned by Eraring Energy. The locality of the mine is illustrated on Figure 1.1.

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 (refer to Section 1.1) over a period of approximately five years or more, depending on actual mining conditions and relevant market drivers. The application for the proposed Project is supported by an Environmental Assessment (“EA”).

Awaba Colliery is a small operation with approximately 100 employees and contractors, 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.

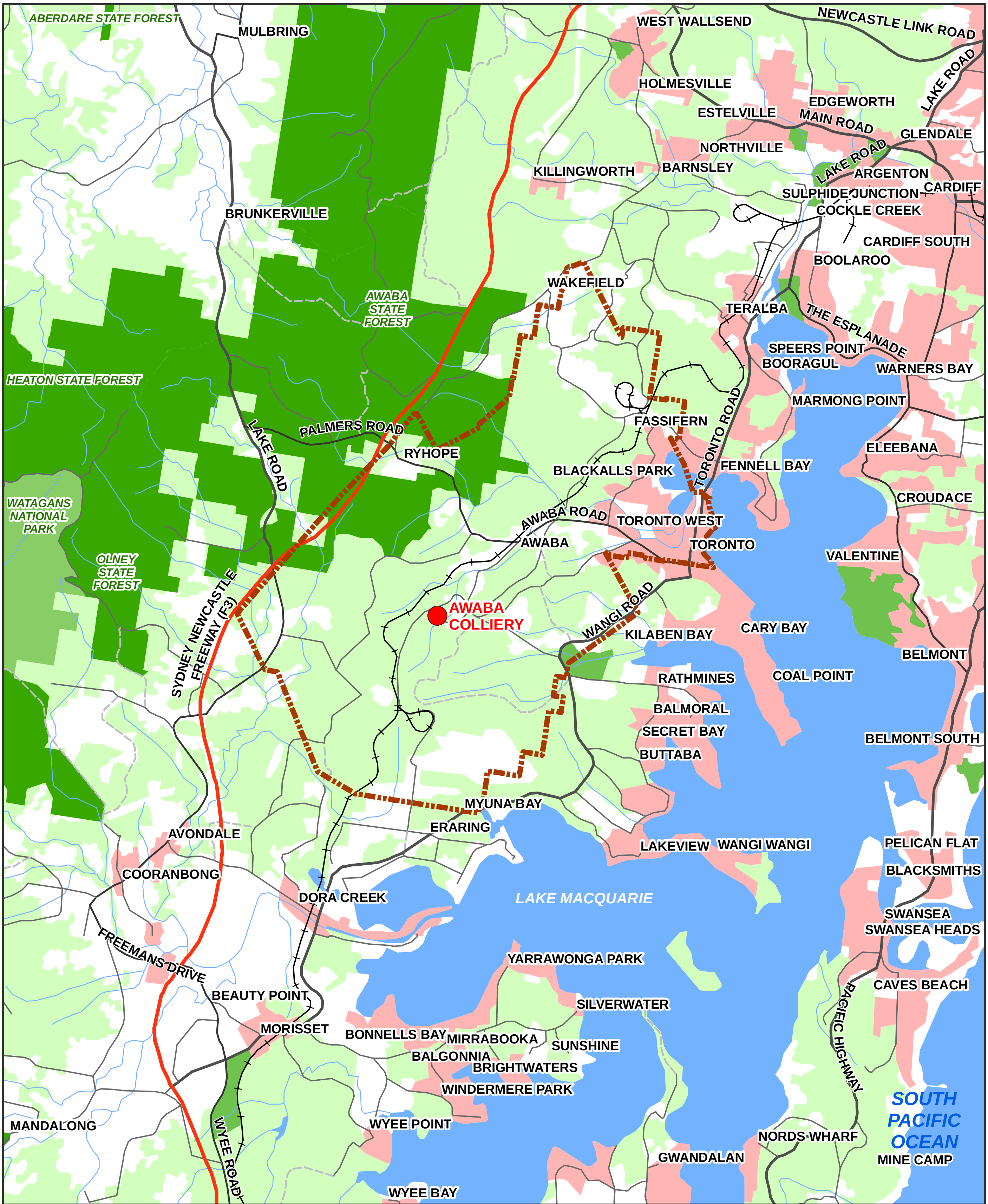
A form of pillar extraction of narrow panels is used to recover coal in pillars developed previously by bord and pillar methods. Development of bords (roadways) and pillars is ongoing but in some areas were developed many years ago. This mining method currently utilises continuous miners. Mine planning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

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. A detailed description of the Project and the Project Application Area *(the “Application Area”)* (including focus study areas) is detailed further in Sections 1.1 and 1.2 below.

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 outlined in Sections 1.1 and 1.2 below.

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 (refer Section 1.1) over a period of approximately five years or more, depending on actual mining conditions and relevant market drivers. The application for the proposed Project is supported by an Environmental Assessment (“EA”).



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0 0.35 0.7 1.4 2.1 2.8
Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geodetic Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

N

GHD

LEGEND

- Newstan Colliery Holding Bdy
- Site Location
- Principal Road
- Secondary Road
- Minor Road
- Track
- Freeway
- Existing Rail
- Watercourse
- Built Up Areas
- Nature Conservation Reserve
- State Forest
- Forest Or Shrub

LOCATION	Awaba
SEAM	Great Northern
DRAWN	F.M
CHECKED	
APPROVED	
SCALE	refer to scalebar

Awaba Colliery

Locality Plan

Centennial Awaba

DATE 20-04-2010

Figure 1.1

GIS Filename: G:\22\15033\GIS\MAPS\Deliverables\Surface Water Assessment\2215033_FIG1-1_Locality_20100420.mxd

1.1 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. 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.

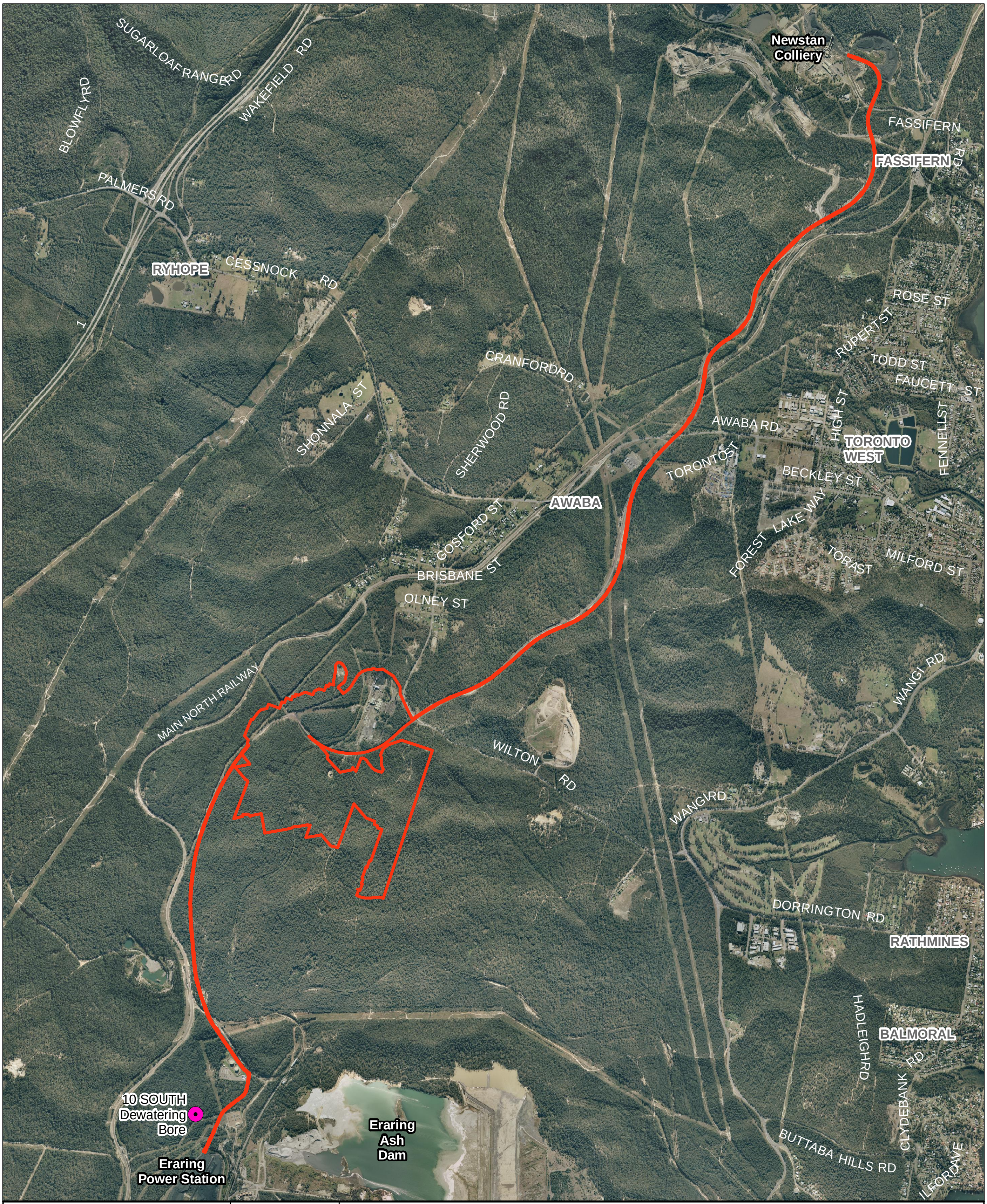
Study Area

The Study Areas that have been assessed as part of this EA are shown on Figure 1.3 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.
- 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 Section 96(1A) of the EP&A Act to allow for the preparation of coal sourced from the Awaba Colliery using the existing Newstan Colliery infrastructure.

This water management assessment has considered Study Areas 1, 2 and 3. The surface water component has considered Study Area 1 only (including the colliery pit top facilities, ventilation shaft, an existing quarry and mine dewatering bore (10 South Bore)) while the ground water assessment considered Study Areas 2 and 3.

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 will also be addressed in the EA.



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Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geodetic Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

N

LEGEND
Project Application Area
Dewatering Bore

LOCATION	Awaba
SEAM	Great Northern
DRAWN	F.M
CHECKED	
APPROVED	
SCALE	refer to scalebar

Awaba Colliery

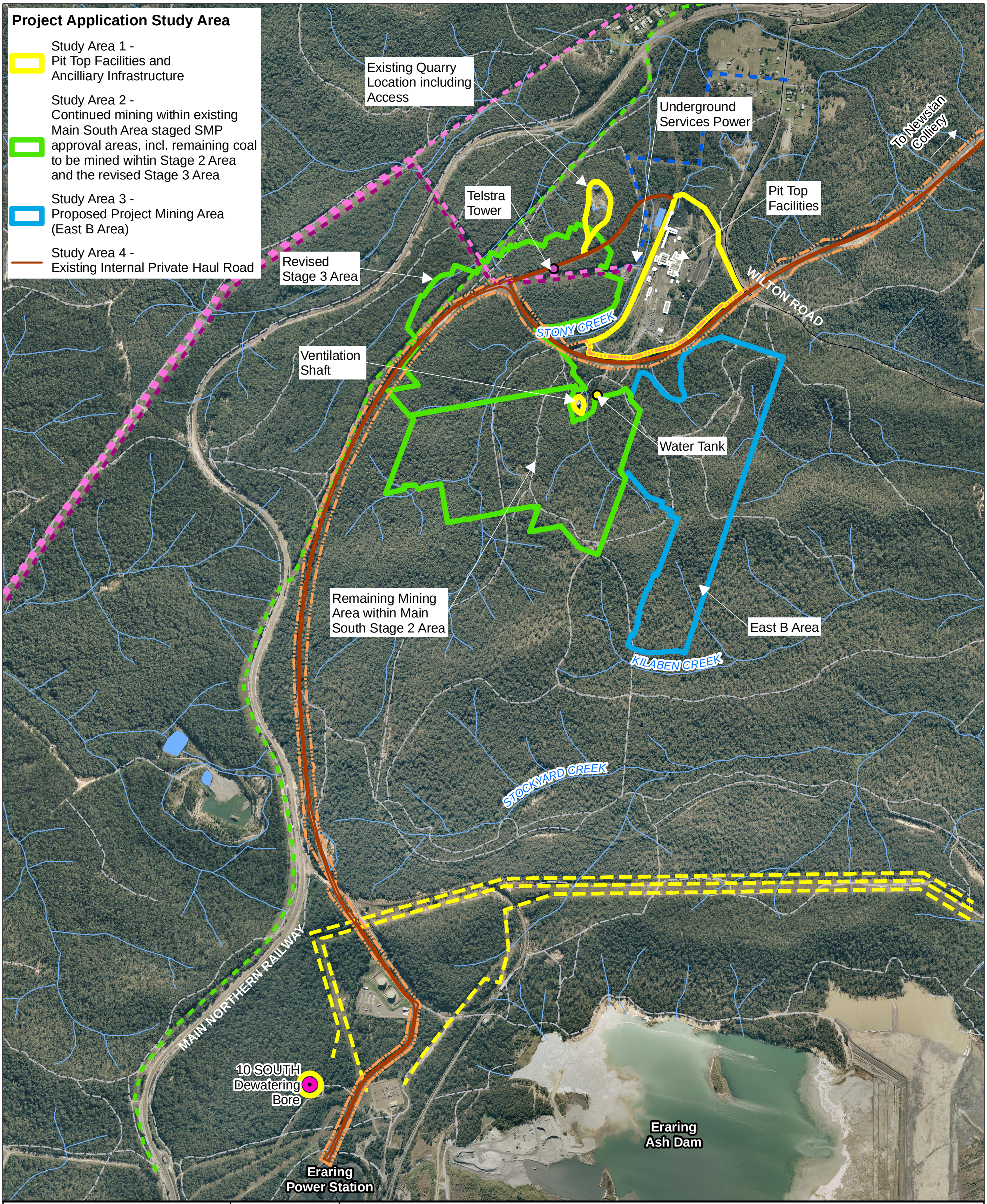
Project Application Area

Centennial Awaba

DATE 02-09-2010

Figure 1.2

GIS Filename: G\22\15033\GIS\MAPS\Deliverables\Surface Water Assessment\2215033_FIG1-2_Site_20100420.mxd



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Meters

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geodetic Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

N

GHD

LEGEND

- Watercourse
- Road
- Tracks
- Haul Road Area
- 11kv Powerline (Awaba)
- 11kv Powerline (Energy Aust.)
- 132kv Powerline (Energy Aust.)
- 33kv Powerline (Energy Aust.)
- 66kv Powerline (Rail Corp)
- Dewatering Bore

LOCATION	Awaba
SEAM	Great Northern
DRAWN	F.M
CHECKED	
APPROVED	
SCALE	refer to scalebar

Awaba Colliery

Project Application Study Areas Detailed

Centennial Awaba

DATE 02-09-2010

Figure 1.3

GIS Filename: G\22\15033\GIS\MAPS\Deliverables\Surface Water Assessment\2215033_FIG1-3_StudyArea_20100421.mxd

1.2 Description 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 final 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 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 Figure 1.3.

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 Figure 1.3:

- 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).

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 1.3) 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 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 NSW in 2009, until such time that a final Detailed Life of Mine Strategy has been developed.

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

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

Existing mining areas, will continue to be utilised for ongoing mining operations including (but not limited to) mine access, emergency management and underground services and infrastructure.

Proposed Changes in Water Management

The Project will include 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 water management at Awaba Colliery by increasing the site's dirty water storage capacity. Construction of the enlarged PCD will be undertaken in an area of the site that has previously been disturbed, and forms part of *Study Area 1* detailed in Section 1.3 below.

The 10 South Bore will continue to be used for groundwater management and underground dewatering under both operational and care and maintenance conditions.

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.

Continuing Mine Operations

For the purposes of environmental assessment, further to the information above regarding continued mining areas, it is noted that the following aspects of mine operations are proposed to continue and remain unchanged. Existing mining operations are presented in detail in Section 3 of the *Environmental Assessment (EA)* and, where relevant, components are discussed further in this specialist report.

- Coal Handling, preparation and stockpiles – No changes are proposed to the current coal handling, preparation or stockpile procedures to the existing operations.
- Mine support facilities and site access – No changes are proposed to the current infrastructure and facilities, with the only exclusion being the expansion of the Pollution Control Dam (PCD) mentioned earlier above, with related water management considerations. Mine access from Wilton Road will continue to be utilised and no significant change is anticipated from current use.
- Plant and equipment – No changes are proposed to the typical plant and equipment used at the Awaba Colliery.
- Transportation procedures – 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.

- Mining methodology – There will be no significant changes to current mining methods 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 (financial year), depending on mining efficiency and market demands.
- Operational water management – 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.
- Mine dewatering procedures – the 10 South Bore will continue to be used for groundwater management and dewatering during both continued operation and care and maintenance conditions.

1.3 Objectives of this Report

The objectives of this water management assessment are to:

- Assess the potential impacts of construction and operation of the Project on water management.
- Address the Director General's Requirements of Part 3A of the EP&A Act in relation to water management.

The Director General's Requirements have identified a number of key issues relating to Water. Table 1.1 outlines the nominated requirements and where they have been addressed within this report.

Table 1.1 Director General's Requirements

Director General's Requirements	Where addressed in this report
A detailed site water balance, including a description of site water demands, water supply and disposal methods	Sections 4.7 and 5.3, Appendix B
Detailed modelling and assessment of potential impacts on: ◗ The quality and quantity of existing surface water and groundwater sources. ◗ Affected licensed water users and basic landholder rights. ◗ The hydrological value of watercourses.	Sections 4.3, 4.4, 4.8 and 5
A detailed description of the proposed water management system (including all infrastructure and storages) and water monitoring program.	Sections 4.2, 5 and 6.3
A detailed description of measures to minimise all water discharges.	Sections 5.1 and 6.1
A detailed description of measures to mitigate surface water and groundwater	Section 6

Director General’s Requirements	Where addressed in this report
impacts.	

1.4 Scope of Work

The scope of work for this investigation included:

- Confirmation of surface and groundwater management systems.
- Assessment of the surface water system within Study Area 1.
- Review of surface water quality data.
- Establishment of a hydrogeologic model.
- Establishment of a detailed site water balance.
- Application of the detailed site water balance to quantify the water budget for Awaba Colliery for the Project.

2. Legislation

2.1 Legislation

The *Environmental Planning and Assessment Act 1979* administered by the NSW Department of Planning outlines the core legislation relating to planning and development activities in NSW and provides the statutory framework under which development proposal are assessed. Under this legislation, Part 3A provides for the control of major projects that require approval from the Minister for Planning. Part 3A has therefore been identified as the application pathway for the Awaba Colliery approval.

The following section provides a brief overview of the legislation and policy documents relevant to surface water investigations for the Project.

Environmental Planning and Assessment Act 1979

Part 3A of the EP&A Act outlines the environmental assessment requirements applicable to major projects.

This report provides the results of a surface water impact assessment for the Project, which was undertaken to satisfy the requirement relevant to surface water for the Project.

Protection of the Environment Operations Act 1997

The objectives of the *Protection of Environment Operations Act 1997* (POEO Act) are to protect, restore and enhance the quality of the environment. Some of the mechanisms that can be applied, under the POEO Act, to achieve these objectives include reduction of pollution at source and monitoring and reporting of environmental quality.

Environmental Protection Licences (EPL's), issued under the POEO Act, are a means by which the impact on the environment is regulated. For Awaba Colliery, the relevant Environmental Protection Licence is EPL 443.

Water Act 1912

The *Water Act 1912* governs access, trading and allocation of licences associated with both surface and underground water for water sources where a water sharing plan has not been put in place. The elements to which the *Water Act 1912* applies include extraction of water from a river, extraction of water from underground sources, aquifer interference and capture of surface runoff in dams.

Water Management Act 2000

The *Water Management Act 2000* (WMAct) is intended to ensure that water resources are conserved and properly managed for sustainable use benefitting both present and future generations. It is also intended to provide formal means for the protection and enhancement of the environmental qualities of waterways and their in-stream uses as well as to provide for protection of catchment conditions.

2.2 Policy

National Water Quality Management Strategy: Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC 2000)

The *National Water Quality Management Strategy* (NWQMS) provides a national framework to improving water quality in Australia's waterways. The main policy objective of the NWQMS is to achieve sustainable use of the nation's water resources by protecting and enhancing their quality while maintaining economic and social development. The NWQMS process involves community and government development and implementation of a management plan for each catchment, aquifer, estuary, coastal water or other water body. This includes use of high-status national guidelines with local implementation. National guidelines relevant to the Project are provided for water quality benchmarks and groundwater management.

National Water Quality Management Strategy Australian Guidelines for Water Quality Monitoring and Reporting (ANZECC 2000)

As part of the NWQMS, there are a number of policies, procedures and guidelines that are nationally accepted for the undertaking of monitoring and reporting of water quality. This applies to fresh, groundwater and marine waters. For the Project these would be applied to surface and groundwater sampling.

Approved Methods for the Sampling and Analysis of Water Pollutants in NSW (DECCW, 2004)

The *Approved Methods for the Sampling and Analysis of Water Pollutants in NSW* lists the sampling and analysis methods to be used when acquiring water samples when complying with an environmental protection legislation, licence or notice.

Managing Urban Stormwater: Soils and Construction (Vol. 1)

Managing Urban Stormwater: Soils and Construction (Vol 1) outlines the basic principles for the design and construction of sediment and erosion control measures. This document relates particularly to urban development sites however it is relevant to the Project as it provides guidance on the configuration of erosion and sedimentation controls required during construction of the Project.

Managing Urban Stormwater: Soils and Construction (Vol. 2E)

Managing Urban Stormwater: Soils and Construction (Vol 2E) provides guidelines, principles and recommended minimum design standards for good management practice in erosion and sediment control during the construction and operation of mines and quarries. Volume 2E provides guidance in the application of the principles and practices of erosion and sediment control described in Volume 1 of Managing Urban Stormwater: Soils and Construction to mines and quarries.

Managing Urban Stormwater: Source Control (EPA 1998)

The intent of this document is to provide guidance to local and state government agencies and developers as well as community and business groups on a range of source control (water quality and quantity) techniques that can be adopted to minimise impacts of works on the surface water environment. It highlights the need for pollutant control using sustainable cost-effective structural and non-structural methods such as swales, basins and gross pollutant traps.

This document provides guidance to the Project for the selection of suitable source control measures where appropriate.

3. Methodology

To establish the potential impact of the Project, the existing hydrologic, hydraulic and water quality conditions needed to be established.

3.1 Desktop Study

For the desktop component of the assessment a number of tasks were undertaken including:

- Identification of waterways and drainage lines within the study area based on the Department of Lands topographic information, in accordance with the *Water Management Act* 2000.
- Review of the existing Site Water Management Plan.
- Review of the Annual Environmental Management Report (AEMR) 2008.
- Review of existing Water Management maps including the documentation of clean and dirty water catchment delineation.
- Search of the NSW Groundwater Bore Database to identify nearby beneficial users of groundwater.
- Development of a groundwater model.
- Development of a water balance model.

3.2 Field Investigations

A site inspection was conducted on 7 April 2010 to confirm the extent of clean and dirty water catchments and presence of water management measures implemented on site.

4. Existing Environment

4.1 Coal Production Process

The coal production process at Awaba Colliery comprises extraction, transfer to surface facilities, processing (crushing and screening) and transportation off site. A schematic of the coal production process is provided in Figure 4.1 while Figure 4.2 indicates the location of the pit top facilities.

4.2 Water Management

Awaba Colliery is located within the Stony Creek catchment, which contributes to Lake Macquarie. Awaba Colliery's Environmental Protection Licence (EPL) 443 therefore includes both volumetric and concentration limits for the discharge of water off site.

The location of Awaba Colliery's discharge points are indicated on Figure 4.3 and include:

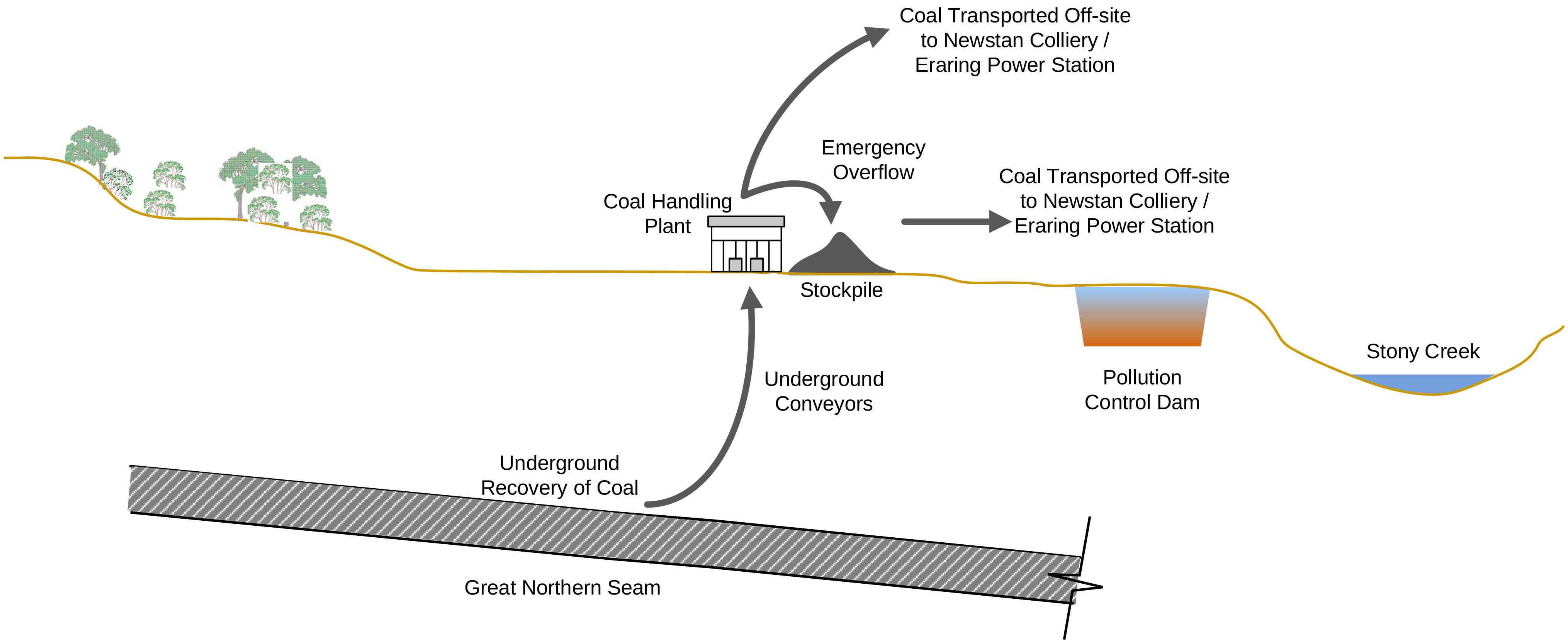
- LDP001 - No longer in use / decommissioned. Borehole still exists.
- LDP002 - No longer in use / decommissioned. Removed.
- LDP003 - No longer in use / decommissioned. Rehabilitated.
- LDP004 - No longer in use / decommissioned. Borehole still exists.
- LDP005 - Barnes Dam no longer in use as at March 2010. Borehole still exists.
- LDP006 - No longer in use / decommissioned. Rehabilitated.
- LDP007 - No longer in use / decommissioned. Borehole still exists.
- LDP008 - Discharge of irrigation water and stormwater runoff adjacent to utilisation area.
- LDP009 - Discharge of mine water from the Pollution Control Dam into Stony Creek.
- 10 South – Discharge of mine water to Eraring Ash Dam.

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 4.4.

The objectives of this water management system are primarily related to the separation of clean and dirty water. Diversion of clean water runoff around the pit top, to avoid contamination, reduces the volume of water reporting to the dirty water management system.

This water management assessment documents the measures that have been put in place to achieve the water management objectives including sedimentation ponds, oil water separators, clean water diversions, maintenance practices for hardstand areas, regular monitoring of water quality and identification of potential risks to water quality.

Within the water management system there are five (5) categories of water including underground (mine) water, dirty water, clean water, sewage and potable water. These categories contribute to either the surface or underground water system as outlined in Figure 4.4.



Coal Movement

LOCATION	Awaba
SEAM	Great Northern
DRAWN	MJP
CHECKED	
APPROVED	
SCALE	

Awaba Colliery
Coal Process Schematic

Centennial

DATE 16-04-2010

Figure 4.1

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Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geodetic Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

N

LEGEND

- 10m Contours
- Watercourse
- Pollution Control Structures

LOCATION	Awaba
SEAM	Great Northern
DRAWN	F.M
CHECKED	
APPROVED	
SCALE	refer to scalebar

Awaba Colliery

Surface Features

Centennial Awaba

DATE 13-05-2010

Figure 4.2

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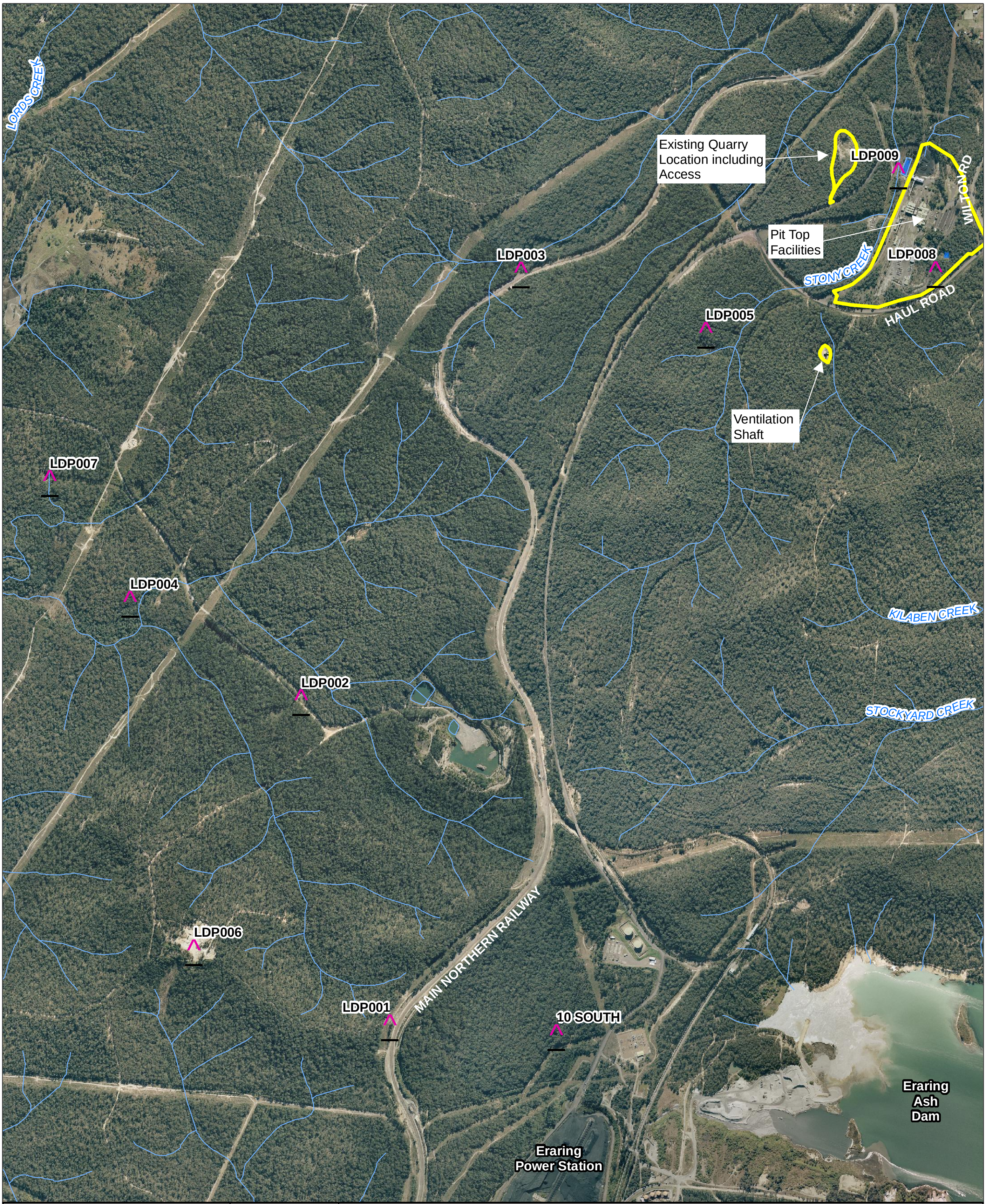

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Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geodetic Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

O

GHD

LEGEND

Discharge Point

Watercourse

Pit Top Facilities and Ancilliary Infrastructure

LOCATION	Awaba
SEAM	Great Northern
DRAWN	F.M
CHECKED	
APPROVED	
SCALE	refer to scalebar

Awaba Colliery

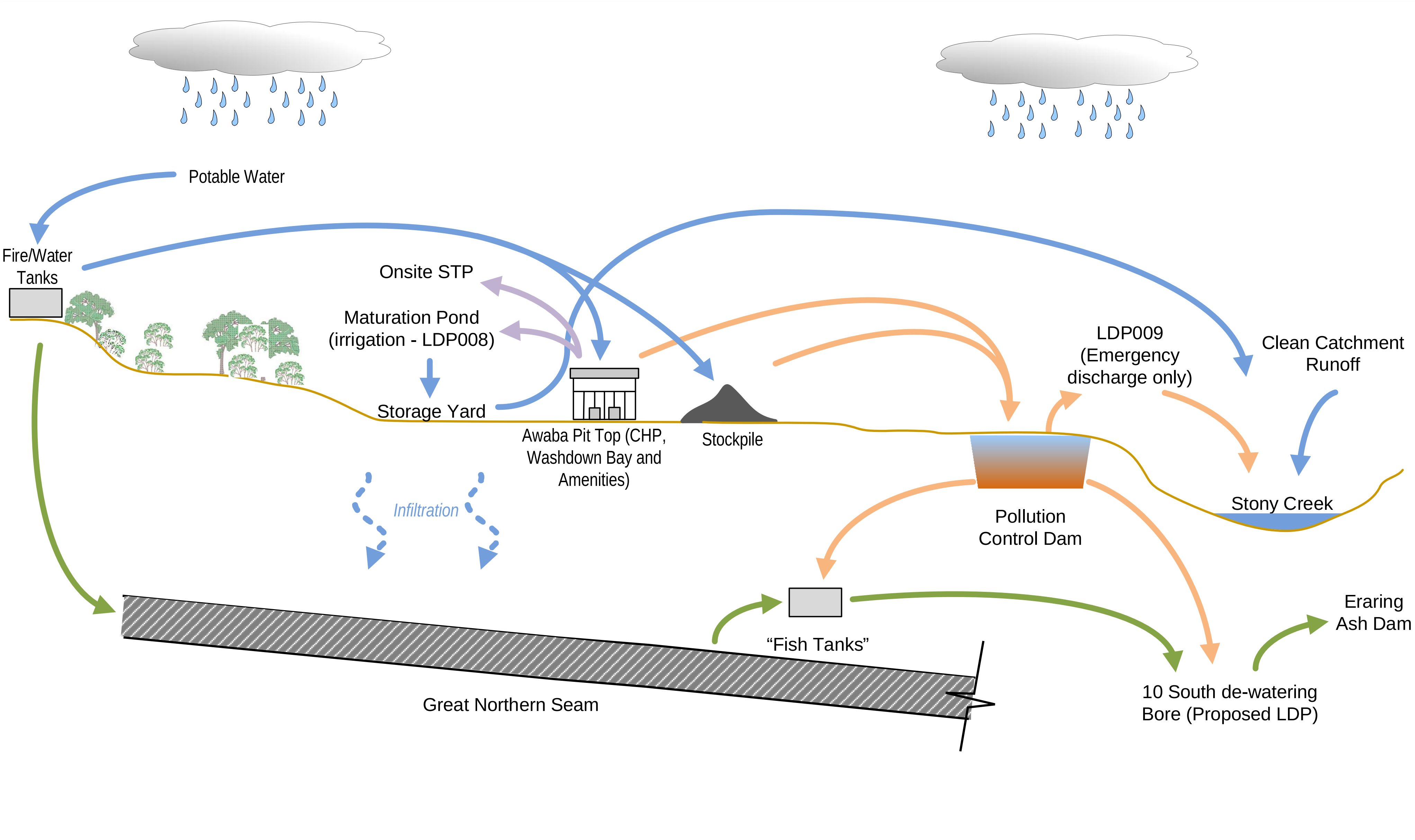
Discharge Point Locations

Centennial Awaba

DATE 13-05-2010

Figure 4.3

GIS Filename: G:\22\15033\GIS\MAPS\Deliverables\Surface Water Assessment\2215033_FIG4-3_LDPs_20100422.mxd



Dirty Water
Clean Water
Underground Water
Sewage Water

LOCATION	Awaba
SEAM	Great Northern
DRAWN	MJP
CHECKED	
APPROVED	
SCALE	

Awaba Colliery
Water Management Schematic

Centennial

DATE 16-04-2010

Figure 4.4

4.3 Surface Water

The surface water system at Awaba Colliery, includes clean and dirty water elements.

Clean Water Management

The management of clean water includes diversion of external catchment runoff as well as management of clean surfaces within the pit top.

Buildings

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.

External Catchment runoff

External catchment clean water is managed through a series of diversion drains that intersect the runoff (to the north of the pit top area) before it enters disturbed areas. These 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 application of these measures enables the reduction of the volume of water contributing to the dirty water system.

The clean water catchment area is indicated in Figure 4.5 while the diversion structure locations are provided in Figure 4.6.

In order to determine the performance of the existing diversion structures, the catchment area contributing to each was determined and the peak flow then estimate using the Probabilistic Rational Method. The capacity of each diversion structure was then compared to the peak flow rate and the outcomes are provided in Table 4.1. From this it can be seen 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.

Table 4.1 Clean Water Structure Diversion Capacities

Diversion Location	Contributing Catchment Area (ha)	Peak Flow (100 Year m^3/s)	Capacity of existing diversion structure (m^3/s)
Downstream of Maturation Pond	4.8	0.9	0.6*
Rear of Storage Yard	6.0	1.1	5.0
Southern External Catchment	12.4	2.0	3.0

* This equates to approximately a 20 year ARI capacity.

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Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geodetic Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

N

GHD

LEGEND

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

LOCATION	Awaba
SEAM	Great Northern
DRAWN	F.M
CHECKED	
APPROVED	
SCALE	refer to scalebar

Awaba Colliery

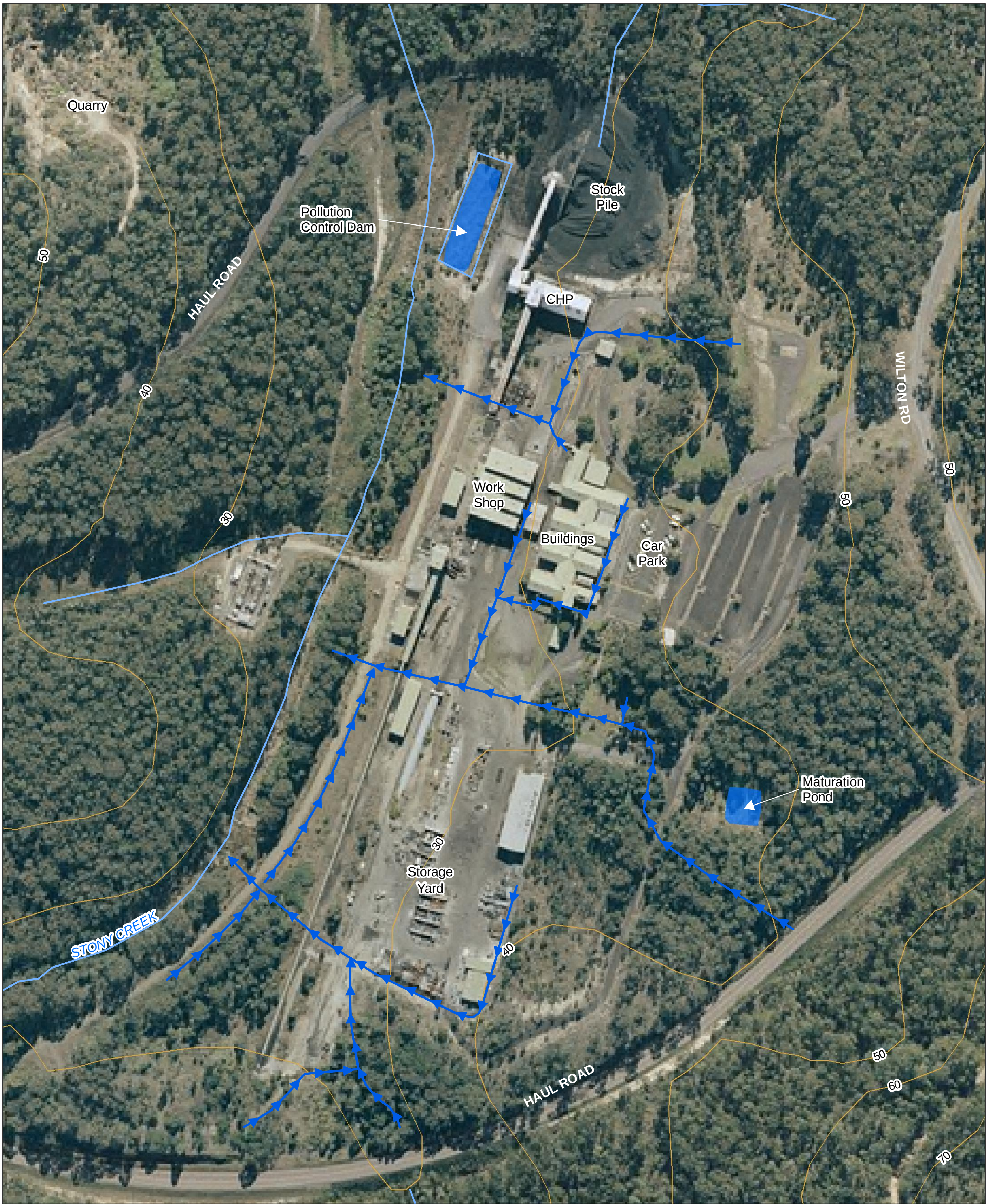
Water Catchments

Centennial Awaba

DATE 13-05-2010

Figure 4.5

GIS Filename: G\22\15033\GIS\MAPS\Deliverables\Surface Water Assessment\2215033_FIG4-5_Catchments_20100422.mxd



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Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geodetic Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

N

GHD

LEGEND

- Pollution Control Structures
- 10m Contours
- Watercourse
- Clean Water Diversions

LOCATION	Awaba
SEAM	Great Northern
DRAWN	F.M
CHECKED	
APPROVED	
SCALE	refer to scalebar

Awaba Colliery

Clean Water Diversions

Centennial Awaba

DATE 13-05-2010

Figure 4.6

GIS Filename: G\22\15033\GIS\MAPS\Deliverables\Surface Water Assessment\2215033_FIG4-6_CleanWater_20100422.mxd

Dirty Water Management

Dirty water runoff from the boot wash, diesel parking bund, washdown bay, stockpile and coal handling plant is collected in a series of collection sumps, pipes, an oil water separator and open drains and then directed to the Pollution Control Dam. The dirty water diversions are shown on Figure 4.7.

Oil Water Separator

Runoff from the washdown bay and diesel tank area is directed to the oil water separator for treatment prior to discharge into the Pollution Control Dam.

In-Seam Coal Storage Bin

The 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 in the in-seam coal storage bin. This water is then pumped to the Pollution Control Dam.

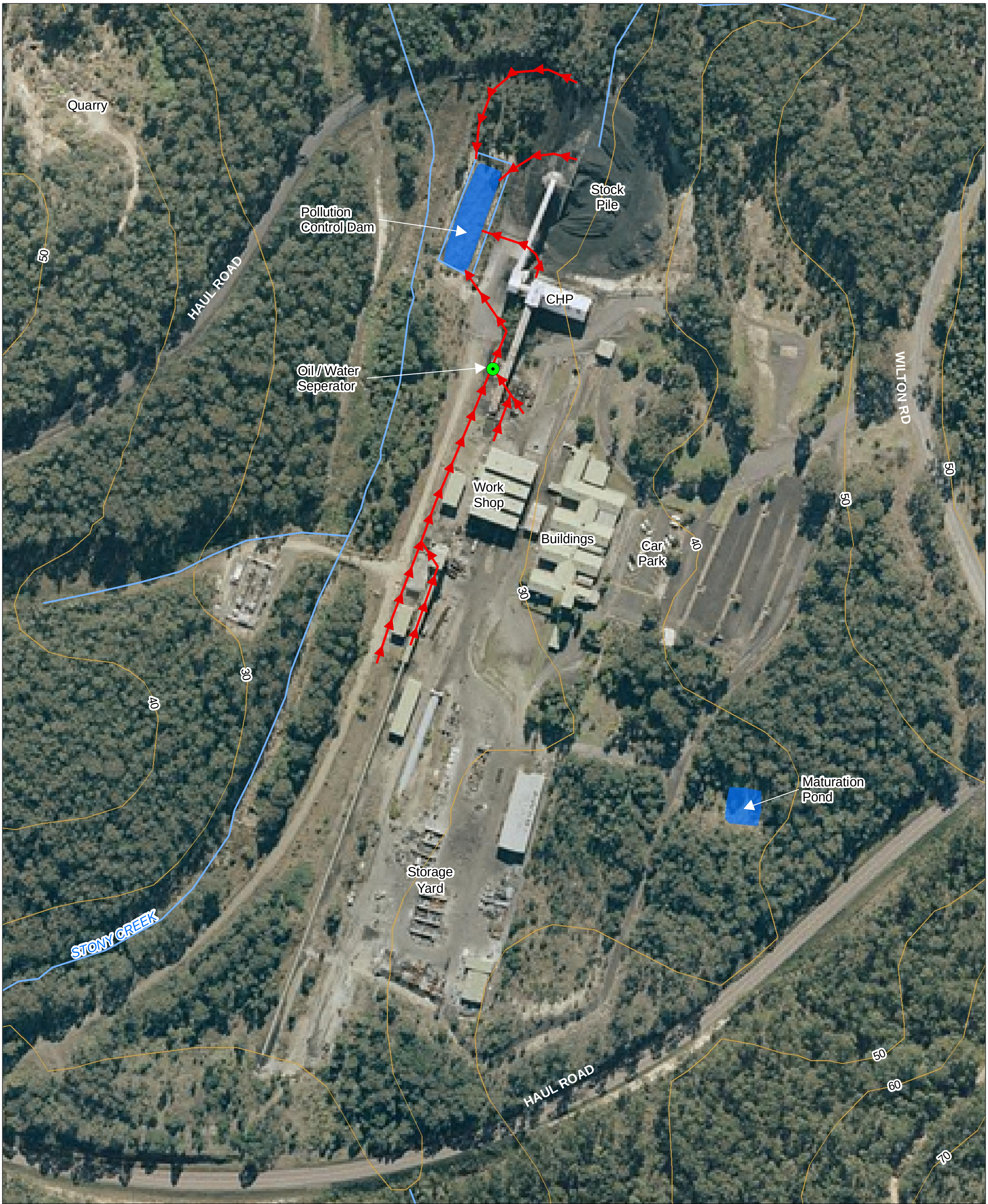
Pollution Control Dam

The 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 performance of this structure was previously assessed by GHD. Through this investigation it was determined that the Pollution Control Dam had a total capacity in the order of 3.2 ML to cater for an overall catchment area of approximately 2.4 hectares. At the time of this investigation, some improvements to the controls applied to the pollution control dam had already been undertaken.

Prior to 20 February 2009, the pumping capacity for removal of dirty water was limited to 1 litre per second (L/s). Pumping commenced once a water level of 26.96m AHD had been reached and ceased at the low water level of 26.90m AHD. This operational system only provided approximately 0.8 ML for the temporary storage of runoff during a rainfall event. Consideration was given to the potential for overtopping for a range of storm events.

The storm events considered included the 1, 2, 5, 10, 20, 50 and 100 year Average Recurrence Interval (ARI) storms for durations ranging from 5 minutes through to 24 hours. It was determined that in its current form, the Pollution Control Dam overtopped in events resulting in rainfall greater than those documented in Table 4.2.



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Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geodetic Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

N

GHD

LEGEND
- Pollution Control Structures
- 10m Contours
- Watercourse
- Dirty Water Diversions
- Oil / Water Seperator

LOCATION	Awaba
SEAM	Great Northern
DRAWN	F.M
CHECKED	
APPROVED	
SCALE	refer to scalebar

Awaba Colliery

Dirty Water Diversions

Centennial Awaba

DATE 13-05-2010

Figure 4.7

GIS Filename: G:\22\15033\GIS\MAPS\Deliverables\Surface Water Assessment\2215033_FIG4-7_CleanWater_20100422.mxd

Table 4.2 Existing Capacity of Pollution Control Dam

ARI	Duration	Average Intensity (mm/hr)
1 Year	Up to 1 hour duration	26.1
2 Year	Up to 30 minute duration	49.3
5 Year	Up to 30 minute duration	63.1
10 Year	Up to 20 minute duration	87.3
20 Year	Up to 10 minute duration	138
50 Year	Up to 10 minute duration	161
100 Year	Up to 10 minute duration	179

On 20 February 2009, the capacity of pumping from the Pollution Control Dam was increased to 11L/s however the same level controls were retained. This resulted in only a minor increase in the performance of the Pollution Control Dam with overtopping occurring under the same conditions for all events with the exception of the 1 year ARI event. For this recurrence interval, overtopping now occurred for events greater than the 2 hour duration (average intensity 17.3 mm/hr) rather than the 1 hour duration.

EPL 443 does not place any volumetric limits on discharges from LDP009 as discharge through this location will be as a direct result of a rainfall event. To minimise the impact on the downstream environment (using reasonable and practicable measures) GHD investigated the storage capacity required within the Pollution Control Dam to cater for a 1 in 10 year ARI 24 hour duration storm event.

The outcomes of this investigation are provided in Appendix A and discussed in more detail within Section 5.1.

Quarry

The location of the existing on-site quarry is such that there are no external catchments contributing to this area therefore no clean water diversions are required for the quarry. 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 (Vol 2E).*

Managing Urban Stormwater: Soils and Construction (Vol 2E) recommends that erosion and sediment control works, for areas of disturbance with durations exceeding three 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.

The existing measures that have been put in place include re-shaping of the maintenance track east of the quarry and installation of sediment fences adjacent to the access track.

Surface Water Management Structures

Details of the water management structures associated with the Awaba Colliery pit top are provided in Table 4.3. The capacity of individual structures was not considered as part of this assessment as the catchment areas contributing to each structure will not be altered as a result of the Project. The capacity of the overall system is discussed in Section 4.7.

Table 4.3 Awaba Colliery Pit Top Water Management Structures

Location	Capacity (ML)
Oil Water Separator	0.06
In-Seam Coal Storage Bin	0.06*
Pollution Control Dam	3.2

* Estimated.

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 and the named watercourses include 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 has been assessed by Hunter Eco as part of the Environmental Assessment process.

Stony Creek

The Awaba Colliery pit top is located in the upper reaches of Stony Creek which discharges into Lake Macquarie. Adjacent to the pit top, 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 phragmites and/or typha. At approximately 600 metres downstream of the pit top, the channel loses definition with the creek line discharging into a swampy environment of up to 50 metres wide.

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 4.8 of this report while the hydrologic impact is discussed in Section 5.1.

4.4 Underground Water

The underground mine water management system is amended from time to time to adapt to the current mining conditions. Within the current area of operations (pre March 2010), water in the underground workings is 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. There is also some discharge through the existing 10 South de-watering bore. Discharges through 10 South contribute to the Eraring Ash Dam.

A detailed hydrogeologic model has been developed by GHD for Awaba Colliery to enable documentation of the behaviour of underground water and the resulting mine water make for the colliery. The outcomes of this investigation were incorporated into the Water Balance Assessment discussed in Sections 4.7 and 5.3 and provided in Appendix B.

The capacity of Barnes Dam was estimated from the floor contours contained within the hydrogeologic model and determined to be approximately 5 ML.

10 South

The 10 South bore is a 300mm diameter bore that extends approximately 33.8m from the surface to the Great Northern seam. While this bore currently has the capacity to extract 5.5 L/s (175 ML/year) from the underground workings, the average discharges over the past four years varied as indicated in Table 4.4. These discharges are conveyed to the Eraring Ash Dam through the existing open channel used by Eraring to convey their ash to the Ash Dam.

Table 4.4 10 South Annual Discharges

Date	Annual Discharge (ML)
June 2007 to December 2007	98.9
2008	131.4
2009	84.9
January 2010 – April 2010	51.4

4.5 Potable Water

Potable water is provided to Awaba Colliery by Hunter Water Corporation to the potable water/fire tanks.

Potable Water / Fire Tanks

There are three existing 200,000 litre tanks located east of the Awaba Colliery pit top, however one of these tanks has been isolated due to cracking and leaking. Subsequently, 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). A connection to the sprinkler system associated with the stockpile area is provided within the coal handling plant.

The stored potable water is also available for fire fighting on both the surface and underground.

4.6 Waste Water

Waste water at Awaba Colliery includes both grey water and sewage.

Grey Water

Grey water from the bathhouse and other buildings contributes to the maturation pond prior to being discharged through the irrigation system to the east of the pit top area as indicated on Figure 4.2. Runoff from the irrigation area (LDP008) is then considered to be clean and contributes to the clean water diversions prior to discharge into Stony Creek.

Sewage

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.

4.7 Water Balance

A detailed operational water balance was undertaken giving consideration to a broad range of data including rainfall, evaporation and water transfer rates and is provided in Appendix B.

The water balance was developed for the existing conditions (pre March 2010) and calibrated against data for discharges from LDP005 and 10 South. The calibrated model was then amended to reflect the proposed conditions (post March 2010) associated with the Project.

Results

The results of the water balance assessment for existing conditions, as provided in Table 4.5, indicated that increases in rainfall had only a minor impact on discharges through LDP005 and 10 South. There were however, increases in the discharges through LDP009 in years of high rainfall.

Table 4.5 Existing Conditions Water Balance Results

	Average Year (1995)	Dry Year (1993)	Wet Year (2007)
Inputs (Rainfall/Runoff) (ML/year)	246.11	66.93	362.53
Outputs (Evaporation) (ML/year)	0.04	0.04	0.04
Discharge through LDP009 (ML/year)	0.00	0.00	4.19
Discharge through LDP005 (ML/year)	121.5	115.5	129.0
Discharge through 10 South (ML/year)	154.7	151.3	157.5

Results for the proposed conditions are discussed in Section 5.2 of this report while the calibration and detailed results are provided in the Water Balance Assessment report in Appendix B.

4.8 Water Quality

In reviewing the water quality associated with the Awaba Colliery pit top, consideration was given to six monitoring locations. These locations are referred to as ‘Upstream’, ‘Downstream’, Lake Macquarie, LDP009, LDP005 and 10 South.

‘Upstream’ is considered to be the most representative of the background of Stony Creek and is located upstream of LDP009 but downstream of the Newstan - Eraring Haul Road. It is influenced by discharges from Barnes Dam (LDP005 – decommissioned in March 2010). ‘Downstream’ is located downstream of LDP009, within Stony Creek while Lake Macquarie is located approximately 8.5 km downstream of LDP009.

Period of Data

The period of data reviewed for each of the monitoring locations is provided in Table 4.6. These locations are generally sampled monthly and analysed for pH, EC (Electrical Conductivity), TSS (Total Suspended Solids), oil and grease and turbidity. A sample of the data assessed is provided in Appendix C.

Table 4.6 Monitoring Location Data Period

Monitoring Location	From Date	To Date
Upstream	March 2002	March 2010
Downstream	January 2002	March 2010
Lake Macquarie	August 2008	October 2008
LDP005	January 2002	March 2010
LDP009	February 2007	March 2010
10 South	January 2003	March 2010

Default Trigger Values

ANZECC/ARMCANZ (2000) default trigger values that apply to this site are outlined in Table 4.7. They include stressor trigger values for lowland or coastal rivers and default freshwater trigger values for the protection of 95% aquatic species.

Table 4.7 ANZECC/ARCMCANZ (2000) Default Trigger Values

Parameter	Trigger Value	Comment
pH	6.5 – 8.0	Lowland river, SE Australia (Table 3.3.2, ANZECC/ARMCANZ 2000)
Electrical Conductivity (EC)	< 2200 µS/cm	Lowland river, SE Australia (Table 3.3.3, ANZECC/ARMCANZ 2000). NSW coastal rivers typically 200-300 µS/cm
TSS	< 50 mg/L	Lowland river, NSW (Table 8.2.12, ANZECC/ARMCANZ 2000). NSW coastal rivers 6 mg/L
Turbidity	< 50 NTU	Lowland river, SE Australia (Table 3.3.3, ANZECC/ARMCANZ 2000). NSW coastal rivers 6 NTU

Parameter	Trigger Value	Comment
Total Nitrogen (TN)	0.35 mg/L	NSW coastal river (Table 3.3.2, ANZECC/ARMCANZ 2000)
Nitrogen Oxides	0.04 mg/L	Lowland river, SE Australia (Table 3.3.2, ANZECC/ARMCANZ 2000)
Total Phosphorus (TP)	0.025 mg/L	NSW coastal river (Table 3.3.2, ANZECC/ARMCANZ 2000)
Aluminium	0.055 mg/L	Applies for pH > 6.5
Arsenic	0.013 mg/L	Guideline for As(V)
Boron	0.37 mg/L	
Copper	0.0014 mg/L	
Iron	0.3 mg/L	Due to insufficient data, the Canadian guideline level is used as an interim indicative working level, as recommended by ANZECC/ARMCANZ (2000)
Lead	0.0034 mg/L	
Manganese	1.9 mg/L	
Zinc	0.008 mg/L	

Note that a hardness correction factor, as outlined in Table 3.4.4 of ANZECC/ARMCANZ (2000), should be applied to the heavy metal criteria if the surface water hardness of the receiving water body exceeds 60 mg/L $CaCO_3$. For Awaba Colliery the 80th percentile total hardness ($CaCO_3$) recorded in the period between September 2009 and March 2010 was 309 mg/L, which is classified as “very hard” in Table 3.4.4 of ANZECC/ARMCANZ (2000). The heavy metal trigger levels were revised as a result of this are provided in Table 4.8.

Table 4.8 ANZECC/ARCMCANZ (2000) Revised Heavy Metal Trigger Values

Parameter	Trigger Value	Comment
Copper	0.0073 mg/L	0.0014 mg/L x 5.2 in accordance with Table 3.4.4 of ANZECC/ARMCANZ (2000).
Lead	0.040 mg/L	0.0034 mg/L x 11.8 in accordance with Table 3.4.4 of ANZECC/ARMCANZ (2000).
Zinc	0.042 mg/L	0.008 mg/L x 5.2 in accordance with Table 3.4.4 of ANZECC/ARMCANZ (2000).

EPL 443

The concentration limits specified in EPL 443 are provided in Table 4.9.

Table 4.9 EPL 443 Concentration Limits

Parameter	Discharge Limit
pH	6.5 – 8.5
TSS	50 mg/L
Oil and Grease	10 mg/L

Surface Water Quality Data

pH

'Upstream' and 'Downstream'

Surface water within the Stony Creek tributary, as indicated by pH results reported for monitoring locations 'Upstream' and 'Downstream', is generally slightly alkaline.

Over 77% and 94% of the reported 'Upstream' and 'Downstream' results respectively are within the ANZECC/ARMCANZ (2000) trigger value range for lowland rivers and over 98% for both locations are within the EPL 443 discharge limit range.

LDP009

Discharges through LDP009 have been limited to event based discharges with the exception of the period between October 2008 and December 2008 during which underground water was transferred from Newstan Colliery. For all discharges through LDP009, the discharge was generally slightly alkaline although all reported pH levels were within the EPL 443 discharge limit range.

LDP005 and 10 South

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.

EC

'Upstream' and 'Downstream'

Reported EC levels indicate that surface water within the Stony Creek tributary is fresh to brackish, with ECs ranging from 186 to 2810 μS/cm at 'Upstream' and 190 to 3410 μS/cm at 'Downstream'. It should be noted that EC levels at 'Downstream' consistently exceeded those reported at 'Upstream' for the period between August 2008 and January 2009.

Reported EC levels at 'Upstream' and 'Downstream' were relatively variable. This is unlikely to be attributable to tidal variations since the tributary is above the Stony Creek tidal limit. It is possible that the EC variability is attributable to the interaction, within the Stony Creek tributary, of rainfall runoff with the licensed discharge of groundwater extracted from the Great Northern seam workings through the recently decommissioned LDP005.

LDP009

The discharge through LDP009 between October 2008 and December 2008 was generally brackish, with ECs ranging from 3160 to 3440 µS/cm. This discharge is likely to have raised the EC at 'Downstream' during late 2008. By comparison, the event based discharges outside this period were determined to be primarily fresh with ECs in the order of 270 µS/cm.

LDP005 and 10 South

The median ECs of 2580 and 6095 resulted in brackish and saline discharges from LDP005 and 10 South respectively. This indicates 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 Environmental Protection Licence (EPL 1429) for Eraring does not contain a limit on the concentration limits for EC. A comparison to the 50th percentile ECs within Lake Macquarie was undertaken. It was determined that discharges through 10 South were 85% lower than 50th percentile concentrations within the Lake.

TSS

'Upstream' and 'Downstream'

TSS concentrations were generally similar at 'Upstream' and 'Downstream'. 96% of the reported concentrations at 'Upstream' (between January 2006 and March 2010) were less than the EPL 443 discharge limit (50 mg/L) and the ANZECC/ARMCANZ (2000) maximum trigger value for NSW lowland rivers, while approximately 50% of results were less than the recommended trigger value for coastal lowland rivers (6 mg/L). At monitoring location 'Downstream', over 98% of reported TSS concentrations were less than the EPL discharge limit and ANZECC/ARMCANZ (2000) maximum trigger value for NSW lowland rivers, while 63% of results were less than the recommended trigger value for coastal lowland rivers.

LDP009

TSS concentrations through LDP009 for event based discharges outside the period between October 2008 and December 2008 exceeded the concentration limits nominated in EPL 443 and the ANZECC/ARMCANZ (2000) maximum trigger value for NSW lowland rivers.

Conversely, the TSS concentration within the period October 2008 and December 2008 was consistently less than or equal to reported concentrations within the Stony Creek tributary and were consistently below both the EPL discharge limit and ANZECC/ARMCANZ (2000) maximum trigger value for NSW lowland rivers. It is further noted that over 80% of results were less than the recommended trigger value for coastal lowland rivers.

LDP005 and 10 South

For discharges through LDP005 and 10 South, 98% of the reported concentrations below the EPL 443 discharge limit (50 mg/L) and the ANZECC/ARMCANZ (2000) maximum trigger value for NSW lowland rivers. Additionally, approximately 88% and 50% of results for LDP005 and 10 South respectively were less than the recommended trigger value for coastal lowland rivers (6 mg/L).

Turbidity

'Upstream' and 'Downstream'

Turbidity levels reported at the 'Upstream' monitoring location were generally higher than those reported at 'Downstream'. At monitoring location 'Downstream', all reported results (with the exception of three) were less than the ANZECC/ARMCANZ (2000) maximum trigger value for NSW lowland rivers (50 NTU), while approximately 50% of reported turbidity levels were less than or equal to the recommended trigger value for coastal lowland rivers (6 NTU). However, at monitoring location 'Upstream', the turbidity exceeded the ANZECC/ARMCANZ (2000) maximum trigger value for NSW lowland rivers on seven occasions between March 2007 and March 2010, while less than 45% of reported turbidity levels were less than the recommended trigger value for coastal lowland rivers.

LDP009

Turbidity of event based discharges through LDP009 outside the period between October 2008 and December 2008 exceeded the ANZECC/ARMCANZ (2000) maximum trigger value for NSW lowland rivers.

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.

LDP005 and 10 South

For discharges through LDP005 and 10 South, 95% and 97% respectively of the reported concentrations below the EPL 443 discharge limit (50 mg/L) and the ANZECC/ARMCANZ (2000) maximum trigger value for NSW lowland rivers. Additionally, approximately 53% and 65% of results for LDP005 and 10 South respectively were less than the recommended trigger value for coastal lowland rivers (6 mg/L).

Oil and Grease

Reported oil and grease concentrations at the 'Upstream', 'Downstream' monitoring locations as well as through LDP009 were consistently below the laboratory detection limit and/or less than the EPL discharge limit (10 mg/L).

Heavy Metals

An assessment of heavy metals was undertaken for six monitoring locations ('Upstream', Lake Macquarie, LDP009, LDP005 and 10 South). The data considered is provided in Appendix C with a discussion on particular metals provided below.

Copper

Both total and dissolved copper were measured at the 'Upstream' location between the period of September 2009 and March 2010. The total copper levels were all below the default

ANZECC/ARMCANZ (2000) trigger value and therefore consideration was not given to the revised trigger level resulting from the 'water hardness'. For dissolved copper, approximately 35% of the reported results exceeded the default ANZECC/ARMCANZ (2000) trigger values however with the application of the 'water hardness' factor, all results were found to be below the revised trigger value.

LDP009

The reported concentrations for total copper through LDP009 were all above the default ANZECC/ARMCANZ (2000) trigger value however with the application of the 'water hardness' factor, all results were found to be below the revised trigger value.

LDP005 and 10 South

60% and 75% of discharges through LDP005 and 10 South respectively recorded concentrations for total copper above the default ANZECC/ARMCANZ (2000) trigger value. With the application of the 'water hardness' factor, it was determined that all of the LDP005 discharges were below the revised trigger level however for 10 South 25% of the recorded discharges were still over the revised level.

Zinc

Approximately 80% of the total zinc and 45% of the dissolved zinc recorded results were determined to be above the default ANZECC/ARMCANZ (2000) trigger values. However, with the application of the 'water hardness' factor, the recorded results were within the revised value range.

LDP009

All zinc concentrations reported for discharges through LDP009 were found to be above both the default ANZECC/ARMCANZ (2000) trigger value and the revised (for 'water hardness') trigger value.

LDP005 and 10 South

All of the recorded concentrations discharged through LDP005 and 10 South were above default ANZECC/ARMCANZ (2000) trigger value. With the application of the 'water hardness' factor, this was reduced to 47% and 25% of recorded concentrations that exceeded the revised trigger value.

Arsenic

No adjustment, as a result of 'water hardness' is applied in Table 3.4.4 ANZECC/ARMCANZ (2000) to arsenic therefore the default trigger values were applied. A review of the recorded results indicated that for both total and dissolved arsenic, these were within the default ANZECC/ARMCANZ (2000) trigger values.

LDP009

All recorded concentrations of arsenic through LDP009 were found to be below the default ANZECC/ARMCANZ (2000) trigger values.

LDP005 and 10 South

All recorded concentrations of arsenic through LDP005 and 10 South were found to be below the default ANZECC/ARMCANZ (2000) trigger values.

Lead

As with arsenic, no adjustment for 'water hardness' is applied in Table 3.4.4 ANZECC/ARMCANZ (2000) to lead therefore the default trigger values were applied. A review of the recorded results indicated that for both total and dissolved lead, these were within the default ANZECC/ARMCANZ (2000) trigger values.

LDP009

All recorded concentrations of lead through LDP009 were found to be above the default ANZECC/ARMCANZ (2000) trigger values, however with the application of the 'water hardness' factor, the recorded results were within the revised value range.

LDP005 and 10 South

All recorded concentrations of lead through LDP005 were found to be below the default ANZECC/ARMCANZ (2000) trigger values while 13% of the discharges through 10 South were above the default trigger values. With the application of the 'water hardness' factor, all recorded discharges complied with the revised trigger value.

Ambient Water Quality Data – Lake Macquarie

In determining trigger values for Awaba Colliery, consideration was also given to the quality of water within Lake Macquarie. As there are numerous contributors to the Lake and historically this receiving water body has been subjected to the discharge of a number of pollutants, it was considered appropriate that the 50th percentile be applied to the existing water quality results. Further, heavy metal concentrations within the Lake may also be a product of natural sources within the catchment.

For the period between August and October 2008, a number of water quality samples were collected by Centennial Coal within Lake Macquarie. Comparison between the 50th percentile of these values and the default ANZECC trigger values was undertaken and is presented in Table 4.10. The shaded sections indicate the parameters for which the 50th percentile levels within Lake Macquarie exceed the default ANZECC trigger values.

Table 4.10 Ambient Trigger Values

Parameter	50th Percentile	ANZECC Trigger Value
pH	7.6	6.5 – 8.0
TSS	82 mg/L	6 – 50 mg/L
EC	40,100 μS/cm	125 – 2200 μS/cm
Turbidity	34 NTU	6 – 50 NTU
Aluminium	1.29 mg/L	0.055 mg/L

Parameter	50^{th} Percentile	ANZECC Trigger Value
Arsenic	0.005 mg/L	0.013 mg/L
Boron	3.25 mg/L	0.37 mg/L
Copper	0.012 mg/L	0.0014 mg/L
Iron	1.44 mg/L	0.03 mg/L
Lead	0.017 mg/L	0.0034 mg/L
Manganese	0.087 mg/L	1.9 mg/L
Zinc	0.07 mg/L	0.008 mg/L
Aluminium (dissolved)	0.05 mg/L	0.055 mg/L
Arsenic (dissolved)	0.0015 mg/L	0.013 mg/L
Boron (dissolved)	3.08 mg/L	0.37 mg/L
Copper (dissolved)	0.003 mg/L	0.0014 mg/L
Iron (dissolved)	0.86 mg/L	0.03 mg/L
Lead (dissolved)	0.002 mg/L	0.0034 mg/L
Manganese (dissolved)	0.034 mg/L	1.9 mg/L
Zinc (dissolved)	0.008 mg/L	0.008 mg/L

Recommended Trigger Values

In determining appropriate trigger values for physical and chemical stressors and toxicants, the preferred ANZECC/ARMCANZ (2000) approach follows the order:

- Use of biological data.
- Local reference data.
- Tables of default values provided in ANZECC/ARMCANZ (2000).

Since no biological toxicology data exists for Stony Creek or its tributaries, guideline levels must be derived from local reference data or, if insufficient, from tables of default values. According to ANZECC/ARMCANZ (2000), a minimum of 24 data values (generally taken over the previous two years over a number of seasons and flow conditions) should exist for a reference site in order to calculate site specific criteria.

Site specific criteria have been calculated for most analytes from the 80^{th} percentile concentrations of recent data reported for 'Upstream'. These criteria are provided in Table 4.11 along with the 50^{th} percentile from ambient data and the default ANZECC/ARMCANZ (2000) trigger values.

According to ANZECC/ARMCANZ (2000), if the default trigger value is less than (or more conservative than) a reliable site-specific criterion, then the site-specific value becomes the guideline. As shown in Table 4.11, this applies to Copper and Zinc only. For pH, TSS and oil and grease, the EPL discharge limits apply. Where 'Upstream' data are consistently below the laboratory detection limit, the 80th percentile concentration has not been calculated.

Table 4.11 outlines the recommended trigger values for nutrients and heavy metals and provides comments on the source of this trigger values.

Table 4.11 Recommended Trigger Values

Parameter	50th Percentile (Ambient) [a]	80th Percentile (Site Specific) [b]	Default Trigger Value [c]	Recommended Trigger Value
pH	7.6[d]	8.0	6.5 – 8.5[e]	6.5 – 8.5
Electrical Conductivity (EC)	40100	2420	< 2200 µS/cm	< 2200 µS/cm
TSS	82	9	< 50 mg/L[f]	< 50 mg/L
Turbidity	34	29.4	< 50 NTU	< 50 NTU
Total Nitrogen (TN)	-[g]	-[g]	0.35 mg/L	0.35 mg/L
Nitrogen Oxides	-[g]	-[g]	0.04 mg/L	0.04 mg/L
Total Phosphorus (TP)	-[g]	-[g]	0.025 mg/L	0.025 mg/L
Aluminium	1.29	-[g]	0.055 mg/L	0.055 mg/L
Arsenic	0.005	0.01	0.013 mg/L	0.013 mg/L
Boron	3.25	-[g]	0.37 mg/L	0.37 mg/L
Copper	0.012	0.004	0.0073 mg/L	0.004 mg/L
Iron	1.44	-[g]	0.3 mg/L	0.3 mg/L
Lead	0.017	-[g]	0.04 mg/L	0.04 mg/L
Manganese	0.087	-[g]	1.9 mg/L	1.9 mg/L
Zinc	0.07	0.016	0.042 mg/L	0.016 mg/L

(a) Based on data for ambient location (Lake Macquarie). Generally 50th percentile concentration/level, unless indicated.
(b) Based on data for upstream location 'Upstream'. Generally 80th percentile concentration/level, unless indicated.
(c) ANZECC/ARMCANZ (2000) trigger values, unless indicated.
(d) 20th percentile – 80th percentile of upstream pH levels.
(e) EPL range.
(f) EPL concentration is 50 mg/L.
(g) Insufficient data.

5. Impact Assessment

As discussed in Section 1.2, the proposed surface works associated with this Project is limited to maintaining existing operations and the expansion of the Pollution Control Dam.

5.1 Surface Water

As no change to the surface infrastructure (with the exception of the Pollution Control Dam) within the pit top area is proposed, it is anticipated that there will be no impact on the existing surface water behaviour.

Quarry

While no changes are proposed for the existing quarry, the function of this facility is to provide material for on-site remedial works. Consequently there is a potential that winning of material from this location may 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 and therefore additional measures are required.

This could include re-shaping of the base of the quarry to retain runoff and incorporation of a sediment trap at the top of the existing access track location. At times of further work, a review of the existing mitigation measures and consideration of additional measures (as required) is also recommended. All measures should be consistent with the recommendations of *Managing Urban Stormwater: Soils and Construction (Vol 2E).*

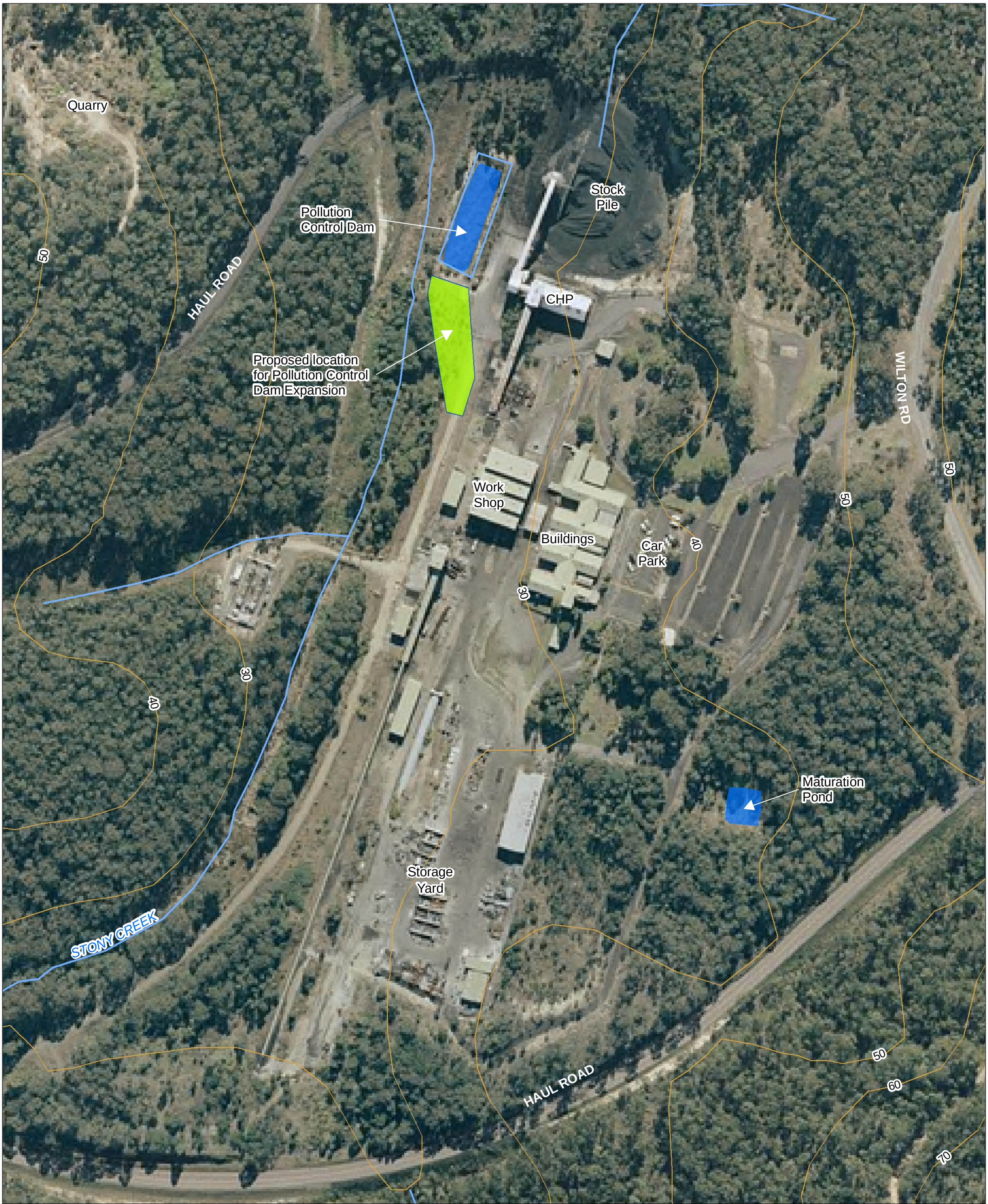
Pollution Control Dam

As indicated in Section 4.3, the capacity of the existing Pollution Control Dam is limited and discharges will occur during what are considered to be reasonably regular rainfall events. In addition, the review of water quality being discharged through LDP009 (as discussed in Section 4.8) indicated that during event based discharges the level of TSS exceeded the conditions of EPL 443.

The options for increasing the capacity (to cater for the 1 in 10 year 24 hour design storm event) of the Pollution Control Dam are provided in Appendix A. These included lowering of the existing control water level and increasing the storage available through the construction of additional dams. Of the proposed options, Awaba Colliery have nominated Option 2, which included lowering of the existing pollution control dam water level by 0.5m and the construction of an additional storage, as the preferred option.

The predicted temporary storage capacity for the final form of the Pollution Control Dam as a result of adopting this option (refer Figure 5.1) was determined to be:

- 1.3 ML as a result of lowering the water level by 0.5m.
- 3.0 ML as a result of construction of an additional storage.
- 4.3 ML total.



1:3,000 for A4

0 0.01 0.02 0.04 0.06 0.08
Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geodetic Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

N

GHD

LEGEND

- 10m Contours
- Watercourse
- Pollution Control Structures
- Pollution Control Dam Expansion

LOCATION	Awaba
SEAM	Great Northern
DRAWN	F.M
CHECKED	
APPROVED	
SCALE	refer to scalebar

Awaba Colliery

Proposed Surface Works

Centennial Awaba

DATE 13-05-2010

Figure 5.1

GIS Filename: G\22\15033\GIS\MAPS\Deliverables\Surface Water Assessment\2215033_FIG5-1_ProSurface_Wks_20100506.mxd

As with the assessment of the existing capacity of the Pollution Control Dam, this investigation considered the 1, 2, 5, 10, 20, 50 and 100 year Average Recurrence Interval (ARI) storms for durations ranging from 5 minutes through to 24 hours. The results of the increased storage options are provided in Table 5.1.

Table 5.1 Increased Performance of Pollution Control Dam

ARI	Lower water level by 0.5m	Lower water level and additional storage
1 Year	Up to 12 hour duration	Up to 72 hour duration
2 Year	Up to 12 hour duration	Up to 72 hour duration
5 Year	Up to 1 hour duration	Up to 72 hour duration
10 Year	Up to 1 hour duration	Up to 24 hour duration
20 Year	Up to 30 minute duration	Up to 12 hour duration
50 Year	Up to 30 minute duration	Up to 6 hour duration
100 Year	Up to 30 minute duration	Up to 6 hour duration

In addition to this, the performance of the increased storage option was assessed within the water balance. The outcomes of this are discussed in Section 5.3.

Stony Creek

While it was indicated in Section 4.3 that Stony Creek is generally well vegetated and stable, the limited capacity of the Pollution Control Dam results in the contribution of TSS over the level nominated in EPL 443 as a result of event based discharges.

While the impact of Awaba Colliery on Stony Creek was negligible, the improved performance of the Pollution Control Dam (which decreases the number of annual event based discharges) will further assist in reducing the impact of the Colliery on the Creek.

Hydrologic Impacts

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.

5.2 Underground Water

Based on the conceptual hydrogeological model outlined in the Water Balance Assessment Report in Appendix B, groundwater in the vicinity of Awaba Colliery occurs primarily within the coal seams. The orientation and dip of the coal seams affect the groundwater flow characteristics.

The hydrogeological model did not estimate any substantial increase in water make i.e. loss of groundwater from the surrounding aquifers, as a result of the project.

The search of the NSW Groundwater Bore Database identified 16 registered bores within approximately 7 km of the Awaba Colliery pit top. Bore construction details are limited, however three stock or test bores (not owned by Centennial) within 3 km of the north western boundary of the Awaba Colliery workings appear to be screened across coal seams. 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.

10 South

As part of the progressive development of mine water management, some changes to underground water transfers have occurred (March 2010). This has resulted in the replacement of the Barnes Dam underground storage with Fish Tanks. These Fish Tanks collect underground water which is then transferred to the underground storage area associated with the 10 South bore. Subsequently, discharges through LDP005 have ceased while discharge through 10 South (at a rate of 5.5 L/s) has continued and is now the only location where underground water is now discharged.

The operation of 10 South is discussed in more detail with the Water Balance report (Appendix B). Through the hydrogeologic model and detailed water balance, it was determined that an increase in discharge through 10 South may be required in order to maintain a safe water level within the underground workings. The recommended de-watering rate through 10 South is 1.2 ML/day (or 440 ML/year).

5.3 Water Balance

By comparing the information provided in Table 5.2 (proposed conditions) to the data within Table 4.5 (existing conditions) it can be seen that construction of the expansion of the Pollution Control Dam will result in a decrease in discharges through LDP009 in years of higher rainfall.

It can also be seen that the removal of Barnes Dam and LDP005 will result in an increase in discharges through 10 South to the Eraring Ash Dam.

Table 5.2 Proposed Conditions Water Balance Results

	Average Year (1995)	Dry Year (1993)	Wet Year (2007)
Inputs (Rainfall/Runoff) (ML/year)	246.11	66.93	362.53
Outputs (Evaporation) (ML/year)	1.38	1.37	1.38
Discharge through LDP009 (ML/year)	0.00	0.00	0.69
Discharge through 10 South (ML/year)	173.5	173.5	173.5

LDP009

A review of the discharges through LDP009, for the full assessment period of January 1987 to February 2010, for both the existing and proposed conditions was undertaken. Through this it was determined that construction of the additional storage associated with the Pollution Control Dam will reduce the average number of discharges from 1.04 per year to 0.17 per year.

10 South

The impact of discharges to the Eraring Ash Dam (from 10 South) was also investigated as part of the water balance assessment. A previous investigation by Connell Wagner into the Ash Dam determined that it had a capacity of 4,000 ML with inflows in the order of 14.07 ML/day from Eraring and an allowable maximum controlled discharge of 47.52 ML/day.

In order to assess the potential impact of discharges from 10 South for the existing conditions, conversion of the average annual discharge to a daily discharge was required. These daily discharges were then compared to the inflows to the Ash Dam and it was found that Awaba Colliery contributes less than 2% of the inflows.

In the event that the pumping capacity at 10 South is not increased, the increased duration in pumping through this discharge point would increase the contribution to the Eraring Ash Dam to approximately 3%.

Under both the existing and proposed conditions (with no increase in pump capacity), discharges from Awaba Colliery (through 10 South) contribute only a minor portion of inflows into the Eraring Ash Dam. The impact of Awaba Colliery on the Ash Dam is therefore considered to be minimal.

To provide greater flexibility for Awaba Colliery to enable the maintenance of an underground water level of -2 m AHD, an increased pumping capacity of 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.

5.4 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 4.8, 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 Pollution Control Dam 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 Pollution Control Dam will reduce the volume of sediment being discharged into Stony Creek in times of high rainfall.

Within Section 4.8, the 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).

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.

6. Mitigation Measures

6.1 Surface Water

Maintenance

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.

Pollution Control Dam

To improve the management of surface water at Awaba Colliery, the capacity of the Pollution Control Dam is proposed to be increased. This has been nominated as works to be undertaken as part of the Project but it is also a mitigation measure 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)*.

Quarry

It is recommended that shaping of the base of the quarry 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.

If is further recommended that the existing sediment and erosion control measures associated with the quarry 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.

10 South

While 10 South 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.

6.2 Underground Water

Water Make

It is anticipated that there will not be any substantial increase in water make into the workings (from rainfall recharge and aquifers) as a result of the Proposal. Further, it is unlikely that the Proposal will impact beneficial users of coal seam groundwater in the vicinity of Awaba Colliery since the groundwater being used does not appear to be from the Great Northern Seam.

Nevertheless, it is recommended that monthly monitoring of underground water levels be undertaken to monitor changes in the level of water stored in underground depressions and to verify that the rate of extraction at 10 South is sufficient.

6.3 Water Quality

The construction of the Pollution Control Dam will reduce the likelihood of discharges of dirty water to Stony Creek.

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 6.1.

Table 6.1 Monitoring Program

Location	Frequency	Monitored Parameters
LDP001	No longer discharging	
LDP002	No longer discharging	
LDP003	No longer discharging	
LDP004	No longer discharging	
LDP005	No longer discharging	
LDP006	No longer discharging	
LDP007	No longer discharging	
LDP008	Monthly	pH, TSS, oil and grease, EC, turbidity
	Bi-Annual	pH, TSS, oil and grease, sulphate, TP, TN, turbidity, TDS, EC, BOD, Ca, Mg, Na, K, NOx, 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
LDP009	Event based	pH, TSS, oil and grease, sulphate, TP, TN, turbidity, TDS, EC, BOD, Ca, Mg, Na, K, NOx, 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
10 South	Monthly	pH, TSS, oil and grease, EC, turbidity
	Bi-Annual	pH, TSS, oil and grease, sulphate, TP, TN, turbidity, TDS, EC, BOD, Ca, Mg, Na, K, NOx, total hardness. Total: Cu, Pb, Hb, Ni, Co, Se, Ag, Zn, Al,

Location	Frequency	Monitored Parameters
		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
Upstream	Monthly	pH, TSS, oil and grease, EC, turbidity
Downstream	Monthly	pH, TSS, oil and grease, EC, turbidity

In accordance with Section 7.4.4.2 of ANZECC, it is recommended that natural background concentrations be established from water quality data collected for at least 24 samples. These samples would preferably be collected on a monthly basis over a period of two (2) years. Therefore it is recommended that sampling continue to be undertaken at 'Upstream' and 'Downstream' associated with Stony Creek.

It is also recommended that sampling be taken at one (1) other reference site in the Jigadee Creek catchment area within the Awaba lease area. Sampling at this location would also include the collection of at least 24 samples preferably taken monthly over a period of two (2) years.

In the event that monthly sampling could not occur (due to the ephemeral nature of same of the watercourse), the review of the ANZECC assessment would completed once the analysis of the 24 samples had occurred.

The samples would be analysed for:

- ph, EC, TSS, turbidity, oil and grease, major cations/anions.
- Total nitrogen (including NOx and ammonia), TP
- Total hardness
- Metals (total/dissolved): Al, As, Cd, Cr, Cu, Fe, Mn, Ni, Pb, Zn, Hg.

7. References

Connel Wagner*, Eraring Power Station Ash Dam Water Forecast for Dense Phase Slurry Proposal,* August 2007.

Department of Environment and Climate Change, 2008 *Managing Urban Stormwater Volum 2E Mines and Quarries.*

Department of Environment and Heritage, Canberra, ANZECC / ARMCANZ 2000, *National Water Quality Management Strategy: Australian and New Zealand guidelines for fresh and marine water quality.*

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Environmental Protection Authority 1998*, Managing Urban Stormwater.*

Landcom 2004b, *Managing Urban Stormwater: Soils and Construction Volume 1*, 4th Edition March 2004, NSW.

Appendix A

Pollution Dam Assessment

Assessment of Pollution Control Dam Capacity

Pollution Control Dam: Options for Augmentation

11 August 2009

Jeffrey Dunwoodie
Centennial Coal
PO Box 1000
TORONTO NSW 2283

Our ref: 22/14622/87756
Your ref:

Dear Jeff

Awaba Pollution Control Dam Assessment

This report provides as assessment of the previous and existing capacities of the Pollution Control Dam (PCD) at Awaba Colliery and proposes possible options for augmentation of the existing system.

1 PART 1 – Assessment of Existing and Required Capacities

Assessment of the documentation provided and liaison with Awaba staff indicated that the catchment contributing to the PCD is limited to the dirty water generating areas, consisting of site infrastructure, stockpiles and hardstand areas of the Awaba Colliery. The ponds volumes assessed by GHD closely agree with values provided for site.

The dam incorporates a pumping system that is triggered at two levels. Pumping commences at a water level of 26.96m RL and ceases when the volume reaches a low water level of 26.90m RL. Retention capacities of the dam have been assessed assuming the dam is maintained at the low water level.

The total capacity of the PCD prior to 20 February 2009 was assessed as 3,187m^3. At the time the dam volume was maintained at a volume of 2,404m^3 therefore the retention capacity of the dam was 783m^3. The retention capability of the dam was further increased by the pumping capacity from the dam of 1L/s.

The retention capacity of the dam prior to 20 February 2009, including the offset of pumping at 1L/s, correlates to the Average Recurrence Intervals (ARI's) and storm durations presented in Table 1-1 below.

Table 1-1 Retention Capacity of Dam

	ARI			
Storm Duration	1 Year	2 Years	5 Years	10 Years
5 min				
6 min				
10 min				
20 min				
30 min				
1 hr				
2 hr				
3 hr				
6 hr				
12 hr				
24 hr				

	No overflow from PCD
	Overflow from PCD

On 20 February 2009 the retention capacity of the dam was increased by augmentation of the capacity of the pump from 1L/s to 11L/s. The retention capacity of the dam alone remains to be 783m^3.

The current retention capacity of the dam, including the offset of pumping at 11L/s, correlates to the ARI's and storm durations in Table 1-2 below.

Table 1-2 Current Retention Capacity of Dam

	ARI			
Storm Duration	1 Year	2 Years	5 Years	10 Years
5 min				
6 min				
10 min				
20 min				
30 min				
1 hr				
2 hr				
3 hr				
6 hr				
12 hr				
24 hr				

	No overflow from PCD
	Overflow from PCD

The volume of runoff generated in the 10 year ARI 24 hour storm event would be approximately 4,485m^3, however, 950m^3 would be offset by continuous pumping from the dam of 11 L/s. Therefore the final retention volume required for the catchment is 3,535m^3. Augmentation of 2,752m^3 from the current system is required to obtain this retention volume.

2 PART 2 – Options for Augmentation

Numerous options for the incorporation of additional storage in conjunction with the existing Pollution Control Dam (PCD) at the Awaba mine site have been examined. The following details the initial assessment of options.

- Required storage volume for the 10 year ARI 24 hour event (from Part 1) 3,535m^3.
- Existing capacity (from Part 1) 783m^3.
- Required additional capacity (from Part 1) 2,752m^3.

2.1 Option 1 - Lower Existing Control Level by 1m

The information provided by site indicates the pond invert level is 24.5m with a pump switch “off” level of 26.9m. Should the pump switch off level be lowered by 1m then an additional 1,035m^3 of storage is available but this in isolation of other works would not achieve the required volume. Since the volume for storing coal fines below the pump “off” level will be reduced, the removal of coal fines may need to be undertaken more frequently than currently to retain the required water storage capacity above the pump “off” level.

To reduce the frequency of cleaning yet still obtain an increase in storage volume, a better total works balance maybe achieved by reducing the pump switch off level by only 0.5m in conjunction with the undertaking of other works. This would increase the storage in the pond by only 525m^3.

2.2 Option 2 - Lower Existing Pump Control Level by 0.5m and Construct a New Pond

Works involved would include:

- Modify the pump switch “off” level to 26.4m (0.5m below the existing level).
- Construct a new pond at either end of the existing pond to dimensions approximately the same as for the existing pond, refer to Figure 1.
- Construct an overflow from the existing pond to the new pond at invert level of approximately 27.2m AHD. The overflow would be a trapezoidal weir approximately 2m in length.
- Construct a new pump in the new pond. This pump would have an “off” level set at 24.5mAHD and would discharge to the current LDP. This would enable the new pond to be kept dry. This new pump would not be optional since the pump “off” level is below that proposed for the existing dam.
- Install piping from the new pump in the new pond to transfer water from the new pond to the current LDP.

The increased storage volumes would be:

- Increase in existing pond 525m^3.
- Approximate volume in new pond 3,000m^3.
- Total increase in capacity 3,525m^3.

Hence, this configuration can provide the required storage capacity and design optimisation could reduce the increase in capacity to the minimum required value.

Additional optional works that could be considered to minimise the amount of coal fines likely to be carried from the existing dam to the new pond through the overflow include:

- Use of an under-overflow weir located within the existing dam adjacent to the overflow. Forcing water to pass through this form of overflow structure would assist to retain floating coal fines in the existing dam.
- Installation of a floating curtain made from a fine filter such as a geofabric could be installed at the overflow to trap the floating coal fines and prevent them discharging into the new pond.

Additional optional works that could be considered to minimise the amount of coal fines likely to be discharged from the existing dam include:

- Use of an under-overflow weir located within the existing dam upstream of the overflow/LDP. Forcing water to pass through this form of overflow structure would assist to retain floating coal fines in the existing dam.
- Installation of a floating curtain made from a fine filter such as a geofabric could be installed upstream of the overflow/LDP to trap the floating coal fines and prevent them discharging into the new pond.
- Installation of a floating curtain or underflow weir around the pump in the existing dam to trap as much floating fines as practical.

2.3 Option 3 – Lower Existing Pump Control Level by 0.5m and Construct Two New Ponds

Works involved would include:

- Modifying the pump switch of levels to 26.4m (0.5m below the existing level).
- Constructing two new ponds, located at both ends of the existing pond. The ponds would have an invert level of approximately 26.5m sloping towards the existing pond.
- Install two 300mm diameter pipes from the invert of the new ponds to just above the modified pumping level of the existing pond, refer to Figure 2.

The increased storage volumes would be:

- Increase in existing pond 525m^3.
- Volume in proposed PCD A 1,185m^3.
- Volume in proposed PCD B 1,130m^3.
- Total increase in capacity 2,840m^3.

This configuration can provide the required storage capacity and design optimisation could reduce the increase in capacity to the minimum required value.

An advantage of this configuration is that a new pump station will not be required. As the water level rises above the pumping level, water will backup through the pipes and into the new dams. Water in the new dams will then naturally drain back into the main existing dam as water is pumped out via the existing pump system.

As with Option 2, additional optional works that could be considered to minimise the amount of coal fines likely to be discharged would include:

- Use of an under-overflow weir located within the existing dam upstream of the overflow/LDP. Forcing water to pass through this form of overflow structure would assist to retain floating coal fines in the existing dam.
- Installation of a floating curtain made from a fine filter such as a geofabric could be installed upstream of the overflow/LDP to trap the floating coal fines and prevent them discharging into the new pond.
- Installation of a floating curtain or underflow weir around the pump in the existing dam to trap as much floating fines as practical.

2.4 Option 4 - Raising the Overflow / Spillway Level of Existing Dam by 500mm

Works involved would include:

- Raising the embankment of the existing dam and extending the embankment in both directions across the haul road and to the south, as sketched in Figure 3.

The system would, in large rainfall events, pond water in the area of regrowth to the north of the existing dam, the truck loading area and also to the south of the existing pond. The advantage of this configuration is that a new pump station will not be required. However, clean up after such an event would be required and may be extensive. Also this option would in our opinion, cause a greater site operational disruption than Options 2 and 3.

2.5 Option 5 – Retaining Existing Dam and Overflowing to Two New Ponds

This option would involve the retention of the existing dam together with the construction of two additional ponds. The dam and ponds would be configured so that:

- Water initially flows into the existing dam.
- The existing dam overflows to one of the new ponds.
- Water then flows from the initial new pond to the second new pond.
- Water would be discharged from the second new pond to the LDP (possibly a new LDP).

The new ponds would be constructed in locations similar to those shown in Figure 1. The logic for the arrangement would be to maximise the detention to maximise the retention of coal fines.

To minimise costs associated with this option the following is suggested:

- The pump in the existing dam would be relocated to the second of the new ponds.

– The configuration would be arranged so that flow gravitates from the existing dam through the first new pond into the second new pond and then is pumped to the LDP. To achieve this there would be new pipes (probably 3 of 375mm diameter pipes or equivalent at an invert level of around 26.4 mAHD) installed to connect the existing dam to the first new pond and also a piped connection between the two new ponds. To achieve gravity flow the second new pond would have an invert of around 24.5 mAHD. The first new pond could have an invert of around 25.0 mAHD.

The increased storage volumes would be:

– Increase in existing pond	$525m^3$.
– Volume in proposed first pond	$950m^3$.
– Volume in proposed second pond	$1,130m^3$.
– Total increase in capacity	$2,613m^3$.

With optimisation during design advancement it should be possible to obtain the additional 139 m^3 of storage.

As with Options 2 and 3 it would be possible to install a combination of underflow weirs and/or curtains to reduce the amount of coal fines transported through the ponds and discharged.

We are unable to determine whether this configuration would be able to achieve a discharge standard of 50 mg/L. The achieved standard is generally dependent upon coal characteristics rather than detention time, as long as the detention exceeds several minutes and there is minimal turbulence to retain coal in suspension. Should there be some results of settling tests or jar tests this could be examined.

3 Recommendations

We suggest that Option 2 or 5 be adopted. To progress one of these options we suggest:

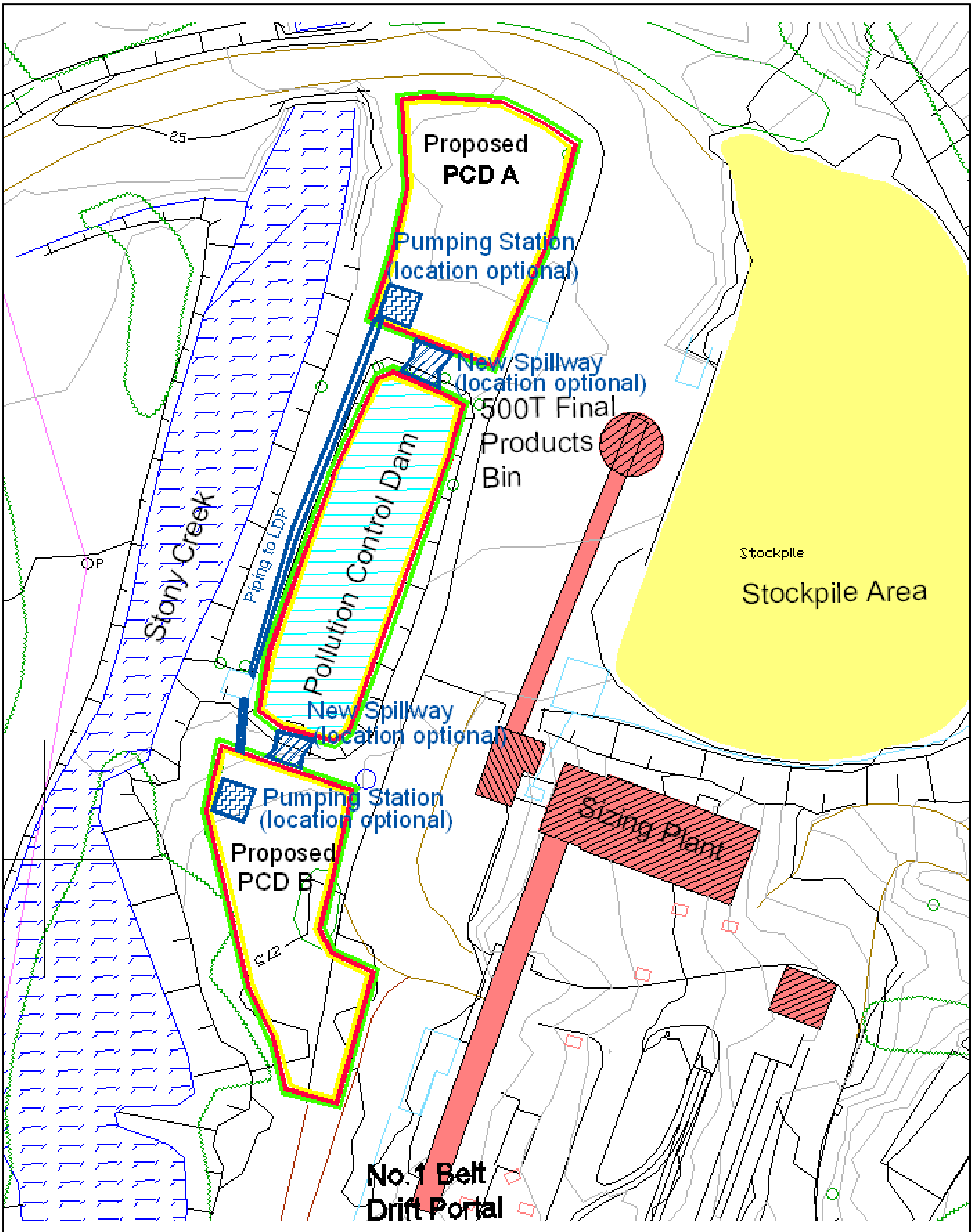
- Underground services be located using available site plans.
- A survey is completed for the proposed end, as the plans and dams levels provided to GHD are not consistent.
- A preliminary cost estimate be prepared to get an in principle budget approval within Awaba.

Yours sincerely

for

Ian Joliffe
Project Director, Principal Water Engineer
02 4979 9934

Attachment: Figures 1 - 3



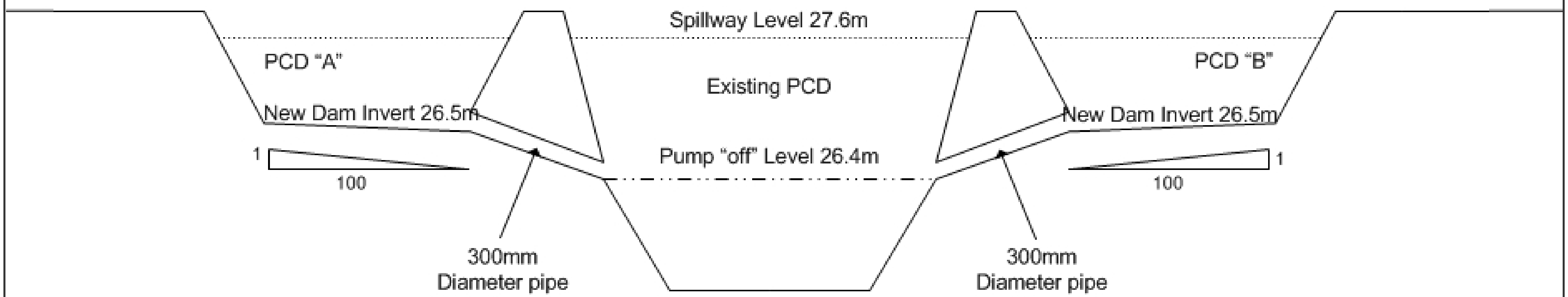
LEGEND

Awaba Colliery
Location of Proposed Pollution
Control Dams

DATE 07-08-2009

Figure 1

GIS Filename: G:\22\14622\GIS\Maps\Figure1.mxd



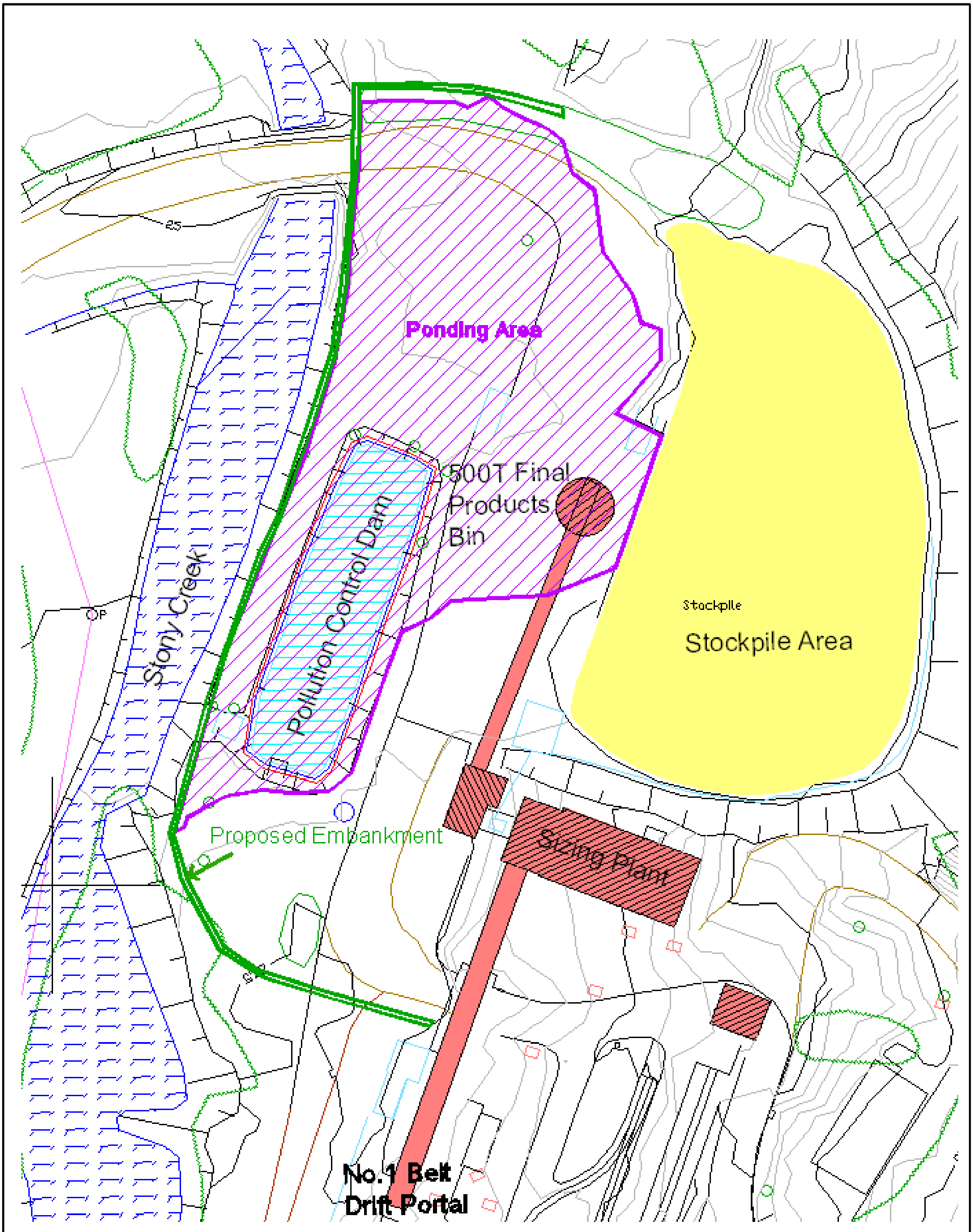
LEGEND

Awaba Colliery
Schematic of Option 3 Configuration

DATE 11-08-2009

Figure 2

GIS Filename: G:\22\14622\GIS\Maps\Figure2



LEGEND

Awaba Colliery
Estimated Ponding Extent
and Embankment Location

DATE 07-08-2009

Figure 3

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Centennial Coal

Appendix B
Water Balance

Centennial Newstan Pty Ltd

Awaba Colliery
Water Balance Assessment
May 2010

FUTURE POWER | Centennial Coal

Contents

Table Index

Figure Index

Appendices

Glossary

Aquifer	Underground water storage within either disturbed or undisturbed strata.
Average Recurrence Interval	A statistical estimate of the average period in years between the occurrence of a flood of a given size or larger, eg. floods with a discharge as big as, or larger than, the 100-year ARI flood event will occur on average once every 100 years. ARI is equal to the reciprocal of annual flood risk, e.g. an annual flood risk of 1/100 has an ARI of 100 years.
Barnes Dam	An underground water storage location. Discharges from Barnes Dam are via LDP005.
Boot Wash	Location where personnel can wash their safety boots.
Bord and Pillar	A mining system whereby coal is extracted leaving 'pillars' of untouched coal to support the strata above.
Bore	A constructed connection between the surface and a source of underground water that enables the underground water to be transferred to the surface either naturally or through artificial means
Clean catchment areas	Catchments in which there are no exposed surfaces containing coal or mined carbonaceous material.
Clean water	Waters on the premises that have not come into physical contact with coal, or mined carbonaceous material.
Coal Handling Plant	A facility where coal is screened and prepared for transport off-site.
Dewatering	Transfer of water from underground workings to the surface.
Dirty catchment areas	Catchments in which coal mined carbonaceous materials are present or areas where the topsoil has been disturbed.
Dirty water	Water on the premises that has come into physical contact with coal, mined carbonaceous materials or otherwise contains elevated sediment load.
Fish Tank	Underground water storage tank located in the proximity of Barnes Dam.
Fractures	Cracks within the strata either natural or resulting from underground works.
Groundwater	Water held in strata that is not overlying the strata of the coal seam, or within the coal seam.
Infiltration	Natural flow of surface water through ground surfaces as a result of rainfall events.

Inbye	Direction towards the mining face of the coal seam.
In-Seam Coal Storage Bin	Coal Storage Bin located at the end of the coal conveyor south of the workshop.
Interburden	The strata between coal seams.
Licensed Discharge Point	A location where Angus Place discharges water in accordance with conditions stipulated within the site Environment Protection License.
Net extraction	Difference between water transferred to, and from, the underground water storage.
Oil Water Separator	Device designed to separate oil and suspended solids from water.
Overburden	The strata between the recoverable topsoil and the upper coal seam.
Pollution Control Dam	A dam located downstream of the pit top facilities. LDP009 is located on the spillway of this dam.
Recharge	Inflow of water from surrounding strata into underground workings through infiltration. This can be as a result of rainfall events or from surrounding aquifers.
Sediment-laden water	Water that has a high level of suspended solids.
Steady state condition	A condition in which the system has achieved equilibrium.
Surface Water	Water that is derived from precipitation or pumped from underground and may be stored in dams, rivers, creeks and drainage lines.
Temporary storage	Volume of storage available within a dam between the permanent water level and the overflow level.
Underground water	Water stored in underground aquifers. During the mining process a proportion of this water is released and managed by the underground settling and pumping system.

Abbreviations

AEMR	Annual Environmental Management Report
AHD	Australian Height Datum
ARI	Average Recurrence Interval
BOM	Bureau of Meteorology
CHP	Coal Handling Plant
DECCW	Department of Environment, Climate Change and Water
DOP	Department of Planning
DWTS	Delta Water Transfer Scheme
EA	Environmental Assessment
EP&A Act	Environmental Planning and Assessment Act 1979
EPL	Environment Protection Licence
kL	Kilolitres
LDP	Licensed Discharge Point
m	Metres
MB	Monitoring bore
ML	Megalitres
MTpa	Million Tonnes per annum
NOW	New South Wales Office of Water
NMQMS	National Water Quality Management Strategy
PA	Project Approval
POEO Act	Protection of the Environment Operations Act 1997
REA	Reject Emplacement Area
ROM	Run of Mine
STP	Sewage Treatment Plant
SWMP	Surface Water Management Plan
T	Tonnes
WMAct	Water Management Act 2000

Executive Summary

Awaba Colliery, operated by Centennial Coal Company Pty Ltd, is an underground operation for which the management of both surface and underground water is an important issue. This water balance assessment was undertaken to confirm the existing water management systems. As part of this assessment, the development of both a water balance numerical model and a hydrogeologic model was undertaken.

Inputs into both of these models were based on information provided by Awaba Colliery and further estimations based on the available data. The hydrogeological model and the water balance model were then calibrated against the recorded information primarily relating to historical discharges and underground water levels.

For the existing conditions (pre March 2010), it was determined that the average annual discharges from Awaba Colliery through LDP009, LDP005 and 10 South were 1.0, 85.5 and 82.0 ML/year respectively.

For the proposed conditions, the calibrated model was adjusted to reflect the increase in capacity of the Pollution Control Dam and the removal of Barnes Dam and subsequently LDP005. The resulting predicted average annual discharges through LDP009 and 10 South were determined to be 0.2 and 173.6 ML/year respectively.

From this it can be seen that there will be a decrease in discharges through LDP009 however there will be an increase in discharges through 10 South. The increase in discharge through 10 South will occur as a result of the increase in pump operation to cater for the increase in underground water storage at 10 South.

10 South discharges into the Eraring Ash Dam and consequently, consideration was given to the potential impact of both the existing and proposed discharges (with no increase in pump capacity). The Ash Dam receives daily inflows from Eraring in the order of 14.07ML/day and has a total capacity of 4,000 ML.

When compared to the total inflows into the Ash Dam, Awaba Colliery currently contributes around 2% of the total inflow however this will increase to approximately 3% for the proposed conditions.

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.

To provide greater flexibility for Awaba Colliery in maintaining an underground water level of -2 m AHD, an increased pumping capacity of 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.

1. Introduction

The Awaba Colliery is operated by Centennial Coal Company Pty Ltd, through a company called Centennial Newstan Pty Ltd. The Colliery is located approximately 1 kilometre south of Awaba township and 5.5 kilometres south west of Toronto on Wilton Road as indicated on Figure 1.1.

1.1 Study Area

This water balance assessment has given consideration to the overall water management system associated with Awaba Colliery and includes all water transfers associated with:

- Existing mining activities.
- Proposed mining activities.
- Surface operations.

1.2 Objectives of this Report

The objectives of this water balance are to:

- Quantify the water budget in relation to the surface water and groundwater management systems for existing operations.
- Revise the water budget in relation to the water management system for future operations.

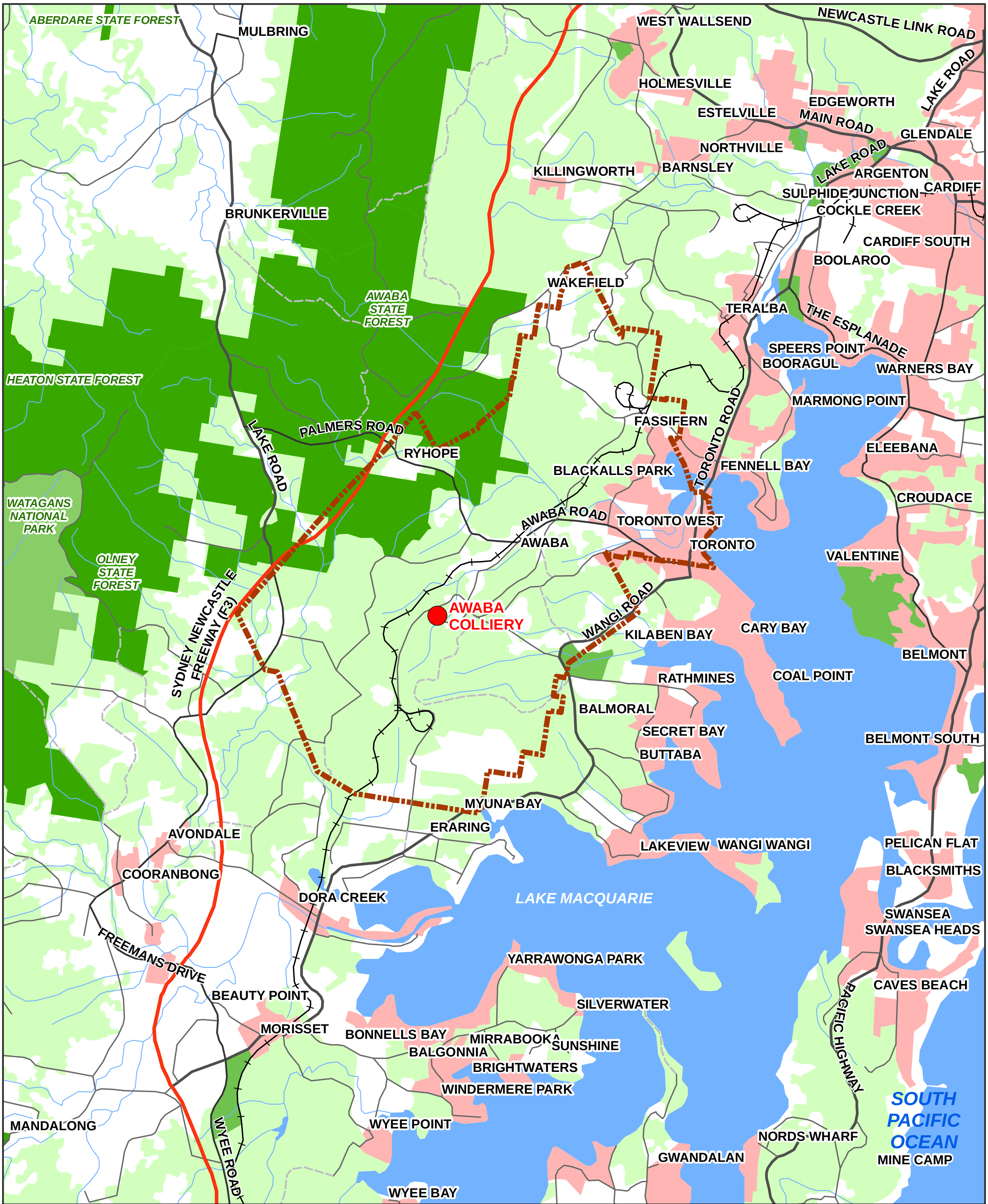
Overview of Site Operations

The site features associated with operations at Awaba Colliery are provided on Figure 1.2 and include:

- Underground mining.
- Coal processing at the Coal Handling Plant (CHP).
- Loading of coal for export from site by road.
- Mechanical maintenance activities – undertaken near the Administration area and at a workshop.
- Office and administrative activities.

Historical Mining Activities

Awaba Colliery commenced bord and pillar operations within the Great Northern Seam in 1947 using hand-mining techniques. Over 30 million tonnes of coal has been won from these workings using a combination of first workings development, pillar extraction, pillar quartering and pillar stripping.



1:120,000 for A4

0 0.35 0.7 1.4 2.1 2.8

Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geodetic Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

N

LEGEND

- Newstan Colliery Holding Bdy
- Site Location
- Principal Road
- Secondary Road
- Minor Road
- Track
- Freeway
- Existing Rail
- Watercourse
- Built Up Areas
- Nature Conservation Reserve
- State Forest
- Forest Or Shrub

LOCATION	Awaba
SEAM	Great Northern
DRAWN	F.M
CHECKED	
APPROVED	
SCALE	refer to scalebar

Awaba Colliery

Locality Plan

Centennial Awaba

DATE 04-05-2010

Figure 1.1

GIS Filename: G:\22\15033\GIS\MAPS\Deliverables\Water Balance Report\2215033_WB_FIG1-1_Locality_20100504.mxd

1:3,000 for A4

0 0.01 0.02 0.04 0.06 0.08
Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geodetic Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

N

LEGEND
- Pollution Control Structures
- 10m Contours
- Watercourse

LOCATION	Awaba
SEAM	Great Northern
DRAWN	F.M
CHECKED	
APPROVED	
SCALE	refer to scalebar

Awaba Colliery

Surface Features

Centennial Awaba

DATE 13-05-2010

Figure 1.2

GIS Filename: G\22\15033\GIS\MAPS\Deliverables\Water Balance Report\2215033_WB_FIG1-2_SiteFeats_20100504.mxd

Existing Mining Activities

Current mining operations include extraction of coal at a rate of approximately 850,000 tonnes per annum utilising a mining system that includes the development of minimum size pillars in a pillar quartering system.

Future Mining Activities

Through productivity improvements, there is a potential that the coal extraction rate could increase to 880,000 tonnes per annum using the existing mining method. No additional change in extraction rates have been proposed, however to increase the life of the mine additional extraction areas have been proposed and are addressed as part of the documentation currently being prepared as part of a Part 3A application under the *Environmental Planning and Assessment Act 1979.*

Site Water Management

Awaba Colliery is located within the Stony Creek catchment, which contributes to Lake Macquarie. Awaba Colliery's Environmental Protection Licence (EPL) 443 therefore includes both volumetric and concentration limits for the discharge of water off site.

The location of Awaba Colliery's discharge points are indicated on Figure 1.3 and include:

- LDP001 - No longer in use / decommissioned. Borehole still exists.
- LDP002 - No longer in use / decommissioned. Removed.
- LDP003 - No longer in use / decommissioned. Rehabilitated.
- LDP004 - No longer in use / decommissioned. Borehole still exists.
- LDP005 - Barnes Dam no longer in use as at March 2010. Borehole still exists.
- LDP006 - No longer in use / decommissioned. Rehabilitated.
- LDP007 - No longer in use / decommissioned. Borehole still exists.
- LDP008 - Discharge of irrigation water and stormwater runoff adjacent to utilisation area.
- LDP009 - Discharge of mine water from the Pollution Control Dam into Stony Creek.
- 10 South – Discharge of mine water to Eraring Ash Dam.

The primary objective of water management at Awaba Colliery is the separation of clean and dirty water and the effective management of water through collection, treatment and discharge. This is managed through a number of separate water systems including:

- Surface infrastructure.
- Underground infrastructure.
- Potable water supply.
- Wastewater collection and treatment.

Figure 1.3 Licensed Discharge Point Locations

Water Management Associated with Mining Operations

There are numerous water movements associated with the coal mining operations at the Awaba Colliery. The main water movements include:

- Rain falling on vegetated areas within the lease area and generating clean water runoff. Where clean water runoff is directed towards the pit top, diversions have been put in place to convey it through to Stony Creek. No clean water runoff is harvested at Awaba Colliery.
- Runoff from disturbed areas is deemed to be dirty water runoff and is directed through the dirty water management system. Discharges from the dirty water system pass through licensed discharge points (LDPs).
- Potable water is provided to both underground and surface facilities from the on site water tanks.
- Water that seeps into the underground workings is extracted and pumped to the underground water storages.

Other Water Management

Potable water is provided to Awaba Colliery by Hunter Water Corporation to the potable water/fire tanks. The water tanks supply water to the offices, bathhouse, underground working face and other surface facilities such as the washdown bay and coal handling plant. A connection to the sprinkler system associated with the stockpile area is provided within the coal handling plant.

Waste water at Awaba Colliery includes both grey water and sewage. Grey water from the bathhouse and other buildings contributes to the maturation pond while sewage from the pit top buildings is treated through an on site septic system.

Site Geology and Hydrogeology

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 also affects the management of water on-site.

The stratigraphy at Awaba Colliery is reported within the Subsidence Management Plan (2005) as:

- Triassic Narrabeen Group sandstones, siltstones and conglomerates in topographically higher areas.
- Teralba Conglomerate sandstone with minor siltstone and mudstone.
- Great Northern Seam coal measures.
- Underlying Awaba Tuff siltstone and sandstone.

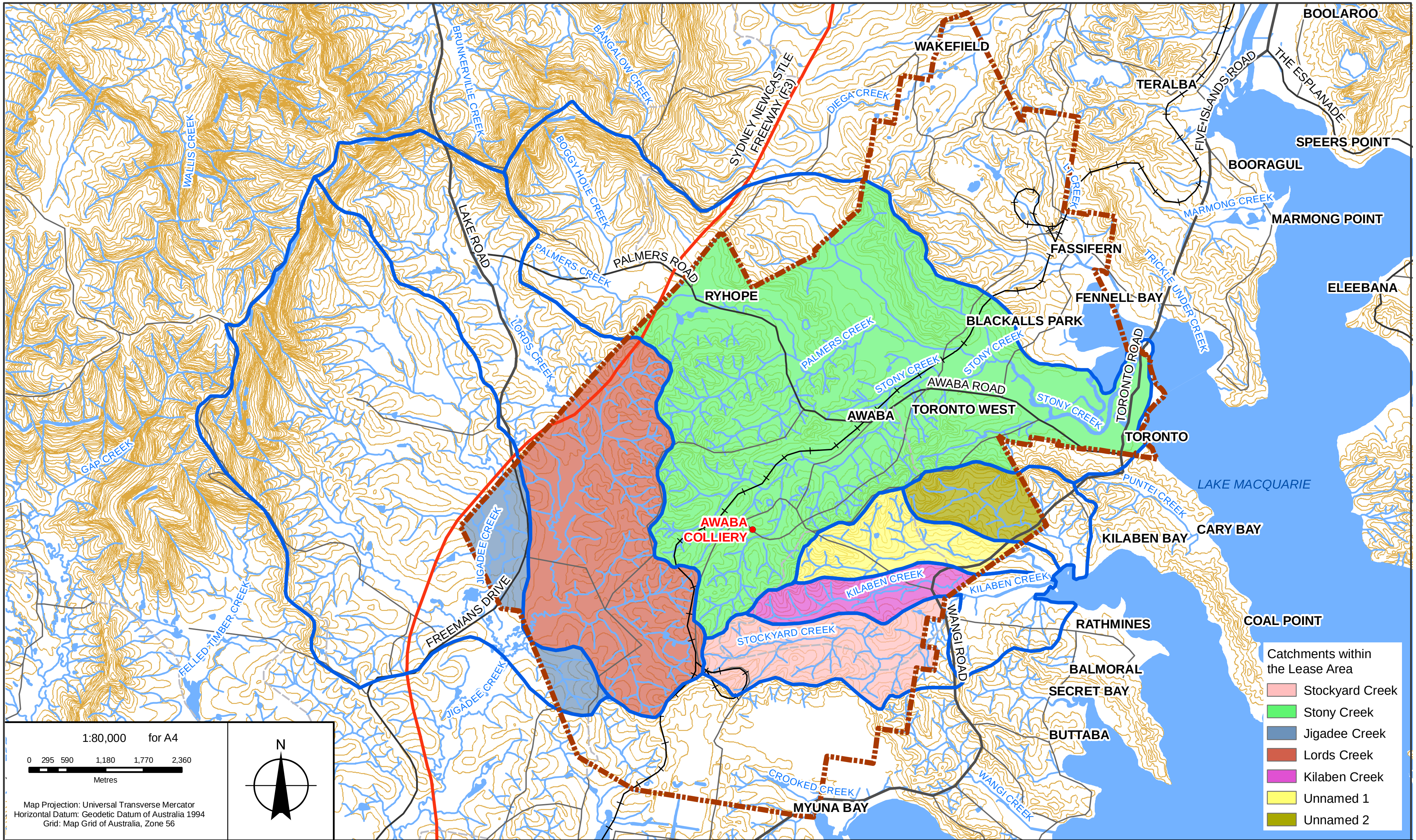
There is no regional aquifer located above the Great Northern Seam and the existing workings have been generally dry with minimal groundwater inflow.

Site Hydrology

Surface water runoff within the Awaba Colliery lease area is conveyed within a number of natural and constructed flow paths. The natural flow paths (watercourses) that originate in or pass through the lease boundary area, contribute to Lake Macquarie. The named watercourses include Lords Creek, Stockyard Creek, Kilaben Creek, Stony Creek and Palmers Creek as shown in Figure 1.4.

Also shown on Figure 1.4 are the overall catchment areas associated with these watercourses. From this it can be seen that the pit top, existing mining areas and proposed mining areas are primarily located within the Stony Creek catchment.

Awaba Colliery does not extract water from any natural water course however it does discharge into Stony Creek, through LDP009, during some rainfall events.



GHD

LEGEND

- Newstan Colliery Holding Bdy
- Watercourse Area
- Catchment Bdys
- Watercourse
- Contours 10m
- Site Location
- Freeway
- Principal Road
- Secondary Road
- Minor Road
- Track

LOCATION	Awaba
SEAM	Great Northern
DRAWN	F.M
CHECKED	
APPROVED	
SCALE	refer to scalebar

Awaba Colliery

Watercourses within Awaba Colliery Lease Area

Centennial Awaba

DATE 05-04-2010

Figure 1.4

GIS Filename: G\22\15033\GIS\MAPS\Deliverables\Water Balance Report\2215033_WB_FIG1-4_Watercourses_20100504_A.mxd

2. Water Management

The water management system at Awaba Colliery is comprised of surface, potable, waste and underground elements. Schematics of the surface, underground and potable and wastewater systems are provided in Figure 2.1, Figure 2.2 and Figure 2.3 while Figure 2.4 provides a schematic of the overall water management system.

2.1 Existing Operations in Mining Lease Area

Surface Water System

Surface water consists of runoff that contributes to surface water storages. At Awaba Colliery these include the Pollution Control Dam, in-seam coal storage bin and maturation pond.

Inputs

The inputs into the surface water system consist of:

- Runoff from the contributing catchment areas (both clean and dirty) as a direct result of runoff.

Outputs

The outputs from the surface water system are:

- Evaporation.
- Discharge of clean catchment runoff into Stony Creek.
- Discharges through LDP009 from the Pollution Control Dam into Stony Creek.
- Transfer of water to underground storage.

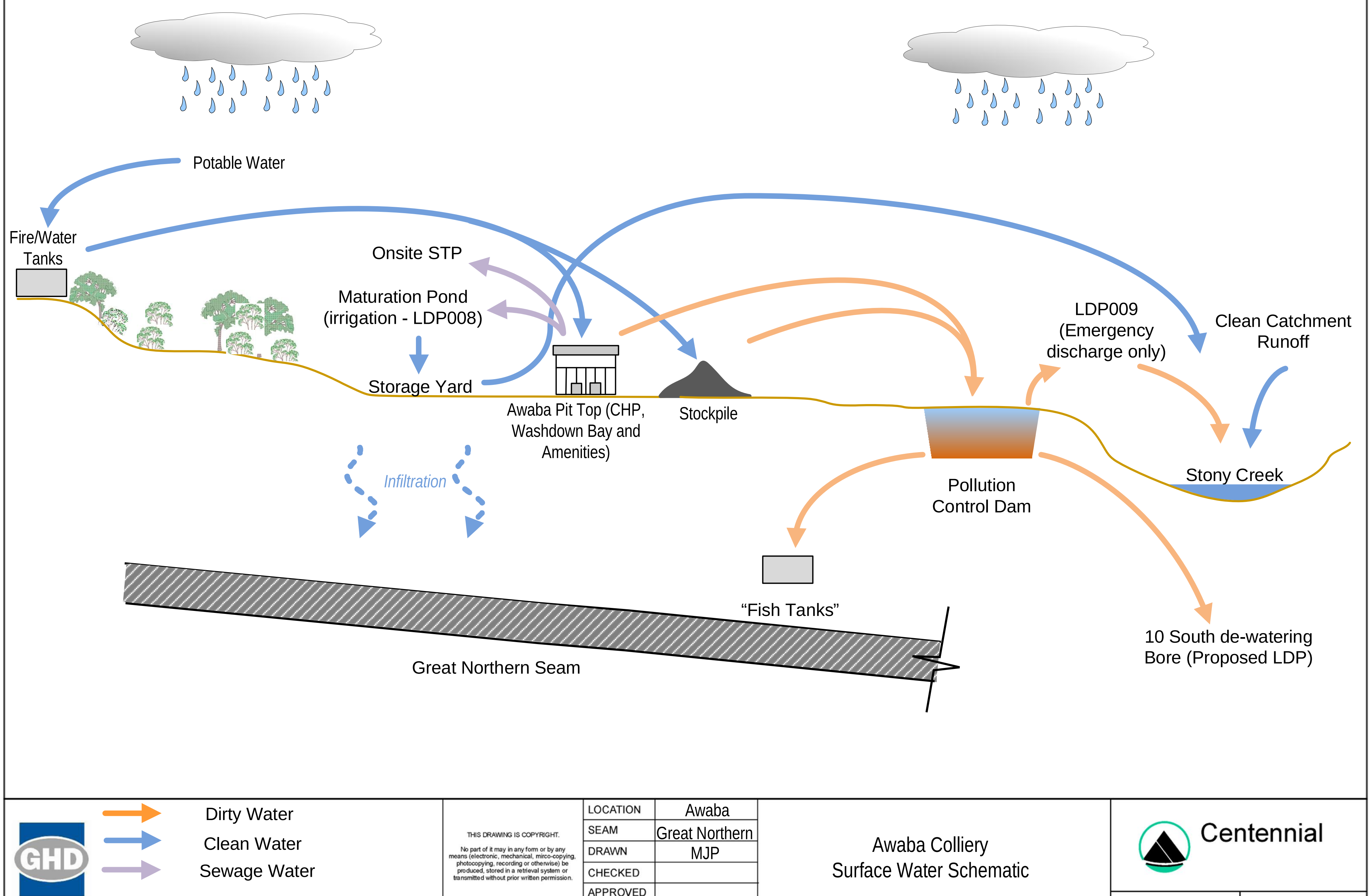
Facilities

The facilities that manage surface water are provided in Table 2.1

Table 2.1 Surface Water Management Structures

Location	Capacity (ML)
Oil Water Separator	0.06
In Seam Coal Storage Bin	0.06*
Final Pollution Control Dam	3.2

* Estimated.



LOCATION	Awaba
SEAM	Great Northern
DRAWN	MJP
CHECKED	
APPROVED	
SCALE	

Awaba Colliery
Surface Water Schematic

Centennial

DATE 16-04-2010

Figure 2.1

Underground Water System

Mining at Awaba Colliery interacts with the Great Northern Seam. Although this seam would be considered a water bearing zone, there is limited groundwater inflow into the workings therefore the mine is considered to be a dry mine.

For the purposes of this water balance, the recent (March 2010) changes to underground water movement have not been considered in the assessment of the existing system but rather as part of the proposed conditions.

Inputs

The inputs into the underground water system consist of:

- Natural recharge of the active underground workings.
- The pumping of water from the Pollution Control Dam into underground storage.

Outputs

The outputs from the underground water system are:

- The pumping of water from the active workings to the underground storage tanks.
- Discharge of water (via Barnes Dam) through LDP005.
- Pumping of water from the underground storage tanks to 10 South de-watering bore and subsequently the Eraring Ash Dam.

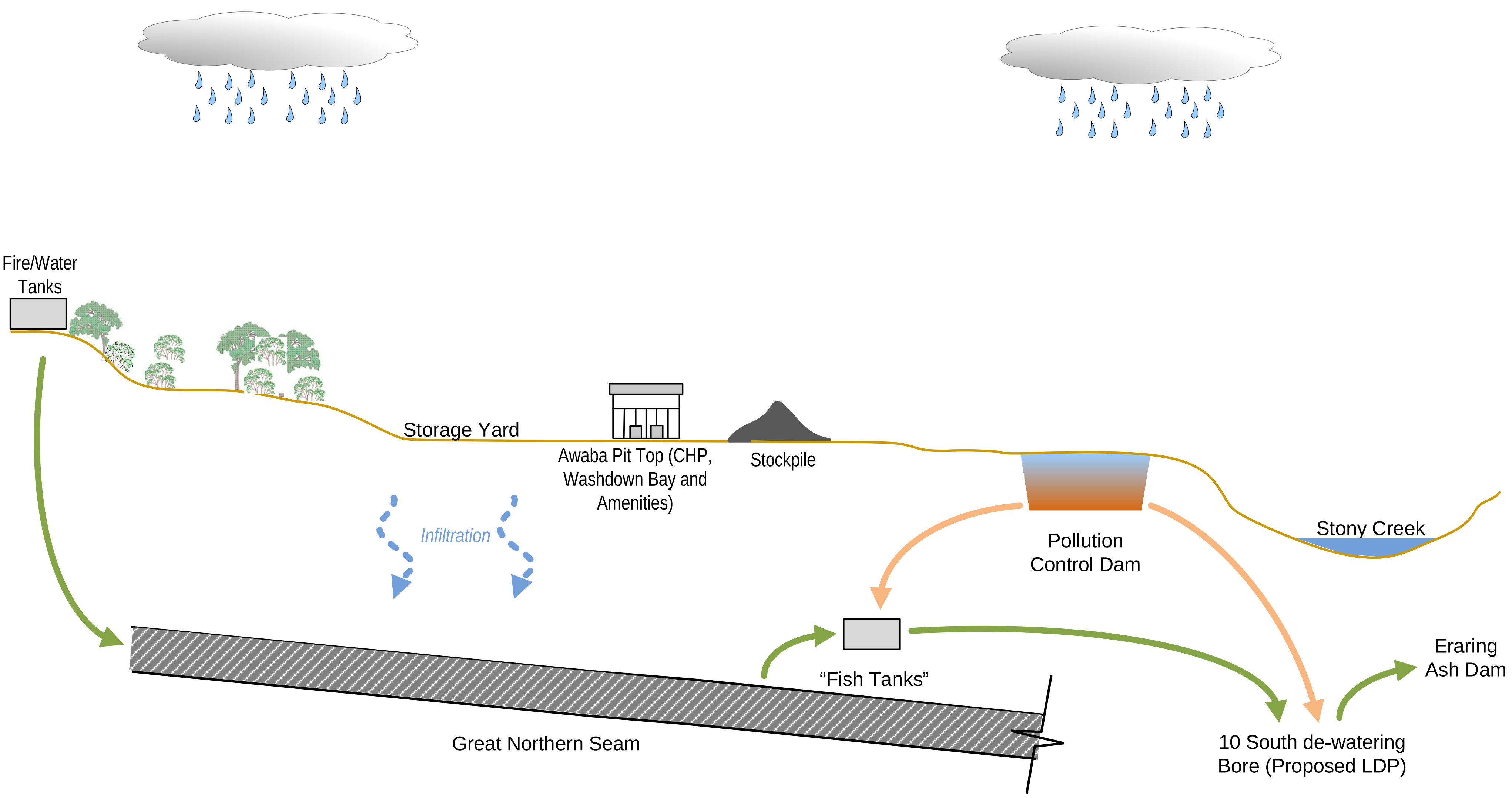
Facilities

To improve management of underground water, recent changes to these facilities have been undertaken. The facilities to store water underground are outlined in Table 2.2.

Table 2.2 Underground Water Management Structures

Location	Capacity (ML)
Barnes Dam	5 (1)
Fish Tank	0.009

(1) Estimated from the floor contours contained within the hydrogeological model.



GHD

Dirty Water
Clean Water
Underground Water
Sewage Water

LOCATION	Awaba
SEAM	Great Northern
DRAWN	MJP
CHECKED	
APPROVED	
SCALE	

Awaba Colliery
Underground Water Management Schematic

Centennial

DATE 16-04-2010

Figure 2.2

Potable and Wastewater systems

The potable and waste water systems are a component of the surface water system at Awaba Colliery.

Inputs

The inputs into the potable and waste water systems consist of:

- Potable water provided to water / fire tanks to service buildings and surface facilities.

Outputs

The outputs from the potable and waste water system are:

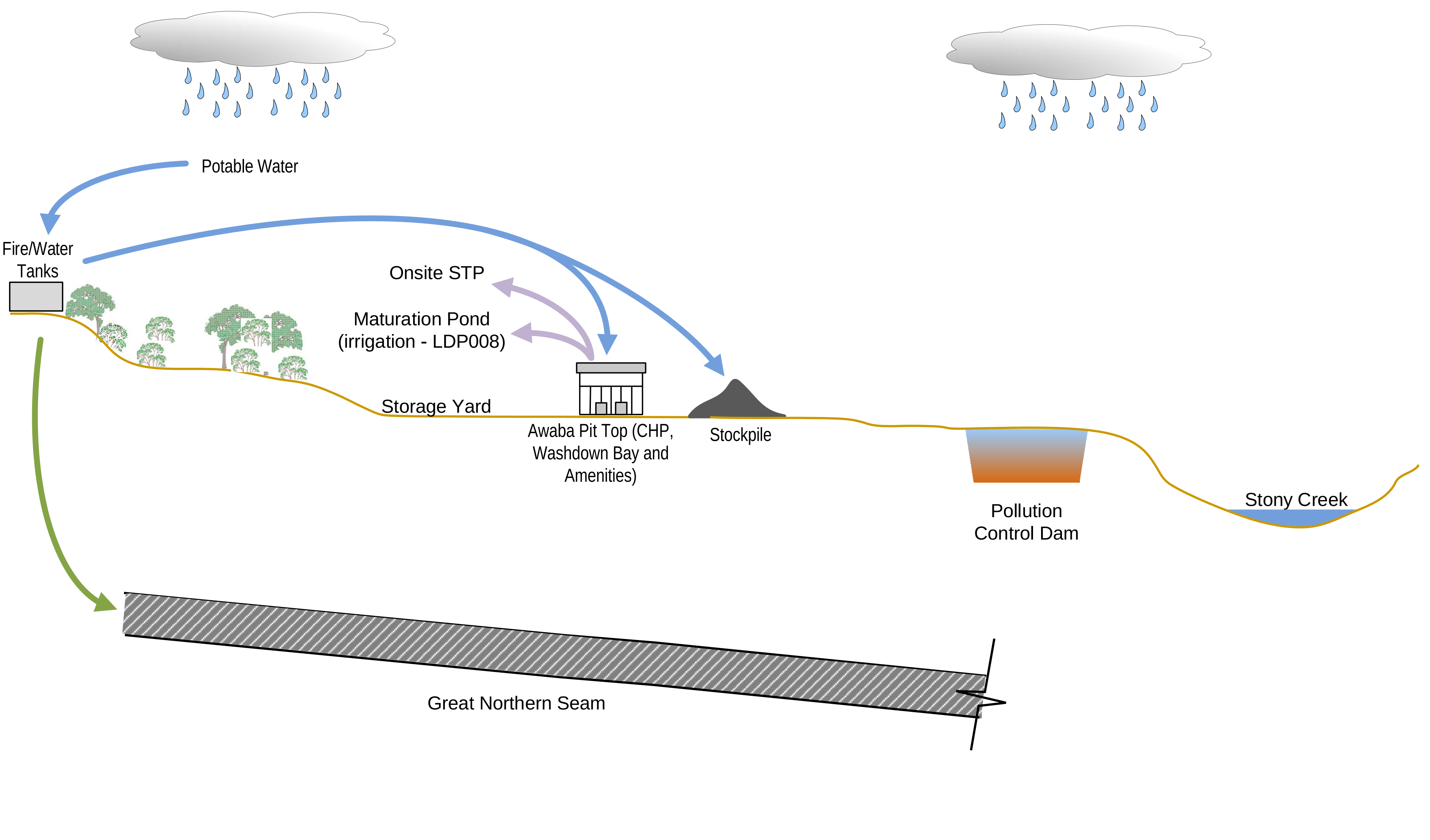
- Grey water from buildings directed to the Maturation Pond.
- Sewage transferred to on-site septic system (pit top buildings).
- Evaporation from the Maturation Pond.
- Discharges through LDP008 from the irrigation area associated with the Maturation Pond.

Facilities

The facilities that manage potable and waste water are detailed in Table 2.3.

Table 2.3 Potable and Waste Water Management Structures

Location	Capacity (ML)
Water / Fire Tanks	0.4
Maturation Pond	0.59
On-site septic system	TBA
Air operated toilets (underground)	TBA



Dirty Water
Clean Water
Underground Water
Sewage Water

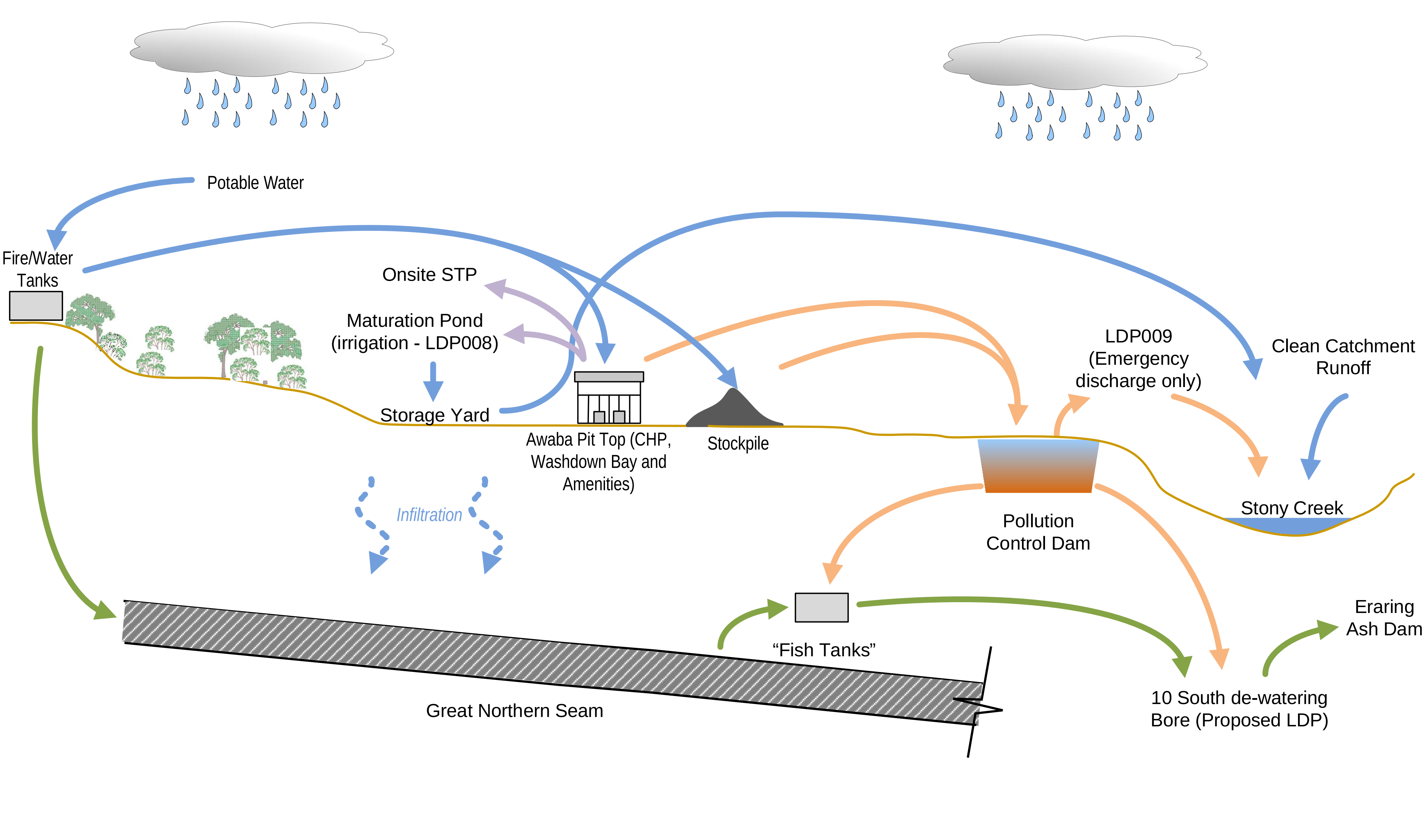
LOCATION	Awaba
SEAM	Great Northern
DRAWN	MJP
CHECKED	
APPROVED	
SCALE	

Awaba Colliery
Potable and Waste Water Schematic

Centennial

DATE 16-04-2010

Figure 2.3



Dirty Water
Clean Water
Underground Water
Sewage Water

LOCATION	Awaba
SEAM	Great Northern
DRAWN	MJP
CHECKED	
APPROVED	
SCALE	

Awaba Colliery
Water Management Schematic

Centennial

DATE 16-04-2010

Figure 2.4

2.2 Future Operations in Existing Mining Lease Area

The future operations proposed at Awaba Colliery, as part of the current Part 3A Major Projects application under the *NSW Environmental Assessment and Planning Act 1979* (EP&A Act), are provided in Table 2.4.

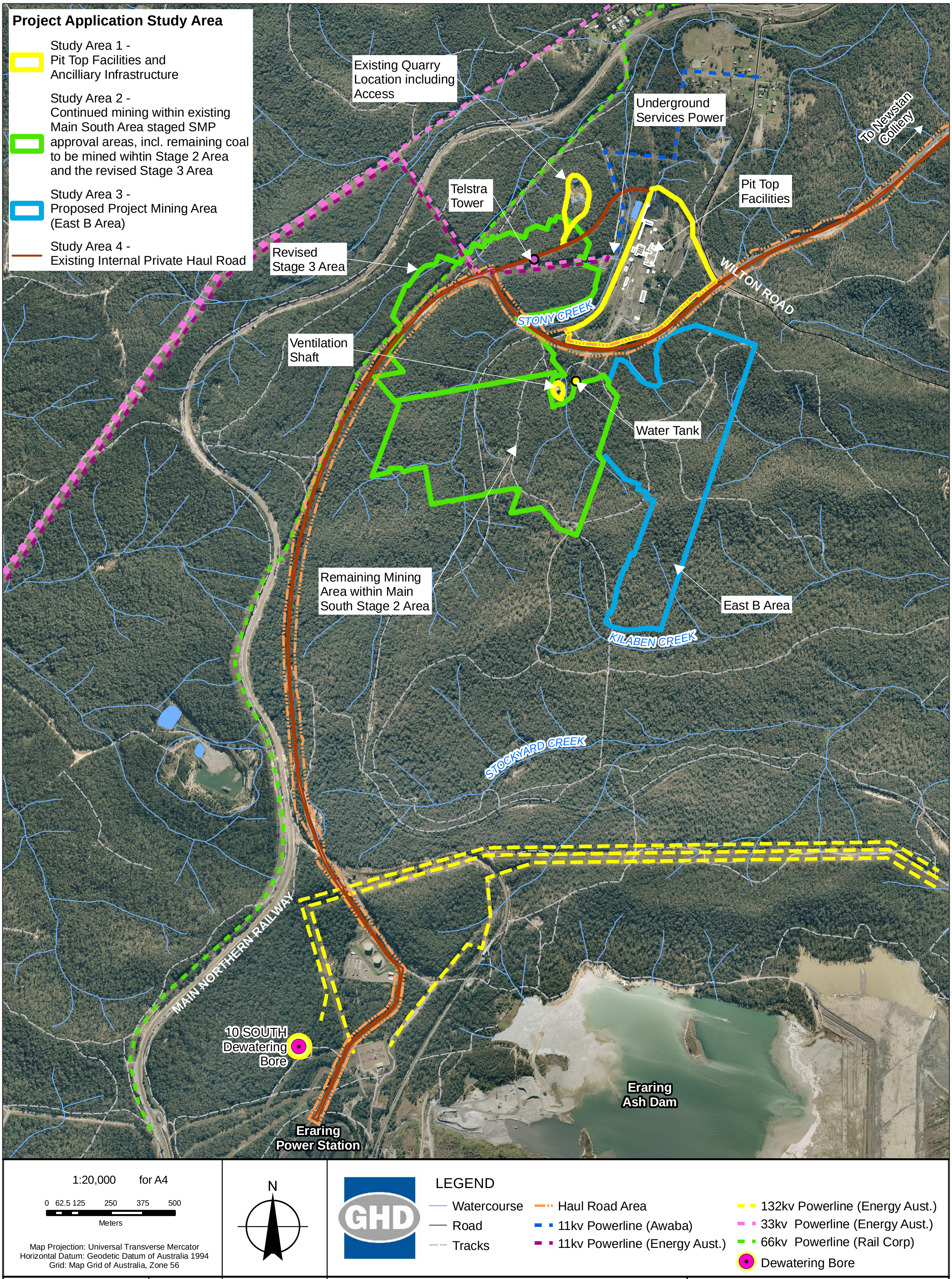
Table 2.4 Project Description

Development Component	Present Operations	Proposed Works
Mining Method	Bord and Pillar development and Pillar Extraction within narrow panels by continuous miners (developed in consultation with the Department of Industry and Investment).	No change.
Mining Areas	Mining is ongoing in existing/historical working areas. (Study area 2 on Figure 2.5).	Proposed East B area includes both existing/historical working areas and new mining areas. (Study area 3 on Figure 2.5).
Predicted Subsidence in Mining Areas	Predicted maximum subsidence is assessed to be less than 200mm (upper limited).	No change.
Production	Approximately 850,000 tonnes per annum.	Potential productivity changes could increase to 880,000 tonnes per annum.
Hours of Operation	24 hours per day, 7 days per week.	No change.
Employment	Approximately 100 employed personnel.	No change.
Coal Preparation	On-site crushing.	No change.
Land Preparation	Minimal land preparation for exploration due to well established underground mine with adequate surface support infrastructure. Existing quarry provides material for on-site remedial works.	No change for mining areas.
Infrastructure	Existing infrastructure includes mine access, ventilation, coal handling, coal preparation, coal transport, workshop, administration buildings, water management and pollution control.	Increase in capacity of Pollution Control Dam.
Mine Access	Access is obtained from Wilton Road.	No change.
Product Coal Transport	Coal from either the Final Product Bin or stockpile is trucked along a private	No change.

Development Component	Present Operations	Proposed Works
	haul road to either Newstan or Eraring Power Station.	
Water Management	Diversion of clean water around dirty areas. Surface dirty water is directed to the Pollution Control Dam prior to transfer to the underground dirty water system and discharged through 10 South. An emergency discharge is located on the Pollution Control Dam weir.	Increase in capacity of Pollution Control Dam.
Rehabilitation	Undertaken in accordance with the existing Life of Mine Plan approved by the Department of Industry and Investment. Primarily relates to the filling of sink holes.	No change.

From the details provided in Table 2.4, it can be seen that minimal changes to the existing operations are proposed for the future operations with the exception of the expansion of the Pollution Control Dam. In addition to this, as noted in Section 2.1, Barnes Dam has recently (March 2010) been decommissioned and replaced with an underground tank (the Fish Tank).

For the purposes of this site water balance, both the existing and proposed water management systems have been assessed.



LOCATION	Awaba
SEAM	Great Northern
DRAWN	F.M
CHECKED	
APPROVED	
SCALE	refer to scalebar

Awaba Colliery

Project Application Study Areas Detailed

Centennial Awaba

DATE 02-09-2010

Figure 2.5

GIS Filename: G:\22\15033\GIS\MAPS\Deliverables\Water Balance Report\2215033_WB_FIG2-5_StudyArea_20100506.mxd

3. Data

For both the hydrogeological and detailed water balance models, a range of data and site operational information was required.

3.1 Underground Water Model

The underground water model was constructed using floor contours of the Great Northern Seam, topographic contours and coal seam outcrop, deterioration and faulting information provided by Centennial.

Underground water sources and sinks were limited to injection and extraction pumping data and rainfall / evaporation data. This information was also provided by Centennial.

Underground water level data provided by Centennial were used to calibrate the hydrogeological model. Further details regarding the conceptualisation of the hydrogeological model are given in Section 4.

3.2 Water Balance Model

Extent of Water Balance Model

The application of grey water from the Maturation Pond over an irrigated area is considered to have minimal to no effect on the site water balance as runoff from the irrigated area is minimal. Consequently, the water balance for Awaba Colliery has been developed including only the pit top infrastructure and mining operations.

Data Available from Awaba Colliery

Data and site operational information has been made available by Awaba Colliery for this assessment. From this provided information, input data for the water balance was derived. Table 3.1 and Table 3.2 indicate the information provided while Table 3.3 outlines the data derived from this information.

Table 3.1 Data Sources

Item	Comment
General Operational Data	Provided by Centennial
Pollution Control Dam Storage Capacities and Operations	Provided by Centennial
Areas of water storages	Measured from provided plans
Catchment areas	Derived from provided topographic information
Maximum water transfer rates	Provided by Centennial
CHP water usage	Estimated by GHD

Item	Comment
Stockpile Dust Suppression Water Usage	Provided by Centennial
Underground water usage	Provided by Centennial
Coal production data	Provided by Centennial
Site Potable Water Demand	Provided by Centennial
Building Usage Rates	Provided by Centennial
Washdown Bay	Estimated by GHD
Fish Tank	Estimated by hydrogeological model
Barnes Dam	Estimated by hydrogeological model
10 South Storage Area	Estimated by hydrogeological model
In Seam Bin Information	Provided by Centennial

Table 3.2 Modelling Parameter Data

Parameter	Value
Mine Operations	Coal produced typically on 7 days/week 6 weeks of non-workdays per year
Potable water provided to underground	90% of daily
Potable water required for non workday	15% of annual
Pasture/grassed initial loss	10 mm
Impervious areas initial loss	2.5 mm
Existing Pollution Control Dam capacity	3.19 ML
Proposed Pollution Control Dam capacity	6.2 ML
Pollution Control Dam catchment area	2.4 ha
Maturation Pond capacity	NA
Barnes Dam capacity	5 ML(1)
Fish Tank capacity	9 kL(2)
Existing ROM coal production rate	0.8 Mta
Design ROM coal production rate	0.88 Mta
In-situ coal moisture	6.1%
Impervious catchment	5.4 ha
Pervious catchment	31.4 ha

Parameter	Value
In-seam bin catchment	0.48 ha
10 South storage area	Infinite
Rainfall factor	1

(1) Estimated from the hydrogeological model.

(2) While the physical size of the Fish Tank has been estimated at 9kL, within the water balance model a capacity of 5ML has been adopted. This is due to the time step within the model and the operational criteria that inflow and outflow from the Fish Tank will be equal.

Table 3.3 Modelling Parameter Data

Parameter	Annual Value	Daily Value
Annual total potable water demand (2009)	44.6 ML/yr	
Total workday potable water demand (323 days/year)	43.74 ML/yr	135.4 kL/day
Total non-workday potable water demand (42 days/year)	0.85 ML/yr	20.31 kL/day
Building usage (workday)	5.5 ML/yr	15.17 kL/day
Coal Handling Plant (workday and non-workday)	0.88 ML/yr	2.4 kL/day
Stockpile dust suppression (workday and non-workday)	1.15 ML/yr	3.15 kL/day
Underground current operations (workday)	39.68 ML/yr	135.4 kL/day
Washdown Bay (workday and non-workday)	2.19 ML/yr	6 kL/day
Building usage (non-workday)	0.18 ML/yr	0.48 kL/day
Underground Current Operations (non-workday)	3.03 ML/yr	20.31 kL/day
10 South Bore pump capacity		475.2 kL/day
Barnes Dam pump capacity		1632.96 kL/day
In-seam bin pump capacity		1278.72 kL/day
Pollution Control Dam priority 1 pump capacity		320 kL/day
Pollution Control Dam priority 2 pump capacity		916 kL/day
Water Make from current underground operations	0 ML/yr	
Water make from old underground operations	0 ML/yr	
Local water make into Barnes Dam	109.5 ML/yr	0.3 ML/day
Local water make into 10 South	109.5 ML/yr	0.3 ML/day

Operational Precedences for Water Transfer

In developing the detailed site water balance, a number of operational precedences were adopted. The rules adopted for the analysis of water transfers is provided in Table 3.4.

Table 3.4 Operational Precedence for Water Transfer

Feature	Comments
Water Supply	Water from Hunter Water Potable Supply. ◗ Work day inflow is 98% of total annual potable water demand. ◗ Non-work day inflow is 2% of the total annual potable water demand.
Tanks	Maintained full. Receives potable water which is distributed (with no more allocated than available) to: ◗ Buildings. ◗ Washdown. ◗ Coal Handling Plant (via pump). ◗ Underground operations.
Buildings	Inflow from tanks. Discharges to: ◗ Maturation Pond. ◗ Septic System.
Maturation Pond	Inflow from buildings. Outflow (irrigation) is equal to the inflow.
Septic System	Inflow from buildings.
Washdown Bay	Inflow from tanks. 50% of the inflow is 'lost' from the system. 50% of the inflow directed as runoff to the Pollution Control Dam.
Coal Handling Plant	Inflow from tanks. 50% of the inflow is 'lost' from the system. 50% of the inflow directed as runoff to the Pollution Control Dam.
Stockpile Dust Suppression	Losses to evaporation and voids within the stockpile coal.
Current Underground Operations	Inflow from tanks (approx 90% of annual supply). Inflow of in-situ coal moisture same as outflow of ROM coal exported. Inflow of water make into underground operations is 0 ML/yr due to the direction of water make to Barnes Dam. Outflow to: ◗ Barnes Dam. ◗ 10 South storage area.
In-Seam Bin and Pump	Inflow from surface runoff. Outflow (via pumping at 14.8l/s maximum) to Pollution Control dam

Feature	Comments
	continues until bin is empty.
Pollution Control Dam (existing conditions)	Maintained at level of 26.4m AHD. Inflow from runoff and In-seam bin. Outflow to: ◗ Evaporation. ◗ LDP009 overflows. ◗ Pumping to Barnes Dam. ◗ Pumping to 10 South. The operational rules on the dam pumps are: ◗ When the capacity is between the maintained water level and 2,199 m^3 pump 1 operates at a rate of 3.7 L/s with flow to 10 South Storage Area. ◗ When the capacity of the dam exceeds 2,199 m^3 both pump 1 and 2 operate at maximum rates of 3.7 and 10.6 L/s respectively with flow to both 10 South and Barnes Dam.
Pollution Control Dam (proposed conditions)	Maintained at level of 26.4m AHD. Inflow from runoff and In-seam bin. Outflow to: ◗ Evaporation. ◗ LDP009 overflows. ◗ Pumping to 10 South. ◗ Pumping to Fish Tank. The operational rules on the dam pumps are: ◗ When the capacity is between the maintained water level and 2,199 m^3 pump 1 operates at a rate of 10.6 L/s with flow to 10 South storage area. ◗ When the capacity of the dam exceeds 2,199 m^3 both pump 1 and 2 operate at maximum rates of 10.6 and 3.7 L/s respectively with flow to both 10 South Storage Area and Fish Tank.
Barnes Dam (existing conditions)	Inflow from underground workings and Pollution Control Dam when pump 2 operates (existing conditions). Nominal capacity for Barnes Dam is 5ML over which pumping occurs at a maximum rate of 18.9L/s until it is empty. Outflows to LDP005.
Fish Tank (proposed conditions)	At full capacity, tank is pumped to 10 South at a maximum rate of 15L/s. When pump 2 from Pollution Control Dam is in operation, Fish Tank pump cannot operate.

Feature	Comments
10 South	Operates as a reservoir with unlimited capacity. Inflow from: ◗ Mine water make. ◗ Underground operations. ◗ Pollution Control Dam. Outflows (at a rate of 5.5L/s) to Eraring Ash Dam via 10 South bore.

Sourced Data

Topography

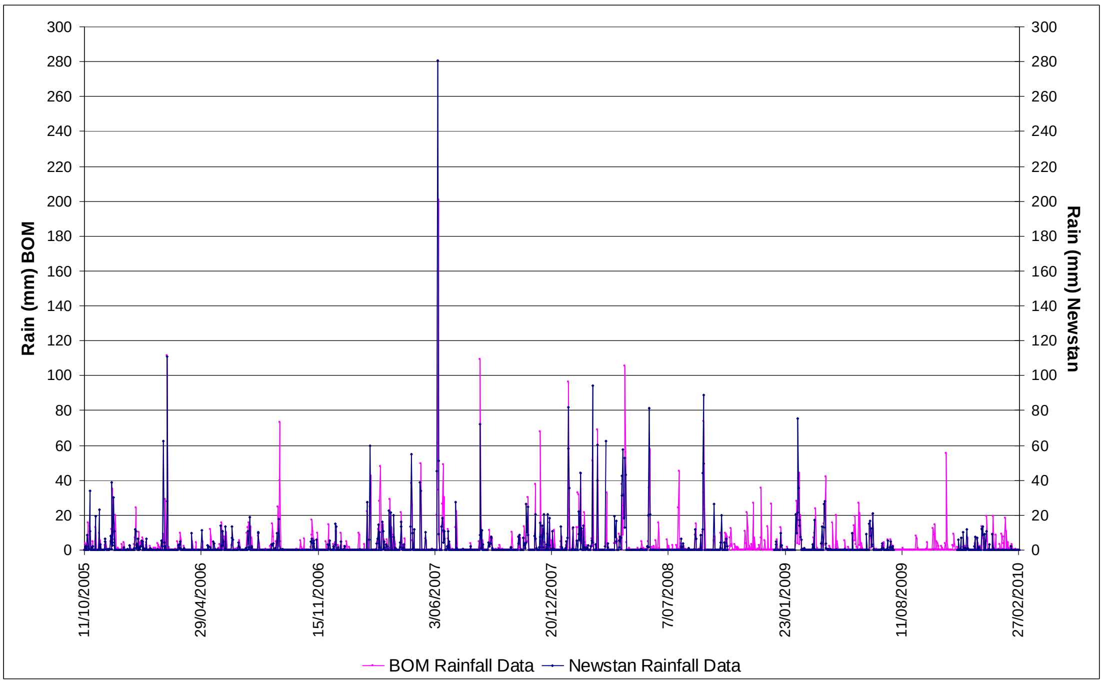
The topographic information used in establishing catchment areas included the provided site survey information and Department of Lands contours for the area.

Rainfall

While rainfall data was made available by Awaba Colliery for the Newstan Meteorological Station, this data only extended from approximately October 2005 to April 2010. Additionally, a review of this data indicated that there were periods of no records for a total of seven months during that five year period.

For the purposes of the water balance assessment, a more complete record period was required and therefore data from the Bureau of Meteorology (BOM) Cooranbong (Avondale) Station (located approximately 14 kilometres to the south west of Awaba Colliery) was obtained and reviewed. The period of data obtained extended from 1944 through to 2010 however due to gaps within this data, the period between January 1987 and February 2010 was adopted.

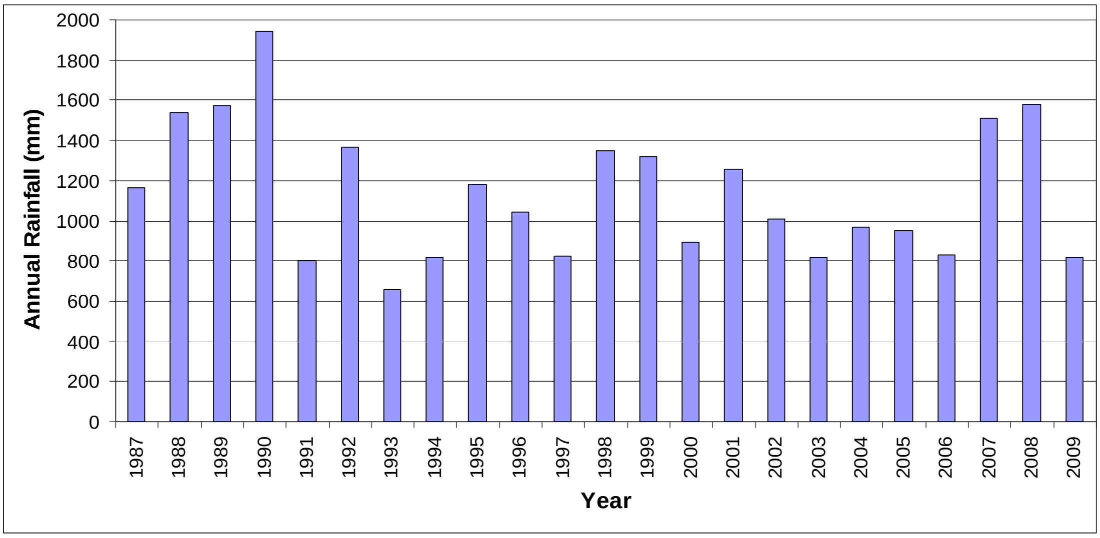
A comparison between the Newstan and BOM data was undertaken for the period between 2005 and 2010 and the outcomes are provided in Graph 3.1. It was determined that the two sets of rainfall data are comparable and therefore adoption of the Cooranbong station rainfall data will provide a reasonable representation of the rainfall at Awaba Colliery.



Graph 3.1 Comparison of Newstan and Cooranbong Rainfall

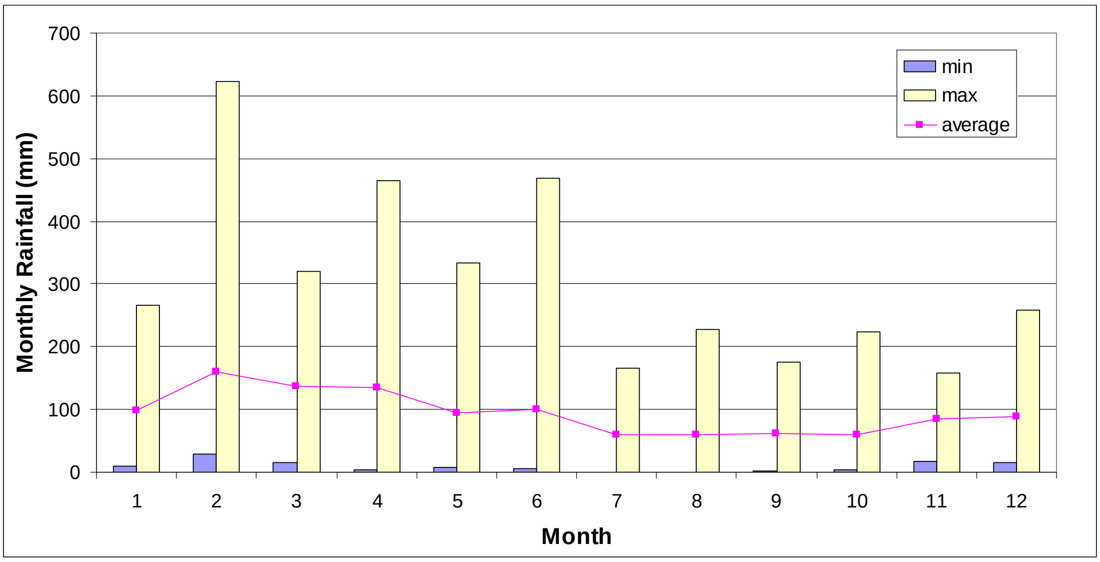
The Cooranbong data was checked for consistency and a summary of the annual rainfall is given in Graph 3.2. The statistics for this rainfall data set were:

- Minimum annual rainfall - 658 mm in 1993.
- Average annual rainfall - 1139 mm.
- Median annual rainfall - 1007 mm.
- Maximum annual rainfall - 1943 mm in 1990.



Graph 3.2 Annual Rainfall at Cooranbong

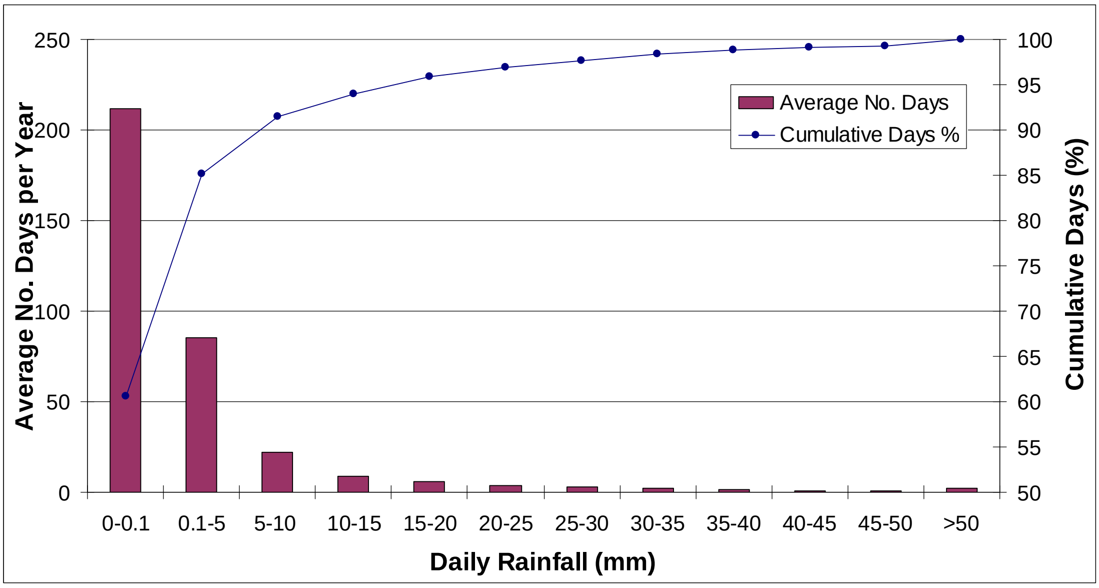
The monthly rainfall statistics were also determined for the period of record and selected statistics are provided in Graph 3.3. The average monthly rainfalls were observed to vary from a low of approximately 60 mm in July to a high of approximately 160 mm in February. Graph 3.3 shows a significant variation in the maximum recorded monthly rainfalls with the maximum monthly value being approximately 623 mm in February to a lowest maximum monthly value of approximately 158 mm in November.



Graph 3.3 Monthly Rainfall Statistics

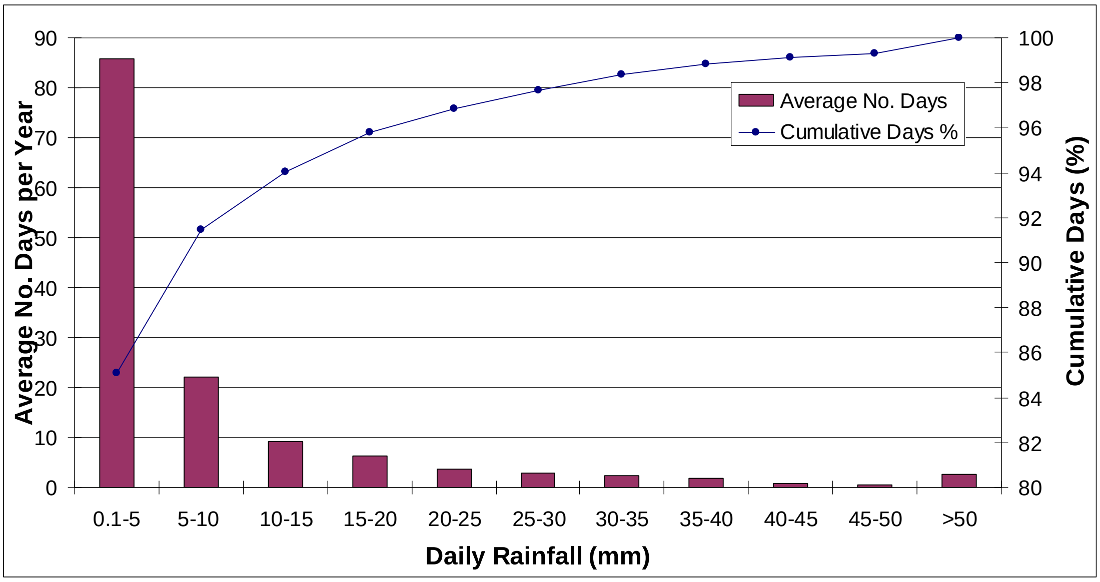
An analysis of the rainfall data was undertaken to enable an understanding of the likely rainfall patterns at the site. For various intervals of daily rainfall, the average number of days per year which fall within each interval are presented in Graph 3.4. The graph also presents the cumulative days per year as a percentage against the same rainfall intervals.

As presented in Graph 3.4, the average number of non rainfall days per year is approximately 212, which is greater than 60% of days in a year while the number of rain days receiving less than 5 mm of rainfall is approximately 25%.



Graph 3.4 Number of Rain Days of Various Magnitudes

The data presented within Graph 3.4 was amended to exclude days without recorded rainfall to enable a more detailed view of the data. As presented in Graph 3.5, the amount of rain falling on any one day decreases for rainfall greater than 5 mm. On average, approximately 15% of days in the year (or 52 days) receive greater than 5 mm of rain with approximately 3% of days in the year (or 11 days) receiving greater than 25 mm of rain.



Graph 3.5 Daily Rainfall Magnitudes

Evaporation Data

In addition to the provision of rainfall data from the Newstan Meteorological Station, Awaba Colliery also provided the daily evaporation data. This information was reviewed for the five years of data and average monthly evaporation rates determined for use within the Goldsim model. The average daily evaporation for Awaba Colliery is presented in Graph 3.6.

Graph 3.6 Average Daily Evaporation Rates

These evaporation rates were then compared to the evaporation maps available from the BOM. In particular, the months of January and July were considered as shown in Figure 3.1.

Figure 3.1 Bureau of Meteorology January Evaporation Maps

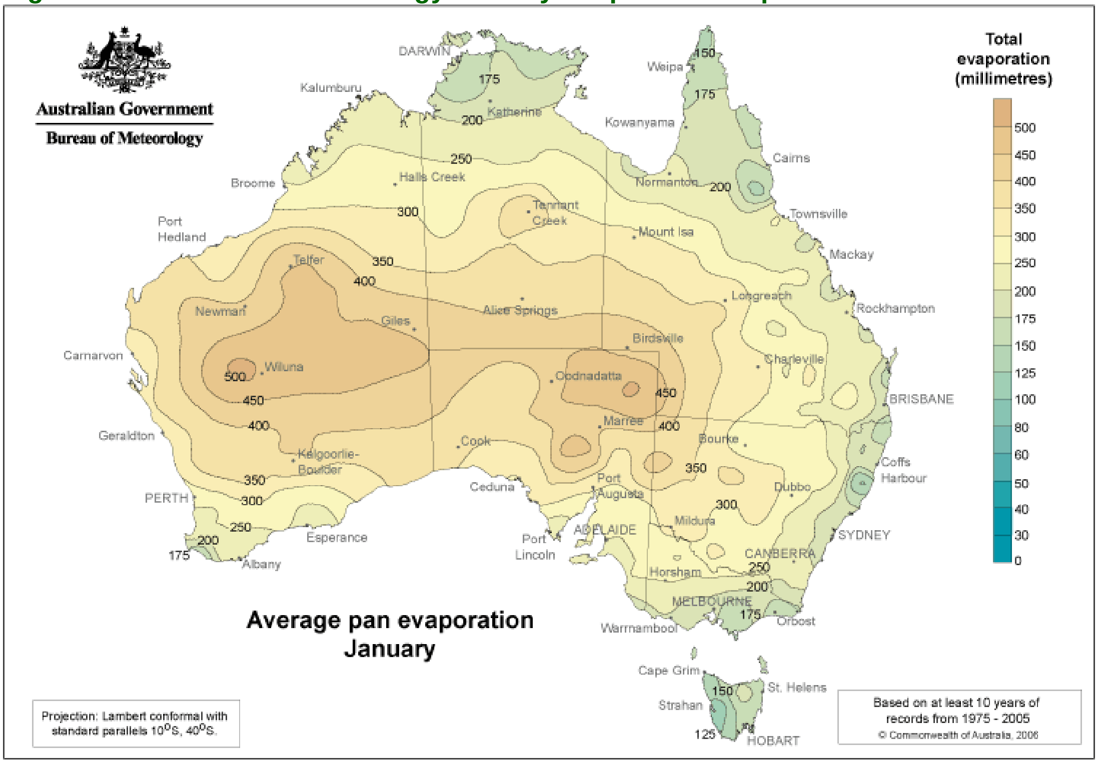
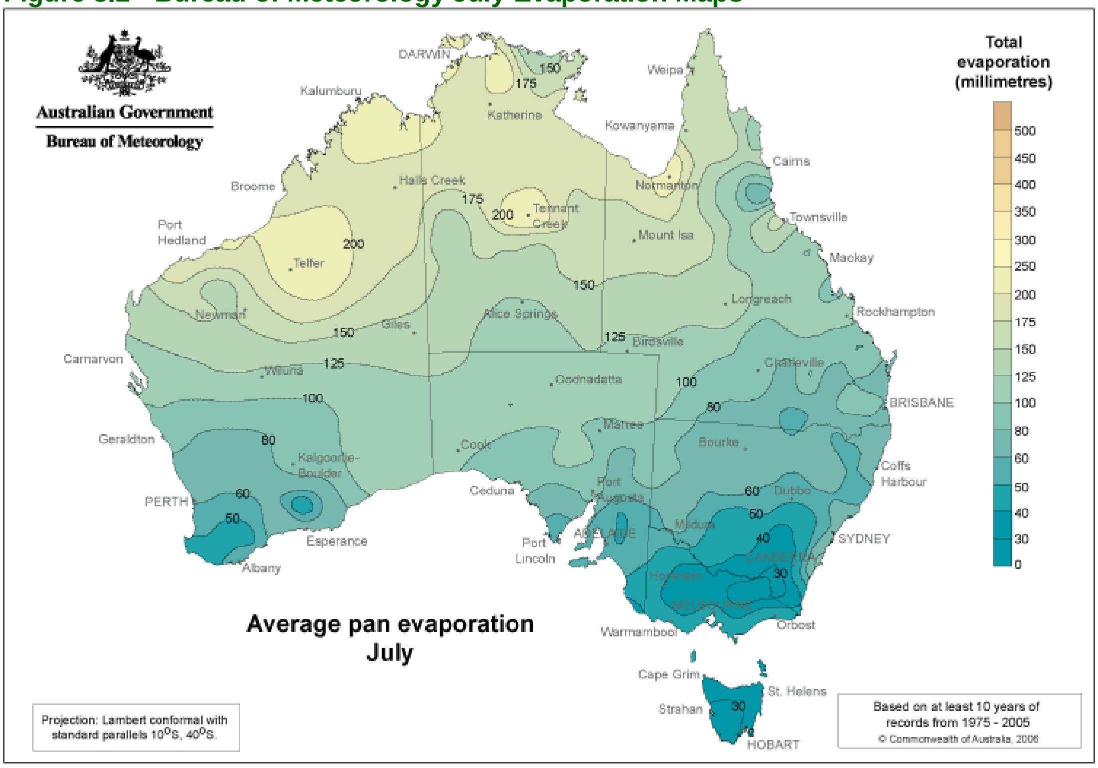


Figure 3.2 Bureau of Meteorology July Evaporation Maps



For both January and July, the monthly average evaporation was assessed and converted to daily evaporation as well as potential minimum and maximums as outlined in Table 3.5.

Table 3.5 Evaporation Data

Month	BOM Monthly Average (mm)	BOM Daily Average (mm)	BOM Daily Minimum (mm)	BOM Daily Maximum (mm)	Newstan Daily Average (mm)
January	150 - 175	5.2	4.8	5.6	4.2
July	50 - 60	1.8	1.6	1.9	2.2

By comparing the average daily from the Newstan Meteorological Station for January and July to the daily average as determined from the BOM data, it can be seen that there is a reasonable correlation between the two sets of data. Therefore the Newstan Meteorological Station data was adopted for the mine water balance.

The average annual evaporation rate was approximately 1333 mm, compared to the annual average rainfall of 1139 mm. This gives an annual deficit (difference between annual rainfall and annual evaporation) of approximately 194 mm.

4. Modelling Representation

This section of the report discusses the development of both the hydrogeological and water balance models for the existing and proposed conditions at Awaba Colliery.

4.1 Hydrogeological Model

The strata of the Newcastle Coal Measures above and including the Great Northern Seam at Awaba have been divided into two hydrogeological units (in order of sequence):

- Narrabeen Sandstone (Triassic) and Teralba Conglomerate (Permian), extending up to almost 100 m thick along the ridgeline to the north of the 10 South bore.
- Great Northern Seam (Permian) of average thickness 3 m. The floor of the Great Northern Seam dips to the south west and extends down to an elevation of approximately -30 m AHD.

The Great Northern Seam is underlain by Awaba Tuff and the Fassifern Seam. It was considered appropriate to vertically limit the model to the floor of the Great Northern Seam since the underlying Awaba Tuff is known to create a barrier to water flow.

Figure 4.1 shows the spatial extent of the hydrogeological model. 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. Figure 4.1 shows how the Great Northern Seam has almost been mined to its economic extent in this area.

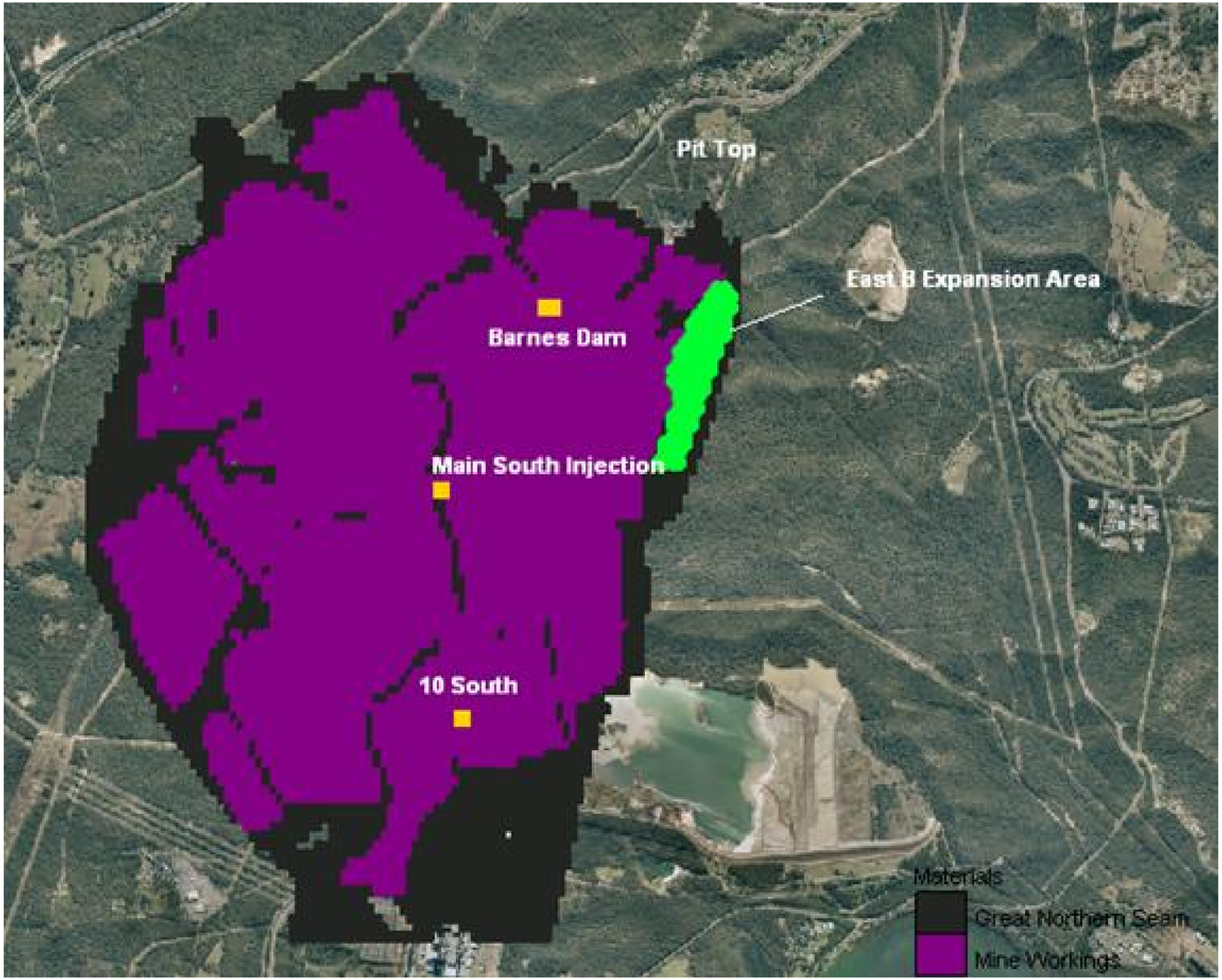
Flow Boundaries

The flow boundaries have been defined geologically as outlined above. Groundwater cannot pass across the geological no-flow boundaries. No constant or general head boundaries have been defined.

Conceptualisation of Groundwater Flow

Water enters the strata via rainfall recharge to the surface and via the injection of water from the Pollution Control Dam. Prior to March 2010, water from the Pollution Control Dam was injected into the workings at Barnes Dam and main south (shown in Figure 4.1). Since March 2010, water from the Pollution Control Dam generally by-passes Barnes Dam and all is directed to main south. In addition, since March 2010 there has been an underground transfer of water make from the Barnes Dam area to main south.

The flow of underground water within the Great Northern Seam and mine workings generally follows the orientation and dip of the seam. Underground water storages form in depressions in the floor of the mine workings. The main underground water storages are at Barnes Dam and 10 South (locations shown in Figure 4.1). Extraction bores are used to dewater the underground storages and discharge the water at the surface. Since March 2010, the 10 South bore is the only dewatering bore that remains active.



GHD

LOCATION	Awaba
SEAM	Great Northern
DRAWN	SG
CHECKED	
APPROVED	
SCALE	

Awaba Colliery
Extent of Hydrogeologic Model

Centennial

DATE 16-04-2010

Figure 4.1

Numerical Modelling

The above conceptual understanding of the hydrogeology at Awaba was used in developing a MODFLOW numerical hydrogeological model of underground water flow. MODFLOW is a finite difference flow model from the United States Geological Survey (USGS) and is an industry standard code for numerical groundwater modelling. The model was built using the Groundwater Modelling System (GMS) software. GMS is a three-dimensional user interface for the MODFLOW groundwater modelling code.

Note that due to limitations in historical data, the numerical model is a preliminary representation of the underground water system developed for the purposes of impact assessment and dewatering requirements. It has been developed with reference to the Groundwater Flow Modelling Guideline (Murray-Darling Basin Commission, 2000), however cannot satisfy all aspects of this guideline.

A two layered model was constructed:

- Layer 1 – Unconfined Conglomerate/Sandstone.
- Layer 2 – Confined Great Northern Seam.

Each layer of the model was initially divided into 100 by 100 equally sized cells, of dimensions 60 m (north-south) by 43 m (east-west). Active and inactive cells were defined by the geological boundaries. Only the active area of Layer 2 is shown in Figure 4.1.

Spatial elevation data for the topography was used to establish the top elevation of Layer 1. The bottom elevation of Layer 2 was established by Great Northern Seam floor contours. The top of Layer 1 (base of Layer 1) was 3 m above the floor of the Great Northern Seam.

The model was divided into three material types:

- Conglomerate/Sandstone Overburden.
- Great Northern Seam (unmined coal).
- Mined Area.

The properties adopted for each material are given in Table 4.1. These values were derived from data presented in the Statement of Environmental Effects – Groundwater for Newstan Colliery (Australasian Groundwater & Environmental Consultants Pty Ltd, 2007), and from model calibration. Differences in hydraulic conductivity between adjacent cells were limited where possible to avoid numerical instability caused by large differences in hydraulic conductivity between adjacent cells. Note that the property data presented in Table 4.1 are consistent with the values adopted by GHD for the hydrogeological model of the old workings at Newstan Colliery to the north of Awaba (GHD, 2009).

Table 4.1 Material Properties for Numerical Hydrogeological Model

Material	K_h (m/d)	S_s (1/m)	S_y	n_e
Overburden	0.05	0.00001	0.1	0.05
Great Northern Seam	0.5	0.00001	0.15	0.15

Material	K_h (m/d)	S_s (1/m)	S_y	n_e
Workings	50	0.00001	0.5	0.5

K_h = horizontal hydraulic conductivity

S_s = specific storage

S_y = specific yield

n_e = effective porosity

Well cells were assigned to simulate water injection into and extraction from the Great Northern Seam. The following extraction data were available:

- 10 South and LDP5 (June 2007 to March 2010).
- LDP4 (June 2007 to May 2008).
- LDP7 (July 2007 to May 2009).

Injection rates were calculated based on the volume of runoff entering the Pollution Control Dam and the pump capacities. Injection into the workings therefore coincided with net runoff and occurred at two injection wells (shown in Figure 4.1):

- Barnes Dam.
- Main South Injection.

4.2 Water Balance

The model used to represent the Awaba Colliery water balance was Goldsim Version 9.6 (Goldsim Technology 2007). This software is a graphical object orientated system simulation software for completing either static or dynamic systems. It is like a “visual spreadsheet” that allows one to visually create and manipulate data and equations.

Simulation, in this context, is defined as a process of creating a model of an existing or proposed system (such as a mine water management system) in order to identify and understand the factors that control the system performance or predict (forecast) the future behaviour of the system.

A model representation of the existing mine water cycles was created using Goldsim and the results verified, as best as practical, for discharges through LDP005 and 10 South prior to March 2010 when LDP005 was decommissioned.

Once the model operation was verified as representing the site conditions prior to March 2010, it was modified to include the future operations and decommissioning of LDP005.

Water Cycle Modelling

The water balance modelling was completed using:

- Daily time steps used for the analysis – daily rainfall data was the shortest period data available.
- Runoff from catchments was represented by an initial loss/runoff factor – this was used to convert daily rainfalls into surface runoff values when the daily rainfall has exceeded the initial loss of rainfall (infiltration which is subsequently transpired by vegetation).

Model Structure

The model was configured to represent the water cycles as a series of elements each containing preset rules and data, that were linked to represent the water transfer around the water cycles.

The overall structure of the model is shown in Appendix A for the existing water cycle and Appendix B for the proposed water cycle.

Model Data and Operational Rules

The data provided in Table 3.3 was incorporated into the model and the water transfer rates shown in Table 3.4 were entered as maximum values that could occur on any single day. In the event that the model determined the required daily water transfer rate was less than the maximum specified daily value for any element, the model adopted the reduced transfer volume. The rules identified in Table 3.4 were specified within the model to determine the priorities adopted within the model for water transfers.

Goldsim Representation

Existing Operations

The operation of the water cycle (prior to March 2010) associated with coal production, as provided in Figure 4.2, was modelled in Goldsim. To undertake the modelling the following simplifications were incorporated:

- Transfer rates were modelled using daily time steps. In reality, transfer rates are determined during the day on an “as needs basis” and may operate over periods smaller than a day.
- The daily coal production rate was determined from the achieved yearly production rate of 850,000 tonnes per annum.
- The pumping rates to the underground were 135.4 kL and 20.31 kL per day on work and non-work days. This was based on underground demand being 90% of the total demand. In reality the demand for the underground workings varies daily.
- The demand of the CHP was assumed to be 2.4 kL per day. In reality this value varies daily.
- Dust suppression rates were determined as 3.15 kL per day, as indicated as an average value by Awaba Colliery staff. In reality the dust suppression rates would vary daily.
- Operating rules/precedences were established within the model in accordance with advice from Awaba Colliery staff.

There was limited data available for the following segments of the model. The values for these portions of the model were therefore adjusted to replicate anecdotal site information.

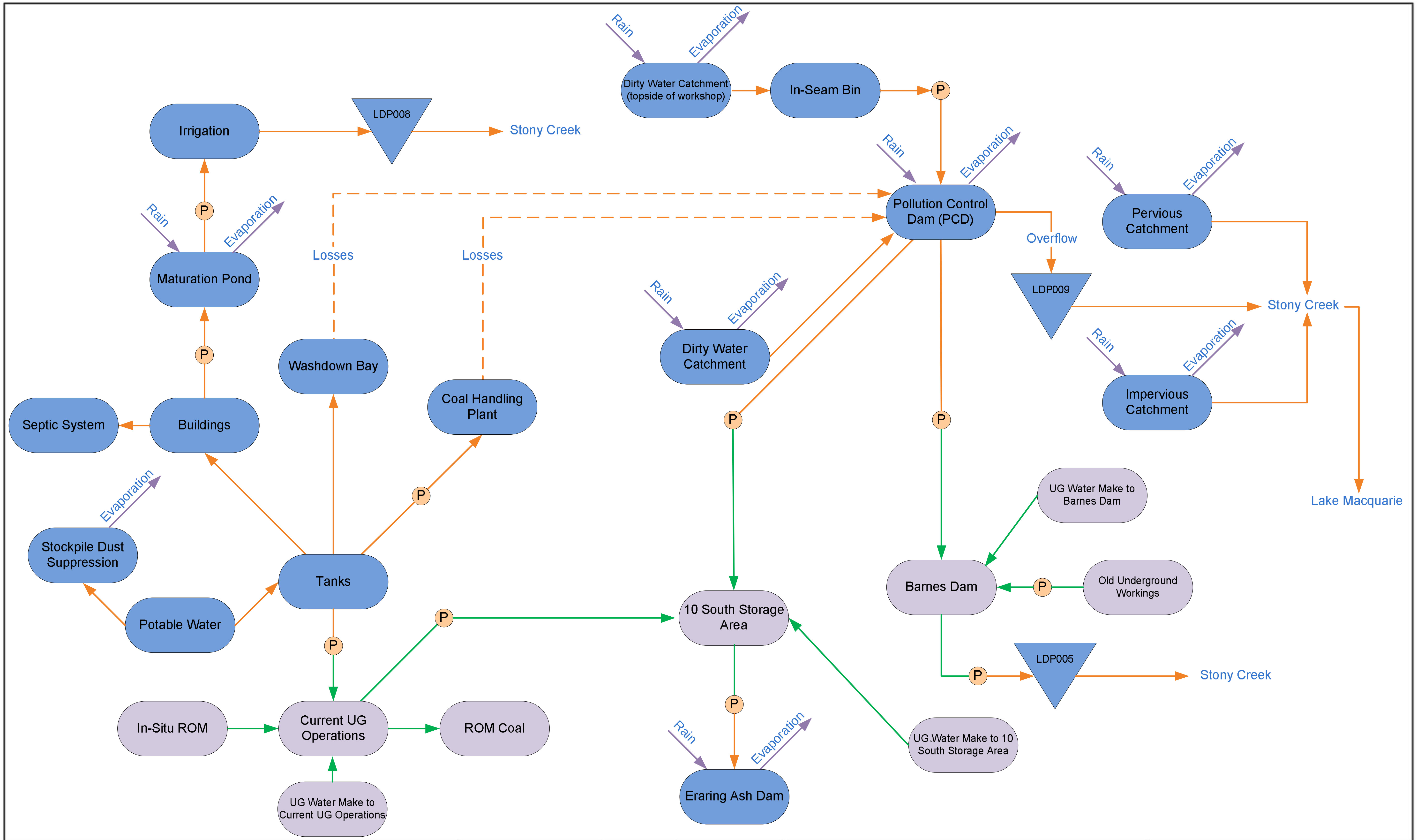
- In-seam bin volume.
- Fish Tank volumes and operation level.
- Barnes Dam volumes and operation level.
- 10 South storage area volume.

Proposed Operations

The existing conditons Goldsim model was modified to represent the proposed conditions of the water cycle on-site following the expansion of the Pollution Control Dam (to the increased capacity of 6.2ML), decommissioning of Barnes Dam and establishment of the Fish Tank as indicated in Figure 4.3.

Amendments to the model to represent these changes were limited to:

- Amendment of storage capacities.
- Amendment of pumping rules (in accordance with Table 3.4).
- Removal LDP005.
- Increase in coal production rate from 0.85 Mtpa to 0.88 Mtpa.



SURFACE
UNDERGROUND
SURFACE COMPONENT
UNDERGROUND COMPONENT
P PUMP

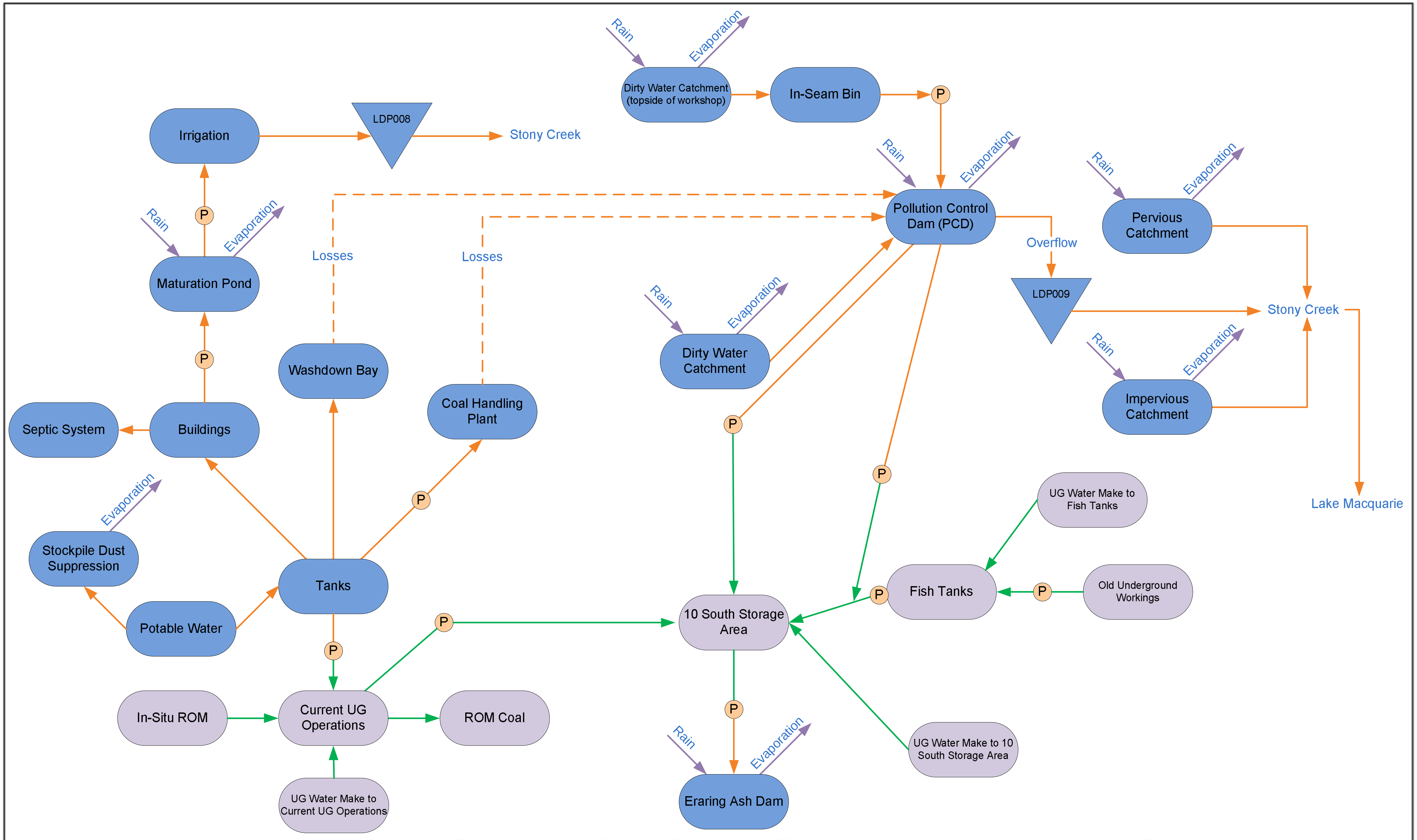
LOCATION	Awaba
SEAM	Great Northern
DRAWN	LH
CHECKED	
APPROVED	
SCALE	

Awaba Colliery
Detailed Water Cycle –
Existing Operations

Centennial

DATE 16-04-2010

Figure 4.2



GHD

- SURFACE
- UNDERGROUND
- SURFACE COMPONENT
- UNDERGROUND COMPONENT
- P PUMP

LOCATION	Awaba
SEAM	Great Northern
DRAWN	LH
CHECKED	
APPROVED	
SCALE	

Awaba Colliery
Detailed Water Cycle –
Proposed Operations

Centennial

DATE 16-04-2010

Figure 4.3

5. Modelling Results

5.1 Hydrogeological Model

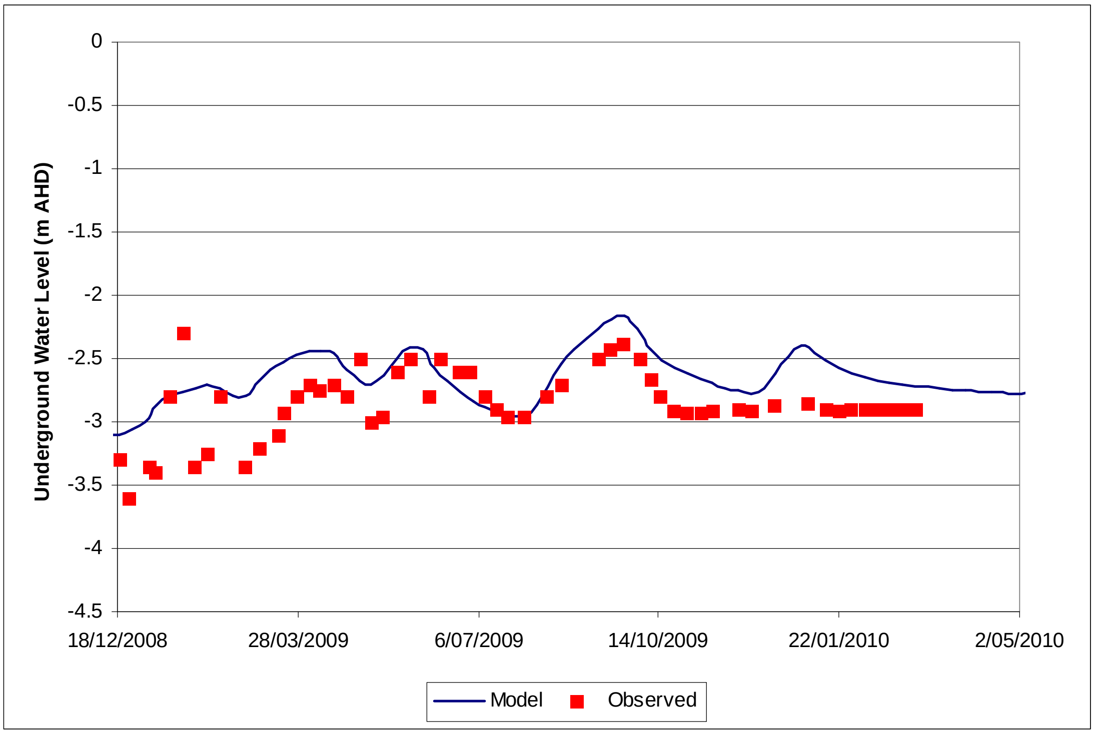
Calibration

Note that hydrogeological models are based on a conceptual representation of the natural hydrogeological environment and assumptions have to be made. In particular, assumptions were necessary due to the limited observed water level data for model calibration and the limited information regarding the overburden. Assumptions and limitations are outlined as follows:

- Aquifer hydrogeological properties do not change spatially or with time for a particular material type.
- No other sources or sinks, other than those already outlined, have been considered (such as creeks or streams).
- There is no vertical seepage of groundwater from the Great Northern Seam into the underlying Awaba Tuff.
- No groundwater level data for the overlying conglomerate were available. It was assumed that the conglomerate did not initially contain permanent groundwater.
- Steady state conditions could not be established due to historical and ongoing disturbances and stresses to the underground water system. Therefore, only transient calibration was undertaken and initial heads were established from observation data. This rendered early model output relatively unreliable.

The model was initially run for 1034 days from 1 June 2007 to 31 March 2010 for transient calibration. Model calibration was carried out by comparing model output and available underground water level data (mainly the water level in the 10 South storage, as measured in the 503 bore) and was used to adjust hydraulic conductivities and net rainfall recharge.

Graph 5.1 shows MODFLOW model output plotted against observed data for the 10 South storage (measured in the 503 bore). In this case, a recharge value of 1% net rainfall was adopted.



Graph 5.1 MODFLOW Calibration

Following the transient calibration process, the hydrogeological model was used to estimate water make into the workings in the vicinity of the Proposal area. This is an input into the detailed water balance. Water make is attributable to seepage into the underground void from surrounding strata and incorporates the effects of rainfall recharge. The following output was obtained from the period 1 January 2009 to 31 March 2010. Since an initial steady state calibration was not undertaken, the output for the period up to 1 January 2009 was excluded.

- 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.

Note that the period 1 January 2009 to 31 March 2010 was a lower than average rainfall period and therefore slightly higher flow rates were adopted for the detailed water balance.

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.

Predictive Simulations

The hydrogeological model was also run over a ten year period up to 30 June 2020 to assess future dewatering requirements. This covers the period of the proposed operations (1 July 2010 to 30 June 2015), plus five years under care and maintenance. Based on the seam floor contours at 10 South dam, it is considered 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.

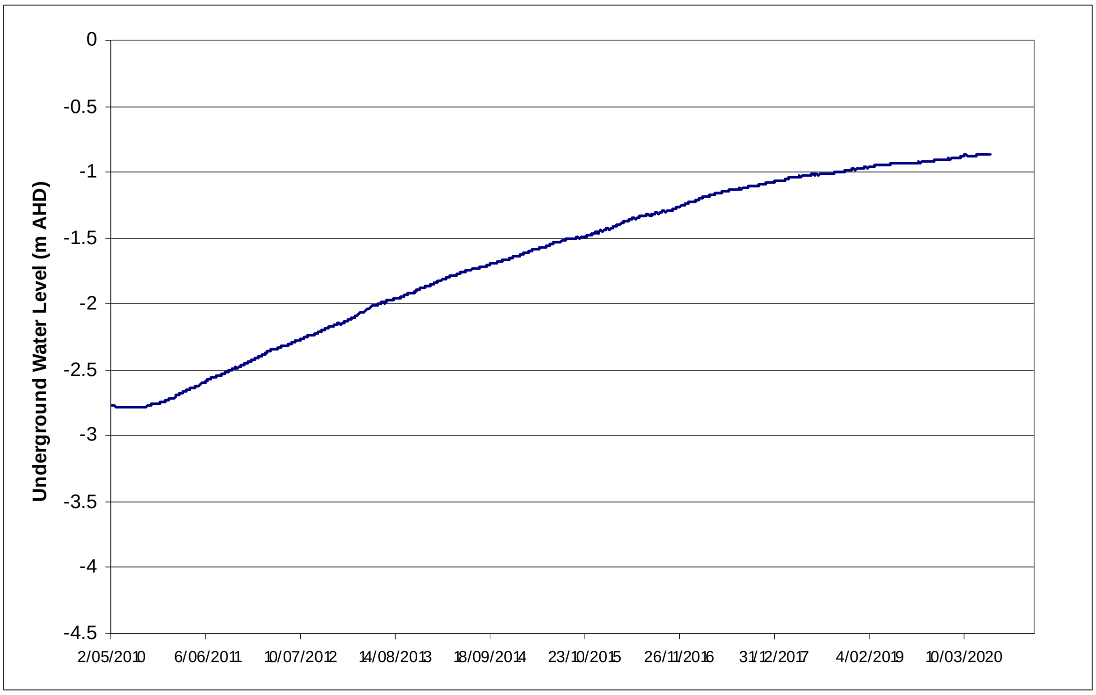
Over this period, the only water extraction from the underground workings was from 10 South, although a small underground transfer from Barnes Dam to 10 South was incorporated into the model to simulate pumping of water make from the fish tanks at Barnes Dam.

Drainage cells were assigned to the East B area and were turned on (i.e. positive conductance) from 1 July 2010 since first workings are proposed in this area. The standard conductance equation was used to establish the drainage rate. Cell rewetting was enabled.

Average daily rainfall for Cooranbong (based on the 1995 year) was used to establish rainfall recharge and injection from the PCD over this period. Note that over this period, all injection from the PCD was directed to main south. Recharge remained at 1% of net rainfall over this period.

Based on a long term extraction rate of 5.5 L/s (0.48 ML/day) at 10 South, underground water levels will rise in this area to approximately -1 m AHD as shown in Graph 5.2. Long term rise would be expected, since during some periods the extraction rate would only cover the water make generated in the Barnes Dam and 10 South areas and would be insufficient to extract the water injected into the underground workings from the Pollution Control Dam. At this extraction rate it is estimated that generally up to 90% of the extracted volume is groundwater that has seeped into the workings, based on the water make predictions from the model.

Due to the gradual predicted rise in underground water level at 10 South, it is recommended that additional pumping capacity be made available to avoid levels exceeding -2 m AHD during periods of heavier rainfall. In order to estimate the likely pump capacity required, the hydrogeologic model was reviewed. Through this it was determined that a daily discharge of 1.2 ML/day would be sufficient to maintain the underground water level at or below -2 m AHD.



Graph 5.2 Long-term Underground Water Level at 10 South

5.2 Water Balance

Calibration

Initially the model was established using the estimated flow rates, water usages and estimated infiltration rates. Adjustments were required to these initial values to more closely replicate the system performance for the period of observed data since 1987 and the results of this modelling are provided in Appendix C.

The results of the calibration indicated that:

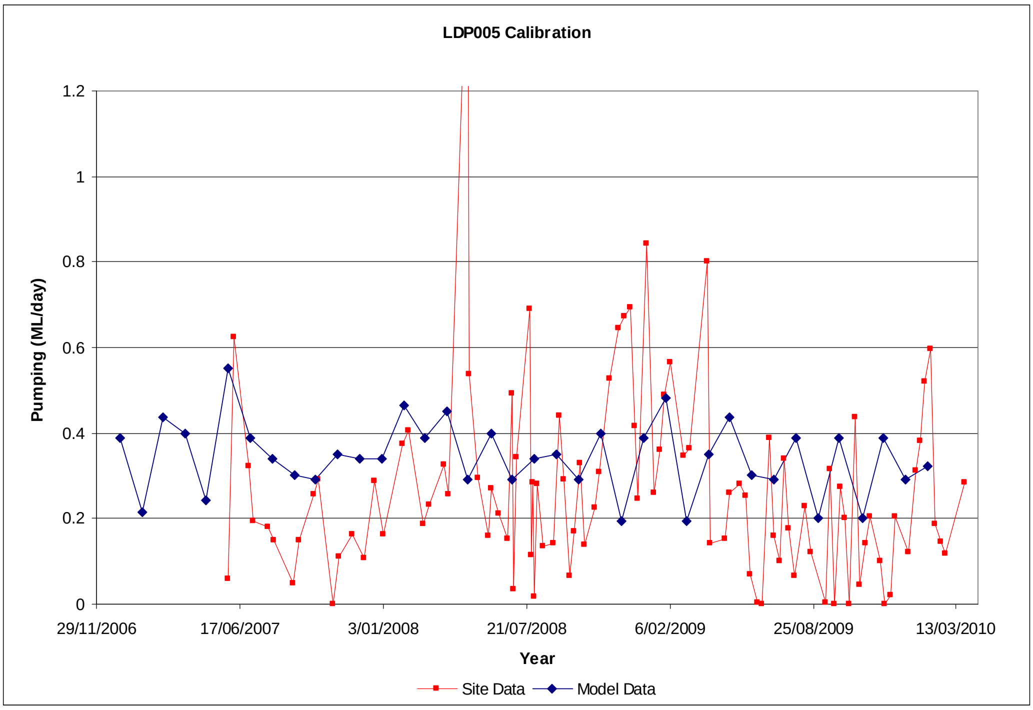
- Rainfall had minimal impact on discharges through LDP005 and 10 South.
- The water make for underground workings should be represented as an inflow to contribute to Barnes Dam.
- LDP009 did not have sufficient data for use in the calibration process.

LDP005

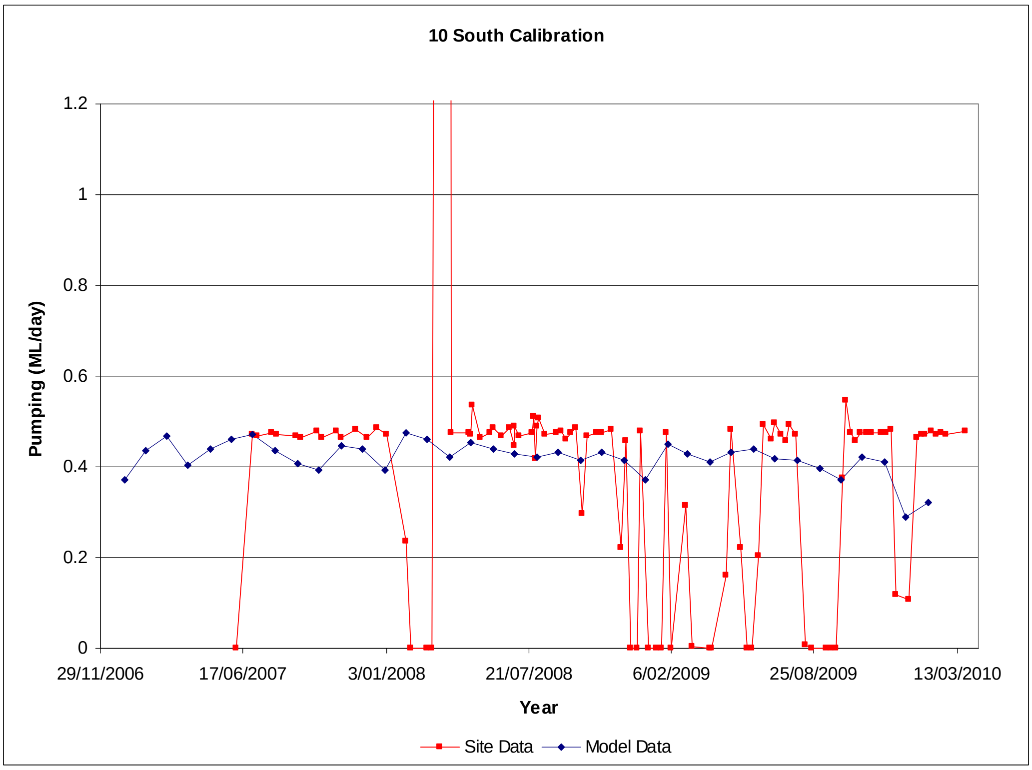
The model outputs (as monthly totals) from February 2009 to January 2010 were compared to the recorded site data for discharges through LDP005 and are provided in Graph 5.3.

10 South

The preliminary modelling results (as monthly totals) from February 2009 to January 2010 were compared to the recorded discharges through the 10 South bore as shown in Graph 5.4.



Graph 5.3 LDP005 Calibration



Graph 5.4 10 South Calibration

Results

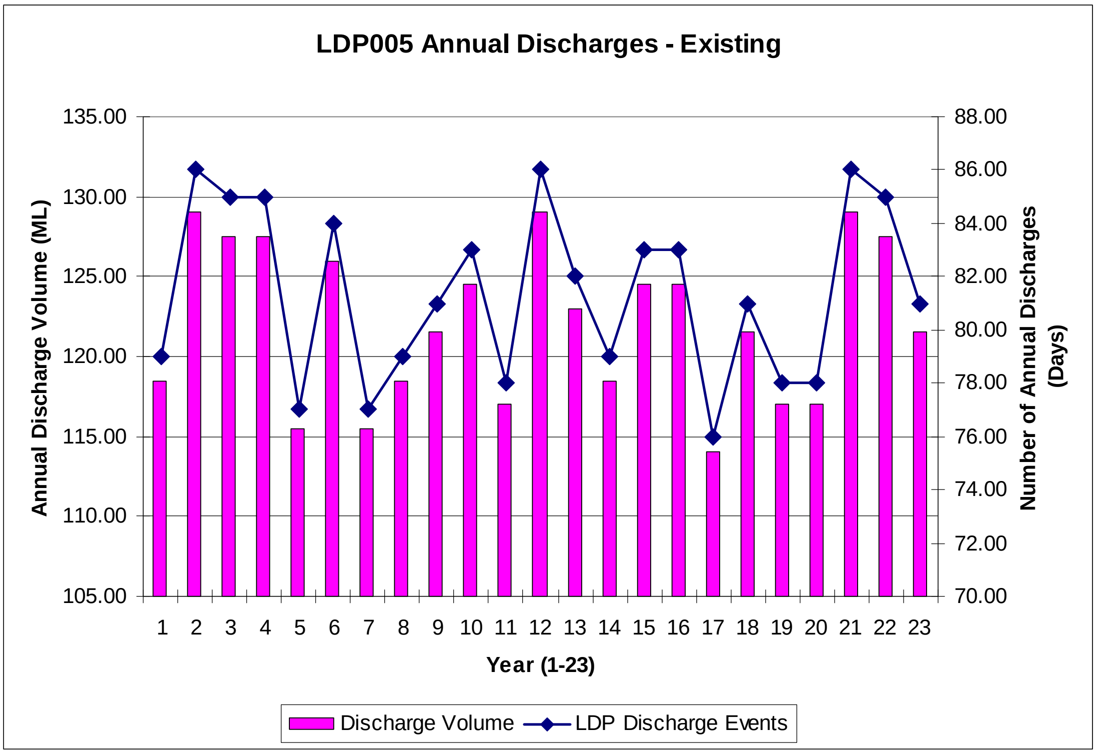
The existing conditions mean predicted values for each of the water transfers over the simulated period are provided on Figure 5.1. Also provided are the respective minimum and maximum values in brackets to give an indication of the range of likely values. Where there is no value in brackets, there was not a range as the transfer rate was static across the simulation period.

A summary of the detailed water balance results is provided in Table 5.1.

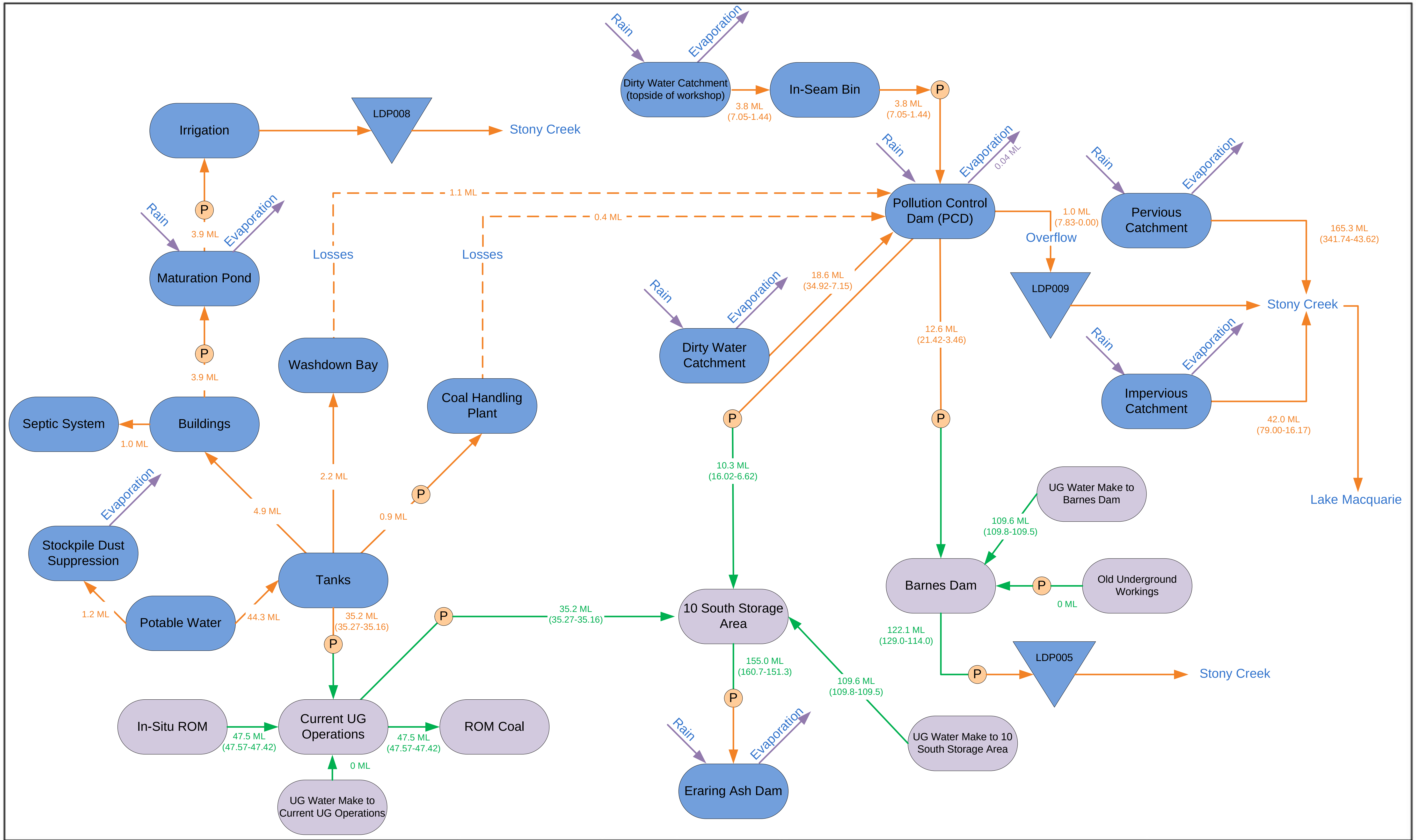
Table 5.1 Discharges

Discharge Point	Average Annual Discharges (ML/yr)	Average Daily Discharges (ML/day)
LDP005	122.09	0.33
LDP009	1.0	0.003
10 South	155.01	0.42

Graph 5.5, Graph 5.6 and Graph 5.7 show the pattern of discharge from LDP005, LDP009 and 10 South respectively for the existing conditions. They also indicated that based on the available information there would be approximately half the analysed years when there would not be any discharge from LDP009 while the discharges from LDP005 and 10 South were reasonably consistent.



Graph 5.5 Predicted LDP005 discharge frequency and discharge volumes



GHD

SURFACE
UNDERGROUND
SURFACE COMPONENT
UNDERGROUND COMPONENT
P PUMP

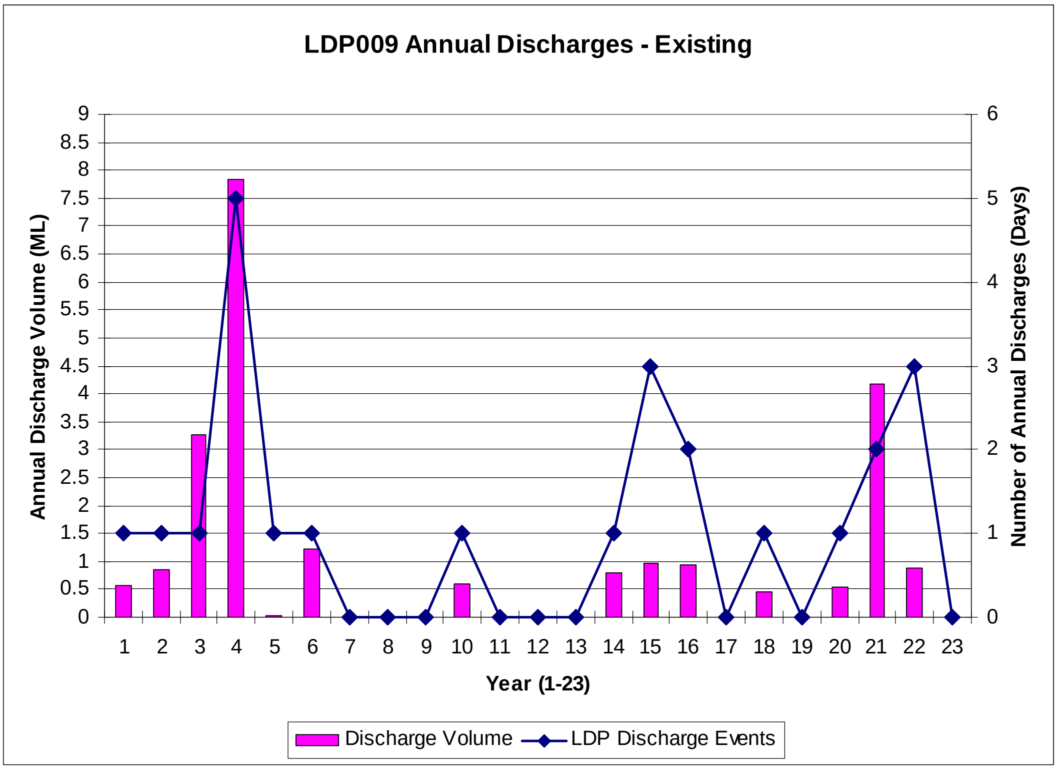
LOCATION	Awaba
SEAM	Great Northern
DRAWN	LH
CHECKED	
APPROVED	
SCALE	

Awaba Colliery
Mean Annual Transfer Rates –
Existing Operational Conditions

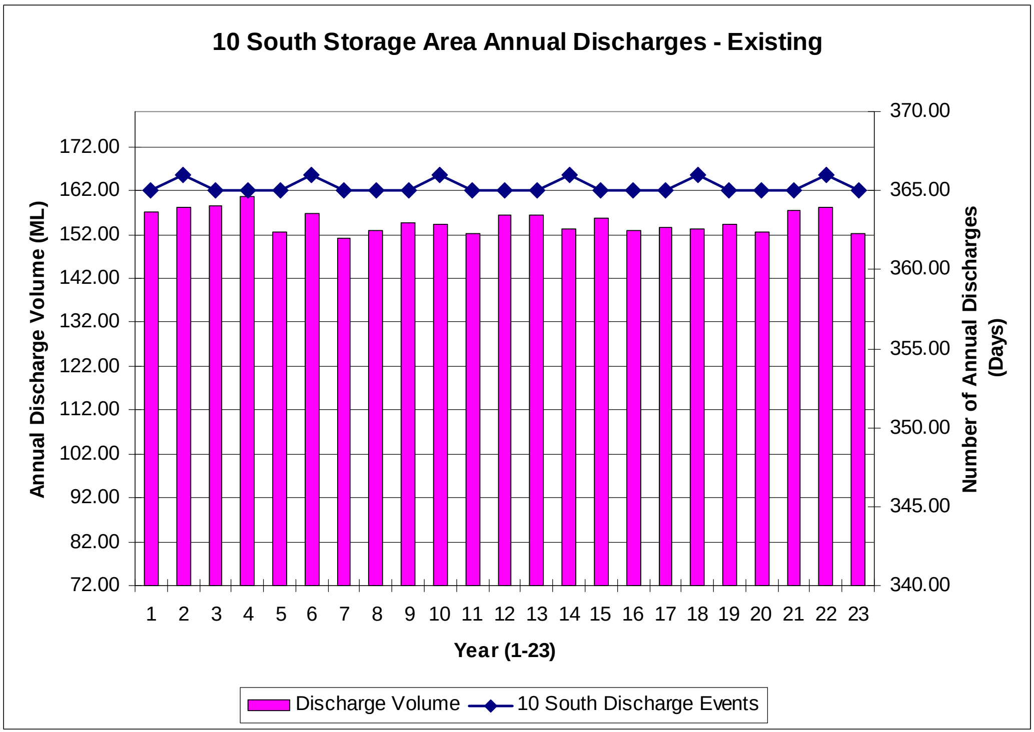
Centennial

DATE 16-04-2010

Figure 5.1



Graph 5.6 Predicted LDP009 discharge frequency and discharge volumes



Graph 5.7 Predicted 10 South discharge frequency and discharge volumes

Operations Including the Proposed Extensions

As discussed in Section 4.2, water balance modelling was completed for both the existing and proposed operation conditions at Awaba Colliery and the modifications made for the proposed operation conditions were also discussed in Section 4.2.

Predicted extraction and water transfer rates for the proposed operational conditions are shown on Figure 5.2 and the detailed results showing the maximum, minimum and mean transfer rates are provided in Appendix C. Additionally, a summary of the detailed water balance results is provided in Table 5.2.

Table 5.2 Annual discharges

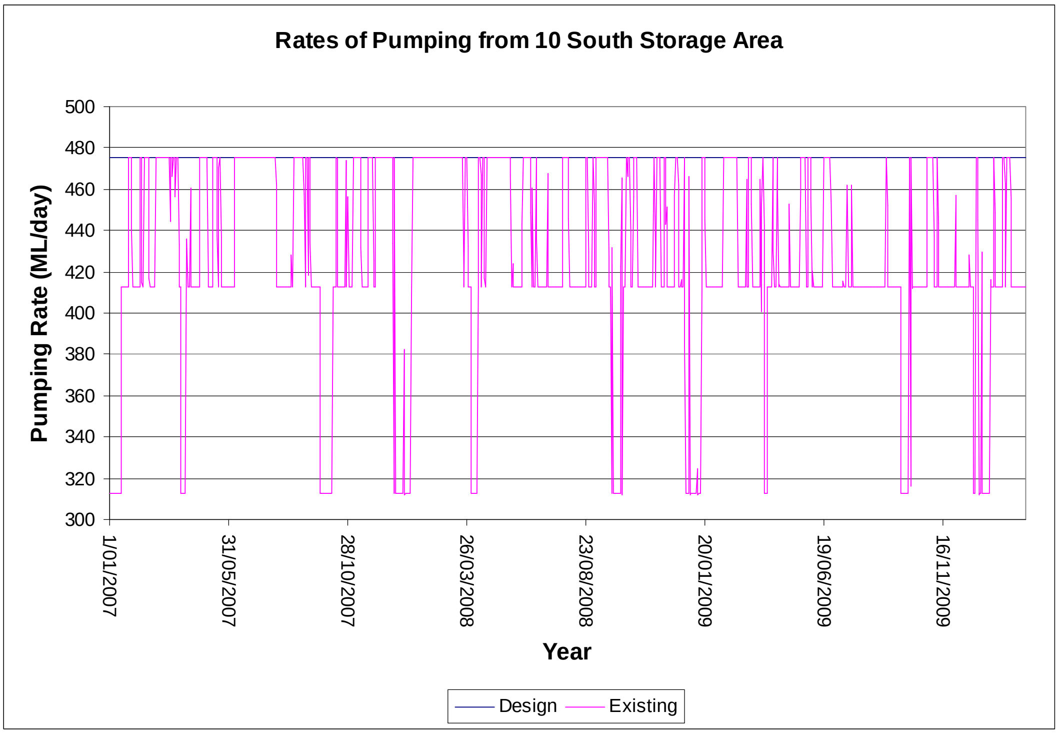
Average over all years	
Through LDP009	0.2 ML/yr
Through 10 South	173.56 ML/yr

By comparing the information provided in Table 5.1 and Table 5.2, it can be determined that the construction of the Pollution Control Dam will result in a decrease in discharge through LDP009. It can also be seen that removal of LDP005 will result in an increase in discharges to the Eraring Ash Dam through 10 South.

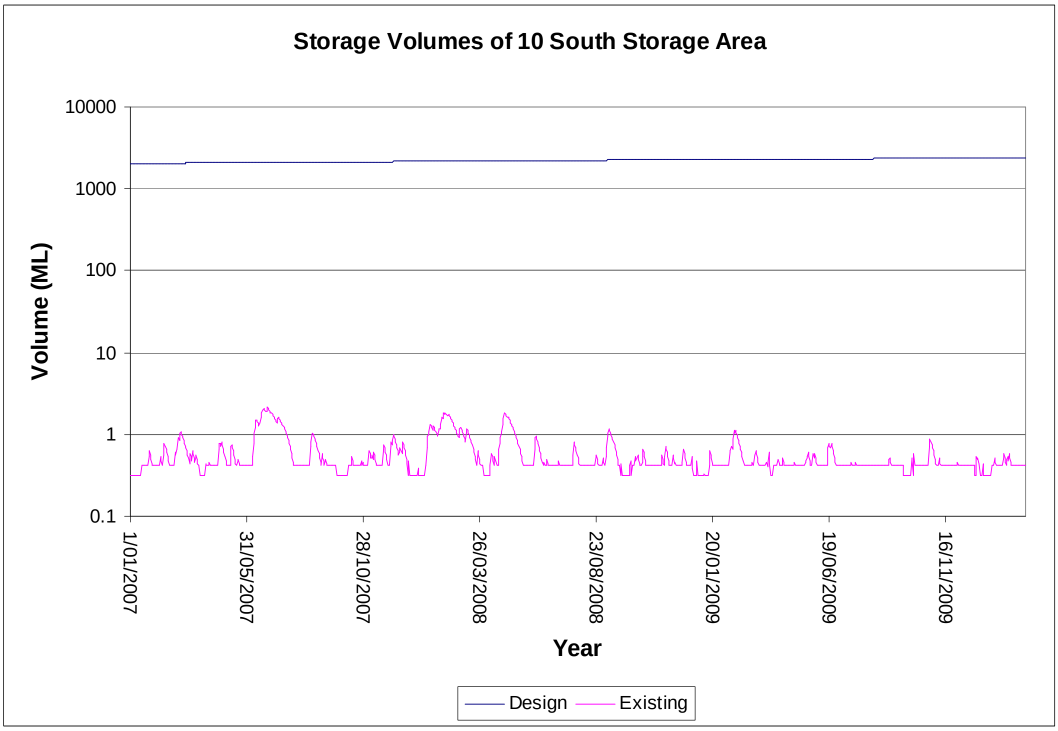
A review of the pumping for the existing and proposed conditions at 10 South (Graph 5.8) indicated that the increase in discharge is primarily a result of an increase in the volume of water contributing to this location. Therefore, while there is no increase in pumping capacity, the pump will operate for greater periods of time and consequently increase the annual discharge.

Consideration was also given to the potential increase in volume of water stored in the vicinity of 10 South.

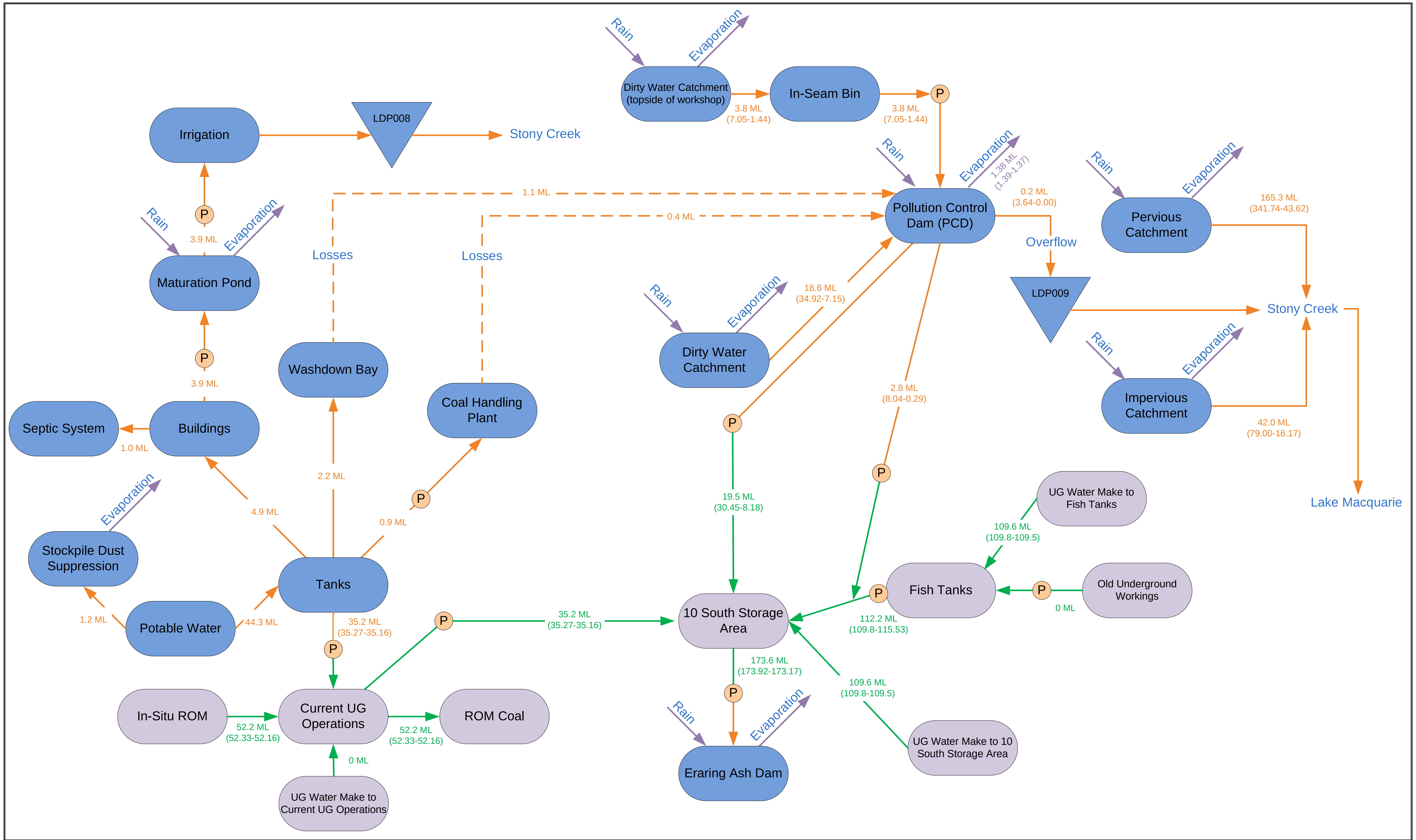
Graph 5.9 shows the storage volumes at 10 South for the existing and proposed conditions. From this it can be seen that the removal of LDP005 will result in a general trend for an increase in water stored at 10 South as well as an increase in discharge.



Graph 5.8 10 South pump operation



Graph 5.9 10 South storage volume



GHD

SURFACE
UNDERGROUND
SURFACE COMPONENT
UNDERGROUND COMPONENT
P PUMP

LOCATION	Awaba
SEAM	Great Northern
DRAWN	LH
CHECKED	
APPROVED	
SCALE	

Awaba Colliery
Mean Annual Transfer Rates –
Proposed Operational Conditions

Centennial

DATE 16-04-2010

Figure 5.2

5.3 Qualifications on Predictions

Predicted water transfers are based upon a mix of data. Typical data sources for model construction and verification included:

- Relatively reliable data
  - Bureau of Meteorology rainfall data.
  - Monitored rainfall data at Newstan.
  - Monitored evaporation from Newstan.
  - Surface catchment areas based on topographic maps.
  - Annual potable water demands.
  - Monitored discharges.
- Less reliable data
  - Estimates of many water transfer rates based upon pipe diameter, pipe material and power of pump motors.
  - Site infiltration rates for normal and revegetated catchment areas.
  - Estimates of some storage capacities.

As a result of the items listed within the “less reliable data” category there is likely to be a risk that the provided estimates may be inaccurate. It is suggested that the individual predictions given above should be considered reliable to +/-30% until more site data is gathered. Additional data will allow refinement of the data sources and hence the model predictions to be confirmed as reliable.

6. Summary

Preparation of this water balance assessment required:

- Confirmation of the surface and groundwater management systems.
- Establishment of a MODFLOW hydrogeological model.
- Establishment of a Goldsim model to represent the water movement on-site.
- Application of the Goldsim model for the existing and proposed site-conditions.

Inputs into both the hydrogeological and water balance models consisted of information provided by Awaba Colliery and estimations based on available information. The estimations adopted included storage volumes and flow rates of some elements within the system as outlined in Table 3.1.

Calibration of the hydrogeological model was carried out conservatively due to the limited observation data. Calibration was focused on output and observation data for the 10 South dam.

Calibration of the existing conditions water balance model confirmed the performance of the model against recorded discharges through LDP005 and 10 South. The results of this model indicated that the annual discharges through LDP009, LDP005 and 10 South were 1.0, 85.5 and 82.0 ML/year respectively.

For the proposed conditions, the calibrated model was adjusted to reflect the proposed water management system amendments discussed in Section 4.2. The resulting predicted annual discharges through LDP009 and 10 South were determined to be 0.2 and 173.6 ML/year respectively. From this it can be seen that there will be a decrease in discharges through LDP009 (corresponding to the increase in the capacity of the Pollution Control Dam) however there is predicted to be an increase in discharges through 10 South. This is considered to be a result of the increase in pump operation to cater for the increase in stored water volume at 10 South.

Consideration was also given to the impact on the Eraring Ash Dam as a result of discharges though 10 South. The existing capacity of the Ash Dam was found to be approximately 4,000 ML with considerable inflows and outflows. The inflows into the Ash Dam (from Eraring) are in the order of 14.07 ML/day and the maximum controlled discharge from the dam is 47.52 ML/day.

A comparison of the existing and proposed conditions (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.

To provide greater flexibility for Awaba Colliery to enable the maintenance of an underground water level of -2 m AHD, an increased pumping capacity of 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.

7. References

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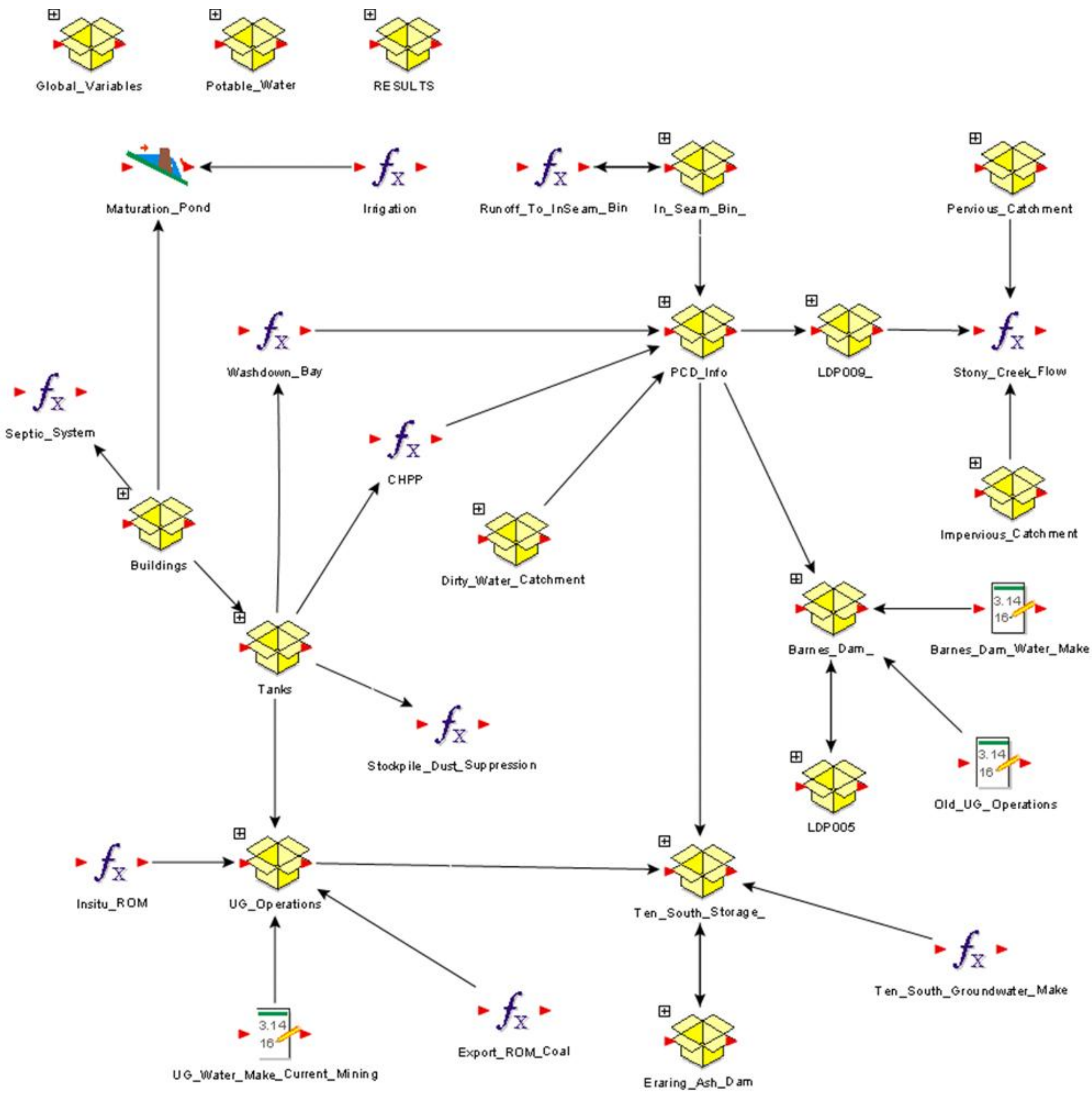
Appendix A

Goldsim - Existing Operations

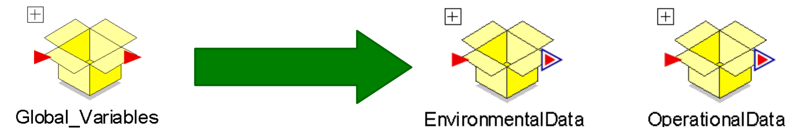
GOLDSIM MODEL LAYOUT

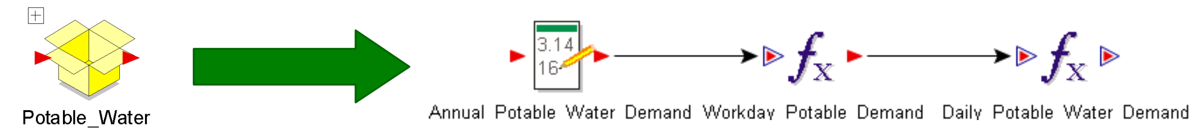
EXISTING OPERATIONS – BROAD SCALE VIEW

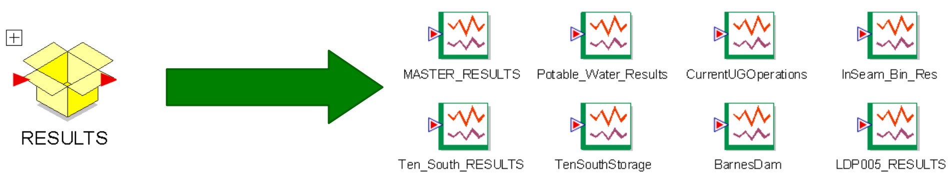


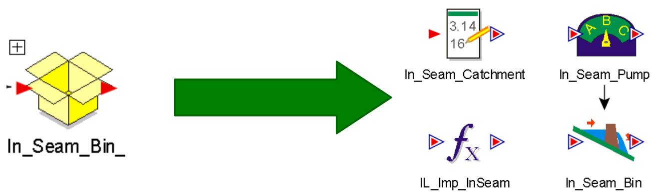
GOLDSIM MODEL LAYOUT

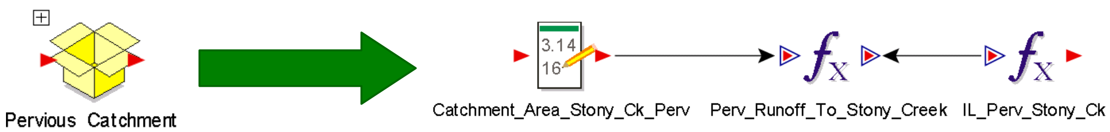
EXISTING OPERATIONS – DETAILED VIEW

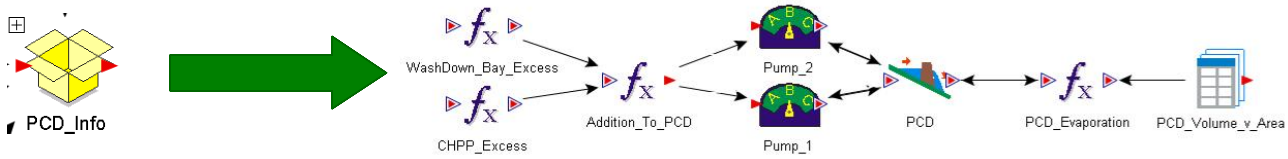








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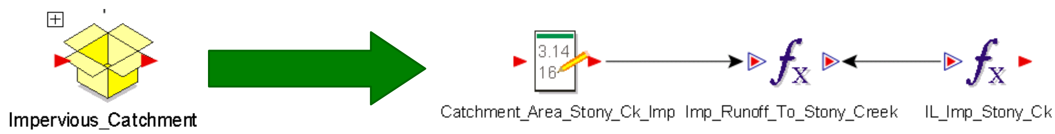
WashDown_Bay_Excess
CHPP_Excess
Addition_To_PCD
Pump_2
Pump_1
PCD
PCD_Evaporation
PCD_Volume_v_Area


LDP009_
LDP009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3.14
16
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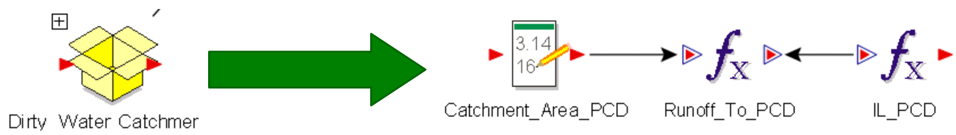
Imp_Runoff_To_Stony_Creek
IL_Imp_Stony_Ck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16
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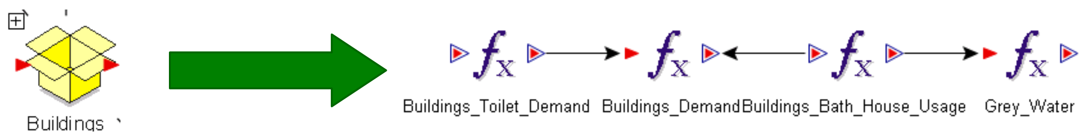
Runoff_To_PCD
IL_PCD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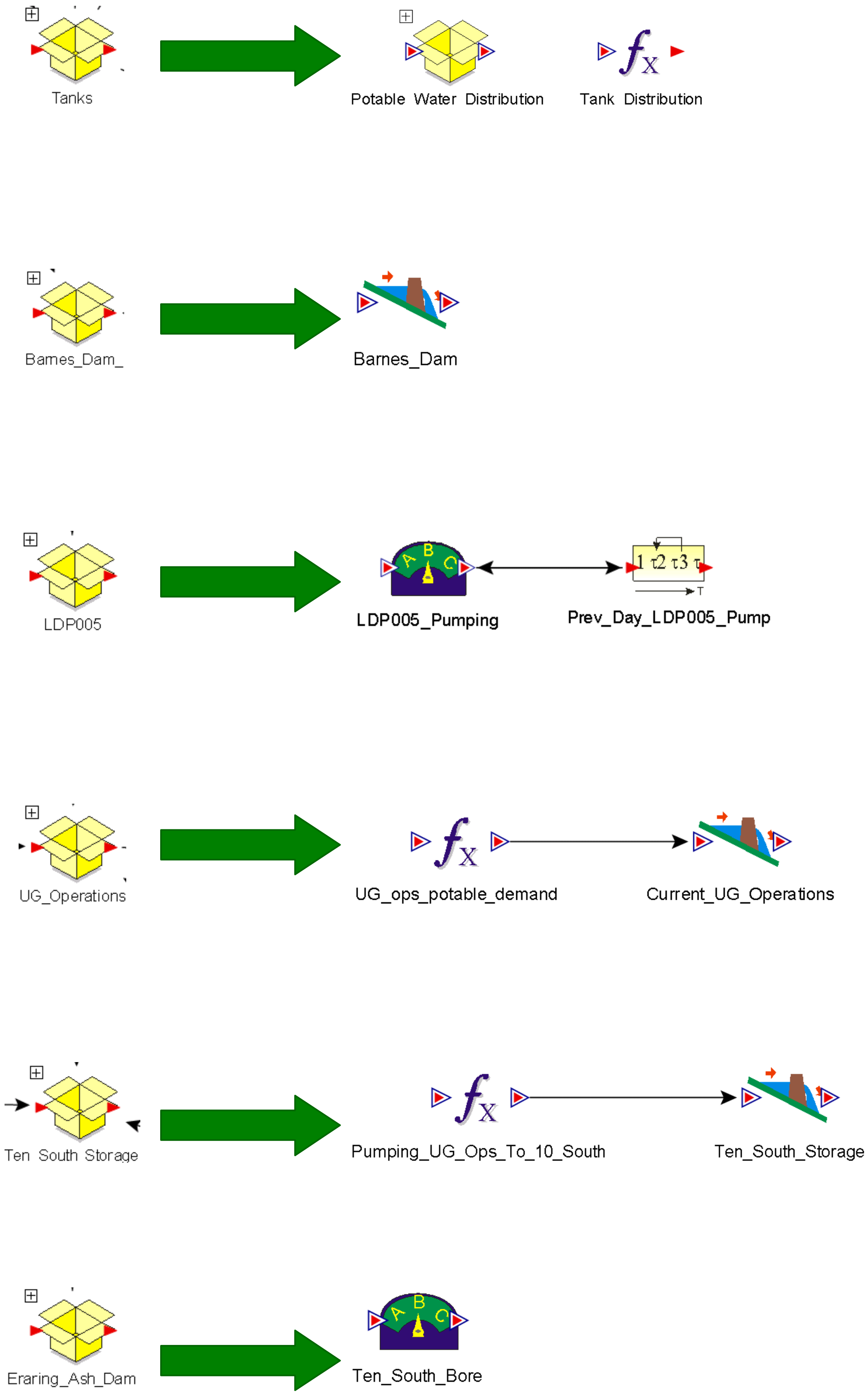
Buildings_Demand
Buildings_Bath_House_Usage
Grey_Water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Tank Distribution
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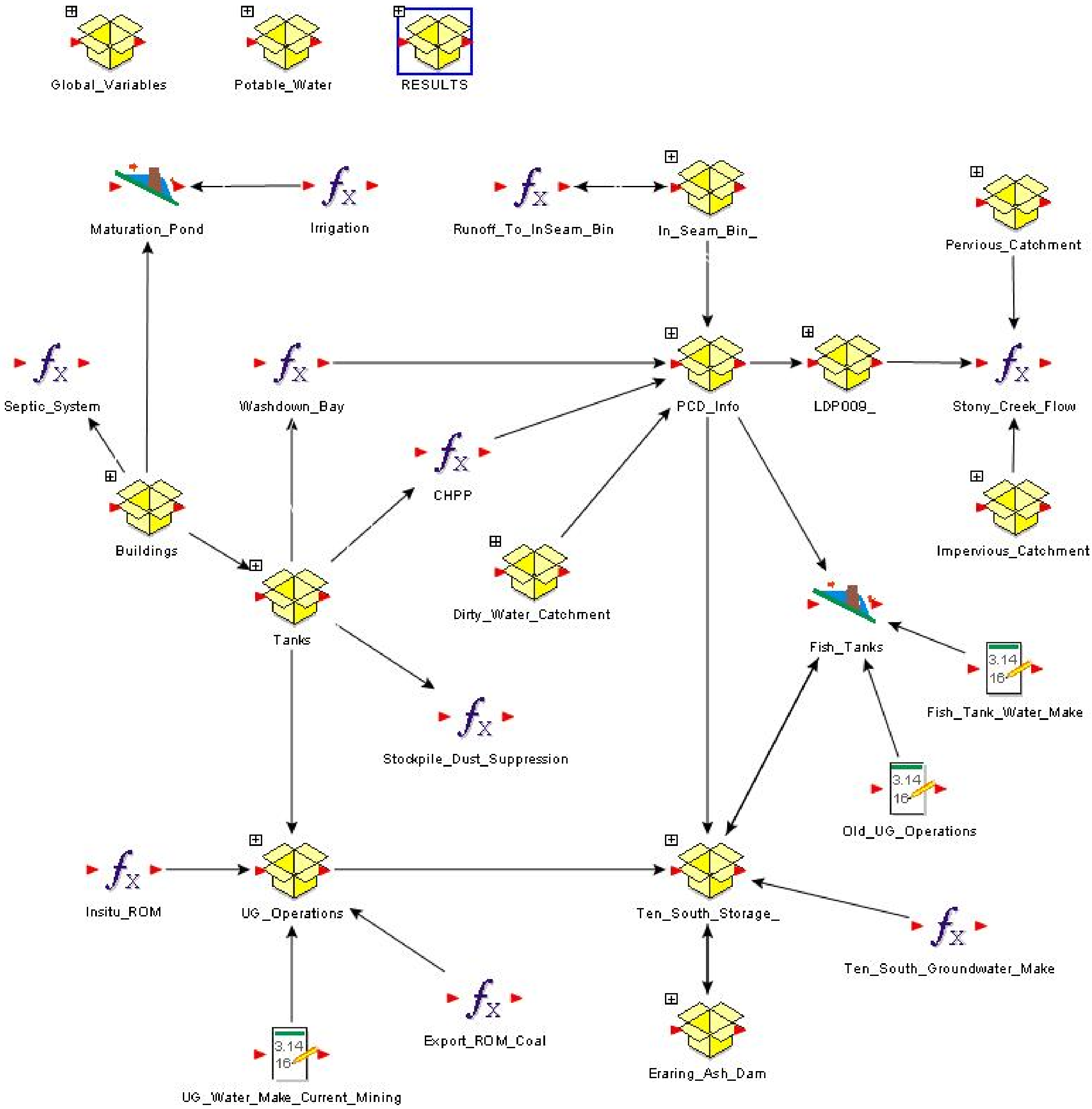
Barnes_Dam
LDP005
LDP005_Pumping
Prev_Day_LDP005_Pump
UG_Operations
UG_ops_potable_demand
Current_UG_Operations
Ten South Storage
Pumping_UG_Ops_To_10_South
Ten_South_Storage
Eraring_Ash_Dam
Ten_South_Bore

Appendix B

Goldsim - Proposed Operations

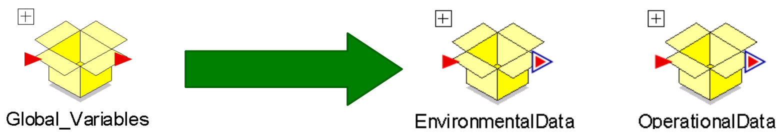
GOLDSIM MODEL LAYOUT

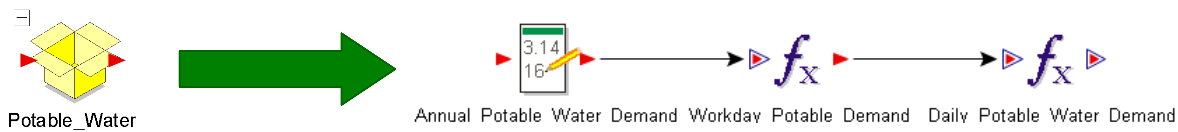
PROPOSED OPERATIONS – BROAD SCALE VIEW

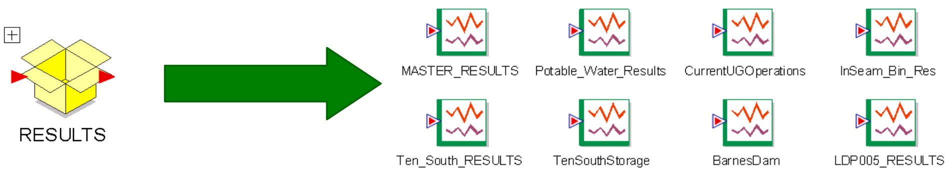


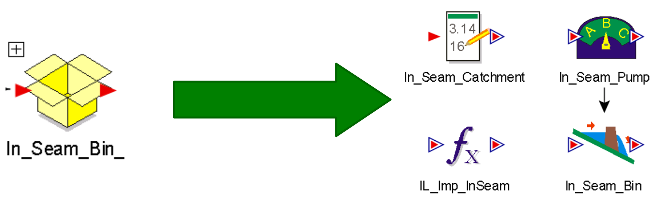
GOLDSIM MODEL LAYOUT

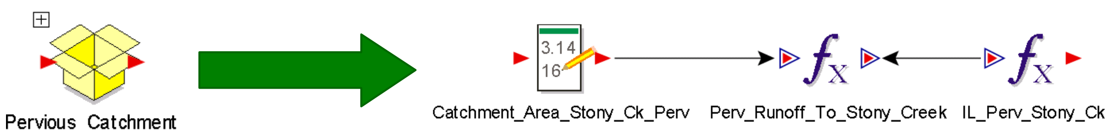
PROPOSED OPERATIONS – DETAILED VIEW

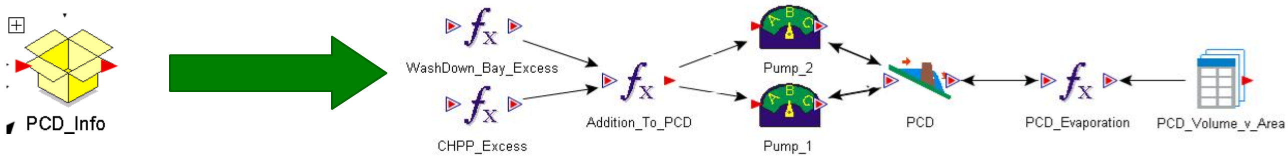








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WashDown_Bay_Excess
CHPP_Excess
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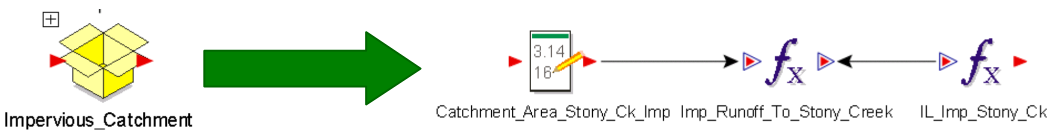
Pump_2
Pump_1
PCD
PCD_Evaporation
PCD_Volume_v_Area


LDP009_
LDP009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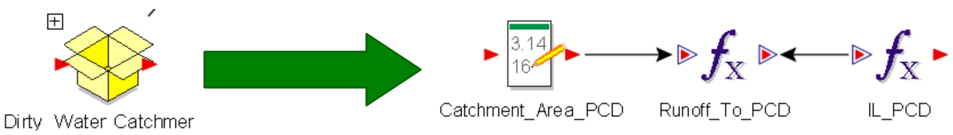
Catchment_Area_Stony_Ck_Imp
Imp_Runoff_To_Stony_Creek
IL_Imp_Stony_Ck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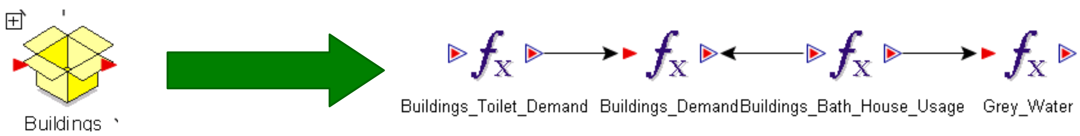
Catchment_Area_PCD
Runoff_To_PCD
IL_PCD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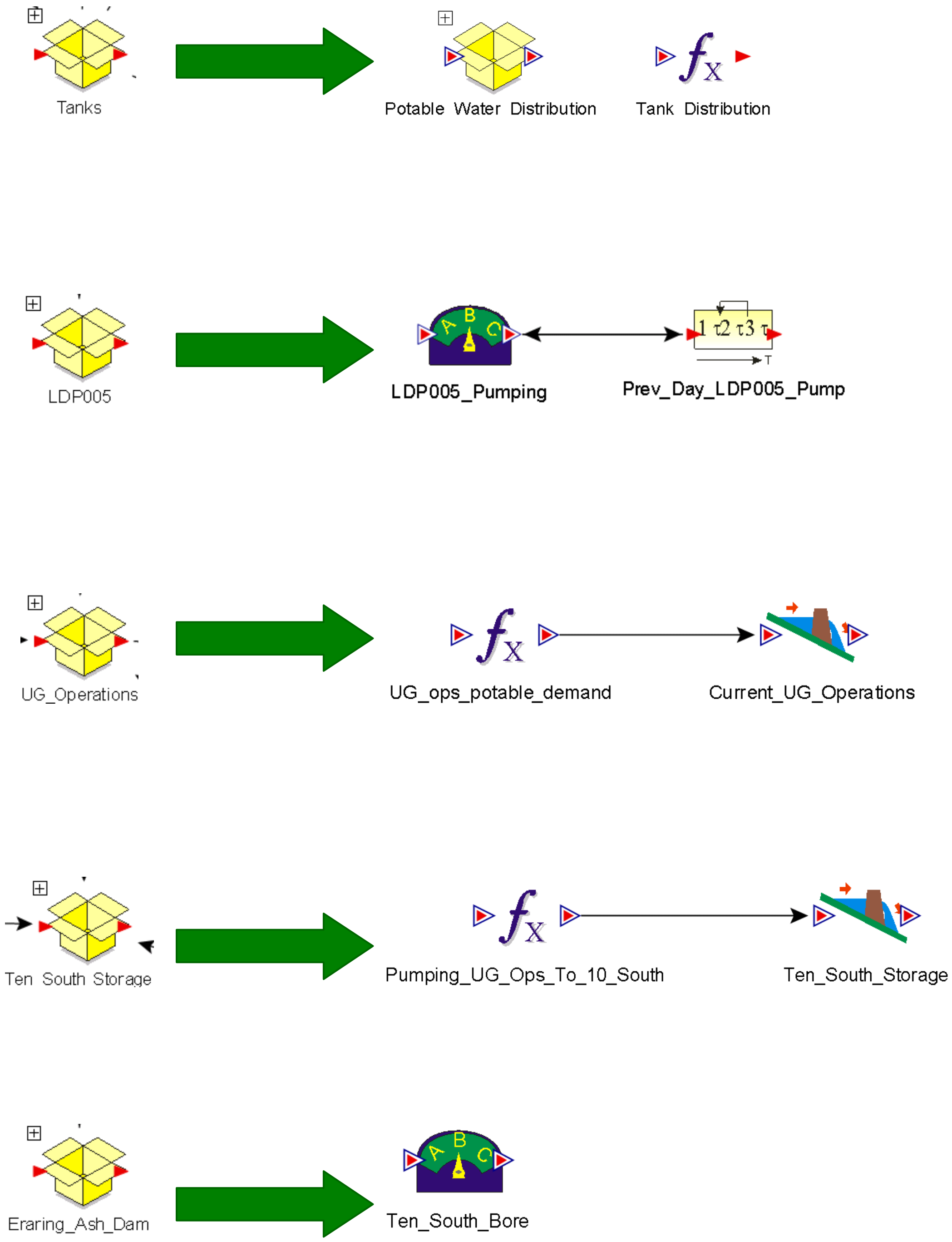
Buildings_Toilet_Demand
Buildings_Demand
Buildings_Bath_House_Usage
Grey_Water



Tanks
Potable Water Distribution
Tank Distribution
LDP005
LDP005_Pumping
Prev_Day_LDP005_Pump
UG_Operations
UG_ops_potable_demand
Current_UG_Operations
Ten South Storage
Pumping_UG_Ops_To_10_South
Ten_South_Storage
Eraring_Ash_Dam
Ten_South_Bore

Centennial Coal

Appendix C

Goldsim - Results

EXISTING OPERATIONS

	Daily Potable Water Demand	Building Demand	Washdown Bay Demand	Coal Handling Processing Plant	Stockpile Dust Depression Demand	UG Operations Potable Demand	Buildings Toliets Demand	Buildings Bath-house Usage	Insitu ROM	Export ROM Coal	UG Water Make from Current Mining	Pumping from UG Operations to 10 South	Pumping from Pollution Control Dam to 10 South (Pump 1)	10 South Groundwater Make Inflow	10 South Bore	Runoff to Pollution Control Dam	In Seam Bin Pump	LDP009	Pumping from Pollution Control Dam to Barnes Dam (Pump 2)	Washdown Bay Excess	CHPP Excess	Old Underground Operations	LDP005 Pumping	Pervious Runoff to Stony Creek	Impervious Runoff to Stony Creek	Pollution Control Dam Evaporation	Barnes Dam Water Make
Units	ML/yr	ML/yr	ML/yr	ML/yr	ML/yr	ML/yr	ML/yr	ML/yr	ML/yr	ML/yr	ML/yr	ML/yr	ML/yr	ML/yr	ML/yr	ML/yr	ML/yr	ML/yr	ML/yr	ML/yr	ML/yr	ML/yr	ML/yr	ML/yr	ML/yr	ML/yr	ML/yr
Current Operations																											
Mean	44.3	4.9	2.2	0.9	1.2	35.2	1.0	3.9	47.5	47.5	0.0	35.2	10.2	109.6	155.0	18.6	3.7	1.0	12.6	1.1	0.4	0.0	122.1	165.3	42.0	0.0	109.6
Max	44.4	4.9	2.2	0.9	1.2	35.3	1.0	3.9	47.6	47.6	0.0	35.3	16.0	109.8	160.7	34.9	7.0	7.8	21.4	1.1	0.4	0.0	129.0	341.7	79.0	0.0	109.8
Min	44.3	4.9	2.2	0.9	1.1	35.2	1.0	3.9	47.4	47.4	0.0	35.2	6.6	109.5	151.3	7.1	1.4	0.0	3.5	1.1	0.4	0.0	114.0	43.6	16.2	0.0	109.5

PROPOSED OPERATIONS

	Daily Potable Water Demand	Building Demand	Washdown Bay Demand	Coal Handling Processing Plant	Stockpile Dust Depression Demand	UG Operations Potable Demand	Buildings Toliets Demand	Buildings Bath-house Usage	Moisture Content Insitu ROM	Export ROM Coal	UG Water Make from Current Mining	Pumping from UG Operations to 10 South	Pumping from Pollution Control Dam to 10 South (Pump 1)	10 South Groundwater Make Inflow	10 South Bore	Runoff to Pollution Control Dam	In Seam Bin Pump	LDP009	Pumping from Pollution Control Dam to 10 South (Pump 2)	Washdown Bay Excess	CHPP Excess	Old Underground Operations	Fish tanks to 10 South Storage Area	Pervious Runoff to Stony Creek	Impervious Runoff to Stony Creek	Pollution Control Dam Evaporation	Fish Tank Water Make
Units	ML/yr	ML/yr	ML/yr	ML/yr	ML/yr	ML/yr	ML/yr	ML/yr	ML/yr	ML/yr	ML/yr	ML/yr	ML/yr	ML/yr	ML/yr	ML/yr	ML/yr	ML/yr	ML/yr	ML/yr	ML/yr	ML/yr	ML/yr	ML/yr	ML/yr	ML/yr	ML/yr
Proposed Operations																											
Mean	44.3	4.9	2.2	0.9	1.2	35.2	1.0	3.9	52.2	52.2	0.0	35.2	19.5	109.6	173.6	18.6	3.7	0.2	2.8	1.1	0.4	0.0	112.2	165.3	42.0	1.4	109.6
Max	44.4	4.9	2.2	0.9	1.2	35.3	1.0	3.9	52.3	52.3	0.0	35.3	30.4	109.8	173.9	34.9	7.0	3.6	8.0	1.1	0.4	0.0	115.5	341.7	79.0	1.4	109.8
Min	44.3	4.9	2.2	0.9	1.1	35.2	1.0	3.9	52.2	52.2	0.0	35.2	8.2	109.5	173.2	7.1	1.4	0.0	0.3	1.1	0.4	0.0	109.8	43.6	16.2	1.4	109.5

Centennial Coal

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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	MJ Piggott	G. Wood per		G. Wood per		2.9.10

Appendix C

Water Quality

Upstream Water Quality Data

Date of Sample	pH	TSS	Ec (uS/cm)	Turbidity (NTU)	Arsenic	Copper	Lead	Zinc	Arsenic (dissolved)	Copper (dissolved)	Lead (dissolved)	Zinc (dissolved)	Bicarbonate Alkalinity as CaCO3
24/09/2009	7.80	25	2280	55.8	0.001	0.001	0.00	0.011	0.00	0.001	0.00	0.007	278
8/10/2009	7.08	8	572		0.00	0.002	0.00	0.021	0.00	0.002	0.00	0.008	92
22/10/2009	7.83	6	2080	1.3	0.00	0.00	0.00	0.006	0.00	0.004	0.00	0.00	292
5/11/2009	7.65	4	1870		0.00	0.004	0.00	0.016	0.00	0.001	0.00	0.012	270
19/11/2009	7.59	17	1380	36.7	0.002	0.001	0.00	0.024	0.00	0.001	0.00	0.011	186
2/12/2009	7.88	5	2060		0.00	0.001	0.00	0.013	0.00	0.00	0.00	0.009	295
17/12/2009	7.82	31	2000	4.3	0.001	0.00	0.00	0.010	0.00	0.00	0.00	0.005	296
14/01/2010	8.64	5	2400	6.7	0.00	0.001	0.00	0.011	0.00	0.002	0.00	0.012	270
28/01/2010	7.70	7	1390	18.4	0.00	0.001	0.00	0.012	0.00	0.002	0.00	0.00	215
11/02/2010	8.15	6	2130	5.2									386
25/02/2010	8.02	8	2550		0.00	0.00	0.00	0.008	0.00	0.001	0.00	0.009	362
12/03/2010	8.04	<1	2160	0.3	0.00	0.00	0.00	0.009	0.00	0.00	0.00	0.008	312
80th Percentile	***8.04***	***9***	***2420***	***29.38***	***0.001***	***0.001***	***0.000***	***0.016***	***0.00***	***0.002***	***0.00***	***0.011***	***308.8***
Default ANZECC	***6.5 - 8.0***	***6 - 50***	***125 -2200***	***6 - 50***	***0.013***	***0.0014***	***0.0034***	***0.008***	***0.013***	***0.0014***	***0.0034***	***0.008***	***60***
Hardness						***0.0073***	***0.040***	***0.042***		***0.0073***	***0.040***	***0.042***	

Centennial Coal

LDP005 Water Quality Data

Date of Sample	pH	TSS	Ec (uS/cm)	Turbidity (NTU)	Arsenic	Copper	Lead	Zinc	Arsenic (dissolved)	Copper (dissolved)	Lead (dissolved)	Zinc (dissolved)
22/04/2004	7.17	1	3170	1.3		0.001	0.01					
27/05/2005	7.3	1	2880	1.1		0.002	0.001	0.146				
8/06/2006	6.96	1	2520	0.4		0.001	0.001	0.057				
24/08/2007	7.56	1	2910	0.4		0.001	0.001	0.022	0.001	0.001	0.001	0.016
8/02/2008	7.92	1	2000	1.8		0.002	0.001	0.021	0.001	0.001	0.001	0.024
22/08/2008	8.71	1	2150	1.8		0.002	0.001	0.093	0.001	0.001	0.001	0.098
16/02/2009	7.65	30	3840	34.6	0.001	0.004	0.001	0.234				
17/02/2009	7.95	24	3820	34.5	0.001	0.003	0.001	0.186				
13/08/2009	7.71	76	2580	98.3		0.004	0.002	0.102	0.001	0.001	0.001	0.018
30/10/2009	7.22	5	2120					0.022	0.001	0.001	0.001	0.011
25/11/2009	7.90	2	2030		0.001	0.001	0.001	0.021	0.001	0.001	0.001	0.013
17/12/2009	7.65	11	2570	11.3	0.001	0.001	0.001	0.230	0.001	0.001	0.001	0.007
20/01/2010	7.82	14	2730	10.8	0.001	0.001	0.001	0.028	0.001	0.006	0.001	0.022
28/01/2010	7.75	7	2600	3.1	0.001	0.002	0.001	0.039	0.001	0.001	0.001	0.007
22/02/2010	7.93	1	2460	6	0.001	0.002	0.001	0.036	0.001	0.001	0.001	0.017
15/03/2010	7.99	9	2600	11	0.001	0.003	0.001	0.039	0.001	0.001	0.001	0.011
80th Percentile	***7.64***	***5.2***	***2910***	***11.38***	***0.001***	***0.003***	***0.001***	***0.154***	***0.001***	***0.001***	***0.001***	***0.022***
Default ANZECC	***6.5 - 8.0***	***6 - 50***	***125 -2200***	***6 - 50***	***0.013***	***0.0014***	***0.0034***	***0.008***	***0.013***	***0.0014***	***0.0034***	***0.008***
Hardness						***0.0073***	***0.040***	***0.042***		***0.0073***	***0.040***	***0.042***

10 South Water Quality Data

Date of Sample	pH	TSS	Ec (uS/cm)	Turbidity (NTU)	Arsenic	Copper	Lead	Zinc	Arsenic (dissolved)	Copper (dissolved)	Lead (dissolved)	Zinc (dissolved)
27/05/2005	7.6	2	7240	1.5	0.001	0.002	0.001	0.023				
8/06/2006	7.01	8	5610	5.8	0.002	0.009	0.016	0.110				
24/08/2007	7.65	3	4810	5.1	0.002	0.001	0.001	0.022	0.001	0.002	0.001	0.011
22/08/2008	8.51	1	5650	1.1	0.001	0.002	0.002	0.021	0.001	0.002	0.005	0.018
13/08/2009	7.49	2	6040	1.9	0.001	0.005	0.001	0.071	0.001	0.002	0.001	0.038
11/02/2010	7.59	17	7940	0.5	0.001	0.012	0.001	0.020	0.001	0.004	0.001	0.022
12/03/2010	7.57	2	9260	0.4	0.001	0.002	0.001	0.019	0.001	0.002	0.001	0.019
80th Percentile	***7.65***	***4***	***7940***	***5.14***	***0.0018***	***0.008***	***0.0018***	***0.055***	***0.001***	***0.0024***	***0.0018***	***0.025***
Default ANZECC	***6.5 - 8.0***	***6 - 50***	***125 -2200***	***6 - 50***	***0.013***	***0.0014***	***0.0034***	***0.008***	***0.013***	***0.0014***	***0.0034***	***0.008***
Hardness						***0.0073***	***0.040***	***0.042***		***0.0073***	***0.040***	***0.042***

Lake Macquarie Water Quality Data

Date of Sample	pH	TSS	Ec (uS/cm)	Manganese Filt	Iron (filt)	Turbidity (NTU)	Aluminium	Arsenic	Boron	Copper	Iron Total	Lead	Manganese Total	Zinc	Aluminium (dissolved)	Arsenic (dissolved)	Boron (dissolved)	Copper (dissolved)	Lead (dissolved)	Zinc (dissolved)
26/08/2008	8.32	10	45800	<0.010	<0.50	6.4	0.21	<0.010	4.77	<0.020	<0.50	<0.010	<0.010	<0.050	<0.10	<0.010	3.08	<0.020	<0.010	<0.050
27/08/2008	7.94	430	44100	<0.010	<0.50	248	9.55	<0.010	3.25	0.036	8.19	0.06	0.186	0.178	<0.10	<0.010	3.09	<0.020	<0.010	<0.050
28/08/2008	8.11	271	39500	<0.010	<0.50	125	2.97	<0.010	3.58	<0.020	3.54	0.024	0.082	0.077	<0.10	<0.010	3.6	<0.020	<0.010	<0.050
29/08/2008	8.05	206	43500	<0.010	<0.50	124	3.46	<0.010	3.25	0.021	3.63	0.028	0.11	0.094	<0.10	<0.010	3.3	<0.020	<0.010	<0.050
5/09/2008	7.06	208	40100	0.081	1.66	125	5.07	0.01	3.64	0.026	5.55	0.032	0.107	0.159	0.61	<0.010	2.94	<0.020	0.026	0.082
8/09/2008	7.16	265	20200	0.013	0.06	181	3.16	0.005	1.69	0.014	3.22	0.021	0.125	0.092	0.08	<0.001	1.73	0.002	0.002	0.014
9/09/2008	7.48	82	13000	0.159	<0.05	63.3	1.66	0.003	1.13	0.008	1.44	0.009	0.254	0.041	0.06	0.001	1.06	0.003	0.001	0.01
10/09/2008	7.58	11	24400	0.036	<0.05	9.8	0.39	<0.001	1.88	0.005	0.25	0.002	0.058	0.013	0.04	0.002	2.04	0.003	<0.001	0.005
11/09/2008	7.67	108	26900	0.013	<0.05	54	1.29	0.002	1.72	0.009	1.38	0.008	0.092	0.035	0.03	<0.001	1.6	0.004	<0.001	0.006
12/09/2008	7.48	13	27300	0.031	<0.05	9.4	0.32	<0.001	1.63	0.005	0.25	0.002	0.048	0.012	0.02	<0.001	2.26	0.003	<0.001	0.006
17/09/2008	7.3	70	46400	<0.010	<0.50	30.6	1.31	<0.010	3.2	<0.020	1.7	0.013	0.08	0.062	<0.10	<0.010	3.08	<0.020	<0.010	<0.050
19/09/2008	7.42	30	48000	<0.010	<0.50	20.1	0.66	<0.010	4.09	<0.010	0.75	<0.010	0.045	<0.050	<0.10	<0.010	3.57	<0.010	<0.010	<0.050
25/09/2008	8.05	31	40100	<0.010	<0.50	11.9	0.26	<0.010	4.07	<0.010	<0.50	<0.010	0.021	<0.050	<0.10	<0.010	3.36	<0.010	<0.010	<0.050
2/10/2008	8.04	85	44700	<0.010	<0.50	34	0.77	0.01	3.94	<0.020	1.16	<0.010	0.056	<0.050	<0.10	<0.010	3.46	<0.020	<0.010	<0.050
10/10/2008	6.92	20	40900	<0.010	<0.50	11.6	0.94	<0.010	2.66	<0.010	1.12	<0.010	0.107	<0.050	<0.10	<0.010	2.86	<0.010	<0.010	<0.050
50th Percentile	7.58	82	40100	0.0335	0.86	34	1.29	0.005	3.25	0.0115	1.44	0.017	0.087	0.0695	0.05	0.0015	3.08	0.003	0.002	0.008

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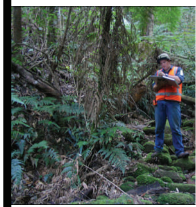
Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	M.Piggott	G.Wood per		G.Wood per		2.9.10

CULTURAL HERITAGE IMPACT ASSESSMENT








APPENDIX 7

RPS

Cultural Heritage Impact Assessment

For Awaba Colliery

Prepared by:

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Draft A	Draft for Client Review	TBM	DR	14.5.10	WJ 14.5.10	DR	15.6.10
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Disclaimers

Executive Summary

This Cultural Heritage Impact Assessment (CHIA) has been prepared for Centennial for proposed mining in the Awaba Colliery. This document has been prepared to assess the cultural heritage impacts associated with the *Awaba Colliery Continuation of Mining Project* (the Project). This report will also support an Environmental Assessment for the Project to be submitted to the Department of Planning under Part 3A of the Environmental Planning and Assessment Act (1979).

The application area for the Project has been divided into four study areas. Study Area 1 includes the pit top facilities and ancillary infrastructure, Study Area 2 comprises the Revised Stage 3 Area and the remaining coal to be mined from the existing Main South Stage 2 approved SMP area, Study Area 3 comprises the East B Area, while the existing internal private coal haul road is Study Area 4.

This report is based on a number of heritage assessments which have been undertaken in the project application area. This report has provided an outline of heritage within the four study areas which make up the project application area and has considered the environmental and archaeological context of these areas. The proposed impacts to Aboriginal and non-Indigenous heritage has been assessed in relation to intended activities within the project application area. It has been prepared in accordance with DECC Standards and Guidelines Kit (NSW National Parks and Wildlife Service 1997).

Recommendations for each study area have been formulated with respect to Aboriginal and non-Indigenous heritage, followed by more general recommendations which relate to the overall project area.

The following is a summary of the recommendations proposed for the Project:

- There are no Aboriginal heritage constraints for the proposed activities in Study Areas 1 or 4;
- There are no non-Indigenous heritage constraints 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 widening of the pollution control dam;
- Areas of moderate and high archaeological sensitivity in Study Area 2, and moderate archaeological sensitivity in Study Area 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 NP&W 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;
- The cultural heritage management plan should be updated as part of the ongoing management of heritage within Awaba Colliery;

- 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.

Contents

Figures

Tables

Plates

Appendices

1 Introduction

RPS has been commissioned by GSS Environmental (GSSE) on behalf of Centennial Coal Company Limited (Centennial) to provide a Cultural Heritage Impact Assessment (CHIA) which addresses mining activities within the Awaba Colliery lease area, which have been separated into four study areas. The main portion of the project application area is located approximately 1.5 km south of the township of Awaba in the Lake Macquarie LGA, but also includes a haul road extending to Eraring Power Station in the southwest and the Newstan Colliery in the northeast. Its land tenure is Crown land which is under lease to Centennial. This CHIA has been compiled using information from previous archaeological investigations and impact assessed in accordance with the four study areas.

1.1 Background

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 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 site is situated on crown land under lease to Centennial for the purpose of mining under Consolidated Coal Lease CCL746, and is adjacent to the Newstan-Eraring haul road owned by Eraring Energy. The locality of the mine is illustrated on Figure 1-1.

Awaba Colliery is a small operation with approximately 100 employees and contractors, 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.

A form of pillar extraction of narrow panels is used to recover coal in pillars developed previously by bord and pillar methods. 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 has been developed in consultation with the Department of Primary Industries – Mineral Resources (now known as Industry and Investment, NSW (I&I)) and has been used successfully to date, and is proposed to be continued for the Project.

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. A detailed description of the Project and the **Project Application Area (the "Application Area")** (including focus study areas) is detailed further in Sections 1.2 and 1.3 below.

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 outlined in Sections 1.2 and 1.3 below.

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 (refer Section 1.2.1) over a period of approximately five years or more, depending on actual mining conditions and relevant market drivers. The application for the proposed Project is supported by an Environmental Assessment ("EA").

1.2 The 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 1.2.1. 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.

1.2.1 Study Areas

The Study Areas that have been assessed as part of this EA are shown on Figure 1-3 and Figure 1-4 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 Figure 1-4); 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 Section 96(1A) of 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 will also be addressed in the EA.

1.3 Project Description

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 to utilise existing ancillary surface facilities (all Study Areas);
- Expand the existing final Pollution Control Dam (refer Study Area 1);
- Continue the delivery of coal to the Newstan Colliery and/or Eraring Power Station using the existing private haul road/transport facilities (refer Study Area 4).

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 Figure 1-2.

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 Figure 1-2:

- 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).

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 1-4) 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 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 NSW in 2009, until such time that a final Detailed Life of Mine Strategy has been developed.

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

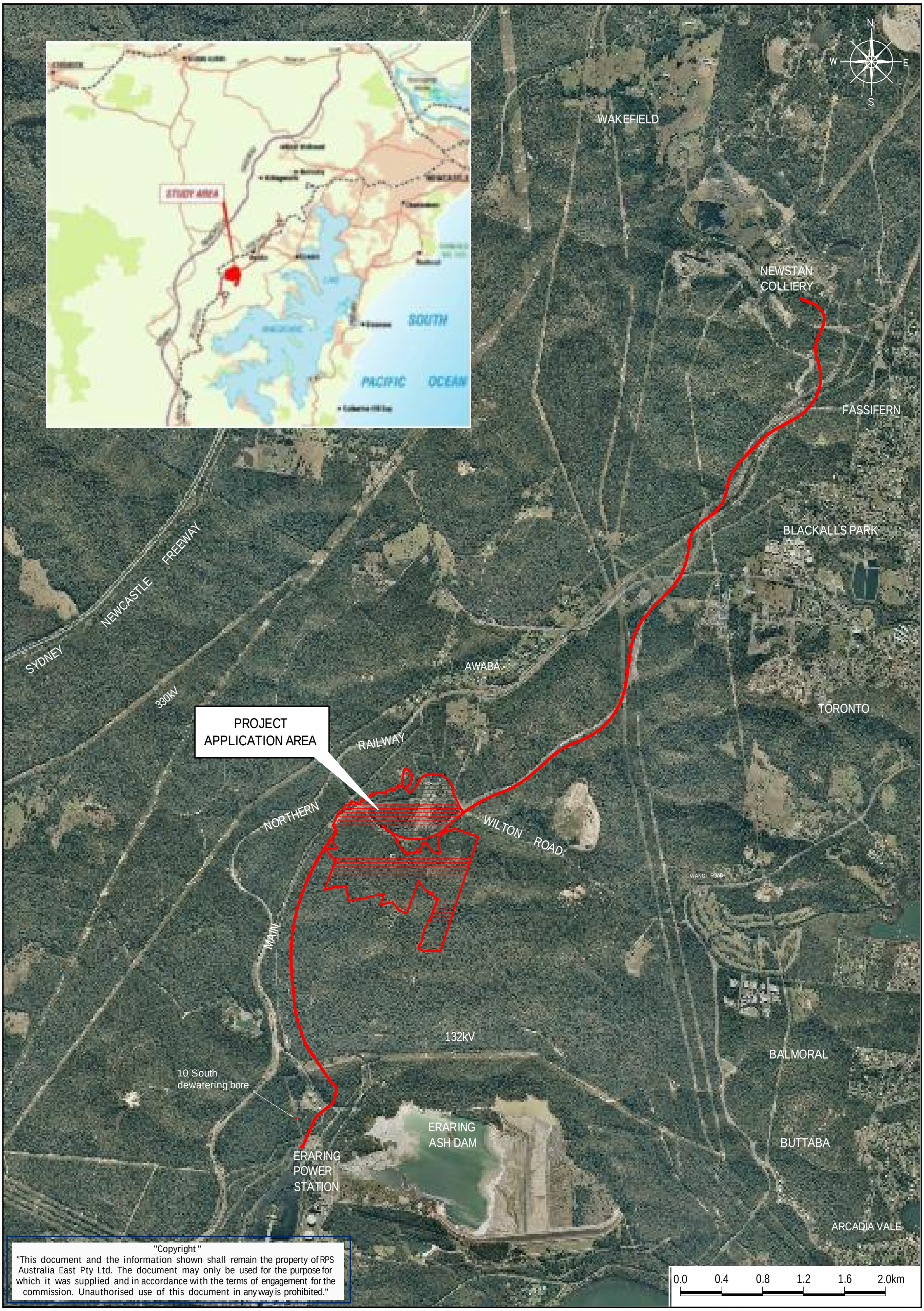
Awaba Colliery requires approval to deliver coal via the private haul road to the Newstan Colliery ROM coal stockpile (in addition to the Rail Loop stockpile). This is assessed within **Study Area 4**. Newstan Colliery has submitted an application to modify its development consent in order to process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

Existing mining areas, will continue to be utilised for ongoing mining operations including (but not limited to) mine access, emergency management and underground services and infrastructure.

Continuing Mine Operations:

For the purposes of environmental assessment, further to the information above regarding continued mining areas, it is noted that the following aspects of mine operations are proposed to continue and remain unchanged. Existing mining operations are presented in detail in Section 3 of the *Environmental Assessment (EA)* and, where relevant, components are discussed further in this specialist report.

- **Coal Handling, preparation and stockpiles** – No changes are proposed to the current coal handling, preparation or stockpile procedures to the existing operations;
- **Mine support facilities and site access** – No changes are proposed to the current infrastructure and facilities, with the only exclusion being the expansion of the Pollution Control Dam (PCD) mentioned earlier above, with related water management considerations. Mine access from Wilton Road will continue to be utilised and no significant change is anticipated from current use;
- **Plant and equipment** – No changes are proposed to the typical plant and equipment used at the Awaba Colliery;
- **Transportation procedures** – 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;
- **Mining methodology** – There will be no significant changes to current mining methods 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 (financial year), depending on mining efficiency and market demands;
- **Operational water management** – 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;
- **Mine dewatering procedures** – the10 South Bore will continue to be used for groundwater management and dewatering during both continued operation and care and maintenance conditions.



TITLE: FIGURE 1-1 STUDY AREA

LOCATION: AWABA

DATUM: DATUM

PROJECTION: MGA ZONE 56 (GDA 94)

DATE: 3/09/2010

PURPOSE: HERITAGE ASSESSMENT

CAD REF: Fig 1-1 Location Plan 100830

VERSION (PLAN BY): A A4 NW (TBM)

CLIENT: CENTENNIAL

JOB REF: 26171

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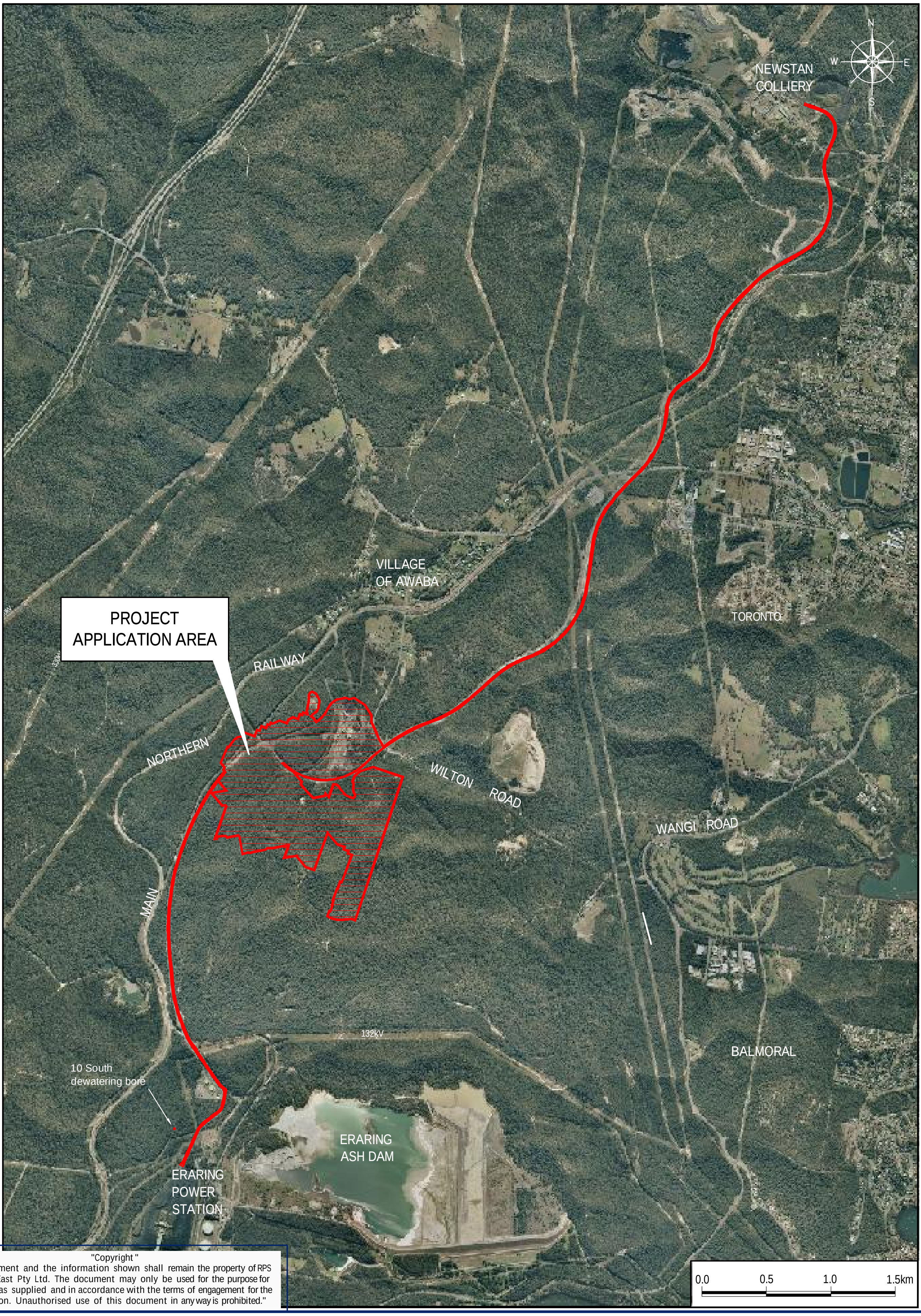

TITLE: Fig 1-2 Project Application Area
LOCATION: AWABA
DATUM: DATUM
PROJECTION: MGA ZONE 56 (GDA 94)
DATE: 3/09/2010
PURPOSE: HERITAGE ASSESSMENT
CAD REF: Fg1.2 Project App Areas100830
VERSION (PLAN BY): A A4 NW (TBM)

CLIENT: CENTENNIAL
JOB REF: 26171

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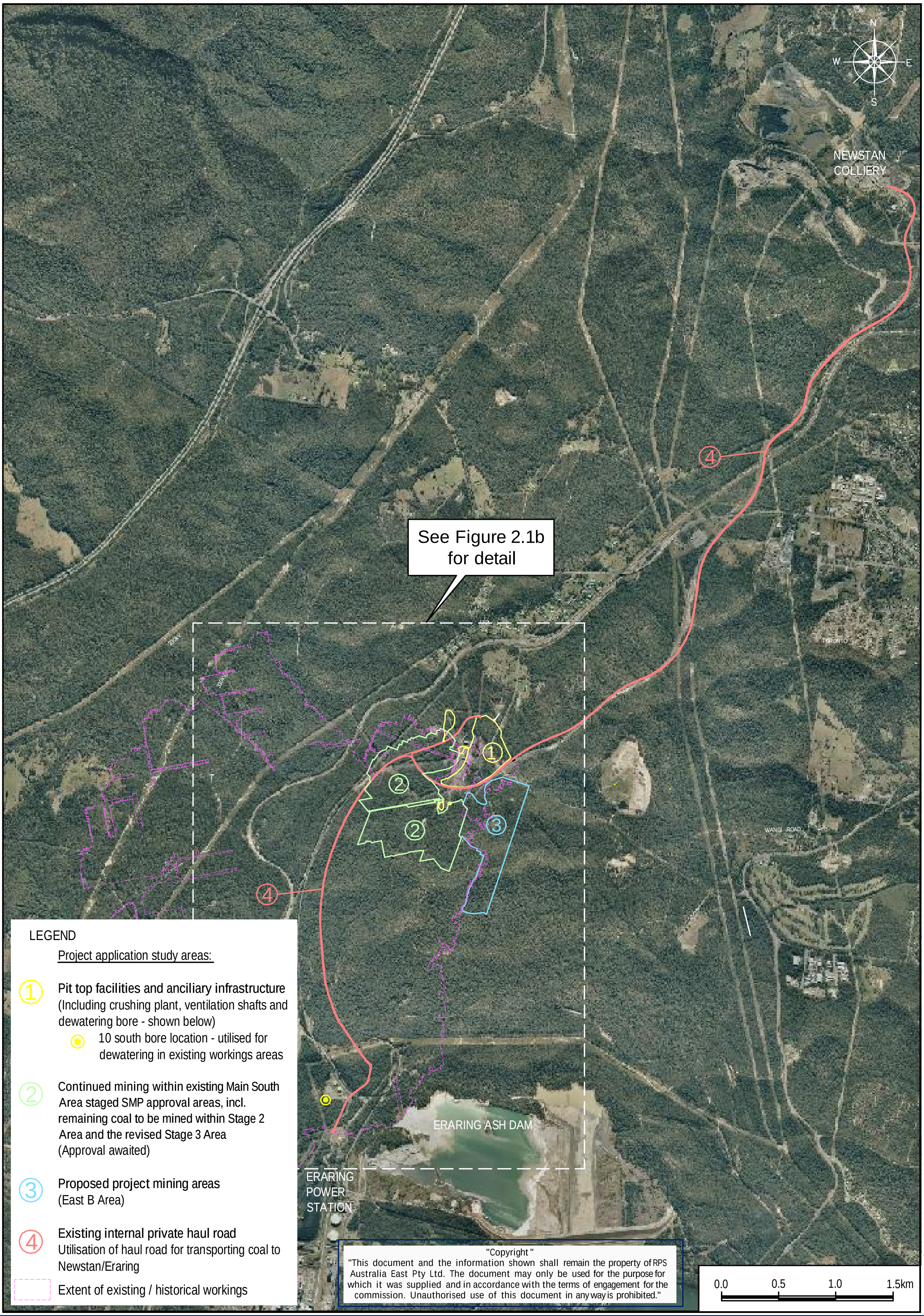

TITLE: FIGURE 1-3 Project Application Study Area

LOCATION: AWABA

DATUM: DATUM

PROJECTION: MGA ZONE 56 (GDA 94)

DATE: 3/09/2010

PURPOSE: HERITAGE ASSESSMENT

CAD REF: Fg2-1a Project App Study Areas 100810

VERSION (PLAN BY): A A4 NW (TBM)

CLIENT: CENTENNIAL

JOB REF: 26171

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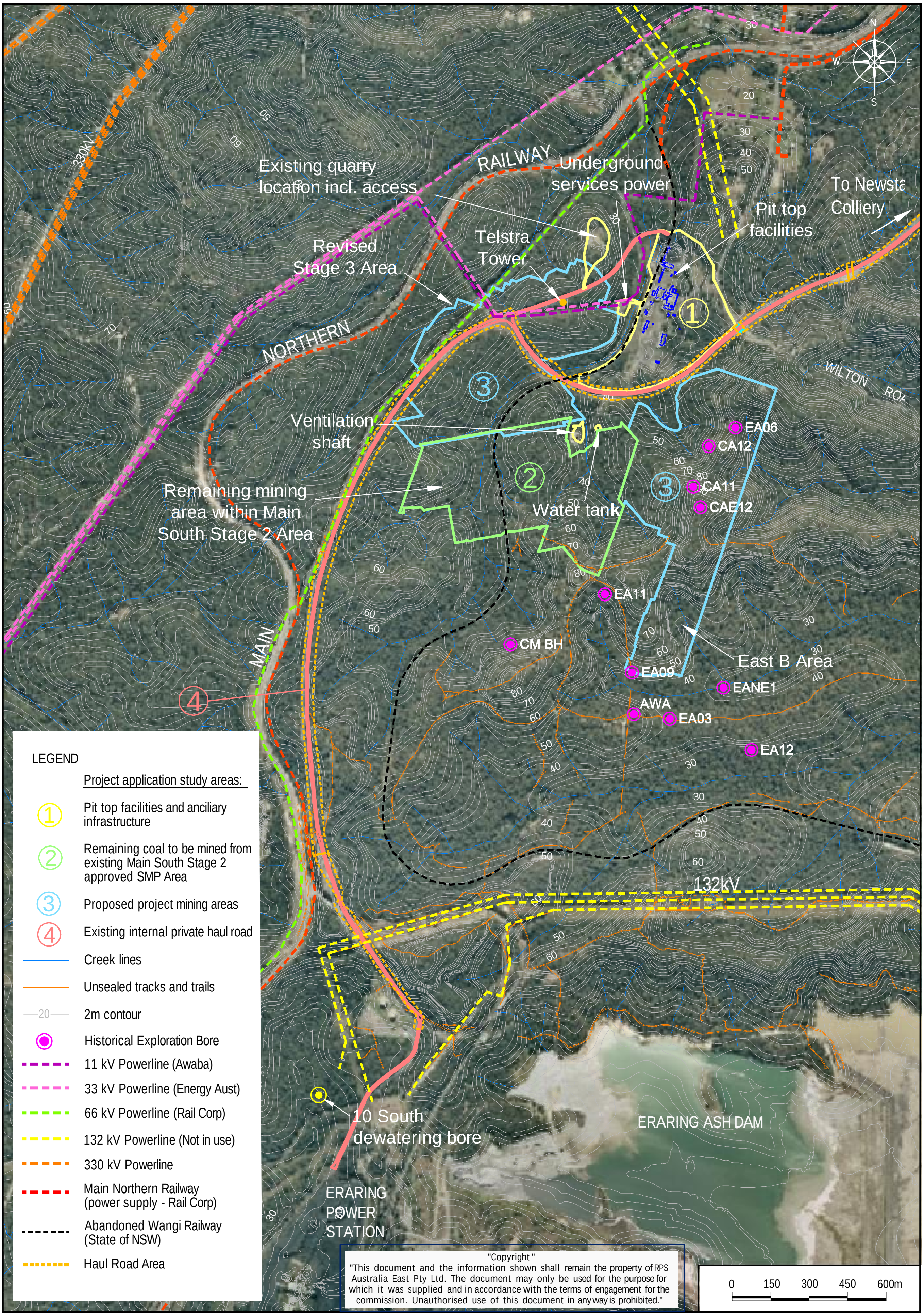

TITLE: Fig 1-4 Project Application Study Area Detailed	LOCATION: AWABA	DATUM: DATUM PROJECTION: MGA ZONE 56 (GDA 94)	DATE: 3/09/2010 PURPOSE: HERITAGE ASSESSMENT	CAD REF: Fg2-1b Project App Study Areas det 100810 VERSION (PLAN BY): A A4 NW (TBM)

CLIENT: CENTENNIAL
JOB REF: 26171

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1.4 Legislative Context

Aboriginal heritage (places, sites and objects) within NSW are protected by *National Parks and Wildlife Act (1974, as amended).* In some cases, Aboriginal heritage may also be protected under the *Heritage Act (1977)*. The *Environmental Planning and Assessment Act (1979)*, along with other environmental planning instruments, trigger the requirement for the investigation and assessment of Aboriginal heritage as part of the development approval process. For crown land, provisions under the Native Title Act (1993) may also apply.

1.4.1 National Parks and Wildlife Act (1974)

In NSW, National Parks and Wildlife (NPW) Act (1974) protect Aboriginal cultural heritage. It is overseen by the Department of Environment, Climate Change and Water (DECCW), and specifically the Director-General of DECCW.

Protection for Aboriginal sites is provided under Part 6 of the NPW Act (1974). It is an offence for a person or company to:

- knowingly destroy, deface, damage, cause or allow the destruction/defacement to an Aboriginal object or Aboriginal place (Section 90);
- disturb, move, excavate for the purposes of finding Aboriginal objects, or take possession of Aboriginal objects (Section 86) unless a valid Permit under Section 87 of the Act has been issued by the Director General of the DECCW; and
- be aware of the location of an Aboriginal object and fail to report it to the DECCW (Director-General) within a reasonable timeframe (Section 91).

The Aboriginal Heritage Management System (AHIMS) is part of the regulatory framework for the implementation of the NPW Act (1974) and is maintained by DECCW. AHIMS comprises a database which identifies the spatial location of Aboriginal sites, as well as indexing information about the site in the form of a site card. For the assessment of development proposals, heritage consultants are required to search AHIMS as part of heritage best practice and in accordance with the *NPWS Aboriginal Heritage Guidelines* (DEC 1997).

In the assessment of Aboriginal heritage, DECCW encourages consultation with relevant Aboriginal stakeholders. If an Aboriginal Heritage Impact Permit (AHIP) is required for an Aboriginal site, then specific DECCW guidelines are triggered for Aboriginal consultation. The *Interim Community Consultation Requirements for Applicants* (ICCR) were released by DEC in 2004 to guide Aboriginal consultation and have been in force until April 2010. These guidelines have now been replaced by the *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (ACH guidelines, DECCW 2010) effective of 12th of April 2010. In the release of the of the ACH guidelines specific transitional arrangements have been stipulated in a supporting document, *Questions and Answers 2: Transitional Arrangements.* Section 1 (Q1) of this document indicates that if Aboriginal consultation was commenced prior to the 12th of April 2010 (including advertising and notification of stakeholders) then consultation is to be continued under the previous ICCR guidelines. Aboriginal consultation for this Project was commenced as stipulated in Section 1 of the transitional guidelines and therefore consultation for this assessment has been undertaken in accordance with the ICCRs.

1.4.2 The Heritage Act (1977)

Historical archaeological relics, buildings, structures, archaeological deposits and features are protected under the Heritage Act 1977 (as amended 1999) and may be identified on the State Heritage Register (SHR) or by and active Interim Heritage Order. Certain types of historic Aboriginal sites may be listed on the SHR or subject to an active Interim Heritage Order; in such cases they would be protected under the Heritage Act 1977 and may require approvals or excavation permits from the NSW Heritage Council.

There are no Aboriginal sites in the study area which are listed on the SHR or are subject to an Interim Heritage Order.

1.4.1 Environmental Planning & Assessment Act 1979 (EP&A ACT)

This Act regulates a system of environmental planning and assessment for NSW. Land use planning requires that environmental impacts are considered, including the impact on cultural heritage and specifically Aboriginal heritage.

Part 3A of the EP&A ACT relates to major projects, and if applicable, precludes the need to conform to other specific legislation. In particular, s75U of the EP&A Act explicitly removes the need to apply for s87 or s90 permits under the NPW Act. Although artefact collected during archaeological investigations, under Part 3A must be transferred to an appropriate authority or Aboriginal organisation under s85 of the NPW Act 1974. In considering approvals for development applications under Park 3A the Director-General of Planning is still obliged to consult with other government agencies, including DECCW and National Parks & Wildlife regarding Aboriginal heritage issues, such consultations generally trigger the requirement for the investigation of Aboriginal sites, prior to development.

1.4.2 Native Title Act (1993)

The *Native Title Act (1993)* recognises that some Aboriginal people 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 study area 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. Section 7 of the Master Deed outlines Centennials obligations, provisions for Aboriginal heritage are outlined in Section 7.2. Schedule 5 provides further 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.

1.5 Aboriginal Community 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. Guidelines for Aboriginal community consultation have been developed, to be implemented in accordance with the relevant sections of the EP&A Act (1979) and the NPW Act (1974). The guidelines relating to Part 3A assessment, the '*Part 3A EP&A Act Guidelines for Aboriginal Cultural Heritage Assessment and Community Consultation'* (2007), are not yet available. As such, this document has been prepared in accordance with the guiding principles of the *Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (DEC 2005), as well as the *Interim Community Consultation Requirements* (Dec 2004).

Consultation regarding this project commenced with the Aboriginal community stakeholders under the *Interim Community Consultation Requirements* (2004) (ICCRs). Although new consultation guidelines *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (2010) were released in April 2010; DECCW has advised that consultation commenced for projects prior to the 12th of April 2010 can continue under the ICCR process. In these circumstances the proponent is not required to recommence consultation under the new 2010 guidelines. Aboriginal consultation has also been undertaken in accordance with the ILUA.

1.6 Authorship and Acknowledgements

This report was written by Tessa Boer-Mah and reviewed by Darrell Rigby.

1.7 Terms and Definitions

Abbreviation	Definition
ADTOAC	Awabakal Descendants Traditional Owners Aboriginal Corporation
AHIMS	Aboriginal Heritage Information Management System
BP	Before present (as in years before present)
cal. years BP	Calibrated years before present, indicates a radiocarbon date has been calibrated using the dendochronology curves, making the date more accurate than an uncalibrated date
DECCW	Department of Environment, Climate Change and Water
GIS	Geographical Information System
KLALC	Koompahtoo Local Aboriginal Land Council
LEP	Local Environment Plan
PAD	Potential Archaeological Deposit
PCD	Pollution Control Dam
REP	Regional Environment Plan
REF	Review of Environmental Factors
SMP	Subsidence Management Plan
WNAC	Wonnarua Nation Aboriginal Corporation

2 Aboriginal 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. Guidelines for Aboriginal community consultation have been developed, to be implemented in accordance with the relevant sections of the EP&A Act (1979) and the NPW Act (1974). The guidelines relating to Part 3A assessment, the '*Part 3A EP&A Act Guidelines for Aboriginal Cultural Heritage Assessment and Community Consultation'* (2007), are not yet available. As such, this document has been prepared in accordance with the guiding principles of the 'Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation' (DEC 2005). In addition to these guidelines, the study area is within an Indigenous Land Use Agreement (ILUA).

Centennial (and formerly Powercoal) has undertaken extensive consultation with the Aboriginal community over a number of years for lands within the Project Application area. Aboriginal consultation in the 1990s 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 Project Application area.

From 2005, Centennial has also undertaken a number of heritage assessments which have involved consultation with the Aboriginal community for various portions of land within the Project Application Area (ERM 2005; Indigenous Outcomes Pty Ltd 2007a; RPS 2010; RPS HSO 2009a). These heritage assessments were undertaken for different consent authorities, including the Mine Subsidence Board and Department of Planning (DoP). Aboriginal consultation has been undertaken in accordance with the specifications of the relevant consent authority. ERM (2005) surveyed the Outbye Pillar area, also known as the Main South Area (southern portion of Study Area 2, Figure 2-1) as part of a Subsidence Management Plan (SMP) with participation of WNAC (12th and 13th of September, 2005) and undertook subsequent consultation, see Aboriginal consultation log in Appendix 1.

In 2007, Indigenous Outcomes produced a heritage assessment for the quarry area (Study Area 1) and also undertook community consultation. The quarry area was surveyed with participation from Koompahtoo Local Aboriginal Land Council (Raymond Smith, David Ahoy, Joseph Williams, Ashley Hudson, Nathan Griffin, Allan Williams) as well as ADTOAC (Shane Frost) (Indigenous Outcomes Pty Ltd 2007b).

Other portions of the Project Application area have been surveyed by RPS in 2009 and 2010 with Aboriginal community participation (Figure 2-1). This includes, the northern portion of Study Area 2 that was surveyed (7th and 13th October, 2009) as part of the Revised Stage 3 SMP application with participation from Arthur Fletcher (WNAC) and Ashley Hudson (KLALC), as well as, the northern portion of Study Area 3 which was surveyed by RPS (7th and 13th October, 2009) with participation from Arthur Fletcher (WNAC) and Ashley Hudson (KLALC).

Once the decision was made by Centennial to apply for a Part 3A consent, Aboriginal consultation was undertaken in accordance with the principles of the Interim Community Consultation Requirements for Proponents (ICCR) to meet the Part 3A assessment requirements. Consultation under the ICCR guidelines was commenced in March 2010.

The notification of stakeholders (Stage 1 ICCR) was undertaken by contacting the relevant authorities regarding potential Aboriginal stakeholders for the study area (Local Aboriginal Land Council, Registrar of Aboriginal Owners, Native Title Services, Local Councils and DECCW) and an advertisement placed in a local print media. The advertisement was published in the Newcastle Herald (3 April 2010), inviting Aboriginal stakeholders to register an expression of interest (Appendix 1).

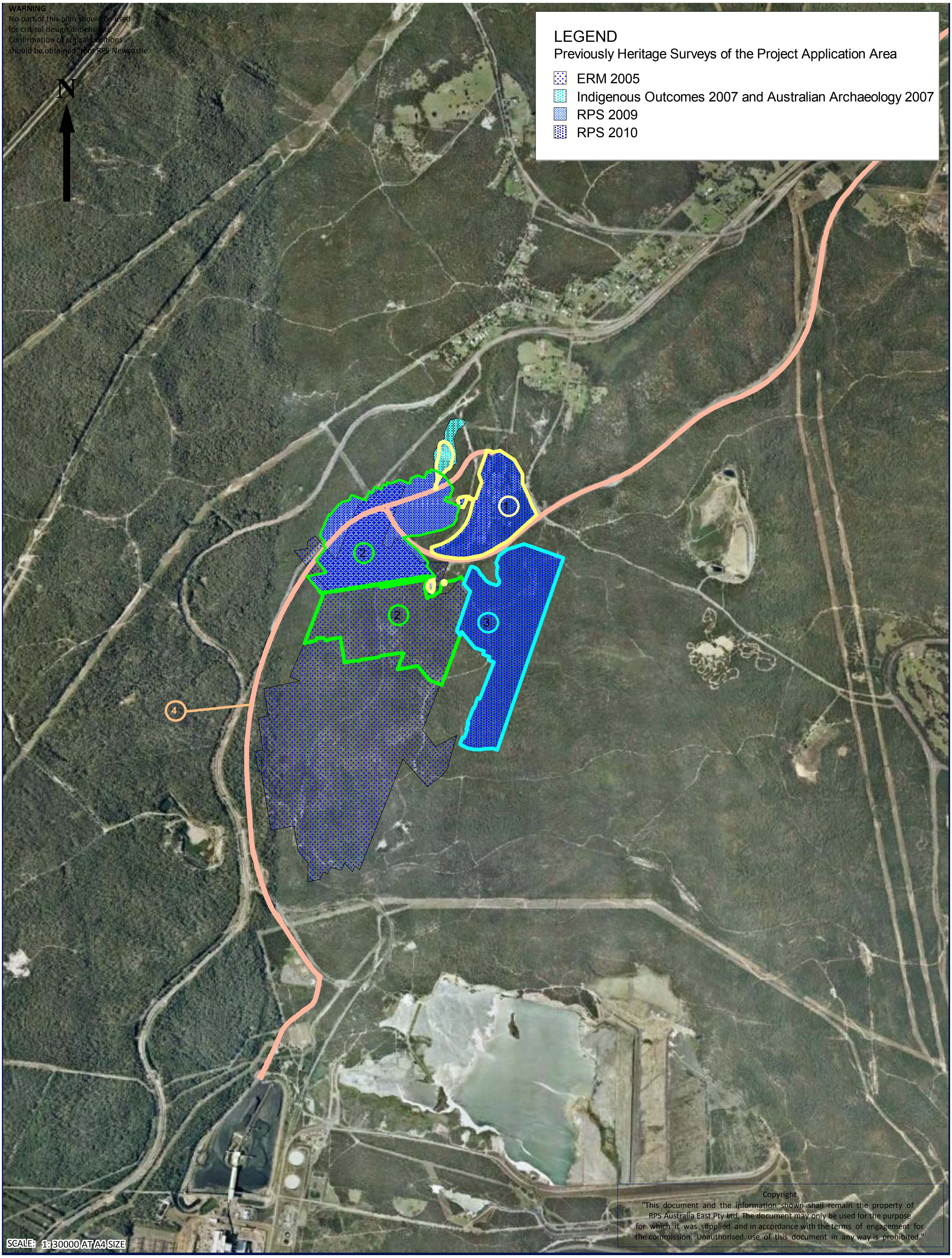
A list of Aboriginal stakeholders who have registered an expression of interest in the study area in 2010 is provided in Table 2-1. All registered stakeholders were sent a copy of the methodology for the assessment (Stage 2 ICCR), details provided in Appendix 1. The draft version of this report has been provided to the relevant Aboriginal Stakeholders (Stage 3 ICCR).

Table 2-1 List of Aboriginal stakeholders who have registered an expression of interest in the Project Application Area in 2010, under ICCR guidelines

Aboriginal Stakeholder	Date Expression of Interest Received (EoI)	Form of EoI
Awabakal Traditional Owners Aboriginal Corporation	30-Mar-2010	In writing (email)
Daniella Chedzey	31-Mar-2010	Verbal (phone)
Wonn1 Contracting	31-Mar-2010	Verbal (phone)
Awabakal Descendants Traditional Owners Aboriginal Corporation	1-Apr-2010	In writing (email)
Gidawaa Walang Cultural Heritage Consultancy	7-Apr-2010	In writing (email)
Wonnarua Nation Aboriginal Corporation	8-Apr-2010	In writing (fax)
NSW Aboriginal Land Council acting on behalf of Koompahtoo Local Aboriginal Land Council	14-Apr-2010	Verbal (Phone) and In writing (email)

The southern portion of Study Area 3 and Study Area 1 was surveyed on the 16th of April, 2010 with participation from Arthur Fletcher (WNAC), Shane and James Frost (ADTOAC).

All registered Aboriginal stakeholders have been consulted in the preparation of this CHIA and details are provided in Appendix 1. The draft version of this report has been provided to the relevant Aboriginal Stakeholders, the responses indicate that there is in principle agreement with the report and that an Aboriginal Cultural Heritage Management Plan (ACHMP) should be prepared as part of the ongoing management of the area. The ACHMP should be prepared in consultation with the relevant Aboriginal stakeholders to ensure that Aboriginal cultural values are adequately addressed.



TITLE: FIG 2-1 HERITAGE SURVEYS

LOCATION: AWABA

DATUM: DATUM
PROJECTION: MGA ZONE 56 (GDA 94)

DATE: 27/5/2010
PURPOSE: PURPOSE

LAYOUT REF: J:\JOBS\Centennial\All Jobs\26171 Awa .... Drafting\MapInfo Archaeology Workspaces\Awaba Colliery Part 3A project\Figure 2-1 Heritage Surveys
VERSION (PLAN BY): NW

CLIENT: CENTENNIAL
JOB REF: 26171

RPS AUSTRALIA EAST PTY LTD (ABN 44 140 292 762)
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RPS

3 Environmental Context

An understanding of environmental context is important for the predictive modelling of Aboriginal sites, as well as, for their interpretation. It provided natural resources for local Aboriginal people, such as, stone (for manufacturing stone tools), food and medicines, wood and bark (for implements such as shields, spears, canoes, bowls, shelters, amongst others), as well as areas for camping and other activities. The nature of Aboriginal occupation and resource procurement is related to the local environment and it therefore needs to be considered in cultural heritage assessment. The NPW Standards and Guidelines kit (1997) also requires the reporting of environmental context as part of the heritage assessment process.

3.1 Geology and Soils

Aboriginal people often made stone tools using silicious rocks and therefore understanding the local geology can provide important information regarding resources in a study area. The nature of stone exploitation by Aboriginal people depends on the characteristics of the source, for example whether it outcrops on the surface (a primary) source, or whether it occurs as gravels (secondary source).

The majority of the study area is underlain by the Moon Island Beach Subgroup of the Newcastle coal measures. It comprises Permian rock including tuff, siltstone and coal (Geoscience Australia). Tuff was often used for stone tools by Aboriginal people and tuff artefacts have been identified in the region.

The study area encompasses the Awaba soil landscape which comprises:

- Gravelly brown loam A1 horizon. Brownish black to brownish grey or greyish yellow brown loamy sand to silty clay loam with rounded conglomerate inclusions; overlaying;
- Gravelly hard-setting sandy loam to sandy clay loam A2 horizon. Dull yellowish brown to light grey in colour with numerous rounded conglomerate inclusions; overlaying;
- Bright yellowish brown sandy clay loam B horizon. Colours range from dull yellow, yellowish brown to bright yellowish brown with grey, yellow or orange mottling occasionally present. The clay content of the B horizon varies depending on the parent material, a sandier B horizon occurs where the parent material has little clay content; overlaying; and
- Grey gravelly clay B2 horizon. The B2 horizon has a light to medium massive structure and porous fabric. Colours range from grey to bleached dull yellow orange with red or yellow mottling. Rounded conglomerate inclusions are frequent. (Murphy 1993:47)

3.2 Topography and Hydrology

The central portion of the study area ranges in elevation from 30m to 100m AHD (Swansea Topographic Mapsheet 92314N 2006). The eastern part of the study area encompasses a first order watercourse which drains into Kilaben Creek. First and second order streams are present in the western part of the study area and drain into Stony Creek. Small pools of water may have been retained within these drainage systems during rainy periods, but would have been a less reliable source of water in drier periods.

The topography and hydrology suggests that Aboriginal occupation in this area would not have been frequent or long term on the basis of limited water availability; however, the study area may have also been used for activities other than campsites and such activities may not have been as greatly influenced by the availability of water.

3.3 Flora and Fauna

Vegetation communities within the Study Area comprise mainly of open forest species. Predominant species include: brown Stringybark (*Eucalyptus capitellata*), scribbly gum (*E. haemastoma*), grey gum (E. punctata), smooth barked apple (*Angophora costata*) and black she-oak (*Allocasuarina littoralis*) (Murphy 1993).

This large array of plant species available indicates that the broader area could have also supported a rich variety of fauna species. Fauna species identified in and around the region of the Study Area include mammal species such as Kangaroo, wallaby, glider and possum species as well as numerous bird species.

The floral and fauna characteristics of the study area suggest that it would have provided food and medicinal resources for Aboriginal people, as well as other natural resources for manufacturing implements.

3.4 Condition of the Study Area

Apart from installed surface infrastructure, many of the original landforms appear intact and are vegetated. Trees in the study area are predominantly re-growth; although there may be some older trees present. Informal dirt tracks are also present across the central portion of the study area.

4 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.

4.1 Regional Archaeological Context

The study area is located in the lower Hunter Valley/Lake Macquarie region. Archaeological evidence suggests that Aboriginal occupation of the Hunter valley region began by at least 35,000 years (Koettig 1987). Additional chronological evidence was recovered from the Hunter Valley's northeast mountains for which the following dates were assigned 34,580±650 (Beta-17009), >20,000 (Beta-20056) and 13,020±360 years BP (Beta-17271) (Koettig 1987, as cited in Attenbrow 2006). These dates show that the region was occupied during the Pleistocene (>10,000 years ago), such sites are generally rare and therefore contain significant archaeological/scientific information, as well as, demonstrating the long occupation of Aboriginal people in the region.

The majority of Aboriginal sites in the region; however, are dated to the more recent Holocene (<10,000 years ago). This may reflect Aboriginal occupation patterns, but may also be influenced by the inaccessibility of potential coastal Pleistocene sites which were inundated when sea levels rose and reached present levels approximately 6000 years ago (Mulvaney and Kamminga 1999:223). Evidence for Holocene Aboriginal occupation has been recovered from Bobadeen (7,760 cal. years BP), as well as Milbrodale (1,420 cal. years BP) and Sandy Hollow (1,310 cal. years BP) (Moore 1970:58).

4.2 Local Archaeological Context

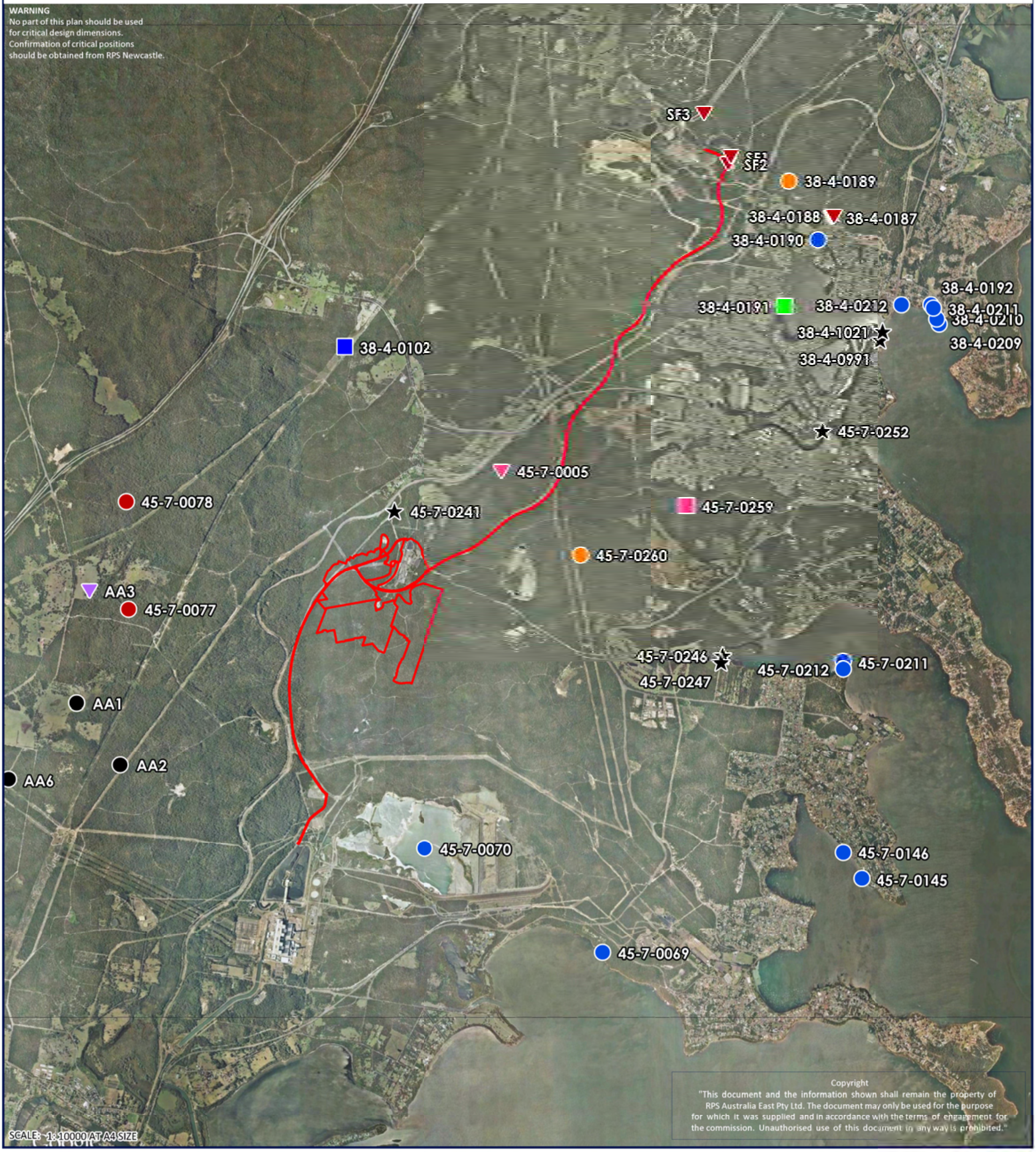
A number of archaeological investigations have been undertaken in the local landscape and the AHIMS results indicate that 30 sites have been recorded within 5 kilometres of the study area (Figure 4-1). The most common site types were middens followed by rockshelters and artefact scatters (Table 4-1). No registered AHIMS sites are located within the study area.

LEGEND

Project Application Area

AHIMS Search Results - by type

- Axe Grinding Groove
- Axe Grinding Groove, Shelter with Deposit
- Axe Grinding Groove, Water Hole/Well
- Isolated Find
- Rockshelter wirh PAD
- Midden
- Natural Mythological (Ritual)
- Open Camp Site
- Possible Scarred Tree
- Rock Engraving
- Nil
- Unknown



TITLE: FIGURE 4-1 AHIMS DATA

LOCATION: AWABA

DATUM: DATUM

PROJECTION: MGA ZONE 56 (GDA 94)

DATE: 20/4/2010

PURPOSE: HERITAGE ASSESSMENT

LAYOUT REF: \26171Awaba\10- Drafting\MapInfoArchaeology Workspaces\Awaba Colliery Part 3A project

VERSION (PLAN BY): A (TBM)

CLIENT: CENTENNIAL

JOB REF: 26171

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Table 4-1 Aboriginal Sites registered with AHIMS in the local area

Site Type	Frequency in AHIMS	Sites issued with permits	Total sites remaining in search area	Registered sites within the Study Area
Axe grinding groove	3	0	3	0
Rock Engraving	1	0	1	0
Isolated Find	1	0	1	0
Midden	13	1 (#2759)	12	0
Natural Mythological Site	1	0	1	0
Shelter	5	2 (#2768)	3	0
Shelter and Axe Grinding Groove	1	0	1	0
Artefact Scatter	4	0	4	0
Axe grinding groove with water hole	1	0	1	0
Total	**30**	**3**	**27**	**0**

The archaeological investigations of the local landscape have primarily been surveys. Due to the extensive vegetation cover in the areas adjacent to the study area, many of these surveys have been limited by low ground surface exposure and low visibility; although informal dirt tracks have provided good visibility and exposure in some areas.

Brayshaw (1982) Archaeological survey for expansion of Awaba State Mine

Both pedestrian and vehicle survey methods were used to cover an area for surface facilities at Awaba State Mine (Brayshaw 1982). Dense vegetation cover inhibited ground surface visibility and exposure. No Aboriginal sites were identified.

Dean-Jones (1989) Archaeological survey of proposed gravel quarry, Awaba State Mine

This survey was conducted to the north of the study area and encompassed approximately one square kilometre in the vicinity of Stony Creek (Dean - Jones 1989). It was noted during the survey that the extensive vegetation coverage inhibited visibility and ground surface exposure. One isolated find (mudstone flake) was recorded on a disturbed creek terrace adjacent to Stony Creek, but is outsided the Project Area (Figure 2-1).

Resource Planning Pty Ltd (1991) Archaeological survey at Awaba

This survey was conducted for a 32 hectare area associated with a proposed clay target shooting facility (Resource Planning Pty Ltd 1991). The area was covered by extensive vegetation; limiting surface visibility and exposure, which was estimated to be less than 10 percent. The survey focussed on tracks, exposures, drainage lines, as well as ridges. No Aboriginal sites were identified.

Umwelt (1998) Archaeological Survey for Newstan Colliery Life Extension Project

This archaeological survey was conducted to the north of the current study area. Due to dense vegetation cover, the survey focussed on exposures, scarred trees and sandstone outcrops (Umwelt 1998). Three isolated finds, one grinding groove site and nine potential rockshelters (with archaeological deposit or potential archaeological deposit) were identified during the survey.

Umwelt (2004) Archaeological survey for Centennial Newstan Longwalls 22 and 23

This survey focussed on the tributaries of Lords and Stony Creeks, as well as a sample of other landforms (Umwelt 2004). The landscape was considered to be heavily disturbed and no new sites were identified.

ERM (2005) Archaeological Survey for Awaba Colliery Outbye Pillar Extraction

This survey was conducted immediately to the west of the study area. Survey transects for this survey aimed to provide a sample of the 206 hectare impact area (ERM 2005). Vegetation coverage was extensive, with visibility and exposure generally 5 percent, although in confined areas such as vehicle tracks visibility and exposure were as high as 100 percent. No Aboriginal sites were identified during the survey.

Indigenous Outcomes (2007) Archaeological Survey Newstan Colliery Area

This survey included the quarry area to the west of the pit top area (within the current Project Application area), as well as, lands to the west of the Project Application area. No Aboriginal sites within the Project Application area were identified. One Aboriginal site (AA4 isolated find) had been previously recorded (outside the Project Application area), but was not identified during the survey. One potential scarred tree was identified (AA3), but is also outside the Project Application Area (Indigenous Outcomes Pty Ltd 2007b).

RPS HSO (2008a). Awaba East Exploratory Drilling Program

This study involved a desktop analysis of AHIMs results and other relevant archaeological reports to create a predictive model and sensivity mapping for the Awaba East Exploratory Drilling study area. Based on available information, areas of high archaeological sensitivity were identified where they met the following criteria:

- Along the ridges and upper slopes of the subject area;
- Within 200 metre radius of any known Aboriginal site;
- Within 200 metres of drainage lines;
- Areas heavily treed with old vegetation; or in
- Areas with a 5 degree slope or less.

On the basis of these criteria archaeological sensitivity was mapped within the Awaba East Exploratory Drilling area in order to develop heritage management protocols (RPS HSO 2008a).

RPS HSO (2008b). SMP Archaeological Assessment 3 North Area

An archaeological survey was conducted for the 3 north area (immediately east of Study area 3). No Aboriginal sites were identified, the area was thus assessed to have moderate-low archaeological sensitivity (RPS HSO 2008b).

RPS HSO (2009). Archaeological Assessment Awaba East Exploration Area Stage 2 Drilling Area

This study involved a desktop assessment for the for Awaba East Exploration Area Stage 2 Drilling area, located within 2km east of the current study area. It identified the locations which had been previously surveyed, areas which had previously been mined, as well as, areas which had neither been mined or subject to archaeological survey. This allowed heritage management zones for the exploration area to be defined, for which a set of heritage management protocols were devised (RPS HSO 2009b).

4.3 Predictive Model for Aboriginal sites within the Study Area

On the basis of previous archaeological investigations, including several archaeological assessments prepared by RPS for Centennial Coal with regard to the Awaba area (RPS HSO 2008a; RPS HSO 2008b; RPS HSO 2009b), a predictive model of archaeological sites can be developed. Site predictions for the study area are:

- Scarred / modified trees have been predicted in areas where sufficient old growth vegetation remains;
- Rockshelters 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;
- Isolated finds may be found across all landforms;
- 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 (ie: along a ridge / crest)

The predictive model provides a basis for contextualising survey results, assisting interpretation of archaeological landscapes, as well as informing the assessment of significance.

5 Methodology

All heritage assessments which have been undertaken in the Project Application area have been undertaken in accordance with DECC guidelines for survey reporting (NSW National Parks and Wildlife Service 1997) and included the following components:

- Documentation of survey coverage
- Documentation of results; and
- Documentation of significance of sites/areas to the Aboriginal community.

5.1 Survey Coverage

The survey methodologies aimed to provide adequate coverage of the study area, sample coverage of all landforms, areas of exposure, as well as, vegetated areas. Survey coverage included:

- Survey Unit description;
- Survey method (pedestrian/vehicle)
- Number of people involved

Survey units were described for each survey area, in particular, exposure and ground surface visibility were reported to ensure comparability of survey results between different areas of the local landscape, as well as, to contextualise survey results. Areas with high visibility and exposure generally have a lot of land surface disturbance, which can expose high quantities of archaeological material (particularly stone artefacts). Conversely, areas with low visibility and exposure particularly due to native vegetation coverage, are generally more intact (undisturbed) landscapes, while the identification of sites (particularly artefact scatters) in such areas are generally low, there is potential for intact archaeological deposits, which have been protected by vegetation coverage.

The survey execution, by vehicle or pedestrian methods, was described, as well as the number of people involved.

5.2 Documentation of Results

The documentation of Aboriginal sites and areas of archaeological sensitivity was undertaken using the following methods:

- Digital Photography;
- GPS recording (differential); and
- field notes

In accordance with DECCW guidelines photographic recording was undertaken of landforms, survey units, Aboriginal cultural material, areas of archaeological or cultural sensitivity, levels of disturbance, as well as, other areas/items of interest. Photographs were scaled, as appropriate.

Differential GPS units were used to record the location of Aboriginal heritage sites/areas of sensitivity. GPS tracklogs were also used for recording the location of survey units.

Field notes incorporated details including the size, location, contents and condition of Aboriginal heritage in the area. Size was recorded, either by GPS or tape measure. Location was recorded using differential GPS. Contents of sites included listing artefact types, raw materials as well as other site features. The condition of Aboriginal sites/areas of sensitivity were recorded including providing a description of the levels and cause of disturbances such as, erosion, land clearing and similar factors.

5.3 Documentation of Aboriginal significance

Aboriginal stakeholders participating in the surveys were asked about the cultural significance of the survey area and where applicable and/or appropriate, about the significance of Aboriginal sites and/or areas of archaeological sensitivity. An opportunity to comment on cultural significance was also provided in the survey preparation documentation and post survey reporting.

6 Heritage within the Project Application Area

The project application comprises four study areas, Aboriginal and non-Indigenous heritage sites/places have been outlined by study area. Centennial has engaged a number of consultants to survey areas within the Awaba Colliery, over several years. All lands within the Project Application have been previously surveyed as shown in Figure 2-1.

6.1 Study Area 1 Heritage

6.1.1 Study Area 1 Aboriginal Heritage

The pit top area was disturbed during the 1950s installation of infrastructure and land surfaces around the quarry were disturbed during the initial quarry activities. The PCD was installed in a highly disturbed area, mainly comprising fill. It is proposed that this dam will be expanded (Plate 6-1).

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 Awabakal Descendents Traditional Owners Aboriginal Corporation (ADTOAC) and Arthur Fletcher of Wonnarua Nation Aboriginal Corporation (WNAC) (ILUA agreement). The PCD inspection revealed that the area was already highly disturbed and no Aboriginal material was identified.

Plate 6-1 Pollution Control Dam (PCD), as inspected by RPS, ADTOAC and WNAC on 16th of April, 2010

6.1.2 Study Area 1 Non-Indigenous Heritage

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). 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 quarry area within Study Area 1 has been previously surveyed and no non-Indigenous heritage items were identified (Archaeology Australia 2007).

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 (Suters Architects Snell 1993b). Coal was originally supplied via a branch rail-line until the c1970 and then by truck.

The colliery buildings date from c1950 and comprise offices, bathhouse, lamp room, boiler house, coal loader/screen, workshops and drift portals (Figure 6-2). The majority of buildings were constructed with orange-red brick and low pitched gable roofs (Plate 6-2). The boiler house and coal loader/screens tower over the lower administration buildings. The workshops and drift portals are situated on a lower level northwest of the administration buildings (Plate 6-3). The drift portals bear the name of the mine, as opened in 1948.

Plate 6-2 Awaba administration buildings, built c1950

Plate 6-3 Drift portal with State Coal Mine Awaba inscription (foreground), station workshops (background).

The statement of significance identifies that Wangi Power Station was the first coalfields sited power station in NSW (Suters Architects Snell 1993b). 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).

6.2 Study Area 2 Heritage

Study Area 2 comprises lands located to the west and south west of the pit top area. Both these areas have been previously surveyed and assessed; western portion by RPS HSO (RPS HSO 2009a), and the south western portion by (ERM 2005). .

6.2.1 Study Area 2 Aboriginal Heritage

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 sites requiring AHIMS registration were identified (RPS HSO 2009a). 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.

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).

6.2.2 Study Area 2 Non-Indigenous Heritage

Non-Indigenous heritage within Study Area 2 includes the abandoned Awaba-Wangi rail line (Lake Macquarie Inventory RT03 – Suters Architects Snell 1993a,b). It comprises a single track rail line on wooden sleepers and two power poles associated with this rail line were identified within Study Area 2, (Figure 6-2). The rail line shares its significance with the Wangi power station (WG-01) and the Awaba Colliery pit top area (AW-07) as an example of extractive industries within the Lake Macquarie LGA (Suters Architects Snell 1993a; Suters Architects Snell 1993b).

6.3 Study Area 3 Heritage

This area is located southeast of the pit top area (East B) and contains portions of land that have not been previously mined. It comprises bush traversed by dirt tracks. This study area was surveyed in two portions (East B north and East B south).

6.3.1 Study Area 3 Aboriginal Heritage

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 2010).

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 2010).

6.3.2 Study Area 3 Non-Indigenous Heritage

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 2010).

6.4 Study Area 4 Heritage

Study area 4 comprises the existing private coal haul road and does not extend beyond the existing road infrastructure.

6.4.1 Study Area 4 Aboriginal heritage

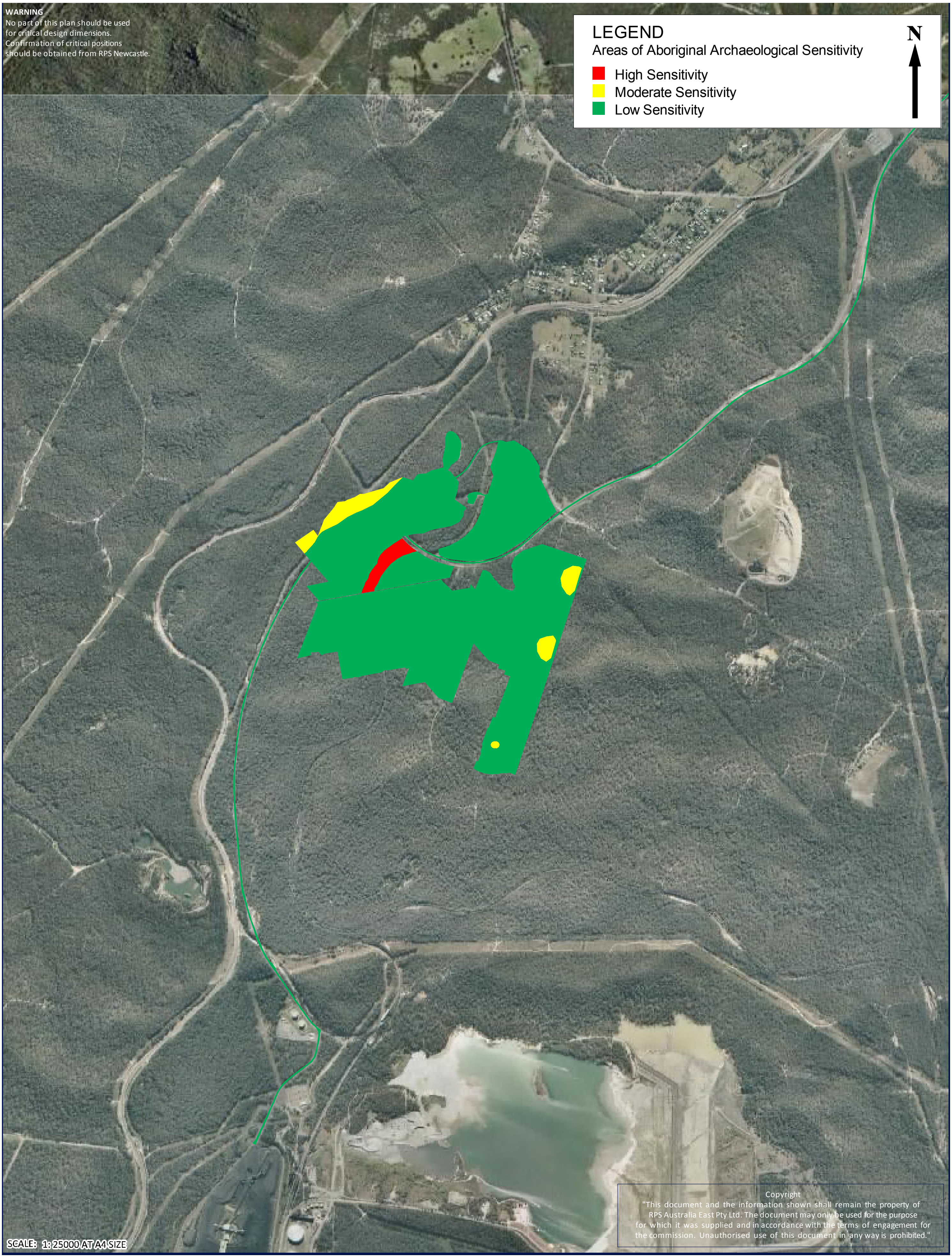
No Aboriginal sites or areas of archaeological sensitivity have been identified within the haul road of Study Area 4.

6.4.2 Study Area 4 non-Indigenous heritage

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.

6.5 Summary of Heritage

Areas of archaeological sensitivity for Aboriginal heritage have been identified within the project application area and are presented in Figure 6-1. Non-Indigenous heritage items are presented in Figure 6-2.



TITLE: FIGURE 6-1 ABORIGINAL ARCHAEOLOGICAL SENSITVITY
LOCATION: AWABA
DATUM: DATUM
PROJECTION: MGA ZONE 56 (GDA 94)
DATE: 14/5/2010
PURPOSE: HERITAGE ASSESSMENT
LAYOUT REF: \26171 Figure 6-4 Aboriginal areas of arch sensitivity A A4
VERSION (PLAN BY): TBM (DR)

CLIENT: CENTENNIAL
JOB REF: 26171

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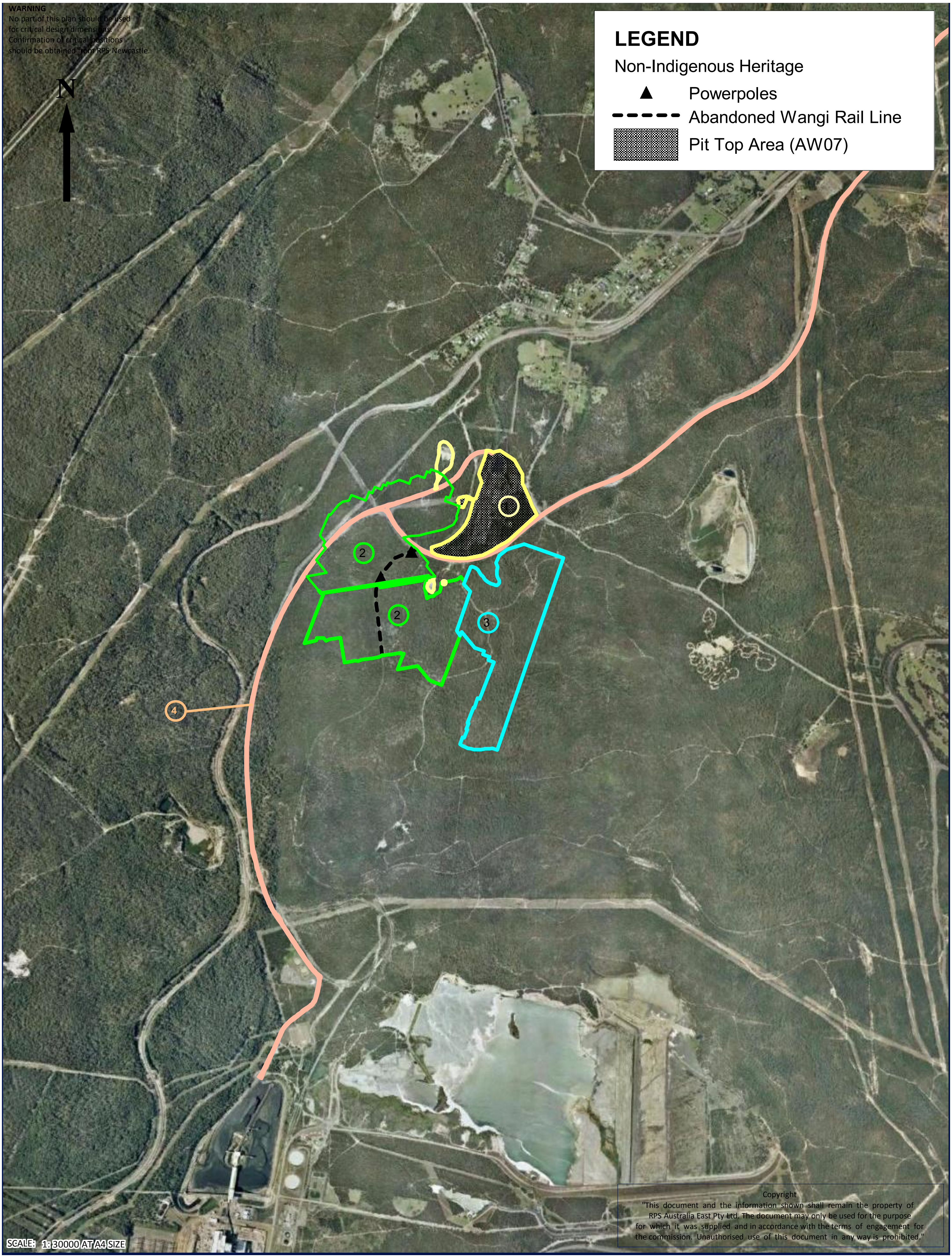

J:\JOBS\Centennial\All Jobs\26171 Awa ....
Drafting\MapInfo Archaeology Workspaces\
Awaba Colliery Part 3A project\
Figure 2-1 Heritage Surveys

TITLE: FIG 6-2 NON-INDIGENOUS HERITAGE	LOCATION: AWABA	DATUM: DATUM PROJECTION: MGA ZONE 56 (GDA 94)	DATE: 27/5/2010 PURPOSE: PURPOSE	LAYOUT REF: VERSION (PLAN BY): NW

CLIENT: CENTENNIAL
JOB REF: 26171

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7 Impact Assessment and Mitigation

Four study areas have been defined within the proposed project area. Heritage sites and areas of archaeological sensitivity have been outlined. The impact assessment considers the impacts of the proposed development on heritage within the project area. Aboriginal archaeological sensitivity mapping with reference to the mine plan layout has been provided in Figure 7-1.

7.1 Study Area I Impact Assessment and Mitigation

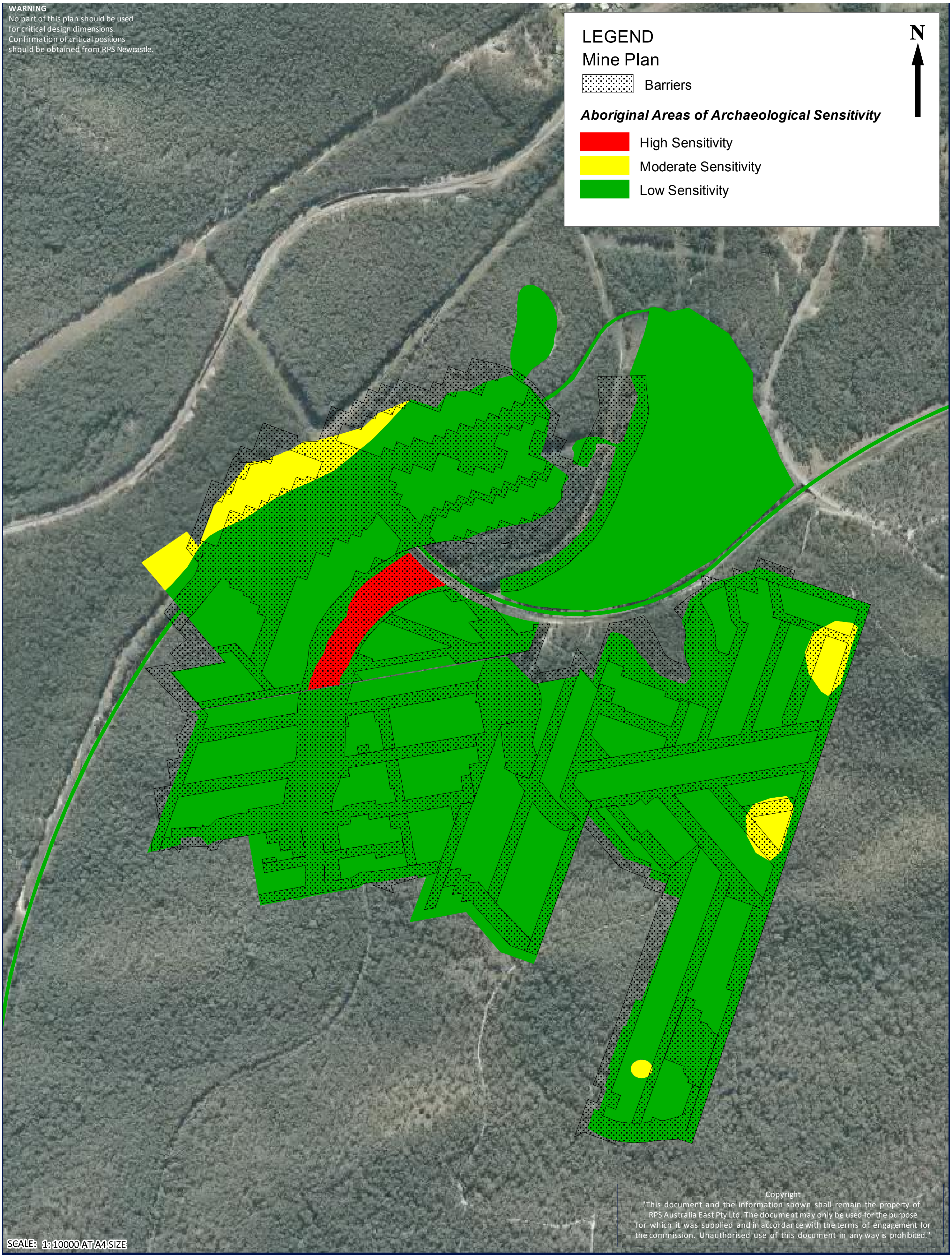
7.1.1 Study Area I Aboriginal Heritage Impact Assessment

Inspection of this area revealed that the pit top area was disturbed during the original installation of infrastructure and land surfaces around the quarry were disturbed during the initial quarry activities. The PCD was installed in a highly disturbed area, mainly comprising fill, the expansion of this dam will involve excavation within this fill area.

No Aboriginal sites or material was identified in this area. Consultation with ADTOAC and WNAC revealed that both stakeholder groups were satisfied that no further archaeological works, or mitigation measures, are required prior to the dam expansion in this area.

7.1.2 Study Area I Non-Indigenous Heritage Impact Assessment

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 area application.



TITLE:	FIGURE 7-1 MINE PLAN AND ABORIGINAL ARCHAEOLOGICAL SENSTIVITY	LOCATION:	AWABA	DATUM:	DATUM	DATE:	14/5/2010
				PROJECTION:	MGA ZONE 56 (GDA 94)	PURPOSE:	HERITAGE

LAYOUT REF: 26171 Figure 7-1 Mine plan Aborigi areas of arch sensitivity A A4.wor

VERSION (PLAN BY): TBM (DR)

CLIENT: CENTENNIAL

JOB REF: 26171

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7.2 Study Area 2 Impact Assessment and Mitigation

Western portion subsidence predictions

Predictions for subsidence within the western portion of Study Area 2, was assessed by Seedsman Geotechnics Pty Ltd (2009). It is predicted that sag between pillars will be less than 10mm and that subsidence above pillars less than 100mm. Vertical subsidence was predicted to develop over an area of approximately 200 metres which includes two panels and one pillar row. Vertical subsidence across such an area is predicted to be in the range of 1mm per metre. While considered there is low potential for plug failure, if this occurs subsidence could be up to 2.5m (Seedsman Geotechnics Pty Ltd 2009).

South western portion subsidence predictions

Predictions for subsidence in the southwestern portion of Study Area 2 have been assessed to be less than 120mm (ERM 2005:32).

7.2.2 Study Area 2 Aboriginal Heritage Impact Assessment and Mitigation

Western

No Aboriginal sites requiring AHIMS registration were identified in the western portion of Study Area 2 (RPS HSO 2009a). However, an area of high archaeological sensitivity was identified along Stony Creek and a small area of moderate archaeological sensitivity adjacent to a tributary of Stony Creek.

South western

No Aboriginal sites, or areas of archaeological sensitivity were identified in Study Area 3 (ERM 2005). Subsidence, therefore, will have no impact on known Aboriginal sites.

There are no identified Aboriginal sites in Study Area 2 and therefore subsidence will not impact on known Aboriginal sites. The vertical movement of soil during subsidence will not necessarily impact areas of archaeological sensitivity; however, if there is cracking or other processes which exposes soil profiles, including plug failure, there is potential for archaeological material to be identified in areas of moderate and high sensitivity. Should cracking, soil erosion, or plug failure occur; areas of moderate and high sensitivity then the following mitigation strategy should be adopted: the area should be inspected by a suitably qualified archaeologists, as well as, the relevant Aboriginal stakeholders.

7.2.3 Study Area 2 Non-Indigenous Heritage Impact Assessment and Mitigation

Non-Indigenous heritage within the study area includes the abandoned Awaba-Wangi rail line (Lake Macquarie Inventory RT-03 – Suters Architects Snell 1993a,b). It comprises a single track rail line on wooden sleepers, which spans both the western and south western portions of the study area. Two power poles associated with this rail line were also identified. 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 (Suters Architects Snell 1993a; Suters Architects Snell 1993b).

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. Impacts posed by the development are not considered detrimental to proposed heritage item (RT-03).

7.3 Study Area 3 Heritage Impact Assessment and Mitigation

Seedsman Geotechnics Pty Ltd (2010) has modelled the subsidence predictions of Study Area 3 (East B area). Depth of cover in this area ranges from 15m to 80m and the thickness of the coal seam to be mined is between 2 and 3 metres thick. Modelling of the geology is based primarily on four bore holes (2 additional bore holes did not reach adequate depths in the conglomerate to provide useful data). The bore hole data reveals that the conglomerate is between 8 and 18m thick.

Subsidence in the study area will be a function of the sag of the conglomerate and compression of the pillar system. If the conglomerate cannot span the panel a ‘plug’ collapse will occur.

Sag of the conglomerate has been associated with vertical subsidence of 10-100mm, while compression of the pillar system is in the order of 50-100mm (maximum of 200mm). A plug collapse would result in vertical subsidence of approximately 2m. Thus far, maximum subsidence within the Awaba Colliery lease has been 125mm (Seedsman Geotechnics Pty Ltd 2010).

7.3.1 Study Area 3 Aboriginal Heritage Impact Assessment

No Aboriginal sites requiring AHIMS registration were identified within Study Area 3 (East B area). One area of moderate archaeological sensitivity was identified.

There are no identified Aboriginal sites in Study Area 3 and therefore subsidence will not impact on known Aboriginal sites. The vertical movement of soil during subsidence will not necessarily impact areas of archaeological sensitivity; however, if there is cracking or other processes which exposes soil profiles, including plug failure, there is potential for archaeological material to be identified in areas of moderate and high sensitivity. Should cracking, soil erosion, or plug failure occur; areas of moderate and high sensitivity, the following mitigation measure adopted: the area should be inspected by a suitably qualified archaeologists, as well as, the relevant Aboriginal stakeholders.

7.3.2 Study Area 3 Non-Indigenous Heritage Impact Assessment

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 and surveys of the area have not identified non-Indigenous heritage items (RPS 2010). Subsidence will not impact non-Indigenous heritage in Study Area 3.

7.4 Study Area 4 Heritage Impact Assessment and Mitigation

7.4.1 Study Area 4 Aboriginal heritage

No Aboriginal sites or areas of archaeological sensitivity have been identified within the haul road of Study Area 4 and thus no mitigation measures have been proposed.

7.4.2 Study Area 4 non-Indigenous heritage

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 project application will not impact on non-Indigenous heritage.

7.5 Principles of Ecologically Sustainable Development

The principles of ecologically sustainable development need to be considered under 2A of the NPW Act. Inter-generational equity is part of these principles, which allows future generations to access the cultural and environmental diversity of the present generation.

Inter-generational equity has been considered as part of the assessment of significance. State significant Aboriginal sites should be considered for blanket protection for future generations, as these sites have been assessed as having highest significance within NSW. No Aboriginal sites of state significance were identified in the project application area.

8 Conclusions and Recommendations

This report is based on a number of heritage assessments which have been undertaken in the project application area. It has provided an outline of heritage within the four study areas which make up the project application area and has considered the environmental and archaeological context of these areas. The proposed impacts to Aboriginal and non-Indigenous heritage has been assessed in relation to intended activities within the project application area.

Recommendations for each study area have been formulated in respect to Aboriginal and non-Indigenous heritage, followed by more general recommendations which relate to the overall project area.

8.1 Recommendations for Study Area 1

Study Area 1 comprises the pit top area and ancillary infrastructure. The only proposed impact in this area comprises the widening and expansion of the pollution control dam, there will be no other changes to infrastructure. No Aboriginal sites or areas of archaeological sensitivity were identified. Non-Indigenous heritage was identified in Study Area 1, but activities proposed for the Project will not impact these items.

Recommendation 1

There are no known Aboriginal heritage sites within Study Area 1 and thus no identified constraints for the proposed activities.

Recommendation 2

There are no non-Indigenous heritage constraints for Study Area 1 on the basis that there are no modifications to the pit top area, other than the widening of the pollution control dam.

8.2 Recommendations for Study Area 2

Study Area 2 comprises primarily of bush which will be impacted by subsidence due to underground mining. No Aboriginal sites requiring AHIMS registration were observed in this area; however, areas of moderate and high archaeological sensitivity were identified.

Study Area 2 contains the abandoned Awaba-Wangi rail line (RT-03), a proposed heritage item. Although RT-03 may be affected by subsidence, it is not anticipated that associated deformation will affect the significance of this proposed heritage item and therefore no mitigation measures are required.

Recommendation 3

Areas of moderate and high archaeological sensitivity in Study Area 2 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.

Recommendation 4

No mitigation measures are required for non-Indigenous heritage in Study Area 2.

8.3 Recommendations for Study Area 3

Study Area 3 is located southeast of the pit top area (East B) and has not been previously mined. It comprises bush traversed by dirt tracks. No Aboriginal sites requiring AHIMS registration were observed in this area; however, an area of moderate archaeological sensitivity was identified. Study Area 3 does not contain any listed non-Indigenous heritage items, nor have any items been identified during recent surveys.

Recommendation 5

The area of moderate archaeological sensitivity in Study Area 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.

Recommendation 6

There are no non-Indigenous heritage constraints for Study Area 3.

8.4 Recommendations for Study Area 4

Study Area 4 comprises the existing private haul road. There are no proposed changes or upgrades associated with the project application and therefore activities will not impact Aboriginal or non-Indigenous heritage.

Recommendation 7

There are no known Aboriginal heritage sites within Study Area 4 and thus no identified constraints for the proposed activities.

Recommendation 8

There are no non-Indigenous heritage constraints for Study Area 4.

8.5 Recommendations for Management of the Project Application Area

The following recommendations apply to all lands within the project application area, as well as, relevant onsite personnel and Centennial staff.

Recommendation 9

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.

Recommendation 10

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.

Recommendation 11

The Aboriginal cultural heritage management plan should incorporated as part of the ongoing management of heritage within Awaba Colliery.

The ACHMP would include strategies which specifically address identified heritage within the Awaba project area, as well as, contingency strategies for any additional heritage issues which may arise. The ACHMP would comprise:

- Roles and Responsibilities (Centennial, Aboriginal stakeholders, heritage consultant)
- Heritage management strategies and step by step protocols for:
  - Identified Aboriginal heritage
  - Subsidence greater than the potential maximum subsidence prediction of 200mm (such as, plug failure)
  - Management of additional sites, if identified

Recommendation 12

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.

Recommendation 13

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.

Recommendation 14

If subsidence, or any other impacts, extend beyond the project application area, then further archaeological assessment and management will be required.

9 References

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Appendix 1

Aboriginal Consultation

Log of Aboriginal Consultation

Date	Description	Contact Method	Outcome
15/07/2010	TBM of RPS spoke to Kerrie Brauer regarding the report	Phone	In principle agreement with the recommendations of the report and would like to have awareness raised in general for Aboriginal cultural heritage in the ACHMP, comments acknowledged
7/07/2010	AN spoke to Arthur Fletcher from Won1 in regards to comments for final report.	Phone	Arthur Fletcher wash satisfied with the report and recommendation and agreed to have his verbal comments noted in the consultation log.
7/07/2010	AN spoke to Laurie Perry of WNAC in regards to comments for final report	Phone	Was satisfied with the report and agreed for comments to be included in the consultation log via verbal communication
5/07/2010	Received comments from ATOAC for report	Email	In principle agreement with the recommendations of the report and comments acknowledged
5/07/2010	AN rang ATOAC, W1, WNAC in regards to comments for final report	Phone	All groups agreed to send their comments as soon as they can
18/06/2010	ADTOAC sent comments with regards to the report	Email	Agreed in principle with the recommendations of the report, additional comments acknowledged
16/06/2010	Gidawaa Walang Cultural Heritage Consultancy agree with the recommendations of the report	Mail	Agreed with the recommendations of the report
31/05/2010	TBM spoke Arthur Fletcher (WNAC) re: receipt of draft report	Phone	AF indicated that he had received it
28/05/2010	Draft report for Part 3A and East B area sent on CD to Wonnarua Nation Aboriginal Corporation, Koompahtoo LALC, Guringai Tribal Link Aboriginal Corporation, Wonnaruah1 , Minmaga Wajaar Pty Ltd, Daniella Chedzey, Awabakal Traditional Owners Aboriginal Corporation, Mur-Roo-Ma, Darkinjung CDEP , Nur-Run-Gee Pty.Ltd, Awabakal Descendents Traditional Owners Aboriginal Corporation	Mail	N/A
4/6/2010	Gidawaa Walang responded to draft report, in agreement with recommendations	Mail	Satisfied with the recommendations
	Draft report sent to Aboriginal stakeholders		
16/04/2010	ADTOAC Shane and James Frost participated in the survey of the study area	In person	ADTOAC indicated they were satisfied with the survey coverage and results
16/04/2010	Wonnarua Nation, Arthur Fletcher participated in the survey of the study area	In person	Wonnarua Nation indicated they were satisfied with the survey coverage and results
14/04/2010	NSW Aboriginal Land Council acting on behalf of Koompahtoo Local Aboriginal Land Council EoI, but advised they	Verbal (Phone) and In writing	Verbal (Phone) and In writing (email)

Date	Description	Contact Method	Outcome
	may not have any sites officers who could attend the survey	(email)	
13/04/2010	Cactua Culture Consultants letter sent inviting EoI	In writing (letter)	N/A
13/04/2010	Arwarbukarl Cultural Consultants letter sent inviting EoI	In writing (letter)	N/A
13/04/2010	Awabakal Newcastle Aboriginal Co-op letter sent inviting EoI	In writing (letter)	N/A
8/04/2010	Wonnarua Nation Aboriginal Corporation EoI	In writing (fax)	Registration of interest noted.
7/04/2010	Gidawaa Walang Cultural Heritage Consultancy EoI received	In writing (letter)	Registration of interest noted.
6/04/2010	Leanne Anderson from Nur-Run-Gee Pty.Ltd rang to inform us that their organisation's area of interest is outside the Awaba Colliery boundaries and therefore do not need to be consulted.	Phone	Nur-Run-Gee Pty. Ltd do not need to be consulted.
1/04/2010	Registration of interest received from Awabakal Descendents Traditional Owners Aboriginal Corporation (ADTOAC)	Email	Registration of interest noted.
31/03/2010	Registration of interest received from Daniella Chedzey	Phone	Registration of interest noted.
31/03/2010	Registration of interest received from Arthur Fletcher Wonn1 contracting	Phone	Registration of interest noted.
30/03/2010	Registration of interest received from Awabakal Traditional Owners Aboriginal Corporation (ATOAC)	Email	Registration of interest noted.
26/03/2010	Wonnarua Nation Aboriginal Corporation letter sent inviting Expression of Interest	In writing (letter)	N/A
26/03/2010	Koompahtoo LALC letter sent inviting EoI	In writing (letter)	N/A
26/03/2010	Guringai Tribal Link Aboriginal Corporation letter sent inviting EoI	In writing (letter)	N/A
26/03/2010	Wonnaruah1 letter sent inviting EoI	In writing (letter)	N/A
26/03/2010	Minmaga Wajaar Pty Ltd letter sent inviting EoI	In writing (letter)	N/A
26/03/2010	Daniella Chedzey letter sent inviting EoI	In writing (letter)	N/A
26/03/2010	Awabakal Traditional Owners Aboriginal Corporation letter sent inviting EoI	In writing (letter)	N/A
26/03/2010	Mur-Roo-Ma letter sent inviting EoI	In writing (letter)	N/A
26/03/2010	Darkinjung CDEP letter sent inviting EoI	In writing (letter)	N/A
26/03/2010	Nur-Run-Gee Pty.Ltd letter sent inviting EoI	In writing (letter)	N/A
26/03/2010	Awabakal Descendents Traditional Owners Aboriginal Corporation letter sent inviting EoI	In writing (letter)	N/A
13/10/2009	Ashley Hudson (Kompahtoo Local Aboriginal Land Council -KLALC) participated in survey of East B north	In person	Ashley Hudson indicated she was satisfied with the level of survey coverage and assessment

Date	Description	Contact Method	Outcome
	area		
7/10/2009	Arthur Fletcher (Wonnarua Nation Aboriginal Corporation -WNAC) participated in survey of East B north area	In Person	Arthur Fletcher indicated he was satisfied with the level of survey coverage and assessment
23 February	Quarry area surveyed (Study Area 1) with participation from Koompahtoo Local Aboriginal Land Council (Raymond Smith, David Ahoy, Joseph Williams, Ashley Hudson, Nathan Griffin, Allan Williams) as well as ADTOAC (Shane Frost)	In Person	All members agreed with the survey results and heritage outcomes
10/11/2005	WNAC (Robert Lester and Scott Franks) met with Andrew Hutton (GSSE) to discuss survey results	In Person	Resolution was reached
6/10/2005	Andrew Hutton discussed survey results with Rober Lester (WNAC Chairperson)	Phone	Meeting proposed to further discuss survey results
13/09/2005	WNAC (Scott Franks) participated in the survey of the Outbye Pillar area with ERM	In Person	WNAC overall were satisfied with the survey results, pending the resolution of a couple of issues
12/09/2005	WNAC (Scott Franks) participated in the survey of the Outbye Pillar area with ERM	In Person	WNAC overall were satisfied with the survey results, pending the resolution of a couple of issues

Aboriginal Consultation Documents

ATOAC
Awabakal Traditional Owners Aboriginal Corporation

30 March 2010

RPS – Harpers Somers O'Sullivan
Attn: Tessa Boer-Mah
PO Box 428
HAMILTON NSW 2303

Dear Tessa,

Re: Awaba Colliery Continuation of Mining Project

The Awabakal Traditional Owners would like to register our interest regarding the anticipated archaeological survey for the proposed Awaba Colliery Continuation of Mining Project Study area.

We wish to comment on the Aboriginal Cultural Heritage being undertaken as participants in the assessment and consultation process archaeological investigation of the proposed project.

The Awabakal People have a Primary Cultural Connection with this area as the Newcastle region is well within our Cultural Boundary. The Awabakal Traditional Owners Aboriginal Corporation are descendants of the Awabakal people, our connection to our ancestral country is both physical and spiritual.

If you require any further information please do not hesitate in contacting me.

Yours sincerely,

K. Brauer

Kerrie Brauer
Director | Administration

Awabakal Traditional Owners Aboriginal Corporation
ABN: 90 203 408 390 | ICN: 4411
PO Box 253 Jesmond NSW 2299 Australia
T: 61 2 49 58 81 70 | E: info@awabakal.com.au | www.awabakal.com.au

Your reference	:
Our reference	: DOC10/14038-02; Fil10/482
Contact	: Sarah Paddington, (02) 4908 6837
Date	: 29 March 2010

01 APR 2010

Ms Tess Boer-Mah
RPS Harper Somers O'Sullivan Pty Ltd
PO Box 428
HAMILON NSW 2303

Dear Ms Boer-Mah,

RE: REGISTERED ABORIGINAL STAKEHOLDER LIST FOR PROPOSED FOR THE LAKE MACQUARIE LGA

I refer to your correspondence dated 29 March 2010, to the Department of Environment, Climate Change and Water (DECCW), regarding the above project located in the Lake Macquarie LGA in NSW.

Please find attached a list of known Aboriginal parties that DECCW considers is likely to have an interest in your development. I note this is not necessarily an exhaustive list of all interested Aboriginal parties. Receipt of this list does not remove the requirement for a proponent/consultant to advertise the proposal in the local print media and contact other bodies and community groups seeking interested Aboriginal parties, in accordance with DECCW's *Interim Community Consultation Requirements for Applicants (2004)*.

If you encounter any changes to the contact details of interested Aboriginal parties, or become aware of additional parties, we encourage you to forward this information to the Department so we can update our records.

If you have any further question regarding this matter, please contact Sarah Paddington, Archaeologist on (02) 4908 6837.

Yours sincerely

DL Crosdale 30/3/10

DIANE CROSDALE
A/Manager Planning and Aboriginal Heritage Section
<u>Environment Protection & Regulation Group</u>

Encl: Attachment 1

Department of **Environment and Climate Change** NSW

ATTACHMENT 1 : LIST OF ABORIGINAL STAKEHOLDER GROUPS

PLEASE ENSURE YOU ALSO CONTACT THE LOCAL ABORIGINAL LAND COUNCIL(S) & ALL OTHER ABORIGINAL STAKEHOLDER GROUPS YOU HAVE PRIOR OR NEW KNOWLEDGE OF FOR THIS AREA

Cacatua Culture Consultants,
Donna & George Sampson
22 Ibis Parade
Woodberry NSW 2322
(02) 4964 4685

cacatua@resetdsl.net.au

Awabakal Traditional Owners Aboriginal Corporation,
Kerrie Brauer
PO Box 253
Jesmond NSW 2299
(02) 4915 6947
0412 866 357

Arwarbukarl Cultural Resource Association,
Darren McKenny
PO Box 240
Broadmeadow NSW 2292
(02) 4961 0515

info@yarnteen.com.au

Awabakal Descendants Traditional Owners Aboriginal Corporation,
Shane Frost
PO Box 384
Wallabadah NSW 2343

Koompahtoo Local Aboriginal Land Council,
Lois Towney
PO Box 1112
TORONTO NSW 2283
(02) 4950 5577

lois.koompahtoo@bigpond.com.au

Awabakal Newcastle Aboriginal Co-op,
Kevin McKenney
64 Hannell Street
Wickham NSW 2203
(02) 4969 4711

Awabakal Local Aboriginal Land Council,
Cheryl Kitchener
PO Box 437
Hamilton NSW 2303
(02) 4965 4532

cheryl.awabaka@bigpond.com.au
awabakal@bigpond.com.au

Bahtahbah Local Aboriginal Land Council,
Michael Green
PO Box 3018
Blacksmith NSW 2281
(02) 4971 4800

bahtabah@nexon.com.au

"From the Mountains to the Sea"
AWABAKAL
Descendants Traditional Owners
Aboriginal Corporation
20402046601

PO BOX 86
CLARENCE TOWN
NSW 2321

Date: 1 April 2010

Attention: Tessa Boer-Mah (Senior Archaeologist)
PO Box 428
Hamilton NSW 2303

Re: Aboriginal Heritage Assessment Proposed for Awaba Mine

ALLA (Hello in Awabakal) Tessa,

We are writing to you in regard to the Aboriginal Heritage Assessment that is proposed for **Awaba Mine, commissioned by Centennial Coal**. We would like to notify you of the ***Awabakal Descendants Traditional Owners Aboriginal Corporations*** registration of interest for the proposed Assessment and that it is our desire to be consulted in regard to any Aboriginal archaeological management or consultation that is to take place for this area. We have also read the proposed methodology and agree that it is reasonably comprehensive and it covers most areas of concern as long as it takes into consideration the survey of all landform units within the assessment area being ridgelines, creeks and slopes.

We are a registered Aboriginal Corporation under the Federal Governments ***Aboriginal Corporations Act*** to carry out business within Australia in regard to the representation of our people through this corporation known as the ***Awabakal Descendants Traditional Owners Aboriginal Corporation***.

Being the direct descendants of the Traditional Awabakal People of the Lake Macquarie/Newcastle area we take this opportunity in a few sentences to quickly formalise our position with you.

Our great great great Grandmother was one of the first Aboriginal People to be recorded in the Lake Macquarie and Newcastle area in 1828 when the Reverend L.E.Threlkeld made the first list of the Aboriginal People of the Newcastle and Lake Macquarie district from his mission station at Belmont. At Warner's Bay our great great great Grandmother and her daughter, our great great Grandmother were recorded by Jonathon Warner in 1833 and then again at Toronto in 1836 by L.E.Threlkeld at his mission there. Our people still live and maintain our cultural ties with our Traditional Country and are concerned and desire to be involved in all the affairs that may affect that Cultural Heritage which is vital to our people in maintaining connectedness in respect of our Traditional Country.

The area in which the Aboriginal Archaeological Survey/Assessment is to be conducted is located within the Traditional Tribal Country of our people, the Awabakal. This area is significant because our people have lived around Newcastle and Lake Macquarie for many thousands of years, these resource rich areas were utilised on many occasions to hunt, fish and carry on traditions that have been passed down for centuries. This area was frequented on many occasions by our people and there are some significant sites located within close proximity to the area in question. There are also many other sites located within the surrounding area which provide tangible evidence of the Cultural Heritage of our people.

This particular area is of great importance because it is an area that our family know very well. Our grandmother was born at the head of Stockyard Creek beside a waterhole there in 1894 which is located just a couple of kilometres to the east from the site of the assessment and she subsequently lived in this very location into the late 1890's along with other members of our family. They lived in a bark hut on the creek (Stockyard Creek) making use of the local resources so as to maintain traditional life as they knew it. We also lived and were brought up in the area.

As you can understand this area and every part of our Traditional Country is special to us, not just for the Physical aspect but also the Spiritual and Oral aspect which all combine to give us our complete culture. Our Cultural Heritage and Traditional Tribal Country are two of the reasons why we take every opportunity to make ourselves available for consultation in regard to the very important issues and decisions that need to be made in regard to protecting what is ours and what gives us the right through birth to be called Traditional Awabakal People.

Given the opportunity to take part in the assessment, I would make representation on behalf of our people bringing the necessary qualifications you require in regard to Cultural knowledge of the study area. Also I am physically capable to undertake the survey due to spending many hours walking our Awabakal Country carrying out survey work for Cultural and educational purposes.

As far as field identification or survey techniques are concerned, I was brought up in the bush around Lake Macquarie and the mountains and have many years of experience spending most of my life being told and shown much by my Father and Grandmother in regard to our places, stories, tools/weapons and foods and how to acquire/use them. I have also been actively involved with many Aboriginal archaeological heritage assessments conducted within our Awabakal Country, accompanying archaeologist from well known companies, (located from within and outside our area) in the field and have also taken part in many projects where monitoring for artefacts during excavation works were carried out and subsequently many artefacts were located. Some of those companies we have worked with on many occasions include, Umwelt, ERM, ENSR, Insite Heritage and many others on major projects located within our area. We are presently involved with many other ongoing long term projects, working with organisations to see favourable outcomes in relation to Awabakal Cultural Heritage issues.

We also have been involved with other Aboriginal Assessments of the area in the past for Centennial Coal that is within the Centennial Coal mining lease and operations. These were assessments for the proposed open cut coal mine and for a new haul road and also above ground facilities for Awaba Mine. It is imperative that we be present at this assessment because of our people's connection to this area for thousands of years and the subsequent knowledge held by us.

Also as far as communicating the results of the survey back to stakeholder community and returning advice on the response, as CEO of our corporation I have the ability and opportunity to contact our members for any comments and information that may be pertinent to this survey and also have the necessary experience in production and reporting of any information in written format in relation to a draft report.

We do hold the relevant insurances needed to participate and the representative of our corporation is covered by public liability and workers compensation insurance. The certificates of currency are supplied separately to this letter due to confidentiality.

The rate of payment for our representative to take part in any fieldwork which would be inclusive of all relevant and associated costs for us to participate in this survey are supplied separately to this letter for confidentiality reasons also.

I hope this addresses any queries you may have Tessa, if not and further information is required please don't hesitate to contact me ASAP. My contact details are as follows.

NGI NOA (Farewell in Awabakal)

Shane Frost
CEO: Awabakal Descendants Traditional Owners Aboriginal Corporation
Email:shanefrost@bigpond.com Phone: 49964362 Fax: 49964325 Mobile: 0428320671

2

Tessa Boer-Mah

From: Mary Loder [mloder@lakemac.nsw.gov.au]
Sent: Tuesday, 6 April 2010 1:31 PM
To: Tessa Boer-Mah
Cc: Louise Sasse; Sharon Pope
Subject: RE: Attn: Heritage advisor

Hi Tessa,

I have attached a list of Aboriginal stakeholders in Lake Macquarie with whom you should consult. Please note that in this case, the Koompahtoo Land Council, plus the two Awabakal corporations are the appropriate stakeholders. However, since the Koompahtoo Land Council has folded, you will need to consult with the NSW Land Council. I do not have a name, but their phone number is 96894444. According to DECCW's guidelines for consultation with the Aboriginal community, you should also advertise in the newspapers for any other Aboriginal stakeholders to register an interest in being consulted about this project.

Should you require any further information or clarification, please email me at mloder@lakemac.nsw.gov.au or ring me on 49210422.

Regards Mary Loder

Name	Company	Address1	Phone No.	City	Dear
Mr Shane Frost	Descendents of Awabakal Aboriginal Corporation	P O Box 86	49964325	CLARENCETOWN NSW 2429	Shane
Ms Cheryl Kitchner	Awabakal Local Aboriginal Land Council	P O Box 437	49654532	HAMILTON NSW 2303	Cheryl
Mr Michael Green	Bahtahbah Local Aboriginal Land Council	P O Box 3018	49714800	BLACKSMITHS NSW 2281	Michael
Ms Lois Towney	Koompahtoo Local Aboriginal Land Council	P O Box 112	49505577	TORONTO NSW 2283	Lois
Mr Dene Hawken	Awabakal Traditional Owners Aboriginal Corporation	87 Hunter Street	49522321	NEWCASTLE NSW 2300	Dene
Mr Wayne Hawken	Awabakal Traditional Owners Aboriginal Corporation	87 Hunter Street		NEWCASTLE NSW 2300	Wayne
Mrs Nola Hawken	Awabakal Traditional Owners Aboriginal Corporation	87 Hunter Street		NEWCASTLE NSW 2300	Nola
Ms Kerrie Brauer	Awabakal Traditional Owners Aboriginal Corporation	87 Hunter Street		NEWCASTLE NSW 2300	Kerrie

Barkuma Neighbourhood Centre Trading as… ABN: 58 290 659 800

Gidawaa Walang

Wiradjuri Meaning ~ Goanna Turning the Stone

Cultural Heritage Consultancy

…To keep our Culture…

12 APR 2010

7th April 2010

Tessa Boer-Mah
RPS Australia East P/L
PO Box 428
Hamilton NSW 2303

Dear Tessa,

Re: Aboriginal Stakeholder Consultation Continued Operation of Awaba Colliery

Gidawaa Walanng Cultural Heritage Consultancy would like to register our interest in the above project . Our interest comes from various members of our community including Elders.

Our organisation is made up of members, staff, management and community from various tribal boundaries including Awabakal, Wonaruah, Worimi, Gamilaroi, Wiradjuri, Darkinjung and Eora country.

I would also like to thank you for the opportunity to register our interest in the project.

Yours sincerely

A. H.

Ann Hickey
Project Officer

76 Lang Street
Kurri Kurri
NSW 2327

Phone: 4937 1094
Fax: 4936 4449
Mob: 0411 196 991

RPS

Attachment 3

Response to: RPS Harper Somers O'Sullivan

Tessa Boer-Mah (Senior Archaeologist)
PO Box 428
Hamilton
NSW 2303
Tessa.Boer-Mah@rpsgroup.com.au

Response from: (Insert your name and organisation contact details here)

LAURIE PERRY
WONNARUA NATION ABORIGINAL CORPORATION
WONNARUA@BIGPOND.COM
0412 593 020
ARTHUR FLECTHER 0402 146 193

Regarding : Proposed survey at Awaba Colliery East B area

Survey Methodology

I am satisfied that the proposed survey methodology is appropriate for East B study area at Awaba Colliery:

Yes ☑ No ☐

Comments (attach an additional page if necessary):

SEE ATTACHED LETTER

RPS

Additional Comments (attach an additional page if necessary):

Name and Organisation:
LAURIE PERRY WONNARUA NATION ABORIGINAL CORP

Signature:

Date:
8 - 4 - 2010

RPS

Attachment 4
Survey Selection Form: Awaba East B area

Organisation Details

Name of Organisation	WONNARUA NATION ABORIGINAL CORPORATION
Street Address	PO BOX 3066 SINGLETON
Suburb / Postcode	, DELIVERY CENTRE 2330
Phone Number	(02) 6571 5419
Fax	(02) 6571 5419
Email	

Nominated Site Officer Details

Name of nominated Site Officer	ARTHUR FLECTHER
Home Phone (to be used for planning purposes if necessary)	( )
Mobile Phone (for use in the field)	0402 146 193
Email (to provide documents if necessary)	

RPS

Emergency Contact Details

Please provide the details of two people that may be contacted in the event of an emergency involving the nominated Site Officer.

Name of emergency contact	LAURIE PERRY
Relation to site officer	COUSIN
Street Address	
Suburb / Postcode	SINGLETON /
Phone Number	( )
Mobile	0412 593 020

Name of emergency contact	
Relation to site officer	
Street Address	
Suburb / Postcode	/
Phone Number	( )
Mobile	

Insurance Details

Please attach a copy of the certificate of currency for the organisation's Public Liability and Worker's Compensation cover.

Will Follow THIS up

RPS

I LAURIE PERRY of (organisation) WONNARUA NATION

confirm that the above details are true and accurate.

(signature) (Date signed) 8 - 4 2010

I have enclosed the following:

Copies of Certificates of Currency (workers compensation & public liability)

A copy of your Site Officer's CV/statement of experience

Emergency contact details for the Site Officer

I agree that the nominated Site Officer has sufficient fitness level to conduct the survey work.

27 APR 2010

OFFICE OF THE REGISTRAR
ABORIGINAL LAND RIGHTS ACT 1983 (NSW)

11-13 Mansfield Street
Glebe NSW 2037
PO Box 112, Glebe NSW 2037
P. 02 9562 6327 F. 02 9562 6350

Ms Tessa Boer-Mah
Senior Archaeologist
241 Denison Street
Broadmeadow NSW 2292

20 April 2010

Dear Ms Boer-Mah,

Re: Request - Search for Registered Aboriginal Owners

I refer to your letter email dated 31 March 2010 regarding Aboriginal Heritage Assessment in the Lake Macquarie area in NSW.

I have searched the Register of Aboriginal Owners and the project area described does not appear to have Registered Aboriginal Owners pursuant to Division 3 of the *Aboriginal Land Rights Act* 1983 (NSW).

I suggest you contact the NSW Aboriginal Land Council. They may also be able to assist you in identifying other Aboriginal stakeholders for this project.

Yours sincerely

CField

Courtney Field
Administrative Officer
Office of the Registrar, *Aboriginal Land Rights Act* (1983)

"From the Mountains to the Sea"
AWABAKAL
Descendants Traditional Owners
Aboriginal Corporation
ICN:4500 ABN:20402046601

PO BOX 86
CLARENCE TOWN
NSW 2321

Date: 18 June 2010

Attention: Tessa Boer-Mah (Senior Archaeologist)
PRS Harpers Somers O'Sullivan Pty Ltd
PO Box 428
Hamilton NSW 2303

Re: Draft Cultural Heritage Impact Assessment Report for Awaba Colliery

ALLA Tessa,

This letter is in response to your request for feedback and any recommendations or comments from the ***Awabakal Descendants Traditional Owners Aboriginal Corporation*** in regard to the **Draft Cultural Heritage Impact Assessment Report for Awaba Colliery.**

We have reviewed the contents of the **Draft Cultural Heritage Impact Assessment Report for Awaba Colliery** and after careful consideration would like to inform you that the general concept of the draft is adequate. With that said we would now like to contribute some comments and recommendations which we believe to be necessary. We would like to see these comments and recommendations included into the draft by RPS so as to compliment the contents of the draft and see our recommendations adopted and subsequently implemented by Awaba Colliery. We would also request a copy of the revised and final draft to be forwarded to us at its completion.

Our objectives as the Traditional Descendants of the Awabakal, who always have been and still are the original and Traditional Aboriginal People of this area, is to see that all Awabakal Cultural Heritage values within the proposed continued underground mining area of the Awaba Colliery is afforded the appropriate ***Recognition***, ***Protection*** and ***Preservation*** deserved.

Statement of significance of this area to Awabakal Traditional Descendants *(Also content on last page)*

- The significance of place to our people does not just rely on the presence of artefacts, grinding grooves, scarred trees or any visible evidence associated with the site or area. Although what does remain in the physical realm whether small or large, does connect us to our Ancestors and our Cultural Heritage being the physical reminder of what helped govern and guide the everyday lives of our people. We can touch the very stone (artefacts) or grinding grooves that they (our Ancestors) worked with to fashion into the tools and implements that are recorded today by some as sites. These places are not just sites they are the places that ***OUR*** Ancestors carried on their everyday life activities. These are some of those places that today fundamentally identify the unique connection we as Awabakal Descendants now have with our Ancestors and this ***OUR*** Traditional Land. Unfortunately, in this day and age it has become too easy due to ignorance, lack of connection and insufficient understanding of the entire picture, not to mention so called progress, to devalue and debase our people and our Cultural Heritage which has belonged and survived in this area for thousands of years. The fact that this area is a contributing part of what makes us who we are and where we come from cannot be defined just as something tangible. The feeling of the area and the extensive connection we have with it, the awareness of knowing this is a connection that is confined to just a handful of people living today because it was ***OUR*** Ancestors that walked upon it, is sufficient enough for us to be adamant in our understanding that we are part of the reason of what makes this place significant. Our people, the Awabakal, have for centuries looked after this area as part of our greater Traditional Tribal Country and we believe that in today's climate we as Awabakal Descendants need to continue to be involved in the protection, consultation and management issues that affect the Traditional Tribal Country of our Ancestors. We consider our involvement paramount and if neglected or overlooked in the process, we believe it is to the detriment of the community and the complete understanding of the Awabakal People and the wellbeing of the area in question. This land holds secrets which are significant to us, many stories from the past connect us to it and these stories will continue to live and be significant because they live in us and are what makes us by birthright, Awabakal People.

__Low Ground Surface Visibility__

- On page 24-25 of the **Draft Cultural Heritage Impact Assessment Report for Awaba Colliery** Section *4.2 Local Archaeological Context* it states in no uncertain terms that during many other Cultural Heritage investigations/assessments the major concern was, as was for this latest assessment, the lack of visibility due to the dense ground cover. It gives several examples of this which state;

    a. 'Due to the extensive vegetation cover in the areas adjacent to the study area, many of these surveys have been limited by low ground surface exposure and low visibility;'
    b. 'Dense vegetation cover inhibited ground surface visibility and exposure.'
    c. 'It was noted during the survey that the extensive vegetation coverage inhibited visibility and ground surface exposure.'
    d. 'The area was covered by extensive vegetation; limiting surface visibility and exposure, which was estimated to be less than 10 percent.'
    e. 'Due to dense vegetation cover..'
    f. 'Vegetation coverage was extensive, with visibility and exposure generally 5 percent..'

    As can be seen from these previous statements made during other surveys of the area, the poor visibility due to ground cover hampered efforts in establishing the presence of Cultural Heritage values within the areas assessed. This does not mean a conclusion can be derived at that there is no Awabakal Cultural Heritage present due to the absence of Cultural Heritage values because of the inability to see it within this particular landscape. There is more reason to believe that Awabakal Cultural Heritage values exist in this landscape because we have the data which indicates from the AHIMS Database record which reveals as stated on page 22 of the **Draft Cultural Heritage Impact Assessment Report for Awaba Colliery** Section *4.2 Local Archaeological Context* that;

    > ***'...the AHIMS results indicate that 30 sites have been recorded within 5 kilometres of the study area (Figure 4-1).'***

    This is only those sites that have been recorded and is not necessarily an exact indication of all Awabakal Cultural Heritage sites that may be present. There are several other sites that have recently been found close by that have not yet been added to the AHIMS Database (or showing up) in which there was an excavation of an area beside a creek line which in turn produce Cultural Heritage materials (artefacts) and in coincidence with this excavation two (2) more additional artefact scatters were discovered close by. Yet these two (2) other artefact scatters had not previously been recorded. Also the presence of subsurface Cultural Heritage materials are revealed in areas not normally expected if excavations area realised. All of this indicates that there is Awabakal Cultural Heritage which remains hidden due to a number of factors in the environment and unless sought out in appropriate ways, go undetected.

    An interesting statement and observation is provided in other documents which demonstrate the points previously mentioned saying that;

    > ***'Once discarded on the ground surface, artefacts are often readily incorporated into the topsoil horizons through the process of bioturbation. Most commonly, dense artefact deposits exist hidden beneath the upper surface, unobservable by the casual observer.' (c.f.Wandsnider and Camilli 1992; Fanning and Holdaway 2001).***[1]

__Surface Impacts due to Subsidence__

- It is stated in the **Draft Cultural Heritage Impact Assessment Report for Awaba Colliery** Section *1.2 The Proposal* page 10 that;

    a. ***'…there is potential for subsidence.'*** and also on page 41 ***'Study Area 2 comprises primarily of bush which will be impacted by subsidence due to underground mining.'***

    and again in section *7.2 Study Area 2 Impact Assessment* page 38 of the **Draft Cultural Heritage Impact Assessment Report for Awaba Colliery** it states the subsidence predictions for the western portion and south western portions are;

[1] ***Page 3, Hunter Water Stage 2 Aboriginal Heritage Assessment Shortland Street, Newcastle 5.1.1 Archaeological Potential. (ERM2009)***

'...that subsidence above pillars less than 100mm.... While considered there is low potential for plug failure, if this occurs subsidence could be up to 2.5m... Predictions for subsidence in the southwestern portion of Study Area 2 have been assessed to be less than 120mm...'

Also for section *7.3 Study Area 3 Heritage Impact Assessment* page 39 of the draft it states that;

'Subsidence in the study area will be a function of the sag of the conglomerate and compression of the pillar system. If the conglomerate cannot span the panel a 'plug' collapse will occur... Sag of the conglomerate has been associated with vertical subsidence of 10-100mm, while compression of the pillar system is in the order of 50-100mm (maximum of 200mm). A plug collapse would result in vertical subsidence of approximately 2m... Thus far, maximum subsidence within the Awaba Colliery lease has been 125mm'

b. Even though experts can give their learned advice to what the probability of surface impacts will be due to subsidence of the underground workings they cannot give a 100% assurance that impacts will not exceed those predicted. As it states on page 10 ***'...there is potential for subsidence'*** and again on page 41 ***'Study Area 2 comprises primarily of bush which will be impacted by subsidence due to underground mining.'***

Provided here are two quotes regarding the effects of subsidence through underground mining;

1. ***'What is Subsidence'?***

'Subsidence is an inevitable consequence of underground mining – it may be small and localised or extend over large areas, it may be immediate or delayed for many years. Underground *[sic]* ***mining, causes' impacts to hydrological features like lakes, streams, wetlands, and underground aquifers. Subsidence is a natural and man-made phenomenon associated with a variety of processes including compaction of natural sediments, ground water dewatering, wetting, and melting of permafrost, liquefaction and crustal deformation, withdrawal of petroleum and geothermal fluids, and mining of coal, limestone, salt, sulphur and metallic ores. Subsidence is a natural result of underground mining. When a void is created nature will eventually seek the most stable geological configuration, which is a collapse of the void and consolidation of overburden materials. Subsidence will occur and will result in impacts to the overlying strata...'***
'The creation of a cavity as a result of mining result in subsidence...'
'To be fully analysed from an environmental as well as mining standpoint, all surface effects of subsidence associated with the mining must be recognized.'
'Subsidence by some has also been defined as ground movements that occur due to the collapse of overlying strata into mine voids which expresses itself in three major ways

i. Cracks, fissures, or step fractures.
ii. Pits and sinkholes.
iii. Troughs or sags.'

'There are several misconceptions about subsidence. For example depth of mine (as measure by the thickness of the overlying strata) is often suggested as a prevention or mitigation measure. Similarly the extraction area is often correlated with the size of subsidence area. Experts opine [sic] that Mining at any depth can result in subsidence, and the affected surface area is generally larger than the extraction area.'

'Room –and Pillar - mining is usually applicable to flat lying deposits on a large scale. In this method some portion of the coal and others left behind in place to support the overlying strata. The portion of the remaining place is typically a function of the required support necessary to prevent the overlying strata from immediately caving or falling in a [sic] while mining is being performed. In many cases, the pillars are, removed or robbed at the end of mining when long term support is no longer necessary.'

'The two most common forms of surface subsidence from room and pillar mining are sink- hole collapse and a saucer shaped depression following pillar failure. In the case of room –and pillar mining surface subsidence can occur many years after mining is done.'

'Control and Prevention:'

> ***'Four types of measures may control subsidence damage: alteration in mining techniques, post –mining stabilization, architectural and structural design, and comprehensive planning. None of these measures entirely prevents prevents [sic] subsidence and most of the measures address only impacts to manmade structures and facilities and not impacts to land use , including aquatic species, wildlife habitat and human recreation , or water quality and flow.'*** [2]

2. ***'Old room and pillar mining techniques — where coal is left in the seam to support the roof of the underground mine — often leads to unpredictable subsidence and damage to surface structures years or even decades after mining has ceased.'*** [3]

- On pages 38 and 39 of the **Draft Cultural Heritage Impact Assessment Report for Awaba Colliery** Sections7.2.2 *Study Area 2 Aboriginal Heritage Impact Assessment* and *7.3.1 Study Area 3 Aboriginal Heritage Impact Assessment* there are several statements that we consider to be a misrepresentation of facts and could be misleading to the reader. They say that;

> ***'South western***
> ***No Aboriginal sites, or areas of archaeological sensitivity were identified in Study Area 3 (ERM 2005). Subsidence, therefore, will have no impact on known Aboriginal sites. There are no identified Aboriginal sites in Study Area 2 and therefore subsidence will not impact on known Aboriginal sites.'***
>
> ***'There are no identified Aboriginal sites in Study Area 3 and therefore subsidence will not impact on known Aboriginal sites.'***

a. The main words here are ***no identified*** Aboriginal sites; therefore subsidence will not impact on ***known*** Aboriginal sites. Going back to the points we made earlier in ***Low Ground Surface Visibility*** there is no reason whatsoever to believe there will not be any Awabakal Cultural Heritage sites within these areas known as Study area 2 and 3. Considering our People have been using this area for many thousands of years and the proximity of these areas to other known Cultural Heritage sites close by. Given the examples we have provided regarding poor visibility and concerning Cultural Heritage sites that are potentially contained below the ground surface and also sites that are covered by vegetation and those sites that have for one reason or another never been recorded on the DECCW AHIMS Database, it should not then be assumed that Aboriginal sites will not be impacted, disturbed or damaged by potentially being exposed to subsidence from the proposed underground mining operations of Awaba Colliery.

b. In a way it is right to say there will be no impacts from subsidence to known Aboriginal sites because at this time there are no known/identified Aboriginal sites within the Study areas of 2 and 3. It is not the '*known/identified'* Aboriginal sites we are worried about, it is the ones we ***don't know about*** that give us cause for the greatest concern. There is a possibility there will be damage and impacts to unknown Aboriginal Cultural Heritage sites from subsidence from this mine, by the time this happens and people are aware of it, it may be too late. We have lost a massive amount of our Cultural Heritage in the past from all types of industrial pursuits that have not taken into account what this means to our People and we don't want to lose more.

c. Under the NPWS Act it is an offence to disturb or damage any Aboriginal Cultural Heritage site/object without a permit; this means it is an offence to even move one Aboriginal artefact from its original location. If there is any potential that Aboriginal sites will now or in the future be disturbed or potential impacts caused, then it is in the best interest for Awaba Colliery to know where these Aboriginal sites are located so it can put strategies in place to diminish the probable disturbance/damage/impacts to any of these sites/objects.

[2] ***From: Energy Bangala Website 'Coal Mining Challenges of Bangladesh (Part – 2)' 2009***

[3] ***From Website: 'Pennsylvania Department of Environmental Protection (DEP), 'At a glance, Act 54 Report on Impacts of Underground Coal Mining'***

d. If there is subsidence, and anyone would be mad to say there won't be any, then we can expect it to be quite likely for some impacts to Awabakal Cultural Heritage within these areas making it an illegal action (without a permit) under the NPWS Act and subject to possible legal action.

- Due to these factors which have been highlighted in our previous statements, we believe that;

    a. it would be in the best interests of Awaba Colliery, RPS and the Aboriginal Stakeholders to formulate a strategy to select certain areas within the Study areas of 2 and 3 to be identified and a series of excavation test pits opened up to assess/evaluate what Awabakal Cultural Heritage values could be situated within these areas. This would then give a better understanding of what is located subsurface that could be impacted due to possible subsidence from the proposed underground mining activities of Awaba Colliery.

    b. it has further been suggested that on page 41 and 42 of the **Draft Cultural Heritage Impact Assessment Report for Awaba Colliery** Section *8.2 Recommendations for Study Area 2* and Section *8.3 Recommendations for Study Area 3* which says;

    'Study Area 2 comprises primarily of bush which will be impacted by subsidence due to underground mining. No Aboriginal sites requiring AHIMS registration were observed in this area; however, areas of moderate and high archaeological sensitivity were identified.'

    'Study Area 3 is located southeast of the pit top area (East B) and has not been previously mined. It comprises bush traversed by dirt tracks. No Aboriginal sites requiring AHIMS registration were observed in this area; however, an area of moderate archaeological sensitivity was identified.'

    c. therefore these moderate to high archaeologically sensitive areas should be the subject of an investigative approach that will be implemented to allow these particular areas to be targeted for investigation to ascertain what these environs contain in regard to Awabakal Cultural Heritage. This in turn would help in the formulation of an Aboriginal Cultural Heritage Management Plan resulting in methods to assist in the mitigation and management of these important areas.

Aboriginal Cultural Heritage Management Plan

- Stated on page 48 of the **Draft Cultural Heritage Impact Assessment Report for Awaba Colliery** Section *Recommendation 11* where recommendations are made that there is the necessity for the provision of a Cultural Heritage Management Plan which, as we understand is a requirement under part 3A consent.

    a. Based on this fact the Aboriginal Cultural Heritage Management Plan would be without foundation if formulated without consultation and inclusion of the Aboriginal Stakeholders within the process.

    b. Consequently this Aboriginal Cultural Heritage Management Plan would then, in consultation with and direct partnership with the Aboriginal Stakeholder groups, be devised to implement measures so as to set in place adequate management/mitigation plans which will protect and preserve the Awabakal Cultural Heritage likely to be impacted/compromised by the proposed underground mining activities of the Awaba Colliery and

    c. Any other issues relevant to the proposal.

    d. We also believe that there is a need for a representative of Centennial Coal/Awaba Colliery to meet with the Aboriginal Stakeholders (which to this point has not been realised) to discuss this matter further. We understand that this would involve a dialogue regarding possible implications of impacts to Awabakal Aboriginal Cultural Heritage and their management.

Intergenerational Equity

What is intergenerational Equity?? We see ***Intergenerational Equity*** as a provision for future generations to benefit from what has transpired in the past and to have been left as much as the previous generation.

- Below are provided three (3) examples we have included quoted from international organisations/standards from around the world which explain what ***Intergenerational Equity*** represents;

    a. ***Intergenerational equity:*** *A core proposition is that future generations have a right to an inheritance (capital bequest) sufficient to allow them to generate a level of well-being no less than that of the current generation. Also refers to fairness in the treatment of different members of the same generation.*[4]

    b. ***Intergenerational equity:*** *Meeting the needs of the present without compromising the ability of future generations to meet their own needs.*[5]

    c. ***Inter-generational equity:*** *The principle of equity between people alive today and future generations. The implication is that unsustainable production and consumption by today's society will degrade the ecological, social, and economic basis for tomorrow's society, whereas sustainability involves ensuring that future generations will have the means to achieve a quality of life equal to or better than today's.*[6]

- Does Centennial Coal/Awaba Colliery truly and adequately address ***Intergenerational Equity*** if their continued underground mining activities cause, as we already have been advised it will in the **Draft Cultural Heritage Impact Assessment Report for Awaba Colliery** on page 10 that; ***'…there is potential for subsidence.'*** and again on page 41; ***'Study Area 2 comprises primarily of bush which will be impacted by subsidence due to underground mining.'***??
  Subsidence and the potential to impact Awabakal Cultural Heritage sites within the continued underground mining area of Awaba Colliery are clearly demonstrated by the earlier examples.

- We would now like to solicit a response from Centennial Coal/Awaba Colliery in regard to these important questions below.

    A. ***So what measures have been put in place within this*** **Draft Cultural Heritage Impact Assessment Report for Awaba Colliery** ***so as to address the issue of Intergenerational Equity in the event of possible damage or disturbance to Awabakal Aboriginal Cultural Heritage if potential surface impacts from subsidence eventuate?***
    B. ***How has and will Centennial Coal/Awaba Colliery address the question now of Intergenerational Equity for future generations of Awabakal People?***

This area is very significant; it is where our People have lived for generations. Our grandmother was born in the late 1800's beside a waterhole (which is still there to this day) in Stockyard Creek, not far from the Study areas in question. Living there with her mother (an Awabakal Woman) and family, trying to survive the best and only way they knew how. Was it possible that she was thinking that in the future, would her descendants still be fighting to protect the Cultural Heritage, the ways of our People living from the lake, sea and mountains and remembering those mysteries, the stories of how her ancestors fought for the place they came from and all that had been passed down to them for centuries!! This today is the legacy we have inherited. We still fight to protect and preserve the integrity and uniqueness of the Awabakal People. We think of the future, will those to come endure and continue this generational legacy?? Ancestors and Descendants are one in the same; they look in both directions, the past and the future. It just depends where you're standing at what time!!

We thank you Tessa for the opportunity to contribute these comments/recommendations in regard to this project. We hope this addresses any queries you may have, if not and further information is required please don't hesitate to contact us ASAP. Our contact details are as follows.

NGI NOA
Shane Frost CEO: Awabakal Descendants Traditional Owners Aboriginal Corporation
Email:shanefrost@bigpond.com Phone: 49964362 Fax: 49964325 Mobile: 0428320671

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[4] ***From Website 'www.traditionalknowledge.info/glossary.php'***

[5] ***From Website'www.konsult.leeds.ac.uk/public/level1/sec17/index.htm'***

[6] ***From Website'www.ic.gc.ca/eic/site/ee-ee.nsf/eng/h_ef00016.html'***

5 July 2010

RPS
Attn: Tessa Boer-Mah
Senior Archaeologist
PO Box 428
Hamilton NSW 2303

Dear Tessa,

Re: Comments for the Awaba Colliery Draft Report Cultural Heritage Impact Assessment.

With regard to the Cultural Heritage Impact Assessment for the Awaba Colliery, we recognise the evaluation by RPS appears to be reasonably comprehensive.

The primary objective of the preliminary Aboriginal Heritage Assessment was to ascertain the presence and evidence of any areas of cultural or archaeological significance within the study area. The project area is defined to consider that the Awaba Colliery is seeking a project approval from the Minister of Planning under the provisions of Part 3A of the Environmental Planning and Assessment Act to:

- Undertake board and pillar development and pillar extraction within narrow panels by continuous miners within the East B Area
- Produce approximately 880,000 tones of 'Run of Mine' coal per annum (financial year)
- Expand the final pollution control dam

In addition, the Awaba Colliery proposes to include its current mining and surface operations within the Part 3A approval, and the proposed development also includes an upgrade of infrastructure.

Our Comments to the contents of the Draft Aboriginal Assessment Report are as follows:

We are concerned that the Executive Summary within the **Report** does not provide for any Mitigation Management Strategies for the proposed project and/or any reference for the inclusion of any consultation involvement with the relevant Aboriginal Stakeholders for the proposed Cultural Heritage Management Plan for the Proposed Project area.

Page3, - Executive Summary Dot Point 3, We believe that the reference made to 'community representatives' in the **Report** should be changed to 'Registered Aboriginal Stakeholders', as the meaning of 'community' has a wider group connotation, whereas the meaning of 'Stakeholders' referrers to independent parties and is more accurate and specific, and therefore we would like the **Report** to consistently refer to the 'Registered Aboriginal Stakeholders' instead of a generic 'community representatives'.

It is our interpretation that Aboriginal communities consist of Aboriginal people, many of whom have relocated into other Aboriginal Nations / Traditional Lands and need to demonstrate their respect of the culture and heritage of the region and the rights of the traditional descendants of the area, given that the Hunter and Lake Macquarie regions consist of many Aboriginal community members who have no cultural association with this land or heritage.

Page 3, Dot Point 5, We believe that an Aboriginal Heritage assessment process involves both a cultural values assessment and an archaeological assessment. Therefore we suggest that all areas of moderate and high archaeological sensitivity should also include Cultural Heritage Sensitivities and Values, as this **Report** should reflect a *Cultural Heritage* perspective for the Assessment.

Therefore we suggest that the **Report** consider the value of 'place' within the Heritage and Cultural weighting, as this consideration is to insure the protection and conservation of Place & Objects which impact significantly on the spirituality, cultural, historic and general legacy needs of Aboriginal people to address inequalities in social and community well being.

Page 4, Dot Point 2, With regard to ' If an Aboriginal site is identified…', we believe that this dot point may have the potential to be misleading, as it reads as if no Aboriginal sites exist within the proposed project area. Therefore we suggest that the sentence should specify… "If further Aboriginal sites are identified…"

We suggest and highly recommend that if approval is granted that an Aboriginal Cultural Heritage Awareness Package be prepared in preparation for an induction for personal and contractors involved in the construction activities on site. We recommend that RPS assist in facilitating the preparation of this package in collaboration with the Registered Aboriginal Stakeholders. In acknowledgement of the importance of the area to the Awabakal people that have a primary attachment to the region, we recommend only the Registered Awabakal Stakeholder groups and the Local Aboriginal Land Council prepare this package.

Page 4, Dot Point 3, We commend and agree with position taken with regard to monitoring for subsidence impacts that may extend beyond the project area. However, we are concerned that the **Report** *does not* include any Mitigation Strategy Measures for the monitoring or timeframes for this process.

Page 6, As the Draft **Report** states that there is potential for subsurface subsidence within the proposed project area, we believe that a Mitigation Management Strategy Plan should be included in the Cultural Heritage Management Plan including Due Diligence for the process of monitoring Aboriginal sites within the Mining Project Area.

Page 10, 1.3, With regard to the Scope within the **Report** we believe that the first dot point relating to "liaison and partnerships" with *all* the Relevant Aboriginal Stakeholders (Aboriginal community), in our view has not been achieved. We believe that this perspective, as Registered Stakeholders who have a primary attachment to the region, have received limited communication and involvement concerning the Awaba Colliery project.

If we are to achieve an inclusive process and a greater understanding of cultural attachment to place, both archaeologists and proponents need to take into consideration what inclusion means to Aboriginal people as part of their healing and self-determination process.

Page 10, 1.3, The aspects of Aboriginal Cultural Heritage sensitivity again seem to be omitted from the Scope within the **Report**. We believe that Cultural Heritage Impact Assessments needs to incorporate an inclusive understanding and explanation of Aboriginal Cultural Heritage for a more comprehensive perceptive.

Page 17, 2.0, With regards to the Aboriginal Consultation within the **Report**, we hold grave concerns that the reference made to ongoing consultation with the Aboriginal community does not include any consultation with the Awabakal Descendants who have a primary attachment to the region, being that we are direct descendants of the People of Awaba. We believe that RPS and Awaba Colliery may have overlooked our cultural and spiritual connections and inherent rights to country.

We believe that reference within the **Report** concerning the ILUA with the Wonnarua People can be seen as confusing and could potentially be misleading. It would seem unfortunate that the Aboriginal Cultural Assessment for the Awaba Colliery (which includes Aboriginal presence and the assessment of site significance) results in an ambiguous determination of the Cultural Tribal area.

Ultimately it is the belief of the descendants of the Awabakal Traditional Owners, and many Aboriginal Community members, as well as Glen Morris (NPWS Officer) that the Awaba Region lies within the Awabakal Traditional Cultural Boundary Area.

Furthermore, although Centennial (formerly Powercoal) does have an ILUA with the Wonnarua People (Wonnarua Nation Aboriginal Corporation) for lands within and adjacent to the Project Application area, that the references made within the Draft **Report** does not mean that the area that the ILUA covers is within the Wonnarua Boundary, and strongly suggest that these references within the **Report** needs additional clarity.

Page 18, Table 2-1, It would be remiss of us to ignore the fact that there are a number of Wonnarua stakeholders who are positioning themselves within the Awabakal Cultural Boundary. We believe that any information or comments provided by any inappropriate stakeholders would be inconsequential as the Awaba region is well within the Awabakal Cultural Boundary. We believe this needs critical attention and resolve when regarding further developments. Naturally we will make ourselves available for a meeting to discuss and clarify this matter further.

Page 21, 3.2, We disagree with the statement in paragraph 2 …"that Aboriginal occupation in this area would not have been frequent or long term on the basis of limited water availability..." as this statement may be misinterpreted.

The occupation of Awabakal people within the region has been well documented and should not be incorporated in the aspects of Topography and Hydrology. These aspects should not be confused with the occupation of Awabakal people within the region, as the **Report** does not include or refer to other water resources that are in close proximity.

Page 21, 3.4, We have concerns that this section within the **Report** indicates that some areas of the Study Area were not assessed, and that assumptions of the study area are being made. We are referring to the statement…'*although there may be some older trees present*'… as this statement may indicate that the assessment and the condition of the study area may be incomplete.

Page 22, 4.1, 4.2, We consider that the "Cultural Heritage perspective" pertaining to the Aboriginal Cultural Heritage aspects of the study area within the **Report** is excluded from the Assessment. We believe that the *Human* element should also be represented within the Draft **Report** and therefore consider that the writings of the Reverend Lancelot Threlkeld are an informative adjunct to the Awabakal Peoples lifestyle that would have indeed broaden the local context of the **Report**.

We also strongly suggest that the final **Report** be referenced and supported by "Australian Reminiscences & Papers of L.E. Threlkeld" who was the missionary to the Aborigines of Lake Macquarie 1824-1859; in whose correspondence and detailed account of the Awabakal People of the Lake Macquarie and Hunter region are the earliest "colonial commentary" recorded.

Pages 24 - 26, We hold grave concerns that previous archaeological investigation comments within the **Report** may be misleading and have the potential to be confused with the Awaba Colliery Study area. We are concerned that the previous archaeological investigation comments may have the potential to detract from the findings of the Aboriginal assessment for the Cultural Heritage Impact Assessment for the Awaba Colliery.

Although anthropologists and/or archaeologists may have the ability to identify past physical use of a location, they do not have the capability to adjudicate on the spirituality of any particular location or site, this being the exclusive right of the Awabakal Traditional Owners who have a cultural and hereditary association with the land of their ancestors.

Page 32, 6.2, With regard to this section we again believe that the information or comments provided by any inappropriate stakeholders from previous assessments would be inconsequential as the Awaba region is well within the Awabakal Cultural Boundary. We believe this section needs critical attention and resolution.

Page 38, 39, 7.2, We believe that the reference in the **Report** stating that there are…"No identified Aboriginal sites or places have been identified within the study area …" can be a misleading assumption unless further investigation proves otherwise, and furthermore we believe that the explanation of the purpose of the defined four (4) zones may potentially be taken out of context. We believe that there is potential for Aboriginal cultural material to be concealed below the vegetated ground surface as a result of the general use of the area by our people, the Awabakal.

We are concerned that these statements in the **Report** may present a foregone conclusion that Aboriginal Cultural Heritage and Values do not exist and therefore would give the impression that these aspects pertaining to Aboriginal Cultural heritage Values are extinct, and suggest that these references will need further clarity.

We also have concerns that the **Report** has not taken into consideration the impact on unknown sites due to the observation and information gathering process which presented minimal visible evidence due to the vegetated ground surface. Therefore, it should not be assumed that Aboriginal artifacts do not exist within the proposed Awaba Colliery project area.

We believe that although the DECCW AHIMS Database may not necessarily have "up-to-date" or current information due to any unreported or unfinished site assessments pertaining to projects within close proximity to the Awaba Colliery project area, we consider that all surrounding Awabakal Aboriginal sites are holistically and historically culturally connected.

Page 41, 42, 8, We disagree with the Conclusions and Recommendation regarding that there are 'No Aboriginal heritage constraints' as this comment may be taken out of context and may have the potential to be misleading. We believe that the Conclusions and Recommendation may also need to include the NPWS and DECCW Acts in relation to the protection of Culture and Heritage in the event that Aboriginal sites are exposed during the suggested monitoring for Study Area 2 and 3, as recommendation for these areas.

We believe that the **Report** has not taken into consideration and/or addresses the issues pertaining to Intergenerational Equity for future generations of Awabakal people in the event of possible damage or disturbance to Awabakal Aboriginal Cultural Heritage if potential surface impacts eventuate from subsurface subsidence.

We also believe that the absence of any Mitigation Strategy and Measures within the **Report** for the Awaba Colliery project area may have been an oversight, if indeed the continued underground mining activity causes subsurface subsidence.

We express a high level of alarm and distress regarding the probability of risk to our cultural heritage values through the proposed activity seeking permit approvals. In the scenario of disturbance to our cultural heritage we state that we find this highly disturbing and that mining activity may be given greater weighting than conservation.

We seek DECCW's serious consideration of the legacy of cumulative and continued proposed damage to our cultural heritage values and examine intergeneration equity standards in determining approvals or non-approvals. Any approval and conditions must use best practice standards and intergenerational equity weighting in consideration in determining the future conservation of our cultural landscape.

Empirical evidence demonstrates that the area has a history of poor cultural heritage recording and reporting and cumulative impact assessment integrated into a weighting for intergenerational legacy is of a poor standard.

Recommendations

- That the **Report** clarify all the concerns and considerations raised.

- That if the project is approved that an Aboriginal Cultural Heritage Management Plan be prepared in consultation with all the Registered Aboriginal Stakeholders.

- That reference made to 'community representatives' in the **Report** should be changed to 'Registered Aboriginal Stakeholders'.

- That if the project is approved that an ***Aboriginal Cultural Heritage Awareness Package*** be prepared in preparation for an induction for all personal and contractors involved in the construction activities on site.

- That a Mitigation Strategy and Measures needs to be included within the **Report**.

- Given that the descendants of the Awabakal people have a cultural and hereditary association with the land of their ancestors, we recommend that there is attention needed for Aboriginal protocols enabling Awabakal descendants in having the exclusive right to adjudicate on the spirituality of any particular location or site.

- The protection of all artifacts is crucial to the descendants of the Awabakal and it is imperative for us to be in a position to protect what connects us with our culture both physically and spiritually. This would also indicate our right to have the final decision regarding the relocation of any Aboriginal artifacts discovered that are associated with our people for the duration of the proposed project. We reserve the right to obtain a **Care and Protection Permit** for any artifacts retrieved.

- **Value of Place -** We recommend that RPS may need to consider the value of 'place' within the Heritage and Cultural weighting, as this consideration is to insure the protection and conservation of Place & Objects which impact significantly on the spirituality, cultural, historic and generational legacy needs of Aboriginal people to address inequalities in social and community well being.

- As there are several previously recorded sites within the vicinity of the proposed project we suggest caution is needed as a number of our sites have previously been destroyed.

- That Intergenerational Equity is taken into consideration in the event of possible damage or disturbance to Awabakal Aboriginal Cultural Heritage if potential surface impacts eventuate from subsurface subsidence.

The Awabakal Traditional Owners Aboriginal Corporation (ATOAC) makes the following assessment conservation recommendations based on the DECCW recommended approach consistent with the NPW Act—Conservation involves identifying, assessing, protecting and maintaining the important cultural and heritage values of landscapes, resources, places, objects, customs and traditions so that we, and generations to come, can enjoy, learn from them, and appropriately manage these values.

Legislation ensures that Aboriginal heritage must be considered as part of land management. DECCW protects Aboriginal heritage through:

- Management planning
- Public education and awareness
- Physical protection works

The following weighted assessment considers the above three areas of Aboriginal Heritage conservation.

The following statements and recommendations are made within the context that:

- The NPWS recognises that Aboriginal culture is living and unique and recognises the right of Aboriginal people to protect, preserve and promote their culture.
- The NPWS recognises that Aboriginal people are the rightful cultural owners of Aboriginal cultural heritage information and Aboriginal sites and objects ('relics' under the National Parks & Wildlife Act, 1974). In the area of Aboriginal cultural heritage, the NPWS is committed to a joint and equitable management partnership with its own Aboriginal heritage staff and with Aboriginal communities.
- The NPWS commits to an active partnership with Aboriginal communities in advocating constructive changes to legal and institutional arrangements governing the control of Aboriginal heritage.

Empirical learning demonstrates that the impact of subsidence can have devastating effects on our cultural heritage landscape and features and our cultural heritage is coming under increasing and continuing pressure and risk because of the volume and level of mining activity. We believe that there is potential for subsurface subsidence within the proposed project.

We are concerned that perspectives of Intergenerational equity are not taken into consideration considering that the **Report** does refer to the potential of subsidence which would impact on Awabakal Cultural Heritage sites within the continued underground mining area of Awaba Colliery. This consideration would clearly demonstrate a commitment to the protection of Aboriginal Cultural Heritage sites by Awaba Colliery if indeed Aboriginal sites are exposed during the life of the mining project.

We believe that the context of the landscape of the surrounding project areas relate to distinctive factors that are associated with Aboriginal inhabitants.

In closing, the principal vision and aim of the Awabakal Traditional Owners Aboriginal Corporation is to protect the cultural heritage of our ancestors. Continued multiple adverse impacts place increasing environmental and cultural heritage values stress on our landscape and specifically to our features and objects which provide a rich evidence of our social function which extended beyond pre-contact into and continuing through post contact, tool ingenuity, ceremony and Dreamtime and commerce and trade, as well as architecture and housing and food and remedial knowledge and practices.

The Awaba region is regarded as highly significant to the Awabakal people, and in our view the region is part of the land that echoes the ethos of our cultural heritage. Therefore, any artifacts and/or residual evidence of our people are held in high regard and are considered a cultural reminder that unites us with our land and sea country, our past and spirituality and provides us with a visual generational legacy.

We reserve the right and reluctance to share our cultural heritage with others with respect to aspects of the cultural significance enabling us to protect our cultural knowledge and values.

We acknowledge RPS and the Awaba Colliery's commitment and support in addressing the many aspects related to the perspectives and diversity that is associated with Aboriginal Cultural Heritage.

We would like to thank RPS for the opportunity to comment and request a copy of the Final Report is forwarded to the Awabakal Traditional Owners Aboriginal Corporation at your earliest convenience.

If you require any further information please do not hesitate in contacting me.

Yours sincerely,

K. Brauer.

Kerrie Brauer
Director | Administration

Awabakal Traditional Owners Aboriginal Corporation
ABN: 90 203 408 390 | ICN: 4411
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Barkuma Neighbourhood Centre Trading as… ABN: 58 290 659 800

Gidawaa Walang

Wiradjuri Meaning ~ Goanna Turning the Stone

Cultural Heritage Consultancy

…To keep our Culture…

Friday 4th June 2010

Tessa Boer-Mah
RPS
241 Denison Street
Broadmeadow
NSW 2292

16 JUN 2010
BY:

Dear Tessa,

Re: Cultural Heritage Impact Assessment for Awaba Colliery

Gidawaa Walang Cultural Heritage Consultancy agrees with the recommendations for Study Area 1 Recommendations 1 and 2, Study Area 2 Recommendations 3 and 4, Study Area 3 Recommendations 5 and 6, Study Area 4 Recommendations 7 and 8.

We also agree with the Recommendations 9 through to 14 for the Management of the Project Application Area.

Yours truly,

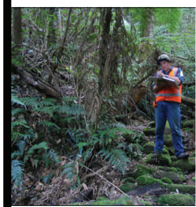
Ann Hickey
Project Officer

76 Lang Street
Kurri Kurri
NSW 2327

Phone: 4937 1094
Fax: 4936 4449
Mob: 0411 196 991








TRAFFIC IMPACT ASSESSMENT

APPENDIX 8

CLIENTS | PEOPLE | PERFORMANCE

Centennial Coal

Report for Awaba Colliery

Traffic Assessment

September 2010

Revision 2

Contents

Table Index

Figure Index

Appendices

A Crash Data

B Traffic Data

C SIDRA Output

Executive Summary

Awaba Colliery is a small underground coal mine operated by Centennial Coal. The mine entry is located on Wilton Road, approximately one kilometre south of the Awaba village and 5.5 kilometres south west of Toronto on the western side of Lake Macquarie.

The objective of this assessment is to examine the existing public road condition in the area around the Awaba Colliery and any impact of the proposed Mining Project.

The scope of the traffic assessment is the intersection of Wilton Road and the Awaba Colliery access road and its approaches.

Wilton Road

Wilton Road is an unclassified road under the control of Lake Macquarie City Council (LMCC). At the township of Awaba, Wilton Road joins to Awaba Road. There are two junctions to the broader road network: one at Wangi Road in the south and one at Cessnock Road in the north.

Road Crashes

In the last five years, there were no crashes in the vicinity of the intersection; the nearest crash was located 540 metres from Colliery intersection.

Road Capacity

Wilton Road has sufficient capacity projected for at least the next 10 years.

Colliery Access

In accordance with Lake Macquarie Council Development Control Plan, the minimum sight distance requirements applying to the colliery access are those applicable to an access driveway.

Sight distances on both approaches to the Colliery are adequate for a local driveway access.

Signage and Guideposts

An improvement to the signage is proposed. These changes would provide early warning to motorists of the Colliery intersection.

Missing guideposts should be replaced on Wilton Road.

1. Introduction

This traffic assessment has been prepared on behalf of Centennial Coal.

1.1 Background

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 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 site is situated on crown land under lease to Centennial for the purpose of mining under Consolidated Coal Lease CCL746, and is adjacent to the Newstan-Eraring haul road owned by Eraring Energy. The locality of the mine is illustrated on Figure 1-1.

Awaba Colliery is a small operation with approximately 100 employees and contractors, 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.

A form of pillar extraction of narrow panels is used to recover coal in pillars developed previously by bord and pillar methods. 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 has been developed in consultation with the Department of Primary Industries – Mineral Resources (now known as Industry and Investment, NSW (I&I)) and has been used successfully to date, and is proposed to be continued for the Project.

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. A detailed description of the Project and the Project Application Area (the "Application Area") (including focus study areas) is detailed further in Sections 1.2 and 1.3 below.

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 outlined in Sections 1.2 and 1.3 below.

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 (refer Section 1.2.1) over a period of approximately five years or more, depending on actual mining conditions and relevant market drivers. The application for the proposed Project is supported by an Environmental Assessment ("EA").

1.2 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 1.2.1. 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.

1.2.1 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 Section 96(1A) of 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 will also be addressed in the EA.

1.3 Project Description

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 final 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 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).

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 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 NSW in 2009, until such time that a final Detailed Life of Mine Strategy has been developed.

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

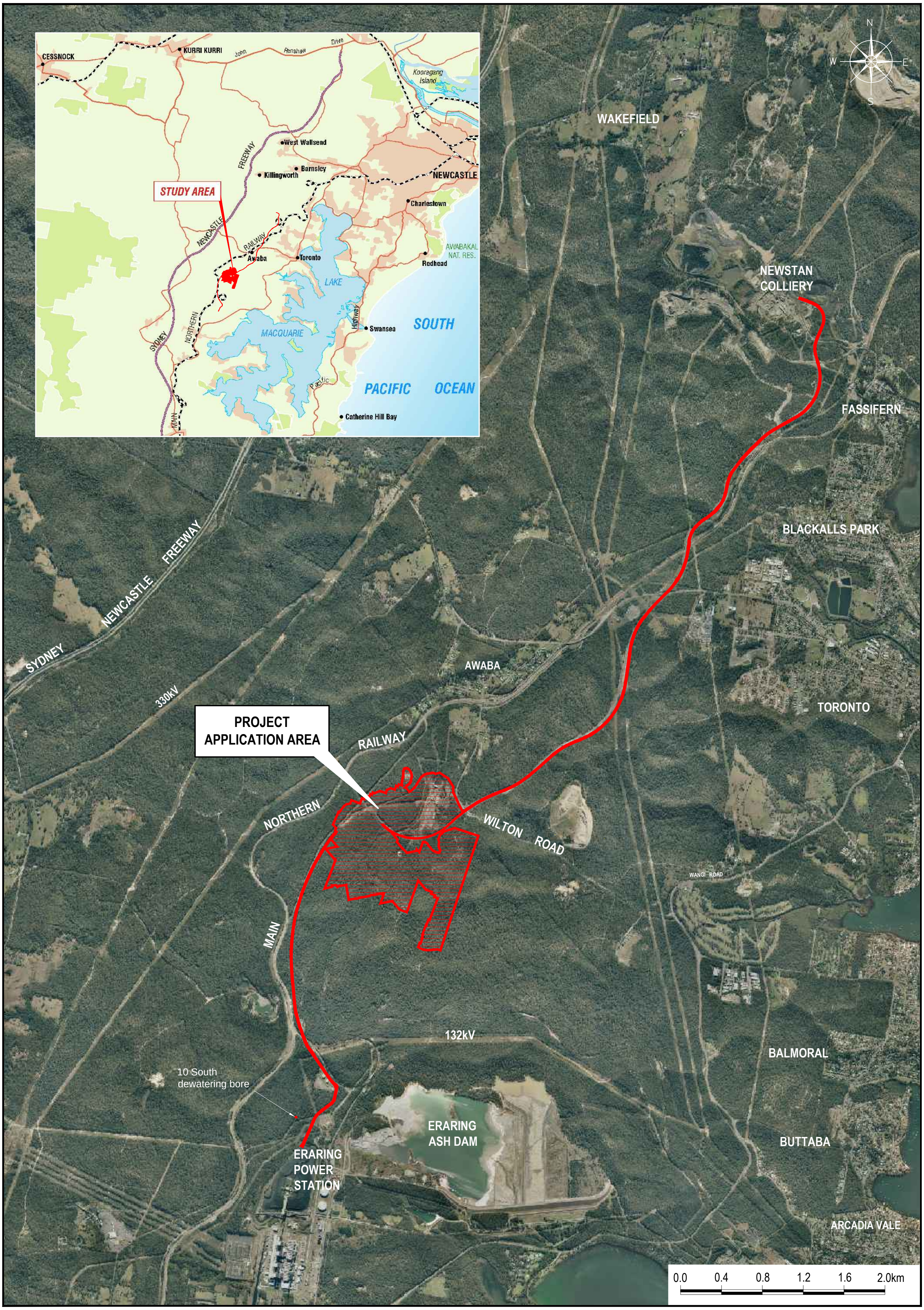
Awaba Colliery requires approval to deliver coal via the private haul road to the Newstan Colliery ROM coal stockpile (in addition to the Rail Loop stockpile). This is assessed within Study Area 4. Newstan Colliery has submitted an application to modify its development consent in order to process coal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

Existing mining areas, will continue to be utilised for ongoing mining operations including (but not limited to) mine access, emergency management and underground services and infrastructure.

Continuing Mine Operations:

For the purposes of environmental assessment, further to the information above regarding continued mining areas, it is noted that the following aspects of mine operations are proposed to continue and remain unchanged. Existing mining operations are presented in detail in Section 3 of the Environmental Assessment (EA) and, where relevant, components are discussed further in this specialist report.

- **Coal Handling, preparation and stockpiles** – No changes are proposed to the current coal handling, preparation or stockpile procedures to the existing operations;
- **Mine support facilities and site access** – No changes are proposed to the current infrastructure and facilities, with the only exclusion being the expansion of the Pollution Control Dam (PCD) mentioned earlier above, with related water management considerations. Mine access from Wilton Road will continue to be utilised and no significant change is anticipated from current use;
- **Plant and equipment** – No changes are proposed to the typical plant and equipment used at the Awaba Colliery;
- **Transportation procedures** – 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;
- **Mining methodology** – There will be no significant changes to current mining methods 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 (financial year), depending on mining efficiency and market demands;
- **Operational water management** – 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;
- **Mine dewatering procedures** – the 10 South Bore will continue to be used for groundwater management and dewatering during both continued operation and care and maintenance conditions.



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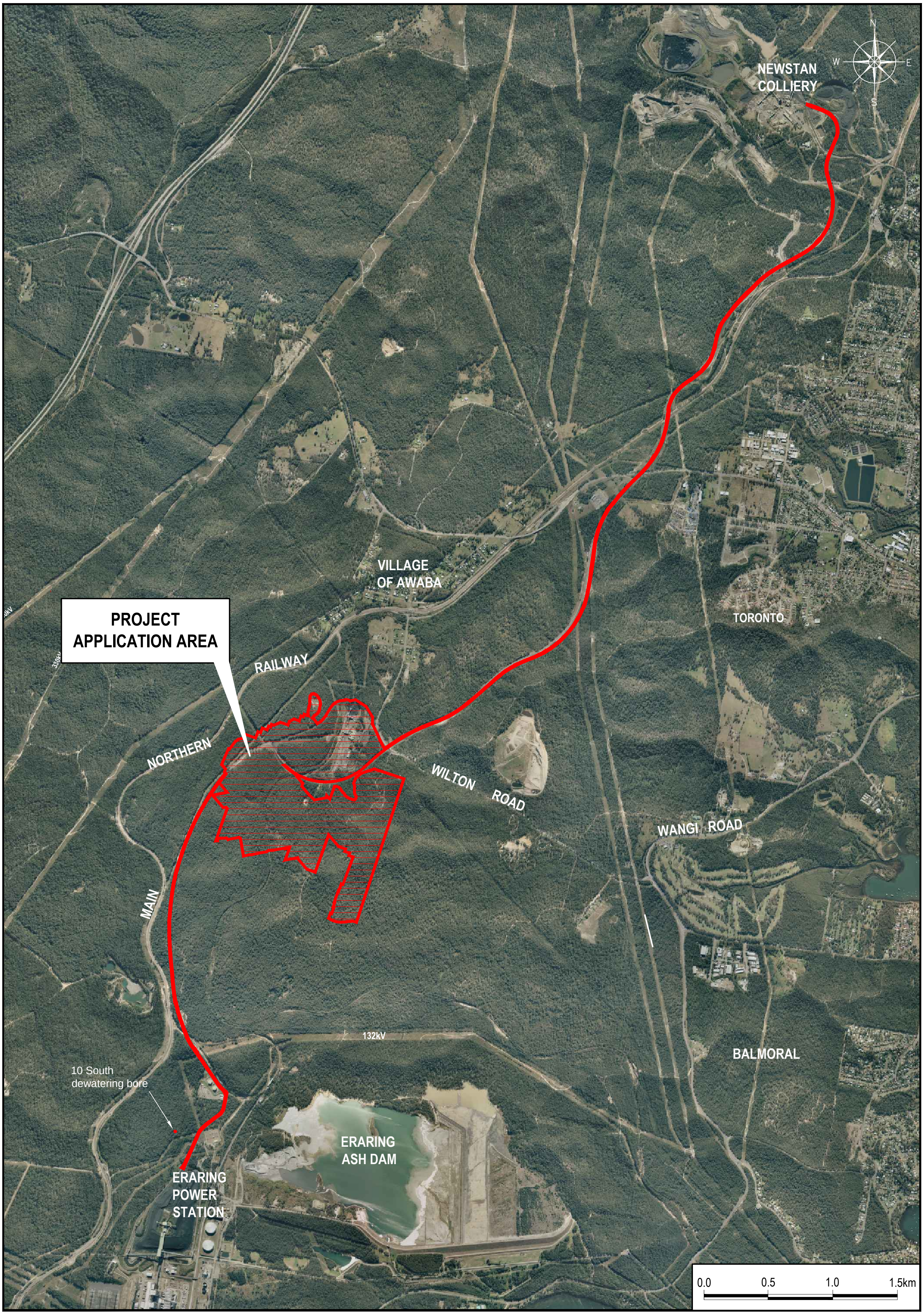
Location Plan

Figure 1.1



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Project Application Area

Figure 1.2

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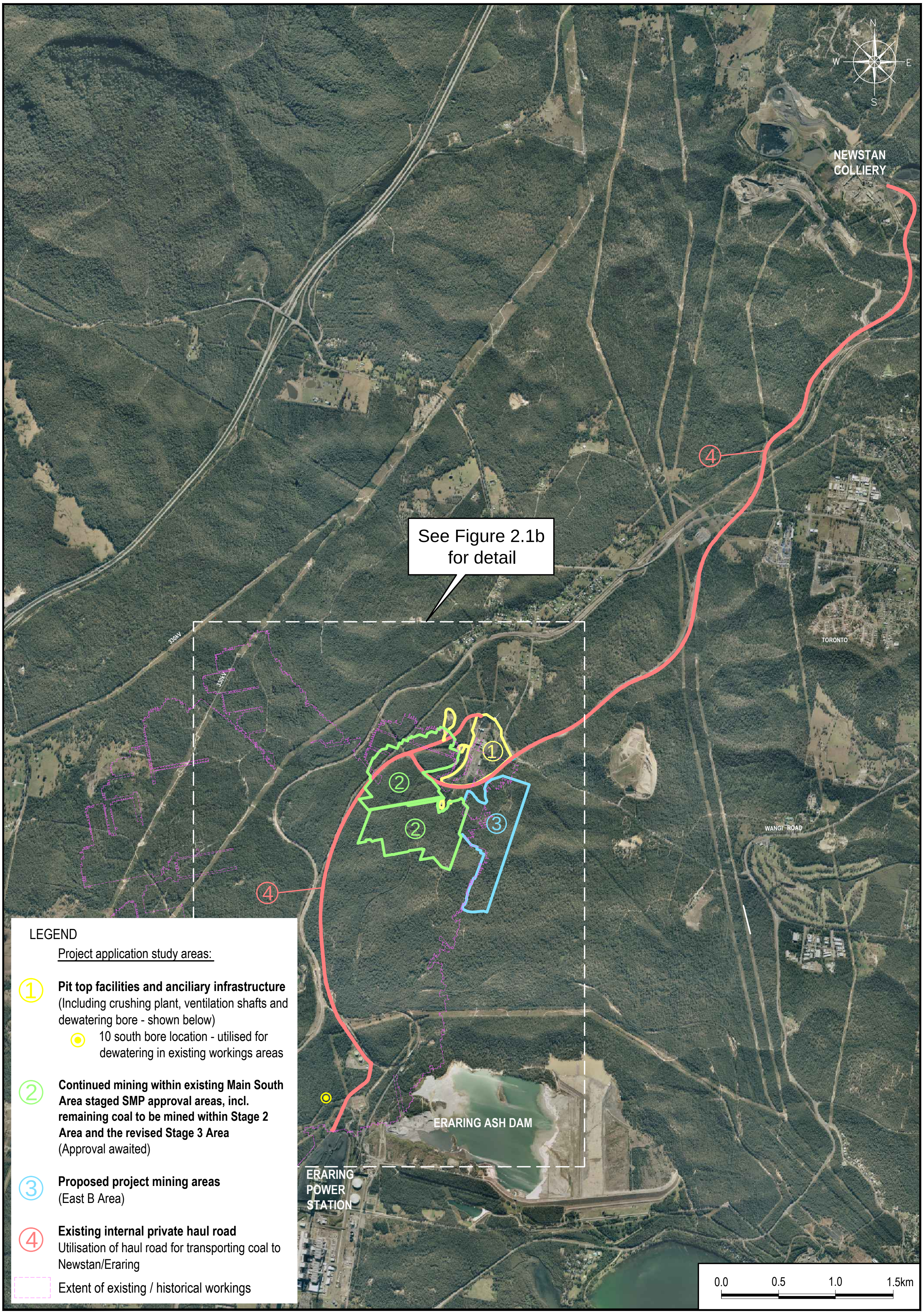
Source: Centennial Coal

Local Road Network

Figure 1.3



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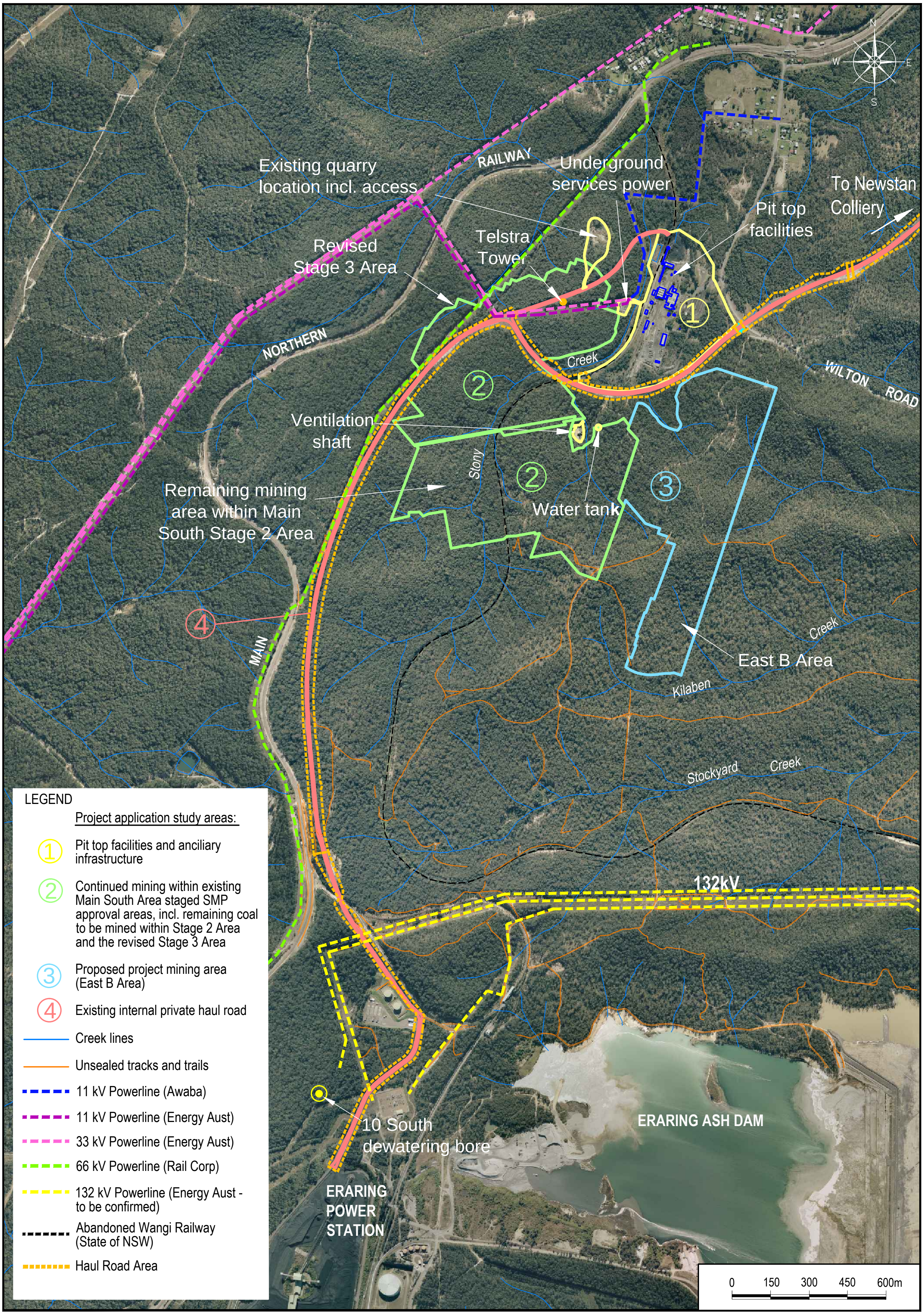
Project Application Study Areas

Figure 2.1a



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Project Application Study Areas Detailed

Figure 2.1b

1.4 Objectives

The objective of this assessment is to examine the existing public road condition in the area around the Awaba Colliery and to assess any impact of the proposed ongoing operation of the Colliery.

1.5 Scope

The scope of this assessment is the intersection of Wilton Road and the Awaba Colliery access road and its approaches. The assessment is limited to the impact of employee and delivery traffic generated by the existing Colliery operation. All coal haulage traffic is via the Newstan-Eraring haul road owned by Eraring Energy.

In assessing this site, it is noted that there have been no crashes recorded by RTA on Wilton Road in the vicinity of the Colliery access road during the past five years. The nearest crash was recorded as occurring at approximately 500 metres from Colliery access.

1.6 Director General Requirements

The Roads and Traffic Authority (RTA) responded to the Director Generals Requirements (DGR) request for key issues to be addressed in the Environmental Impact Assessment. These are summarised in Table 1-1 and where they have been addressed in this report.

Table 1-1 RTA Director General Requirements

Requirement	Where Addressed
Assessment of all relevant vehicular traffic routes and intersections for access to/from the subject area during the construction and operational phases	No construction phase Section 4.2 Existing Traffic
Current traffic counts for all of the traffic routes and intersections	Section 4.2.1 Wilton Road Traffic
Anticipated additional vehicular traffic generated from the proposed development and associated trip distribution on the road network during both the construction and operation phases	No additional vehicular traffic to be generated
Traffic impacts on existing and proposed intersections, including the cumulative traffic impact of other proposed developments in the area.	Section 4.2 Existing Traffic
Identify the necessary road network infrastructure upgrades that are required to maintain existing levels of service on both the local and classified road network	Road signage improvements discussed in Section 6 Traffic Safety

Requirement	Where Addressed
Intersection analysis	Section 5 Future Conditions and Impact Assessment SIDRA output attached in Appendix A
Impact of construction traffic on the road network in the vicinity of the development and measures to minimise any identified impact	No construction phase traffic. All coal haulage is via a private road.

2. Consultation

2.1 Lake Macquarie City Council

Marc Desmond of Lake Macquarie City Council (LMCC) expressed concern about the lack of signage on the approach to the Colliery. LMCC had no other comment on the condition of Wilton Road in the vicinity of the access road.

LMCC had no current records of traffic flow or traffic crashes on Wilton Road in the immediate vicinity of the Colliery Access Road. The nearest traffic flow information was between MR 217 Wangi Road and Awaba Waste Management Facility.

Through this consultation, and referring to the Development Control Plan, if the number of carparking spaces is below 250, the road may be considered as an access driveway.

2.2 Roads and Traffic Authority

The Roads and Traffic Authority (RTA) advised that it has reviewed the information provided in relation to the traffic impact of the Project. RTA provided written confirmation that it has no objections to or requirements for the Project as it is unlikely to have a significant impact on the classified road network.

3. Methodology

3.1 Assessment of Existing Conditions

A site inspection was undertaken of Wilton Road to obtain intersection geometry, measure sight distances, to confirm traffic movements at a change of shift at the Colliery and to observe traffic movements and driver behaviour in the vicinity of the intersection.

3.2 Standards

This assessment is carried out in accordance with the RTA Guide to Traffic Generating Developments, October 2002, Version 2.2 and with reference to the relevant Austroads publications and Australian Standards relating to road design and road safety.

3.3 Modelling

SIDRA version 4.0 was used to model the Wilton Road intersection. SIDRA is a micro-analytical traffic evaluation tool used to measure capacity, level of service and performance of intersections.

Traffic data from LMCC from 2002 was obtained on Wilton Road from the nearest location, approximately two kilometres to away, and extrapolated to 2010 based on the traffic growth rate of the nearest main road, Wangi Road. The worst hour of traffic data was used to model the peak traffic of the Colliery intersection.

This was further extrapolated to 2015 and 2020 to analyse future road and intersection performance.

Colliery traffic has a scheduled change of shift at 6:30 am, 2:30 pm and 10:30 pm. Although these do not coincide with the commuter peak period on Wilton Road/Awaba Road peak hour, a conservative approach to the analysis was taken by assuming a coincidence between the Colliery peak traffic flow and the public road peak traffic flow. This provides the worst possible combination of movements at the intersection.

4. Existing Conditions

4.1 Existing Road Network

4.1.1 Wilton Road

Wilton Road is an unclassified road under the control of LMCC. At the township of Awaba, Wilton Road joins to Awaba Road. There are two junctions, one at Wangi Road in the south and one at Cessnock Road in the north.

Wilton Road is a two-lane two-way sealed road extending west from Wangi Road (MR 217). The posted speed limit is 80 km/hr between Wangi Road and the Colliery access 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. The Awaba Waste Management Facility is located approximately 1.4 kilometres from Wangi Road and 1.2 kilometres from the Colliery access. The section of Wilton Road in the vicinity of the Awaba Waste Management Facility has a narrower road formation with generally narrow unsealed shoulders. The road alignment through this section is winding. Wilton Road crosses the Colliery haul-road via an overbridge approximately 200 metres to the south of the Colliery access road.

4.1.2 Colliery Access Road

The Colliery access road intersects Wilton Road on a slight bend. There is no hold line or regulatory sign for the side road traffic. An advisory sign for the Colliery is located at the intersection.

Figure 4-1 Wilton Road at the haul road overbridge, looking north

Figure 4-2 Wilton Road at approach to Colliery access, looking north

Approximately 300 metres to the north of Colliery access, the speed limit reduces from 80 km/hr to 60 km/hr and the surrounding land use becomes rural-residential with direct driveway access from Wilton Road.

Several guideposts on Wilton Road are missing due to vehicles running off the road on the curve north of the Colliery access.

Guide Post missing

Figure 4-3 Wilton Road at the Colliery intersection looking north

At Awaba Railway Station, approximately 600 metres north of the Colliery access Wilton Road turns sharply to the west and becomes Awaba Road. One kilometre to the east, Awaba Road passes under Cessnock Road overbridge and terminates at Cessnock Road.

4.1.3 Crash Data

A summary of the crash history was supplied by RTA for Wilton Road between Cessnock Road and Wangi Road covering a period of five years between July 2004 and July 2009.

There were no crashes in the vicinity of the intersection; the nearest crash was located 540 metres from Colliery intersection.

On the 5.4 kilometre length of road, there were:

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

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

Crash Data is shown in Appendix A.

4.1.4 Intersection Geometry and Sight Distance

The intersection of Awaba Colliery and Wilton Road is a T-intersection. There is no hold line or signage, and operates as a Give Way intersection.

From the intersection geometry, the turn paths of 19 metre articulated vehicle were applied to the Colliery intersection to determine the adequacy of the existing pavement to accommodate large turning vehicles. These turn paths are shown in Figure 4-4.

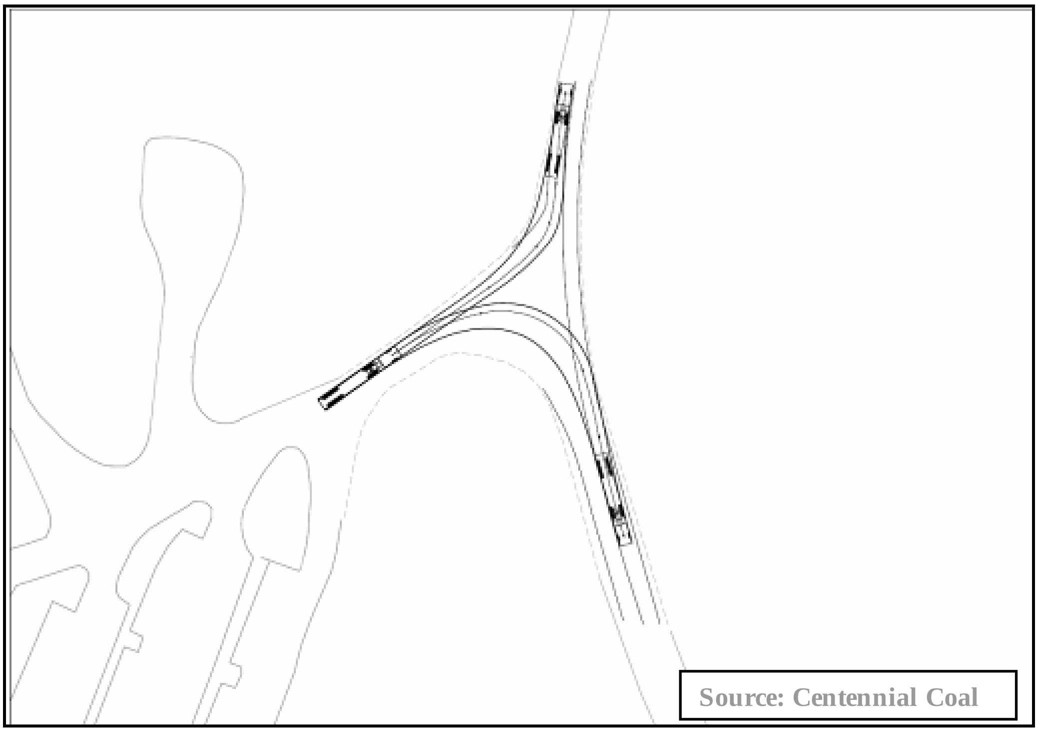


Figure 4-4 Turning Paths

From Figure 4-4 it is evident that the existing intersection is able to satisfactorily accommodate the turn paths of 19 metre articulated vehicles.

Terrain is generally level in the vicinity of the Colliery intersection.

The sight distances measured on Wilton Road on the approaches to the intersection were 130 metres on the northern approach and 220 metres on the southern approach. The sight distances at the Colliery intersection measured during a site inspection are shown in Figure 4-5.

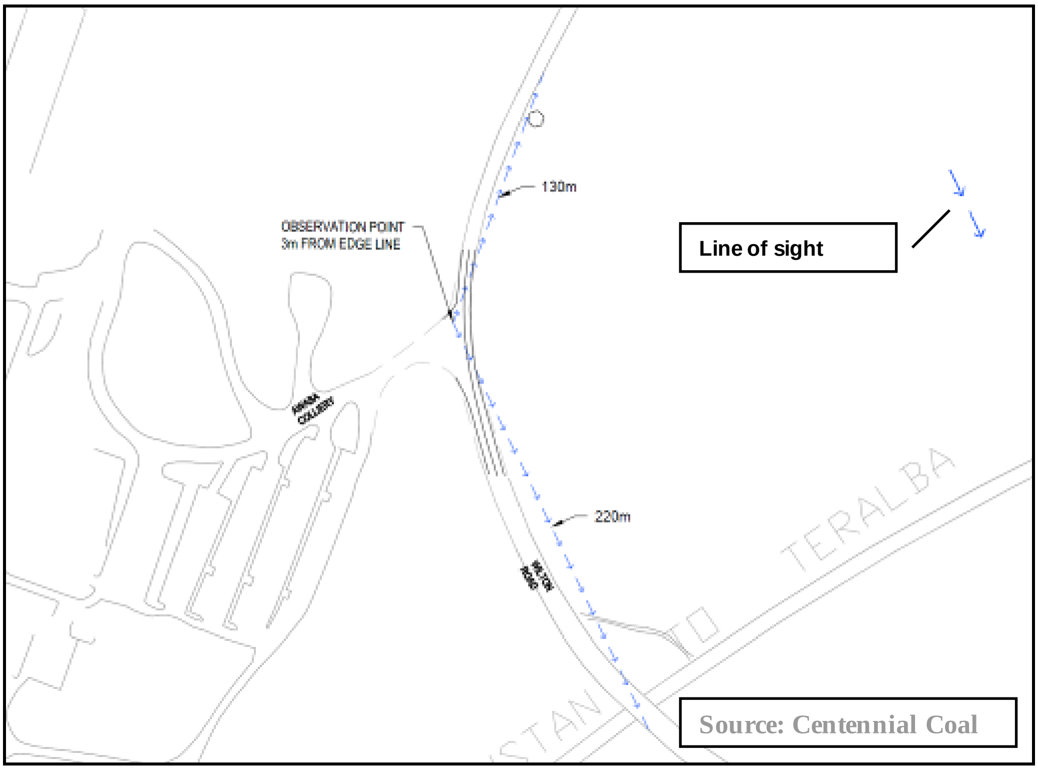


Figure 4-5 Sight Distance

To provide safe access for vehicles from the Colliery to the local road network, minimum sight distances for intersecting traffic are required.

Lake Macquarie Council Development Control Plan Number 1 Part 2.6 *Transport, Parking, Access and Servicing* specifies minimum sight distances for access driveways in Section 2.6.8 Table 13. For a driveway providing access for between 25 and 250 car spaces in an 80 km/hr speed zone, the absolute minimum sight distance is 105 metres.

As there are 200 car parking spaces at the Colliery, the access is described as a driveway and there is sufficient sight distance at the intersection.

4.1.5 Signage

There is no advance signage warning drivers on Wilton Road of traffic turning at the Colliery Access. The sign at the intersection pointing to the Colliery is too small and is obscured by vegetation.

4.2 Existing Traffic Conditions

4.2.1 Wilton Road Traffic

Traffic flow and traffic speed data for Wilton Road was supplied by LMCC. The peak hour traffic flow is summarised in Table 4-1.

Table 4-1 LMCC 2002 Traffic Data

Year of Survey	2002
Two-way Average Daily Volume (Weekday)	1951
Peak hour AM	8am-9am
Peak hour PM	2pm-3pm
Two-way peak of traffic	178
Vehicle Classes 1-2	74.5%
Vehicle Classes 3-12	25.4%

The traffic count data showed the classes of vehicles using Wilton Road over the surveyed week. The Austroads classifications range form 1 to 12. Classes 1 and 2 are considered as light vehicles, ie motorcycles and cars. Classes 3 to 12 are considered as heavy vehicles.

During the traffic survey, between 10 and 17 January 2002, 25% of the vehicles surveyed were classified as heavy vehicles. It should be noted that the survey site was located between MR 217 Wangi Road and Awaba Waste Management Facility and service vehicles accessing this facility would not generally drive past the Colliery. This data has been used for modelling and would be considered a very conservative estimate of traffic volumes passing the Colliery access. The traffic data is shown in Appendix A.

AADT data was recorded on MR217 Wangi Road at Stockyard Creek Bridge, approximately 200 metres south of the 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, a growth of 2% pa was applied to the 2002 traffic count data to estimate the 2010 traffic volume on Wilton Road.

4.2.2 Colliery Traffic

There are currently approximately 100 contractors and staff at the Colliery and it is in operation 24 hours a day, seven days a week. In general:

- There are three shifts per day:
  - 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.
- The distribution of traffic is approximately 50% turning north towards Awaba village and 50% turning south towards Balmoral.

To model the Colliery Intersection, the following assumptions were made for traffic movements during the peak period:

- Traffic growth on Wilton Road is assumed to be 2% per year.
- 50%-50% distribution of traffic entering and exiting from Wilton Road.
- 45 staff arriving and 30 leaving in light vehicles at the peak shift changeover.
- 4 delivery trucks arrive and leave (4 in/4 out).

The most significant traffic volume would be when a change of shift occurs in conjunction with a number of deliveries. Figure 4-6 shows the potential Colliery traffic generated at the change of shift at 2:30 pm.

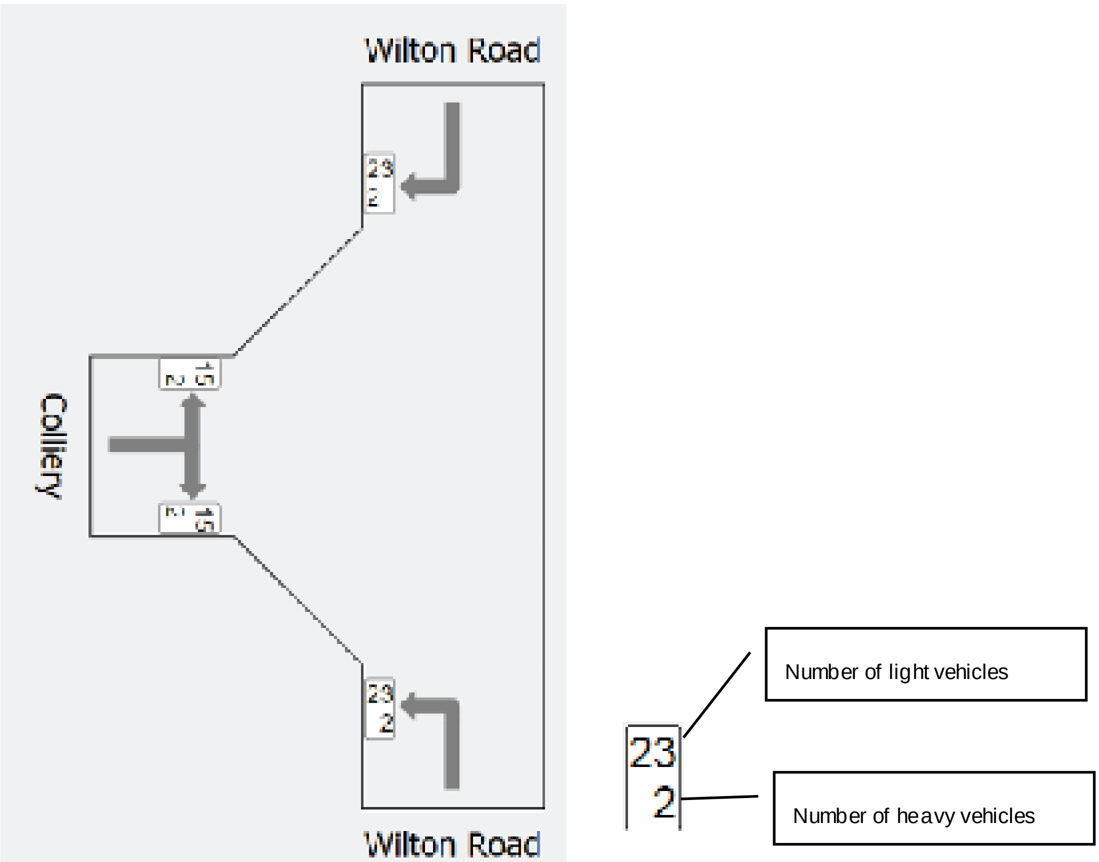


Figure 4-6 Colliery Traffic Breakdown in the Peak Hour

4.2.3 Existing Level of Service

Wilton Road

A summary of the traffic volumes on Wilton Road are shown in Table 4-2.

Table 4-2 Wilton Road Traffic Volumes

Year	Two-way Peak Hour Volume (Weekday)	% HV	One-way Peak Hour Volume LV	One-way Peak Hour Volume HV
2002	178	25%	67	23
2010	209	25%	79	27

All volumes were rounded up to the next whole vehicle.

The LOS criteria on two-lane two-way rural roads, as defined in RTA's Guide to Traffic Generating Developments, is shown in Table 4-3. These threshold values are based on a design speed of 80 km/hr and rolling terrain with 40% 'no overtaking'.

Table 4-3 Peak Hour Flow on Two-Lane Rural Road (Vehicles/Hour)

Level of Service	Veh/hr
B	264
C	485
D	595
E	1283

Source: RTA Guide to Traffic Generating Developments, October 2002, Version 2.2

As the estimated existing traffic volume on Wilton Road is below the threshold volume for level of service B, the existing level of service for traffic using Wilton Road can be described as A/B. This indicates a free flow to stable flow conditions with spare capacity.

Wilton Road/Colliery Access Intersection

Given that the waste management facility is approximately 1.3 kilometres from Wangi Road, it is reasonable to assume that most of the heavy vehicles identified in the traffic survey are entering and leaving via Wangi Road, and not passing the Colliery. It is therefore conservative to apply all of these heavy vehicles to the intersection.

The peak of movements at the Colliery is at shift changes at 6:30 am, 2:30 pm and 10:30 pm. These times are outside of the peak recorded in the traffic survey. The worst combination of change of shift traffic peak and Wilton Road traffic peak has been used to model the performance of the intersection. This is also a conservative approach to the analysis and represents a 'worst-case' scenario.

The estimated intersection turning flows for 2010 in vehicles per hour are shown in Figure 4-7. The existing performance of the Wilton Road/Colliery Access intersection was assessed by analysing the estimated peak period traffic flows using SIDRA Version 4. The results are shown in Figure 4-8. The SIDRA output file is supplied in Appendix A.

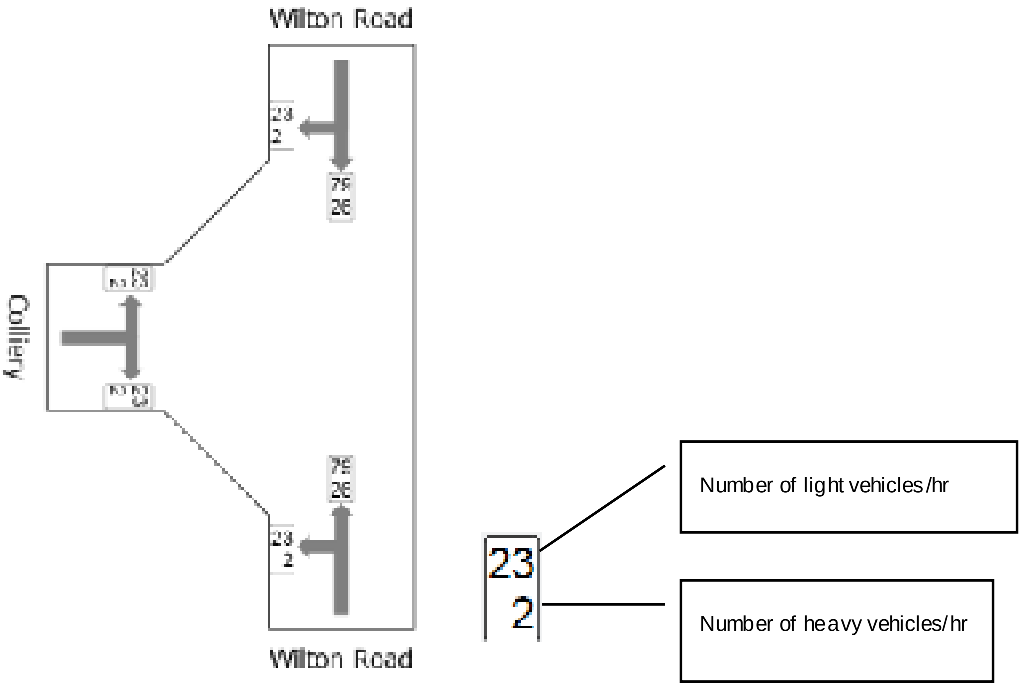


Figure 4-7 Modelled Flow Volumes in the Peak Hour for the Year 2010

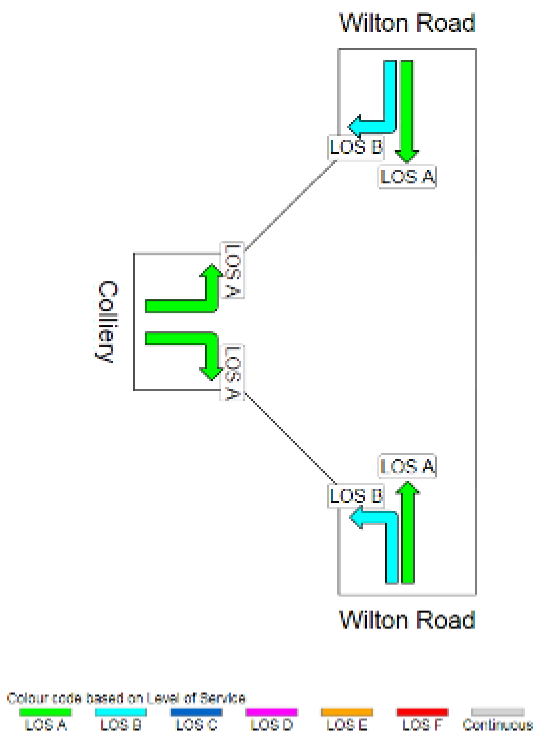


Figure 4-8 Existing 2010 Intersection LOS

A description of the various levels of service for intersections is given in Table 4-4. From the analysis results, it is evident that the existing intersection operates at a good level of service (LOS A) and has spare capacity.

Table 4-4 Performance Criteria for Intersections

LOS	Average Delay/Vehicle (secs/veh)	Give-Way and Stop Signs
A	Less than 14	Good operation
B	15 to 28	Acceptable delays and spare capacity
C	29 to 42	Satisfactory, but accident study required
D	43 to 56	Near capacity and accident study required
E	57 to 70	At capacity; requires other control mode

Source: RTA Guide to Traffic Generating Developments, October 2002, Version 2.2

5. Future Conditions and Impact Assessment

5.1 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. Grade-separated overpasses along the haul roads avoid any impact to traffic using public roads.

It is understood that there will be no mining near or under public roads.

5.2 Traffic Volume Estimates

No additional traffic will be generated by the Project. The traffic modelling assumed the existing level of traffic generated by the Colliery is expected to remain relatively constant for the life of the mine until 2015

Manning levels for Awaba will reduce towards mine closure. Deliveries are expected to remain similar to current levels until mine closure.

The projected traffic volumes on Wilton Road due to ambient traffic growth to 2020 and based on historic growth trends are shown in Table 5-1.

Table 5-1 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

These volumes have been used in the traffic assessments for 2015 and 2020.

5.3 Traffic Assessment for Future Years

5.3.1 Traffic Analysis

Wilton Road

The LOS criteria on two-lane two-way rural roads, as defined in RTA's Guide to Traffic Generating Developments, is shown in Table 5-2.

Table 5-2 Peak Hour Flow on Two-Lane Rural Road (Vehicles/Hour)

Level of Service	Veh/hr
B	264
C	485
D	595
E	1283

Source: RTA Guide to Traffic Generating Developments, October 2002, Version 2.2

The threshold values in Table 5-2 are based on a design speed of 80 km/hr and rolling terrain with 40% 'no overtaking'. As the estimated future peak hour traffic volumes in 2015 and 2020 on Wilton Road (refer Table 5-1) are below the threshold volumes for level of service B given in Table 5-2, the existing level of service for traffic using Wilton Road can be described as A/B. This indicates a free flow to stable flow conditions with spare capacity.

Wilton Road/Colliery Access Intersection

The estimated future traffic flows at the intersection in 2015 and 2020 were analysed using SIDRA Version 4. The results for level of service are the same in 2015 and 2020 and are shown in Figure 5-1 and Figure 5-2. An output report for this model is in Appendix A.

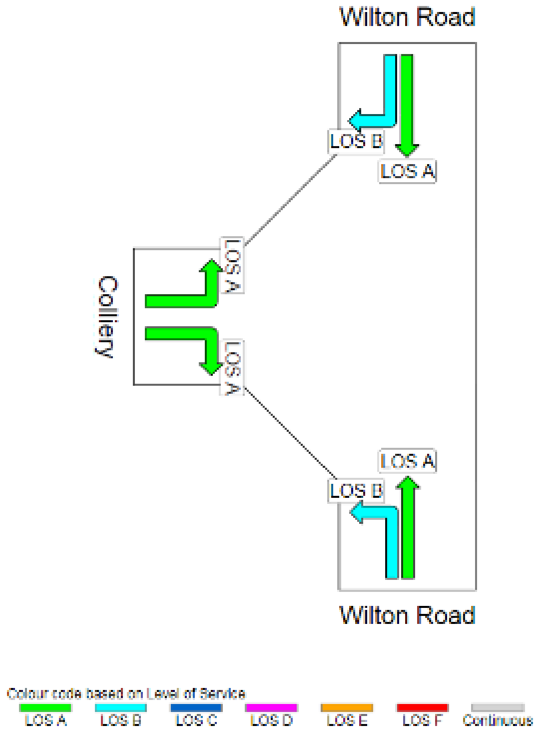


Figure 5-1 Intersection LOS for 2015 Projected Traffic Volumes

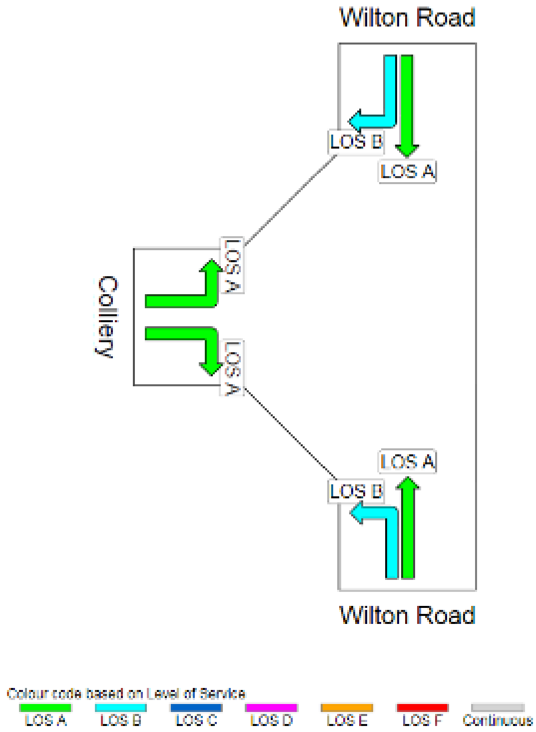


Figure 5-2 Intersection LOS 2020 Projected Traffic Volumes

Based on the intersection Level of Service 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.

6. Traffic Safety

The approach to the 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 for the period from 2004 to 2009.

Observations on-site indicate that a tree in the eastern verge opposite the access road is within the 'clear zone' and may be hazardous to a vehicle that runs off the road.

Figure 6-1 Eastern verge showing substandard shoulder and tree in 'clear zone'

The volume of traffic turning right into the Colliery is small and is expected to remain constant or decline over the remaining life of the mine operations. The SIDRA analysis results in Appendix B indicate that it is unlikely that a driver would need to stop before finding a suitable gap in oncoming traffic to turn safely; that is, the probability of a southbound through vehicle having to avoid a vehicle waiting to turn is very low.

The absence of warning signs on Wilton Road advising drivers of the Colliery access road is a safety issue. There is one small direction sign at the Colliery access intersection that is obscured by trees and bushes for southbound traffic. In order to address the potential safety issue, the additional signs indicated on Figure 6-2 are recommended. They would increase drivers' awareness of the intersection and generally improve the legibility of the intersection.

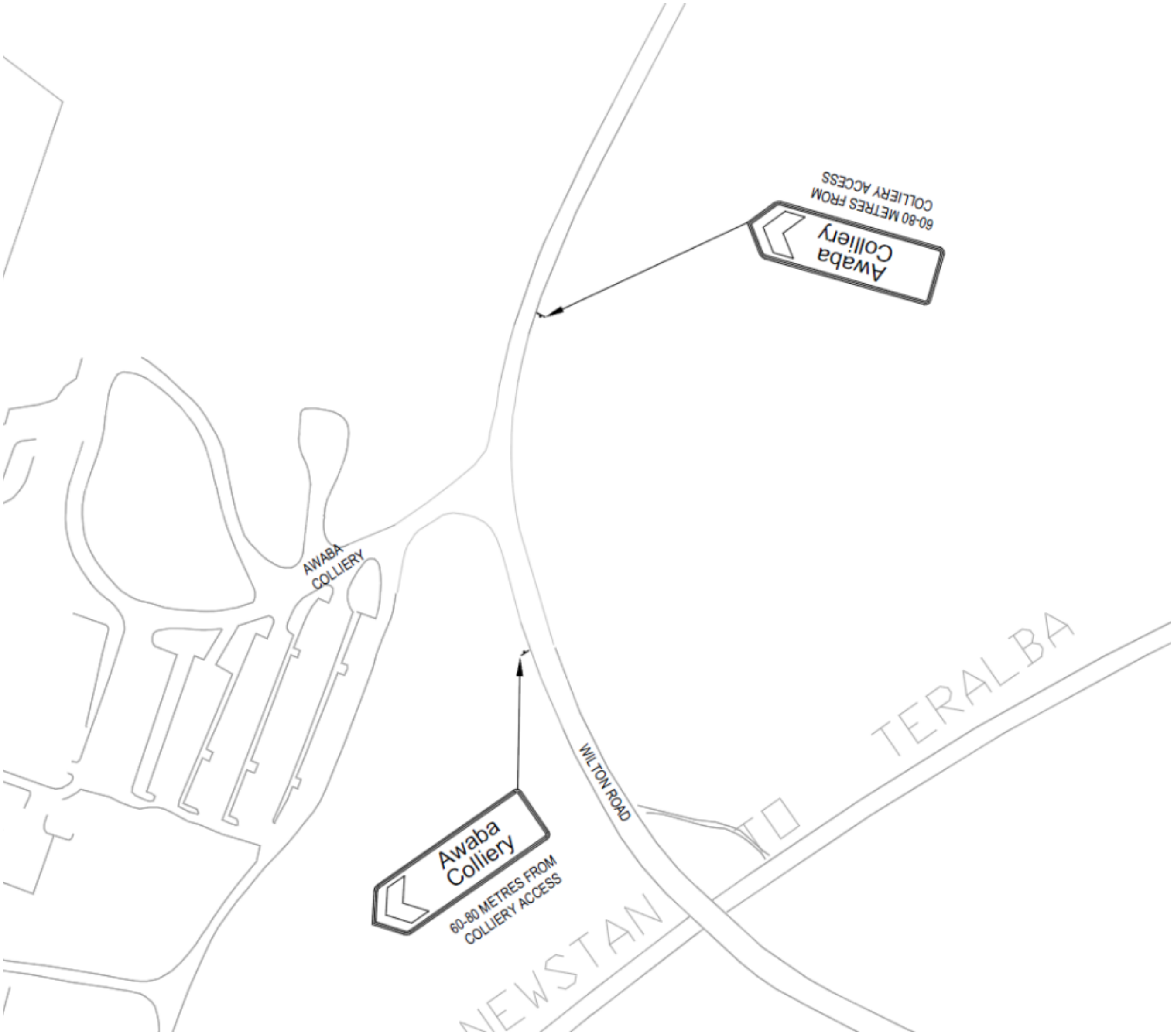


Figure 6-2 Signage Plan

7. Conclusions and Mitigation Measures

7.1 Conclusions

The following conclusions are made based on the assessment:

- Wilton Road and its intersection with the Colliery access road have sufficient traffic capacity for at least the next 10 years.
- Sight distance on both approaches to the Colliery is adequate for a local driveway access.
- Traffic signage on Wilton Road warning approaching drivers of traffic turning at the Colliery access is deficient.
- Guideposts along sections of Wilton Road near the Colliery access road are missing.
- The volume of traffic turning right into the Colliery is small and is expected to remain constant or decline over the remaining life of the mine operations.
- Removal of a tree in the 'clear zone' would provide more space for a through-vehicle to pass to the left of a right turning vehicle. The probability of this manoeuvre being required is very low.

7.2 Mitigation Measures

The following mitigation measures are made to improve safety at the Colliery access:

- Improve signage as shown in Figure 6-2.
- Replace missing guideposts on Wilton Road in the vicinity of the colliery access.

8. References

Australian Standard 2009, *AS 1742.2 – 2009 Manual of uniform traffic control devices*, October 2009, Standards Australia, Sydney, NSW.

Austroads 2009*, Guide to road design: Part 4A: Unsignallised and Signalised Intersections*, Austroads, Sydney,NSW.

Lake Macquarie City Council 2009, *Development Control Plan No.1 Principles of Development* Revision 4, November 2009.

GSS Environmental 2010, *Preliminary Environmental Assessment Awaba Colliery Continuation of Mining,* February 2010.

RTA 2002, *Guide to Traffic Generating Development*, October 2002 Issue 2.2, Roads and Traffic Authority of New South Wales, Sydney, NSW.

Appendix A

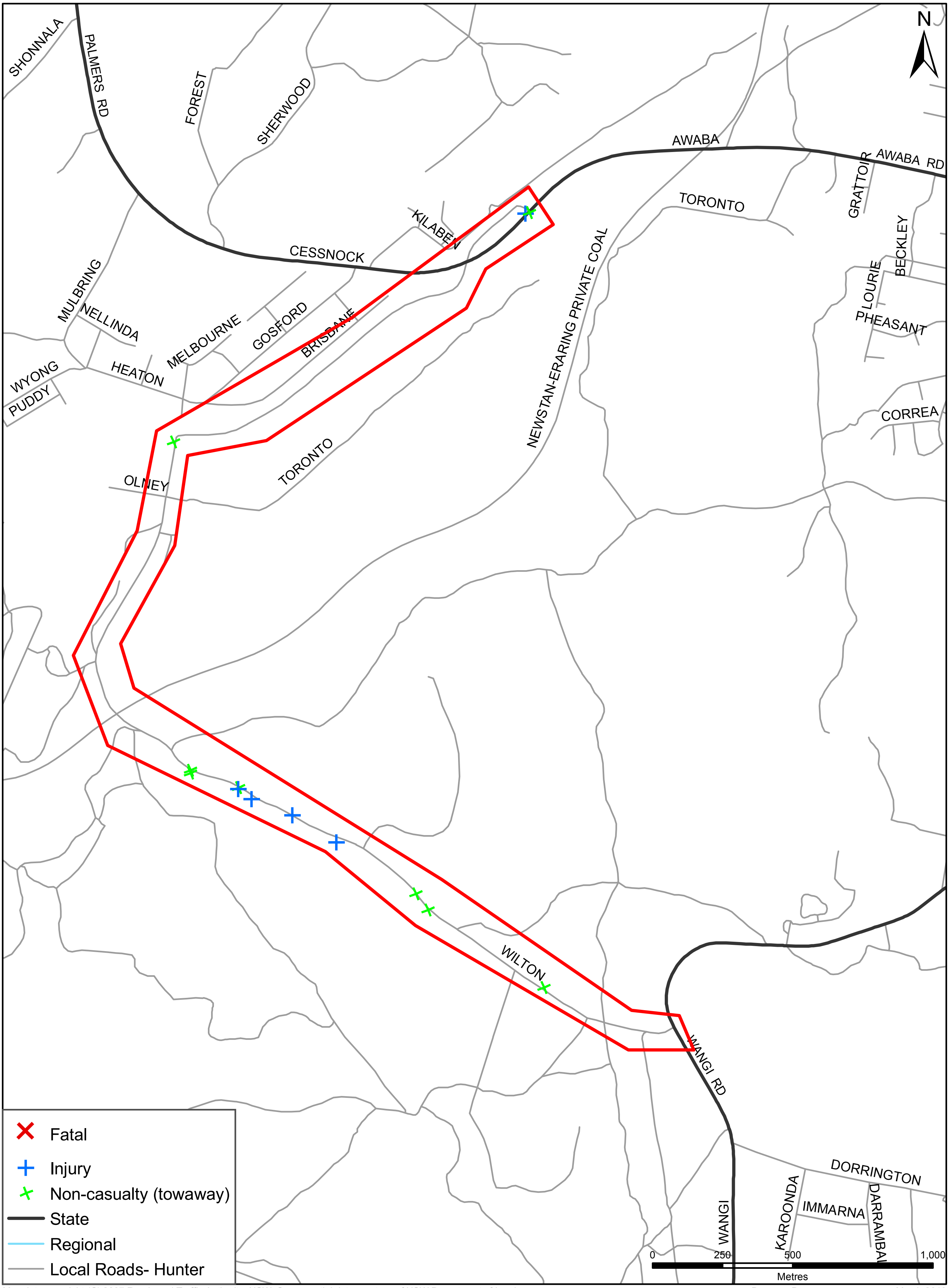
Crash Data

RTA

Wilton Road between Awaba Road and Wangi Road, Awaba

Crashes period 1/7/2004 to 30/6/2009 (Finalised data).

Plus Provisional data (which is incomplete & subject to change) from March Quarter 2009.



Bronwyn Bosse

March 2010

Summary Crash Report

RTA

# Crash Type		
Car Crash	9	69.2%
Light Truck Crash	4	30.8%
Rigid Truck Crash	1	7.7%
Articulated Truck Crash	0	0.0%
'Heavy Truck Crash	(1)	(7.7%)
Bus Crash	0	0.0%
"Heavy Vehicle Crash	(1)	(7.7%)
Emergency Vehicle Crash	0	0.0%
Motorcycle Crash	1	7.7%
Pedal Cycle Crash	0	0.0%
Pedestrian Crash	0	0.0%

' Rigid or Artic. Truck " Heavy Truck or Heavy Bus
These categories are NOT mutually exclusive

Location Type		
*Intersection	2	15.4%
Non intersection	11	84.6%

* Up to 10 metres from an intersection
~ 07:30-09:30 or 14:30-17:00 on school days

Collision Type		
Single Vehicle	8	61.5%
Multi Vehicle	5	38.5%

Road Classification		
Freeway/Motorway	0	0.0%
State Highway	0	0.0%
Other Classified Road	2	15.4%
Unclassified Road	11	84.6%

Contributing Factors		
Speeding	5	38.5%
Fatigue	2	15.4%

Weather		
Fine	10	76.9%
Rain	2	15.4%
Overcast	1	7.7%
Fog or mist	0	0.0%
Other	0	0.0%

Road Surface Condition		
Wet	2	15.4%
Dry	11	84.6%
Snow or ice	0	0.0%

Natural Lighting		
Dawn	0	0.0%
Daylight	5	38.5%
Dusk	0	0.0%
Darkness	8	61.5%

Crash Movement		
Intersection, adjacent approaches	2	15.4%
Head-on (not overtaking)	2	15.4%
Opposing vehicles; turning	0	0.0%
U-turn	1	7.7%
Rear-end	0	0.0%
Lane change	0	0.0%
Parallel lanes; turning	0	0.0%
Vehicle leaving driveway	0	0.0%
Overtaking; same direction	0	0.0%
Hit parked vehicle	0	0.0%
Hit railway train	0	0.0%
Hit pedestrian	0	0.0%
Permanent obstruction on road	0	0.0%
Hit animal	0	0.0%
Off road, on straight	1	7.7%
Off road on straight, hit object	0	0.0%
Out of control on straight	0	0.0%
Off road, on curve	2	15.4%
Off road on curve, hit object	4	30.8%
Out of control on curve	0	0.0%
Other crash type	1	7.7%

Speed Limit					
			~ 40km/h or less	0	0.0%
40 km/h or less	0	0.0%	80 km/h zone	7	53.8%
50 km/h zone	0	0.0%	90 km/h zone	2	15.4%
60 km/h zone	3	23.1%	100 km/h zone	0	0.0%
70 km/h zone	1	7.7%	110 km/h zone	0	0.0%

CRASHES	13	
Fatal crash	0	0.0%
Injury crash	5	38.5%
Non-casualty crash	8	61.5%

CASUALTIES	5	
Killed	0	0.0%
Injured	5	100.0%
^ Unrestrained	1	20.0%

^ Belt fitted but not worn, No restraint fitted to position OR No helmet worn

Time Group			% of Day
00:01 - 02:59	3	23.1%	12.5%
03:00 - 04:59	1	7.7%	8.3%
05:00 - 05:59	0	0.0%	4.2%
06:00 - 06:59	0	0.0%	4.2%
07:00 - 07:59	1	7.7%	4.2%
08:00 - 08:59	0	0.0%	4.2%
09:00 - 09:59	0	0.0%	4.2%
10:00 - 10:59	0	0.0%	4.2%
11:00 - 11:59	2	15.4%	4.2%
12:00 - 12:59	0	0.0%	4.2%
13:00 - 13:59	0	0.0%	4.2%
14:00 - 14:59	0	0.0%	4.2%
15:00 - 15:59	2	15.4%	4.2%
16:00 - 16:59	0	0.0%	4.2%
17:00 - 17:59	0	0.0%	4.2%
18:00 - 18:59	1	7.7%	4.2%
19:00 - 19:59	0	0.0%	4.2%
20:00 - 21:59	1	7.7%	8.3%
22:00 - 24:00	2	15.4%	8.3%

Street Lighting Off/Nil		% of Dark
8	of	8 in Dark 100.0%

Crashes		Casualties
1	2010	0
1	2009	0
3	2008	0
2	2007	1
3	2006	2
2	2005	1
1	2004	1

~ School Travel Time		
Involvement	2	15.4%

McLean Periods			% Week
A	2	15.4%	17.9%
B	0	0.0%	7.1%
C	2	15.4%	17.9%
D	0	0.0%	3.5%
E	0	0.0%	3.6%
F	1	7.7%	10.7%
G	2	15.4%	7.1%
H	1	7.7%	7.1%
I	1	7.7%	12.5%
J	4	30.8%	10.7%

Day of the Week								
Monday	1	7.7%	Thursday	2	15.4%	Sunday	2	15.4%
Tuesday	3	23.1%	Friday	2	15.4%	WEEKDAY	9	69.2%
Wednesday	1	7.7%	Saturday	2	15.4%	WEEKEND	4	30.8%

# Holiday Periods								
New Year	0	0.0%	Queen's BD	0	0.0%	Easter SH	1	7.7%
Aust. Day	0	0.0%	Labour Day	0	0.0%	June/July SH	0	0.0%
Easter	0	0.0%	Christmas	0	0.0%	Sept./Oct. SH	0	0.0%
Anzac Day	0	0.0%	January SH	0	0.0%	December SH	1	7.7%

Crashid dataset Wilton Road between Awaba Road to Wangi Road, Awaba . Crash Period 01/07/04 to 30/06/09. Plus provisional data

Note: Data for the 9 month period prior to the generated date of this report are incomplete and are subject to change.

Percentages are percentages of all crashes. Unknown values for each category are not shown on this report.

Detailed Crash Report - sorted

Crash No.	Date	Day of Week	Time	Distance	ID Feature	Loc Type	Alignment	Weather	Surface Condition	Speed Limit	No. of Tus	Tu Type/Obj	Age/Sex	Street Travelling	Speed Travelling	Manoeuvre	Degree of Crash	Killed	Injured	Factors
					Natural Lighting															**S F**
Hunter Region					**Lake Macquarie City LGA**	**Awaba**			**Wilton Rd**											
453383	19/11/2004	Fri	00:45	1.75 km W	WANGI RD	2WY	CRV	Fine	Dry	60	1	WAG	M20	E in WILTON RD	60	Proceeding in lane	I	0	1	S F
E22356979					Darkness	DCA: 804	R	Off left bend into obj				Tree/bush								
Hunter Region					**Lake Macquarie City LGA**	**Awaba**			**Wilton Rd**											
488878	21/08/2005	Sun	15:15	500 m W	WASTE DEPOT ENT	2WY	STR	Fine	Dry	60	2	CAR	M26	W in WILTON RD	30	Perform U-turn	I	0	1	
E24624661					Daylight	DCA: 304		Same - U-turn				M/C	M27	W in WILTON RD	30	Proceeding in lane				
Hunter Region					**Lake Macquarie City LGA**	**Awaba**			**Wilton Rd**											
494144	13/10/2005	Thu	20:03	2 km N	WANGI RD	2WY	CRV	Fine	Dry	80	1	CAR	M31	S in WILTON RD	80	Proceeding in lane	N	0	0	
E25869739					Darkness	DCA: 804	L	Off left bend into obj				Tree/bush								
Hunter Region					**Lake Macquarie City LGA**	**Awaba**			**Awaba Rd**											
508477	03/02/2006	Fri	07:50	at	WILTON RD	TJN	STR	Overcast	Dry	90	2	CAR	F79	E in WILTON RD	10	Turning right	I	0	1	
E25946354					Daylight	DCA: 104		Adj - Right-thru from right				CAR	M18	N in AWABA RD	90	Proceeding in lane				
Hunter Region					**Lake Macquarie City LGA**	**Awaba**			**Wilton Rd**											
515105	19/03/2006	Sun	01:25	1.265 km S	AWABA ROAD OP	2WY	CRV	Raining	Wet	60	1	WAG	M33	N in WILTON RD	60	Proceeding in lane	N	0	0	S
E26357817					Darkness	DCA: 801	L	Off cway right bend												
Hunter Region					**Lake Macquarie City LGA**	**Awaba**			**Wilton Rd**											
525704	29/04/2006	Sat	23:00	2 km S	RAILWAY SN	2WY	CRV	Fine	Dry	80	1	TRK	M34	W in WILTON RD	80	Proceeding in lane	I	0	1	S
E26609660					Darkness	DCA: 803	R	Off right bend into obj				Embankment								
Hunter Region					**Lake Macquarie City LGA**	**Awaba**			**Wilton Rd**											
558124	12/02/2007	Mon	04:40	1 km W	WANGI RD	2WY	STR	Raining	Wet	80	1	TRK	M60	W in WILTON RD	70	Proceeding in lane	N	0	0	
E29147135					Darkness	DCA: 607		On path - Hit temp object				Other non fixed object								
Hunter Region					**Lake Macquarie City LGA**	**Awaba**			**Wilton Rd**											
599155	20/11/2007	Tue	11:00	1.6 km W	WANGI RD	2WY	CRV	Fine	Dry	80	2	CAR	M57	W in WILTON RD	65	Incorrect side	I	0	1	S
E32244068					Daylight	DCA: 201		Opp - Head on				TRK	M70	E in WILTON RD	50	Proceeding in lane				
Hunter Region					**Lake Macquarie City LGA**	**Awaba**			**Wilton Rd**											
616589	15/03/2008	Sat	22:00	500 m W	WANGI RD	2WY	STR	Fine	Dry	80	1	CAR	M17	E in WILTON RD	80	Proceeding in lane	N	0	0	F
E33450849					Darkness	DCA: 702		Off carriageway to right												
Hunter Region					**Lake Macquarie City LGA**	**Awaba**			**Wilton Rd**											
625400	29/05/2008	Thu	18:32	250 m E	AWABA COUNCIL ENT	2WY	CRV	Fine	Dry	80	1	CAR	M32	E in WILTON RD	80	Proceeding in lane	N	0	0	
E112826098					Darkness	DCA: 803	R	Off right bend into obj				Embankment								

Detailed Crash Report - sorted

Crash No.	Date	Day of Week	Time	Distance	ID Feature	Loc Type	Alignment	Weather	Surface Condition	Speed Limit	No. of Tus	Tu Type/Obj	Age/Sex	Street Travelling	Speed Travelling	Manoeuvre	Degree of Crash	Killed	Injured	Factors
					Natural Lighting															**S F**
Hunter Region				**Lake Macquarie City LGA**	**Awaba**				**Wilton Rd**											
637661	27/08/2008	Wed	00:01	2 km W	WANGI RD	2WY	CRV	Fine	Dry	70	1	WAG	M67	E in WILTON RD	Unk	Proceeding in lane	N	0	0	
E34715127					Darkness	DCA: 802	L	Off cway left bend												
Hunter Region				**Lake Macquarie City LGA**	**Awaba**				**Wilton Rd**											
693483	22/12/2009	Tue	11:15	500 m W	WASTE FACILITY ENT	2WY	CRV	Fine	Dry	80	2	LOR	M41	S in WILTON RD	70	Incorrect side	N	0	0	S
E75971002					Daylight	DCA: 201		Opp - Head on				LOR	M27	N in WILTON RD	70	Proceeding in lane				
Hunter Region				**Lake Macquarie City LGA**	**Awaba**				**Cessnock Rd**											
697223	19/01/2010	Tue	15:05	at	WILTON RD	TJN	STR	Fine	Dry	90	2	TRK	M50	E in WILTON RD	15	Turning left	N	0	0	
E39455952					Daylight	DCA: 107		Adj - Left-thru from right				TRK	U U	N in CESSNOCK RD	70	Proceeding in lane				

Report Totals: Total Crashes: 13 Fatal Crashes: 0 Injury Crashes: 5 Killed: 0 Injured: 5

Crashid dataset Wilton Road between Awaba Road to Wangi Road, Awaba . Crash Period 01/07/04 to 30/06/09. Plus provisional data

Note: Ordered by: Crash Date,Crash Time,Crash No. Data for the 9 month period prior to the generated date of this report are incomplete and are subject to change.

Appendix B

Traffic Data

LMCC

MetroCount Traffic Executive
Class Speed Matrix

ClassMatrix-57 -- English (ENA)

Datasets:

Site:	**[10409] WILTON RD AWABA BETWEEN DUMP & MR217**
Direction:	6 - West bound A>B, East bound B>A. **Lane:** 0
Survey Duration:	0:00 Thursday, 10 January 2002 => 9:57 Thursday, 17 January 2002
File:	1040916JAN2002.EC0 (Plus)
Identifier:	J475Y576 MC55-3 [MC50] (c)Microcom 11/02/99
Algorithm:	Factory default
Data type:	Axle sensors - Paired (Class/Speed/Count)

Profile:

Filter time:	**0:00 Thursday, 10 January 2002 => 9:57 Thursday, 17 January 2002**
Included classes:	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
Speed range:	10 - 160 km/h.
Direction:	North, East, South, West (bound)
Separation:	All - (Headway)
Name:	Default Profile
Scheme:	Vehicle classification (ARX)
Units:	Metric (meter, kilometer, m/s, km/h, kg, tonne)
In profile:	Vehicles = 13520 / 13528 (99.94%)

Class Speed Matrix

ClassMatrix-57
Site: 10409.0WE
Description: **WILTON RD AWABA BETWEEN DUMP & MR217**
Filter time: **0:00 Thursday, 10 January 2002 => 9:57 Thursday, 17 January 2002**
Scheme: Vehicle classification (ARX)
Filter: Cls(1 2 3 4 5 6 7 8 9 10 11 12) Dir(NESW) Sp(10,160) Headway(>0)

Speed (km/h)	Class 1	2	3	4	5	6	7	8	9	10	11	12	Speed Totals	
10 - 20	7	3	.	.	.	.	.	.	.	.	.	.	10	0.1%
20 - 30	2	1	1	.	1	.	.	.	.	.	.	.	5	0.0%
30 - 40	.	21	2	4	1	.	.	.	.	10	.	.	38	0.3%
40 - 50	2	102	25	18	24	8	.	2	2	183	18	3	387	2.9%
50 - 60	3	213	88	62	70	8	.	1	8	121	27	1	602	4.5%
60 - 70	2	1003	462	165	180	7	8	9	7	21	5	.	1869	13.8%
70 - 80	18	2820	605	167	119	15	5	48	24	126	14	.	3961	29.3%
80 - 90	31	3561	242	107	97	4	3	6	9	114	18	.	4192	31.0%
90 - 100	15	1643	44	49	27	.	.	1	3	20	3	.	1805	13.4%
100 - 110	12	464	12	7	.	.	.	.	1	1	.	.	497	3.7%
110 - 120	8	96	2	3	.	.	.	.	.	.	.	.	109	0.8%
120 - 130	4	24	.	3	.	.	.	.	.	.	.	.	31	0.2%
130 - 140	1	8	.	.	.	.	.	.	.	.	.	.	9	0.1%
140 - 150	.	3	.	.	.	.	.	.	.	.	.	.	3	0.0%
150 - 160	.	2	.	.	.	.	.	.	.	.	.	.	2	0.0%
Class Totals	105	9964	1483	585	519	42	16	67	54	596	85	4	13520	
	0.8%	73.7%	11.0%	4.3%	3.8%	0.3%	0.1%	0.5%	0.4%	4.4%	0.6%	0.0%		

MetroCount Traffic Executive
Weekly Vehicle Counts (Virtual Week)

VirtWeeklyVehicle-56 -- English (ENA)

Datasets:

Site:	**[10409] WILTON RD AWABA BETWEEN DUMP & MR217**
Direction:	6 - West bound A>B, East bound B>A. **Lane:** 0
Survey Duration:	0:00 Thursday, 10 January 2002 => 9:57 Thursday, 17 January 2002
File:	1040916JAN2002.EC0 (Plus)
Identifier:	J475Y576 MC55-3 [MC50] (c)Microcom 11/02/99
Algorithm:	Factory default
Data type:	Axle sensors - Paired (Class/Speed/Count)

Profile:

Filter time:	**0:00 Thursday, 10 January 2002 => 9:57 Thursday, 17 January 2002**
Included classes:	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
Speed range:	10 - 160 km/h.
Direction:	North, East, South, West (bound)
Separation:	All - (Headway)
Name:	Default Profile
Scheme:	Vehicle classification (ARX)
Units:	Metric (meter, kilometer, m/s, km/h, kg, tonne)
In profile:	Vehicles = 13520 / 13528 (99.94%)

Weekly Vehicle Counts (Virtual Week)

VirtWeeklyVehicle-56
Site: 10409.0WE
Description: **WILTON RD AWABA BETWEEN DUMP & MR217**
Filter time: **0:00 Thursday, 10 January 2002 => 9:57 Thursday, 17 January 2002**
Scheme: Vehicle classification (ARX)
Filter: Cls(1 2 3 4 5 6 7 8 9 10 11 12) Dir(NESW) Sp(10,160) Headway(>0)

Hour	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Averages 1 - 5	Averages 1 - 7
0000-0100	5.0	10.0	9.0	7.5	12.0	14.0	9.0	8.5	9.3
0100-0200	2.0	3.0	4.0	8.0	4.0	7.0	7.0	4.8	5.4
0200-0300	1.0	1.0	1.0	1.5	4.0	3.0	4.0	1.7	2.1
0300-0400	4.0	5.0	7.0	8.0	4.0	4.0	0.0	6.0	5.0
0400-0500	11.0	10.0	8.0	9.5	7.0	9.0	1.0	9.2	8.1
0500-0600	55.0	57.0	47.0	59.0	42.0	46.0	15.0	53.2	47.5
0600-0700	102.0	108.0	97.0	87.0	88.0	25.0	39.0	94.8	79.1
0700-0800	119.0	131.0	**146.0<**	144.0	137.0	59.0	25.0	136.8	113.1
0800-0900	149.0	**178.0<**	128.0	151.5	**158.0<**	96.0	71.0	152.7	135.4
0900-1000	155.0	148.0	128.0	70.0	153.0	122.0	114.0	120.7	120.0
1000-1100	**158.0<**	151.0	136.0	155.0	157.0	148.0	144.0	151.4	149.9
1100-1200	154.0	176.0	134.0	**156.0<**	148.0	**169.0<**	**160.0<**	**153.6<**	**156.7<**
1200-1300	120.0	153.0	110.0	**159.0<**	152.0	151.0	151.0	138.8	142.3
1300-1400	**156.0<**	**163.0<**	121.0	150.0	163.0	**154.0<**	145.0	**150.6<**	**150.3<**
1400-1500	138.0	135.0	127.0	118.0	**173.0<**	151.0	147.0	138.2	141.3
1500-1600	146.0	136.0	**138.0<**	139.0	164.0	128.0	**163.0<**	144.6	144.9
1600-1700	133.0	131.0	127.0	125.0	129.0	86.0	94.0	129.0	117.9
1700-1800	133.0	136.0	107.0	131.0	122.0	66.0	88.0	125.8	111.9
1800-1900	69.0	95.0	80.0	90.0	93.0	62.0	60.0	85.4	78.4
1900-2000	45.0	50.0	31.0	41.0	50.0	42.0	47.0	43.4	43.7
2000-2100	42.0	38.0	27.0	35.0	23.0	14.0	32.0	33.0	30.1
2100-2200	28.0	32.0	24.0	33.0	25.0	17.0	27.0	28.4	26.6
2200-2300	18.0	22.0	20.0	22.0	18.0	20.0	23.0	20.0	20.4
2300-2400	22.0	22.0	16.0	18.0	23.0	8.0	11.0	20.2	17.1
Totals									
0700-1900	1630.0	1733.0	1482.0	1588.5	1749.0	1392.0	1362.0	1627.6	1561.9
0600-2200	1847.0	1961.0	1661.0	1784.5	1935.0	1490.0	1507.0	1827.2	1741.5
0600-0000	1887.0	2005.0	1697.0	1824.5	1976.0	1518.0	1541.0	1867.4	1779.1
0000-0000	1965.0	2091.0	1773.0	1918.0	2049.0	1601.0	1577.0	1950.7	1856.4
AM Peak	1000	0800	0700	1100	0800	1100	1100		
	158.0	178.0	146.0	156.0	158.0	169.0	160.0		
PM Peak	1300	1300	1500	1200	1400	1300	1500		
	156.0	163.0	138.0	159.0	173.0	154.0	163.0		

*** - No data.**

MetroCount Traffic Executive
Speed Statistics by Hour

SpeedStatHour-58 -- English (ENA)

Datasets:

Site:	**[10409] WILTON RD AWABA BETWEEN DUMP & MR217**
Direction:	6 - West bound A>B, East bound B>A. **Lane:** 0
Survey Duration:	0:00 Thursday, 10 January 2002 => 9:57 Thursday, 17 January 2002
File:	1040916JAN2002.EC0 (Plus)
Identifier:	J475Y576 MC55-3 [MC50] (c)Microcom 11/02/99
Algorithm:	Factory default
Data type:	Axle sensors - Paired (Class/Speed/Count)

Profile:

Filter time:	**0:00 Thursday, 10 January 2002 => 9:57 Thursday, 17 January 2002**
Included classes:	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
Speed range:	10 - 160 km/h.
Direction:	North, East, South, West (bound)
Separation:	All - (Headway)
Name:	Default Profile
Scheme:	Vehicle classification (ARX)
Units:	Metric (meter, kilometer, m/s, km/h, kg, tonne)
In profile:	Vehicles = 13520 / 13528 (99.94%)

Speed Statistics by Hour

SpeedStatHour-58
Site: 10409.0WE
Description: **WILTON RD AWABA BETWEEN DUMP & MR217**
Filter time: **0:00 Thursday, 10 January 2002 => 9:57 Thursday, 17 January 2002**
Scheme: Vehicle classification (ARX)
Filter: Cls(1 2 3 4 5 6 7 8 9 10 11 12) Dir(NESW) Sp(10,160) Headway(>0)

Vehicles = 13520
Posted speed limit = 60 km/h, Exceeding = 12478 (92.29%), Mean Exceeding = 81.46 km/h
Maximum = 154.1 km/h, **Minimum** = 13.5 km/h, **Mean** = 79.1 km/h
85% Speed = 91.4 km/h, **95% Speed** = 99.4 km/h, **Median** = 79.6 km/h
20 km/h Pace = 71 - 91, **Number in Pace** = 8212 (60.74%)
Variance = 183.56, **Standard Deviation** = 13.55 km/h

Hour Bins (Partial days)

Time	Bin		Min	Max	Mean	Median	85%	95%	>PSL 60 km/h	
0000	74	0.5%	62.7	119.7	90.5	87.1	105.5	112.0	74	100.0%
0100	43	0.3%	52.0	135.6	83.9	84.2	91.1	105.8	41	95.3%
0200	17	0.1%	68.9	120.1	91.4	91.1	104.4	107.6	17	100.0%
0300	40	0.3%	33.8	119.4	75.2	73.4	91.1	112.7	32	80.0%
0400	65	0.5%	47.5	120.0	84.0	83.5	92.5	97.2	64	98.5%
0500	380	2.8%	14.2	130.6	84.4	84.2	94.7	103.3	373	98.2%
0600	633	4.7%	53.1	126.7	85.3	84.2	96.1	103.3	628	99.2%
0700	905	6.7%	16.3	125.7	78.2	81.0	91.4	98.3	792	87.5%
0800	1083	8.0%	20.5	122.1	76.6	77.4	89.6	96.1	953	88.0%
0900	960	7.1%	13.5	121.6	75.6	76.3	88.2	95.0	851	88.6%
1000	1049	7.8%	14.2	128.7	74.5	74.9	87.5	93.6	930	88.7%
1100	1097	8.1%	30.5	128.9	75.3	76.0	87.5	94.3	985	89.8%
1200	996	7.4%	27.9	129.7	75.4	76.3	87.1	94.3	895	89.9%
1300	1052	7.8%	35.2	122.1	76.6	76.7	88.9	96.1	950	90.3%
1400	989	7.3%	13.8	141.6	76.6	77.0	88.9	96.1	905	91.5%
1500	1014	7.5%	30.7	130.8	78.5	78.8	90.0	97.6	951	93.8%
1600	825	6.1%	32.5	154.1	81.8	83.2	92.9	102.2	775	93.9%
1700	783	5.8%	21.7	153.1	85.3	85.3	95.0	102.6	761	97.2%
1800	549	4.1%	60.6	133.6	87.0	85.3	96.8	105.5	549	100.0%
1900	306	2.3%	37.1	130.0	86.6	85.7	97.6	106.9	303	99.0%
2000	211	1.6%	56.2	130.6	85.1	83.5	97.9	106.2	209	99.1%
2100	186	1.4%	50.1	147.4	84.5	82.8	95.0	107.6	183	98.4%
2200	143	1.1%	14.0	127.6	82.9	82.4	94.0	105.1	139	97.2%
2300	120	0.9%	57.3	149.0	87.2	86.0	96.8	109.1	118	98.3%
----	**13520**	**100.0%**	**13.5**	**154.1**	**79.1**	**79.6**	**91.4**	**99.4**	**12478**	**92.3%**

Appendix C

SIDRA Output

Existing 2010

Projected 2015

Projected 2020

MOVEMENT SUMMARY

Site: Existing Case

Wilton Road Existing Case
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South	Wilton Road										
1	L	26	8.0	0.082	18.0	LOS B	0.0	0.0	0.00	1.35	50.4
2	T	112	25.5	0.082	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
Approach		138	22.1	0.082	3.4	LOS B	0.0	0.0	0.00	0.26	70.4
North	Wilton Road										
8	T	112	25.5	0.084	0.6	LOS A	0.5	4.5	0.28	0.00	67.5
9	R	26	8.0	0.084	20.5	LOS B	0.5	4.5	0.28	1.23	49.4
Approach		138	22.1	0.084	4.4	LOS B	0.5	4.5	0.28	0.23	62.2
West	Colliery										
10	L	18	11.8	0.045	8.1	LOS A	0.2	1.5	0.29	0.53	39.0
12	R	18	11.8	0.045	8.1	LOS A	0.2	1.5	0.29	0.62	39.0
Approach		36	11.8	0.045	8.1	LOS A	0.2	1.5	0.29	0.57	39.0
All Vehicles		312	20.9	0.084	4.4	NA	0.5	4.5	0.16	0.28	60.8

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (RTA NSW).
Approach LOS values are based on the worst delay for any vehicle movement.

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8000065, GHD PTY LTD, UNLIMITED

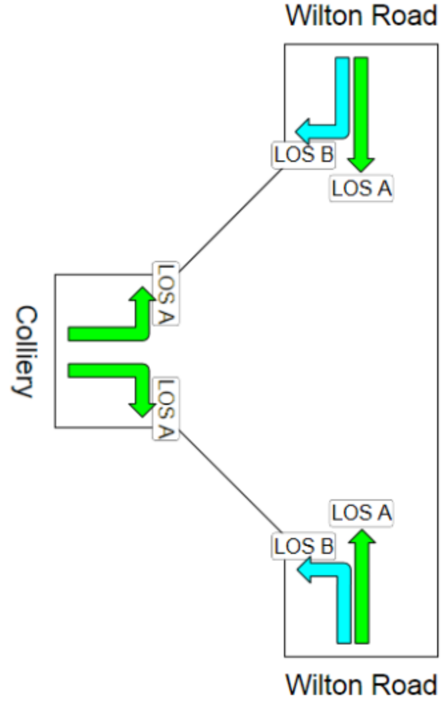
SIDRA INTERSECTION

LEVEL OF SERVICE

Level of Service Method: Delay (RTA NSW)

Site: Existing Case

Wilton Road Existing Case
Giveway / Yield (Two-Way)



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Project: G:\22\15032\Technical\SIDRA\Wilton Road.sip
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SIDRA INTERSECTION

Projected 2015

MOVEMENT SUMMARY

Site: 5 Year Projection

Wilton Road 5 Year Projection
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South	Wilton Road										
1	L	26	8.0	0.088	18.2	LOS B	0.0	0.0	0.00	1.37	50.2
2	T	122	25.0	0.088	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
Approach		148	22.0	0.088	3.2	LOS B	0.0	0.0	0.00	0.24	70.9
North	Wilton Road										
8	T	122	25.0	0.095	0.8	LOS A	0.7	5.5	0.32	0.00	66.4
9	R	26	8.0	0.095	21.0	LOS B	0.7	5.5	0.32	1.24	49.2
Approach		148	22.0	0.095	4.4	LOS B	0.7	5.5	0.32	0.22	61.7
West	Colliery										
10	L	18	11.8	0.033	7.6	LOS A	0.2	1.3	0.31	0.53	39.1
12	R	18	11.8	0.033	7.7	LOS A	0.2	1.3	0.31	0.58	39.2
Approach		36	11.8	0.033	7.6	LOS A	0.2	1.3	0.31	0.55	39.1
All Vehicles		333	20.9	0.095	4.2	NA	0.7	5.5	0.17	0.27	61.1

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (RTA NSW).
Approach LOS values are based on the worst delay for any vehicle movement.

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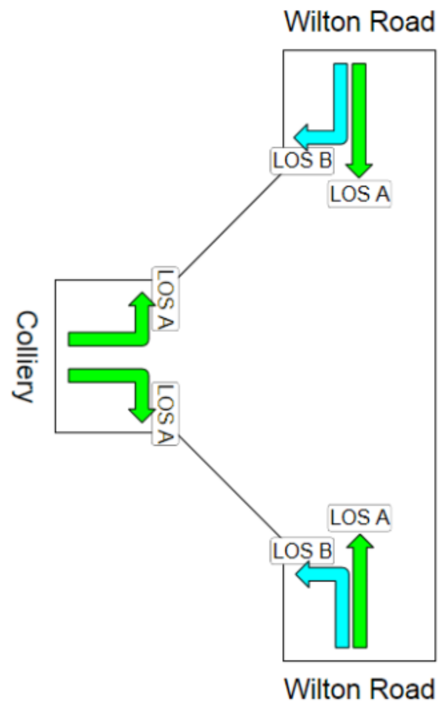
SIDRA INTERSECTION

LEVEL OF SERVICE

Level of Service Method: Delay (RTA NSW)

Site: 5 Year Projection

Wilton Road 5 Year Projection
Giveway / Yield (Two-Way)



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SIDRA INTERSECTION

Projected 2020

MOVEMENT SUMMARY

Site: 10 Year Projection

Wilton Road 5 Year Projection

Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South	Wilton Road										
1	L	26	8.0	0.095	18.5	LOS B	0.0	0.0	0.00	1.40	50.1
2	T	135	25.0	0.095	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
Approach		161	22.2	0.095	3.0	LOS B	0.0	0.0	0.00	0.23	71.5
North	Wilton Road										
8	T	135	25.0	0.103	0.9	LOS A	0.7	6.2	0.33	0.00	65.9
9	R	26	8.0	0.103	21.4	LOS B	0.7	6.2	0.33	1.25	49.0
Approach		161	22.2	0.103	4.2	LOS B	0.7	6.2	0.33	0.20	61.7
West	Colliery										
10	L	18	11.8	0.034	7.7	LOS A	0.2	1.3	0.32	0.53	39.0
12	R	18	11.8	0.034	7.8	LOS A	0.2	1.3	0.32	0.59	39.2
Approach		36	11.8	0.034	7.8	LOS A	0.2	1.3	0.32	0.56	39.1
All Vehicles		358	21.2	0.103	4.0	NA	0.7	6.2	0.18	0.25	61.5

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (RTA NSW).
Approach LOS values are based on the worst delay for any vehicle movement.

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Project: G:\22\15032\Technical\SIDRA\Wilton Road.sip
8000065, GHD PTY LTD, UNLIMITED

SIDRA INTERSECTION

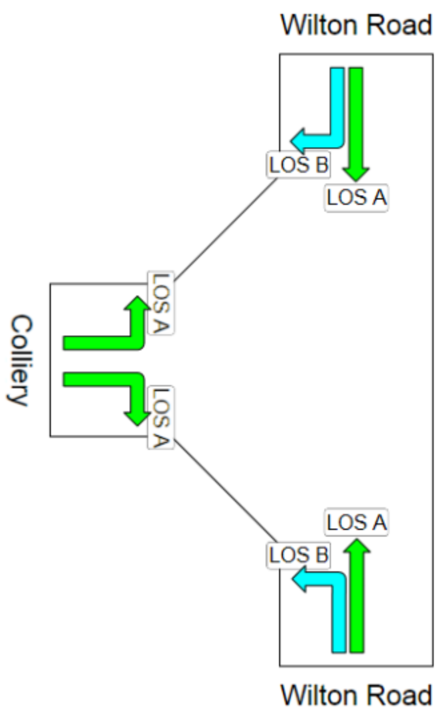
LEVEL OF SERVICE

Level of Service Method: Delay (RTA NSW)

Site: 10 Year Projection

Wilton Road 5 Year Projection

Giveway / Yield (Two-Way)



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Project: G:\22\15032\Technical\SIDRA\Wilton Road.sip
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SIDRA INTERSECTION

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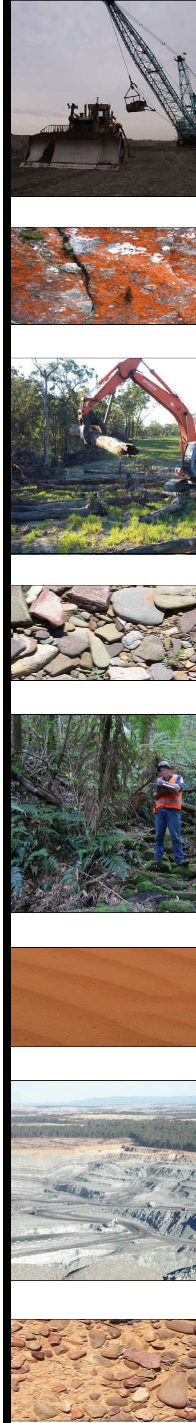
Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	K Burns	M Lyons	*M Lyons*	P Youman	*P Youman*	5/7/10
1	K Burns	M Lyons	*M Lyons*	P Youman	*P Youman*	3/9/10
2	K Burns	M Lyons	MLyons	P Youman	Youman	8.9.10

NOISE IMPACT ASSESSMENT



APPENDIX 9

HEGGIES

REPORT 30-2497-R2

Revision 1

Awaba Colliery Mining Project
Part 3A Application
Noise Impact Assessment

PREPARED FOR

Centennial Coal Company
PO Box 1000
Toronto NSW 2283

9 SEPTEMBER 2010

HEGGIES PTY LTD
ABN 29 001 584 612

Awaba Colliery Mining Project

Part 3A Application

Noise Impact Assessment

PREPARED BY:

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DOCUMENT CONTROL

Reference	Status	Date	Prepared	Checked	Authorised
30-2497-R2	Revision 1	9 September 2010	Katie Teyhan	John Cotterill	John Cotterill
30-2497-R2	Revision 0	21 July 2010	Katie Teyhan	John Cotterill	John Cotterill

EXECUTIVE SUMMARY

Heggies Pty Ltd (Heggies) has been commissioned by GSS Environmental (GSSE) on behalf of Centennial Coal Pty Limited (Centennial) to undertake a Noise Impact Assessment for the Awaba Colliery Mining Project located on Wilton Road, Awaba, NSW.

Broadly, the objective of the noise assessment was to identify the potential impacts of noise from operation of the facility and to provide advice with regard to effective mitigation strategies where necessary.

An ambient noise monitoring program was undertaken by Heggies. Ambient noise levels were monitored at two locations, considered to be representative of the nearest potentially affected receivers. The objective of this survey was to measure $L_{A90(period)}$ and $L_{Aeq(15minute)}$ noise levels at the nearest potentially affected residential locations during the day, evening and night-time periods to enable the determination of the project specific noise criteria for the project.

OPERATIONAL NOISE PREDICTIONS

A computer model was used to predict noise emissions from the project. Noise levels were predicted for the general operational scenario summarised in **Section 7.1.3** with the inclusion of the noise mitigation and management procedures detailed in **Section 2.5**.

Operational noise levels are predicted to meet the project specific noise criteria at all considered residential locations under calm and prevailing weather conditions.

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.

SLEEP DISTURBANCE ASSESSMENT

In the interests of minimising sleep disturbance impacts it has been assumed that there will be no requirement for trucks to reverse on site during the night-time period due to the layout of the site.

The highest L_{Amax} noise level at any residential area is predicted to occur as a result of truck pass-by events on either the Newstan or Eraring private haul roads in the presence of a temperature inversion. 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. Hence, predicted noise levels meet the most stringent recommended sleep disturbance noise goal of 46 dBA.

VIBRATION ASSESSMENT

It is noted that blasting is not proposed to occur for the life of the project. The main vibration generating activities will include 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 is predicted to be negligible and below levels for human perception at the nearest residential locations.

TABLE OF CONTENTS

TABLE OF CONTENTS

1 INTRODUCTION

Heggies Pty Ltd (Heggies) has been commissioned by GSS Environmental (GSSE) on behalf of Centennial Coal Pty Limited (Centennial) to undertake a Noise Impact Assessment for Awaba Colliery located on Wilton Road, Awaba, NSW.

Broadly, the objective of the noise assessment was to identify the potential impacts of noise from operation of the facility and to provide advice with regard to effective mitigation strategies where necessary.

The Noise Impact Assessment (NIA) has been 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 Department of Environment, Climate Change and Water (DECCW) NSW 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 Scope for the NIA has been designed to address the Director General's Requirements (DGR's) with regard to the assessment of noise emissions. Comments on the DGR's have also been provided by other government agencies. These have been reviewed with regard to their relevance to the assessment of noise impacts. Where relevant, these have also been addressed within the NIA. A summary of the DGR's and relevant comments is provided in **Table 1** together with the relevant section of the NIA addressing the particular DGR/comment.

Table 1 Director General's Requirements and Government Agency Comments

Requirement	Relevant Section of NIA Report
Director-General's Requirements	
Noise & Vibration - including a quantitative assessment of potential operational and transport noise impacts	Refer to entire NIA
DECCW Comments	
The EA must include a comprehensive noise assessment of the existing environment, potential impacts and proposed noise amelioration measures in accordance with the guidelines and methodologies detailed in Appendix B[1].	Refer to entire NIA
The EA must determine the rating background noise level and ambient ($L_{Aeq(Period)}$) noise levels in accordance with the NSW Industrial Noise Policy.	Refer to **Sections 5.1**, **5.2** and **5.3**
The project specific noise levels for the site must be determined. For each identified potentially affected receiver, this should include:	
- determination of the intrusive criterion for each identified potentially affected receiver,	Refer to **Section 6.1**
- selection and justification of the appropriate amenity category for each identified potentially affected receiver,	
- determination of the amenity criterion for each receiver,	
- determination of the appropriate sleep disturbance limit.	Refer to **Section 6.2**
The noise and vibration levels likely to be received at the most sensitive locations (these may vary for different activities at each phase of the development) should be determined. Potential impacts should be determined for any identified significant adverse meteorological conditions. Predicted noise levels under calm conditions may also aid in quantifying the extent of impact where this is not the most adverse condition.	Refer to **Section 7**
The EA should include an assessment of cumulative noise impacts, having regard to existing developments and developments which have received development consent in the area but which have not commenced.	Refer to **Section 7.1.5**
The EA should include noise amelioration measures proposed to address any noise issues identified.	Refer to **Section 7**. No noise issues identified.

1. These include DECCW's *Interim Construction Noise Guideline*, *NSW Industrial Noise Policy* (EPA, 2000) and *Industrial Noise Policy Application Notes*, DECCW's *Environmental Noise Management - Assessing Vibration: a technical guideline*, *Environmental Criteria for Road Traffic Noise* (EPA, 1999) and, if blasting is required, *Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration* (ANZEC, 1990).

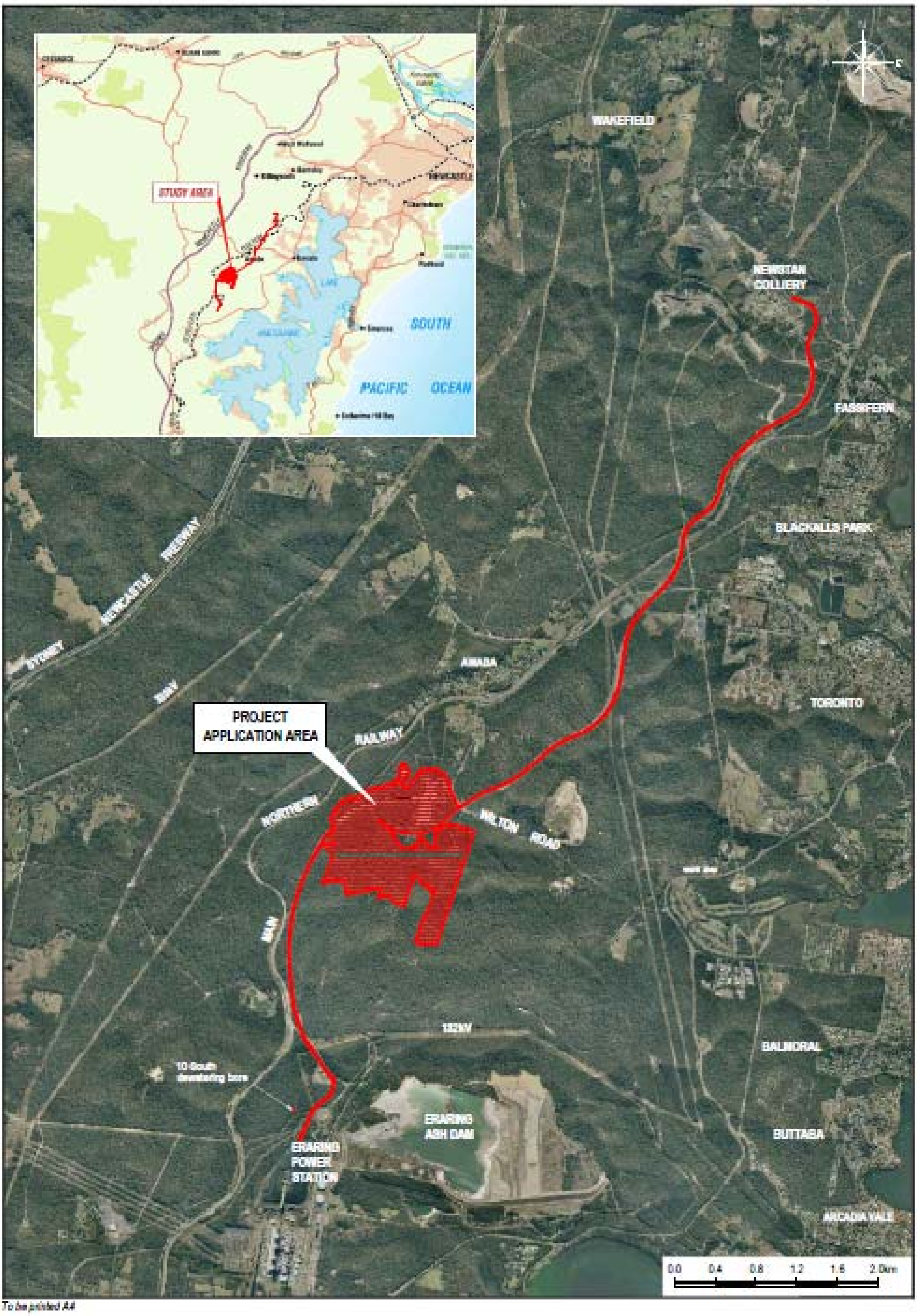
2 PROJECT OVERVIEW

2.1 Background

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 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 site is situated on crown land under lease to Centennial for the purpose of mining under Consolidated Coal Lease CCL746, and is adjacent to the Newstan-Eraring haul road owned by Eraring Energy. The locality of the mine is illustrated in **Figure 1**.

Figure 1 Awaba Colliery Project Location Area



Source: GSSE, September 2010

Awaba Colliery is a small operation with approximately 100 employees and contractors, 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.

A form of pillar extraction of narrow panels is used to recover coal in pillars developed previously by bord and pillar methods. 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 has been developed in consultation with the Department of Primary Industries – Mineral Resources (now known as Industry and Investment, NSW (I&I)) and has been used successfully to date, and is proposed to be continued for the Project.

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. A detailed description of the Project and the **Project Application Area (the "Application Area")** (including focus study areas) is detailed further in **Sections 2.2** and **2.3**.

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 outlined in **Sections 2.2** and **2.3**.

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 (refer **Section 2.2.1**) over a period of approximately five years or more, depending on actual mining conditions and relevant market drivers. The application for the proposed Project is supported by an Environmental Assessment ("EA")..

2.2 Project Application Area

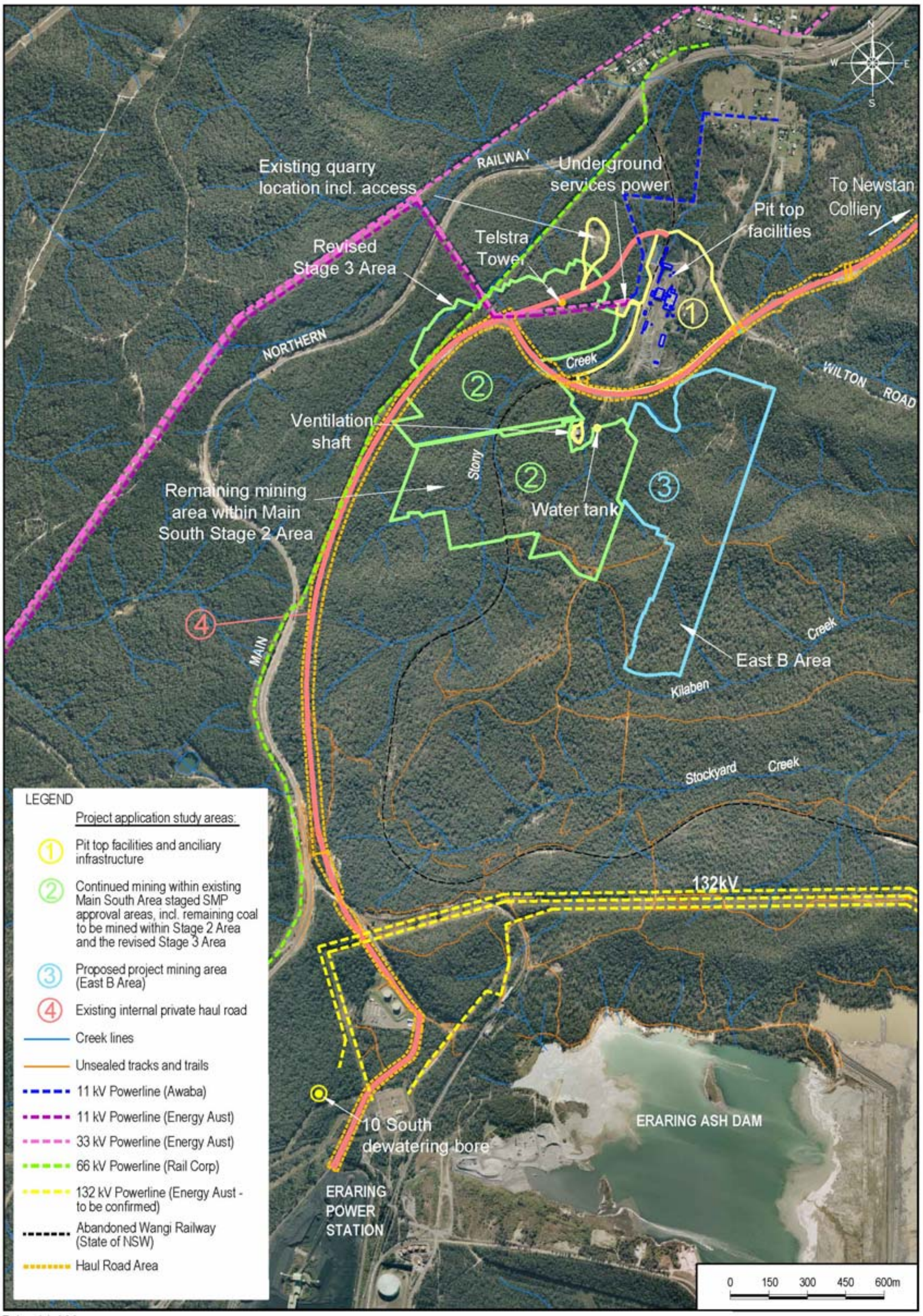
The **Project Application Area** (the "Application Area") is illustrated in **Figure 1**. The Application Area has been identified as the footprint of the proposed Project including proposed mining areas and related surface operations that are considered relevant to the continuation of Awaba Collieries 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 2.2.1** below. 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.

2.2.1 Study Areas

The Study Areas that have been assessed as part of this EA are illustrated in **Figure 2**.

Figure 2 Project Application Study Areas



Source GSSE July2010

The study areas are described as follows:

- **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; 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 Section 96(1A) of 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 will also be addressed in the EA.

2.3 Project Description

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 final Pollution Control Dam (refer **Study Area 1**);
- Continue the delivery of coal to the Newstan Colliery and/or Eraring Power Station using existing private haul road/transport facilities (refer **Study Area 4**).

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 discussed in **Section 2.2** above.

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

- **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).

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**) 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 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 NSW in 2009, until such time that a final Detailed Life of Mine Strategy has been developed.

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

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

Existing mining areas, will continue to be utilised for ongoing mining operations including (but not limited to) mine access, emergency management and underground services and infrastructure.

Continuing Mine Operations:

For the purposes of environmental assessment, further to the information above regarding continued mining areas, it is noted that the following aspects of mine operations are proposed to continue and remain unchanged. Existing mining operations are presented in detail in Section 3 of the *Environmental Assessment (EA)* and, where relevant, components are discussed further in this specialist report.

- **Coal Handling, preparation and stockpiles** – No changes are proposed to the current coal handling, preparation or stockpile procedures to the existing operations.
- **Mine support facilities and site access** – No changes are proposed to the current infrastructure and facilities, with the only exclusion being the expansion of the Pollution Control Dam (PCD) mentioned earlier above, with related water management considerations. Mine access from Wilton Road will continue to be utilised and no significant change is anticipated from current use.
- **Plant and equipment** – No changes are proposed to the typical plant and equipment used at the Awaba Colliery.
- **Transportation procedures** – 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.
- **Mining methodology** – There will be no significant changes to current mining methods 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 (financial year), depending on mining efficiency and market demands.
- **Operational water management** – 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.
- **Mine dewatering procedures** – the10 South Bore will continue to be used for groundwater management and dewatering during both continued operation and care and maintenance conditions.

2.4 Acoustically Significant Sources

2.4.1 Mining Operations

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.

Noise measurements have been conducted of acoustically significant plant and equipment utilised during operations at the Surface Facilities. Sound power levels of such plant have been determined and utilised for the purpose of this noise assessment. Where on-site measurements could not be conducted sound power levels have been obtained from a Heggies database of similar equipment. The relevant acoustically significant plant and equipment and the associated sound power levels are provided in **Table 2**.

Table 2 Awaba Colliery - Acoustically Significant Plant and Equipment

Plant and Equipment	Sound Power Level
Mining - Surface Operations	
Conveyor drive (adjacent to ROM bin)	97 dBA
Compressor shed	105 dBA
Processing plant	116 dBA
Forklift*	93 dBA
Underground man transport vehicle	111 dBA
Truck loaded (at 500t final product bin)	107 dBA
Front end loader (utilised during occasions where coal is stockpiled)	107 dBA
Workshop* (eg use of grinder)	104 dBA
Ventilation fan	88 dBA
Haul truck	98 dBA
Quarry	
Excavator*	106 dBA
Truck (approx. 20t) Pass-by*	98 dBA

* Sound power levels for these sources have been obtained from a Heggies database. All other sound power level data presented here has been obtained from noise measurements undertaken at the project site.

It should be noted that the plant and equipment utilised underground has not been considered as acoustically significant.

2.4.2 Construction

Minimal changes are proposed to existing surface operations, with only one proposed new surface disturbance relating to increased pollution control dam capacity. This activity would be considered as construction activity and require assessment in accordance with the Interim Construction Noise Guideline.

Increasing the capacity of the pollution control dam is expected to take up to 2 weeks duration and involve the use of one excavator and some haul trucks. For the purpose of the noise assessment the sound power level of these items has been assumed to be the same as those in use at the quarry (refer **Table 2**).

2.5 Existing Noise Mitigation and Management Measures

Noise mitigation and management measures currently implemented at Awaba Colliery include the following:

- Standard work procedures and maintenance tasks to minimise noise emissions.
- Enclosed conveyors and processing plant.

2.6 Noise Complaints

Awaba has received a noise complaint in 2007. The following text is an extract from the 2007 AEMR in regard to the complaint.

The complaint was received via telephone from an Awaba resident 30 October 2007 late at night. The complaint was in relation to concerns of a noise similar to a "reversing buzzer" late at night. No machinery with reversing buzzers was operating at the time. It was thought that noise may have been a conveyor magnet warning buzzer although hasn't been able to be confirmed.

3 PROJECT SETTING

3.1 Site Details

Awaba Colliery is located on the sloping side of a narrow valley, which trends in a north-south direction. The site has an approximate elevation of 55 metres at the eastern end of the surface facilities and Stoney Creek borders the western side of the mine. The township of Awaba is situated less than 1 km north and Toronto is approximately 5.5 km northeast of the site. The western shore of Lake Macquarie is approximately 4km east of the site.

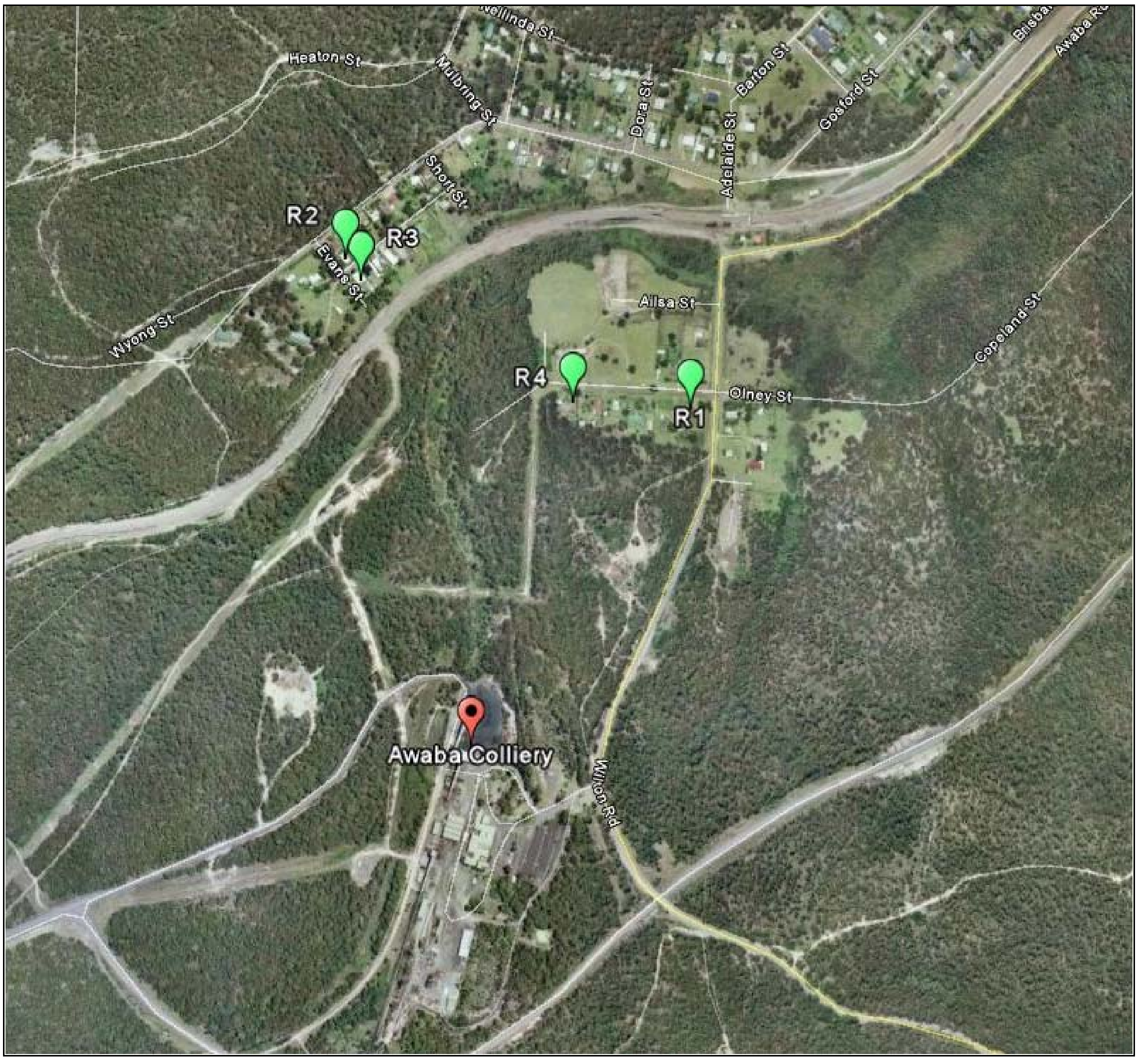
3.2 Sensitive Receptors

A number of residences are located in the area surrounding the Project Site. The nearest residences have been identified as sensitive receptor locations to be taken into account during the assessment. A list of the nearest sensitive receptors (R1 to R4) identified in the immediate vicinity of the Project Site, and their respective distances from the Project Site boundary, are presented in **Table 3** and **Figure 3**.

Table 3 Nearest Sensitive Receptors

Receptor ID	Location	Location (m, MGA56)		Distance (km) / Direction From Site Boundary	Elevation (m, AHD)
		Easting	Northing		
R1	9 Olney Street, Awaba	363733	6346064	0.6 / NNE	30
R2	15 Evans Street, Awaba	363203	6346323	0.8 / N	32
R3	51 Puddy Lane, Awaba	363220	6346274	0.7 / N	29
R4	1A Olney Street, Awaba	363547	6346080	0.5 / NNE	32

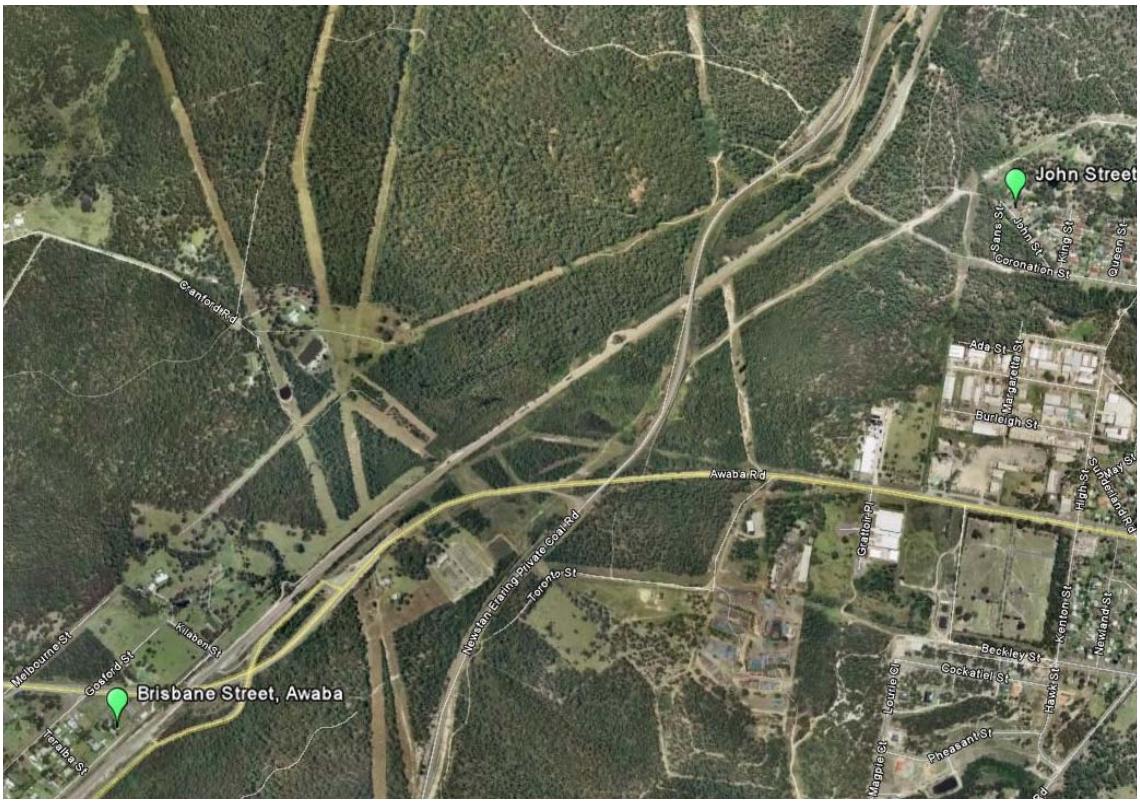
Figure 3 Surrounding Sensitive Receptor Locations



Source: Google Earth

For the purpose of assessing potential noise impacts from the haul roads the residential locations shown in **Figure 4** have also been considered.

Figure 4 Other Noise Sensitive Receivers



Source: Google Earth

It is noted that other noise-sensitive locations such as schools, churches and hospitals are not in the vicinity of Awaba Colliery and, as such, have not been considered as being potentially affected by noise emissions from the Project.

4 NOISE IMPACT ASSESSMENT PROCEDURES

4.1 General Objectives - Industrial Noise Policy

The Industrial Noise Policy (INP) was released in January 2000 and provides a framework and process for deriving noise criteria for consents and licences that enables the DECCW to regulate premises that are scheduled under the Protection of the Environment Operations Act, 1997.

The specific policy objectives are:

- To establish noise criteria that would protect the community from excessive intrusive noise and preserve amenity for specific land uses.
- To use the criteria as the basis for deriving project specific noise levels.
- To promote uniform methods to estimate and measure noise impacts, including a procedure for evaluating meteorological effects.
- To outline a range of mitigation measures that could be used to minimise noise impacts.
- To provide a formal process to guide the determination of feasible and reasonable noise limits for consents or licences that reconcile noise impacts with the economic, social and environmental considerations of industrial development.
- To carry out functions relating to the prevention, minimisation and control of noise from premises scheduled under the Act.

The INP provides two forms of noise criteria with the aim of achieving environmental noise objectives; one to account for intrusive noise which involves setting a noise goal relative to the existing acoustic environment and the other to protect the amenity of particular land uses.

For assessing intrusiveness, the background noise needs to be measured. The intrusiveness criterion essentially means that the equivalent continuous noise level of the source over any 15 minute period ($L_{Aeq(15minute)}$) should not be more than five (5) decibels above the measured background level (L_{A90}).

The amenity assessment is based on noise criteria specific to land use and associated activities. The criteria relate only to industrial-type noise and do not include road, rail or community noise. An extract from the INP that relates to the amenity criteria is given in **Table 4**.

Table 4 Amenity Criteria
Recommended L_{Aeq} Noise Levels from Industrial Noise Sources

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended $L_{Aeq(Period)}$ Noise Level (dBA)	
			Acceptable	**Recommended Maximum**
Residence	Rural	Day	50	55
		Evening	45	50
		Night	40	45
	Suburban	Day	55	60
		Evening	45	50
		Night	40	45
	Urban	Day	60	65
		Evening	50	55
		Night	45	50
	Urban/Industrial Interface (for existing situations only)	Day	65	70
		Evening	55	60
		Night	50	55
School classrooms - internal	All	Noisiest 1 hour period when in use	35	40
Hospital wards	All	Noisiest 1 hour period		
- internal			35	40
- external			50	55
Place of worship - internal	All	When in use	40	45
Area specifically reserved for passive recreation (eg National Park)	All	When in use	50	55
Active recreation area (eg school playground, golf course)	All	When in use	55	60
Commercial premises	All	When in use	65	70
Industrial premises	All	When in use	70	75

Note: 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 - 6.00 pm; Evening 6.00 pm - 10.00 pm; Night-time 10.00 pm - 8.00 am. The L_{Aeq} index corresponds to the level of noise equivalent to the energy average of noise levels occurring over a measurement period.

If the measured existing noise level from industry approaches the criterion value, then noise levels from new industries need to be designed so that the cumulative effect does not produce noise levels that would significantly exceed the criterion. In this case, the amenity criteria provided in **Table 4** would need to be adjusted in accordance with the INP as per **Table 5**.

Table 5 Modification to Acceptable Noise Level (ANL)* to Account for Existing Levels of Industrial Noise

Total Existing L_{Aeq} noise level from Industrial Noise Sources	**Maximum L_{Aeq} Noise Level for Noise from New Sources Alone, dBA**
≥ Acceptable noise level plus 2 dBA	If existing noise level is *likely to decrease* in future acceptable noise level minus 10 dBA If existing noise level is *unlikely to decrease* in future existing noise level minus 10 dBA
Acceptable noise level plus 1 dBA	Acceptable noise level minus 8 dBA
Acceptable noise level	Acceptable noise level minus 8 dBA
Acceptable noise level minus 1 dBA	Acceptable noise level minus 6 dBA
Acceptable noise level minus 2 dBA	Acceptable noise level minus 4 dBA
Acceptable noise level minus 3 dBA	Acceptable noise level minus 3 dBA
Acceptable noise level minus 4 dBA	Acceptable noise level minus 2 dBA
Acceptable noise level minus 5 dBA	Acceptable noise level minus 2 dBA
Acceptable noise level minus 6 dBA	Acceptable noise level minus 1 dBA
< Acceptable noise level minus 6 dBA	Acceptable noise level

* ANL = recommended acceptable L_{Aeq} noise level for the specific receiver, area and time of day from **Table 4**

4.2 Assessing Sleep Disturbance

The DECCW has acknowledged that the relationship between maximum noise levels and sleep disturbance is not currently well defined. Criteria for assessing sleep disturbance has not been identified under the INP and hence, sleep arousal is often assessed using the guidelines set out in the Environmental Noise Control Manual (ENCM) Chapter 19-3.

To avoid the likelihood of sleep disturbance the ENCM recommends that the $L_{A1(1minute)}$ noise level of the source under consideration should not exceed the background noise level (L_{A90}) by more than 15 dBA when measured outside the bedroom window of the receiver during the night-time hours (10.00 pm to 7.00 am).

4.3 Assessing Construction Noise

The DECCW released the Interim Construction Noise Guideline in July 2009. The guideline sets out noise management levels, in relation to construction type activities, for sensitive receivers and how they are to be applied. The guideline suggests restriction to the hours of construction that apply to activities that generate noise at noise-sensitive receivers above the 'highly affected' noise management level. A summary of the noise management levels relevant to residential locations from the Guideline is contained in **Table 6**.

Table 6 Interim Construction Noise Guideline (Residences)

Time of day	Management level $L_{Aeq(15minute)}$	How to apply
Recommended standard hours Monday to Friday 7am to 6pm Saturday 8am to 1pm No work Sundays or public holidays	Noise Affected RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. - Where the predicted or measured $L_{Aeq(15minute)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. - The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dBA	The highly noise affected level represents the point above which there may be strong community reaction to noise. - Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: 1. times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences. 2. if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise Affected RBL + 5 dB	A strong justification would typically be required for works outside the recommended standard hours. - The proponent should apply all feasible and reasonable work practices to meet the noise affected level. - Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community.

5 EXISTING ACOUSTICAL AND METEOROLOGICAL ENVIRONMENT

5.1 General Methodology

Ambient noise surveys were conducted to characterise and quantify the existing acoustical environment 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.

All acoustic instrumentation employed throughout the monitoring programme has been designed to comply with the requirements of AS 1259.2-1990, "Sound Level Meters" and carries current NATA or manufacturer calibration certificates. Instrument calibration was checked before and after each measurement survey, with the variation in calibrated levels not exceeding ±0.5 dBA.

5.2 Operator-Attended Noise Monitoring

Operator attended noise measurements were conducted during the day and night-time periods at both noise monitoring locations. The purpose of these surveys was twofold; 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.

Each noise survey was conducted over a 15 minute period using a B&K 2270 integrating sound level meter (S/N 2449940). The results of the operator-attended noise measurements are given in **Table 7**. Ambient noise levels given in the table include all noise sources such as road, insects, birds, as well as any industrial operations.

Table 7 Operator Attended Noise Survey Results

Location	Date/ Start time/ Weather	Primary Noise Descriptor (dBA re 20 µPa)					Description of Noise Emission, Typical Maximum Levels LAmax (dBA)
		LAmax	LA1	LA10	LA90	LAeq	
Location 1 11 Olney St	9/4/2010 3:42pm Temp 22 °C Wind Calm	61	55	49	38	46	Dominated by road traffic on Wilton Rd 40-55 Insect noise to 61 Birds to 54 Local residential activity to 60 No industrial noise discernible
Location 1 11 Olney St	10/2/2010 12:54am Temp 22 °C Wind Calm	83	71	50	32	58	Freight train to 65 Car pass-by to 83 Industrial hum 30-32 Awaba Colliery only audible in very quiet lulls ~25
Location 2 1A Olney St	9/4/2010 4:07pm Temp 22 °C Wind Calm	55	46	42	37	40	Dominated by road traffic on Wilton Rd 40-50 Boy kicking football to 55 Birds 40-43 Lawn mower to 40 No industrial noise discernible
Location 2 1A Olney St	10/2/2010 12:34am Temp 22 °C Wind Calm	72	66	50	40	53	Distant traffic to 52 Freight train to 72 Residential a/c unit ~40 Passenger train to 50, horn 57 Cicadas 40-43 Awaba Colliery inaudible

Results of operator-attended noise surveys indicate that local traffic, the natural environment and residential activity are the main contributors to the ambient noise environment during the daytime period at each monitoring location. Local traffic and noise from trains are significant contributors during the night-time period with no significant noise contribution from Awaba Colliery or any other industrial sources during this period.

5.3 Unattended Continuous Noise Monitoring

Background noise levels were monitored by Heggies. The objective of the background noise survey was to measure $L_{A90(period)}$ and $L_{Aeq(15minute)}$ noise levels at the nearest potentially affected residential locations during the day, evening and night-time periods to enable the determination of the intrusiveness and amenity criteria for the project.

Background noise levels were monitored at two separate locations, considered to be representative of the nearest potentially affected receivers, from Tuesday 30 March to Friday 9 April 2010, inclusive. Details of monitoring locations are provided in **Table 8**.

Table 8 Ambient Noise Monitoring Locations

Location	Address Location Description	Logger Serial No.
Location 1	11 Olney Street, Awaba Logger located in backyard, on Eastern boundary fence.	16-306-039
Location 2	1A Olney Street, Awaba Logger located in backyard, on Eastern boundary fence.	16-203-509

It is noted that the monitoring period coincided with the Easter long-weekend and school holiday period. It is anticipated that this would not significantly affect the measured ambient noise levels in the area. It is also 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.

ARL Type EL316 noise loggers were used to monitor the ambient noise levels at each location. The noise loggers were programmed to record statistical noise level indices continuously in 15 minute intervals, including L_{Amax}, L_{A1}, L_{A50}, L_{A90}, L_{A99}, L_{Amin} and L_{Aeq}. Precautions were taken to minimise influences from extraneous noise sources and reflections from adjacent buildings.

Weather data for the survey period was obtained from the automatic weather station located at Newstan Colliery (approximately 6 km north-west of the Awaba Colliery). Noise data corresponding to periods of rainfall and/or wind speeds in excess of 5 m/s (approximately 9 knots) were discarded in accordance with INP data exclusion methodology. A summary of the results of the background surveys is given in **Table 9**. Results are displayed graphically in **Appendix A**.

Table 9 Summary of Existing Ambient Noise Levels

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

Note: 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
Morning Shoulder 6.00 am 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
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
L_{Aeq} - The equivalent continuous noise level is defined as the level of noise equivalent to the energy average of noise levels occurring over a measurement period

5.4 Effects of Meteorology on Noise Levels

5.4.1 Wind

Wind has the potential to increase noise at a receiver when it is light and stable and blows from the direction of the source of the noise. As the strength of the wind increases the noise produced by the wind will obscure noise from most industrial and transport sources.

Wind effects need to be considered when wind is a feature of the area under consideration (in accordance with the INP). Where wind blows from the source to the receiver at speeds up to 3 m/s for more than 30% of the time in any season, then wind is considered to be a feature of the area and noise level predictions must be made under these conditions.

Weather data was obtained from the Newstan Colliery automatic weather station. This location is approximately 6 km north-west of the Awaba Colliery. Wind speed and direction data for the period January 2006 to April 2010 was analysed to determine the frequency of occurrence of winds up to speeds of 3 m/s for daytime, evening and night in each season. A summary of the most frequently occurring winds is contained within **Table 10**, **Table 11** and **Table 12**. The percentage occurrence figures provided in bold are those that exceed the 30% threshold.

Table 10 Seasonal Frequency of Occurrence of Wind Speed Intervals - Daytime

Period	Calm	Wind Direction	0.5 - 2 m/s	2 - 3 m/s	0.5 - 3 m/s
Summer	4.2%	SE±45°	12.0%	15.4%	27.4%
Autumn	2.9%	SSE±45°	20.6%	16.0%	**36.6%**
Winter	2.6%	S±45°	16.6%	14.7%	**31.3%**
Spring	1.1%	SE±45°	11.7%	15.8%	27.6%

Table 11 Seasonal Frequency of Occurrence of Wind Speed Intervals - Evening

Period	Calm	Wind Direction	0.5 - 2 m/s	2 - 3 m/s	0.5 - 3 m/s
Summer	5.2%	ENE±45°	20.6%	17.0%	**37.5%**
Autumn	8.3%	S±45°	25.2%	11.2%	**36.4%**
Winter	7.2%	SSW±45°	26.2%	13.2%	**39.4%**
Spring	4.4%	SSE±45°	20.2%	8.7%	28.9%

Table 12 Seasonal Frequency of Occurrence of Wind Speed Intervals - Night

Period	Calm	Wind Direction	0.5 - 2 m/s	2 - 3 m/s	0.5 - 3 m/s
Summer	13.7%	S±45°	**32.4%**	9.6%	**42.0%**
Autumn	14.2%	S±45°	29.7%	10.5%	**40.2%**
Winter	6.4%	S±45°	23.1%	14.5%	**37.6%**
Spring	9.8%	S±45°	26.1%	9.9%	**36.1%**

Seasonal wind records indicate that source-to-receiver winds (from the south) from 0.5 m/s to 3 m/s exceed the 30% threshold during all periods (day, evening and night) in most seasons. Therefore, a prevailing southerly wind is deemed to be a feature of the area and has been considered as part of this noise assessment.

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; this is currently under investigation. Notwithstanding this, the prevailing winds are from the south and are considered to be worst case meteorological conditions for potential noise impacts at the receivers. The Newstan meteorological data is considered highly conservative and an applicable data set to use in this instance.

5.4.2 Temperature Inversion

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.

Meteorological data was not available to allow the determination of the percentage occurrence of temperature inversions during winter nights. A worst case analysis was therefore undertaken and the occurrence of temperature inversion during the night-time period has been considered as part of this noise assessment. 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**.

6 PROJECT SPECIFIC NOISE CRITERIA

6.1 Operational Noise Design Criteria

The noise emission design criteria for the project have been established with reference to the INP outlined in **Section 4.1** of this report.

The existing L_{Aeq} noise levels in the vicinity of the subject site are dominated by traffic and local residential activity. The amenity criteria have been established using the results of ambient noise measurements.

The acoustical environment typifies a suburban environment; "*an area that has local traffic with characteristically intermittent traffic flows or with some limited commerce or industry"* (INP). Therefore, the residences in the general area have been assessed as "suburban" receiver types.

The resulting operational project specific noise criteria for the project are shown in **Table 13**.

Table 13 Project Specific Noise Criteria

Location	Period	Measured Background Noise Level (LA90)	Adopted RBL* LA90	Intrusiveness Criteria LAeq(15minute)	Amenity Criteria LAeq(Period)	Project Specific Noise Criteria
Location 1	Day	33 dBA	33 dBA	38 dBA	55 dBA	38 dBA
11 Olney St, Awaba	Evening	38 dBA	33 dBA	38 dBA	45 dBA	38 dBA
	Night	36 dBA	33 dBA	38 dBA	40 dBA	38 dBA
Location 2	Day	33 dBA	33 dBA	38 dBA	55 dBA	38 dBA
1A Olney St, Awaba	Evening	34 dBA	33 dBA	38 dBA	45 dBA	38 dBA
	Night	31 dBA	31 dBA	36 dBA	40 dBA	36 dBA

* For the purposes of determining the relevant project specific noise criteria the adopted RBL has been chosen such that the intrusive noise goal (RBL+5dBA) for evening is no greater than that determined for the daytime period and the intrusive noise goal for night is no greater than that determined for the day or evening period. This is consistent with information provided in the DECCW *Application Notes - NSW Industrial Noise Policy*.

6.2 Sleep Disturbance Noise Goals

The relevant sleep disturbance noise goals for each residential area are provided in **Table 14**.

Table 14 Sleep Disturbance Noise Goals

Location	Period	Measured Background Noise Level (LA90)	Adopted RBL* LA90	Sleep Disturbance Noise Goal
Location 1 11 Olney Street	Night	36 dBA	33 dBA	48 dBA
Location 2 1A Olney Street	Night	31 dBA	31 dBA	46 dBA

* For the purposes of determining the relevant sleep disturbance noise goal the lowest measured RBL (for day, evening and night-time periods) has been adopted.

The Environmental Criteria for Road Traffic Noise (ECRTN) provides further guidance with regard to sleep disturbance and calls upon a number of studies that have been conducted into the effect of maximum noise levels on sleep. The DECCW policy document acknowledges that, at the current level of understanding, it is not possible to establish absolute noise level criteria that would correlate to an acceptable level of sleep disturbance. However, the ECRTN provides that maximum internal noise levels below 50 dBA to 55 dBA are unlikely to cause awakening reactions and one or two events per night, with maximum internal noise levels of 65 dBA to 70 dBA (inside dwellings) are not likely to significantly affect health and wellbeing.

6.3 Construction Noise Goals

The relevant construction noise goals have been developed with reference to the Interim Construction Noise Guideline outlined in **Section 4.3** and are contained in **Table 15**.

Note that the Noise Affected level for daytime is determined as background noise plus 10 dBA. The Noise Affected level for evening and night (ie outside recommended hours) is determined as background noise plus 5 dBA. The Highly Noise Affected level is defined in the Interim Construction Noise Guideline. It should be noted that a Highly Noise Affected level is not defined for the evening or night periods. A strong justification would typically be required for works outside the recommended standard hours. It is Heggies understanding that no construction activity would occur during the evening or night-time periods.

Table 15 Construction Noise Goals

Location	Period	Construction Noise Goal LAeq(15minute)	
		Noise Affected (dBA)	Highly Noise Affected (dBA)
Location 1 11 Olney Street	Day	43 dBA	75
	Evening	38 dBA	n/a
	Night	38 dBA	n/a
Location 2 1A Olney Street	Day	43 dBA	75
	Evening	38 dBA	n/a
	Night	36 dBA	n/a

7 ASSESSMENT OF NOISE IMPACTS

7.1 Operational Noise Modelling

7.1.1 Operational Noise Modelling Parameters

A computer model was used to predict noise emissions from operation of the project. The operational noise modelling was undertaken using SoundPLAN v6.4 software, developed by Braunstein and Berndt Gmbh in Germany. A three-dimensional digital terrain map giving all relevant topographic information was used in the modelling process. The model used this 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.

Topographic contours and operational plans were supplied by Centennial for the purpose of modelling noise from the project. Prediction of noise emission levels was carried out under calm and prevailing atmospheric conditions. Atmospheric parameters under which noise predictions were made are given in **Table 16**.

Table 16 Meteorological Parameters Considered for Noise Predictions

	Temperature	Humidity	Wind Speed	Wind Direction (degrees from north)	Temperature Inversion
Calm (All periods)	20°C	65%	n/a	n/a	n/a
Southerly Wind (All periods)	20°C	65%	3m/s	180°	n/a
Inversion (Night only)	10°C	90%	n/a	n/a	3°C/100m

Sound power levels of relevant plant and equipment have been obtained from measurements of plant already operating at the site or have been sourced from a Heggies database of similar equipment.

Assumptions made in modelling noise emissions from the subject site include the following:

- All acoustically significant plant and equipment operates simultaneously.
- Mobile noise sources, such as delivery and product despatch trucks, were modelled at typical locations and assumed to operate in repetitive cycles.
- All mitigation measures described in **Section 2.5** are implemented.
- The quarry operates only in the daytime period (7.00am - 4.00pm).
- The loader operates only in the daytime period (7.00am - 3.00pm) and is utilised during occasions where coal is stockpiled. The loader may operate up to midnight on very rare occasions, if required, but this has not been considered in predicting noise emission levels from the project.

7.1.2 Noise Management and Mitigation

Noise emission levels have been predicted assuming that the existing noise management and mitigation measures described in **Section 2.5** are implemented. No additional noise management or mitigation measures have been considered.

7.1.3 Operational Scenario - Noise Model Summary

The operational scenario modelled during each period is summarised in **Table 17**. A tick (✓) indicates that the equipment is in operation during the relevant period. A cross (×) indicates that the equipment is not in operation during the relevant period. Where there is a number in brackets following a tick, this represents the number of pieces of the equipment that has been considered in the noise model during the relevant period. It should be noted that the operational scenario modelled is likely to represent an acoustically worst-case scenario.

Table 17 Operational Scenario Considered in Noise Model

Plant and Equipment	Day	Evening	Night
Mining - Surface Operations			
Conveyor drive (adjacent to ROM bin)	✓	✓	✓
Compressor shed	✓	✓	✓
Processing plant	✓	✓	✓
Forklift	✓	✓	✓
Underground man transport vehicle (entering or exiting portal)	✓ (1)	✓ (1)	✓ (1)
Truck loaded (at 500t final product bin)	✓ (1)	✓ (1)	✓ (1)
Front end loader (utilised during occasions where coal is stockpiled)	✓	×	×
Workshop (eg use of grinder)	✓	✓	✓
Ventilation fan	✓	✓	✓
Haul truck (transporting product on Newstan haul road)	✓ (4)	✓ (4)	✓ (4)
Haul truck (transporting product on Eraring haul road)	✓ (4)	✓ (4)	✓ (4)
Quarry			
Excavator	✓	×	×
Truck (approx. 20t) Pass-by	✓	×	×

7.1.4 Operational Noise Modelling Results and Discussion

Noise emission levels were predicted from the proposed development for the typical operational scenario described in **Table 17** including the noise mitigation and management procedures described in **Section 2.5**.

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). The appropriate modifying factors, as outlined in the INP, have been applied where these characteristics are considered to be present. Noise levels predicted at the nearest potentially affected residential locations are provided in **Table 18**. Noise contour maps are provided in **Appendix B** for each meteorological scenario considered.

Table 18 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*	Day	< 30	< 30	n/a	38 dBA
	Evening	< 30	< 30	n/a	38 dBA
	Night	< 30	< 30	< 30	38 dBA
Brisbane St, Awaba**	Day	< 30	< 30	n/a	38 dBA
	Evening	< 30	< 30	n/a	38 dBA
	Night	< 30	< 30	< 30	36 dBA
John St, Blackalls Park**	Day	< 30	< 30	n/a	38 dBA
	Evening	< 30	< 30	n/a	38 dBA
	Night	< 30	< 30	< 30	36 dBA
Puddy Lane, Awaba**	Day	30	35	n/a	38 dBA
	Evening	< 30	33	n/a	38 dBA
	Night	< 30	33	33	36 dBA
Wilton Road, Awaba*	Day	< 30	< 30	n/a	38 dBA
	Evening	< 30	< 30	n/a	38 dBA
	Night	< 30	< 30	< 30	38 dBA

*Project Specific Noise Criteria applicable to 11 Olney Street have been adopted at these locations.
**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.

Results presented in **Table 18** indicate that operational noise levels are predicted to meet the project specific noise criteria at all considered residential locations under calm and prevailing weather conditions.

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.

7.1.5 Cumulative Noise Assessment

Potential cumulative noise impacts from existing and successive developments are embraced by the INP procedures by ensuring that the appropriate noise emission criteria are established with a view to maintaining acceptable noise *amenity* levels for residences. It is noted that there are no developments in the vicinity of the subject site that have received development consent but which have not commenced.

The cumulative noise impact of the project with other existing industrial noise sources has been assessed in the determination of the amenity levels at surrounding potentially affected noise sensitive areas.

7.2 Sleep Disturbance Analysis

In the interests of minimising sleep disturbance impacts it has been assumed that there will be no requirement for trucks to reverse on site during the night-time period due to the layout of the site.

In assessing sleep disturbance, typical L_{Amax} noise levels of acoustically significantly plant and equipment to be used at the subject site (refer to **Table 19**) were used as input to the noise model. L_{Amax} noise level predictions were made at the nearest residential areas in Awaba under adverse weather conditions at night. Noise events considered include loading into an empty truck and those associated with haul truck drive-off or pass-by. The use of the L_{Amax} noise level provides a worst-case prediction since the $L_{A1(1minute)}$ noise level of a noise event is likely to be less than the L_{Amax}.

Table 19 L_{Amax} Sound Power Levels

Source	Maximum Sound Power Level
FEL loading into an empty truck*	117 dBA
Haul truck pass-by	113 dBA

*It is anticipated that this activity is unlikely to occur during the night-time period but has been included for the purpose of assessing the potential for sleep disturbance.

The highest L_{Amax} noise level at any residential area is predicted to occur as a result of truck pass-by events on either the Newstan or Eraring private haul roads in the presence of a temperature inversion. 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. Hence, predicted noise levels meet the most stringent recommended sleep disturbance noise goal of 46 dBA.

7.3 Construction Noise Assessment

Given the temporary nature of construction works (up to 2 weeks duration) and that noise emissions from proposed construction activity is identical in nature to operational noise from the Project it is unlikely that noise impacts will occur from construction-type activity at the site. It is also noted that construction activity is anticipated to occur during the daytime period only.

Notwithstanding this, noise levels from the operation of an excavator and haul trucks at the pollution control dam are expected to be in the order of 30 dBA under adverse weather conditions (3m/s southerly wind) at the nearest potentially affected residential locations. This is significantly below the relevant daytime construction noise goal of 43 dBA.

7.4 Vibration Assessment

It is noted that blasting is not proposed to occur for the life of the project. The main vibration generating activities will include 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 is predicted to be negligible and below levels for human perception at the nearest residential locations.

8 CONCLUSION

Heggies Pty Ltd (Heggies) has undertaken a Noise Impact Assessment for the Awaba underground coal mine located on Wilton Road, Awaba, NSW.

Broadly, the objective of the noise assessment was to identify the potential impacts of noise from operation of the facility and to provide advice with regard to effective mitigation strategies where necessary.

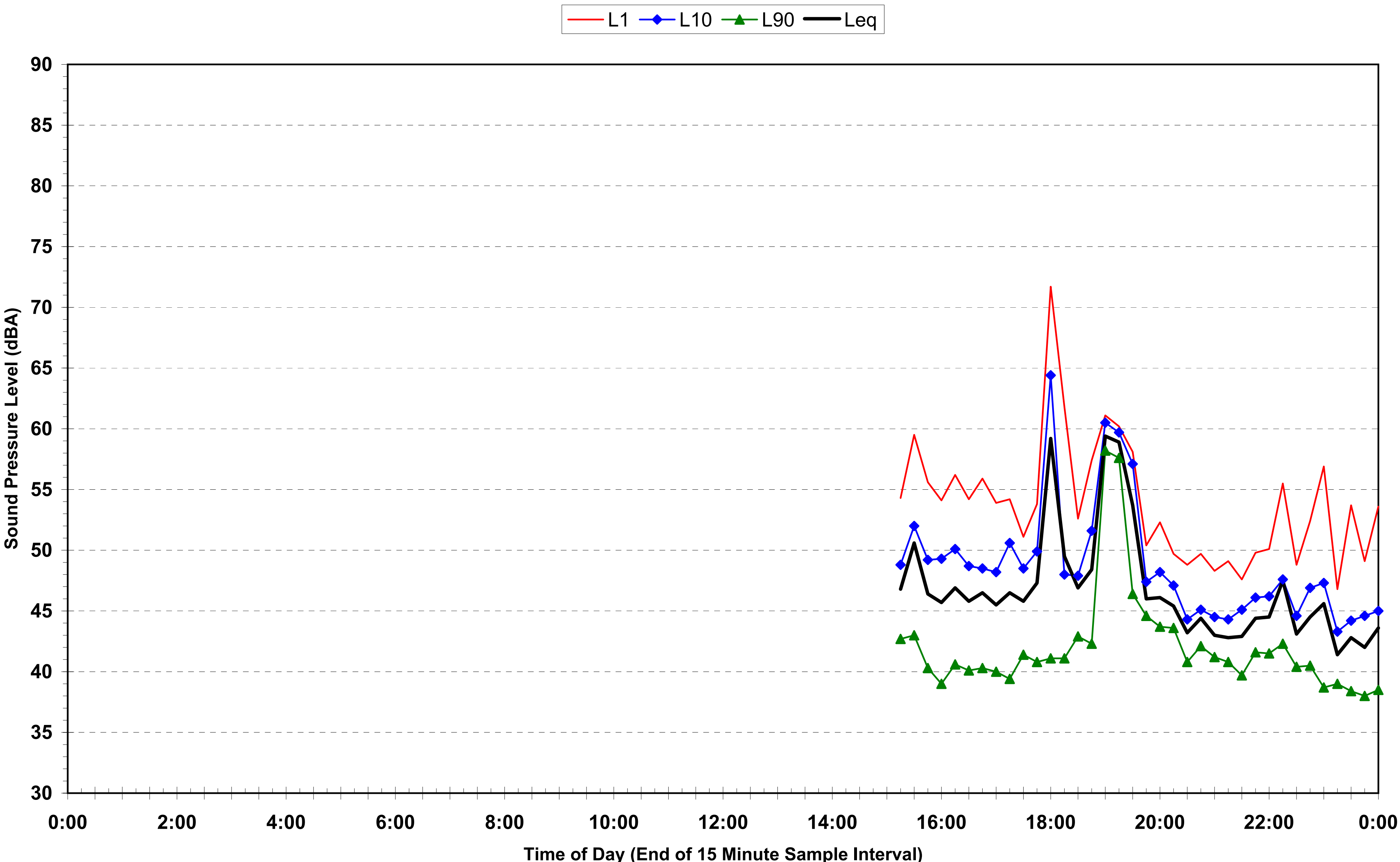
Results presented in **Table 18** indicate that operational noise levels are predicted to meet the project specific noise criteria at all considered residential locations under calm and prevailing weather conditions.

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.

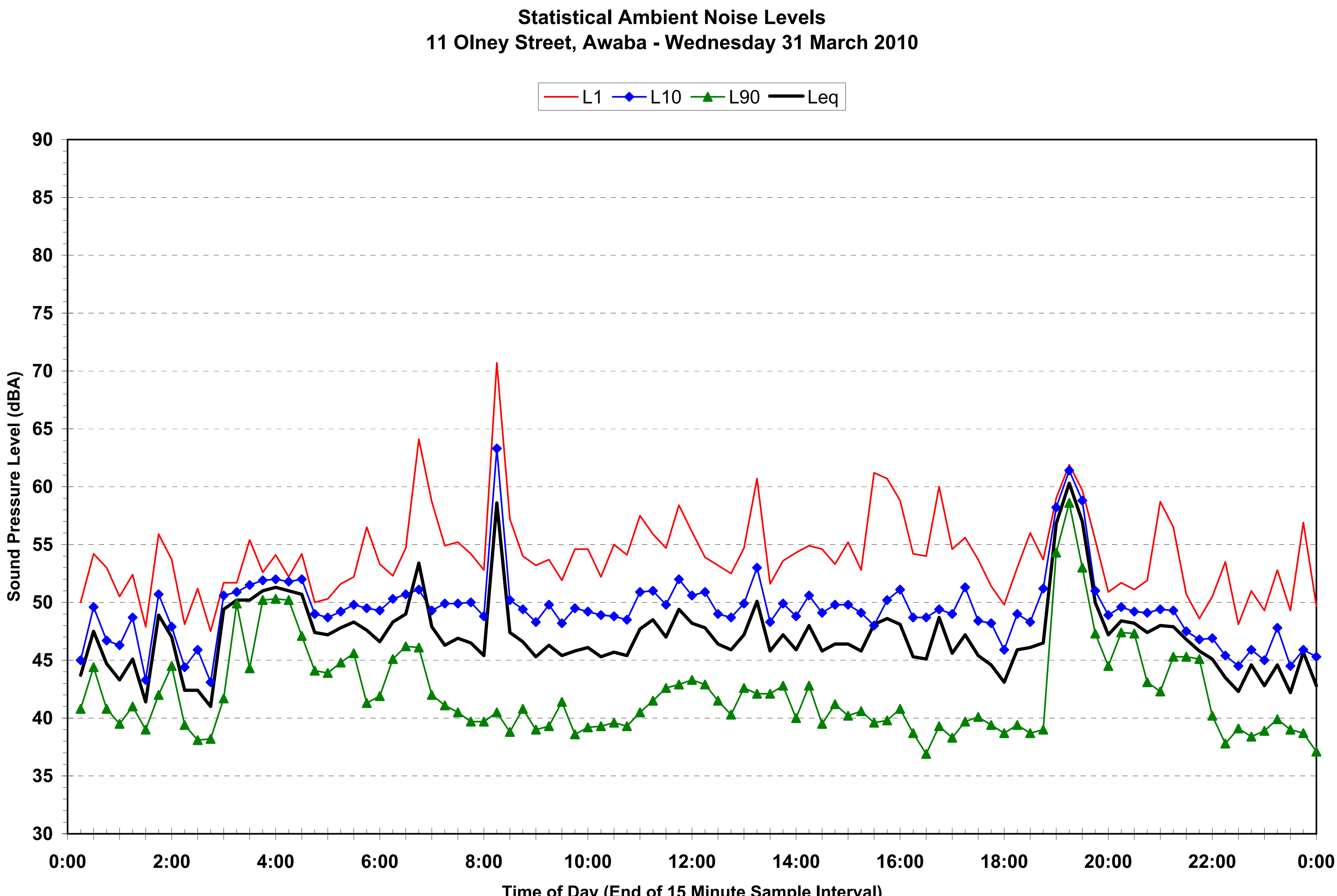
In addition, L_{Amax} noise levels are predicted to meet the most stringent recommended sleep disturbance noise goal of 46 dBA.

Accordingly, no further mitigation measures other than those outlined in **2.5**, or additional noise monitoring, are considered to be required in relation to this project.

Statistical Ambient Noise Levels
11 Olney Street, Awaba - Tuesday 30 March 2010



Appendix A1 - Page 1
Statistical Noise Levels
Heggies Report 30-2497

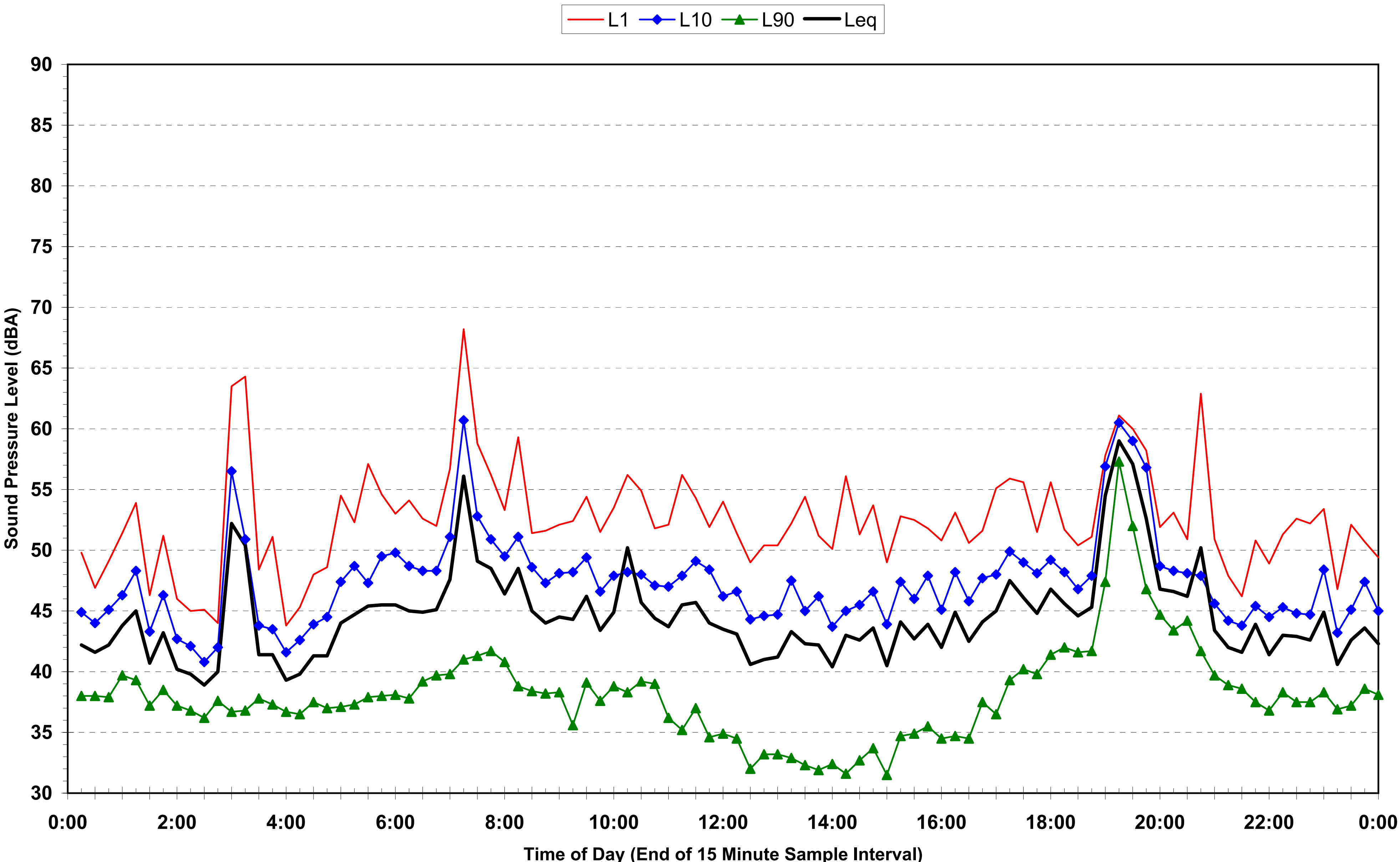


Appendix A1 - Page 2

Statistical Noise Levels

Heggies Report 30-2497

Statistical Ambient Noise Levels
11 Olney Street, Awaba - Thursday 1 April 2010



Statistical Ambient Noise Levels
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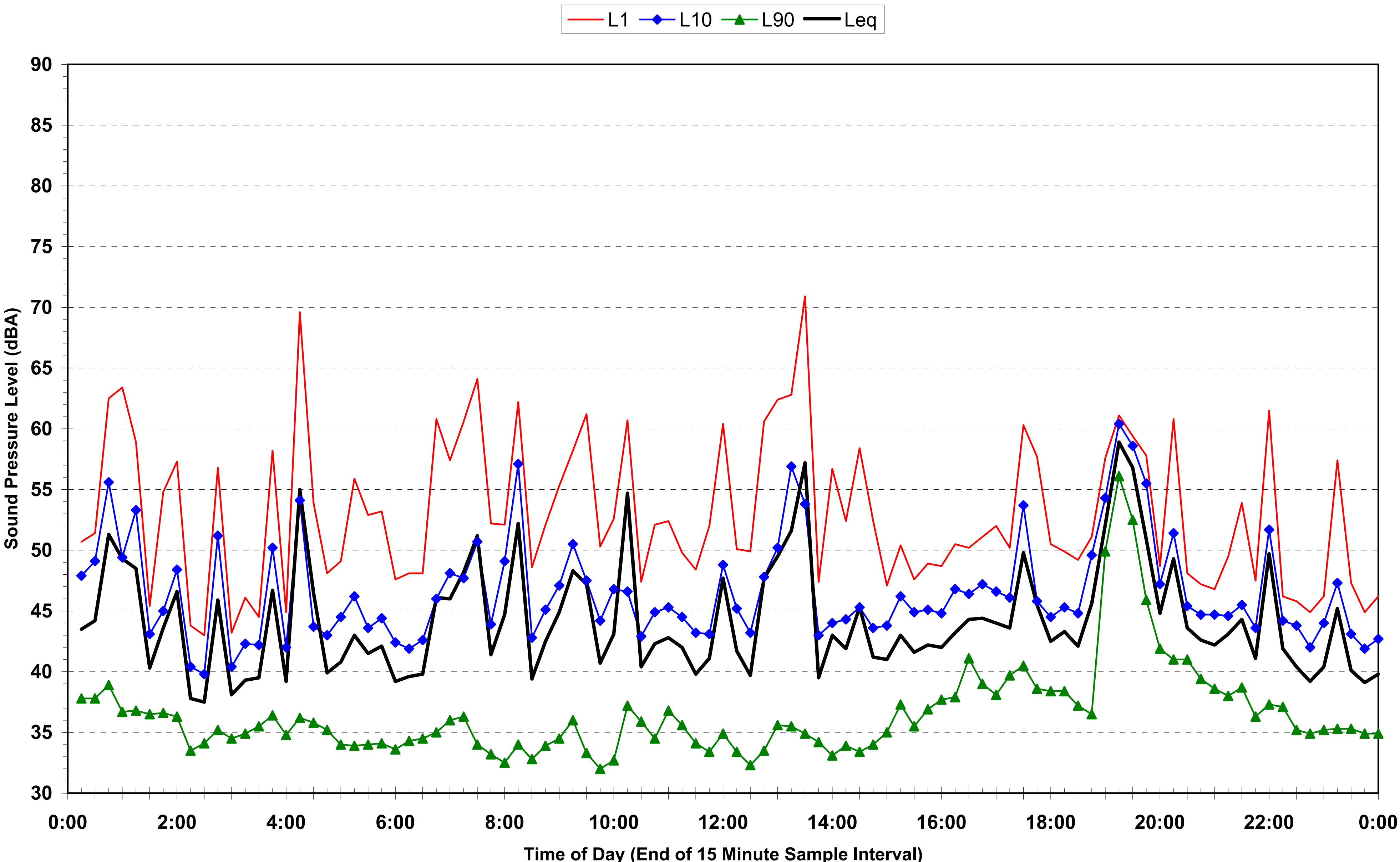
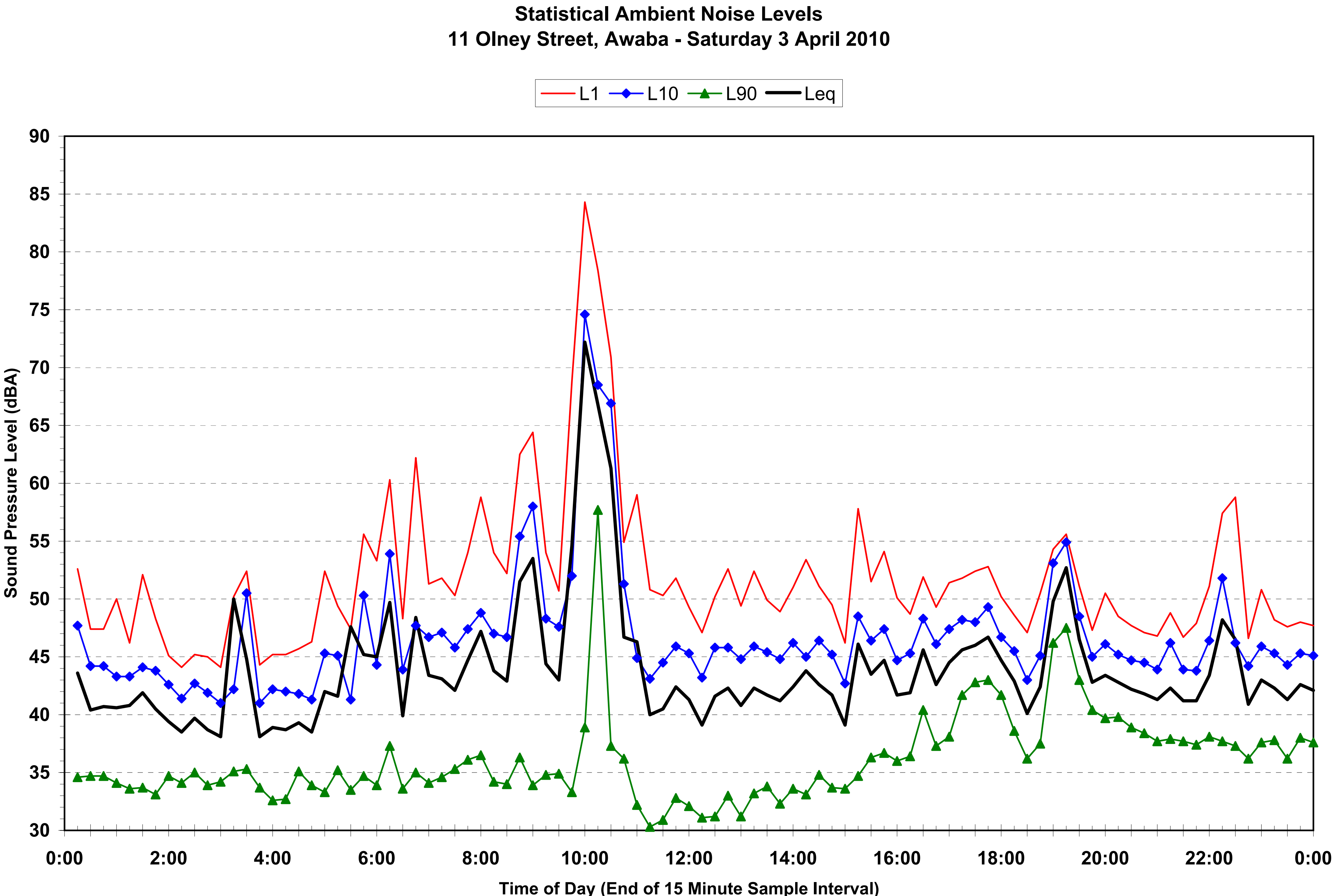


Appendix A1 - Page 4
Statistical Noise Levels
Heggies Report 30-2497



Statistical Ambient Noise Levels
11 Olney Street, Awaba - Saturday 3 April 2010
L1
L10
L90
Leq
Sound Pressure Level (dBA)
90
85
80
75
70
65
60
55
50
45
40
35
30
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00
Time of Day (End of 15 Minute Sample Interval)

Statistical Ambient Noise Levels
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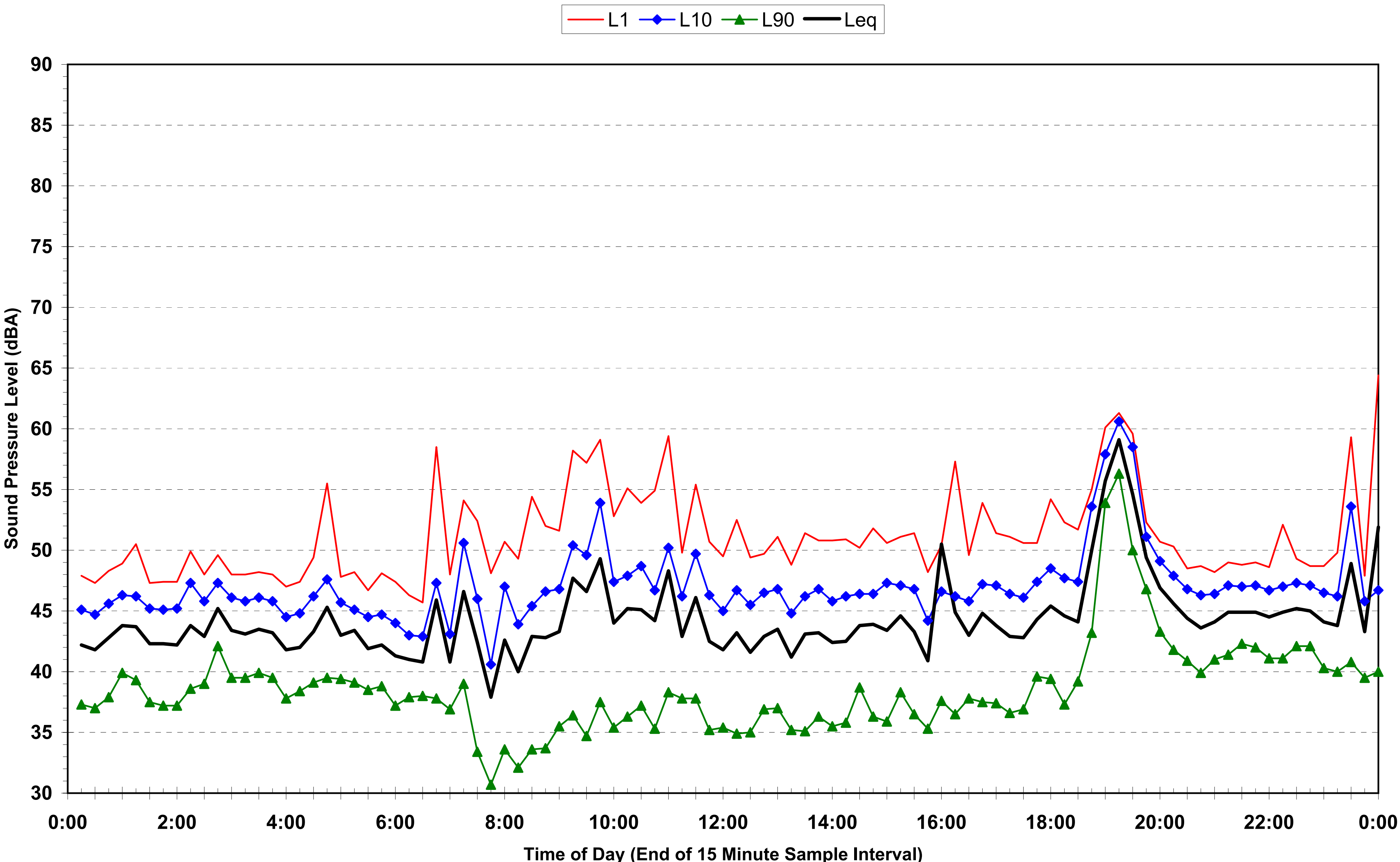
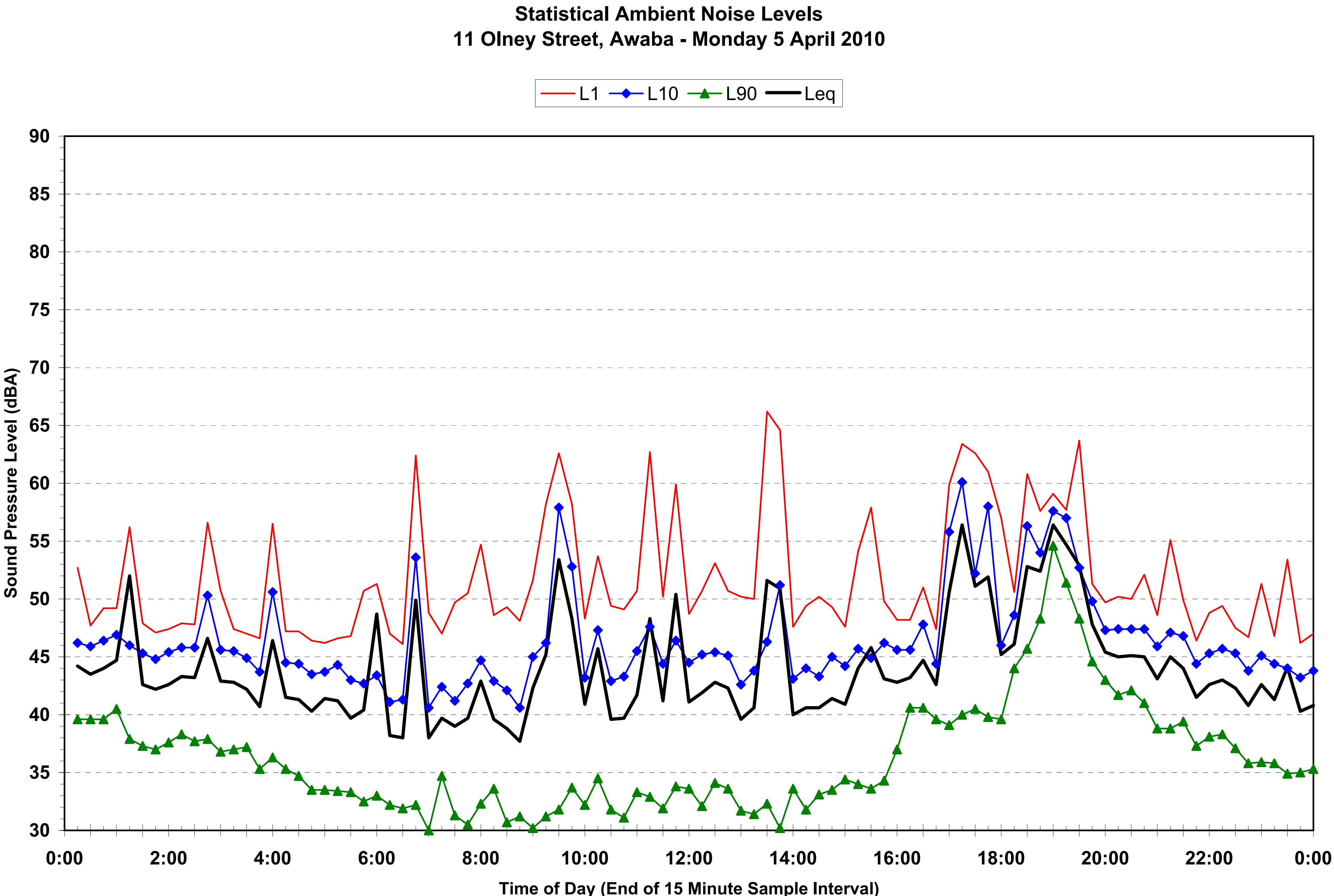
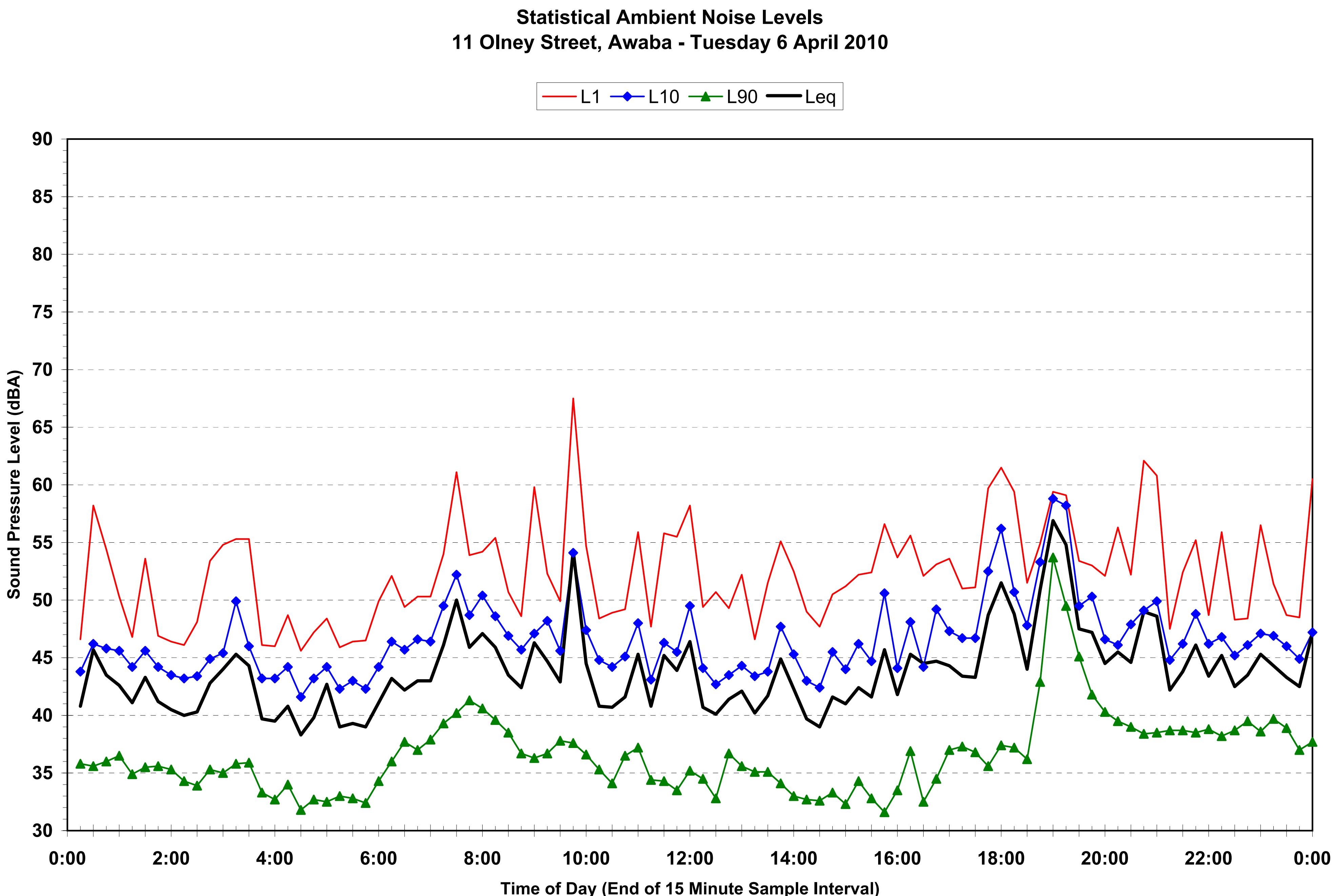




Appendix A1 - Page 7

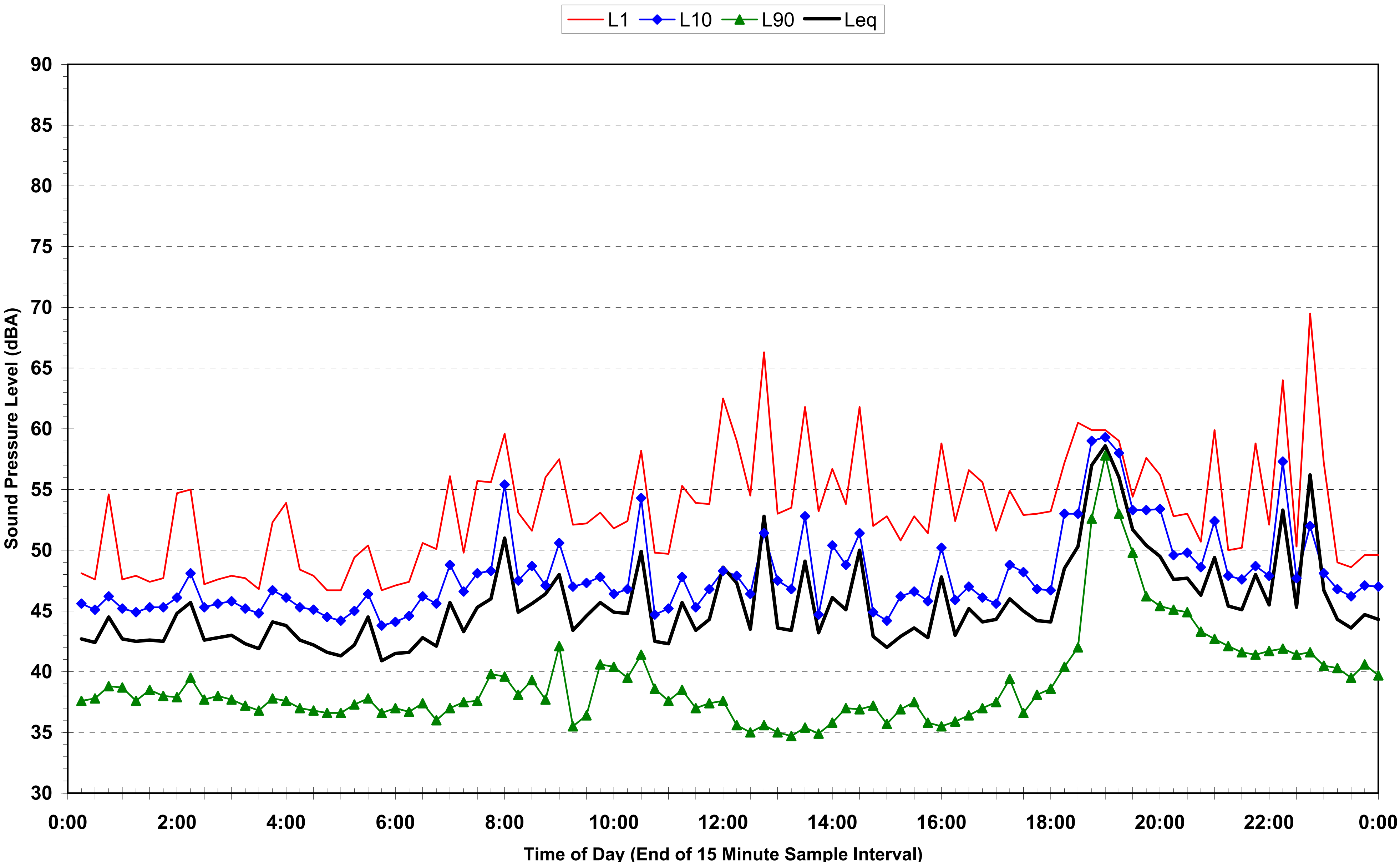
Statistical Noise Levels

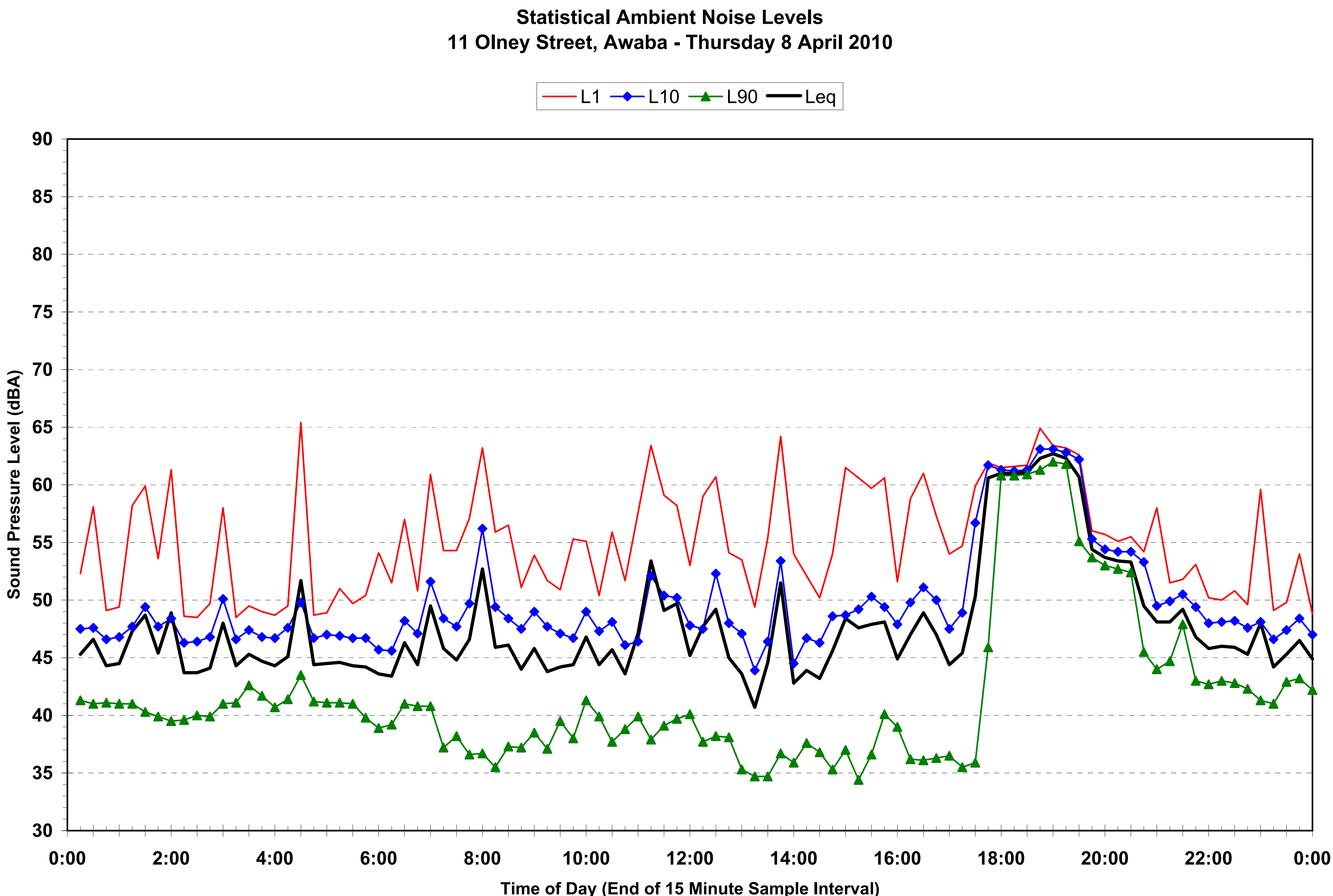
Heggies Report 30-2497



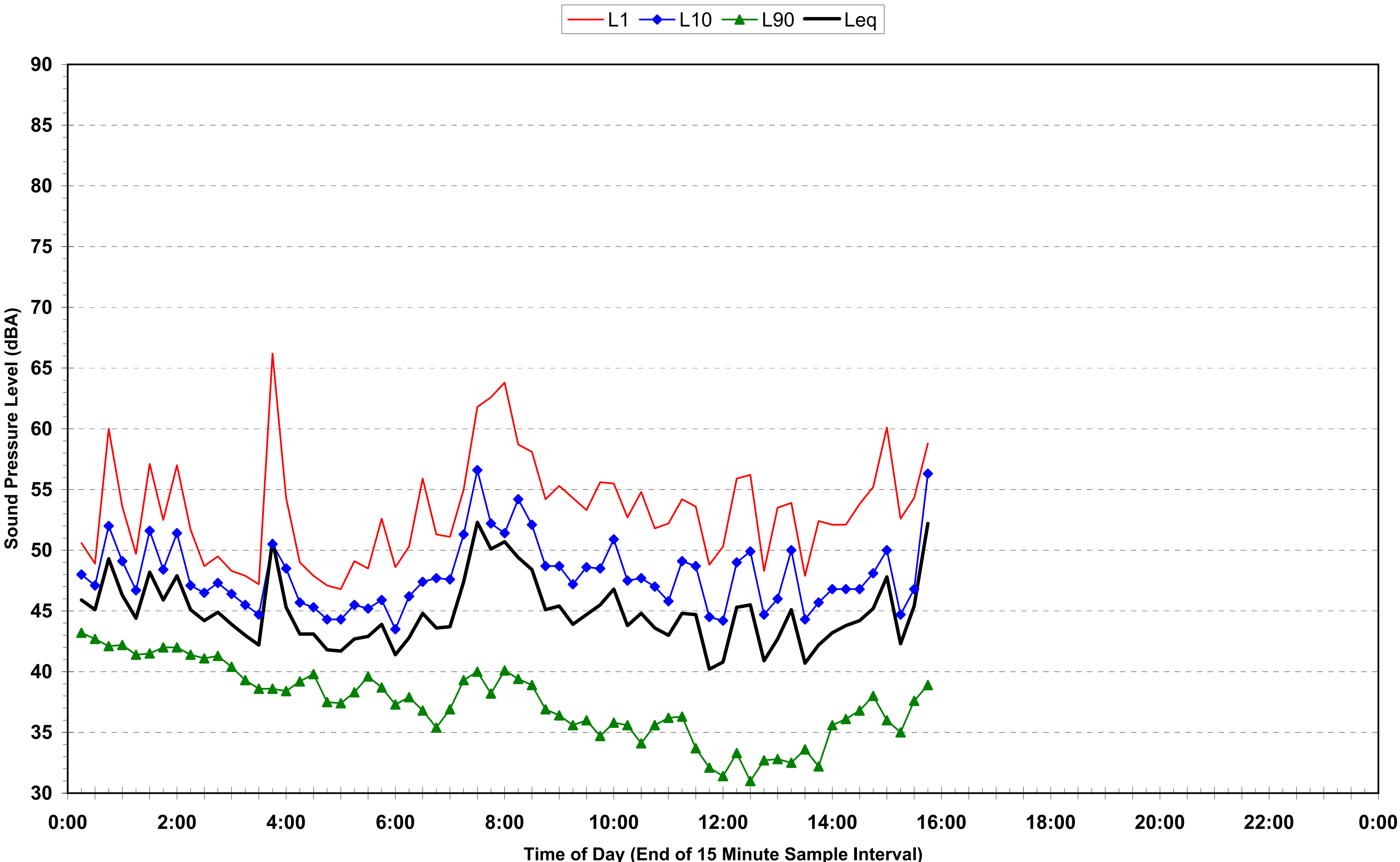
Statistical Ambient Noise Levels
11 Olney Street, Awaba - Tuesday 6 April 2010
L1
L10
L90
Leq
Sound Pressure Level (dBA)
90
85
80
75
70
65
60
55
50
45
40
35
30
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00
Time of Day (End of 15 Minute Sample Interval)

Statistical Ambient Noise Levels
11 Olney Street, Awaba - Wednesday 7 April 2010

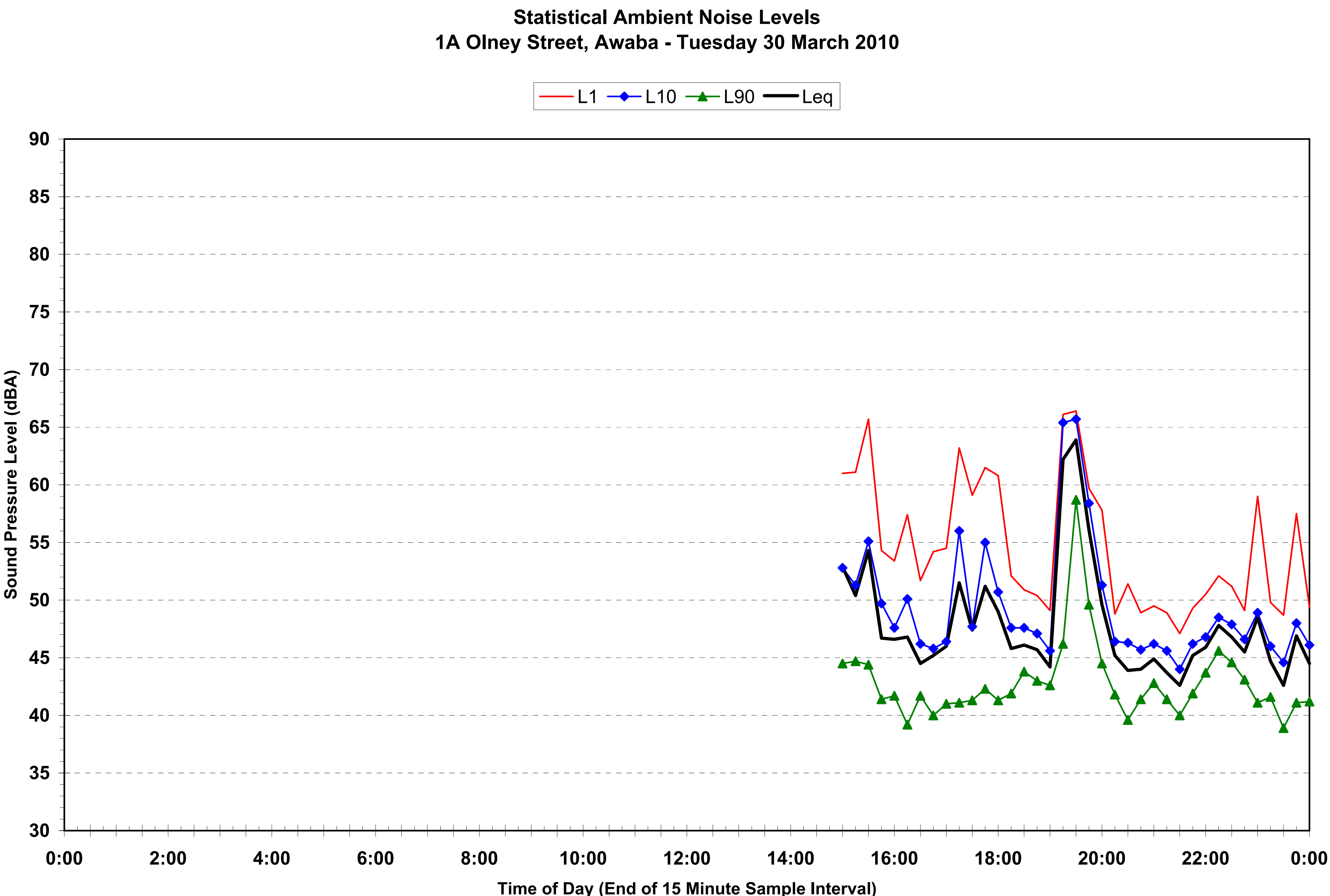



Statistical Ambient Noise Levels
11 Olney Street, Awaba - Thursday 8 April 2010
L1
L10
L90
Leq
Sound Pressure Level (dBA)
90
85
80
75
70
65
60
55
50
45
40
35
30
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00
Time of Day (End of 15 Minute Sample Interval)

Statistical Ambient Noise Levels
11 Olney Street, Awaba - Friday 9 April 2010



Appendix A1 - Page 11
Statistical Noise Levels
Heggies Report 30-2497

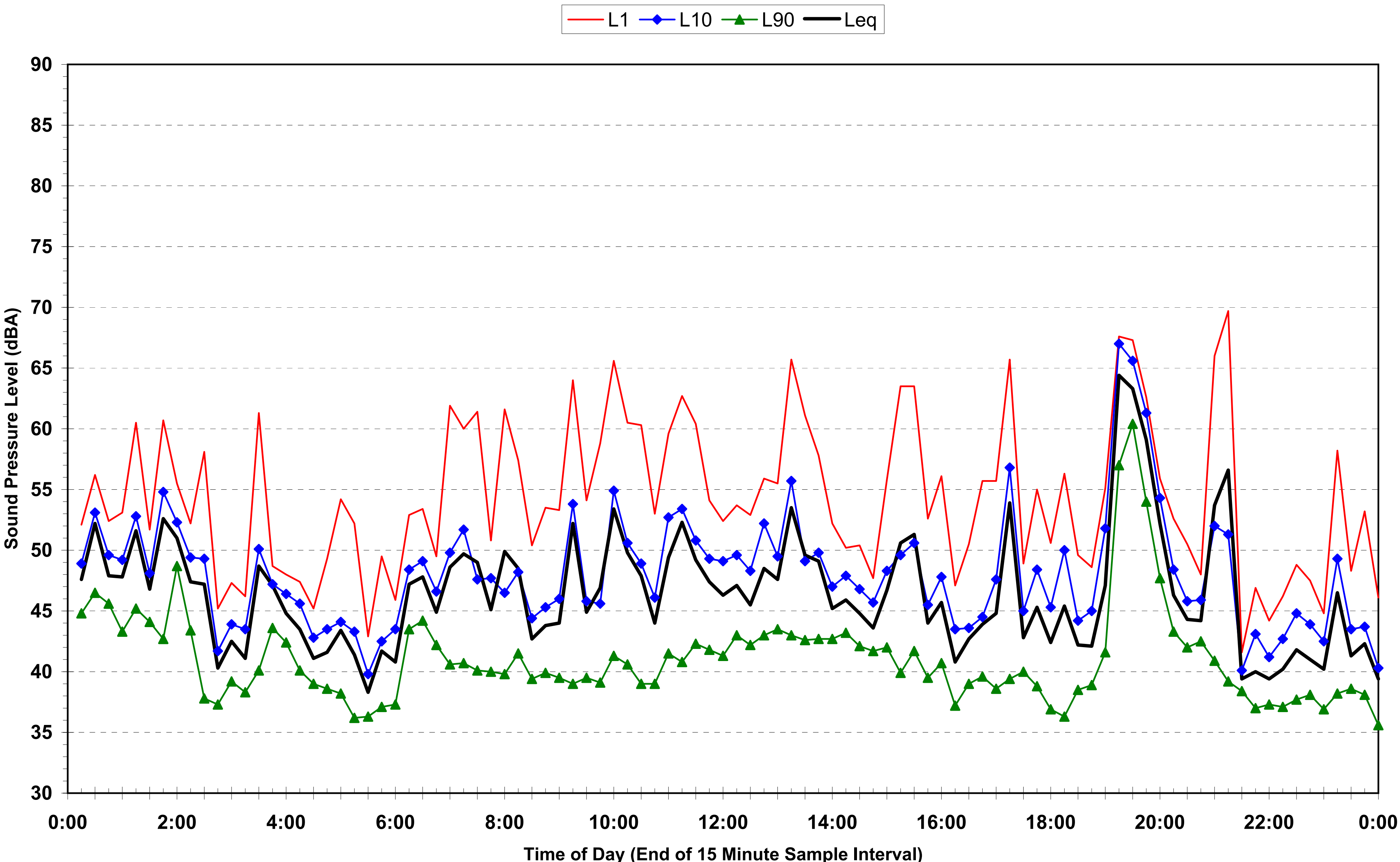


Appendix A2 - Page 1

Statistical Noise Levels

Heggies Report 30-2497

Statistical Ambient Noise Levels
1A Olney Street, Awaba - Wednesday 31 March 2010

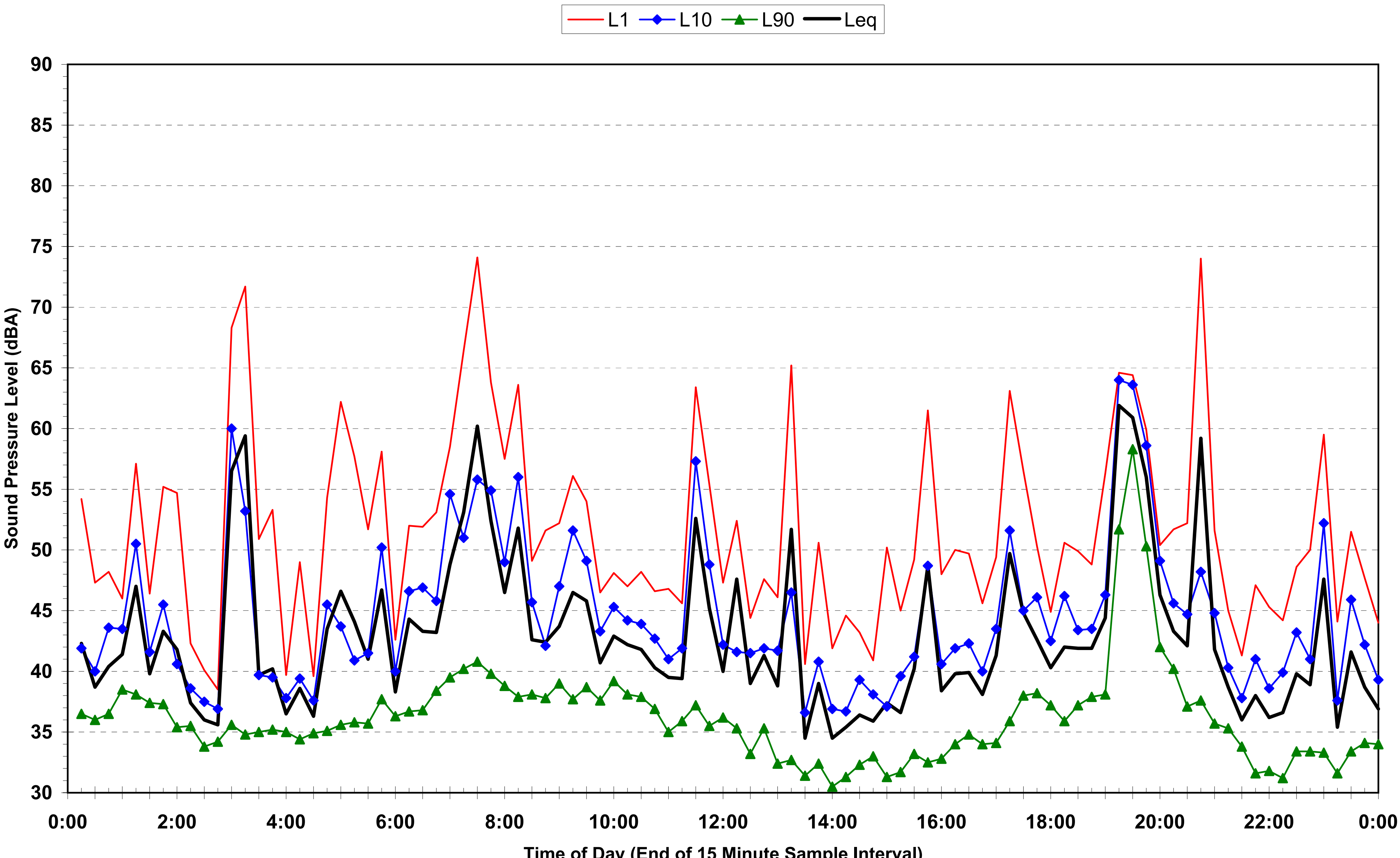


Appendix A2 - Page 2

Statistical Noise Levels

Heggies Report 30-2497

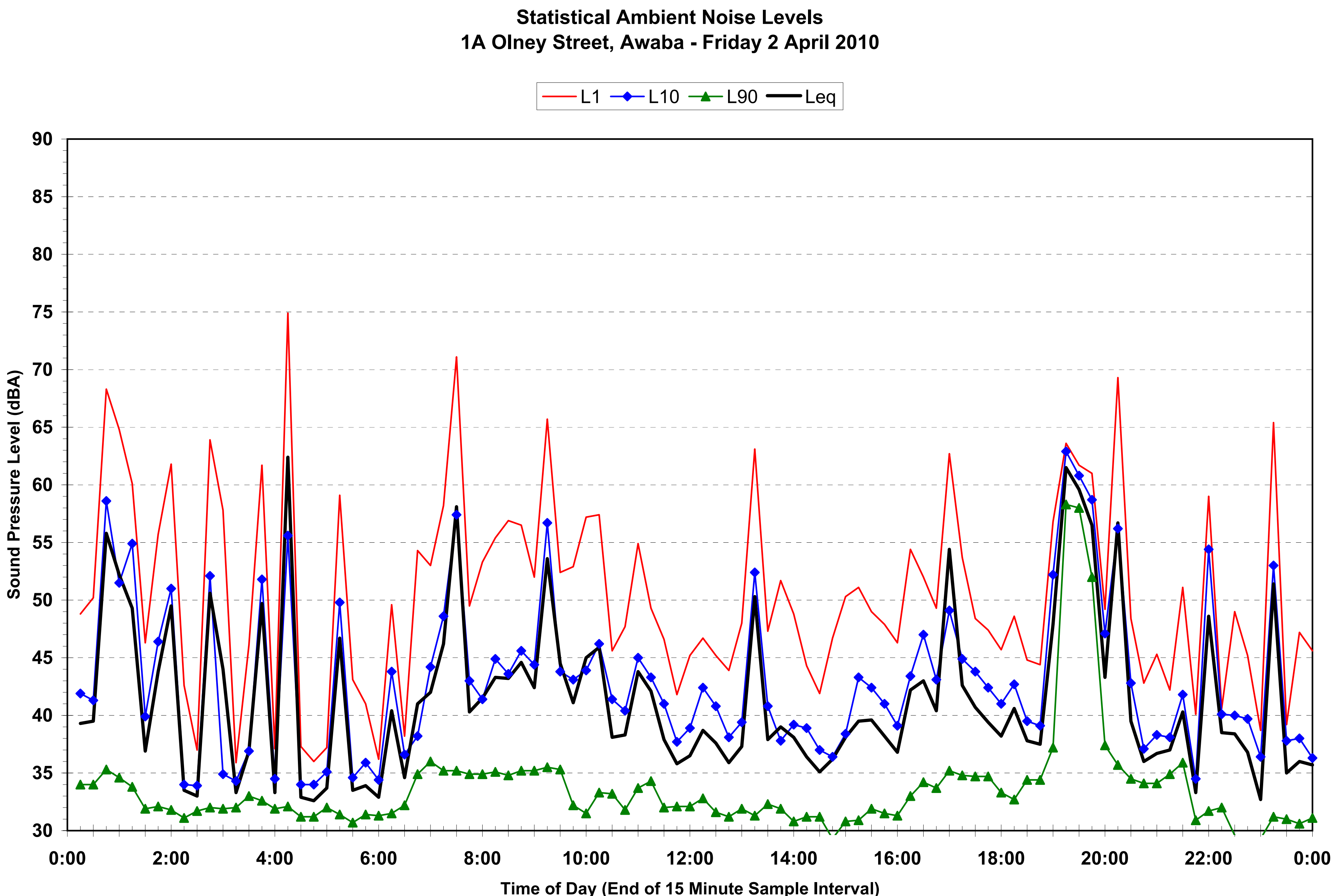
Statistical Ambient Noise Levels
1A Olney Street, Awaba - Thursday 1 April 2010



Appendix A2 - Page 3

Statistical Noise Levels

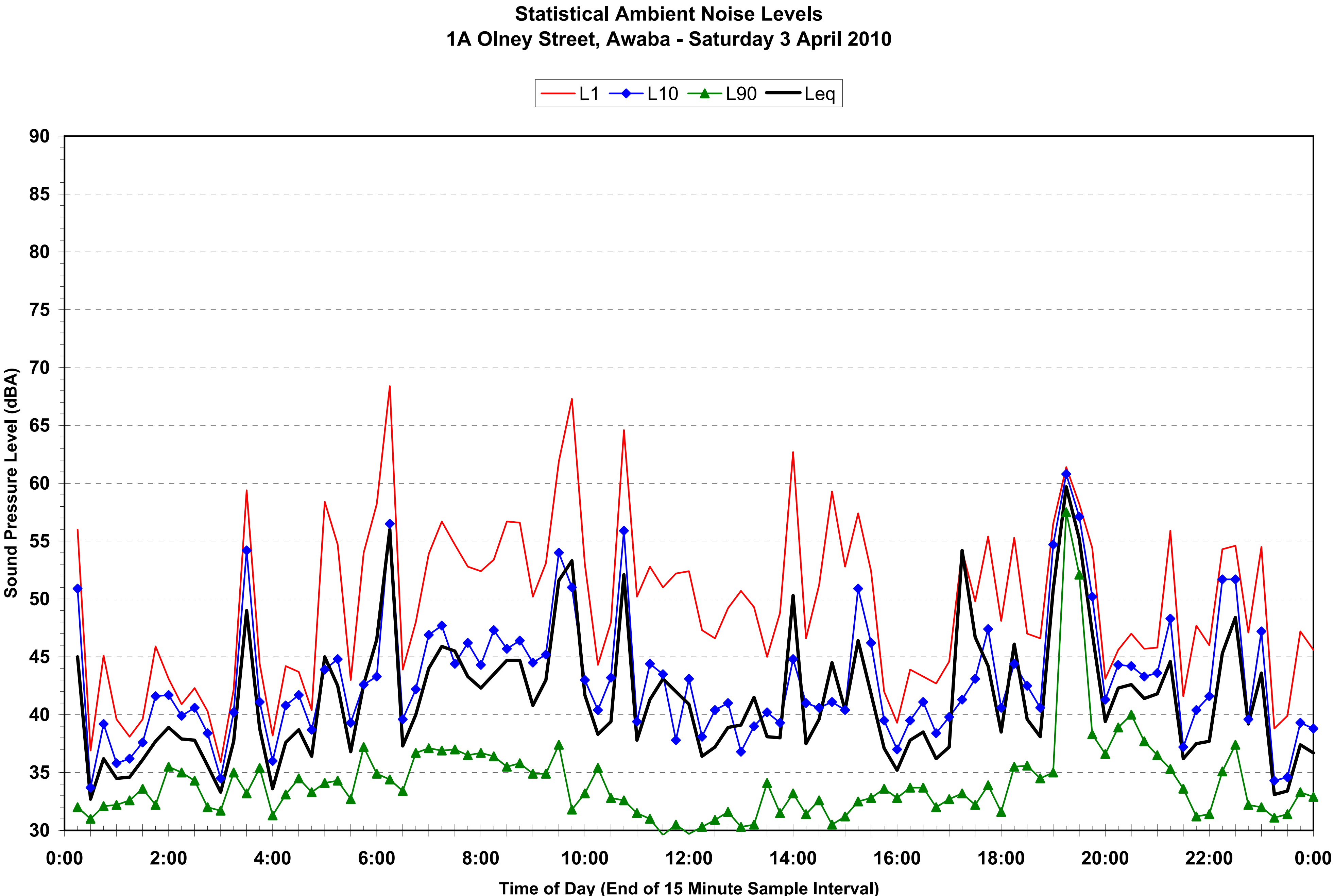
Heggies Report 30-2497



Appendix A2 - Page 4

Statistical Noise Levels

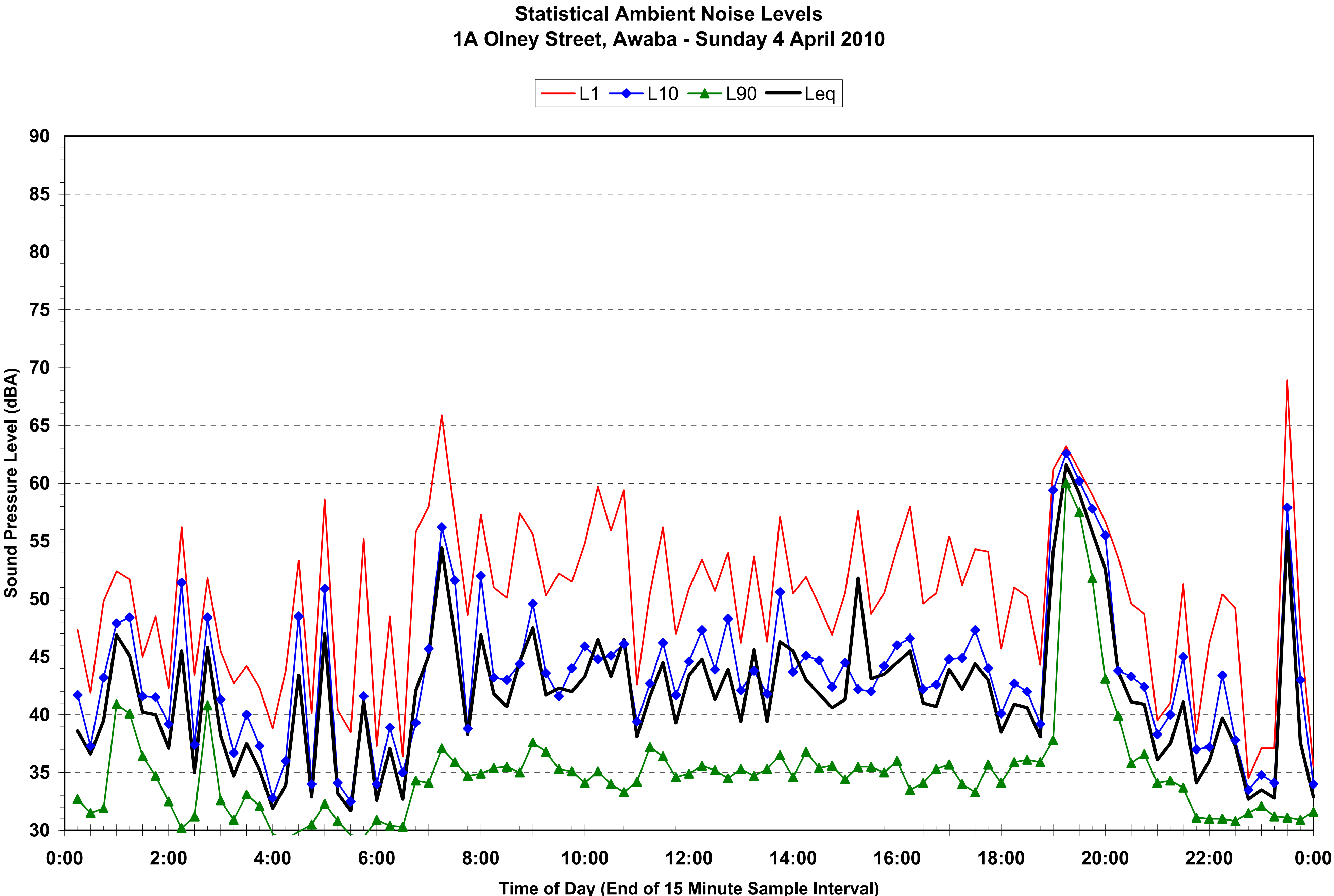
Heggies Report 30-2497



Appendix A2 - Page 5

Statistical Noise Levels

Heggies Report 30-2497

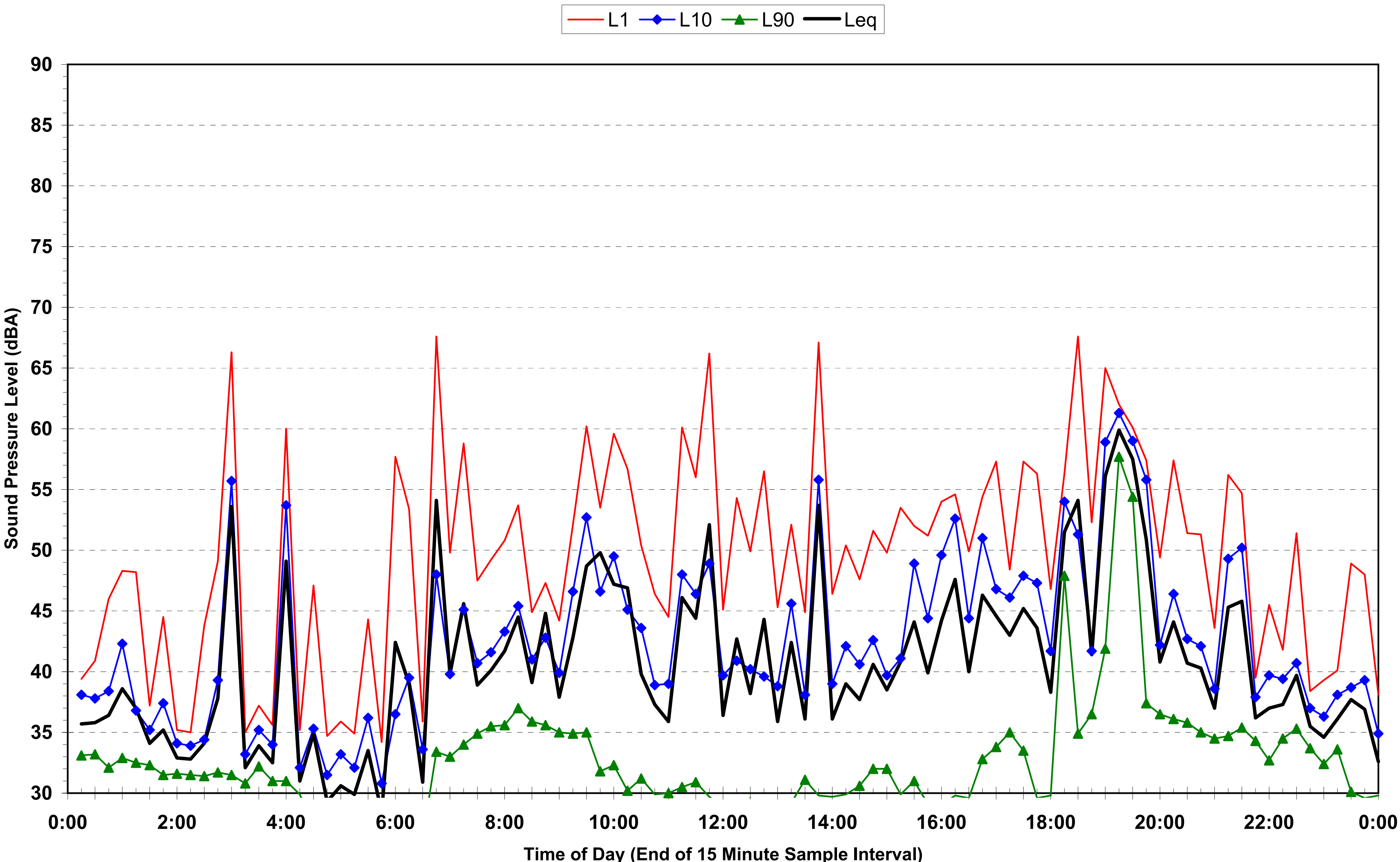


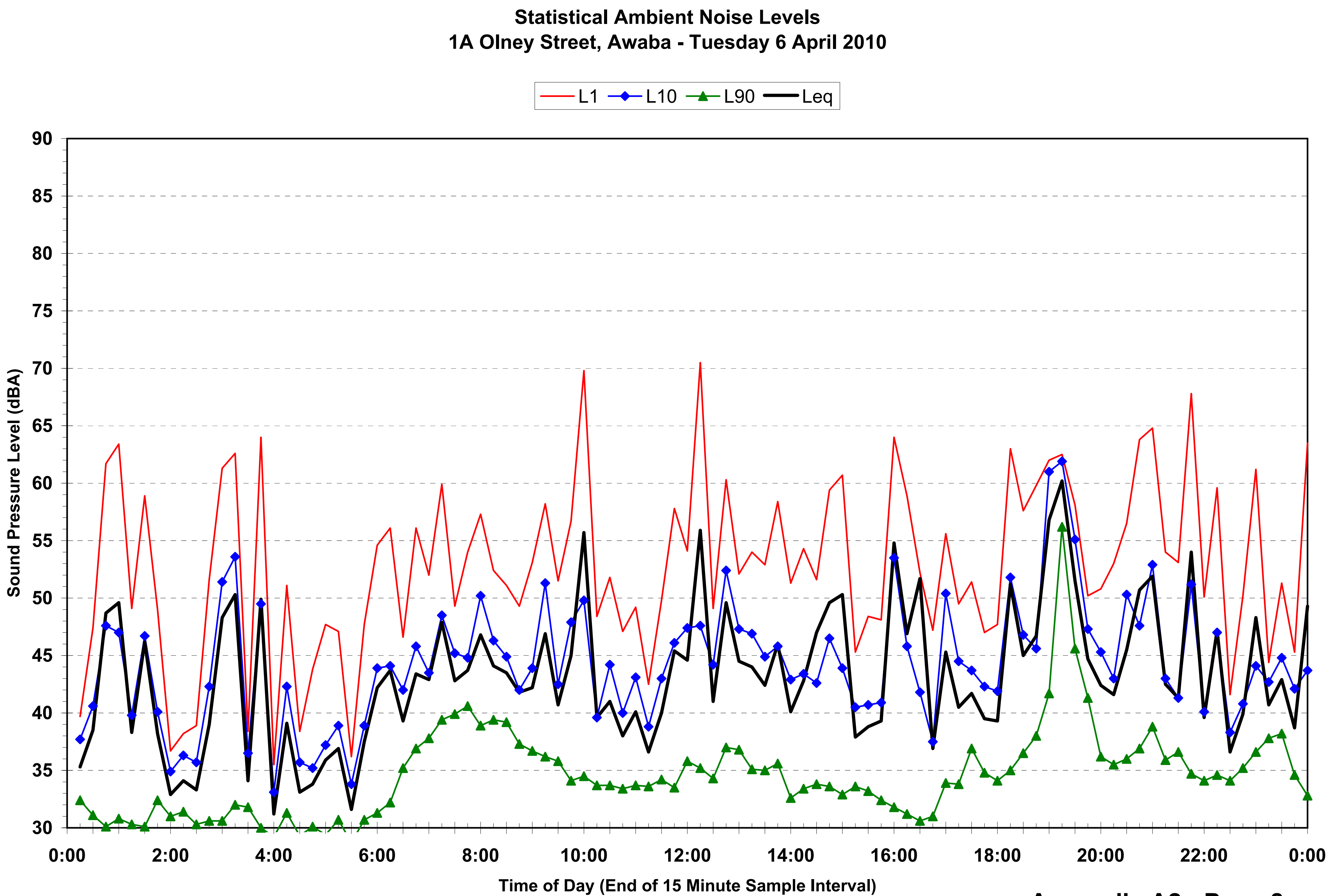
Appendix A2 - Page 6

Statistical Noise Levels

Heggies Report 30-2497

Statistical Ambient Noise Levels
1A Olney Street, Awaba - Monday 5 April 2010

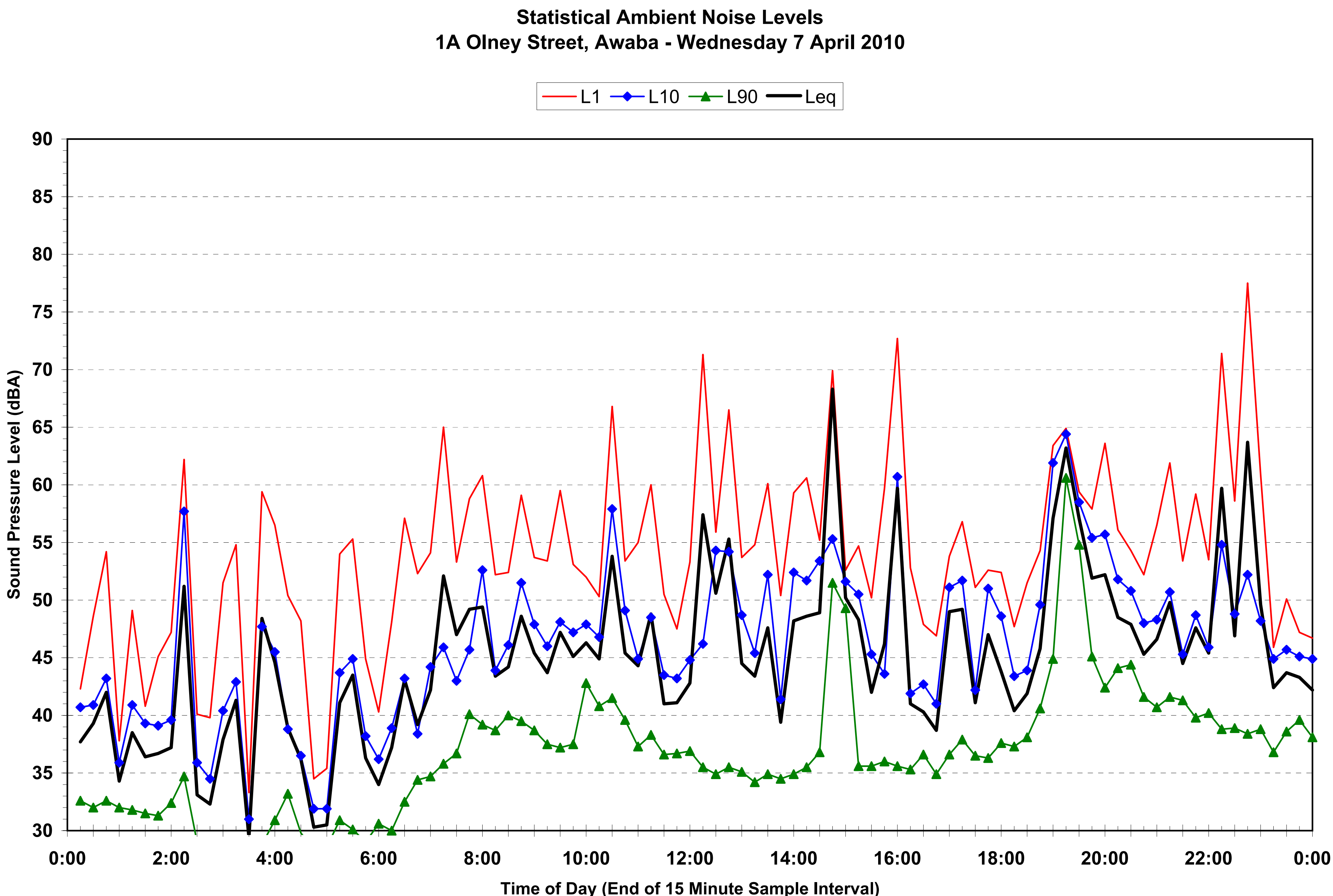




Appendix A2 - Page 8

Statistical Noise Levels

Heggies Report 30-2497

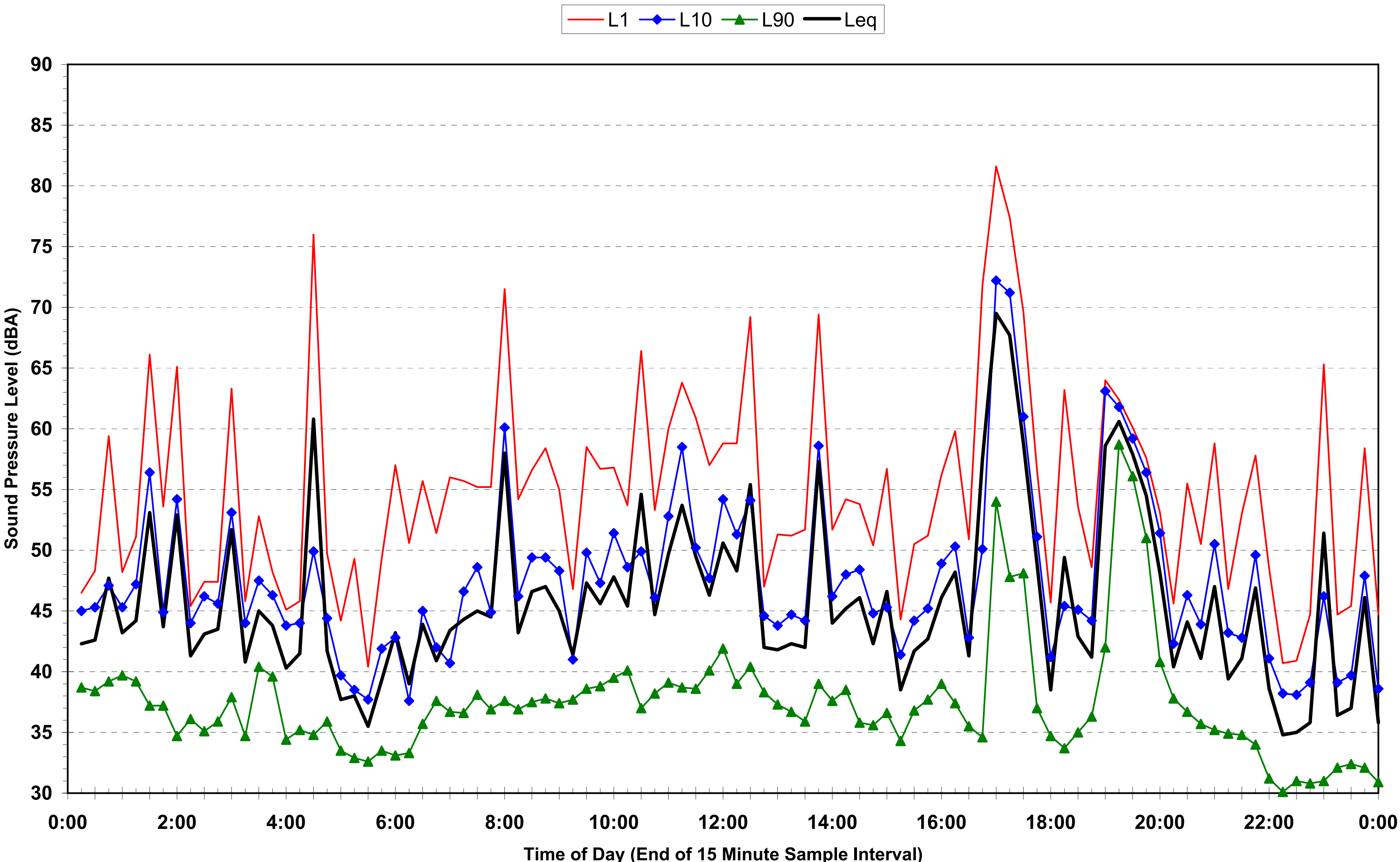


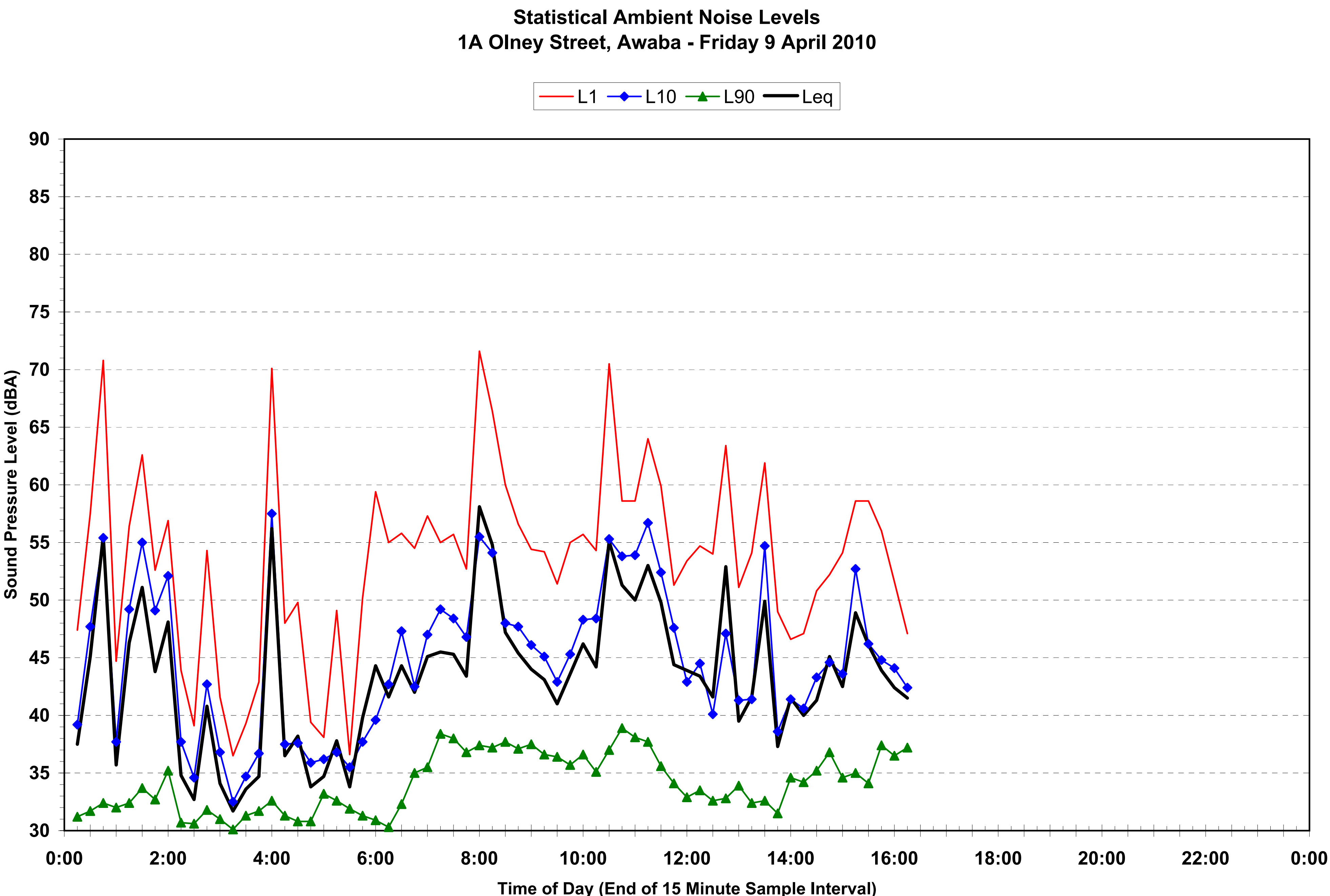
Appendix A2 - Page 9

Statistical Noise Levels

Heggies Report 30-2497

Statistical Ambient Noise Levels
1A Olney Street, Awaba - Thursday 8 April 2010



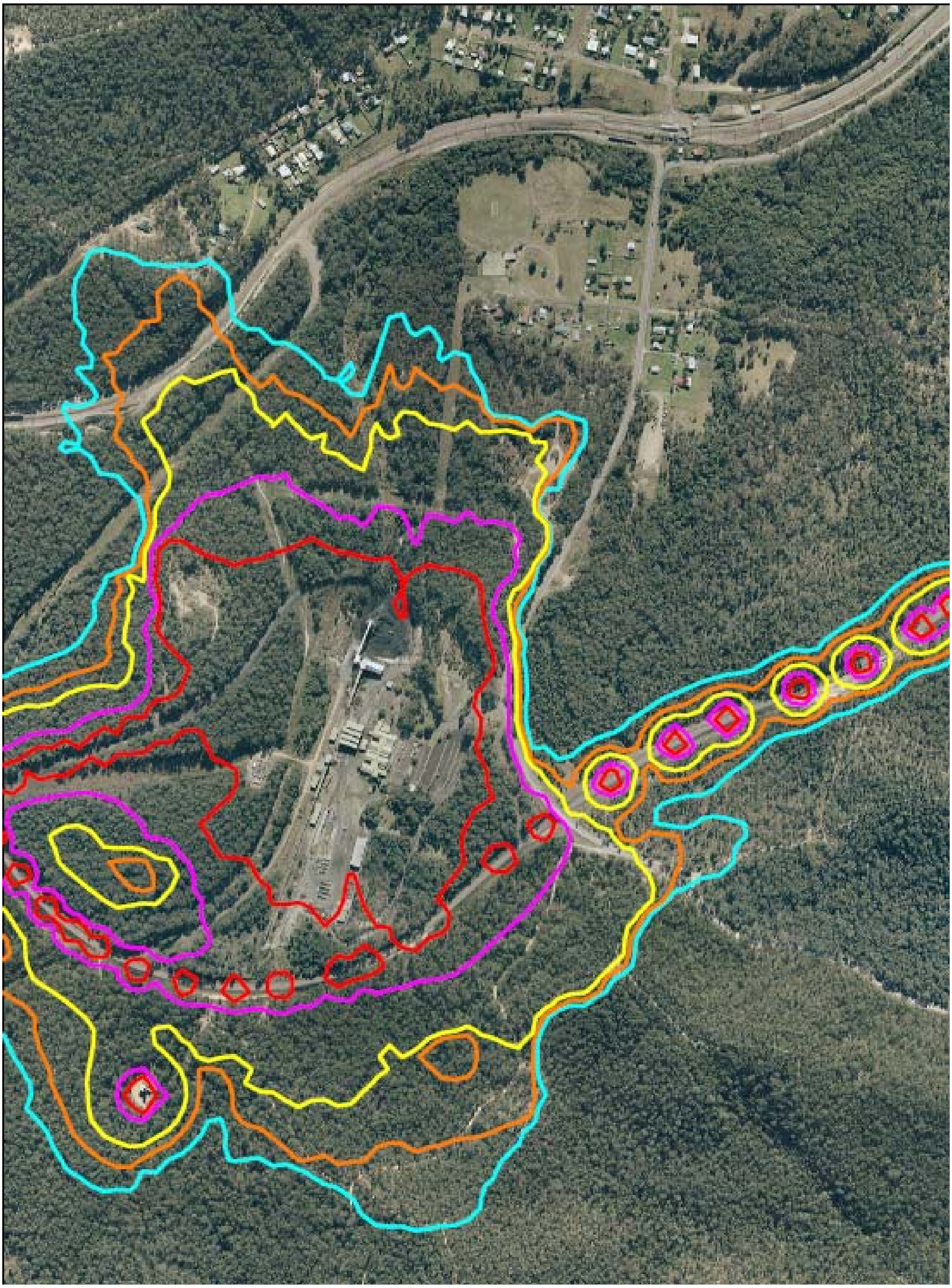


Appendix A2 - Page 11

Statistical Noise Levels

Heggies Report 30-2497

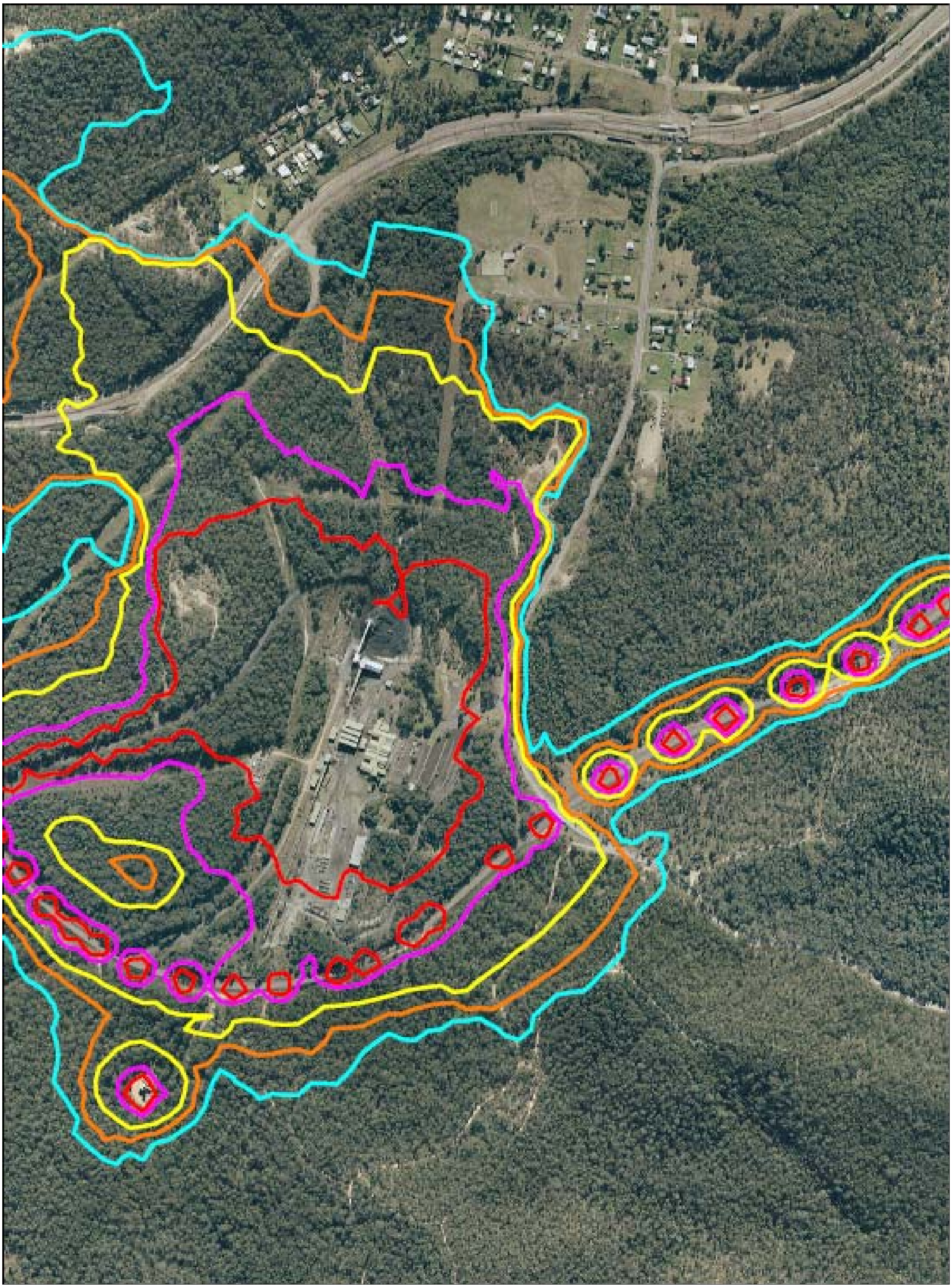
Operational Noise Contours - Calm Meteorological Conditions



36 dBA $L_{Aeq(15minute)}$ 40 dBA $L_{Aeq(15minute)}$ 50 dBA $L_{Aeq(15minute)}$

38 dBA $L_{Aeq(15minute)}$ 45 dBA $L_{Aeq(15minute)}$

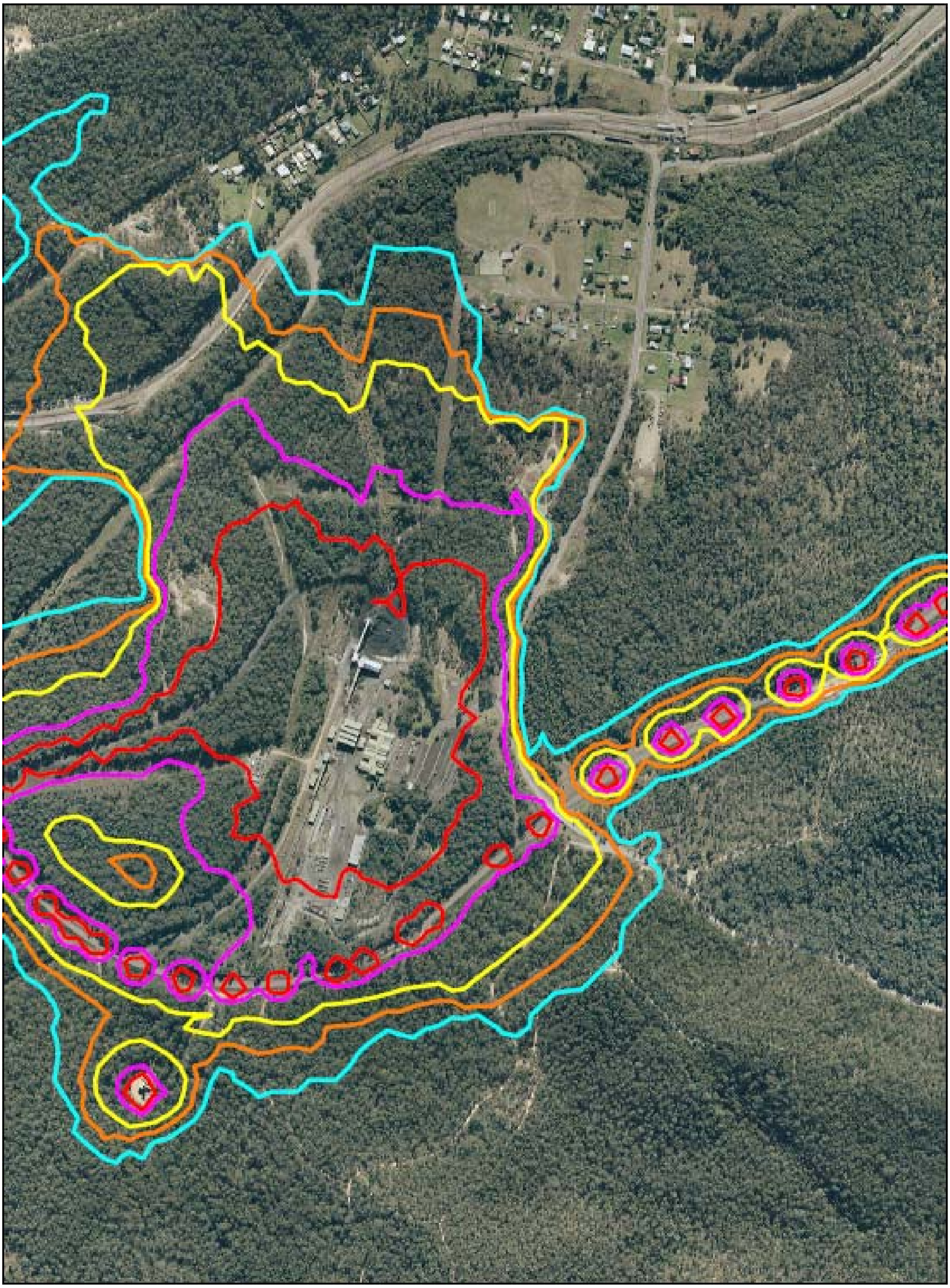
Operational Noise Contours - 3m/s Southerly Wind - Daytime



36 dBA $L_{Aeq(15minute)}$ | 40 dBA $L_{Aeq(15minute)}$ | 50 dBA $L_{Aeq(15minute)}$

38 dBA $L_{Aeq(15minute)}$ | 45 dBA $L_{Aeq(15minute)}$

Operational Noise Contours - 3m/s Southerly Wind - Evening & Night



36 dBA $L_{Aeq(15minute)}$

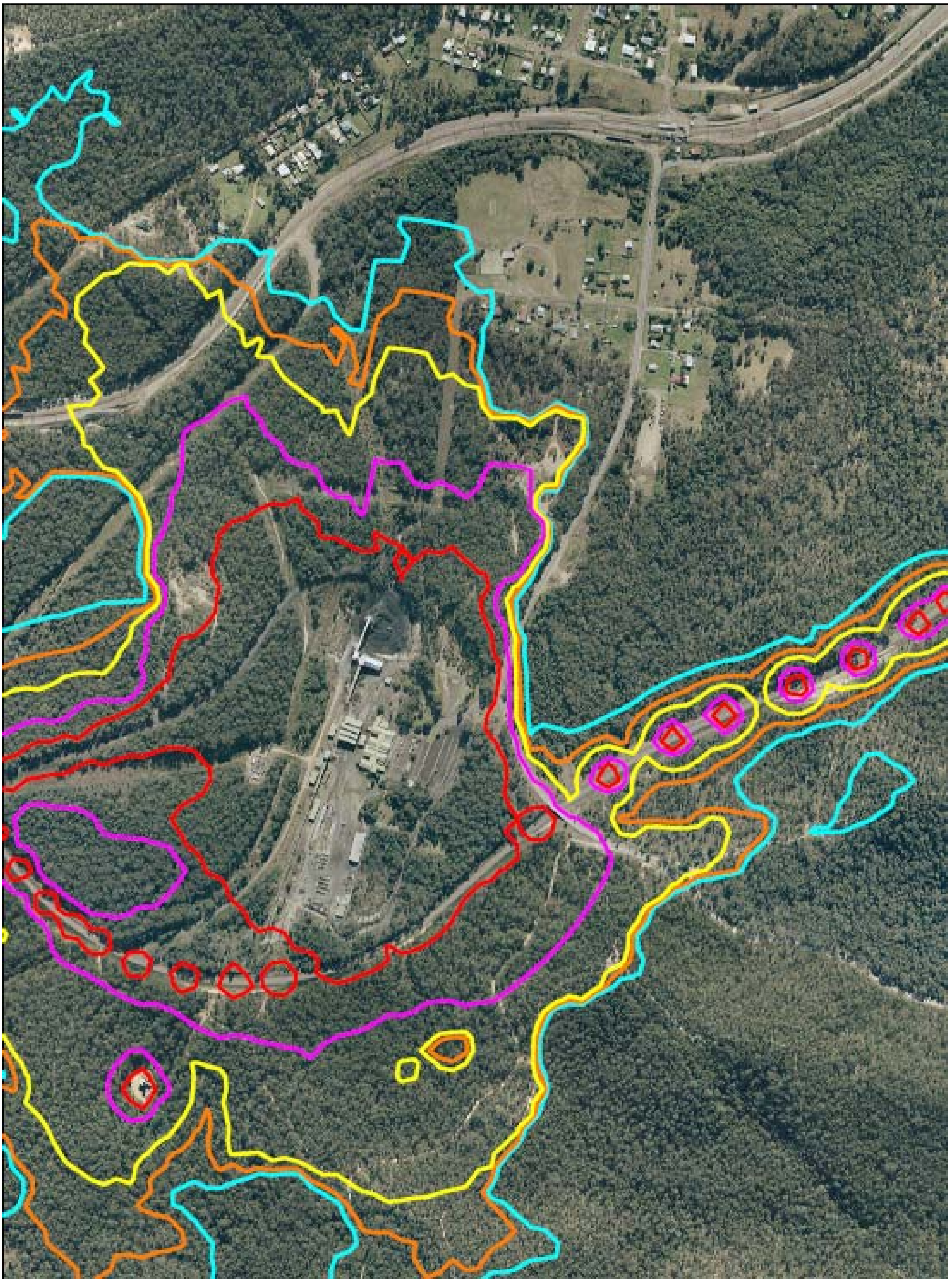
40 dBA $L_{Aeq(15minute)}$

50 dBA $L_{Aeq(15minute)}$

38 dBA $L_{Aeq(15minute)}$

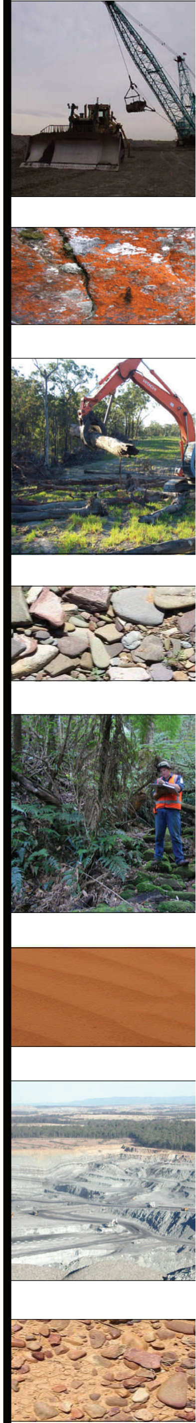
45 dBA $L_{Aeq(15minute)}$

Operational Noise Contours - Temperature Inversion



36 dBA $L_{Aeq(15minute)}$
40 dBA $L_{Aeq(15minute)}$
50 dBA $L_{Aeq(15minute)}$
38 dBA $L_{Aeq(15minute)}$
45 dBA $L_{Aeq(15minute)}$

AIR QUALITY IMPACT ASSESSMENT



APPENDIX 10

HEGGIES

REPORT 30-2497-R1

Revision 0

Awaba Colliery Mining Project
Part 3A Application
Air Quality Impact Assessment

PREPARED FOR

Centennial Coal Company
PO Box 1000
TORONTO NSW 2283

9 SEPTEMBER 2010

HEGGIES PTY LTD
ABN 29 001 584 612

Awaba Colliery Mining Project

Part 3A Application

Air Quality Impact Assessment

PREPARED BY:

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DOCUMENT CONTROL

Reference	Status	Date	Prepared	Checked	Authorised
30-2497-R1	Revision 0	9 September 2010	Florence Mananyu	Gary Graham and Jason Watson	Gary Graham

EXECUTIVE SUMMARY

Heggies Pty Ltd (Heggies) has been commissioned by GSS Environmental (GSSE) on behalf of Centennial Coal Pty Limited (Centennial) to undertake an Air Quality Impact Assessments (AQIA) for the Awaba underground coal mine (hereafter referred to as "Awaba Colliery") 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.

Broadly, the objective of the air quality 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.

Awaba Colliery is seeking a project approval from the NSW Department 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 final 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).

Ambient background particulate matter monitoring data was obtained from the NSW Department of Environment, Climate Change and Water (DECCW), who maintains an air quality monitoring site in Wallsend, approximately 18 km northeast of the Project Site.

Based on the available data**,** site-specific ambient air quality levels adopted for assessment purposes are as follows.

- Dust: An annual average ambient dust deposition level of the order of 2 g/m^2/month
- PM_{10}: A daily varying 24-hour average concentration based on local ambient monitoring data
- An annual average PM_{10} concentration of 21.5 $\mu g/m^3$
- TSP: An annual average of 47.0 $\mu g/m^3$

The following project-specific air quality goals have been established for assessment of the Project Site operations.

- A 24-hour maximum PM_{10} concentration of 50 $\mu g/m^3$.
- An annual average PM_{10} concentration of 30 $\mu g/m^3$.
- An annual average TSP concentration of 90 $\mu g/m^3$.
- A total monthly average dust deposition rate (background plus increment) of 4 g/m^2/month.
- A 1-hour average NO_2 concentration of 246 $\mu g/m^3$.
- A 1-hour average CO concentration of 30 $\mu g/m^3$.

EXECUTIVE SUMMARY

Atmospheric dispersion modelling predictions of fugitive emissions from the Project Site were undertaken using the Ausplume Gaussian Plume Dispersion Model software (Version 6.0) developed by the EPA (Victoria).

All modelling predictions indicate that the concentrations of particulate matter and dust deposition attributable to the Project would be within the current NSW DECCW air quality goals at all surrounding residences.

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

1 INTRODUCTION

Heggies Pty Ltd (Heggies) has been commissioned by GSS Environmental (GSSE) on behalf of Centennial Coal Pty Limited (Centennial) to undertake an Air Quality Impact Assessments (AQIA) for the Awaba underground coal mine (hereafter referred to as "Awaba Colliery") located on Wilton Road, approximately 1 km south of the township of Awaba and approximately 5.5 km southwest of Toronto, NSW.

This AQIA has been prepared in accordance with the NSW Department of Environment and Climate Change and Water's (DECCW) "*Approved Methods for the Modelling and Assessment of Air Pollutants in NSW*" (NSW Department of Environment and Conservation [DEC], 2005) (hereafter the Approved Methods). The Approved Methods outline the requirements for conducting an AQIA, as follows:

- Description of local topographic features and sensitive receptor locations.
- Establishment of air quality assessment criteria.
- Analysis of climate and dispersion meteorology for the region.
- Description of the existing air quality environment.
- Compilation of a comprehensive emissions inventory for existing operations.
- Completion of atmospheric dispersion modelling and analysis of results.

The scope of the AQIA was also designed to address the DECCW's and Director-General's requirements for the project with regard to air quality. A synopsis of these requirements is given in **Table 1**.

Table 1 Requirement Pertaining to Air Quality Issues

Requirements	Relevant Section
A description of the existing air quality including the following parameters: • Dust deposition; • Total suspended particulates; and • PM_{10} particulate matter.	**Section 6**
Identification and location of all fixed and mobile sources of air emissions from the development including: • Location of all emission sources; • Identification of all pollutants of concern; and • Estimation of emissions quantity.	Appendix C (Emissions Inventory)
Details of the project essential for predicting and assessing impacts on air quality.	**Section 2.5**
A description of the topography and surrounding land uses.	**Section 3.1**
Details of exact locations of dwellings.	**Section 3.2**
Estimation of resulting ground level concentrations of all pollutants.	**Section 8**
Detailed description of the methodology used to assess air quality impacts including: • Justification and discussion of choice of dispersion model and model parameters; and • Dispersion model input/output files.	**Section 7** and **Appendix D**
Air quality impact predictions including plans showing projected incremental levels of; • 24-hour average PM_{10} concentrations; • annual average dust deposition rates; and • annual average total suspended particulate concentrations.	**Section 8**
Assessment of cumulative air quality impacts and a description of the methodology used.	**Section 7**
Assessment of the potential impacts on air quality other than by dust, e.g. nitrogen oxide emissions from diesel equipment and/or odour emissions arising from mine ventilation.	**Section 2** and **Section 7**
Description of the effects and significance of pollutant concentration on the environment, human health, amenity and regional ambient air quality goals.	**Section 8**
Description of contribution (if any) that the development will make to regional pollution particularly in sensitive locations.	**Section 8**
Description of control measures to be implemented to minimise pollutants including dust generation during any construction activities and coal handling and stockpiles.	**Section 2**
Specifications of pollution control equipment and management protocols for both point and fugitive emissions.	**Section 2**
Details of an air quality monitoring program to determine effectiveness of mitigation and to verify predictions, including: • provision for investigations in response to complaints.	**Section 2**

This report also includes a quantitative Greenhouse Gas Assessment which examines the potential Scope 1, 2 and 3 greenhouse gas emissions of the Project.

Additional policies, guidelines and plans referenced within this assessment are the *Protection of the Environment Operations (Clean Air) Regulation, 2002*, the “*Approved Methods for the Sampling and Analysis of Air Pollutants in NSW*” (DEC, 2007), and the “*National Greenhouse Accounts (NGA) Factors*” (hereafter the NGA Factors) (Commonwealth Department of Climate Change [DCC], 2009).

1.1 Report Structure

This AQIA is structured as follows:

Section 1	Introduction and report structure
Section 2	A description of the existing operations at Awaba Colliery including: • overview of current Awaba Colliery operations; • particulate sources and emissions; • existing mitigation and management measures; and • complaints history
Section 3	Description of the study area including: • local topography; • receptor details; • neighbouring emission sources; and • regional emission sources
Section 4	Ambient Air Quality criteria including: • goals applicable to particulate matter less than 10 microns in size (PM_{10}); • goals applicable to Total Suspended Particulate (TSP); • nuisance impacts of fugitive emissions; and • Project air quality goals.
Section 5	A description of the prevailing dispersion meteorology including: • meteorological conditions; and • meteorological modelling.
Section 6	A description of the baseline air quality in the region
Section 7	A description of the Air Quality modelling methodology including: • emissions parameters and calculations.
Section 8	Dispersion modelling results.
Section 9	Greenhouse gas assessment.
Section 10	Conclusions.
Section 11	Lists the reports and other material cited in this document.

2 PROJECT OVERVIEW

2.1 Background and Existing Awaba Colliery Mine Operations

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 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 site is situated on crown land under lease to Centennial for the purpose of mining under Consolidated Coal Lease CCL746, and is adjacent to the Newstan-Eraring haul road owned by Eraring Energy. The locality of the mine is illustrated on **Figure 1**.

Awaba Colliery is a small operation with approximately 100 employees and contractors, 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.

A form of pillar extraction of narrow panels is used to recover coal in pillars developed previously by bord and pillar methods. 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 has been developed in consultation with the Department of Primary Industries – Mineral Resources (now known as Industry and Investment, NSW (I&I)) and has been used successfully to date, and is proposed to be continued for the Project.

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.

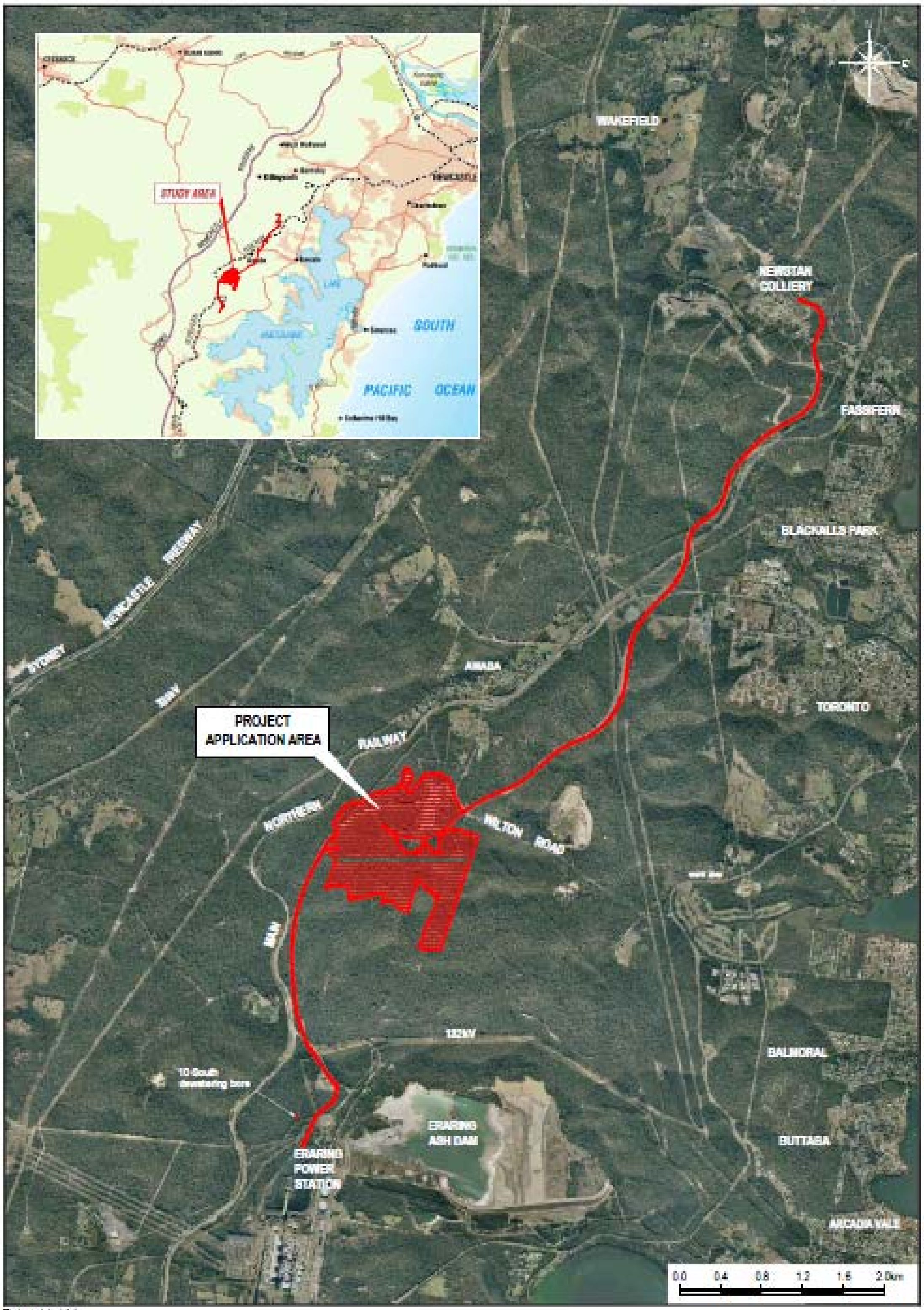
Minimal changes are proposed to existing surface operations, with one proposed additional surface disturbance relating to increased pollution control dam capacity located in a previously disturbed area. No significant changes to coal handling are proposed At present, it is anticipated that the Project 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 over a period of approximately five years or more, depending on actual mining conditions and relevant market drivers.

Adjacent to the Awaba colliery is a quarry, which is owned and operated by Centennial ("Awaba Quarry"). Material stockpiled within the Awaba Quarry will be used occasionally to supply material for rehabilitation of sinkholes and subsidence cracks at Awaba and Newstan Collieries. The material will also be used for road base at both sites. It is Heggies understanding that the material stockpiled within the quarry will be utilised possibly once every two (2) months on average for a period of one day.

2.2 Project Application Area

The Project Application Area is illustrated on **Figure 1**. 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.

Figure 1 Awaba Colliery Project Location Area



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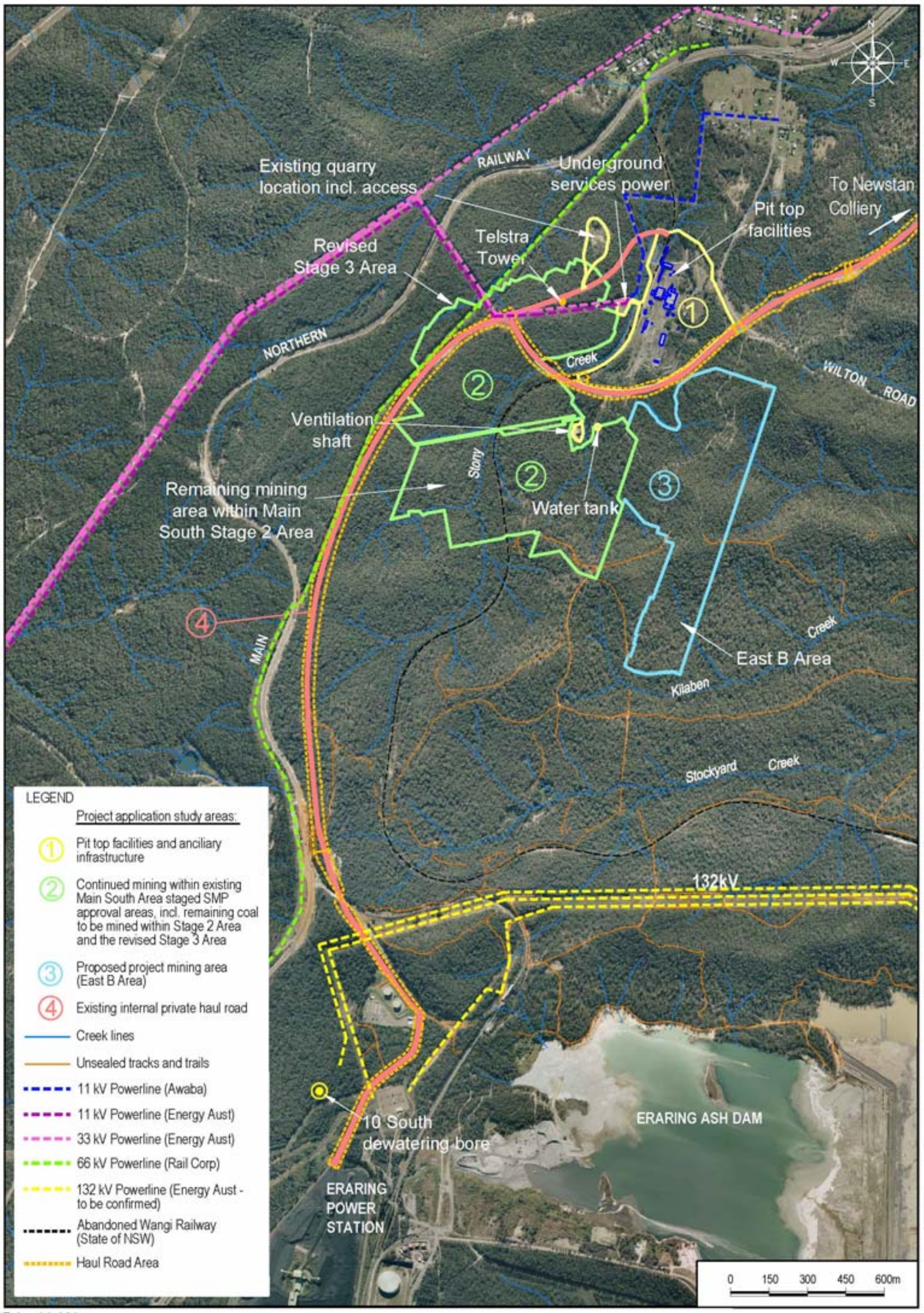
Source: GSSE, February 2010

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 2.2.1**. 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.

2.2.1 Study Areas

The Project Application Study Areas for the Environmental Assessment are illustrated in **Figure 2**.

Figure 2 Project Application Area



Source: GSSE

The study areas are described as follows:

- **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;
- **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); and
- **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 Section 96(1A) of 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 will also be addressed in the EA.

It should be noted that for the purposes of assessing potential impacts of air pollutants from the Project Site only Study Area 1 has been considered. The impacts from Study Areas 2, 3 and 4 are minimal and have not been included as part of this assessment.

The Greenhouse Gas Assessment relates to the entire Application Area, and includes Scope 1, 2 and 3 emissions for the Project.

2.3 Project Description

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 final 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 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 is part of ***Study Area 3*** for the Project as discussed in **Section 2.2.1** above.

Mining will also be continued at Awaba Colliery in two (2) separate areas, these have been outlined below:

- 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. This area is part of ***Study Area 2*** for the Project as discussed in **Section 2.2.1**.
- 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). Along with Stage 2 of the Main South Area, this area is part of Study Area 2 for the Project as discussed in **Section 2.2.1**.

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 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 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 NSW in 2009, until such time that a final Detailed Life of Mine Strategy has been developed.

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

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.

Existing mining areas, will continue to be utilised for ongoing mining operations including (but not limited to) mine access, emergency management and underground services and infrastructure.

2.4 Continuing Mine Operations:

For the purposes of environmental assessment, further to the information above regarding continued mining areas, it is noted that the following aspects of mine operations are proposed to continue and remain <u>unchanged</u>. Existing mining operations are presented in detail in Section 3 of the *Environmental Assessment (EA)* and, where relevant, components are discussed further in this specialist report.

- **Coal Handling, preparation and stockpiles –** No changes are proposed to the current coal handling, preparation or stockpile procedures to the existing operations;

- **Mine support facilities and site access** – No changes are proposed to the current infrastructure and facilities, with the only exclusion being the expansion of the Pollution Control Dam (PCD) mentioned earlier above, with related water management considerations. Mine access from Wilton Road will continue to be utilised and no significant change is anticipated from current use;
- **Plant and equipment** – No changes are proposed to the typical plant and equipment used at the Awaba Colliery;
- **Transportation procedures** – 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;
- **Mining methodology** – There will be no significant changes to current mining methods 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 (financial year), depending on mining efficiency and market demands;
- **Operational water management** – 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; and
- **Mine dewatering procedures** – the10 South Bore will continue to be used for groundwater management and dewatering during both continued operation and care and maintenance conditions.

Table 2 provides a summary of the existing operations and the proposed changes as part of this project.

Table 2 Summary Comparison of Existing Awaba Colliery Operations and Proposed Changes

Project Component	Summary of the Existing Awaba Colliery	Summary of the Project (Proposed changes)
Active Mine Period	-	5 years or more
Mining Method	Bord and Pillar development and Pillar Extraction within narrow panels by continuous miners	No change
Annual Coal Production Rate	Approximately 850,000 tonnes per annum	Allowing for potential productivity improvements up to 800,000 tonnes per annum
Operating Hours	24 hours per day ,7 days a week	No change
Mine Access	Access to surface facilities is off Wilton Road	No change
Run-of-Mine (ROM) Coal Stockpile	Approximately 30,000 tonnes (t)	No change
On-site Coal Crushing and Screening	Loaded onto conveyor and through the ROM bin then send to Coal Preparation Plant where it is crushed to less than 100mm before truck loading or movement to stockpiles	No change
On-site Coal Crushing and Screening Operating Hours	24 hours per day, 7 days a week	No change
Product Coal Stockpile	Product coal stockpile area with a capacity of 35,000 to 50,000 t	No change
Road Transport Requirements	Use of internal haul roads and main Mine Access road. Use of private haul road to either Newstan ROM stockpile or Rail Loop (export) or Eraring Power Station.	No change
Mine infrastructure and service facilities	Mine access and ventilation, coal handling, coal preparation and transport, workshop, administration, water management and pollution control	No change
Workforce	Approximately 100 staff and contractors	No change

2.5 Particulate Sources and Emissions from Awaba Colliery

This subsection provides a review of the likely sources of particulate associated with the existing Awaba Colliery and Awaba Quarry.

Atmospheric pollutants generated by activities occurring at the Project Site primarily comprise fugitive emissions of particulates (PM_{10}[1] and TSP[2]), 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.

[1] PM_{10} is used to describe particulate matter with an aerodynamic diameter of 10 microns (μm) or less.
[2] TSP (Total Suspended Particulate) describes particulate matter which is less than 50 microns in diameter.

Therefore, the focus of this assessment will be fugitive emissions of dust and particulates.

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 3**.

Table 3 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

2.6 Existing Air Quality Mitigation and Management Measures

Air quality management at Awaba Colliery is described in the Dust Management Plan (Centennial Coal Awaba Colliery, February 2009). Current air quality mitigation and management measures employed at Awaba Colliery 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; and,
- Covering of truck loads entering and leaving the premises.

It is Heggies understanding that a sprinkler dust suppression system has been installed adjacent to the stockpile in September 2009.

2.7 Air Quality Complaints

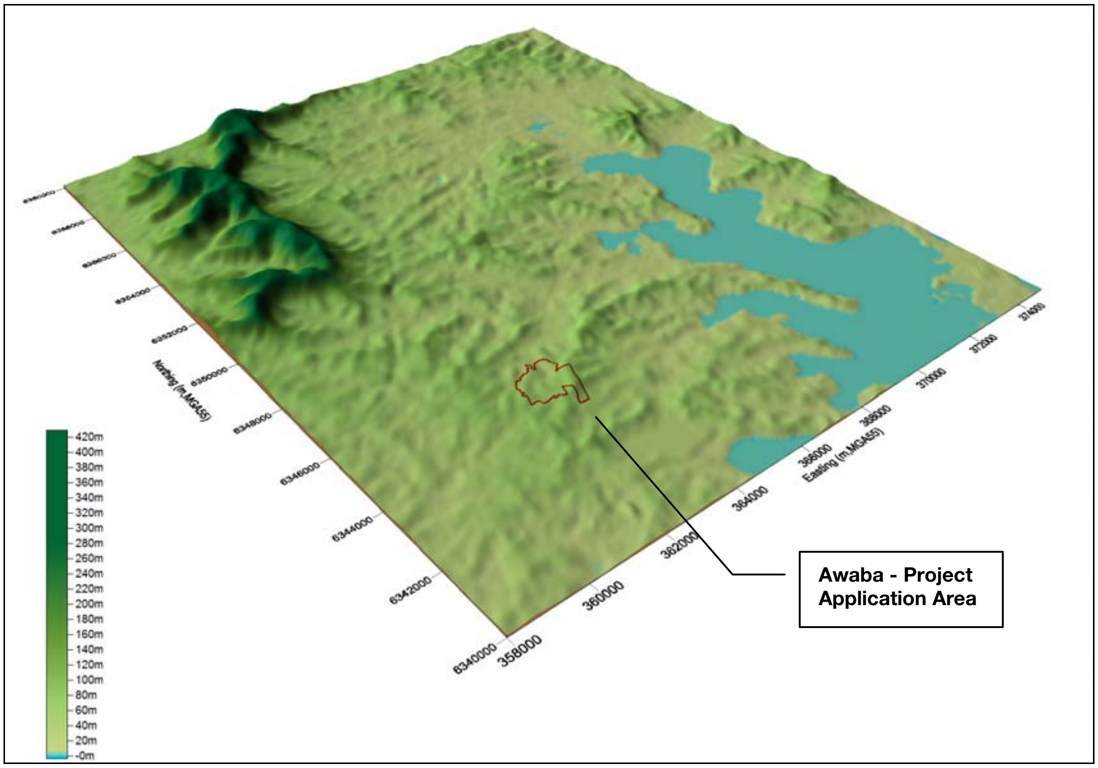
There have been no community complaints received regarding air quality from the Project Site.

3 PROJECT SETTING

3.1 Local Topography

A three (3) dimensional representation of the regional scale topography surrounding Awaba Colliery is illustrated in **Figure 3**. The Project Site is located in forested undulating terrain, bordered by dense vegetation, on the sloping side of a narrow valley, which trends in an approximate north-south orientation. The pit top topography falls between 55 m AHD (eastern pit top) and 31 m AHD (western pit top). Further south of the Project Site the topography undulates, decreasing to 0 m AHD at the western edge of Lake Macquarie.

Figure 3 Three Dimensional Representation of the Regional Scale Topography Surrounding Awaba Colliery



Note: Vertical exaggeration factor of 2 is applied

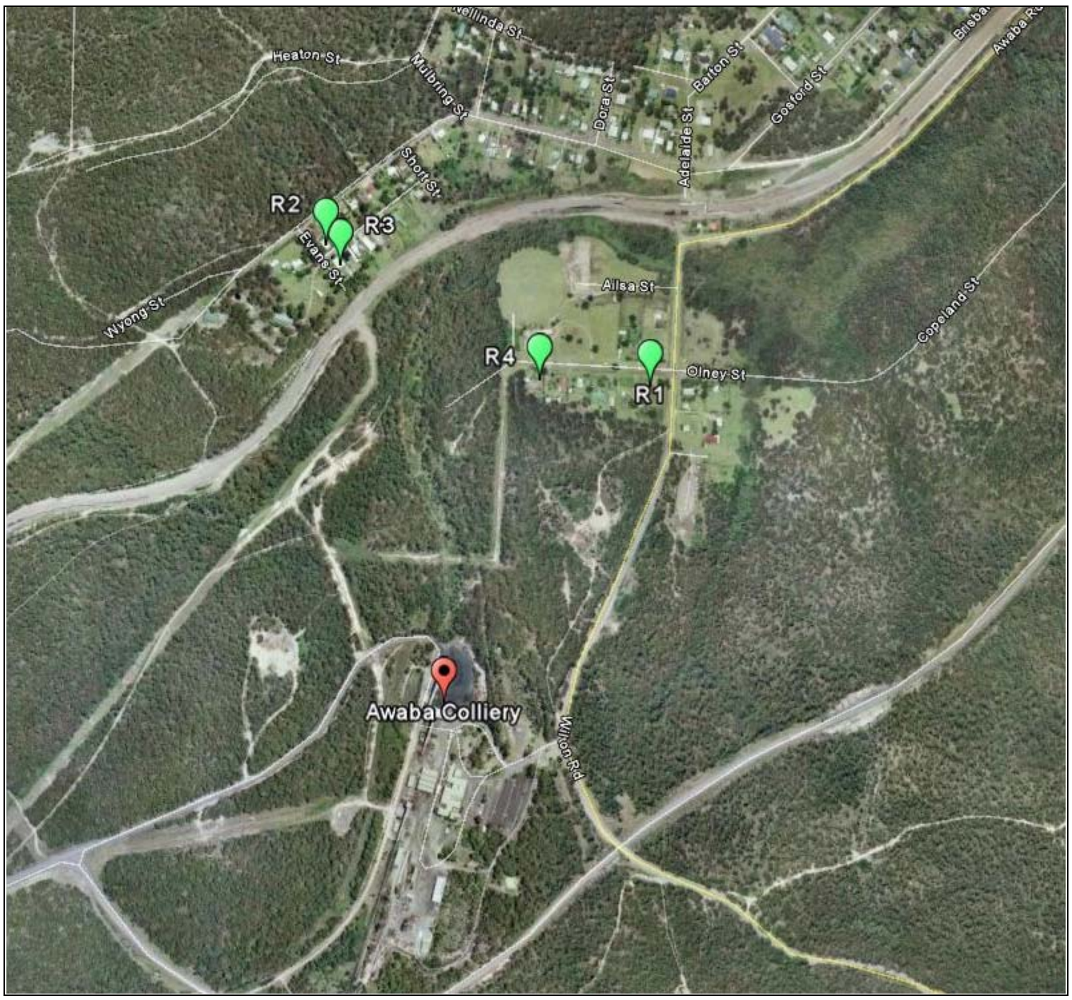
3.2 Sensitive Receptors

A number of residences or land uses are located in the area surrounding the Project Site. The nearest residences have been identified as sensitive receptor locations to be taken into account during the assessment. A list of the nearest sensitive receptors, as described within the Newstan EIS (R1 to R4) identified in the immediate vicinity of the Project Site, and their respective distances from the Project Site boundary are presented in **Table 4** and **Figure 4**.

Table 4 Nearest Sensitive Receptors

Receptor ID	Location	Location (m, MGA56)		Distance (km) / Direction From Site Boundary	Elevation (m, AHD)
		Easting	Northing		
R1	9 Olney Street, Awaba	363733	6346064	0.6 / NNE	30
R2	15 Evans Street, Awaba	363203	6346323	0.8 / N	32
R3	51 Puddy Lane, Awaba	363220	6346274	0.7 / N	29
R4	1A Olney Street, Awaba	363547	6346080	0.5 / NNE	32

Figure 4 Surrounding Sensitive Receptor Locations



Source: Google, 2010

3.3 Neighbouring Pollutant Sources

3.3.1 Local Sources

Sources of atmospheric pollution surrounding the Project Site are mainly from mining activities from the mines in the vicinity of the Project Site. Awaba Colliery is situated approximately 5.5 km southwest of Newstan Colliery, approximately 5.4 km southwest of Myuna Colliery and approximately 3.3 km north-northeast of the Eraring Power station. The ash dam at Eraring Power station 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 Project Site due to the relatively small distances between the Project Site and these identified sources.

3.3.2 Regional Sources

Concentrations of pollutants can 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.

4 AMBIENT AIR QUALITY CRITERIA

4.1 Particulate Matter

4.1.1 Goals Applicable to PM_{10}

PM_{10} is considered to be an important pollutant in terms of potential impact due to its ability to penetrate into the respiratory system.

The DECCW PM_{10} assessment goals as expressed in the Approved Methods are:

- a 24-hour maximum of 50 micrograms per cubic metre (µg/m^3); and
- an annual average of 30 µg/m^3.

The 24-hour PM_{10} reporting standard of 50 µg/m^3 is numerically identical to the "*Ambient Air Quality National Environment Protection Measure*" (NEPM) (National Environmental Protection Council, 1998) reporting standard except that the NEPM reporting standard allows for five exceedances per year.

4.1.2 Goals Applicable to TSP

The annual goal for TSP is given as 90 µg/m^3 as recommended by the National Health and Medical Research Council (NHMRC) at their 92nd session in October 1981. This goal has also been adopted in the Approved Methods.

4.1.3 Nuisance Impacts of Fugitive Emissions

The preceding sections are concerned in large part with the health impacts of particulate matter. Nuisance impacts need also to be considered, mainly in relation to dust deposition. In NSW, accepted practice regarding the nuisance impact of dust is that dust-related nuisance can be expected to impact on residential areas when annual average dust deposition levels exceed 4 g/m^2/month. To avoid dust nuisance the DECCW has developed assessment criteria for dust deposition, or fallout. **Table 5** presents the allowable increase in dust deposition relative to the ambient levels.

Table 5 DECCW Goals for Allowable Dust Deposition

Averaging Period	Maximum Increase in Deposited Dust Level	Maximum Total Deposited Dust Level
Annual	2g/m^2/month	4g/m^2/month

Source: Approved Methods, DECCW 2005.

4.1.4 Nitrogen Dioxide

The impact assessment criterion for nitrogen dioxide (NO_2) as described within the Approved Methods, DECCW 2005 are:

- a 1-hour average of 246 µg/m^3.
- an annual average of 62 µg/m^3.

4.1.5 Carbon Monoxide

The impact assessment criterion for carbon monoxide (CO), as described within the Approved Methods, DECCW 2005 are:

- a 1-hour average of 30 µg/m^3.
- an 8-hour average of 10 µg/m^3.

4.2 Project Air Quality Goals

The air quality goals adopted for the assessment of the Project are those specified in the Approved Methods or the NEPM. In summary, the specific goals being applied to this study are as follows:

- PM_{10}: 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.

5 PREVAILING DISPERSION METEOROLOGY

5.1 Meteorological Data Availability

There is no weather station located at the Project Site. There are two (2) weather stations located in the area surrounding the Project Site. These include:

- Newstan Colliery; and
- Cooranbong- Lake Macquarie - Bureau of Meteorology (BOM).

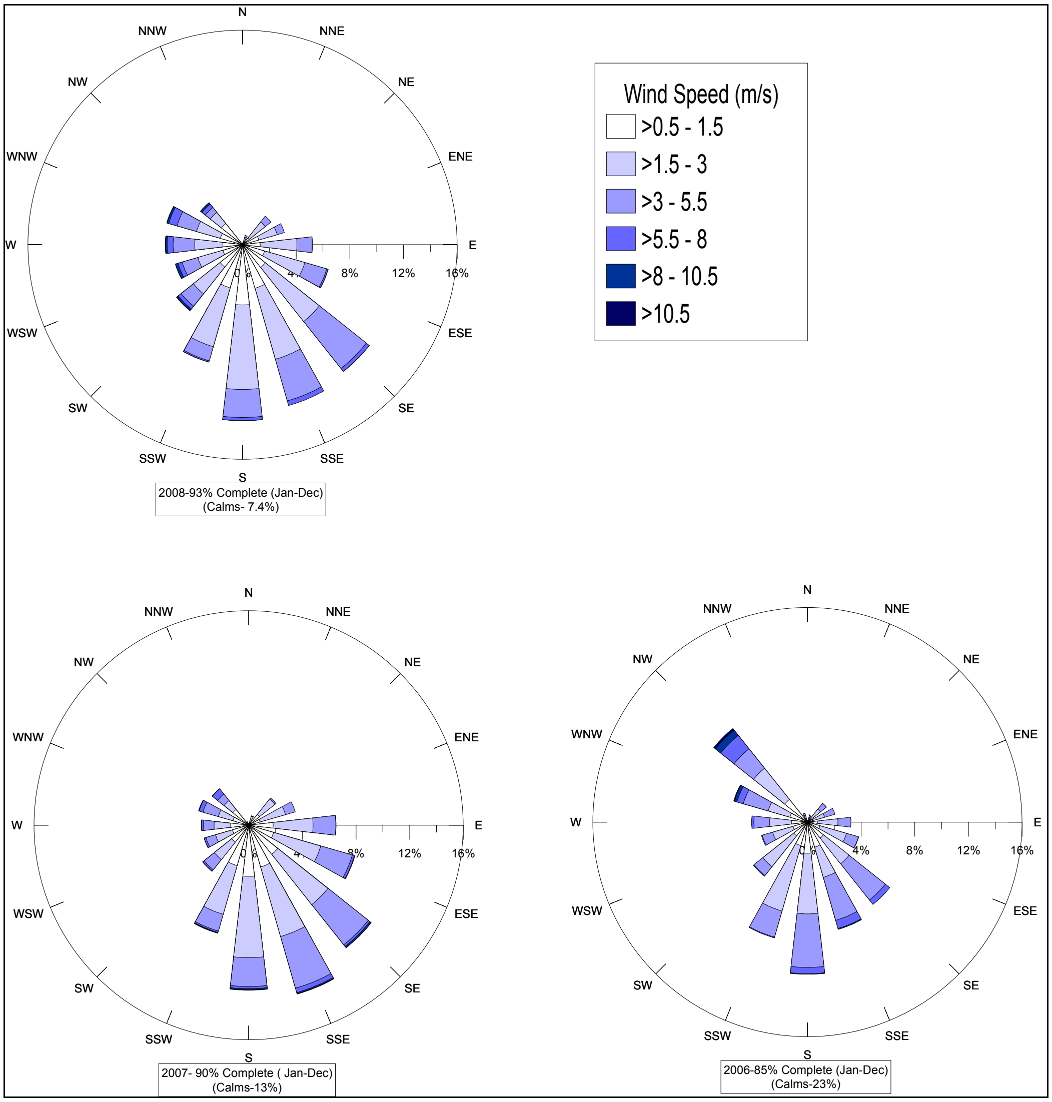
5.1.1 Newstan Colliery Weather Station

Newstan Colliery is located approximately 5.5 km northeast of the Project Site. The following parameters, recorded at hourly intervals, were available from this station.

- Wind Speed.
- Wind Direction.
- Temperature.
- Relative Humidity.
- Solar Radiation.

Hourly data recorded between October 2005 and April 2009 was provided by Newstan Colliery. The wind speed and direction profile of the calendar years 2006, 2007 and 2008 is presented within **Figure 5**.

Figure 5 Hourly Annual Wind Rose Comparison - Newstan Colliery Weather Station January 2006 to December 2008



As illustrated in **Figure 5**, the trends for both wind speed and wind direction are similar for each year presented. The 2006 windrose does indicate a higher proportion of north-west winds, which was not measured in the 2007 and 2008 data. The 2008 calendar year represents the most complete dataset recorded by the Newstan weather station, with a total percentage complete of approximately 93% and has been selected as an appropriate year for consideration within this assessment.

The wind roses illustrated in **Figure 3** indicate that northerly winds from the north north-west to north north-east are absent. Following a review of the weather station calibration records, it would seem that winds within this range during calibration were determined to be faulty. Winds detected in all other directions were determined to be appropriately calibrated and functional.

As described in **Figure 4**, the sensitive receivers are all located to the north of the project site. With winds dominating from the south, this meteorological data set is considered to be worse case, when assessing to these sensitive receiver locations.

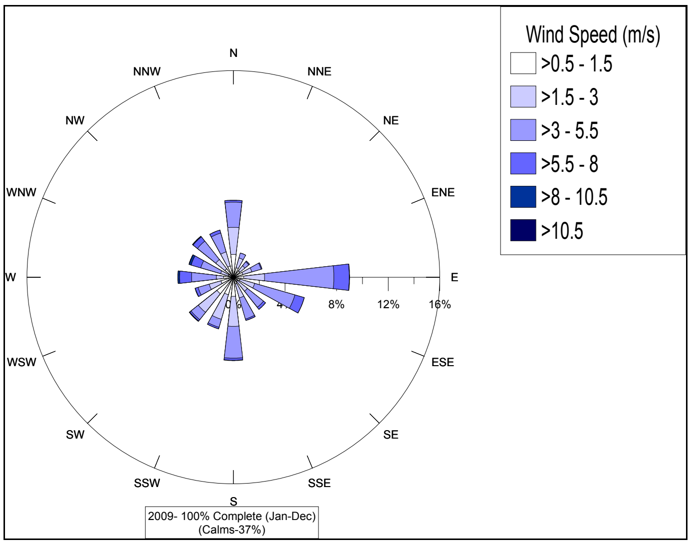
5.1.2 Cooranbong - Lake Macquarie Bureau of Meteorology Weather Station

Cooranbong - Lake Macquarie weather station (061412) is located approximately 10.5 km south-west of the Project Site. The following parameters, recorded at hourly intervals, were available from this station.

- Wind Speed
- Wind Direction
- Temperature
- Relative Humidity
- Rainfall

Hourly data recorded between August 2008 and December 2009 was provided by the Cooranbong- Lake Macquarie station. The wind speed and direction profile of the calendar year 2009 is presented within **Figure 6**.

Figure 6 Hourly Annual Wind Rose - Cooranbong - Lake Macquarie 2009



The Cooranbong meteorological station was installed in mid 2008. Therefore, no historic data before this date is available at the site. Data for a full calendar year was limited to 2009.

The wind rose illustrated in **Figure 6** indicates that the prevailing wind direction at the Cooranbong monitoring site is from the East. A point of interest is that 37% of the data is impacted by calm conditions. The majority of these occur between 6pm and 8am.

It is noted that Heggies consider that the percent calms in unusually high, and is not typical for a location with relatively uncomplicated terrain. The Bureau of Meteorology (BOM) was contacted to investigate the quality of the data. They indicated that the data was quality checked and the data is considered to be within their acceptable ranges.

5.1.3 Meteorology Applicable for this Assessment

The Approved Methods state in Section 4.1 that for a Level 2 air quality assessment, a site-specific meteorological dataset with at least 90% complete hourly observational data for a one year period must be used (i.e. for 8760 hours, maximum of 876 missing).

The Newstan monitoring locality is 5.5 km from the project site, and is considered to be representative of site conditions of the Awaba Colliery. As discussed above, the 2008 dataset is 93% complete and is the preferred data set.

Cooranbong is considered to be too far from the project site to represent local conditions (10.5 km), has only been operational since the middle of 2008 and the high percent calms within the data set are potentially erroneous.

It is recognised that within the Newstan meteorological data, northerly winds from the north north-west to north north-east are absent. However, the prevailing winds are from the south. This is considered to be worst case meteorological conditions for dust dispersion towards the receivers and is considered highly conservative and an applicable data set to use in this instance. As described in **Section 5.3** TAPM has been used to also generate a synthetic meteorological file for the calendar year 2008. **Figure 17** illustrates a windrose comparison between the Newstan and TAPM 2008 annual wind roses. To provide a robust approach, a sensitivity modelling run was undertaken to determine the impacts upon the nearest receivers from the Awaba Colliery under these meteorological conditions.

5.2 Meteorological Conditions

5.2.1 Wind Regime

A summary of the 2008 annual wind speed and direction experienced at Newstan and adopted at the Project Site is presented as a windrose in **Figure 7**.

Figure 7 Annual Wind Rose for Project Site - 2008

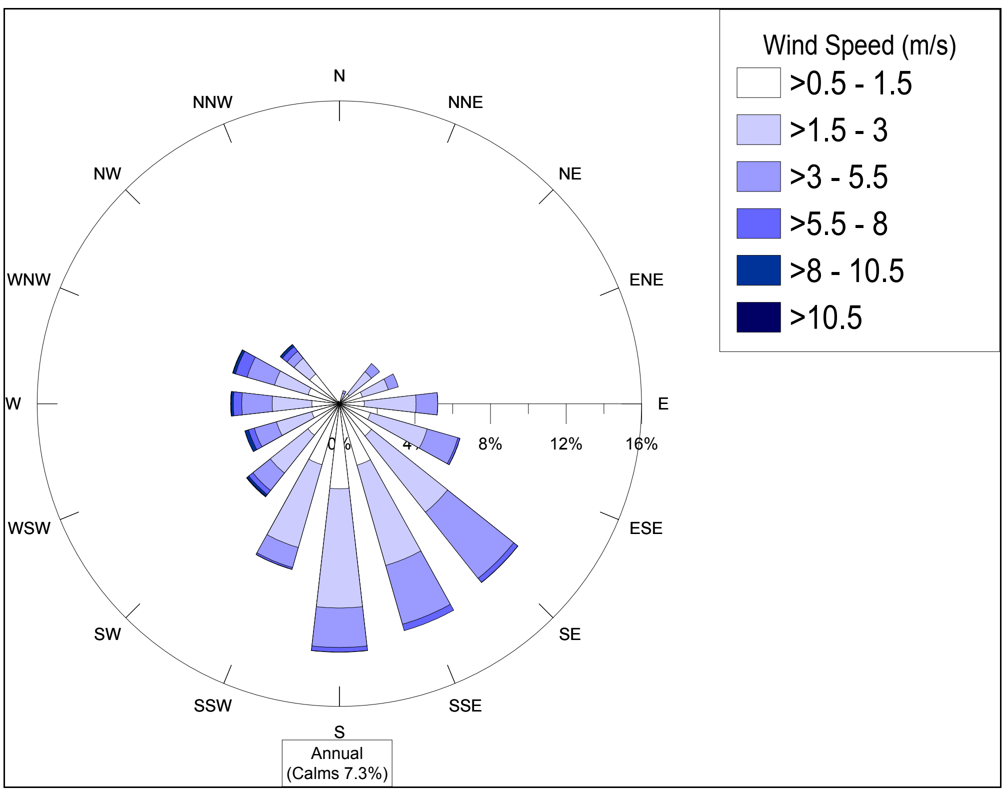


Figure 7 indicates that winds experienced are predominately light to moderate winds (between 1.5 m/s and 5.5 m/s and primarily from the southeast to the south. Calm wind conditions (wind speed less than 0.5m/s were observed to occur 7.3% of the time throughout 2008.

The seasonal variation in predicted wind speed and direction is presented in **Appendix A**. The seasonal wind roses indicate that:

- 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.
- In winter fresh to light winds are experienced predominately from the south southeast to the west northwest.

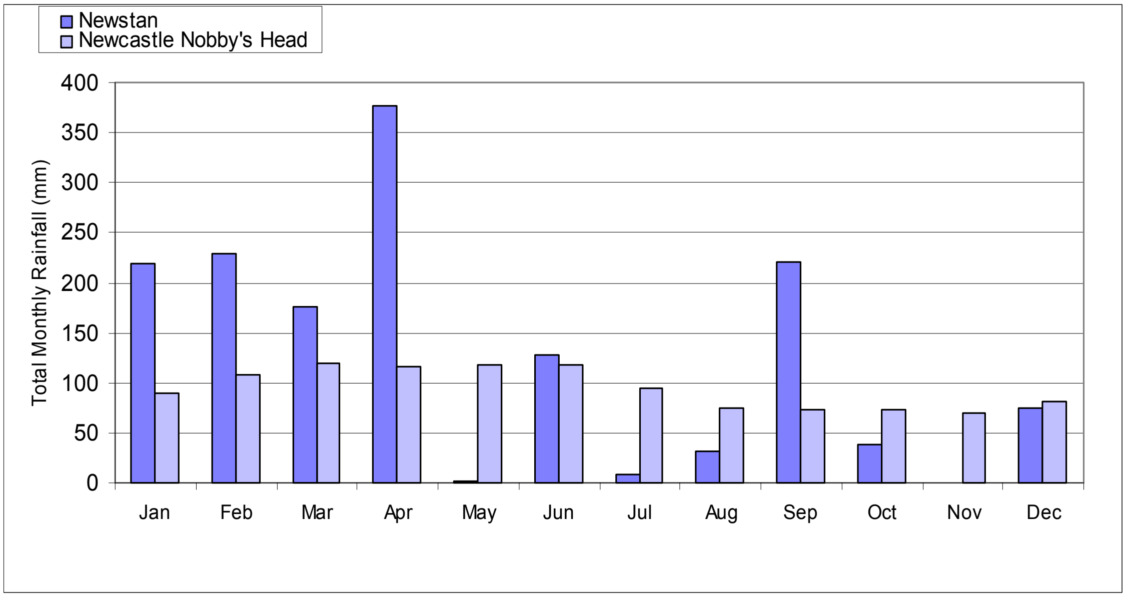
5.2.2 Rainfall

Precipitation is important to air pollution studies since it reduces the potential for fugitive dust emissions and represents an effective removal mechanism of atmospheric pollutants. A graph displaying the recorded total monthly rainfall measured at Newstan during 2008 is shown in **Figure 8**. Also shown is the monthly mean rainfall measured at Newcastle Nobby's Head between 1862 and 2010 (BoM, 2010).

Rainfall experienced in the greater region surrounding the Project Site can be described as low to moderate, with the historic annual average rainfall recorded at Newcastle Nobby's Head totalling 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.

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

Figure 8 Monthly Rainfall for Newstan Colliery - 2008 and Historic Annual Rainfall, Newcastle Nobby's Head



5.2.3 Relative Humidity

The relative humidity in the region surrounding the Project Site can be described as moderate. The mean 9 am relative humidity at Newcastle Nobby's Head was between 68% to 80%, while the 3 pm relative humidity varies between 56% and 74% throughout the year (BoM, 2010). This is in agreement with relative humidity data collected at Newstan, with a 9am and 3pm annual average relative humidity of 79% and 80% respectively recorded throughout 2008.

5.3 Meteorological Modelling

In order to calculate all required meteorological parameters required by the dispersion modelling process, meteorological modelling using The Air Pollution Model (TAPM) meteorological model (Version 3) has been undertaken.

TAPM, developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) is a prognostic model which may be used to predict three-dimensional meteorological data and air pollution concentrations with no local data inputs required.

TAPM model predicts wind speed and direction, temperature, pressure, water vapour, cloud, rain water and turbulence. The program allows the user to generate synthetic observations by referencing databases (covering terrain, vegetation and soil type, sea surface temperature and synoptic scale meteorological analyses) which are subsequently used in the model input to generate site-specific hourly meteorological observations at user-defined levels within the atmosphere.

Additionally, the TAPM model may assimilate actual local wind observations so that they can optionally be included in a model solution. The wind speed and direction observations are used to realign the predicted solution towards the observation values. This function of accounting for actual meteorological observations within the region of interest is referred to as "data assimilation".

Thus, direct measurements for 2008 of hourly average wind speed and wind direction at the Newstan onsite weather station were input into the TAPM simulations to provide realignment to local conditions.

Table 6 details the parameters used in the TAPM meteorological modelling for this assessment.

Table 6 Meteorological Parameters Used for the Assessment

TAPM (v 3.0)	
Number of grids (spacing)	4 (30 km, 10 km, 3 km, 1 km)
Number of grid points	25 x 25 x 30
Year of analysis	2008
Centre of analysis	336292 m E, 6350733 m S (Awaba Colliery)
Data assimilation	Meteorological data assimilation using wind data from the Newstan onsite weather station into lower 4 levels of model

5.3.1 Atmospheric Stability and Mixing Depth

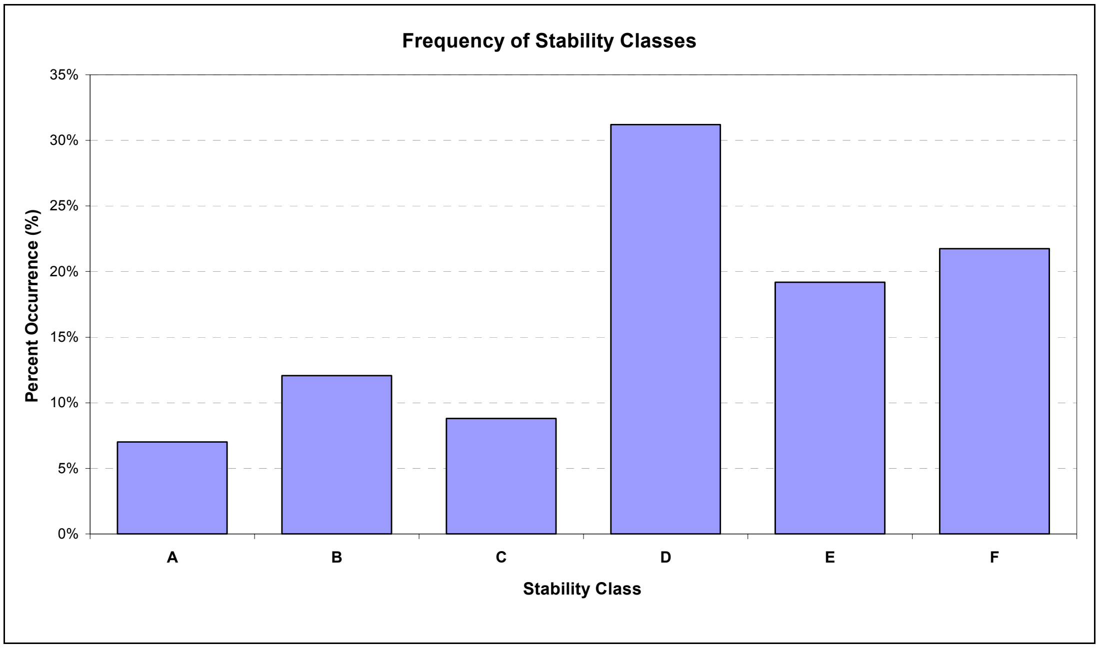
Atmospheric stability refers to the tendency of the atmosphere to resist or enhance vertical motion. The Pasquill-Turner assignment scheme identifies six Stability Classes, “A” to “F”, to categorise the degree of atmospheric stability. These classes indicate the characteristics of the prevailing meteorological conditions and are used as input into various air dispersion models

Table 7 Description of Atmospheric Stability Classes

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

The TAPM predicted frequency of each stability class at the Project Site during 2008 is presented in **Figure 9**. The TAPM predicted seasonal stability class distributions for the Project Site are included in **Appendix B.**

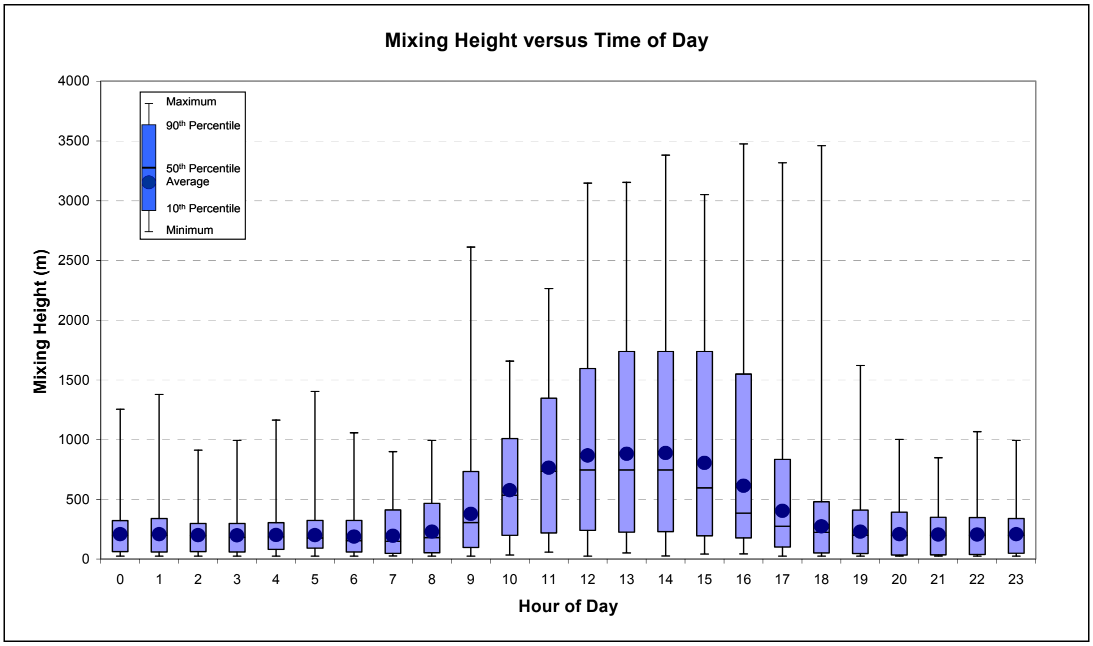
Figure 9 TAPM Predicted Annual Stability Class Distributions for Project Site 2008



The results indicate a high frequency of conditions typical to Stability Class "D". Stability Class "D" is indicative of neutral conditions, conducive to a moderate level of pollutant dispersion due to mechanical mixing.

Diurnal variations in maximum and average mixing depths predicted by TAPM at the Project Site during 2008 are illustrated in **Figure 10**. It can be seen that an increase in the mixing depth during the morning, arising due to the onset of vertical mixing following sunrise, is apparent with maximum mixing heights occurring in the mid to late afternoon, due to the dissipation of ground-based temperature inversions and the growth of the convective mixing layer.

Figure 10 TAPM-Predicted Diurnal Variation in Mixing Depth for Project Site-2008

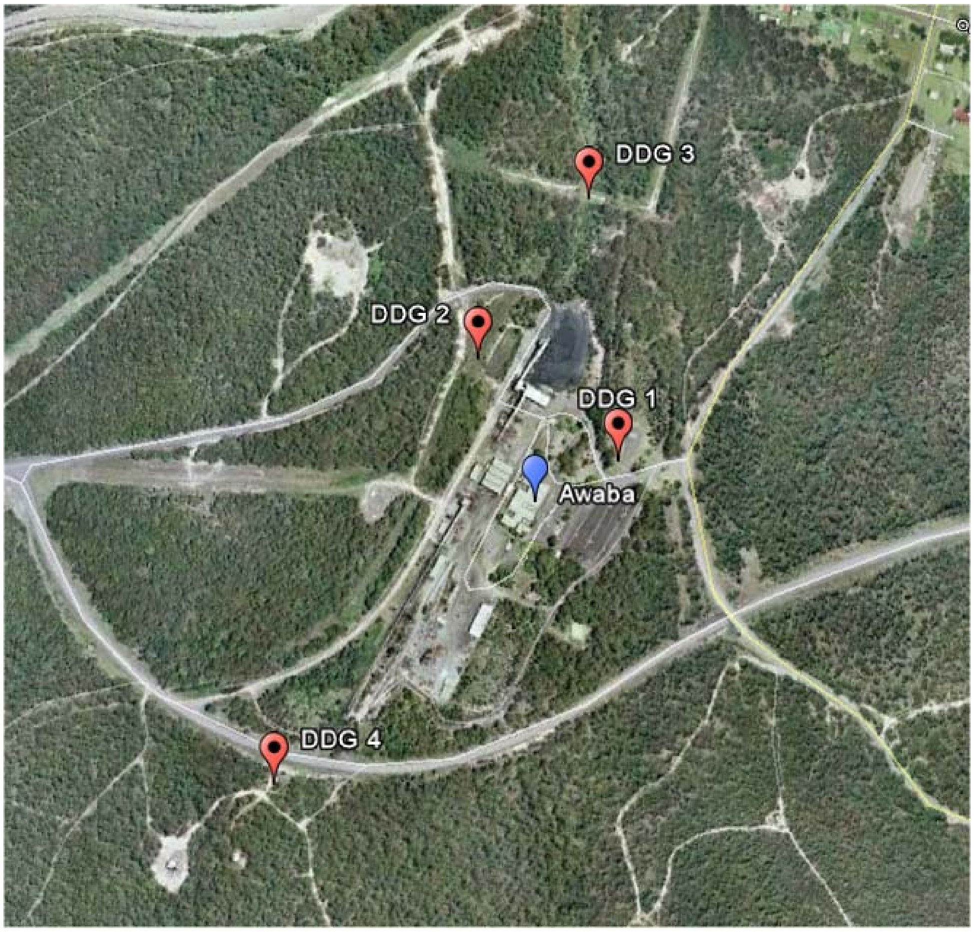


6 BASELINE AIR QUALITY

6.1 Awaba Colliery Air Quality Monitoring Network

In order to determine the effectiveness of the colliery's dust control measures, a monitoring network has been established. The pollutant monitored by the Awaba Colliery air quality monitoring network is dust deposition. **Figure 11** illustrates the distribution of the Awaba Colliery air quality monitoring network.

Figure 11 Environmental Monitoring Locations

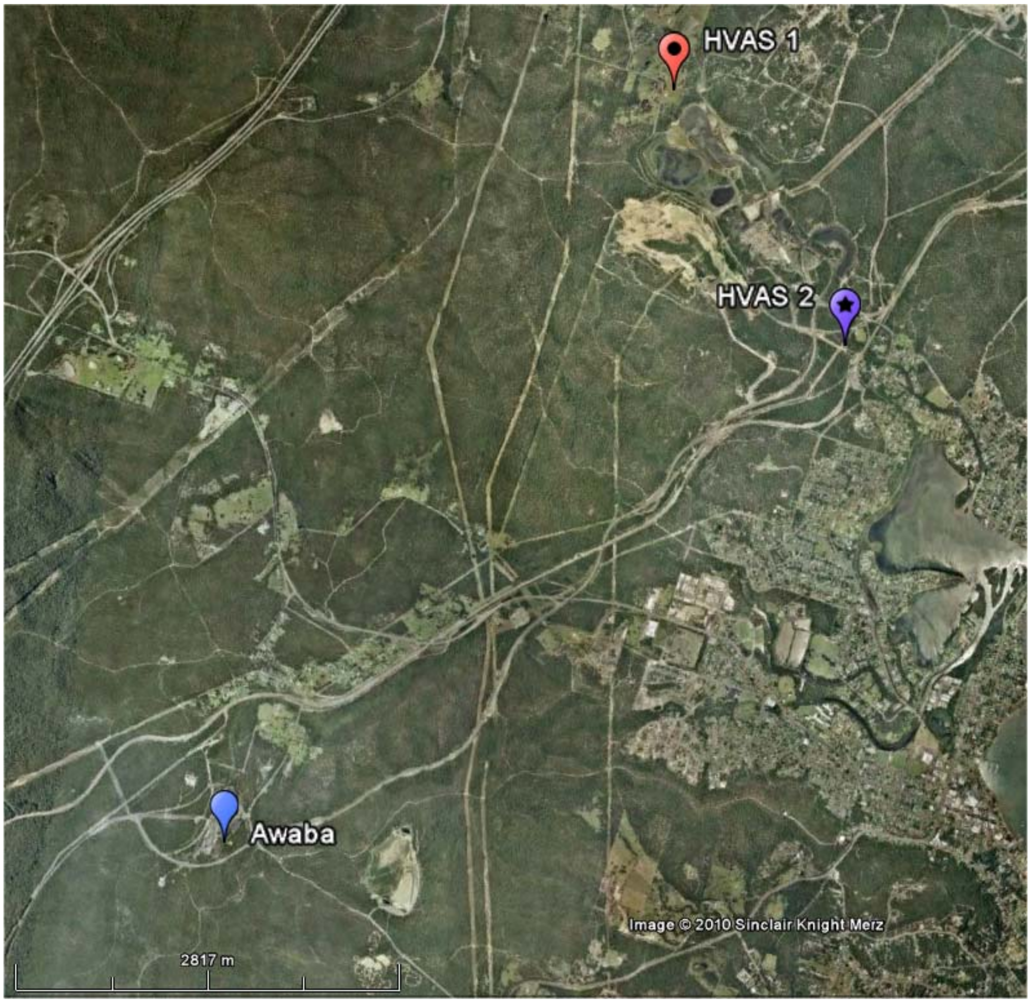


Source: Google Earth 2010

6.2 Particulate Matter

PM_{10} concentrations (24-hour average, 1-in-6 day cycle) are measured by High Volume Air Sampler (HVAS) at two locations in the vicinity of the Awaba Colliery. The HVAS locations are situated at “Culgan” property on a hilltop north of the Northern Reject Emplacement Area at Newstan Colliery and at “Fassifern” south of Newstan Colliery near Fassifern Railway Station. It is noted that both HVAS are maintained by Newstan Colliery. The locations of the HVAS are illustrated in **Figure 12** below.

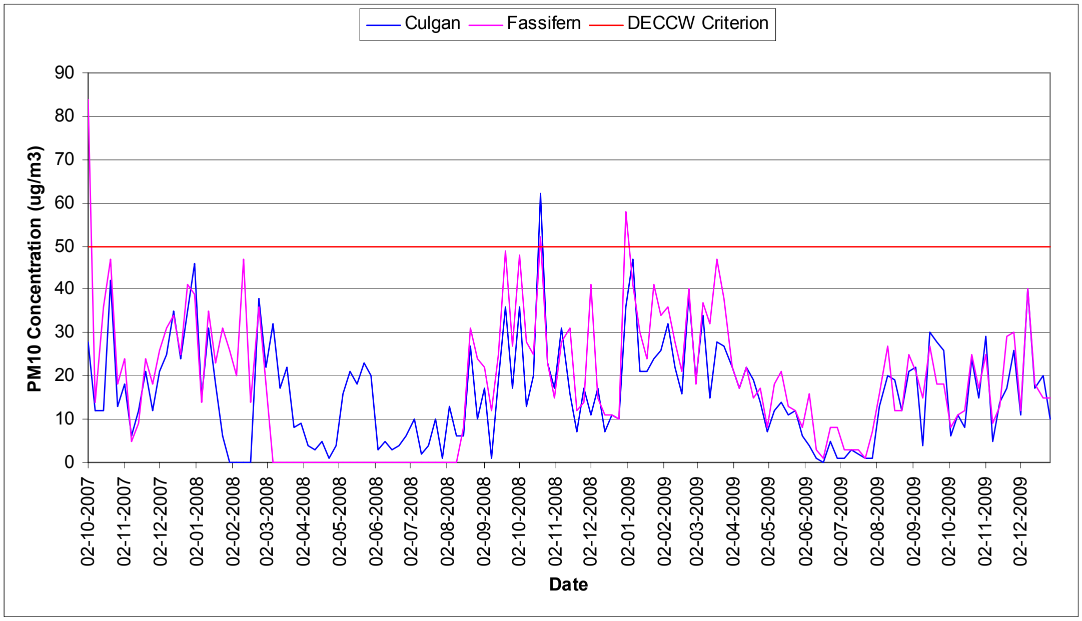
Figure 12 HVAS Monitoring Locations, Newstan Colliery



Source: Google Earth 2010

In order to assess 24-hour average PM_{10} concentrations for the region surrounding Awaba Colliery, data recorded at the "Culgan" and "Fassifern" HVAS locations between January 2007 and December 2009 has been sourced from Newstan Colliery and presented in **Figure 13**

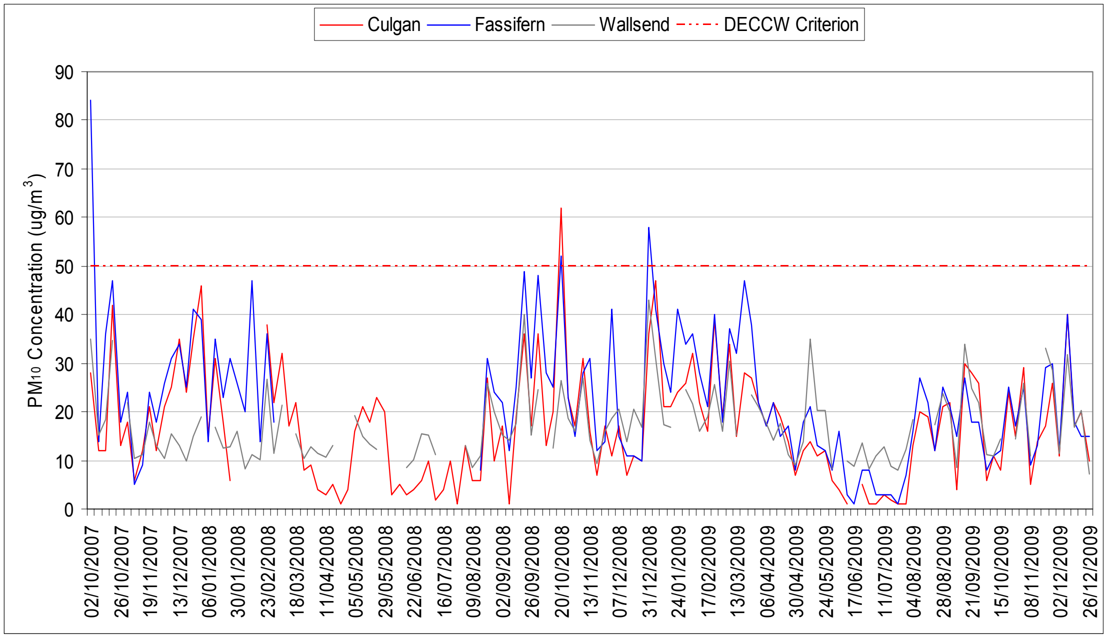
Figure 13 24-hour Average PM_{10} Concentrations - January 2007 to December 2009 - Newstan Air Quality Monitoring Network



With the exception of four 24-hour periods - three in the "Fassifern" dataset (20 October 2008 and 31 December 2008) and one in the "Culgan" dataset (20 October 2008), all measured concentrations at both HVAS locations between January 2007 and December 2009 were below the DECCW 24-hour average criterion of 50 µg/m³. The exact cause of these exceedances is not readily known, and may have been due to a localised event. The annual average PM_{10} concentrations of the "Fassifern" and "Culgan" HVAS datasets are 21.2 µg/m³ and 15.8 µg/m³ respectively, which may be compared against the Project assessment goal of 30 µg/m³ (reference **Section 4.2**).

The NSW DECCW maintains a network of continuous air quality monitoring stations across NSW. The closest of these stations is located at Wallsend, approximately 18 km northeast of the Project Site. This air quality monitoring site is located in the grounds of the Newcastle City Swimming Pool, off Frances Street, Wallsend and was commissioned in November 1992. The 24-hour average PM_{10} concentrations recorded at the DECCW Wallsend monitoring station between January 2007 and December 2009, along with the HVAS data recorded by Newstan Colliery in that period are presented in **Figure 14.**

Figure 14 DECCW Wallsend data compared to Newstan HVAS data



As illustrated in **Figure 14**, concentrations of PM_{10} are generally lower at Wallsend than at the Newstan HVAS locations. It is therefore considered that in the absence of a continuous site-specific monitoring 24-hour varying PM_{10} dataset, data from the DECCW Wallsend monitoring station can be used as it is not impacted by the influence of mining operations and hence can be considered site representative.

In order to illustrate that the data recorded at the DECCW Wallsend can be considered site-representative, an analysis of the maxima and averages in each dataset has been tabulated.

Table 8 DECCW Wallsend 2008 dataset in comparison with Newstan dataset

PM_{10} Concentrations (µg/m³)	**DECCW Wallsend**	**Newstan-Culgan**	**Newstan-Fassifern**
Maximum	56.5	62.0	58.0
Average	15.7	15.2	26.0

Table 8 shows that the Wallsend dataset has the lowest maximum concentration in comparison with the Newstan dataset. Overall the Wallsend dataset shows lower concentrations as seen in **Figure 14**.

Therefore, in order to meet the requirements of Section 5.1.1 of the Approved Methods regarding continuous monitoring data, the 24-hour average PM_{10} concentrations recorded at the DECCW Wallsend monitoring station for the period 1 January 2008 to 31 December 2008, presented in **Figure 15** will be drawn upon in conjunction with the Newstan PM_{10} HVAS data to estimate existing levels of PM_{10}. The Wallsend data will be used as measured background data while the Newstan data used to obtain corresponding dispersion model predictions in the atmospheric dispersion modelling This 2008 dataset is concurrent with the meteorological data set to be used in the atmospheric dispersion modelling process (as discussed in **Section 7.2**).

Figure 15 DECCW PM_{10} (24-Hour Average) Monitoring Results for Wallsend 2008

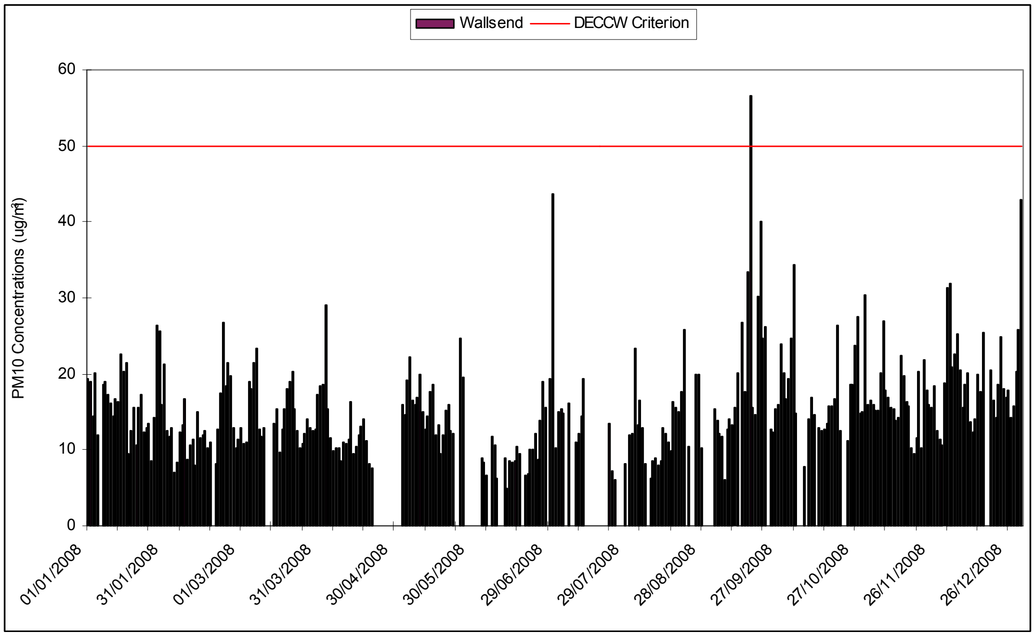


Figure 15 indicates that the highest 24-hour average PM_{10} recorded in DECCW's Wallsend monitoring station was 56.5 µg/m^3 recorded on 16 September 2008. This is above the DECCW goal of 50 µg/m^3. However, in accordance with the Approved Methods, these values have been included in the assessment as it is appropriate to demonstrate that no additional exceedances of the impact assessment criteria will occur as a result of the proposed continued operations at the Project Site.

The highest PM_{10} concentration not in exceedance of the 24-hour criterion at Wallsend was 43.6 µg/m^3, recorded on 1 July 2008. It is noted that this concentration is also amongst the identified dust storm period and may be considered as elevated for the region. The annual average PM_{10} concentration for 2008, recorded at the DECCW's Wallsend monitoring site was 21.5 µg/m^3.

6.3 Total Suspended Particulates (TSP)

TSP concentrations (24-hour average, 1-in-6 day cycle) are also measured by High Volume Air Sampler (HVAS) at two (2) locations in the vicinity of the Awaba Colliery. The HVAS locations are situated at "Culgan" property on a hilltop north of the Northern Reject Emplacement Area at Newstan Colliery and at "Fassifern" south of Newstan Colliery near Fassifern Railway Station. It is noted that both HVAS are maintained by Newstan Colliery. The locations of the HVAS are illustrated in **Figure 12**.

The TSP monitoring results for 2008 (including site specific TSP/PM_{10} ratios) are presented in **Table 9**.

Table 9 2008 TSP Newstan Monitoring Results (including TSP/PM_{10} ratio)

	Newstan-Culgan	**Newstan-Fassifern**
Annual Average TSP	33.0	53.0
Annual Average PM_{10}	15.2	26.0
TSP/PM_{10} Ratio	2.1:1	2:1

Due to the one-in-six day cycle, there is insufficient data available for use in the assessment of existing background TSP concentrations in accordance with the DECCW Approved Methods.

It is considered appropriate that the above TSP/PM_{10} ratio be applied to the annual PM_{10} data measured at Wallsend to enable the calculation of an annual background TSP concentration.

Based on the TSP/PM_{10} ratio for Newstan - Fassifern provided in **Table 9**, and the annual average PM_{10} concentration for PM_{10} at Wallsend (21.5 µg/m^3), the proposed background TSP concentration for the project site is 47.0 µg/m^3.

6.4 Dust Deposition

Dust deposition levels have been monitored surrounding the Project Site since 2003 at the locations indicated in **Figure 11**. Available dust deposition data for the period January 2004 to December 2009 is presented in **Table 10** and **Figure 16**.

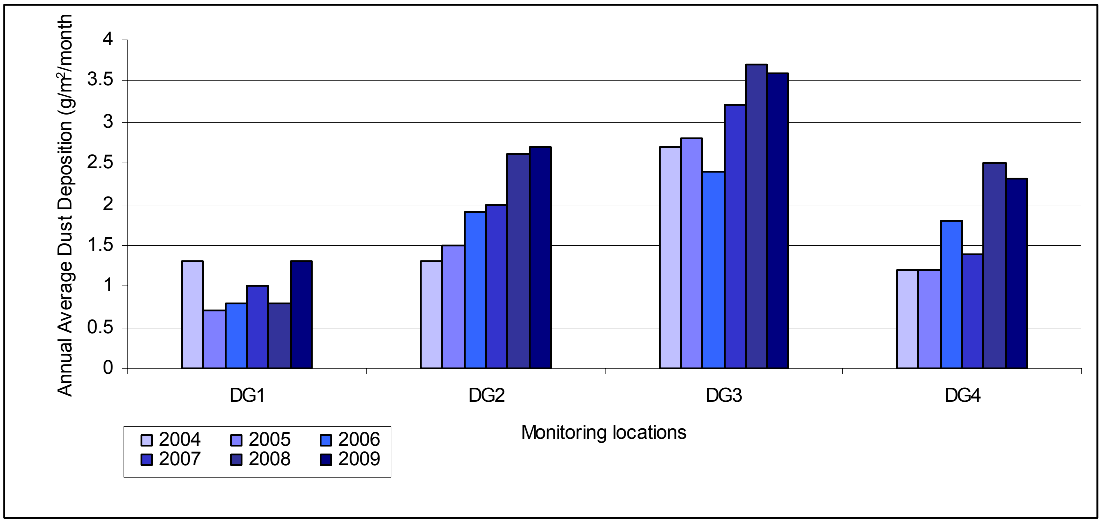
A review of the dust deposition levels presented within **Table 10** indicate that the highest annual average for any site was 3.0 g/m^2/month occurring at DG3 located on the northern boundary adjacent to the coal stockpile. The highest monthly average at any site was 3.7 g/m^2/month, occurring at DG3 during 2008.

Taking into account the large number and geographical spread of dust deposition monitoring undertaken around the Project Site; given the distance of the DG2 monitoring location Awaba Colliery operations, it is likely that this location best provides a measure of ambient dust deposition levels without the influence of local mining operations.

Table 10 Annual Average Dust Deposition Levels - Awaba Colliery 2004-2009

Monitoring Location	Annual Average Dust Deposition Levels (g/m^2/month)						Site Average
	2004	2005	2006	2007	2008	2009	
DG1	1.3	0.7	0.8	1.0	0.8	1.3	**1.0**
DG2	1.3	1.5	1.9	2.0	2.6	2.7	**2.0**
DG3	2.7	2.8	2.4	3.2	3.7	3.6	**3.0**
DG4	1.2	1.2	1.8	1.4	2.5	2.3	**1.7**
Annual Average	**1.6**	**1.6**	**1.7**	**1.9**	**2.4**	**2.5**	**2.0**

Figure 16 Annual Dust Deposition Levels - Awaba Colliery Network, 2004-2009



6.5 Background Air Quality for Assessment Purposes

For the purposes of this assessment background air quality concentrations/levels as presented **Table 11** have been adopted. The maximum monitored values from site data have been adopted. Daily varying background 24-hour PM_{10} concentrations from the DECCW Wallsend monitoring site have been adopted.

Table 11 Background Air Quality Used for Assessment Purposes

Air Quality Parameter	Concentration / Level
PM_{10}	Daily varying (24- hour)
	21.5 µg/m³ (annual average)
TSP	47.0 µg/m³ (annual average)
Dust Deposition	2.0 g/m²/month (annual average)

7 AIR QUALITY MODELLING METHODOLOGY

Activities associated with the existing Awaba Colliery operations with the potential to generate particulates that have been identified in **Section 2.5** of this report. As the Project is proposed to be a continuation of existing operations, potential sources of dust are considered to be the same.

The dust generating activities identified in **Section 2.5** have been quantified for the Project as outlined in **Section 7.1**.

7.1 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 12** below presents the emissions inventory for the Project.

Table 12 Emissions Inventory Summary

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

7.1.1 Model Assumptions

The following sections detail the assumptions made in creating the emissions inventory for the operational scenario. **Appendix C** details the emissions inventory compiled for this assessment.

- Underground coal mining and product distribution (excluding mobile plant) operations occur 24 hours a day, seven days a week.
- It is assumed that maximum annual production is 880,000 tonnes.
- It is assumed that coal to the ROM stockpile is loaded directly from underground conveying. ROM Coal is then transported to the surface via underground reclaiming. Product coal is loaded straight onto trucks via the overhead bin from the coal preparation plant (CPP) via conveying.
- It is assumed that one front end loader is in operation at the product stockpiles.
- It is assumed that the front end loader is in operation 9 hours per day, 5 days a week.
- The emission factors for the excavator and front end loader were derived from Table 1 of the EETM for Mining (EETMM). The equations corresponding to excavators (on overburden) and front end loaders (on coal) were used.
- The emission factor for truck loading was derived from Table 1 of the EETMM. The emission factor corresponding to train loading were used.
- The following moisture content (mc) and silt content (sc) have been assumed for the modelling.
  - Coal: mc - 6.1%, sc - 25.2% (based on information provided by the Proponent).
  - Quarry: sc- 6% (based on USEPA)

7.1.2 Wind Erosion Estimation

Annual Wind Erosion at the Project Site was estimated using the following equation, as per Section A1.1.15 of the EETMM:

$$EF = 1.9 \times \left(\frac{s}{1.5}\right) \times 365 \times \left(\frac{365 - p}{235}\right) \times \left(\frac{f}{15}\right) \text{ kg/ha/year}$$

where s= silt content, p = number of days when rainfall is greater than 0.25mm, f= percentage of time that wind speed at the mean height of the stockpile is greater than 5.4 m/s. PM_{10} is 50% of TSP, as derived by this equation.

The suspension of particulate matter typically commences when wind speed approaches 5 m/s (SKM, 2005). To reflect this within the modelling process, the annual wind erosion amount has been divided proportionally amongst the hours throughout the year that are greater than 5m/s.

Ausplume provides the following default wind speed bands by which the emission rate for a source can be varied: 0-1.54, 1.54-3.09, 3.09-5.14, 5.14-8.23, 8.23-10.8 and 10.8+.

To derive a wind erosion proportion for each wind speed band, the US EPA's erosion potential equation within Chapter 13, Section 13.2.5 Industrial Wind Erosion (US EPA, 2006), was used to estimate the erosion potential for each band. Within this equation, a Particle Threshold Friction Velocity of 0.5 m/s (considered highly conservative as fine coal dust is quoted as 0.54 m/s) was assumed. Hourly friction velocity was derived from hourly wind speed and the US EPA's conversion equation (US EPA, 2006).

7.1.3 Underground Ventilation Emissions

There is one ventilation fan situated within the Project Site, 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). Heggies have conducted a number of dispersion modelling assessments for the ventilation shaft associated with underground coal mining operations.

Based on the level of annual underground extraction at the Project Site (proposed 880,000tpa) 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 at the Project Site. With this conclusion in mind, and in the absence of site specific monitoring data, potential particulate and odorous emissions from the ventilation shaft at the Project Site have not been considered further in this modelling assessment.

Diesel is used in the underground mining areas by a range of plant and equipment. A total of 126,000 litres of diesel is anticipated to be consumed per annum as part of the Project. In accordance with the DECCW requirements, the nitrogen dioxide (NO_2) and carbon monoxide (CO) emissions associated with the combustion of the diesel, which is emitted via the ventilation system are quantitatively assessed below.

There was no data available to determine site specific emissions of NO_2 and CO. The following has been assumed to approximate NO_2 and CO emissions from the ventilation system:

- 100% of the 126,000 litres of diesel is assumed to be consumed underground;
- 14.4 litres per hour is assumed as a constant underground consumption;
- Emissions data for a Rigid Truck, contained within Table 4.4 of the Environment Australia Document *Technical Report 1: Toxic Emissions from Diesel Vehicles in Australia*, 2003 has been adopted to represent the plant and equipment NO_2 and CO emissions underground;

- The ventilation system is operated at 130 m^3 per second;
- 100% of NO_X emitted is assumed to be NO_2.;
- an in-stack NO_2 of 1.02 mg/m^3;
- an in-stack CO of 0.33 mg/m^3;
- an exit velocity of the order of 10.6 m/s;
- an exit temperature of 293 K (20°C);
- a stack release height of the order of 6 m; and
- a stack diameter of the order of 3.9 m.

It is considered that the above assumptions provide a conservative assessment of the emission of NO_2 and CO from the mine ventilation system.

Considering the above, **Table 13** describes the emission rates for the Project Site.

Table 13 Qualitative ventilation system emission rate estimates

Contaminant	Emission Factor (g/L)*	Emission Rate (g/hr)	Underground ventilation emission rate at source ($\mu g/m^3$)
NO_2	33.2	478	1020
CO	10.78	155	331

Note: * Emission factors were developed considering Table 4.4 of the Environment Australia Document *Technical Report 1: Toxic Emissions from Diesel Vehicles in Australia*, 2003.

Based on the above inputs, atmospheric modelling was undertaken using Ausplume (as described in **Section 7.2**). Concentrations of NO_2 and CO were predicted to the nearest sensitive receivers described in **Section 3.2**. The results of the dispersion modelling for both NO_2 and CO were negligible (<0.1 $\mu g/m^3$) at all receivers. Therefore the relevant assessment criteria (refer **Section 4**) was achieved at each of the identified sensitive receivers.

7.2 Atmospheric Dispersion Modelling

The particulate dispersion modelling carried out for the Project utilises the Ausplume Gaussian Plume Dispersion Model software (Version 6.0) developed by the EPA (Victoria).

Ausplume is the dispersion model that DECCW has approved for use in the majority of applications in New South Wales, and is commonly regarded as the "workhorse" model for assessments of extractive industries in particular. According to Section 6.4 of the EETMM Ausplume is a steady state model and assumes the atmosphere is in a state of uniform flow, and wind velocity is a function of height and does not vary with direction.

From the regional topography surrounding the project site in **Figure 3**, it is clear that the terrain within both the immediate and regional vicinity of the Project Site is not steep or complex. NSW DECCW guidance for dispersion model selection within the Approved Methods states that a dispersion model, such as Ausplume, should be used where the subject site is located within uncomplex terrain.

Default options specified in the Technical Users Manual (EPA Victoria, 2000) have been used, as per the Approved Methods. A number of validation studies for the Ausplume model have been conducted, comparing predicted concentrations of pollutants with actual recorded observations, in particular by Hamilton (1999) and Hurley & Luhar (2005). Findings from these studies indicated that Ausplume performs well in predicting upper percentile concentrations of pollutants at specific locations.

8 AIR QUALITY MODELLING RESULTS

Results of the dispersion model predictions for the Project Site are presented in the following sections.

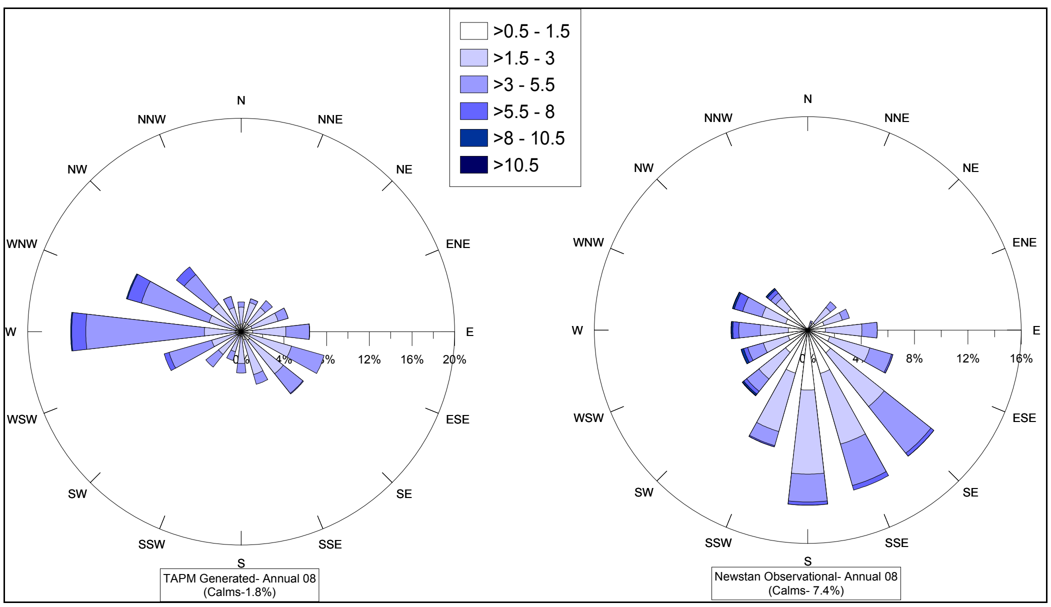
As discussed in Section **5.1.3**, a sensitivity analysis was carried out within the dispersion modelling using a synthetic TAPM generated file to account for the identified limitation in the meteorology data for Newstan.

8.1 Sensitivity Analysis

This sensitivity analysis was conducted to account for the missing northly data from within the Newstan Colliery meteorological data

A summary of the annual wind behaviour experienced from both datasets is presented as a windroses in **Figure 17** .

Figure 17 Hourly Annual Wind Rose Comparison - TAPM Generated vs Newstan Colliery Weather Station



As illustrated in **Figure 17** there is no similarity in wind speed or wind direction pattern from both datasets.

The TAPM generated data indicates that winds experienced at Awaba Colliery are predominately light to moderate winds (between 1.5m/s and 8m/s). They are primarily westerly, with calm wind conditions observed to occur 1.8% of the time.

The Newstan observational data indicates that winds experienced are predominately light to fresh winds (between 1.5m/s and 5.5m/s). They are primarily southerlys, with calm wind conditions observed to occur approximately 7.4 % of the time.

Both datasets were run through the dispersion model to identify any differences in impacts to the sensitive receptors. It was identified that the Newstan observational data had higher impacts, with the sensitive receptors being to the north of Awaba Colliery and the high incidences of southerlys from that dataset.

Therefore for the purpose of this assessment the Newstan observational dataset was used in the dispersion modelling for the assessment as it was deemed to be a conservative worst case scenario.

8.2 Ausplume Modelling Results

Dispersion modelling predictions of dust deposition and PM_{10} concentrations for the receptors nominated in **Section 3.2** attributable to the Project operations are presented in **Section 8.2.1** to **Section 8.2.4**.

8.2.1 Dust Deposition

Table 14 shows the results of the dispersion modelling for dust deposition (annual average) resulting from the Project operations at each of the identified receptors using the emission rates calculated in **Appendix C**.

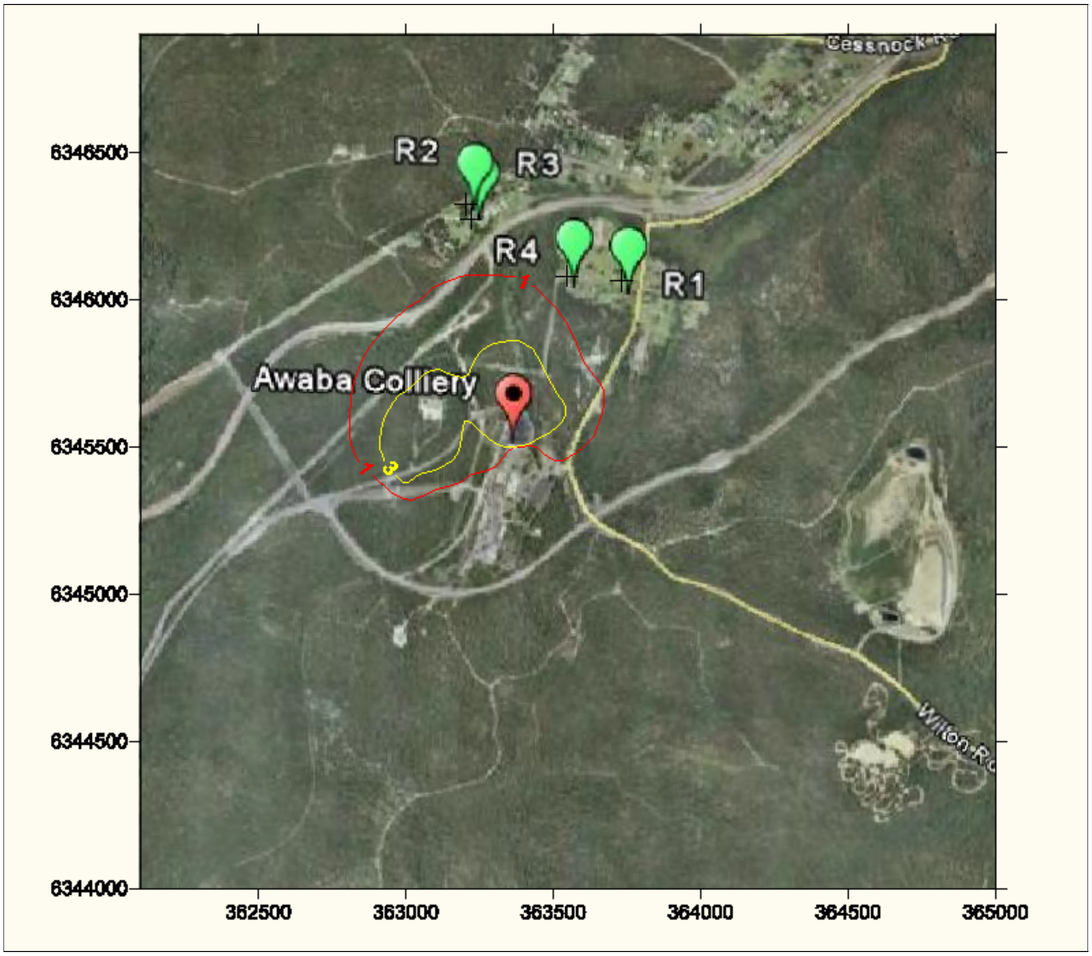
Table 14 Background and Incremental Dust Deposition - Annual Average

Residence ID	Dust Deposition Annual Average (g/m^2/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

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 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 18**.

Figure 18 Predicted Total Annual Dust Deposition Contours



8.2.2 Total Suspended Particulates (TSP)

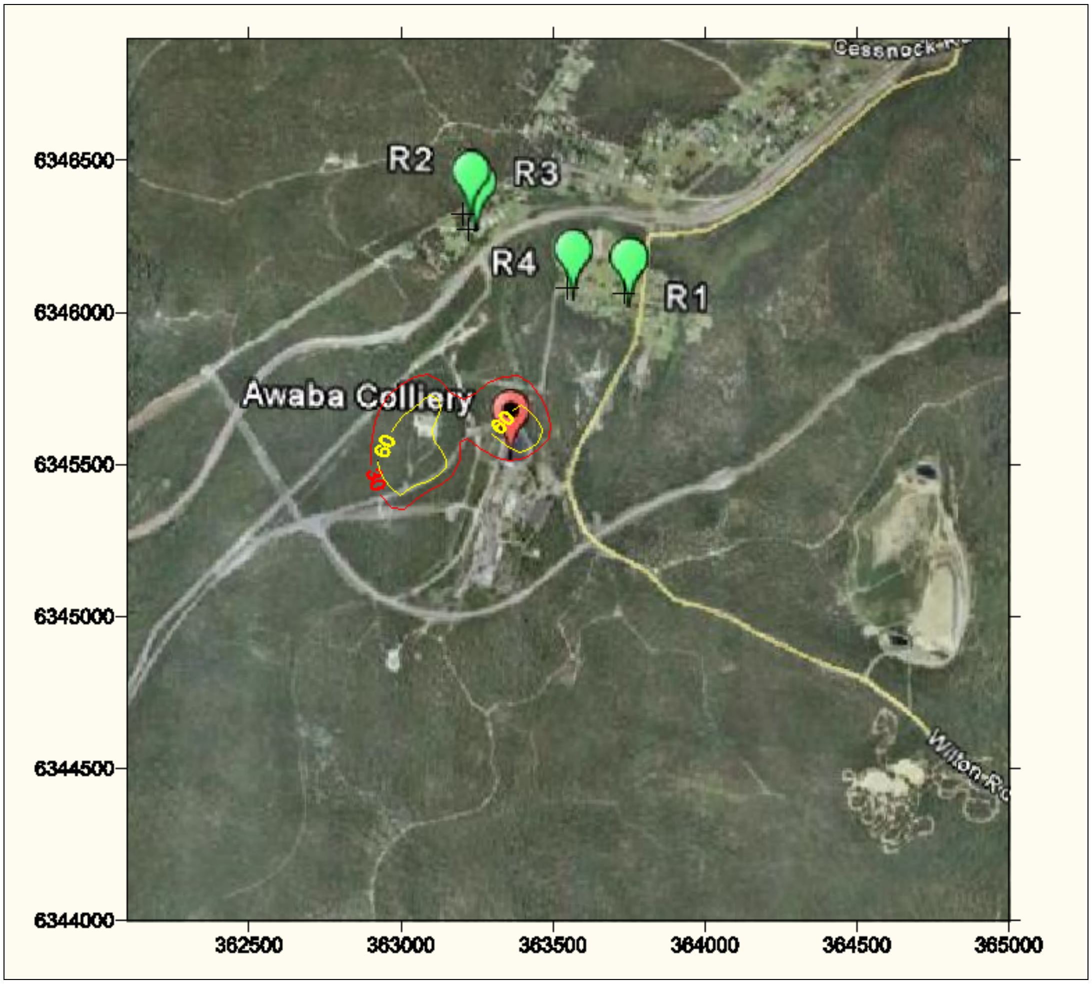
Table 15 shows the results of the dispersion modelling for TSP from the Project at each of the identified receptors using the emission rates calculated in **Appendix C**.

Table 15 Background and Incremental TSP - Annual Average

Residence ID	TSP Annual Average (µg/m³)			
	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

A contour plot of the incremental increase in TSP concentrations attributable to the Project is presented in **Table 16**. The contour plot is indicative of the concentrations of TSP that could potentially be reached under the meteorological conditions modelled.

Table 16 Predicted TSP Annual Average Concentration Contours



8.2.3 Particulate Matter (PM_{10})-24 Hour Average

Table 17 to **Table 20** shows the results of the dispersion modelling for 24-hour maximum PM_{10} concentrations resulting from the Project operations at each of the identified receptors using the emission rates calculated in **Appendix C**. The tables show the five highest maximum 24-hour average PM_{10} concentrations as well as the five highest predicted increment concentrations predicted at receptors R1 to R4. This has been simulated by using daily monitoring data provided by the NSW DECCW, coupled with contemporaneous meteorological observations.

A contour plot of the predicted PM_{10} concentrations experienced around the site is presented in **Figure 19**.

Table 17 24-Hour Average PM_{10} Concentrations - R1

Date	PM_{10} 24-hour average (µg/m³)			Date	PM_{10} 24-hour average (µg/m³)		
	Background	Predicted increment	Total		Background	Highest predicted increment	Total
16/09/2008	56.5	1.3	57.8	04/07/2008	15.3	7.9	23.2
01/07/2008	43.6	0.6	44.2	18/02/2008	11.1	7.8	18.9
31/12/2008	43.0	2.1	45.1	14/07/2008	21.5	7.6	29.1
20/09/2008	40.0	1.2	41.2	07/06/2008	11.8	7.0	18.8
01/10/2008	35.2	0.0	35.2	12/03/2008	21.5	6.5	28.0

Table 18 24-Hour Average PM_{10} Concentrations - R2

Date	PM_{10} 24-hour average (µg/m³)			Date	PM_{10} 24-hour average (µg/m³)		
	Background	Predicted increment	Total		Background	Highest predicted increment	Total
16/09/2008	56.5	1.3	57.8	29/07/2008	8.2	14.3	22.5
01/07/2008	43.6	0.0	43.6	31/05/2008	21.5	11.1	32.6
31/12/2008	43.0	0.4	43.4	27/05/2008	19.6	10.4	30.0
20/09/2008	40.0	0.2	40.0	06/04/2008	9.9	10.1	20.0
01/10/2008	35.2	0.0	35.2	22/04/2008	21.5	8.8	30.3

Table 19 24-Hour Average PM_{10} Concentrations - R3

Date	PM_{10} 24-hour average (µg/m³)			Date	PM_{10} 24-hour average (µg/m³)		
	Background	Predicted increment	Total		Background	Highest predicted increment	Total
16/09/2008	56.5	1.3	57.8	27/05/2008	19.6	14.1	33.7
01/07/2008	43.6	0.0	43.6	29/07/2008	8.2	13.4	21.6
31/12/2008	43.0	0.4	43.4	31/05/2008	21.5	12.0	33.5
20/09/2008	40.0	0.3	40.3	21/04/2008	7.6	10.9	18.5
01/10/2008	35.2	0.0	35.2	06/04/2008	9.9	10.5	20.4

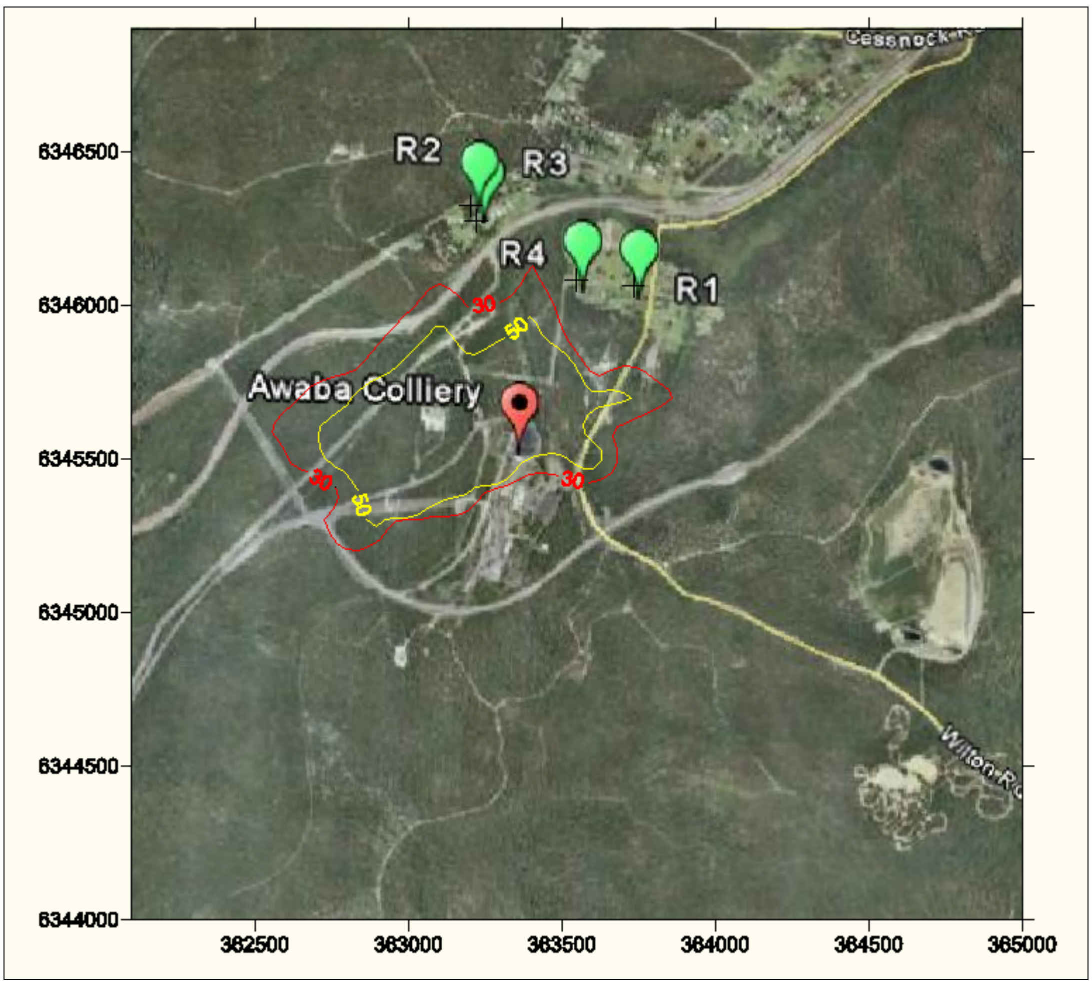
Table 20 24-Hour Average PM_{10} Concentrations - R4

Date	PM_{10} 24-hour average (µg/m³)			Date	PM_{10} 24-hour average (µg/m³)		
	Background	Predicted increment	Total		Background	Highest predicted increment	Total
16/09/2008	56.5	1.3	57.8	27/05/2008	19.6	17.1	36.7
01/07/2008	43.6	0.1	43.7	21/02/2008	12.7	14.8	27.5
31/12/2008	43.0	1.4	44.4	23/05/2008	12.2	13.0	25.2
20/09/2008	40.0	0.8	40.8	07/03/2008	23.3	12.3	35.6
01/10/2008	35.2	0.0	35.2	20/02/2008	8.2	11.5	19.7

Table 17 to **Table 20** differentiate between the five highest predicted maximum 24-hour average PM_{10} concentrations (background plus predicted increment) and the five highest predicted PM_{10} increment concentrations associated with the Project Site experienced by receptors surrounding the site. It can be seen from **Table 17** to **Table 20** that total 24-hour average PM_{10} (background plus predicted increment) are all in exceedance of 50 µg/m^3 at all the nearest sensitive receptors. As indicated in **Section 0** this exceedance is attributed to the background PM_{10} used within this assessment.

However, the total 24-hour average PM_{10} (background plus highest predicted increment) are predicted to be below the Project criterion of 50 µg/m^3, hence showing that no additional exceedances have occurred as a result of the proposed expanded operations at the Project Site.

Figure 19 Predicted 24-Hour Average PM_{10} Concentrations Contours



8.2.4 Particulate Matter (PM_{10}) - Annual Average

Table 21 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

An annual average background concentration of 21.5 µg/m³ 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 of 30 µg/m³.

The results indicate that annual average PM_{10} levels at all receptors surrounding the Project are predicted to below the Project criterion of 30 µg/m³.

A contour plot of the predicted annual average PM_{10} concentrations experienced around the site is not presented for this assessment due to the low concentrations across the modelling domain.

8.3 Air Quality Mitigation, Management and Monitoring Measures

As discussed in **Section 2.4**, Awaba Colliery currently employs air quality mitigation and management measures at the Colliery which is considered to be generally best practice.

Specific air quality mitigation measures that were included in the dispersion modelling include:

- Permanent road sealing (bitumen seals);
- Enclosures on all main conveyors; and
- Enclosed coal chute at stacking conveyor discharge point.

9 GREENHOUSE GAS ASSESSMENT

A quantitative greenhouse gas assessment has been undertaken to estimate potential greenhouse gas (GHG) emissions associated with the Project.

Activity data for the following have been obtained from the Proponent:

- Total Run of Mine (ROM) Coal Production (tonnes[t]);
- Total Electricity Consumption (kilowatt-hours [kWh]);
- Total Diesel Consumption (litres[L]);
- Solid Waste to Landfill (t);
- Fugitive Emissions of Coal Seam Methane (CH_4) and CO_2 via ventilation shafts (m³ and percentage content of CO_2 and CH_4 in ventilation return air);
- Emissions from use of sulphur hexafluoride (SF_6);
- 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.

Data have been sourced primarily from the Proponent provided spreadsheet 'AWA Greenhouse Report 2008-2009' with data on employee transport provided separately.

Data was made available for the period July 2008 to June 2009, being the most recent complete financial year of data which has been independently audited and verified to meet the requirements of the National Greenhouse and Energy Reporting System (NGERS) legislation. The product extracted during this reporting period was 805,825 tonnes. Data presented in this report for Scope 1 and 2 emissions is directly extracted from the Awaba NGERS report for the July 2008 to June 2009 period and utilises NGERS emission factors, or other acceptable NGERS emission calculation methodologies. Scope 3 emissions have been calculated using proponent provided data, or activity data reported under NGERS in the case of diesel and electricity consumption.

To assess the GHG impact of the proposed Awaba operations (to 880,000 tonnes per annum (tpa) extraction rate), activity data has been scaled to reflect the proposed modified ROM extraction operations of 880,000 tpa as outlined in **Table 22**. Also presented are the calculated annual activity data reflecting this modification.

Table 22 Summary of Project Related Activity Data Relevant to GHG Emissions (Current and Proposed Operations)

Activity	Quantity (Current Project Operations – July 2008 to June 2009 [805,825 tpa])	Quantity (Modified Project Operations [880,000 tpa])	Scaling Factor Applied
Annual ROM production (Mt)	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)	115,275	125,886	1.09
coal haulage contractor (L)	279,995	305,768	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
Petroleum Based Oil/ greases used (L)	204,000	223,000	1.09
Employee Vehicle Movements	4,680	4,680	Assumed no change in employee numbers

9.1 Direct and Indirect Emissions (Emissions Scope)

National Greenhouse and Energy Reporting Regulations 2008 defines scope 1 and scope 2 emissions as;

Division 2.5 Meaning of *emissions*, production and consumption: section 10

2.23 Meaning of *emissions*, *production* and *consumption*

(2) ***Emissions*** of greenhouse gas, in relation to a facility, means the release of greenhouse gas into the atmosphere as a direct result of one of the following:

(a) an activity, or series of activities (including ancillary activities) that constitute the facility (***scope 1 emissions***);

(b) 1 or more activities that generate electricity, heating, cooling or steam that is consumed by the facility but that do not form part of the facility (***scope 2 emissions***).

Meaning of production

(3) ***Production*** of energy, in relation to a facility, means 1 of the following:

(a) the extraction or capture of energy from natural sources for final consumption by or from the operation of the facility or for use other than in the operation of the facility;

(b) the manufacture of energy by the conversion of energy from 1 form to another form for final consumption by or from the operation of the facility or for use other than in the operation of the facility.

Note 1: Emissions from the use of petroleum based oils/ greases not reported in 2008/2009 however may be required in future

Meaning of consumption

(4) ***Consumption*** of energy, in relation to a facility, means the use or disposal of energy from the operation of the facility including own-use and losses in extraction, production and transmission.

The NGERS legislation does not include scope 3 emissions.

The National Greenhouse Accounts workbook (NGA) the methodology used for estimating scope 3 emissions in this assessment is defined as follows:

- *Various emission factors can be used to calculate scope 3 emissions. For ease of use, this workbook reports specific 'scope 3' emission factors for organisations that:*

  (a) burn fossil fuels: to estimate their indirect emissions attributable to the extraction, production and transport of those fuels; or

  (b) consume purchased electricity: to estimate their indirect emissions from the extraction, production and transport of fuel burned at generation and the indirect emissions attributable to the electricity lost in delivery in the T&D network.

It is noted that Centennial Coal has a restricted capacity to reduce their GHG emissions under Scope 3. Reductions in the emissions of GHG resulting from the extraction and transport of fossil fuels for use in electricity production or onsite diesel combustion are beyond the control of Centennial coal but are reported here for completeness, as required by the Department of Planning.

9.2 Greenhouse Gas Calculation Methodology

Quantification of potential Project emissions has been undertaken in relation to both carbon dioxide (CO_2) and other non-CO_2 greenhouse gas emissions.

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. The CO_2-e of a gas is calculated using an index called the Global Warming Potential (GWP). The GWPs for a variety of non-CO_2 greenhouse gases are contained within the Intergovernmental Panel on Climate Change (IPCC), (1996) document "*Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*".

The GWPs of relevance to this assessment are:

- methane (CH_4): GWP of 21 (21 times more effective as a greenhouse gas than CO_2);
- nitrous oxide (N_2O): GWP of 310 (310 times more effective as a greenhouse gas than CO_2); and,
- Sulphur hexafluoride (SF_6): GWP of 23,900 (23,900 times more effective as a greenhouse gas than CO_2).

The 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, GWP values are generally not attributed to these gases nor have they been considered further as part of this assessment.

The greenhouse gas emissions associated with the modified Project have been assessed in terms of direct (Scope 1) emission potential, indirect (Scope 2) emission potential and significant upstream/downstream (Scope 3) emission potential.

A summary of the potential Project GHG emission sources is provided in **Table 23**.

Table 23 Summary of Potential Project 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 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	NA	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

Fugitive emissions - Coal Seam Methane and Carbon Dioxide

The process of coal formation creates significant amounts of CH_4. Some of this CH_4 remains trapped in the coal until the pressure on the coal is reduced, which occurs during the coal mining process. The stored CH_4 is then released to the atmosphere.

Fugitive emissions from extraction of coal as defined by NGERS were estimated for the 08-09 financial year using Method 4, subdivision 3.2.2.2 of the NGERS Measurement Determination 2008.

It is assumed that based on the mine being non gassy and additionally that in association with the planned production there will be no increase in ventilation required and therefore no increase in fugitive emissions will result from the project modifications

Diesel Usage

The primary fuel source for the vehicles operating at the Project Site is diesel. Diesel consumption for all mobile and fixed equipment is calculated as 115,275 (L) used in the underground operation and 279,995 L by coal haulage contractors in the assessment year (July 2008 to June 2009). Based on the adopted scaling factor of 1.09 (880,000/805,825) the estimated diesel consumption resulting from modified Project operations for all mobile and fixed equipment is assumed to be 125,886 L per annum, and 305,768 L by coal haulage contractors.

Scope 1 emissions from use of diesel fuel as defined by NGERS were estimated for the 08-09 financial year using Method 1, Division 2.4.2 section 2.41 of the NGERS Measurement Determination 2008.

Liquid Petroleum Gas

LPG used on site is related to periodic use for staff amenities

LPG consumption is estimated as 200 kg per annum, which is not expected to change due to the modified Plant operations.

Scope 1 emissions from use of LPG as defined by NGERS were estimated for the 08-09 financial year using Method 1, Division 2.4.2 section 2.41 of the NGERS Measurement Determination 2008.

Emissions of Sulphur Hexafluoride

Sulphur hexafluoride (SF_6) is used in gas insulated switchgear and circuit breaker applications on site.

The stock of SF_6 for the financial year 08-09 is estimated as 8.028 kg per annum, which is not expected to change due to the modified Plant operations.

Scope 1 emissions from use of SF_6 as defined by NGERS were estimated for the 08-09 financial year using Method 1, Division 2.48A of the NGERS Measurement Determination.

It has been assumed that the leakage rate from switchgear is 0.5% per annum as per Table 25 of the NGA Factors Workbook (2009).

9.2.1 Scope 2: Indirect Emissions through the Consumption of Purchased Electricity

Scope 2 GHG emissions as defined by NGERS were estimated for the 08-09 financial year using Method 1, Chapter 7, section 7.2 of the NGERS Measurement Determination 2008

State emission factors are used because electricity flows between states are significantly constrained by the capacity of the inter-state interconnectors and in some cases there are no interconnections.

Electricity consumption at the Project Site has been calculated as (approximately) 13 Megawatt-hours (MWh) in the current year of mining (July 2008 to June 2009). Based on the adopted scaling factor of 1.09 the estimated electricity consumption resulting from modified Project operations is assumed to be (approximately) 14 MWh per annum.

The emission factor for Scope 2 (0.89 tonnes of CO_2-equivalents per kilowatt hour [t CO_2-e/kWh]) represents the consumption of purchased electricity in NSW.

9.2.2 Scope 3: Other Indirect Emissions

As discussed previously, Scope 3 emissions of GHG attributable to the Project are reported for completeness. Centennial Coal has a restricted capacity to reduce their GHG emissions under Scope 3. Reductions in the emissions of GHG resulting from the extraction and transport of fossil fuels for use in electricity production or onsite diesel combustion are beyond the control of Centennial coal. Also beyond the control of Centennial Coal are the operations of coal consumers.

Combustion of Product Coal

Indirect emissions of GHG from the combustion of product coal are expected "downstream" due to the combustion of coal produced by the Project. Up to 880,000 tpa of ROM coal is expected to be produced by the Project, with the majority destined for domestic markets.

This calculation assumes that 100% of ROM coal produced by the Project is combusted as coking coal this is because a Scope 3 emission factor associated with coal combustion for use in electricity generation (thermal coal) is not available. In lieu of this availability, the most appropriate Scope 3 emission factor has been utilised. The Scope 3 emission factor for coking coal (20.7 kg CO_2-e/GJ) has been used which is considered to be conservative, given that 100% of coal produced by the Project will not be used as coking coal, and that coking coal use results in significantly higher emissions of GHG than coal used in electricity production. However, in the absence of appropriate Scope 3 emission factors or details on coal consumer operations, the most relevant have been used to present a worst case scenario.

The GHG emissions from combustion of product coal by other (non-Centennial) entities have been based on a coal energy content of 30 gigajoules per tonne (GJ/t) for coking coal (Table 1 of the NGA Factors). Standard emission factors for Scope 3 emissions from coal combustion have been taken from Table 36 of the NGA Factors.

Extraction, Production and Transport of Fuel Burned for the Generation of Electricity and Electricity Consumed in the Transmission and Distribution System

The NGA Factors provides Scope 3 emission factors for the consumption of purchased electricity by each state. State emission factors are used because electricity flows between states are significantly constrained by the capacity of the inter-state interconnectors and in some cases there are no interconnections.

The NSW Scope 3 emission factor (0.18 kg CO_2-e/kWh) covers both the emissions from the extraction, production and transport of fuels used in the production of the purchased electricity (i.e. fugitive emissions and stationary and mobile fuel combustion emissions) and also the emissions associated with the electricity lost in transmission and distribution on route to the customer. In this report, Scope 2 and 3 emissions for the consumption of purchased electricity have been reported separately so that the share of the transport and distribution loss can be correctly attributed under Scope 3 emissions - Generation of Electricity Consumed in a transmission and distribution system.

Extraction, Production and Transport of Diesel Consumed at the Project

Scope 3 GHG emissions attributable to diesel used at the Project relate to its extraction, production and transport.

The annual emissions of CO_2 and other GHG from this source have been estimated using Table 38 of the NGA Factors, an emission rate of 5.3 kg CO_2-e/GJ and an assumed energy content of Diesel of 38.6 GJ/kL.

Employees Commuting To and From Work

Fuel usage and consequent GHG emissions attributable to company employees commuting to and from work can be reported under Scope 3 GHG emissions. Data has been provided by the Proponent on the assumed number of vehicle trips undertaken by mine employees per week. It has been assumed that employee numbers will not change as part of the Project modification and therefore the number of trips per week will remain at 90 vehicle movements per week or 4,680 movements per year (one way).

No data on the origin of the employee trips has been provided by the Proponent although it has been assumed that all employee vehicle trips originate within a 20 km radius of the Project Site. Assuming that all employee-owned vehicles have a fuel efficiency of 10 L/100 km and operate on diesel as a *worst case assumption*, the total annual diesel consumption by employee owned vehicles would be 1,460L per annum.

The annual emissions of CO_2 and other GHG from this source have been estimated using Table 38 of the NGA Factors, an emission rate of 5.3 kg CO_2-e/GJ and an assumed energy content of Diesel of 38.6 GJ/kL.

Waste Generation

Solid waste generated at the Project Site and disposed of in landfill between July 2008 and June 2009 totalled 43 tonnes. It has been assumed that generation of waste is independent of ROM production and, assuming that employee numbers remain constant during the proposed modification, waste generation is assumed to remain at 43 tonnes per annum.

Waste sent to landfill results in emissions of CH_4 as waste is degraded. Table 42 of the NGA Factors provides GHG emission factors based on broad waste streams (municipal solid waste, commercial and industrial waste and construction and demolition waste). To provide a worst case assessment of GHG emissions from waste sent to landfill, the emission rate for commercial and industrial waste (1.1 t CO_2-e / tonne waste) has been used within this assessment.

Sources not Included

The following Scope 3 GHG emission sources were not included within the assessment:

- Employee business travel;
- Outsourced activities; and,
- Combustion of product coal.

Extraction, Production and Transport of Diesel Consumed at the Modified Project

Scope 3 greenhouse gas emissions attributable to diesel used at the modified Project relate to its extraction, production and transport.

The annual emissions of CO_2 and other greenhouse gases from this source have been estimated using Table 38 of the NGA Factors (DCC, 2009).

9.3 Greenhouse Gas Calculation Results

Calculated Scope 1, Scope 2 and Scope 3 emissions of greenhouse gas resulting from the emissions sources outlined above for the existing (July 2008 to June 2009, 805,825 tpa ROM extraction rate) and modified Project (880,000 tpa ROM extraction rate) are presented in **Table 24.**

9.3.1 Scope 1 Emissions Estimations

Direct (Scope 1) GHG emissions (CO_2-e) resulting from modified Project operations are estimated to be 14,565 t per annum, an increase of approximately 116 tonnes per annum.

9.3.2 Scope 2 Emissions Estimations

Indirect (Scope 2) GHG emissions (CO_2-e) resulting from modified Project operations are estimated to be 12,601 tonnes per annum, an increase of approximately 1,062 tonnes per annum on current operations. This increase is directly related to the increased extraction scenario of 880,000 tpa increased from 805,825 tpa.

9.3.3 Scope 3 Emissions Estimations

Indirect (Scope 3) GHG emissions (CO_2-e) resulting from modified Project operations are estimated to be 715,484 tonnes per annum, an increase of approximately 61,000 tonnes per annum on current operations. The increased emissions are due to increases in diesel and electricity consumption and combustion of coal by third parties. No increases result from employee vehicle use or waste generation as these activities are assumed to remain constant between the current and modified scenarios.

Table 24 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	Source	Current	Modification
Scope 1	Fugitive Emissions [1]	805,825	880,000	tpa ROM	-	-	NGERS method 4	13,160	13,160
	Diesel Combustion	395	431	kL/annum	69.9[2]	kg CO_2-e /GJ	Table 4 NGA Factors	1,066	1,162
	LPG consumption	0.39	0.39	kL/annum	60.8	kg CO_2-e/GJ	Table 4 NGA Factors	1	1
	Use of sulphur hexafluoride	8.028	8.028	kg/annum	23.9	t CO2 /kg	App 1 NGA Factors	1	1
	Use of oils / grease	204	223	kL/annum	1.08	t CO2 /kL	NGERS method 1	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	Table 5 NGA Factors	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	Appendix 4 Table 39 NGA Factors	81	88
	Electricity Consumption	13	14	MWh/annum	0.18	kg CO_2-e /kWh	Appendix 4 Table 39 NGA Factors	2,334	2,549
	Waste Generation	43	43	t/annum	1.1	t CO_2-e / t waste	Appendix 4 Table 42 NGA Factors	47	47
	Employee Transport	1,460	1,460	L/annum	5.3	kg CO_2-e /GJ	Appendix 4 Table 38 NGA Factors	0.3	0.3

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	Source	Current	Modification
	Coal Combustion	805,825	880,000	tpa ROM	20.7	kg CO_2-e /GJ	Appendix 4 Table 36 NGA Factors	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 Awaba during the 08/09 year under NGERS using NGERS Method 4

Note 2: For transport energy purposes

9.4 Comparison with National and State GHG Emissions

The estimated annual emissions associated with the modified Project are presented in **Table 25**.

Table 25 Scope 1, 2 and 3 GHG Emissions Estimated to Result from Modified Project Operation (t CO_2-e / annum)

Emission Scope	Estimated Emissions (t CO_2-e/annum)
1	14,565
2	12,601
3	715,484
TOTAL	**742,650**

Emissions of GHG in NSW were reported to be 163 Mt in 2007, 27% of the Australian total GHG emissions of 597 Mt. Comparison of the emissions attributable to the modified Project with NSW and Australia emission totals is presented in **Table 26**.

Table 26 Comparison of Modified Project GHG Emissions with State and National Totals 2007

Emission Scope	Estimated Emissions (tCO_2-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

9.5 Greenhouse Gas Mitigation Measures

Awaba is currently implementing a number of measures to minimise to the greatest extent practicable GHG emissions from the 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 the Project Site are striving to achieve include:

- Identify and implement cost effective measures to improve energy efficiency;
- Regular maintenance of plant and equipment to minimise fuel consumption;
- Consideration of energy efficiency in plant and equipment selection/phase; and,

10 CONCLUSIONS

Modelling of potential mining fugitive dust, TSP and PM_{10} emissions was undertaken using the Ausplume Gaussian Plume Dispersion Model software (Version 6.0) developed by the EPA (Victoria) and approved by the DECCW.

One (1) scenario was modelled to represent the potential particulate emissions from the Project Site.

The findings of the modelling exercise indicate 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.

The modelling methodology contains a number of assumptions which mean that conservative 'worst case' scenarios were modelled. Therefore, all particulate predictions should be viewed as conservative, with levels expected to be lower than those modelled during standard operations.

The total direct (Scope 1) emissions from the Project are estimated to be approximately 14,565 t CO_2-e in any one year.

Indirect (Scope 2 and 3) emissions would be released in the process of mining coal, and through the transport and end use of the coal. The total indirect emissions (Scope 2 and 3) from mining coal are estimated to be 728085 t CO_2-e, per annum.

The total GHG emissions (direct and indirect) will contribute 0.45% of the NSW 2007 GHG emission total and 0.12% of the Australian 2007 GHG emission total.

11 REFERENCES

The following material has been referenced within this report:

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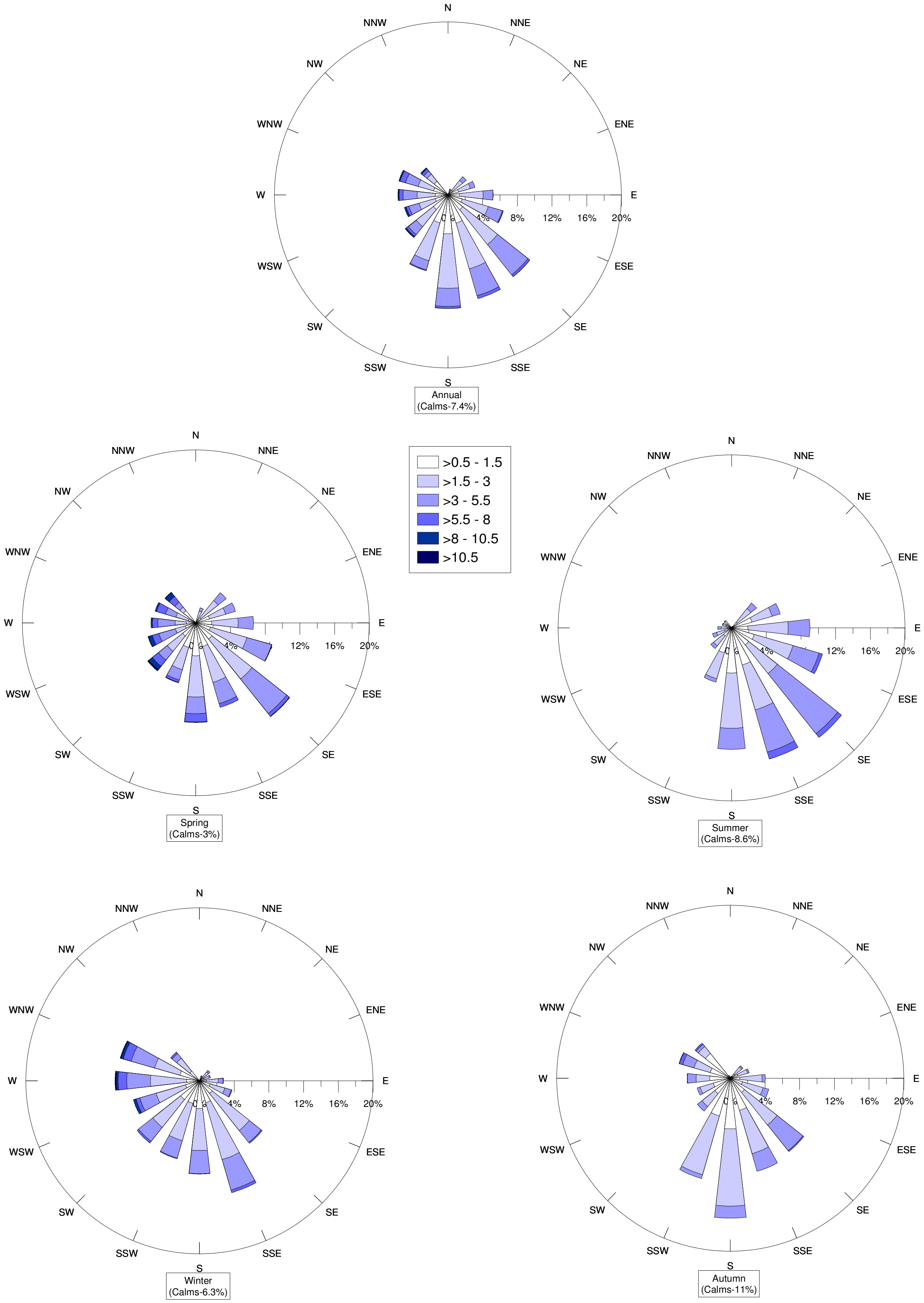
12 GLOSSARY AND TERMS

AHD	Australian Height Datum
AEMR	Annual Environmental Management Report
Approved Methods NSW	Approved Methods for the Modelling and Assessment of Air Pollutants in
CHPP	Coal Handling and Preparation Plant
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DECCW	NSW Department of the Environment, Climate Change and Water
g/m^2/month	Grams per square metre per month
Heggies	Heggies Pty Ltd
HVAS	High Volume Air Sampler
µg	Microgram ($g \times 10^{-6}$)
m^3	Cubic metre
MGA	Map Grid of Australia
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
NHMRC	National Health and Medical Research Council
PM_{10}	Particulate matter less than 10 microns in aerodynamic diameter
ROM	Run of Mine
TAPM	"The Air Pollution Model"
tpa	Tonnes per Annum
TSP	Total Suspended Particulate
USEPA	United States Environmental Protection Agency

ANNUAL AND SEASONAL WIND ROSE - 2008



Heggies Pty Ltd	Designed by	Checked by	Approved by - date	Filename	Dated
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	Appendix A: Annual and Seasonal Wind Roses for the Project Site (2008)				

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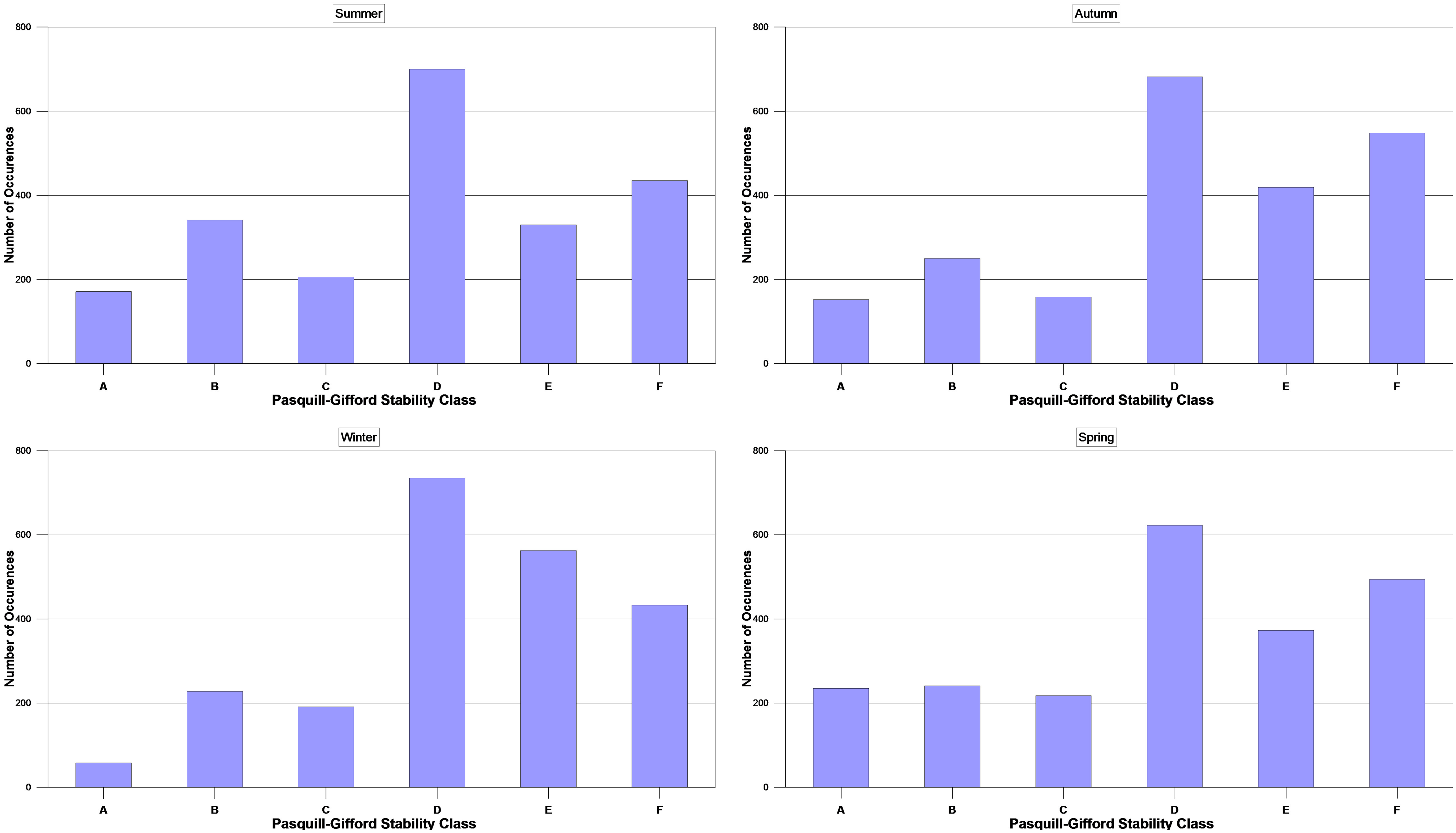
SEASONAL STABILITY CLASS DISTRIBUTION



Summer
Autumn
Winter
Spring
Number of Occurences
Pasquill-Gifford Stability Class
0
200
400
600
800
A
B
C
D
E
F

Appendix C

EMISSIONS INVENTORY

Awaba Part 3A Application Project	**Source ID**	**Moisture content (%)**	**Silt Content (%)**	**TSP Emission Factor**	**PM_{10} Emission Factor**	**Emission Factor Units**	**Notes/Controls**	**Emission Reduction from controls**	**Throughput (tonnes per hour)**	**Number of Hectares of stockpile**	**Average number of kilometres per hour**	**Working days available**	**Working hours per day**	**Annual Average Dust Emission Rate (g/s)**	**Total Dust Emission Rate (mg/s)**	**PM_{10} Emission Rate (mg/s)**	**TSP Emission Flux ($mg/s/m^2$)**	**PM_{10} Emission Flux ($mg/s/m^2$)**	**Easting**	**Northing**	**width**	**length**	**height**
Particulate Generating Activities																							
Quarry																							
Excavator	Exca	N/A	N/A	0.025	0.012	kg/t			42	N/A	N/A	54	9	0.01	291.7	140.0	N/A	N/A	363088	6345644	3	4	4
Loading truck	TruLoa	N/A	N/A	0.005	0.002	kg/t			42	N/A	N/A	54	9	0.00	58.3	23.3	N/A	N/A	363079	6345619	2	1	4
Coal Processing and Handling																							
Front End Loader	FEL	6.1	N/A	0.025	0.012	kg/t			100.5	N/A	N/A	260	8	165.6	697.6	334.9	N/A	N/A	363383	6345601	3.4	4	4
Loading Stockpiles(via conveyor)	LoaSto	N/A	N/A	0.004	0.0017	kg/t			100.5	N/A	N/A	365	24	N/A	111.62	47.4	N/A	N/A	363362	6345566	2	2	4
Truck loading (from loading chute)	TruLoa	N/A	N/A	0.0004	0.00017	kg/t			100.5	N/A	N/A	365	24	N/A	11.16	4.74	N/A	N/A	363352	6345571	1	1	1
Stockpiles and Exposed areas																							
Main Stockpile Wind Erosion	Mstoc	N/A	25.2	0.04	0.02	kg/ha/hr			N/A	1	N/A	N/A	N/A	N/A	N/A	N/A	0.0007	0.0003	363390	6345561	10	30	4
Stockpiles and Exposed areas	StoExp	N/A	25.2	0.04	0.02	kg/ha/hr			N/A	0.30	N/A	N/A	N/A	N/A	N/A	N/A	0.0003	0.0002	363392	6345548	5	7	2
Quarry Stockpiles and Exposed areas	QStoExp	N/A	N/A	0.04	0.02	kg/ha/hr			N/A	0.40	N/A	N/A	N/A	N/A	N/A	N/A	0.0005	0.0002	363080	6345637	6	8	2
Product Transportation																							
Quarry Haul Road (3 sources)	QHauRd	N/A	N/A	1.997	0.532	kg/VKT			N/A	N/A	2.04	54	9	21	377	101	N/A	N/A	varies	varies	3	8	2

Assumed 6% for Surface Silt Content for Quarry Haul Road

Appendix D

AUSPLUME INPUT AND OUTPUT FILE

1

30-2497 Awaba PM10

Concentration or deposition	Concentration
Emission rate units	grams/second
Concentration units	microgram/m3
Units conversion factor	1.00E+03
Constant background concentration	0.00E+00
Terrain effects	None
Smooth stability class changes?	No
Other stability class adjustments ("urban modes")	None
Ignore building wake effects?	Yes
Decay coefficient (unless overridden by met. file)	0.000
Anemometer height	10 m
Roughness height at the wind vane site	0.300 m
Use the convective PDF algorithm?	No
Averaging time for sigma-theta values	60 min.

DISPERSION CURVES

Horizontal dispersion curves for sources <100m high	Sigma-theta
Vertical dispersion curves for sources <100m high	Pasquill-Gifford
Horizontal dispersion curves for sources >100m high	Briggs Rural
Vertical dispersion curves for sources >100m high	Briggs Rural
Enhance horizontal plume spreads for buoyancy?	Yes
Enhance vertical plume spreads for buoyancy?	Yes
Adjust horizontal P-G formulae for roughness height?	Yes
Adjust vertical P-G formulae for roughness height?	Yes
Roughness height	0.100m
Adjustment for wind directional shear	None

PLUME RISE OPTIONS

Gradual plume rise?	Yes
Stack-tip downwash included?	Yes
Building downwash algorithm:	PRIME method.
Entrainment coeff. for neutral & stable lapse rates	0.60,0.60
Partial penetration of elevated inversions?	No
Disregard temp. gradients in the hourly met. file?	No

and in the absence of boundary-layer potential temperature gradients given by the hourly met. file, a value from the following table (in K/m) is used:

Wind Speed Category	Stability Class A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES
Boundaries between categories (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Urban" values (unless overridden by met. file)

AVERAGING TIMES
24 hours

1

30-2497 Awaba PM10

SOURCE CHARACTERISTICS

____

INTEGRATED POLYGON AREA SOURCE: MSTOC

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
363352	6345549	0m	4	4m	4m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	363352	6345549	2	363385	6345557
3	363370	6345606	4	363370	6345606

Emission rates by stability and wind speed, in grams/second per square metre:

Wind speeds (m/s):	< 1.5	1.5_ 3.1	3.1_ 5.1	5.1_ 8.2	8.2_10.8	>10.8
Stability A:	0.00E+00	0.00E+00	0.00E+00	1.16E-03	8.09E-03	3.82E-02
Stability B:	0.00E+00	0.00E+00	0.00E+00	1.16E-03	8.09E-03	3.82E-02
Stability C:	0.00E+00	0.00E+00	0.00E+00	1.16E-03	8.09E-03	3.82E-02
Stability D:	0.00E+00	0.00E+00	0.00E+00	1.16E-03	8.09E-03	3.82E-02
Stability E:	0.00E+00	0.00E+00	0.00E+00	1.16E-03	8.09E-03	3.82E-02
Stability F:	0.00E+00	0.00E+00	0.00E+00	1.16E-03	8.09E-03	3.82E-02

No gravitational settling or scavenging.

INTEGRATED POLYGON AREA SOURCE: STOEXP

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
363359	6345521	0m	7	1m	2m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	363359	6345521	2	363402	6345526
3	363408	6345579	4	363396	6345609
5	363385	6345616	6	363391	6345566
7	363354	6345537			

Emission rates by stability and wind speed, in grams/second per square metre:

Wind speeds (m/s):	< 1.5	1.5_ 3.1	3.1_ 5.1	5.1_ 8.2	8.2_10.8	>10.8
Stability A:	0.00E+00	0.00E+00	0.00E+00	1.16E-03	8.09E-03	3.82E-02
Stability B:	0.00E+00	0.00E+00	0.00E+00	1.16E-03	8.09E-03	3.82E-02
Stability C:	0.00E+00	0.00E+00	0.00E+00	1.16E-03	8.09E-03	3.82E-02
Stability D:	0.00E+00	0.00E+00	0.00E+00	1.16E-03	8.09E-03	3.82E-02
Stability E:	0.00E+00	0.00E+00	0.00E+00	1.16E-03	8.09E-03	3.82E-02
Stability F:	0.00E+00	0.00E+00	0.00E+00	1.16E-03	8.09E-03	3.82E-02

No gravitational settling or scavenging.

INTEGRATED POLYGON AREA SOURCE: QSTOEX

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
363115	6345601	0m	5	1m	2m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	363115	6345601	2	363098	6345665
3	363058	6345685	4	363038	6345651
5	363049	6345606			

Emission rates by stability and wind speed, in grams/second per square metre:

Wind speeds (m/s):	< 1.5	1.5_ 3.1	3.1_ 5.1	5.1_ 8.2	8.2_10.8	>10.8
Stability A:	0.00E+00	0.00E+00	0.00E+00	1.16E-03	8.09E-03	3.82E-02
Stability B:	0.00E+00	0.00E+00	0.00E+00	1.16E-03	8.09E-03	3.82E-02
Stability C:	0.00E+00	0.00E+00	0.00E+00	1.16E-03	8.09E-03	3.82E-02
Stability D:	0.00E+00	0.00E+00	0.00E+00	1.16E-03	8.09E-03	3.82E-02
Stability E:	0.00E+00	0.00E+00	0.00E+00	1.16E-03	8.09E-03	3.82E-02
Stability F:	0.00E+00	0.00E+00	0.00E+00	1.16E-03	8.09E-03	3.82E-02

No gravitational settling or scavenging.

VOLUME SOURCE: EXCA

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
363088	6345644	0m	4m	1m	1m

Emission rates by hour of day in grams/second:

1	0.00E+00	2	0.00E+00	3	0.00E+00	4	0.00E+00
5	0.00E+00	6	0.00E+00	7	1.40E+02	8	1.40E+02
9	1.40E+02	10	1.40E+02	11	1.40E+02	12	1.40E+02
13	1.40E+02	14	1.40E+02	15	1.40E+02	16	1.40E+02
17	0.00E+00	18	0.00E+00	19	0.00E+00	20	0.00E+00
21	0.00E+00	22	0.00E+00	23	0.00E+00	24	0.00E+00

No gravitational settling or scavenging.

VOLUME SOURCE: TRULOA

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
363079	6345619	0m	4m	1m	1m

Emission rates by hour of day in grams/second:

1	0.00E+00	2	0.00E+00	3	0.00E+00	4	0.00E+00
5	0.00E+00	6	0.00E+00	7	2.33E+01	8	2.33E+01
9	2.33E+01	10	2.33E+01	11	2.33E+01	12	2.33E+01
13	2.33E+01	14	2.33E+01	15	2.33E+01	16	2.33E+01
17	0.00E+00	18	0.00E+00	19	0.00E+00	20	0.00E+00
21	0.00E+00	22	0.00E+00	23	0.00E+00	24	0.00E+00

No gravitational settling or scavenging.

VOLUME SOURCE: FEL

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
363383	6345601	0m	4m	1m	1m

Emission rates by hour of day in grams/second:

1	0.00E+00	2	0.00E+00	3	0.00E+00	4	0.00E+00
5	0.00E+00	6	0.00E+00	7	3.35E+02	8	3.35E+02
9	3.35E+02	10	3.35E+02	11	3.35E+02	12	3.35E+02
13	3.35E+02	14	3.35E+02	15	3.35E+02	16	0.00E+00
17	0.00E+00	18	0.00E+00	19	0.00E+00	20	0.00E+00
21	0.00E+00	22	0.00E+00	23	0.00E+00	24	0.00E+00

No gravitational settling or scavenging.

VOLUME SOURCE: LOASOC

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
363362	6345566	0m	4m	1m	1m

Emission rates by hour of day in grams/second:

1	4.74E+01	2	4.74E+01	3	4.74E+01	4	4.74E+01

```
  5 4.74E+01     6 4.74E+01     7 4.74E+01     8 4.74E+01
  9 4.74E+01    10 4.74E+01    11 4.74E+01    12 4.74E+01
 13 4.74E+01    14 4.74E+01    15 4.74E+01    16 4.74E+01
 17 4.74E+01    18 4.74E+01    19 4.74E+01    20 4.74E+01
 21 4.74E+01    22 4.74E+01    23 4.74E+01    24 4.74E+01

        No gravitational settling or scavenging.


         VOLUME SOURCE: CTRULO

  X(m)     Y(m)     Ground Elevation    Height   Hor. spread   Vert. spread
363352  6345571            0m             1m          0m             0m

       Emission rates by hour of day in grams/second:
  1 4.74E+00     2 4.74E+00     3 4.74E+00     4 4.74E+00
  5 4.74E+00     6 4.74E+00     7 4.74E+00     8 4.74E+00
  9 4.74E+00    10 4.74E+00    11 4.74E+00    12 4.74E+00
 13 4.74E+00    14 4.74E+00    15 4.74E+00    16 4.74E+00
 17 4.74E+00    18 4.74E+00    19 4.74E+00    20 4.74E+00
 21 4.74E+00    22 4.74E+00    23 4.74E+00    24 4.74E+00

        No gravitational settling or scavenging.


         VOLUME SOURCE: QHARD1

  X(m)     Y(m)     Ground Elevation    Height   Hor. spread   Vert. spread
363028  6345512            0m             1m          0m             0m

       Emission rates by hour of day in grams/second:
  1 0.00E+00     2 0.00E+00     3 0.00E+00     4 0.00E+00
  5 0.00E+00     6 0.00E+00     7 1.01E+02     8 1.01E+02
  9 1.01E+02    10 1.01E+02    11 1.01E+02    12 1.01E+02
 13 1.01E+02    14 1.01E+02    15 1.01E+02    16 1.01E+02
 17 0.00E+00    18 0.00E+00    19 0.00E+00    20 0.00E+00
 21 0.00E+00    22 0.00E+00    23 0.00E+00    24 0.00E+00

        No gravitational settling or scavenging.


         VOLUME SOURCE: QHARD2

  X(m)     Y(m)     Ground Elevation    Height   Hor. spread   Vert. spread
363069  6345508            0m             1m          0m             0m

       Emission rates by hour of day in grams/second:
  1 0.00E+00     2 0.00E+00     3 0.00E+00     4 0.00E+00
  5 0.00E+00     6 0.00E+00     7 1.01E+02     8 1.01E+02
  9 1.01E+02    10 1.01E+02    11 1.01E+02    12 1.01E+02
 13 1.01E+02    14 1.01E+02    15 1.01E+02    16 1.01E+02
 17 0.00E+00    18 0.00E+00    19 0.00E+00    20 0.00E+00
 21 0.00E+00    22 0.00E+00    23 0.00E+00    24 0.00E+00

        No gravitational settling or scavenging.


         VOLUME SOURCE: QHARD3

  X(m)     Y(m)     Ground Elevation    Height   Hor. spread   Vert. spread
363024  6345422            0m             1m          0m             0m

       Emission rates by hour of day in grams/second:
  1 0.00E+00     2 0.00E+00     3 0.00E+00     4 0.00E+00
  5 0.00E+00     6 0.00E+00     7 1.01E+02     8 1.01E+02
  9 1.01E+02    10 1.01E+02    11 1.01E+02    12 1.01E+02
 13 1.01E+02    14 1.01E+02    15 1.01E+02    16 1.01E+02
 17 0.00E+00    18 0.00E+00    19 0.00E+00    20 0.00E+00
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21 0.00E+00   22 0.00E+00   23 0.00E+00   24 0.00E+00

No gravitational settling or scavenging.

1

30-2497 Awaba PM10

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):

362100.m 362200.m 362300.m 362400.m 362500.m 362600.m 362700.m
362800.m 362900.m 363000.m 363100.m 363200.m 363300.m 363400.m
363500.m 363600.m 363700.m 363800.m 363900.m 364000.m 364100.m
364200.m 364300.m 364400.m 364500.m 364600.m 364700.m 364800.m
364900.m 365000.m

and these y-values (or northings):

6344000.m 6344100.m 6344200.m 6344300.m 6344400.m 6344500.m 6344600.m
6344700.m 6344800.m 6344900.m 6345000.m 6345100.m 6345200.m 6345300.m
6345400.m 6345500.m 6345600.m 6345700.m 6345800.m 6345900.m 6346000.m
6346100.m 6346200.m 6346300.m 6346400.m 6346500.m 6346600.m 6346700.m
6346800.m 6346900.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	363733	6346064	0.0	0.0	3	363220	6346274	0.0	0.0
2	363203	6346323	0.0	0.0	4	363547	6346080	0.0	0.0

METEOROLOGICAL DATA : "AUSPLUM " E M " ETFI" " L E"

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1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)

AVERAGING TIME = 24 HOURS

X (km):	362.100	362.200
Y (km)		
6346.900	4.15E+00 24,16/06/08	4.55E+00 24,16/06/08
6346.800	4.02E+00 24,16/06/08	4.83E+00 24,16/06/08
6346.700	3.59E+00 24,16/06/08	4.73E+00 24,16/06/08
6346.600	3.43E+00 24,24/12/08	4.19E+00 24,16/06/08
6346.500	3.74E+00 24,17/06/08	3.82E+00 24,24/12/08
6346.400	4.61E+00 24,17/06/08	4.35E+00 24,17/06/08
6346.300	5.16E+00 24,17/06/08	5.46E+00 24,17/06/08
6346.200	5.48E+00 24,17/06/08	6.23E+00 24,17/06/08
6346.100	6.14E+00 24,17/06/08	6.82E+00 24,17/06/08
6346.000	9.33E+00 24,04/02/08	9.06E+00 24,04/02/08
6345.900	1.22E+01 24,04/02/08	1.32E+01 24,04/02/08
6345.800	1.22E+01 24,04/02/08	1.41E+01 24,04/02/08
6345.700	1.03E+01 24,04/02/08	1.24E+01 24,04/02/08
6345.600	9.02E+00 24,04/02/08	1.13E+01 24,04/02/08
6345.500	1.03E+01 24,18/06/08	1.16E+01 24,18/06/08
6345.400	9.44E+00 24,04/02/08	1.05E+01 24,04/02/08
6345.300	6.15E+00 24,04/02/08	6.92E+00 24,29/10/08
6345.200	5.50E+00 24,16/03/08	7.03E+00 24,16/03/08

1

30-2497 Awaba TSP

Concentration or deposition	Concentration
Emission rate units	grams/second
Concentration units	microgram/m3
Units conversion factor	1.00E+03
Constant background concentration	0.00E+00
Terrain effects	None
Smooth stability class changes?	No
Other stability class adjustments ("urban modes")	None
Ignore building wake effects?	Yes
Decay coefficient (unless overridden by met. file)	0.000
Anemometer height	10 m
Roughness height at the wind vane site	0.300 m
Use the convective PDF algorithm?	No
Averaging time for sigma-theta values	60 min.

DISPERSION CURVES

Horizontal dispersion curves for sources <100m high	Sigma-theta
Vertical dispersion curves for sources <100m high	Pasquill-Gifford
Horizontal dispersion curves for sources >100m high	Briggs Rural
Vertical dispersion curves for sources >100m high	Briggs Rural
Enhance horizontal plume spreads for buoyancy?	Yes
Enhance vertical plume spreads for buoyancy?	Yes
Adjust horizontal P-G formulae for roughness height?	Yes
Adjust vertical P-G formulae for roughness height?	Yes
Roughness height	0.100m
Adjustment for wind directional shear	None

PLUME RISE OPTIONS

Gradual plume rise?	Yes
Stack-tip downwash included?	Yes
Building downwash algorithm:	PRIME method.
Entrainment coeff. for neutral & stable lapse rates	0.60,0.60
Partial penetration of elevated inversions?	No
Disregard temp. gradients in the hourly met. file?	No

and in the absence of boundary-layer potential temperature gradients given by the hourly met. file, a value from the following table (in K/m) is used:

Wind Speed Category	Stability Class A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES
Boundaries between categories (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Urban" values (unless overridden by met. file)

AVERAGING TIMES
average over all hours

1

30-2497 Awaba TSP

SOURCE CHARACTERISTICS

INTEGRATED POLYGON AREA SOURCE: MSTOC

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
363352	6345549	0m	4	4m	4m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	363352	6345549	2	363385	6345557
3	363370	6345606	4	363370	6345606

Emission rates by stability and wind speed, in grams/second per square metre:

Wind speeds (m/s):	< 1.5	1.5_ 3.1	3.1_ 5.1	5.1_ 8.2	8.2_10.8	>10.8
Stability A:	0.00E+00	0.00E+00	0.00E+00	1.16E-03	8.09E-03	3.82E-02
Stability B:	0.00E+00	0.00E+00	0.00E+00	1.16E-03	8.09E-03	3.82E-02
Stability C:	0.00E+00	0.00E+00	0.00E+00	1.16E-03	8.09E-03	3.82E-02
Stability D:	0.00E+00	0.00E+00	0.00E+00	1.16E-03	8.09E-03	3.82E-02
Stability E:	0.00E+00	0.00E+00	0.00E+00	1.16E-03	8.09E-03	3.82E-02
Stability F:	0.00E+00	0.00E+00	0.00E+00	1.16E-03	8.09E-03	3.82E-02

No gravitational settling or scavenging.

INTEGRATED POLYGON AREA SOURCE: STOEXP

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
363359	6345521	0m	7	1m	2m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	363359	6345521	2	363402	6345526
3	363408	6345579	4	363396	6345609
5	363385	6345616	6	363391	6345566
7	363354	6345537			

Emission rates by stability and wind speed, in grams/second per square metre:

Wind speeds (m/s):	< 1.5	1.5_ 3.1	3.1_ 5.1	5.1_ 8.2	8.2_10.8	>10.8
Stability A:	0.00E+00	0.00E+00	0.00E+00	1.16E-03	8.09E-03	3.82E-02
Stability B:	0.00E+00	0.00E+00	0.00E+00	1.16E-03	8.09E-03	3.82E-02
Stability C:	0.00E+00	0.00E+00	0.00E+00	1.16E-03	8.09E-03	3.82E-02
Stability D:	0.00E+00	0.00E+00	0.00E+00	1.16E-03	8.09E-03	3.82E-02
Stability E:	0.00E+00	0.00E+00	0.00E+00	1.16E-03	8.09E-03	3.82E-02
Stability F:	0.00E+00	0.00E+00	0.00E+00	1.16E-03	8.09E-03	3.82E-02

No gravitational settling or scavenging.

INTEGRATED POLYGON AREA SOURCE: QSTOEX

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
363115	6345601	0m	5	1m	2m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	363115	6345601	2	363098	6345665
3	363058	6345685	4	363038	6345651
5	363049	6345606			

Emission rates by stability and wind speed, in grams/second per square metre:

Wind speeds (m/s):	< 1.5	1.5_ 3.1	3.1_ 5.1	5.1_ 8.2	8.2_10.8	>10.8
Stability A:	0.00E+00	0.00E+00	0.00E+00	1.16E-03	8.09E-03	3.82E-02
Stability B:	0.00E+00	0.00E+00	0.00E+00	1.16E-03	8.09E-03	3.82E-02
Stability C:	0.00E+00	0.00E+00	0.00E+00	1.16E-03	8.09E-03	3.82E-02
Stability D:	0.00E+00	0.00E+00	0.00E+00	1.16E-03	8.09E-03	3.82E-02
Stability E:	0.00E+00	0.00E+00	0.00E+00	1.16E-03	8.09E-03	3.82E-02
Stability F:	0.00E+00	0.00E+00	0.00E+00	1.16E-03	8.09E-03	3.82E-02

No gravitational settling or scavenging.

VOLUME SOURCE: EXCA

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
363088	6345644	0m	4m	1m	1m

Emission rates by hour of day in grams/second:

1	0.00E+00	2	0.00E+00	3	0.00E+00	4	0.00E+00
5	0.00E+00	6	0.00E+00	7	2.92E+02	8	2.92E+02
9	2.92E+02	10	2.92E+02	11	2.92E+02	12	2.92E+02
13	2.92E+02	14	2.92E+02	15	2.92E+02	16	2.92E+02
17	0.00E+00	18	0.00E+00	19	0.00E+00	20	0.00E+00
21	0.00E+00	22	0.00E+00	23	0.00E+00	24	0.00E+00

No gravitational settling or scavenging.

VOLUME SOURCE: TRULOA

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
363079	6345619	0m	4m	1m	1m

Emission rates by hour of day in grams/second:

1	0.00E+00	2	0.00E+00	3	0.00E+00	4	0.00E+00
5	0.00E+00	6	0.00E+00	7	5.83E+01	8	5.83E+01
9	5.83E+01	10	5.83E+01	11	5.83E+01	12	5.83E+01
13	5.83E+01	14	5.83E+01	15	5.83E+01	16	5.83E+01
17	0.00E+00	18	0.00E+00	19	0.00E+00	20	0.00E+00
21	0.00E+00	22	0.00E+00	23	0.00E+00	24	0.00E+00

No gravitational settling or scavenging.

VOLUME SOURCE: FEL

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
363383	6345601	0m	4m	1m	1m

Emission rates by hour of day in grams/second:

1	0.00E+00	2	0.00E+00	3	0.00E+00	4	0.00E+00
5	0.00E+00	6	0.00E+00	7	6.98E+02	8	6.98E+02
9	6.98E+02	10	6.98E+02	11	6.98E+02	12	6.98E+02
13	6.98E+02	14	6.98E+02	15	6.98E+02	16	0.00E+00
17	0.00E+00	18	0.00E+00	19	0.00E+00	20	0.00E+00
21	0.00E+00	22	0.00E+00	23	0.00E+00	24	0.00E+00

No gravitational settling or scavenging.

VOLUME SOURCE: LOASOC

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
363362	6345566	0m	4m	1m	1m

Emission rates by hour of day in grams/second:

1	1.12E+02	2	1.12E+02	3	1.12E+02	4	1.12E+02

5 1.12E+02	6 1.12E+02	7 1.12E+02	8 1.12E+02
9 1.12E+02	10 1.12E+02	11 1.12E+02	12 1.12E+02
13 1.12E+02	14 1.12E+02	15 1.12E+02	16 1.12E+02
17 1.12E+02	18 1.12E+02	19 1.12E+02	20 1.12E+02
21 1.12E+02	22 1.12E+02	23 1.12E+02	24 1.12E+02

No gravitational settling or scavenging.

VOLUME SOURCE: CTRULO

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
363352	6345571	0m	1m	0m	0m

Emission rates by hour of day in grams/second:

1 1.12E+01	2 1.12E+01	3 1.12E+01	4 1.12E+01
5 1.12E+01	6 1.12E+01	7 1.12E+01	8 1.12E+01
9 1.12E+01	10 1.12E+01	11 1.12E+01	12 1.12E+01
13 1.12E+01	14 1.12E+01	15 1.12E+01	16 1.12E+01
17 1.12E+01	18 1.12E+01	19 1.12E+01	20 1.12E+01
21 1.12E+01	22 1.12E+01	23 1.12E+01	24 1.12E+01

No gravitational settling or scavenging.

VOLUME SOURCE: QHARD1

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
363028	6345512	0m	1m	0m	0m

Emission rates by hour of day in grams/second:

1 0.00E+00	2 0.00E+00	3 0.00E+00	4 0.00E+00
5 0.00E+00	6 0.00E+00	7 3.77E+02	8 3.77E+02
9 3.77E+02	10 3.77E+02	11 3.77E+02	12 3.77E+02
13 3.77E+02	14 3.77E+02	15 3.77E+02	16 3.77E+02
17 0.00E+00	18 0.00E+00	19 0.00E+00	20 0.00E+00
21 0.00E+00	22 0.00E+00	23 0.00E+00	24 0.00E+00

No gravitational settling or scavenging.

VOLUME SOURCE: QHARD2

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
363069	6345508	0m	1m	0m	0m

Emission rates by hour of day in grams/second:

1 0.00E+00	2 0.00E+00	3 0.00E+00	4 0.00E+00
5 0.00E+00	6 0.00E+00	7 3.77E+02	8 3.77E+02
9 3.77E+02	10 3.77E+02	11 3.77E+02	12 3.77E+02
13 3.77E+02	14 3.77E+02	15 3.77E+02	16 3.77E+02
17 0.00E+00	18 0.00E+00	19 0.00E+00	20 0.00E+00
21 0.00E+00	22 0.00E+00	23 0.00E+00	24 0.00E+00

No gravitational settling or scavenging.

VOLUME SOURCE: QHARD3

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
363024	6345422	0m	1m	0m	0m

Emission rates by hour of day in grams/second:

1 0.00E+00	2 0.00E+00	3 0.00E+00	4 0.00E+00
5 0.00E+00	6 0.00E+00	7 3.77E+02	8 3.77E+02
9 3.77E+02	10 3.77E+02	11 3.77E+02	12 3.77E+02
13 3.77E+02	14 3.77E+02	15 3.77E+02	16 3.77E+02
17 0.00E+00	18 0.00E+00	19 0.00E+00	20 0.00E+00

21 0.00E+00   22 0.00E+00   23 0.00E+00   24 0.00E+00

No gravitational settling or scavenging.

1

30-2497 Awaba TSP

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):
362100.m 362200.m 362300.m 362400.m 362500.m 362600.m 362700.m
362800.m 362900.m 363000.m 363100.m 363200.m 363300.m 363400.m
363500.m 363600.m 363700.m 363800.m 363900.m 364000.m 364100.m
364200.m 364300.m 364400.m 364500.m 364600.m 364700.m 364800.m
364900.m 365000.m

and these y-values (or northings):
6344000.m 6344100.m 6344200.m 6344300.m 6344400.m 6344500.m 6344600.m
6344700.m 6344800.m 6344900.m 6345000.m 6345100.m 6345200.m 6345300.m
6345400.m 6345500.m 6345600.m 6345700.m 6345800.m 6345900.m 6346000.m
6346100.m 6346200.m 6346300.m 6346400.m 6346500.m 6346600.m 6346700.m
6346800.m 6346900.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	363733	6346064	0.0	0.0	3	363220	6346274	0.0	0.0
2	363203	6346323	0.0	0.0	4	363547	6346080	0.0	0.0

METEOROLOGICAL DATA : "AUSPLUM " E M " ETFI" " L E"

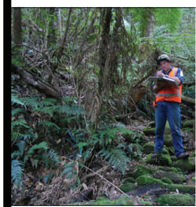
AVERAGE OVER ALL HOURS AND FOR ALL SOURCES
in microgram/m3

Y (km) \ X (km):	362.100	362.200	362.300	362.400	362.500	362.600
6346.900	1.17E+00	1.29E+00	1.40E+00	1.53E+00	1.67E+00	1.74E+00
6346.800	1.22E+00	1.35E+00	1.49E+00	1.63E+00	1.80E+00	1.92E+00
6346.700	1.26E+00	1.40E+00	1.56E+00	1.74E+00	1.93E+00	2.12E+00
6346.600	1.30E+00	1.46E+00	1.64E+00	1.85E+00	2.09E+00	2.32E+00
6346.500	1.34E+00	1.52E+00	1.73E+00	1.96E+00	2.24E+00	2.55E+00
6346.400	1.35E+00	1.56E+00	1.81E+00	2.09E+00	2.40E+00	2.79E+00
6346.300	1.36E+00	1.58E+00	1.86E+00	2.21E+00	2.61E+00	3.06E+00
6346.200	1.37E+00	1.59E+00	1.89E+00	2.27E+00	2.80E+00	3.40E+00
6346.100	1.40E+00	1.62E+00	1.92E+00	2.34E+00	2.91E+00	3.72E+00
6346.000	1.44E+00	1.67E+00	1.98E+00	2.42E+00	3.03E+00	3.95E+00
6345.900	1.48E+00	1.74E+00	2.08E+00	2.53E+00	3.20E+00	4.20E+00
6345.800	1.44E+00	1.72E+00	2.10E+00	2.64E+00	3.41E+00	4.56E+00
6345.700	1.36E+00	1.63E+00	2.00E+00	2.54E+00	3.35E+00	4.67E+00
6345.600	1.28E+00	1.54E+00	1.89E+00	2.40E+00	3.19E+00	4.51E+00
6345.500	1.22E+00	1.44E+00	1.76E+00	2.20E+00	2.90E+00	4.04E+00
6345.400	1.17E+00	1.37E+00	1.64E+00	2.01E+00	2.55E+00	3.41E+00
6345.300	1.04E+00	1.20E+00	1.41E+00	1.70E+00	2.09E+00	2.65E+00
6345.200	9.25E-01	1.06E+00	1.22E+00	1.41E+00	1.66E+00	1.98E+00
6345.100	8.21E-01	9.12E-01	1.02E+00	1.15E+00	1.30E+00	1.49E+00

ECOLOGY IMPACT ASSESSMENT








APPENDIX 11

Centennial Coal

Awaba Colliery Mining Project

Part 3A Application Ecology Assessment

HUNTER ECO

FUTURE POWER | Centennial Coal

Centennial Coal

Awaba Colliery Mining Project

Part 3A Application Ecology Assessment

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HUNTER ECO

Colin Driscoll

Colin Driscoll
Environmental Biologist
NPWS Scientific Licence S10565

April 2010

Executive Summary

The proposed Project is currently anticipated to recover approximately 2.0 million tonnes of coal which will be extracted from those areas depicted in Study Area 2 and Study Area 3 over a period of approximately five years or more, depending on actual mining conditions and relevant market drivers.

No changes are proposed to the current coal handling, preparation or stockpile procedures to the existing operations. Minimal changes are proposed to existing surface operations, with a proposed additional surface disturbance within a disturbed area relating to increased Pollution Control Dam (PCD) capacity. 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 to utilise existing ancillary surface facilities (all **Study Areas**);
- Expand the existing final 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**).

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). 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.

The end result of the mining will be 44 voids of varying dimensions spanned by conglomerate rock. As the spanning conglomerate, supporting pillars and floor take up the load it is estimated that surface subsidence will be a maximum of 200 mm and this subsidence would be the main source of any ecological impact. An extreme event would be if the spanning conglomerate failed, an event termed 'plug failure', which would result in a 2 m deep hole in the ground the width and length of the original void.

Five vegetation communities were mapped across the mined area with one being a listed Endangered Ecological Community (EEC). The EEC, *Swamp Sclerophyll Forest on Coastal Floodplains*, would also be classed as a groundwater dependent ecosystem (GDE). The threatened plant *Tetratheca juncea* has been recorded in some of the subsidence areas. There were no records for *Grevillea parviflora* subsp *parviflora* or *Cryptostylis hunteriana* although suitable habitat for these species was present. A desktop review indicated that the area could be used by several species of threatened fauna.

It was determined that there would be no impact on threatened species or downstream GDE's as a consequence of the predicted amount of subsidence even in the unlikely worst case scenario of a total collapse of the spanning conglomerate.

TABLE OF CONTENTS

FIGURES

TABLES

DOCUMENT DETAILS

Name:	Awaba Mining Project - Ecology
Author:	Colin Driscoll – HUNTER ECO
Reference:	
Revision No.:	
Document Status	Final

APPROVAL DETAILS

Revision No.	Date Sent	Details of Approval	Approved By	Approval Date
0	9 July 2010			
1	23 July 2010			
2	6 September 2010			
3	9 September 2010			

CIRCULATION DETAILS

Name	Department	No of Final Approved Copies

Centennial Coal

Awaba Colliery Mining Project

Part 3A Application Ecology Assessment

1.0 Introduction

1.1 Background

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 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 site is situated on crown land under lease to Centennial for the purpose of mining under Consolidated Coal Lease CCL746, and is adjacent to the Newstan-Eraring haul road owned by Eraring Energy. The locality of the mine is illustrated on **Figure 1**.

Awaba Colliery is a small operation with approximately 100 employees and contractors, 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.

A form of pillar extraction of narrow panels is used to recover coal in pillars developed previously by bord and pillar methods. 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 has been developed in consultation with the Department of Primary Industries – Mineral Resources (now known as Industry and Investment, NSW (I&I)) and has been used successfully to date, and is proposed to be continued for the Project.

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. A detailed description of the Project and the **Project Application Area (*the "Application Area"*)** (including focus study areas) is detailed further in **Sections 1.2 and 1.3** below.

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 outlined in **Sections 1.2** and **1.3** below.

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 (refer **Section 1.2.1**) over a period of approximately five years or more, depending on actual mining conditions and relevant market drivers.

The application for the proposed Project is supported by an Environmental Assessment ("EA").

1.2 Project application area

The **Project Application Area** (the "Application Area") is illustrated on **Figure 1**. 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 1.2.1**. 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.

1.2.1 Study areas

The Study Areas that have been assessed as part of this EA are shown on **Figure 2** 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**); 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 Section 96(1A) of 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 will also be addressed in the EA.

1.3 Project description

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 to utilise existing ancillary surface facilities (all **Study Areas**);
- Expand the existing final 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 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**.

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**:

- **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).

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 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 NSW in 2009, until such time that a final Detailed Life of Mine Strategy has been developed.

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

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. Existing mining areas will continue to be utilised for ongoing mining operations including (but not limited to) mine access, emergency management and underground services and infrastructure.

Continuing Mine Operations:
For the purposes of environmental assessment, further to the information above regarding continued mining areas, it is noted that the following aspects of mine operations are proposed to continue and remain <u>unchanged</u>. Existing mining operations are presented in detail in Section 3 of the *Environmental Assessment (EA)* and, where relevant, components are discussed further in this specialist report.

- **Coal Handling, preparation and stockpiles** – No changes are proposed to the current coal handling, preparation or stockpile procedures to the existing operations;

- **Mine support facilities and site access** – No changes are proposed to the current infrastructure and facilities, with the only exclusion being the expansion of the Pollution Control Dam (PCD) mentioned earlier above, with related water management considerations. Mine access from Wilton Road will continue to be utilised and no significant change is anticipated from current use;

- **Plant and equipment** – No changes are proposed to the typical plant and equipment used at the Awaba Colliery;

- **Transportation procedures** – 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;

- **Mining methodology** – There will be no significant changes to current mining methods 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 (financial year), depending on mining efficiency and market demands;

- **Operational water management** – 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;

- **Mine dewatering procedures** – the10 South Bore will continue to be used for groundwater management and dewatering during both continued operation and care and maintenance conditions.

1.4 Scope and objectives of this report

This ecological report has been prepared according to the Draft Guidelines for Threatened Species Assessment under Part 3A of the *Environmental Planning and Assessment Act 1979* (DECC & DoP 2005). The investigation is specifically targeted at the land that would be subject to subsidence, this being the only event having the potential for ecological impact.

1.5 General impact area description

The area over which subsidence would occur is about 90 ha of fully vegetated forest with a well-developed shrub and ground layer. The proposed workings lie under a system of ridges of elevation around 50 - 90 m AHD. The primary catchment is that of Stony Creek which flows north, ultimately into Lake Macquarie (**Figure 3**). The Stony Creek catchment is about 220 ha and originates to the south of the mining areas. A mining buffer has been set from creek centreline of 50 m for 3rd order streams and 30 m for 2nd order streams (**Figure 2**). Mining has also been excluded from areas having cover (depth from surface to coal seam) of 25 m or less.

The soils are predominantly the Awaba Associated Landscape derived from the Narrabeen Group - Munmorah Conglomerate Formation. These soils are characterised by high levels of stoniness, high permeability, high erodability and low fertility (Matthei 1995).

FIGURE 1

The application area (red) in a regional context

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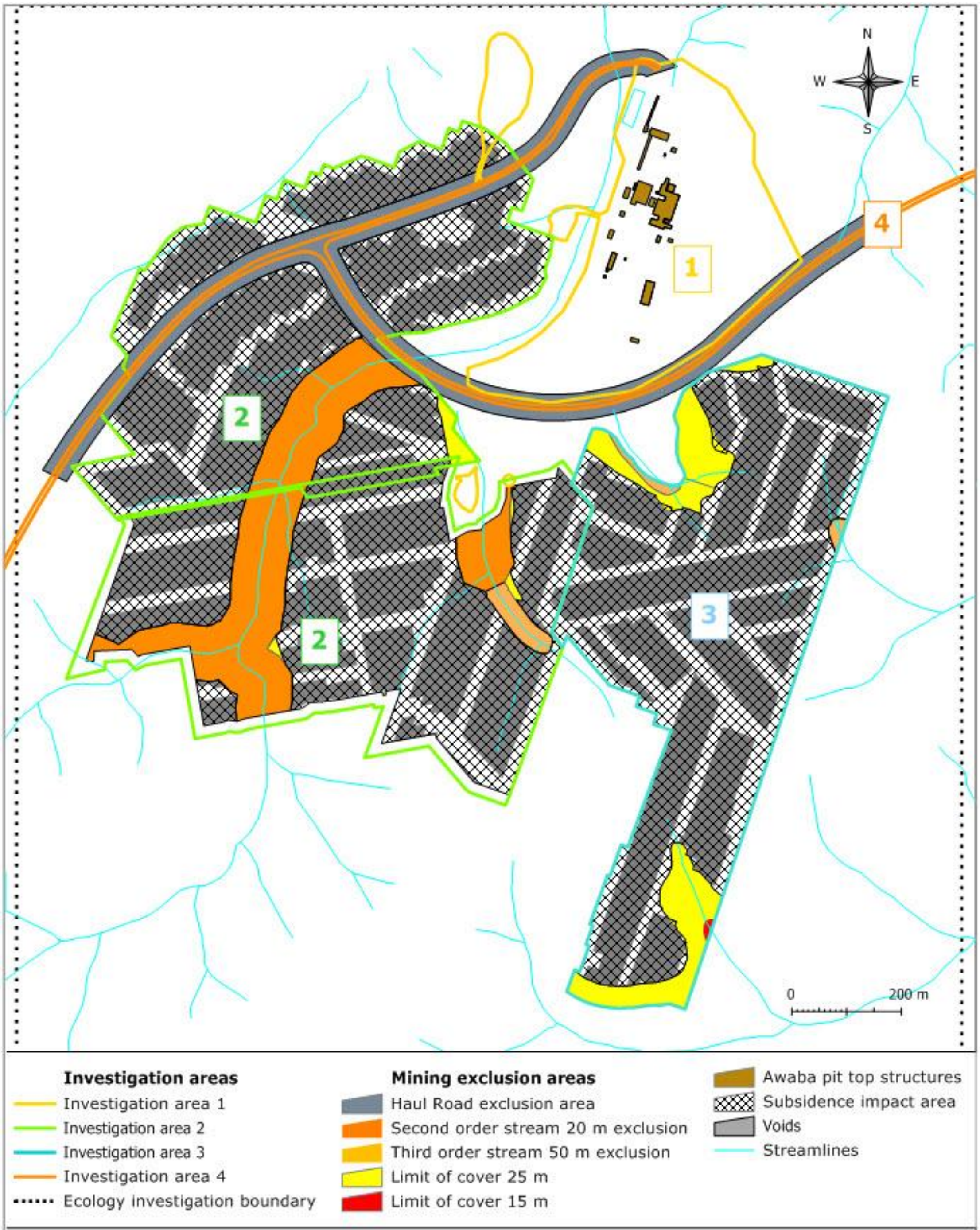

FIGURE 2

Components of the project and study areas

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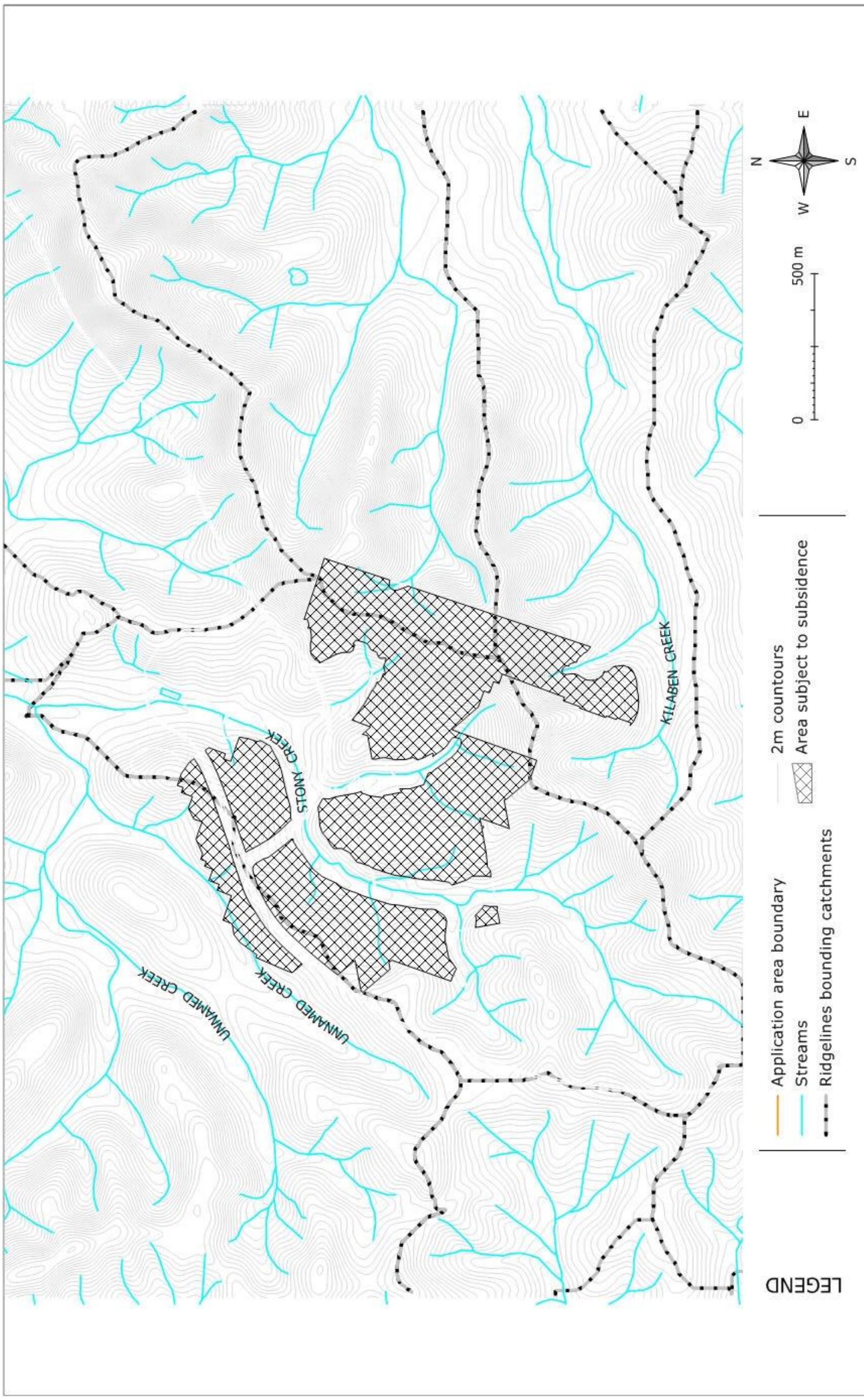

FIGURE 3

Catchments and creeklines

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2.0 Methods

In order to assess the potential for ecological impacts by the subsidence, vegetation communities were classified and mapped across the subsidence area which was included within a wider ecology investigation area (**Figure 2**). Any threatened species of flora or fauna were recorded during the field work. 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.

Given that there would be no habitat clearing and that the only impact would be surface deformation up to a maximum predicted of 200 mm, no fauna trapping or targeted field searches for fauna were conducted. For the purposes of an impact assessment, all fauna species that would be likely to occur in the surface habitat types were assumed to be present.

2.1 Vegetation community mapping

Recent ground-truthed vegetation mapping of the area and threatened flora records (Hunter Eco 2008) were used for this project. The vegetation community map was prepared using the ground-truthing methods described in DECC (2008a). In principle the method involves recording the dominant species in the canopy, shrub and ground structural layers at a number of locations across an area. These data points are termed Rapid Data Points (RDP). This data is then given a community code that matches the classification found in the NPWS (2000) model, commonly referred to as the REMS or HCCREMS data. The RDP data is then extrapolated across the investigation area in a GIS and the polygons refined using aerial photographic interpretation all the while remaining true to the RDP ground-truthed data.

In order to better define the location of the Stony Creek riparian communities the path of the drainage line was walked and plotted using a hand-held GPS.

2.2 Threatened species and communities - NSW State

Threatened species and communities considered here were those listed in the NSW *Threatened Species Conservation Act 1995* (TSC ACT).

The threatened species present in any area are dependant on the habitat types represented. As a guide to the threatened species that might be present in the investigation area data was obtained from the NPWS Atlas of NSW Wildlife for an area within 10 km of the investigation area boundary.

The species listed in the 10 km data were assessed against their known habitat preferences (DECC 2008b) and the habitat found to be present as a result of the vegetation mapping. The location of any threatened species observed during the field work was recorded.

2.3 Threatened species and communities - Commonwealth

Threatened species and communities considered here were those listed in the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Potential Commonwealth listed threatened species for the application area were extracted using the protected matters research tool (http://www.environment.gov.au/erin/ert/epbc/index.html) for a 10 km bounding box centred on the application area.

3.0 Threatened species assessment results

3.1 Probable threatened species – NSW State

Table 1 lists the species of threatened flora recorded in the Atlas of NSW Wildlife from within a 10 km radius of the subject site. The likelihood of occurrence on the subject site, given the habitat types present, is evaluated.

Table 1 Threatened species from the Atlas of NSW Wildlife

Common Name	Scientific Name	Likelihood of presence
	FLORA	
Bynoe's Wattle	*Acacia bynoeana*	Marginal habitat
Charmhaven Apple	*Angophora inopina*	Unsuitable habitat
Netted Bottle Brush	*Callistemon linearifolius*	Grows in dry sclerophyll forest
Leafless Tongue Orchid	*Cryptostylis hunteriana*	Suitable habitat
Small-flowered Grevillea	*Grevillea parviflora subsp. parviflora*	Suitable habitat
Biconvex Paperbark	*Melaleuca biconvexa*	Suitable habitat
Heath Wrinklewort	*Rutidosis heterogama*	Grows in heath on sandy soils and moist open forest areas
Black-eyed Susan	***Tetratheca juncea***	**Suitable habitat (Recorded present)**
	AMPHIBIANS	
Wallum Froglet	*Crinia tinnula*	No suitable habitat
Giant Burrowing Frog	*Heleioporus australiacus*	Needs heath or open forest in sandy soils, no suitable habitat
Green And Golden Bell Frog	*Litoria aurea*	Inhabit marches, dams, streams having rushes and open water, no suitable habitat
Green-thighed Frog	*Litoria brevipalmata*	Need flood-prone grassy areas & grassy semi-permanent ponds, no suitable habitat
Stuttering Barred Frog	*Mixophyes balbus*	Inhabits rainforest & wet tall open forest, no suitable habitat
Giant Barred Frog	*Mixophyes iteratus*	Inhabit rainforest, moist forest having flowing rocky streams, no suitable habitat
Red-crowned Toadlet	*Pseudophryne australis*	Occur in open forests on Hawkesbury or Narrabeen sandstone, no suitable habitat
	REPTILES	
Pale-headed Snake	*Hoplocephalus bitorquatus*	Dry eucalypt forest and woodland. Suitable habitat present.
Stephen's Banded Snake	*Hoplocephalus Stephensii*	Eucalypt forest, possible suitable habitat
Rosenberg's Goanna	*Varanus rosenbergi*	Inhabits heath and open forest. Termite mounds are a critical component of habitat. No suitable habitat

	BIRDS	
Australian Bittern	*Botaurus poiciloptilus*	A wetland bird, no suitable habitat
Bush Stone-curlew	*Burhinus grallarius*	Inhabits open forest/woodland with sparse groundcover, no suitable habitat
Gang-gang Cockatoo	*Callocephalon fimbriatum*	A possible winter migrant from tall mountain forests and woodlands.
Glossy Black Cockatoo	*Calyptorhynchus lathami*	Suitable foraging habitat in the *Allocasuarina* species.
Brown Treecreeper	*Climacteris picumnus ssp. victoriae*	Generally unsuitable habitat with the shrub and ground layers too dense.
Varied Sittella	*Daphoenositta chrysoptera*	Suitable habitat
Black-necked Stork	*Ephippiorhynchus asiaticus*	A wetland bird, no suitable habitat
Little Lorikeet	*Glossopsitta pusilla*	Suitable foraging habitat in flowering eucalypts and bloodwoods
Black Bittern	*Ixobrychus flavicollis*	A wetland bird, no suitable habitat
Comb-crested Jacana	*Irediparra gallinacea*	A wetland bird, no suitable habitat
Swift Parrot	*Lathamus discolor*	Suitable foraging habitat in flowering Swamp Mahogany
Square-tailed Kite	*Lophoictinia isura*	A preference for timbered watercourses, no suitable habitat
Black-chinned Honeyeater (eastern subspecies)	*Melithreptus gularis ssp. gularis*	Prefers Box/Ironbark woodlands, generally unsuitable habitat
Powerful Owl	*Ninox strenua*	Suitable foraging habitat throughout; possibility of breeding hollows in some large trees.
Osprey	*Pandion haliaetus*	Possible use of large trees for nesting purposes.
Grey-crowned Babbler (eastern subspecies)	*Pomatostomus temporalis ssp. temporalis*	Inhabits open forest/woodland with sparse groundcover, no suitable habitat
Superb Fruit-dove	*Ptilinopus superbus*	A rainforest species, no suitable habitat
Speckled Warbler	*Pyrrholaemus saggitatus*	Inhabits open forest/woodland with sparse groundcover, no suitable habitat
Masked Owl	*Tyto novaehollandiae*	Suitable habitat in the open woodlands of the MU30 and MU31 communities along with suitable breeding hollows.
Sooty Owl	*Tyto tenebricosa*	Generally unsuitable habitat with the bird preferring dense mesic gullies.
Regent Honeyeater	*Xanthomyza phrygia*	Suitable foraging habitat in flowering Swamp Mahogany
	MAMMALS	
Eastern Pygmy-possum	*Cercartetus nanus*	Prefers heathy woodlands, possible suitable habitat in the Scribbly Gum woodland
Large-eared Pied Bat	*Chalinolobus dwyeri*	Well-timbered habitat containing gullies. Generally unsuitable habitat.
Spotted-tailed Quoll	*Dasyurus maculatus*	Probable foraging habitat.
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	Moist habitat with trees >20m tall. Marginal habitat
Golden-tipped Bat	*Kerivoula papuensis*	Inhabits rainforest and adjacent forest. No suitable habitat
Parma Wallaby	*Macropus parma*	Moist dense shrubby forest adjoining grassy areas. No suitable habitat.
Little Bentwing-bat	*Miniopterus australis*	Moist forest, rainforest, dense coastal banksia scrub. No suitable habitat
Eastern Bent-wing Bat	*Miniopterus schreibersii subsp. oceanensis*	Forested areas. Suitable habitat.
Eastern Freetail bat	*Mormopterus*	A variety of forest types. Suitable habitat

	norfolkensis	present.
Large-footed Myotis	*Myotis adversus*	The Fishing Bat and needs forested habitat close to water. No suitable habitat.
Squirrel Glider	*Petaurus norfolcensis*	Suitable habitat
Koala	*Phascolarctos cinereus*	Marginal habitat, very few eucalypt feed tree species
Yellow-bellied Glider	*Petaurus australis*	Prefers tall mature eucalypt forests in nutrient rich soils, no suitable habitat
Brush-tailed Rock-wallaby	*Petrogale penicillata*	Needs rocky escarpments, no suitable habitat
Long-nosed Potoroo	*Potorous tridactylus*	A variety of forest types. Suitable habitat present.
Grey-headed Flying-fox	*Pteropus poliocephalus*	Foraging habitat wherever eucalypts or bloodwoods blossom across the subject site.
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	A variety of forest types. Suitable habitat present.
Greater Broad-nosed Bat	*Scoteanax rueppellii*	A variety of forest types. Suitable habitat present.
Eastern Cave Bat	*Vespadelus troughtoni*	A variety of forest types. Suitable habitat present.

3.2 Probable threatened species – Commonwealth

Table 2 lists the species of threatened flora obtained from the protected matters search tool for the area within 5 km of the application area.

Table 2 Commonwealth listed species from the protected matters search tool (extracted 31/3/10)

Species	Common Name	Status	Likelihood of presence
	FLORA		
Acacia bynoeana	Bynoe's Wattle	V	Present locally
Angophora inopina	Charmhaven Apple	V	Present locally
Cryptostylis hunteriana	Leafless Tongue-orchid	V	Suitable habitat
Grevillea parviflora subsp. parviflora	Small-flower Grevillea	V	Present in subject site
Melaleuca biconvexa	Biconvex Paperbark	V	Limited suitable habitat in Swamp Sclerophyll forest
Rhizanthella slateri	Eastern Underground Orchid	E	No suitable habitat. Nearest records are 60 km away
Syzygium paniculatum	Magenta Lilly Pilly	V	Limited suitable habitat
Tetratheca juncea	Black-eyed Susan	V	Present in subject site
	BIRDS		
Rostratula australis	Australian Painted Snipe	E	No suitable habitat – a wetland species
Anthochaera phrygia	Regent Honeyeater	V	Suitable foraging habitat in flowering Swamp Mahogany
Lathamus discolor	Swift Parrot	E	Suitable foraging habitat in flowering Swamp Mahogany
	MARSUPIALS		
Dasyurus maculatus maculatus	Spotted-tailed Quoll	E	Suitable habitat
Potorous tridactylus tridactylus	Long-nosed Potoroo (SE mainland)	V	Suitable habitat
Petrogale penicillata	Brush-tailed Rock-wallaby	V	No suitable habitat. Needs rocky escarpments

	MEGACHIROPTERAN BATS		
Pteropus poliocephalus	Grey-headed Flying-fox	V	Foraging habitat wherever eucalypts or bloodwoods blossom across the subject site.
	MICROCHIROPTERAN BATS		
Chalinolobus dwyeri	Large-eared Pied Bat	V	Suitable habitat
	AMPHIBIANS		
Heleioporus australiacus	Giant Burrowing Frog	V	No suitable habitat – needs heath or open forest in sandy soils
Litoria aurea	Green and Golden Bell Frog	V	No suitable habitat – needs open reedy swamps/dams
Litoria littlejohni	Littlejohn's Tree Frog	V	No suitable habitat – needs sandstone woodland & heath habitat at higher altitudes
Mixophyes iteratus	Giant Barred Frog	E	No suitable habitat – needs deep damp leaf litter in wet forest

3.3 Migratory species – Commonwealth

In addition to listed threatened species, migratory birds is also a matter of Commonwealth significance. **Table 3** lists the migratory species, all birds, obtained from the protected matters search tool for a 10 km area centred on the subject site.

Table 3 Commonwealth listed migratory species from the protected matters search tool (extracted 31/3/10)

Scientific Name	Common Name	Likelihood of occurrence
Anthochaera phrygia	Regent Honeyeater	Suitable foraging habitat in flowering Swamp Mahogany
Haliaeetus leucogaster	White-bellied Sea-Eagle	Forages along lakes and waterways but could be suitable nesting habitat in tall eucalypts
Hirundapus caudacutus	White-throated Needletail	An aerial forager not coming to ground
Merops ornatus	Rainbow Bee-eater	No suitable habitat. Needs sandy eroded banks for nesting and forages in open woodland
Monarcha melanopsis	Black-faced Monarch	Suitable habitat particularly in riparian areas
Myiagra cyanoleuca	Satin Flycatcher	Suitable habitat
Rhipidura rufifrons	Rufous Fantail	Suitable habitat

4.0 Field survey results

4.1 Vegetation communities

Five vegetation communities were present on the subject site (**Figure 3**). **Table 4** lists these communities and their areas.

Table 4 Vegetation communities mapped across the subject site

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

MU15 Coastal Foothills Spotted Gum – Ironbark Forest

Canopy: dominated by *Corymbia maculata* and *Eucalyptus globoidea* along with locally abundant *Eucalyptus piperita, Eucalyptus umbra, Eucalyptus paniculata* or *Eucalyptus punctata*.

Shrubs: varying proportions of *Dodonaea triquetra, Doryanthes excelsa, Pultenaea villosa, Acacia ulicifolia, Acacia terminalis,* and *Podolobium ilicifolium*.

Ground: dominated by *Entolasia stricta, Themeda australis* and *Imperata cylindrica*.

MU30 Coastal Plains Smooth-barked Apple Woodland

Canopy: dominated by *Angophora costata, Eucalyptus capitellata* and *Corymbia gummifera* along with locally abundant *Eucalyptus piperita, Eucalyptus umbra, Eucalyptus resinifera* and *Allocasuarina torulosa*. Disturbance areas frequently had a dense midstorey of *Allocasuarina littoralis*.

Shrubs: the shrub content varied with position in the landscape with elevated drier areas being dominated by *Banksia spinulosa, Dillwynia retorta, Pultenaea retusa, Lambertia formosa* and *Podolobium ilicifolium*. On the sheltered lower slopes the dominant shrubs were *Leptospermum trinervium, Leptospermum polygalifolium* and *Doryanthes excelsa*.

Ground: dominated in varying proportions by *Entolasia stricta, Themeda australis, Joycea pallida* and *Xanthorrhoea latifolia*.

MU31 Coastal Plains Scribbly Gum Woodland

Canopy: dominated by *Eucalyptus haemastoma, Eucalyptus capitellata* and *Corymbia gummifera*. One small area located on a ridge in the northeast of the subject site contained *Eucalyptus racemosa* as the scribbly gum component and another area on the eastern side contained the threatened *Angophora inopina*. Disturbance areas frequently had a dense midstorey of *Allocasuarina littoralis*.

Shrub: The shrub content varied with position in the landscape with elevated drier areas being dominated in varying proportions by *Banksia spinulosa, Banksia obtusifolia* and *Lambertia formosa*. Along with *Isopogon anemonifolius, Hakea laevipes, Persoonia levis* and *Bossiaea obcordata*. On sheltered lower slopes, upper drainage lines and drainage basins dominant species were *Hakea bakeriana*, *Leptospermum trinervium, Leptospermum polygalifolium, Leptospermum juniperinum, Melaleuca sieberi* and *Gahnia clarkei*.

Ground: dominated in varying proportions by *Entolasia stricta, Themeda australis, Ptilothryx deusta*, *Xanthorrhoea latifolia*, *Joycea pallida* and *Anisopogon avenaceus*.

MU37 Swamp Mahogany – Paperbark Forest (EEC)
The composition of this community is consistent with the listed EEC *Swamp Sclerophyll Forest on Coastal Floodplains*. Winning (2008) conducted a detailed assessment of the vegetation of Stony Creek and drew the same conclusion.

Canopy: Scattered *Eucalyptus robusta* with a mid-canopy of *Melaleuca linariifolia, Melaleuca styphelioides, Melaleuca sieberi* and in places mesic species such as *Syzygium oleosum, Acmena smithii* and *Glochidion ferdinandi*.
Shrub: dominated by *Leptospermum polygalifolium, Leptospermum juniperinum* and *Gahnia clarkei* and *Prostanthera incisa*.
Ground: ground cover was generally sparse due to the dense shrub and canopy layers however sedges such as *Empodisma minus* were present in some areas.

Undefined Riparian
This is a community of the lower slopes and upper drainage lines. It is described as undefined because there is no equivalent in the NPWS (2000) classification.
Canopy: dominated in varying proportions by *Eucalyptus piperita, Eucalyptus resinifera* and *Angophora costata*. A mid canopy of the paperbarks *Melaleuca linariifolia* and *Melaleuca styphelioides* was also present in wetter areas.
Shrub: dominated in varying proportions by *Acacia longifolia, Callicoma serratifolia*, *Leptospermum polygalifolium, Leptospermum juniperinum* and *Gahnia clarkei*.
Ground: dominated by *Themeda australis* and *Entolasia stricta* and in more moist areas a variety of sedges.

4.2 Groundwater dependent ecosystems

Groundwater dependent ecosystems (GDE), as the name implies, are specialised ecosystems that rely on the persistence of groundwater. Australasian Groundwater & Environmental Consultants conducted a survey of the Stony Creek alluvium (AGEC 2008) and found that an unconfined groundwater aquifer existed in the alluvial bed of Stony Creek along the strip that contains riparian vegetation (**Figure 4**). 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 and off site as water accumulates.

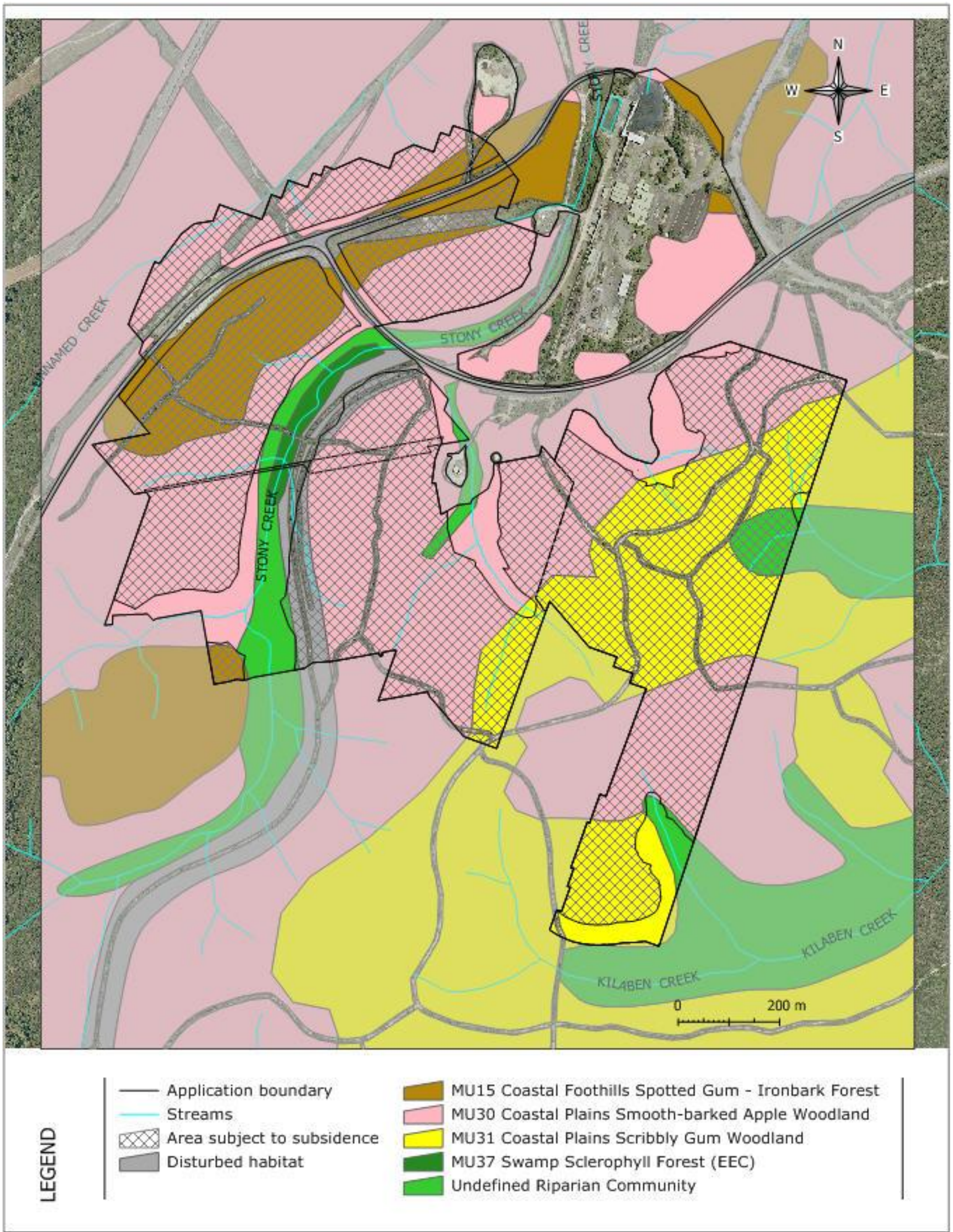

FIGURE 4

Map of the vegetation in and around the application area

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4.3 Threatened flora

Both *Tetratheca juncea* and *Grevillea parviflora* subsp. *parviflora* have been recorded within the subsidence area or in surrounding areas (**Figure 5**). No *Cryptostylis hunteriana, Angophora inopina*, *Melaleuca biconvexa* or *Acacia bynoeana* were recorded during field surveys although the latter has been recorded in several areas to the east of the application area.

4.4 Threatened fauna

Two threatened fauna species, Glossy Black-Cockatoo and Little Lorikeet have been recorded just to the south of the main application areas (**Figure 5**). No species of threatened fauna were recorded on the subject site during field surveys. However the available habitat types suggest that several threatened species in addition to the two mentioned above, could use the site as part of a foraging area or home range. The most likely species would be insectivorous bats, Squirrel Glider and one or more of the large forest owls.

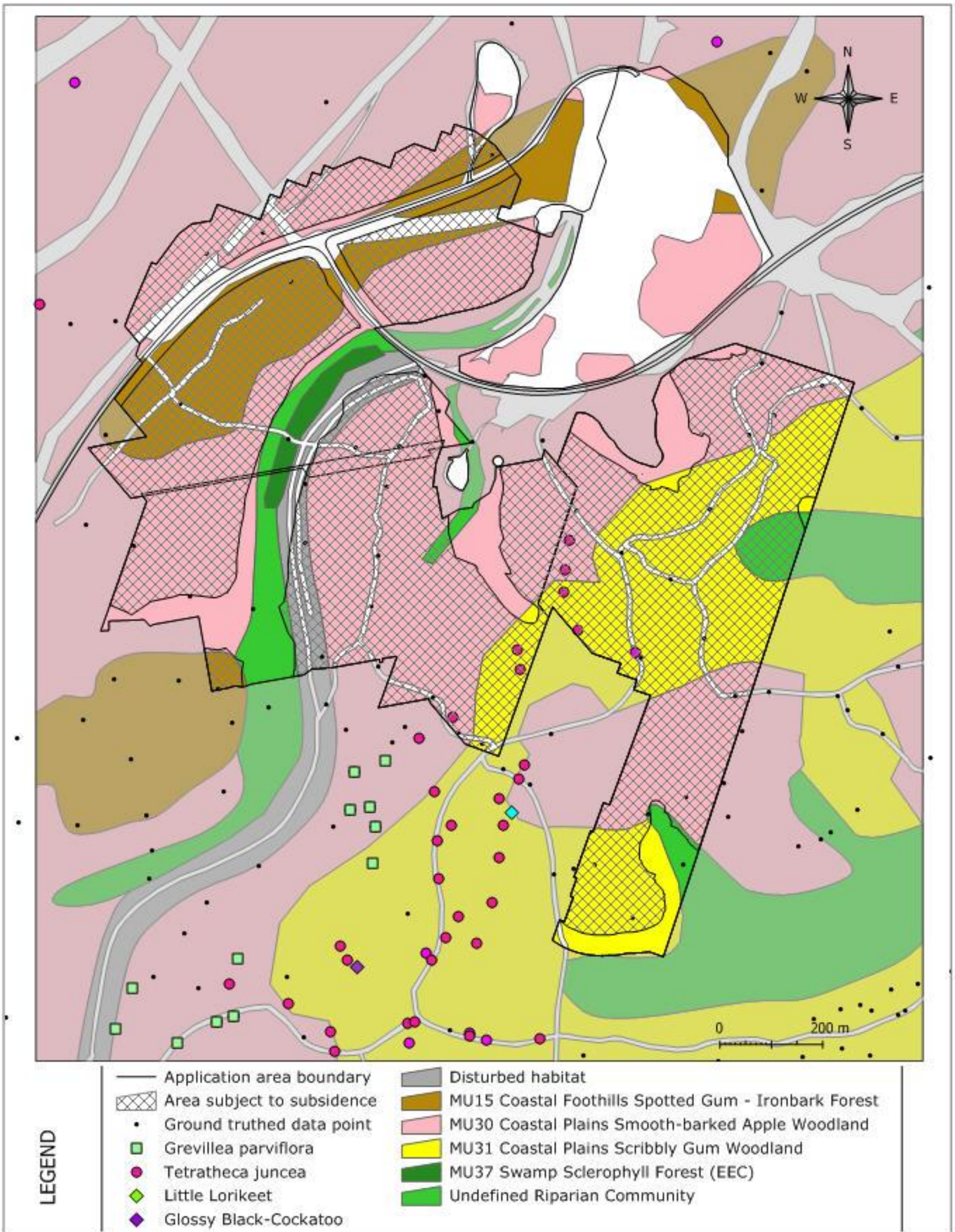

FIGURE 5

Threatened species records in and around the application area

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5.0 Subsidence impact – expected scenario

Subsidence would need to result in major changes to the surface hydrology of an area for there to be a significant impact on ecosystems. Such impacts are generally associated with subsidence from long-wall mining (not used at Awaba Colliery) where subsidence in the order of metres can occur with bed cracking often occurring as a result of tilts and strains. The mine plan has been developed conservatively so that the majority of subsidence across the subject site would be a maximum of 200 mm comprising of surface deformation only (no cracking).

Detailed assessment of the impact of the expected levels of subsidence on specific threatened species can be found in Appendix 1, NSW listed threatened species, and Appendix 2, Commonwealth listed threatened species.

5.1 Vegetation communities

The three main vegetation communities MU15, MU30 and MU31 are hardy, dry sclerophyll vegetation and a small change in the surface would have no impact on their viability.

Groundwater dependent 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 NSW TSC Act.

The 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. This vegetation would be groundwater dependent.

Downstream (off site) impacts should also be considered as GDE's develop as a result of the cumulative increase in groundwater water availability. The overall slopes on the subject site 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.

5.2 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, additional to the recorded locations. Both species are hardy and the small expected surface deviation would not threaten any local population with extinction. For example, both species can be found in regularly slashed powerline easements or immediately beside forest trails.

5.3 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.

5.4 Habitat connectivity

As there would be no vegetation clearing there would be no change to habitat connectivity as a consequence of the underground mining and associated small level of surface deformation.

6.0 Subsidence impact – worst case scenario

As previously described, at the completion of mining voids will remain which are supported by pillars of coal and are spanned by a layer of conglomerate rock, on top of which sits the surface soil and vegetation. These voids will range in size from 45 – 96 m wide and 80 – 580 m long with the longer voids being of narrower width. The subsidence at the surface results from the spanning conglomerate taking up the strain across the void and by the supporting pillars being compressed into the material on which they are standing.

The mining plan has been designed to take into account both past experience and sensitive areas. Historically, serious levels of subsidence have only occurred where cover depths were less than 15 m and, allowing a safety margin, mining will not be carried out under areas where the depth of cover is below 25 m. Buffers have been provided along 2nd and 3rd order creeks to eliminate the possibility of subsidence of any magnitude impacting directly on the flow in these creeks (See **Figure 2** above).

A Strata Failure Management Plan has been prepared that provides strategies for checking the strength of the roof and floor to make sure that they fit within the mine design guidelines. A Watercourse Management Plan and a Public Safety Management Plan have been prepared that detail the appropriate responses to any significant surface changes.

While the mine plan has been designed such that the probability of such an event is low, it is possible that the spanning conglomerate can fail to hold the load. The point of failure would be at the edges of the void and is catastrophic resulting in the entire piece of spanning conglomerate shearing and falling into the void. This is known as a 'plug failure' and occurs without warning and takes about 2 seconds. The end result is an approximately 2 m hole in the ground with sheer sides and with the original surface vegetation at the bottom of the hole.

There would be several ecological consequences of unremediated plug failure:

- Changes to the micro-environment could result in the loss of any individual threatened species;
- The sheer-sided cavities would become a potential pit trap for terrestrial fauna species;
- The hydrology of the surface would be altered with rainfall flowing into the cavity and flowing into the underground mine workings. This would have both local impacts as well as downstream impacts.

At this point in time it is not possible to be specific about remediation or impacts. Options for remediation would involve the cavities being filled back to the original surface or cavity edges being sealed and battered leaving a sunken area. Stormwater diversion channels could be cut above the affected area to divert water from soaking through into the old workings. This could result in the loss of any threatened flora species growing in the original habitat. There would also be the possibility of trees with habitat hollows being lost along with any occupants.

The odds of all 44 voids failing together are so low as to make the event virtually improbable. For this assessment the single void having the worst-case impact on ecology or hydrology was selected and **Figure 6** shows the selected voids. There was no engineering evaluation as to which of the 44 voids would have the highest failure risk.

6.1 Ecology

The void selected as likely to have the greatest ecological impact was the one with the largest surface area being 3.74 ha.

The two vegetation communities which would be impacted by plug failure would be *Coastal Plains Smooth-barked Apple Woodland* and *Coastal Plains Scribbly Gum Woodland*. *Tetratheca juncea* is known to occur in the area above this void and it is also possible for *Grevillea parviflora* subsp *parviflora* and *Cryptostylis hunteriana* to occur.

The mobility of threatened fauna means that they would not be impacted directly by a plug failure.

6.2 Hydrology

The hydrological (or water) cycle consists of inputs:

- Precipitation, generally rainfall although under the right circumstances mist condensing on foliage also contributes;
- Infiltration, the fallen rain moves into the surface. The infiltration rate is dependent on a number of factors such as the vegetation structure and density, soil type, the level of soil saturation, time since last wetting, rainfall intensity. Overland flow will occur when input exceeds the infiltration rate;
- Percolation, the water moves down through the substrate by way of capillary action and breaks in the physical structure. Factors involved here are particle size, contraction cracking, plant root action, soil fauna activity; and,
- Groundwater flow, finally the water accumulates against an impermeable barrier such as bedrock and if unconstrained, flows along a gravity gradient.

And losses:

- Transpiration, water being released back into the atmosphere through plant respiration processes; and,
- Evaporation, direct evaporation back into the atmosphere. This can occur from the canopy and from the ground.

The vegetation in any area is in part the product of the net hydrological cycle for that area; of course there are other factors such as soil type that influence composition of species. 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 dry conditions or where water accumulates and more water dependent vegetation develops.

Australian vegetation is adapted to extreme conditions and any change in conditions needs to become permanent for a change in vegetation type to become established. Even periodic replenishment can be sufficient to maintain a particular community such as a GDE.

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 the case where a catastrophic plug failure occurs, the water cycle is impacted by the loss of flow from the area of subsided surface into the mine workings. In addition to the subsided surface, water is also lost from any areas of unsubsided surface that are upstream from the subsided areas as water from these areas will flow into the subsided areas.

The void which would have the greatest impact on flow in Stony Creek (**Figure 6**) would result in the loss of 4% of flow into the downstream EEC; there would be no impact on the smaller upstream patch of EEC.

6.3 The impact of plug failure

It is difficult to be precise about the impact of plug failure in advance of the event. However, the preceding information shows that the maximum impact of a sustained failure would be low both on the hydrology and ecology of the affected areas. In fact a failure would need to be remediated primarily for safety reasons and so the event would not result in a sustained impact.

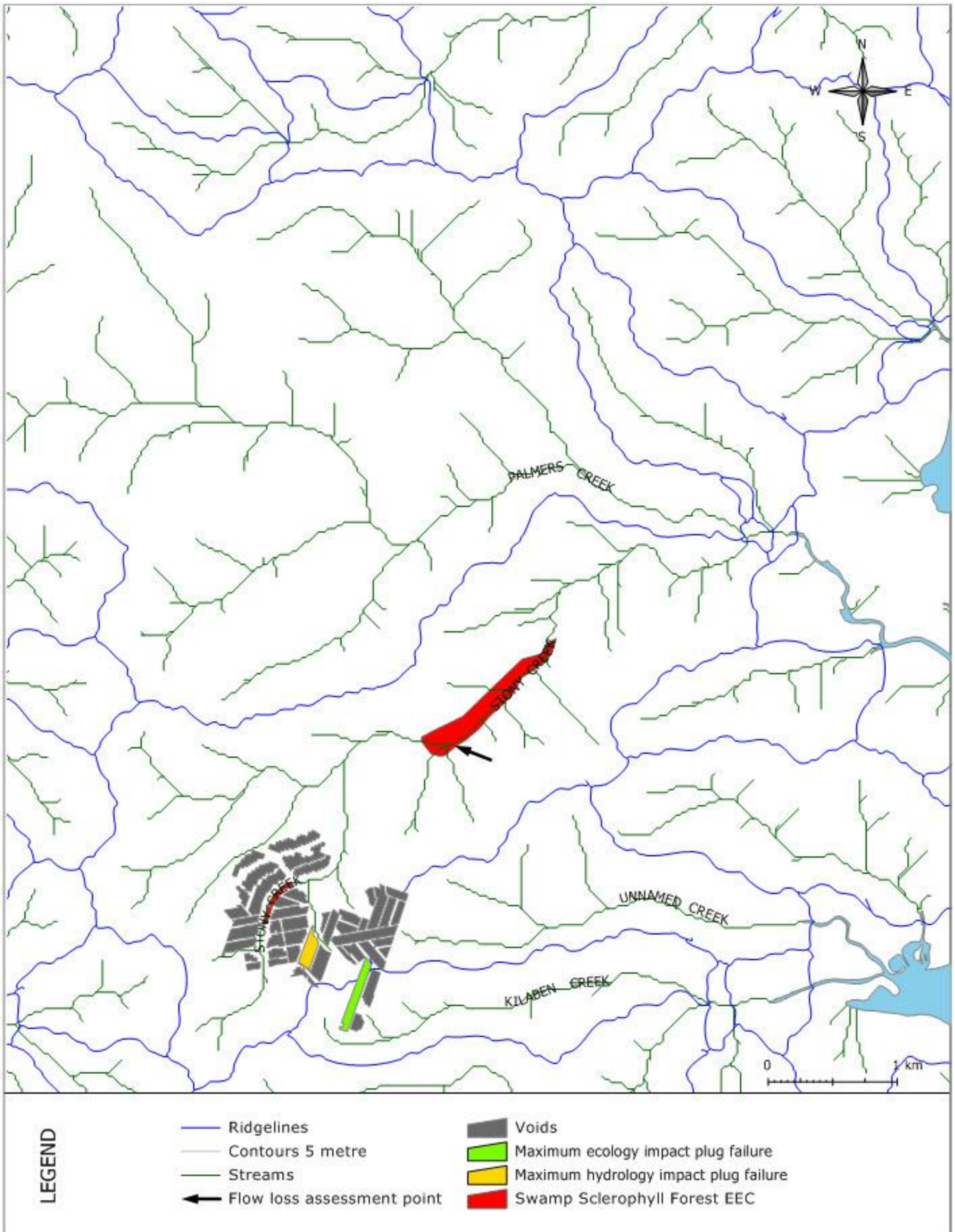

FIGURE 6

The components of the plug failure impact analysis

HUNTER ECO

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Appendix 1 Species and communities, impact assessments

NSW State assessment

The disturbance

Maximum predicted subsidence across the subject site of 200 mm comprising of surface deformation only (no cracking).

Impact assessment

This section examines the possible impact of the predicted level of subsidence on threatened species and endangered communities. An impact assessment is conducted as provided for in the Draft Guidelines for Threatened Species Assessment (DECC & DPI 2005).

A review of threatened species profiles (DECC 2008b) shows that there were threatened species that could be found on the subject site under different conditions to those prevailing at the time of this investigation or could be found in similar habitat in the immediate region. An impact assessment was applied to these species.

FLORA

Tetratheca juncea

a) How is the proposal likely to affect the lifecycle of a threatened species and/or population?

No threatened populations were present.

To affect the lifecycle of a plant species, an impact would need to significantly adversely impact on growing conditions, lower pollinator population and activity or restrict dispersal vectors. The expected level of subsidence would not result in alteration to overall habitat attributes and in turn, there would be no affect on the lifecycle of *Tetratheca juncea*.

b) How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The expected level of subsidence would not result in alteration to overall habitat attributes.

c) Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

Tetratheca juncea is not at the limit of its distribution at this location. The species is found from Wyong to Bulahdelah.

d) How is the proposal likely to affect current disturbance regimes?

There would be no alteration to current disturbance regimes as no habitat clearing would be involved and the expected level of subsidence would not alter the existing habitat.

e) How is the proposal likely to affect habitat connectivity?

The existing connectivity would be maintained.

f) How is the proposal likely to affect critical habitat?

No critical habitat was present.

Acacia bynoeana

a) How is the proposal likely to affect the lifecycle of a threatened species and/or population?

No threatened populations were present.

To affect the lifecycle of a plant species, an impact would need to significantly adversely impact on growing conditions, lower pollinator population and activity or restrict dispersal vectors. The expected level of subsidence would not result in alteration to overall habitat attributes and in turn, there would be no affect on the lifecycle of *Acacia bynoeana*.

b) How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The expected level of subsidence would not result in alteration to overall habitat attributes.

c) Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

Acacia bynoeana is not at the limit of its distribution at this location. The species is found from Nowra to North Rothbury and west to Lithgow.

d) How is the proposal likely to affect current disturbance regimes?

There would be no alteration to current disturbance regimes as no habitat clearing would be involved and the expected level of subsidence would not alter the existing habitat.

e) How is the proposal likely to affect habitat connectivity?

The existing connectivity would be maintained.

f) How is the proposal likely to affect critical habitat?

No critical habitat was present.

Cryptostylis hunteriana

a) How is the proposal likely to affect the lifecycle of a threatened species and/or population?

No threatened populations were present.

To affect the lifecycle of a plant species, an impact would need to significantly adversely impact on growing conditions, lower pollinator population and activity or restrict dispersal vectors. The expected level of subsidence would not result in alteration to overall habitat attributes and in turn, there would be no affect on the lifecycle of *Cryptostylis hunteriana*.

b) How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The expected level of subsidence would not result in alteration to overall habitat attributes.

c) Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

Cryptostylis hunteriana is not at the limit of its distribution at this location. The species is found from Victoria to Queensland.

d) How is the proposal likely to affect current disturbance regimes?

There would be no alteration to current disturbance regimes as no habitat clearing would be involved and the expected level of subsidence would not alter the existing habitat.

e) How is the proposal likely to affect habitat connectivity?

The existing connectivity would be maintained.

f) How is the proposal likely to affect critical habitat?

No critical habitat was present.

Grevillea parviflora subsp parviflora

a) How is the proposal likely to affect the lifecycle of a threatened species and/or population?

No threatened populations were present.

To affect the lifecycle of a plant species, an impact would need to significantly adversely impact on growing conditions, lower pollinator population and activity or restrict dispersal vectors. The expected level of subsidence would not result in alteration to overall habitat attributes and in turn, there would be no affect on the lifecycle of *Grevillea parviflora* subsp *parviflora.*

b) How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The expected level of subsidence would not result in alteration to overall habitat attributes.

c) Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

Grevillea parviflora subsp *parviflora* is not at the limit of its distribution at this location. The species is found from south of Sydney to the Port Stephens area.

d) How is the proposal likely to affect current disturbance regimes?

There would be no alteration to current disturbance regimes as no habitat clearing would be involved and the expected level of subsidence would not alter the existing habitat.

e) How is the proposal likely to affect habitat connectivity?

The existing connectivity would be maintained.

f) How is the proposal likely to affect critical habitat?

No critical habitat was present.

ENDANGERED ECOLOGICAL COMMUNITIES

Swamp Sclerophyll Forest on Coastal Floodplains

a) How is the proposal likely to affect the lifecycle of a threatened species and/or population?

Not applicable

b) How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The SSFCF community is totally dependent on the shallow groundwater in the Stony Creek drainage line. The mine plan has been designed to provide a 50 m buffer either side of the creek centreline so that there will be no subsidence in the creek bed itself and so no risk of bed cracking and subsequent loss of water. There will be subsidence in a part of the Stony Creek catchment however the small scale of this subsidence will not reduce the amount of water flowing from rain events or subsurface base flow.

c) Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

Not applicable.

d) How is the proposal likely to affect current disturbance regimes?

There would be no alteration to current disturbance regimes.

e) How is the proposal likely to affect habitat connectivity?

Habitat connectivity would not be altered.

f) How is the proposal likely to affect critical habitat?

No critical habitat was present.

FAUNA

A generic test has been prepared for the following fauna species that were considered as occurring or likely to occur across the subsidence area:

Birds
Gang-gang Cockatoo
Glossy Black-Cockatoo
Little Lorikeet
Masked Owl
Osprey
Powerful Owl
Regent Honeyeater
Swift Parrot
Varied Sittella
Marsupials
Spotted-tailed Quoll
Squirrel Glider
Megachiropteran Bats
Grey-headed Flying-fox
Microchiropteran Bats
Eastern Freetail-bat
Eastern Bentwing-bat
Eastern False Pipistrelle
Greater Broad-nosed Bat
Little Bentwing-bat

These species are highly mobile, have large home ranges or are itinerant opportunists.

a) How is the proposal likely to affect the lifecycle of a threatened species and/or population?

No threatened populations were present.

In order to significantly impact on the lifecycle of any of these species there would need to be a substantial loss of habitat or habitat quality such that foraging resources were reduced, roosting or denning habitat was lost or exposure to predators was increased. The level of expected subsidence would not impact negatively on any of these necessary habitat attributes to the extent of affecting the lifecycle of these species.

b) How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

There would be no alteration to the habitat for any of these threatened species.

c) Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

None of these species would be at the limit of their known distribution.

d) How is the proposal likely to affect current disturbance regimes?

Current disturbance regimes would not be altered.

e) How is the proposal likely to affect habitat connectivity?

Habitat connectivity would not be altered.

f) How is the proposal likely to affect critical habitat?

No critical habitat was present.

Appendix 2 Species and communities, impact assessments

Commonwealth assessment

The disturbance

Maximum predicted subsidence across the subject site of 200 mm comprising of surface deformation only (no cracking).

Impact assessment

This section examines the possible impact of the predicted level of subsidence on threatened species and endangered communities. Matters of national significance protected under the EPBC Act 1999 are as follows:

- World Heritage properties
- National heritage places
- Wetlands of international importance (Ramsar wetlands)
- Threatened species and ecological communities
- Migratory species
- Commonwealth marine areas
- Nuclear actions (including uranium mining)

There are two relevant matters of national significance for the Awaba project: Threatened species (there are no nationally listed EEC's present); and, Migratory species.

Impact assessment criteria are provided in EPBC Act Policy Statement 1.1 (EPBC 2006).

FLORA

Vulnerable species

The following vulnerable species were considered as possibly occurring in the application area:

Acacia bynoeana
Angophora inopina
Cryptostylis hunteriana
**Grevillea parviflora subsp. parviflora*
Melaleuca biconvexa
Syzygium paniculatum
**Tetratheca juncea*
*Known to occur

Significant impact criteria

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

- **lead to a long-term decrease in the size of an important population of a species;**

The expected level of subsidence would not have any impact on habitat or foraging resources that would lead to a long-term decrease in the population size of these species.

- **reduce the area of occupancy of an important population;**

The expected level of subsidence would not have any impact on habitat or foraging resources that would lead to a reduction in the area of occupancy of these species.

- **fragment an existing important population into two or more populations;**

No habitat clearing is involved so no population fragmentation would occur.

- **adversely affect habitat critical to the survival of a species;**

There would be no impact on habitat critical to the survival of the species.

- **disrupt the breeding cycle of an important population;**

The breeding cycles of these species would not be disrupted by the subsidence.

- **modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;**

There would be no alteration to habitat resulting from the expected level of subsidence.

- **result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;**

There would be no habitat alteration resulting from the expected level of subsidence that would result in invasive species becoming established.

- **introduce disease that may cause the species to decline; or**

No diseases would be introduced.

- **interfere substantially with the recovery of the species.**

The expected level of subsidence would not interfere with the recovery of the species.

FAUNA

Critically endangered and endangered species

Two endangered species were considered as possibly occurring in the application area:

Swift Parrot
Spotted-tailed Quoll

Significant impact criteria

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

- **lead to a long-term decrease in the size of a population;**

The expected level of subsidence would not have any impact on habitat or foraging resources that would lead to a long-term decrease in the population size of these species.

- **reduce the area of occupancy of the species;**

The expected level of subsidence would not have any impact on habitat or foraging resources that would lead to a reduction in the area of occupancy of these species.

- **fragment an existing population into two or more populations;**

No habitat clearing is involved so no population fragmentation would occur.

- **adversely affect habitat critical to the survival of a species;**

There would be no impact on habitat critical to the survival of the species.

- **disrupt the breeding cycle of a population;**

The breeding cycles of these species would not be disrupted by the subsidence.

- **modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;**

There would be no alteration to habitat resulting from the expected level of subsidence.

- **result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat;**

There would be no habitat alteration resulting from the expected level of subsidence that would result in invasive species becoming established.

- **introduce disease that may cause the species to decline; or**

No diseases would be introduced.

- **interfere with the recovery of the species.**

The expected level of subsidence would not interfere with the recovery of the species.

Vulnerable species

Three vulnerable species were considered as possibly occurring in the application area:

Regent Honeyeater
Grey-headed Flying-fox
Large-eared Pied Bat

Significant impact criteria

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

- **lead to a long-term decrease in the size of an important population of a species;**

The expected level of subsidence would not have any impact on habitat or foraging resources that would lead to a long-term decrease in the population size of these species.

- **reduce the area of occupancy of an important population;**

The expected level of subsidence would not have any impact on habitat or foraging resources that would lead to a reduction in the area of occupancy of these species.

- **fragment an existing important population into two or more populations;**

No habitat clearing is involved so no population fragmentation would occur.

- **adversely affect habitat critical to the survival of a species;**

There would be no impact on habitat critical to the survival of the species.

- **disrupt the breeding cycle of an important population;**

The breeding cycles of these species would not be disrupted by the subsidence.

- **modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;**

There would be no alteration to habitat resulting from the expected level of subsidence.

- **result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;**

There would be no habitat alteration resulting from the expected level of subsidence that would result in invasive species becoming established.

- **introduce disease that may cause the species to decline; or**

No diseases would be introduced.

- **interfere substantially with the recovery of the species.**

The expected level of subsidence would not interfere with the recovery of the species.

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