Bombala Quarry Expansion
Environmental Impact Statement

Draft Final for Stakeholder Review
Volume II

Boral Resources (Country) Pty Ltd

July 2006

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Delivering sustainable solutions in a more competitive world

Approved by:	*Alex McDonald*
Position:	Project Manager
Signed:	
Date:	*July 2006*
Approved by:	*Karl Rosen*
Position:	Project Director
Signed:	Karl Rosen
Date:	*July 2006*

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FINAL DRAFT REPORT

Boral Resources (Country) Pty Ltd

Bombala Quarry Expansion

Environmental Impact Statement

July 2006

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Annex A

EIS Study Team

STUDY TEAM

This EIS has been prepared by ERM in association with Boral Resources (Country). The study team responsible for both inputs to and the preparation of this EIS are as follows.

Company / Consultant	Area of Responsibility
Boral Resources (Country)	
Wes Martini	Business Development Manager
Grenville Pollington	Senior Geologist / Quarry Plan
Tom Behrens	Bombala Quarry Production Manager
Environmental Resources Management (ERM)	
Karl Rosen	Project Director
Alex McDonald	Project Manager / EIS Preparation
Mike Shelly	Technical Expert / EIS Review
Jodi Kelehear	EIS Preparation
Andy Berelowitz	EIS Preparation
Geoff Herman	Surface Water Assessment / Strategic Advice
Kate Stephens	Surface Water Assessment / Concept Design
Katie Moroney	Air Quality
Troy Powell	Air Quality
Kell Pearsal	Planning Framework, Socio-Economics
Joanne Woodhouse	Ecology
Jacqui Couglan	Ecology
Magaesh Naidu	Noise and Vibration
Najah Ishac	Noise and Vibration
Janne Lamb	Heritage
Neville Baker	Heritage
Paul Hodkinson	GIS
Michelle Lorimer	Graphics
Cherie Henderson	Administrator

Annex B

Government Agency Consultation

NSW GOVERNMENT
Department of Planning

Mining & Extractive Industries
Major Development Assessment
Phone: (02) 9228 6487
Fax: (02) 9228 6466
Email: **david.kitto@dipnr.nsw.gov.au**
Level 4 Western Gallery
23-33 Bridge Street
GPO Box 39
SYDNEY NSW 2001

Our ref: Q92/00085

Environmental Resources Management Australia		
Referred to:		
Date Received	18 JAN 2006	
Checked By: AM	Date 21-2-06	

Mr Mike Shelly
Environmental Resources Management Australia
PO Box 71
THORNTON NSW 2322

Dear Mr Shelly

Proposed Expansion of the Bombala Quarry

I refer to your request for the Director-General's requirements for the preparation of an Environmental Impact Statement (EIS) for the proposed expansion of the Bombala Quarry in the Bombala local government area.

Statutory Issues
Attachment No. 1 outlines the statutory matters that must be included in any EIS under clauses 71 and 72 of the *Environmental Planning and Assessment Regulation 2000* (the Regulation).

Specific Issues
Under clause 73 (1) of the Regulation, the Director-General requires the EIS to address the following specific issues:

- **Description of the Proposal:** The EIS must include a full description of the proposal, clearly identifying the resource, the proposed site, the proposed works and intensity of operations and relationship to the existing extraction operations.
- **Justification for the Proposal:** The EIS must include a detailed justification of the proposal.
- **Environmental Planning Instruments:** The EIS must assess the proposal against the relevant provisions of *State Environmental Planning Policy No. 11 – Traffic Generating Developments; State Environmental Planning Policy No. 33 – Hazardous and Offensive Developments; State Environmental Planning Policy No. 44 – Koala Habitat Protection; State Environmental Planning Policy No. 55 – Remediation of Land; Bombala Local Environmental Plan 1990* and relevant development control plans and section 94 plans.
- **Key Issues:** The EIS must assess the following potential impacts of the proposal during construction and operation, and describe what measures would be implemented to manage, mitigate or off-set these potential impacts:
  - noise;
  - blasting and vibration;
  - air quality;
  - water quality (including surface water and ground water);
  - traffic and transport;
  - flora and fauna (particularly critical habitats; threatened species, populations or ecological communities, or their habitats);
  - heritage (both Aboriginal and non-Aboriginal);
  - waste management;
  - visual;
  - utilities and services; and
  - social and economic.
- **Rehabilitation and Final Land Use:** The EIS must:
  - justify the final land use in relation to the strategic land use objectives for the area;
  - describe in detail how the site would be progressively rehabilitated; and
  - describe what measures would be put in place for the ongoing management of the site following cessation of extraction activities, including consideration of the most appropriate mechanisms for securing sufficient resources for the implementation of these measures in the long term.
- **Environmental Monitoring and Management:** The EIS must describe in detail how the environmental performance of the proposal would be monitored and managed over time.

Guidelines
During the preparation of the EIS, you must consult the Department's EIS Guideline - *Extractive Industries – Quarries.*

The EIS guideline is available for purchase from the Department's Information Centre, 23-33 Bridge Street, Sydney or by calling 1300 305 695.

Integrated Development
Under section 91 of the *Environmental Planning and Assessment Act 1979* the development is "integrated development" if it requires certain approvals in addition to development consent before it may be carried out.

In your Form A, you indicated that your proposal will require an additional approval under the *Protection of the Environment Operations Act* 1997. The Department of Environment and Conservation have provided their requirements for the proposal (see Attachment No. 2) and these must be addressed in the EIS.

If further integrated approvals are identified before the Development Application (DA) is lodged, you must conduct your own consultation with the relevant agencies, and address their requirements in the EIS.

When you lodge your DA for the proposal, you must include:
- At least one copy of the DA and supporting information for each of the integrated approval bodies; and
- Cheques for $250, made payable to each of the integrated approval bodies.

Consultation
During the preparation of the EIS, you must consult the relevant local, State and Commonwealth government authorities, service providers and community groups, and address any issues they may raise in the EIS. In particular, you should consult the surrounding landowners and occupiers that are likely to be impacted by the proposal. Details of the consultations carried out and issues raised must be included in the EIS.

The Commonwealth Environment Protection and Biodiversity Conservation Act
If your proposal contains any actions that could have a significant impact on matters of National Environmental Significance, then it will require an additional approval under the Commonwealth *Environment Protection Biodiversity Conservation Act 1999 (EPBC Act).* These approvals are in addition to any approvals required under NSW legislation. If you have any questions about the application of the EPBC Act to your proposal, you should contact the Department of the Environment and Heritage in Canberra ((02) 6274 1111 or www.deh.gov.au).

Administration
You should note that if the DA to which these requirements relate is not made within two years of the date of this letter, you must re-consult with the Director-General prior to lodging the application.

Enquiries
If you have any enquiries about the above, please contact Michael Young on (02) 9228 6437.

Yours sincerely

DKitto 10/1/06

David Kitto
A/Director
Major Development Assessment

As delegate of the Director-General

ATTACHMENT NO. 1

STATUTORY REQUIREMENTS FOR THE PREPARATION OF AN ENVIRONMENTAL IMPACT STATEMENT UNDER PART 4 OF THE ENVIRONMENTAL PLANNING AND ASSESSMENT ACT 1979

In accordance with the *Environmental Planning and Assessment Act 1979* (the Act), an environmental impact statement (EIS) must meet the following requirements.

Content of EIS

Pursuant to Schedule 2 and clause 72 of the *Environmental Planning and Assessment Regulation 2000* (the Regulation), an EIS must include:

1. A summary of the environmental impact statement.
2. A statement of the objectives of the development or activity.
3. An analysis of any feasible alternatives to the carrying out of the development or activity, having regard to its objectives, including the consequences of not carrying out the development or activity.
4. An analysis of the development or activity, including:
   (a) a full description of the development or activity; and
   (b) a general description of the environment likely to be affected by the development or activity, together with a detailed description of those aspects of the environment that are likely to be significantly affected; and
   (c) the likely impact on the environment of the development or activity, and
   (d) a full description of the measures proposed to mitigate any adverse effects of the development or activity on the environment, and
   (e) a list of any approvals that must be obtained under any Act or law before the development or activity may be lawfully carried out.
5. A compilation, (in a single section of the environmental impact statement) of the measures referred to in item 4(d).
6. The reasons justifying the carrying out of the development or activity in the manner proposed, having regard to biophysical, economic and social considerations, including the following principles of ecologically sustainable development:
   (a) The precautionary principle - namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.
   In the application of the precautionary principle, public and private decisions should be guided by:
      (i) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and
      (ii) an assessment of the risk-weighted consequences of various options,
   (b) Inter-generational equity - namely, that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations,
   (c) Conservation of biological diversity and ecological integrity, namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration,
   (d) Improved valuation, pricing and incentive mechanisms, namely, that environmental factors should be included in the valuation of assets and services, such as:
      (i) polluter pays, that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,
      (ii) the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste,
      (iii) environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.

An environmental impact statement referred to in Section 78A(8) of the Act shall be prepared in written form. The prescribed form to accompany the environmental impact statement must comply with the requirements of clause 71 of the Regulation and be signed by the person who has prepared it.

Procedures for public exhibition of the EIS are set down in clauses 77 to 81 of the Regulation.

Attention is also drawn to clause 283 of the Regulation regarding false or misleading statements in EISs.

Note

If the development application to which the EIS relates is not made within 2 years from the date of issue of the Director-General's requirements, under clause 73(6) of the Regulation the proponent is required to re-consult with the Director-General.

– ✧ –

Department of
Environment and Conservation (NSW)

Our reference : 290768A1

Mr David Kitto
A/Director
Major Development Assessment
Department of Planning
GPO Box 39
Sydney NSW 2001

Received
8 DEC 2005
Major Development Assessme
OSDAA

Dear Mr Kitto,

Integrated Development Application (IDA)
Bombala Hard Rock Quarry. DGR ID No: 181

I refer to your letter dated 24 November 2005, in relation to the proposed expansion of the Bombala Hard Rock Quarry, requesting the Department of Environment and Conservation (DEC) requirements for the Environmental Impact Statement (EIS) for the proposal.

The DEC emphasises the importance of ensuring that it is provided with all necessary information essential to its determination of the proposal and preparation of General Terms of Approval (GTAs), and appreciates the opportunity of providing its information requirements for the subject proposal.

The DEC has considered the details of the proposal as provided by the Department of Planning (DoP) and has identified the information required to issue GTAs in Attachments A and C. In summary, the DEC's key information requirements for the proposal are in regard to:

- Noise;
- Air quality, particularly dust;
- Water quality;
- General waste management;
- Cultural Heritage; and,
- Fauna and flora (including Threatened Species)

A fauna and flora survey is required as part of the EIS and prepared in accordance with Attachment B. If threatened species or their habitat are found or likely to occur in the area, an assessment under Part 5A of the *Environmental Planning and Assessment Act 1979* is required. This work should be undertaken by qualified ecologists who are familiar with the flora, fauna and endangered ecological communities that occur in the Bombala council area. The potential for removal of any extant forest/woodland or natural temperate grassland in a largely cleared landscape should be specifically addressed in the EIS.

An Aboriginal Cultural Heritage survey will also be required as part of the EIS preparation on all areas that may be impacted by all phases of the proposal. This work should be undertaken by a qualified archaeologist in accordance with the NSW National Parks and Wildlife Service (NPWS) "Aboriginal Cultural Heritage: Standards and Guidelines" kit. Should any Aboriginal objects be found and likely to be impacted upon by the proposal, then the proponent must apply for a Section 90 Consent issued under the *National Parks and Wildlife Act 1974*.

Based upon the information provide to the DEC, the applicant will require an Environment Protection Licence for scheduled development works and carrying out the scheduled activity of the quarry. All aspects of the proposal need to be assessed in relation to sensitive receptors. Should consent be granted for the proposal, the applicant will need to make a separate application to the DEC to obtain an Environment Protection Licence.

To assist the DEC in assessing the EIS once it has been lodged with the consent authority, it is suggested that the format of the EIS be consistent with the format of DoP's EIS guidelines and specific EIS requirements as outlined in Attachment A, B and C.

The DEC would like to receive 4 copies of the EIS for assessment purposes.

Should you have any further enquiries regarding this matter, please contact Craig Jones on (02) 6122 3100.

Yours sincerely,

Nigel Sargent
Head of Operations Unit
South East Region
6/12/05

<u>3 attachments</u>

ATTACHMENT A: EIS REQUIREMENTS FOR
Bombala Hard Rock Quarry

How to use these requirements

The DEC requirements have been structured in accordance with the DoP EIS Guidelines, as follows. It is suggested that the EIS follow the same structure:

A. Executive summary
B. The proposal
C. The location
D. Identification and prioritisation of issues
E. The environmental issues
F. List of approvals and licences
G. Compilation of mitigation measures
H. Justification for the proposal

A Executive summary

The executive summary should include a brief discussion of the extent to which the proposal achieves identified environmental outcomes.

B The proposal

1. Objectives of the proposal

- The objectives of the proposal should be clearly stated and refer to:
  a) the size and type of the operation, the nature of the processes and the products, by-products and wastes produced
  b) a life cycle approach to the production, use or disposal of products
  c) the anticipated level of performance in meeting required environmental standards and cleaner production principles
  d) the staging and timing of the proposal and any plans for future expansion
  e) the proposal's relationship to any other industry or facility.

2. Description of the proposal

General

- Outline the production process including:
  a) the environmental "mass balance" for the process – quantify in-flow and out-flow of materials, any points of discharge to the environment and their respective destinations (sewer, stormwater, atmosphere, recycling, landfill etc)
  b) any life-cycle strategies for the products.
- Outline cleaner production actions, including:
  a) measures to minimise waste (typically through addressing source reduction)
  b) proposals for use or recycling of by-products
  c) proposed disposal methods for solid and liquid waste
  d) air management systems including all potential sources of air emissions, proposals to re-use or treat emissions, emission levels relative to relevant standards in regulations, discharge points

e) water management system including all potential sources of water pollution, proposals for re-use, treatment etc, emission levels of any wastewater discharged, discharge points, summary of options explored to avoid a discharge, reduce its frequency or reduce its impacts, and rationale for selection of option to discharge.

f) soil contamination treatment and prevention systems.

- Outline construction works including:
  a) actions to address any existing soil contamination
  b) any earthworks or site clearing; re-use and disposal of cleared material (including use of spoil on-site)
  c) construction timetable and staging; hours of construction; proposed construction methods
  d) environment protection measures, including noise mitigation measures, dust control measures and erosion and sediment control measures.

Air

- Identify all sources of air emissions from the development.

  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, conveyors, storage facilities, plant and yard operation, vehicle movements (dust from road, exhausts, loss from load), land clearing and construction works).*

- Provide details of the project that are essential for predicting and assessing air impacts including:
  a) the quantities and physio-chemical parameters (eg concentration, moisture content, bulk density, particle sizes etc) of materials to be used, transported, produced or stored
  b) an outline of procedures for handling, transport, production and storage
  c) the management of solid, liquid and gaseous waste streams with potential for significant air impacts.

Noise and vibration

- Identify all noise sources from the development (including both construction and operation phases). Detail all potentially noisy activities including ancillary activities such as transport of goods and raw materials.
- Specify the times of operation for all phases of the development and for all noise producing activities.
- For projects with a significant potential traffic noise impact provide details of road alignment (include gradients, road surface, topography, bridges, culverts etc), and land use along the proposed road and measurement locations – diagrams should be to a scale sufficient to delineate individual residential blocks.

Water

- Provide details of the project that are essential for predicting and assessing impacts to waters:
  a) including the quantity and physio-chemical properties of all potential water pollutants and the risks they pose to the environment and human health, including the risks they pose to Water Quality Objectives in the ambient waters (as defined on www.environment.nsw.gov.au/ieo, using technical criteria derived from the Australian and New Zealand Guidelines for Fresh and Marine Water Quality, ANZECC 2000)
  b) the management of discharges with potential for water impacts

c) drainage works and associated infrastructure; land-forming and excavations; working capacity of structures; and water resource requirements of the proposal.

- Outline site layout, demonstrating efforts to avoid proximity to water resources (especially for activities with significant potential impacts eg effluent ponds) and showing potential areas of modification of contours, drainage etc.
- Outline how total water cycle considerations are to be addressed showing total water balances for the development (with the objective of minimising demands and impacts on water resources). Include water requirements (quantity, quality and source(s)) and proposed storm and wastewater disposal, including type, volumes, proposed treatment and management methods and re-use options.

Waste and chemicals

- Provide details of the quantity and type of both liquid waste and non-liquid waste generated, handled, processed or disposed of at the premises. Waste must be classified according to the *Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-liquid Wastes* (NSW EPA, 1999).
- Provide details of liquid waste and non-liquid waste management at the facility, including:
  a) the transportation, assessment and handling of waste arriving at or generated at the site
  b) any stockpiling of wastes or recovered materials at the site
  c) any waste processing related to the facility, including reuse, recycling, reprocessing (including composting) or treatment both on- and off-site
  d) the method for disposing of all wastes or recovered materials at the facility
  e) the emissions arising from the handling, storage, processing and reprocessing of waste at the facility
  f) the proposed controls for managing the environmental impacts of these activities.
- Provide details of spoil disposal with particular attention to:
  a) the quantity of spoil material likely to be generated
  b) proposed strategies for the handling, stockpiling, reuse/recycling and disposal of spoil
  c) the need to maximise reuse of spoil material in the construction industry
  d) identification of the history of spoil material and whether there is any likelihood of contaminated material, and if so, measures for the management of any contaminated material
  e) designation of transportation routes for transport of spoil.
- Provide details of procedures for the assessment, handling, storage, transport and disposal of all hazardous and dangerous materials used, stored, processed or disposed of at the site, in addition to the requirements for liquid and non-liquid wastes.
- Provide details of the type and quantity of any chemical substances to be used or stored and describe arrangements for their safe use and storage.
- Reference should be made to the guidelines: *Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-Liquid Wastes* (NSW EPA, 1999).

ESD

- Demonstrate that the planning process and any subsequent development incorporates objectives and mechanisms for achieving ESD, including:
  a) an assessment of a range of options available for use of the resource, including the benefits of each option to future generations
  b) proper valuation and pricing of environmental resources
  c) identification of who will bear the environmental costs of the proposal.

3. Rehabilitation

- Outline considerations of site maintenance, and proposed plans for the final condition of the site (ensuring its suitability for future uses).

4. Consideration of alternatives and justification for the proposal

- Consider the environmental consequences of adopting alternatives, including alternative:
  a) sites and site layouts
  b) access modes and routes
  c) materials handling and production processes
  d) waste and water management
  e) impact mitigation measures
  f) energy sources
- Selection of the preferred option should be justified in terms of:
  a) ability to satisfy the objectives of the proposal
  b) relative environmental and other costs of each alternative
  c) acceptability of environmental impacts and contribution to identified environmental objectives
  d) acceptability of any environmental risks or uncertainties
  e) reliability of proposed environmental impact mitigation measures
  f) efficient use (including maximising re-use) of land, raw materials, energy and other resources.

C The location

1. General

- Provide an overview of the affected environment to place the proposal in its local and regional environmental context including:
  a) meteorological data (eg rainfall, temperature and evaporation, wind speed and direction)
  b) topography (landform element, slope type, gradient and length)
  c) surrounding land uses (potential synergies and conflicts)
  d) geomorphology (rates of landform change and current erosion and deposition processes)
  e) soil types and properties (including erodibility; engineering and structural properties; dispersibility; permeability; presence of acid sulfate soils and potential acid sulfate soils)
  f) ecological information (water system habitat, vegetation, fauna)
  g) availability of services and the accessibility of the site for passenger and freight transport.

2. Air

- Describe the topography and surrounding land uses. Provide details of the exact locations of dwellings, schools and hospitals. Where appropriate provide a perspective view of the study area such as the terrain file used in dispersion models.
- Describe surrounding buildings that may effect plume dispersion.
- Provide and analyse site representative data on following meteorological parameters:
  a) temperature and humidity
  b) rainfall, evaporation and cloud cover
  c) wind speed and direction
  d) atmospheric stability class
  e) katabatic air drainage

3. Noise and vibration

- Identify any noise sensitive locations likely to be affected by activities at the site, such as residential properties, schools, churches, and hospitals. Typically the location of any noise sensitive locations in relation to the site should be included on a map of the locality.
- Identify the land use zoning of the site and the immediate vicinity and the potentially affected areas.

4. Water

- Describe the catchment including proximity of the development to any waterways and provide an assessment of their sensitivity/significance from a public health, ecological and/or economic perspective. The Water Quality and River Flow Objectives on the website: www.environment.nsw.gov.au/ieo should be used to identify the agreed environmental values and human uses for any affected waterways. This will help with the description of the local and regional area.

5. Soil Contamination Issues

- Provide details of site history – if earthworks are proposed, this needs to be considered with regard to possible soil contamination, for example if the site was previously a landfill site or if irrigation of effluent has occurred.

D Identification and prioritisation of issues / scoping of impact assessment

- Provide an overview of the methodology used to identify and prioritise issues. The methodology should take into account:
  a) relevant NSW government guidelines
  b) industry guidelines
  c) EISs for similar projects
  d) relevant research and reference material
  e) relevant preliminary studies or reports for the proposal
  f) consultation with stakeholders.
- Provide a summary of the outcomes of the process including:
  a) all issues identified including local, regional and global impacts (eg increased/ decreased greenhouse emissions)
  b) key issues which will require a full analysis (including comprehensive baseline assessment)
  c) issues not needing full analysis though they may be addressed in the mitigation strategy
  d) justification for the level of analysis proposed (the capacity of the proposal to give rise to high concentrations of pollution compared with the ambient environment or environmental outcomes is an important factor in setting the level of assessment).

E The environmental issues

1. General

- The potential impacts identified in the scoping study need to be assessed to determine their significance, particularly in terms of achieving environmental outcomes, and minimising environmental pollution.
- Identify gaps in information and data relevant to significant impacts of the proposal and any actions proposed to fill those information gaps so as to enable development of appropriate management and mitigation measures. This is in accordance with ESD requirements.

Note: The level of detail should match the level of importance of the issue in decision making which is dependent on the environmental risk.

Describe baseline conditions

- Provide a description of existing environmental conditions for any potential impacts.

Assess impacts

- For any potential impacts relevant for the assessment of the proposal provide a detailed analysis of the impacts of the proposal on the environment including the cumulative impact of the proposal on the receiving environment especially where there are sensitive receivers.
- Describe the methodology used and assumptions made in undertaking this analysis (including any modelling or monitoring undertaken) and indicate the level of confidence in the predicted outcomes and the resilience of the environment to cope with the predicted impacts.
- The analysis should also make linkages between different areas of assessment where necessary to enable a full assessment of environmental impacts eg assessment of impacts on air quality will often need to draw on the analysis of traffic, health, social, soil and/or ecological systems impacts; etc.
- The assessment needs to consider impacts at all phases of the project cycle including: exploration (if relevant or significant), construction, routine operation, start-up operations, upset operations and decommissioning if relevant.
- The level of assessment should be commensurate with the risk to the environment.

Describe management and mitigation measures

- Describe any mitigation measures and management options proposed to prevent, control, abate or mitigate identified environmental impacts associated with the proposal and to reduce risks to human health and prevent the degradation of the environment. This should include an assessment of the effectiveness and reliability of the measures and any residual impacts after these measures are implemented.
- Proponents are expected to implement a 'reasonable level of performance' to minimise environmental impacts. The proponent must indicate how the proposal meets reasonable levels of performance. For example, reference technology based criteria if available, or identify good practice for this type of activity or development. A 'reasonable level of performance' involves adopting and implementing technology and management practices to achieve certain pollutant emissions levels in economically viable operations. Technology-based criteria evolve gradually over time as technologies and practices change.
- Use environmental impacts as key criteria in selecting between alternative sites, designs and technologies, and to avoid options having the highest environmental impacts.
- Outline any proposed approach (such as an Environmental Management Plan) that will demonstrate how commitments made in the EIS will be implemented. Areas that should be described include:

  a) operational procedures to manage environmental impacts
  b) monitoring procedures
  c) training programs
  d) community consultation
  e) complaint mechanisms including site contacts
  f) strategies to use monitoring information to improve performance
  g) strategies to achieve acceptable environmental impacts and to respond in event of exceedences.

2. Air

Describe baseline conditions

- Provide a description of existing air quality and meteorology, using existing information and site representative ambient monitoring data. This description should include the following parameters:
    - o Particulates, pm10

Assess impacts

- Identify all pollutants of concern and estimate emissions by quantity (and size for particles), source and discharge point.
- Estimate the resulting ground level concentrations of all pollutants. Where necessary (eg potentially significant impacts and complex terrain effects), use an appropriate dispersion model to estimate ambient pollutant concentrations. Discuss choice of model and parameters with the DEC.
- 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 that the development will make to regional and global pollution, particularly in sensitive locations.
- For potentially odorous emissions provide the emission rates in terms of odour units (determined by techniques compatible with EPA / DEC procedures). Use sampling and analysis techniques for individual or complex odours and for point or diffuse sources, as appropriate.

  Note: With dust and odour, it may be possible to use data from existing similar activities to generate emission rates.
- Reference should be made to *Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW* (EPA, 2001), and *Approved Methods for the Sampling and Analysis of Air Pollutants in NSW* (EPA, 2001).

Describe management and mitigation measures

- 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.

3. Noise and vibration

Describe baseline conditions

- Determine the existing background (L_{A90}) and ambient (L_{Aeq}) noise levels in accordance with the *NSW Industrial Noise Policy.*
- Determine the existing road traffic noise levels in accordance with the *NSW Environmental Criteria for Road Traffic Noise*, where road traffic noise impacts may occur.
- The noise impact assessment report should provide details of all monitoring of existing ambient noise levels including:

  a) details of equipment used for the measurements

  b) a brief description of where the equipment was positioned

c) a statement justifying the choice of monitoring site, including the procedure used to choose the site, having regards to the definition of 'noise sensitive locations(s)' and 'most affected locations(s)' described in Section 3.1.2 of the *NSW Industrial Noise Policy*

d) details of the exact location of the monitoring site and a description of land uses in surrounding areas

e) a description of the dominant and background noise sources at the site

f) day, evening and night assessment background levels for each day of the monitoring period

g) the final Rating Background Level (RBL) value

h) graphs of the measured noise levels for each day should be provided

i) a record of periods of affected data (due to adverse weather and extraneous noise), methods used to exclude invalid data and a statement indicating the need for any re-monitoring under Step 1 in Section B1.3 of the *NSW Industrial Noise Policy*

j) determination of L_{Aeq} noise levels from existing industry.

Assess impacts

- Determine the project specific noise levels for the site. For each identified potentially affected receiver, this should include:
  a) determination of the intrusive criterion for each identified potentially affected receiver
  b) selection and justification of the appropriate amenity category for each identified potentially affected receiver
  c) determination of the amenity criterion for each receiver
  d) determination of the appropriate sleep disturbance limit.
- Maximum noise levels during night-time period (10pm-7am) should be assessed to analyse possible affects on sleep. Where $L_{A1(1min)}$ noise levels from the site are less than 15 dB above the background L_{A90} noise level, sleep disturbance impacts are unlikely. Where this is not the case, further analysis is required. Additional guidance is provided in Appendix B of the *NSW Environmental Criteria for Road Traffic Noise.*
- Determine expected noise level and noise character (eg tonality, impulsiveness, vibration, etc) likely to be generated from noise sources during:
  a) site establishment
  b) construction
  c) operational phases
  d) transport including traffic noise generated by the proposal
  e) other services.

  Note: *The noise impact assessment report should include noise source data for each source in 1/1 or 1/3 octave band frequencies including methods for references used to determine noise source levels. Noise source levels and characteristics can be sourced from direct measurement of similar activities or from literature (if full references are provided).*
- Determine the noise levels likely to be received at the most sensitive locations (these may vary for different activities at each phase of the development). 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 noise impact assessment report should include:
  a) a plan showing the assumed location of each noise source for each prediction scenario

b) a list of the number and type of noise sources used in each prediction scenario to simulate all potential significant operating conditions on the site

c) any assumptions made in the predictions in terms of source heights, directivity effects, shielding from topography, buildings or barriers, etc

d) methods used to predict noise impacts including identification of any noise models used. Where modelling approaches other than the use of the ENM or SoundPlan computer models are adopted, the approach should be appropriately justified and validated

e) an assessment of appropriate weather conditions for the noise predictions including reference to any weather data used to justify the assumed conditions

f) the predicted noise impacts from each noise source as well as the combined noise level for each prediction scenario under any identified significant adverse weather conditions as well as calm conditions where appropriate

g) for developments where a significant level of noise impact is likely to occur, noise contours for the key prediction scenarios should be derived

h) an assessment of the need to include modification factors as detailed in Section 4 of the *NSW Industrial Noise Policy*.

- Discuss the findings from the predictive modelling and, where relevant noise criteria have not been met, recommend additional mitigation measures.
- The noise impact assessment report should include details of any mitigation proposed including the attenuation that will be achieved and the revised noise impact predictions following mitigation.
- Where relevant noise/vibration criteria cannot be met after application of all feasible and cost effective mitigation measures the residual level of noise impact needs to be quantified by identifying:

a) locations where the noise level exceeds the criteria and extent of exceedence

b) numbers of people (or areas) affected

c) times when criteria will be exceeded

d) likely impact on activities (speech, sleep, relaxation, listening, etc)

e) change on ambient conditions

f) the result of any community consultation or negotiated agreement.

- For the assessment of existing and future traffic noise, details of data for the road should be included such as assumed traffic volume; percentage heavy vehicles by time of day; and details of the calculation process. These details should be consistent with any traffic study carried out in the EIS.
- Where blasting is intended an assessment in accordance with the *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* (ANZECC, 1990) should be undertaken. The following details of the blast design should be included in the noise assessment:

a) bench height, burden spacing, spacing burden ratio

b) blast hole diameter, inclination and spacing

c) type of explosive, maximum instantaneous charge, initiation, blast block size, blast frequency.

Describe management and mitigation measures

- Determine the most appropriate noise mitigation measures and expected noise reduction including both noise controls and management of impacts for both construction and operational noise. This will include selecting quiet equipment and construction methods, noise barriers or acoustic screens, location of stockpiles, temporary offices, compounds and vehicle routes, scheduling of activities, etc.

- For traffic noise impacts, provide a description of the ameliorative measures considered (if required), reasons for inclusion or exclusion, and procedures for calculation of noise levels including ameliorative measures. Also include, where necessary, a discussion of any potential problems associated with the proposed ameliorative measures, such as overshadowing effects from barriers. Appropriate ameliorative measures may include:
  a) use of alternative transportation modes, alternative routes, or other methods of avoiding the new road usage
  b) control of traffic (eg: limiting times of access or speed limitations)
  c) resurfacing of the road using a quiet surface
  d) use of (additional) noise barriers or bunds
  e) treatment of the façade to reduce internal noise levels buildings where the night-time criteria is a major concern
  f) more stringent limits for noise emission from vehicles (i.e. using specially designed 'quite' trucks and/or trucks to use air bag suspension
  g) driver education
  h) appropriate truck routes
  i) limit usage of exhaust breaks
  j) use of premium muffles on trucks
  k) reducing speed limits for trucks
  l) ongoing community liaison and monitoring of complaints
  m) phasing in the increased road use.

4. Water

Describe baseline conditions

- Describe existing surface and groundwater quality – an assessment needs to be undertaken for any water resource likely to be affected by the proposal and for all conditions (e.g. a wet weather sampling program is needed if runoff events may cause impacts).

  Note: Methods of sampling and analysis need to conform with an accepted standard (e.g. Approved Methods for the Sampling and Analysis of Water Pollutants in NSW (DEC 2004) *or be approved and analyses undertaken by accredited laboratories).*
- Provide site drainage details and surface runoff yield.
- State the ambient Water Quality and River Flow Objectives for the receiving waters. These refer to the community's agreed environmental values and human uses endorsed by the Government as goals for the ambient waters. These environmental values are published on the website: www.environment.nsw.gov.au/ieo. The EIS should state the environmental values listed for the catchment and waterway type relevant to your proposal. NB: A consolidated and approved list of environmental values are not available for groundwater resources. Where groundwater may be affected the EIS should identify appropriate groundwater environmental values and justify the choice.
- State the indicators and associated trigger values or criteria for the identified environmental values. This information should be sourced from the ANZECC 2000 *Guidelines for Fresh and Marine Water Quality* (http://www.deh.gov.au/water/quality/nwqms/volume1.html)(Note that, as at 2004, the NSW Water Quality Objectives booklets and website contain technical criteria derived from the 1992 version of the ANZECC Guidelines. The Water Quality Objectives remain as Government Policy, reflecting the community's environmental values and long-term goals, but the technical criteria are replaced by the more recent ANZECC 2000 Guidelines). NB: While specific guidelines for groundwater are not available, the ANCECC 2000 Guidelines endorse the application of the trigger values and decision trees as a tool to assess risk to environmental values in groundwater.

- State any locally specific objectives, criteria or targets, which have been endorsed by the government e.g. the Healthy Rivers Commission Inquiries (www.hrc.nsw.gov.au) or the NSW Salinity Strategy (DLWC, 2000) (www.dlwc.nsw.gov.au/care/salinity/#Strategy).
- Where site specific studies are proposed to revise the trigger values supporting the ambient Water Quality and River Flow Objectives, and the results are to be used for regulatory purposes (e.g. to assess whether a licensed discharge impacts on water quality objectives), then prior agreement from the DEC on the approach and study design must be obtained.
- Describe the state of the receiving waters and relate this to the relevant Water Quality and River Flow Objectives (i.e. are Water Quality and River Flow Objectives being achieved?). Proponents are generally only expected to source available data and information. However, proponents of large or high risk developments may be required to collect some ambient water quality / river flow / groundwater data to enable a suitable level of impact assessment. Issues to include in the description of the receiving waters could include:
  a) lake or estuary flushing characteristics
  b) specific human uses (e.g. exact location of drinking water offtake)
  c) sensitive ecosystems or species conservation values
  d) a description of the condition of the local catchment e.g. erosion levels, soils, vegetation cover, etc
  e) an outline of baseline groundwater information, including, but not restricted to, depth to watertable, flow direction and gradient, groundwater quality, reliance on groundwater by surrounding users and by the environment
  f) historic river flow data where available for the catchment.

Assess impacts

- No proposal should breach clause 120 of the *Protection of the Environment Operations Act* 1997 (i.e. pollution of waters is prohibited unless undertaken in accordance with relevant regulations).
- Identify and estimate the quantity of all pollutants that may be introduced into the water cycle by source and discharge point including residual discharges after mitigation measures are implemented.
- Include a rationale, along with relevant calculations, supporting the prediction of the discharges.
- Describe the effects and significance of any pollutant loads on the receiving environment. This should include impacts of residual discharges through modelling, monitoring or both, depending on the scale of the proposal. Determine changes to hydrology (including drainage patterns, surface runoff yield, flow regimes, wetland hydrologic regimes and groundwater).
- Describe water quality impacts resulting from changes to hydrologic flow regimes (such as nutrient enrichment or turbidity resulting from changes in frequency and magnitude of stream flow).
- Identify any potential impacts on quality or quantity of groundwater describing their source.
- Identify potential impacts associated with geomorphological activities with potential to increase surface water and sediment runoff or to reduce surface runoff and sediment transport. Also consider possible impacts such as bed lowering, bank lowering, instream siltation, floodplain erosion and floodplain siltation.
- Identify impacts associated with the disturbance of acid sulfate soils and potential acid sulfate soils.
- Containment of spills and leaks shall be in accordance with the technical guidelines section 'Bunding and Spill Management' of the *Authorised Officers Manual* (EPA, 1995) (http://www.environment.nsw.gov.au/mao/bundingspill.htm) and the most recent versions of the

Australian Standards referred to in the Guidelines. Containment should be designed for no-discharge.

- The significance of the impacts listed above should be predicted. When doing this it is important to predict the ambient water quality and river flow outcomes associated with the proposal and to demonstrate whether these are acceptable in terms of achieving protection of the Water Quality and River Flow Objectives. In particular the following questions should be answered:
  a) will the proposal protect Water Quality and River Flow Objectives where they are currently achieved in the ambient waters; and
  b) will the proposal contribute towards the achievement of Water Quality and River Flow Objectives over time, where they are not currently achieved in the ambient waters.
- Consult with the DEC as soon as possible if a mixing zone is proposed (a mixing zone could exist where effluent is discharged into a receiving water body, where the quality of the water being discharged does not immediately meet water quality objectives. The mixing zone could result in dilution, assimilation and decay of the effluent to allow water quality objectives to be met further downstream, at the edge of the mixing zone). The DEC will advise the proponent under what conditions a mixing zone will and will not be acceptable, as well as the information and modelling requirements for assessment.

  Note: The assessment of water quality impacts needs to be undertaken in a total catchment management context to provide a wide perspective on development impacts, in particular cumulative impacts.

- Where a licensed discharge is proposed, provide the rationale as to why it cannot be avoided through application of a reasonable level of performance, using available technology, management practice and industry guidelines.
- Where a licensed discharge is proposed, provide the rationale as to why it represents the best environmental outcome and what measures can be taken to reduce its environmental impact.
- Reference should be made to *Managing Urban Stormwater: Soils and Construction* (Landcom, 2004).

Describe management and mitigation measures

- Outline stormwater management to control pollutants at the source and contain them within the site. Also describe measures for maintaining and monitoring any stormwater controls.
- Outline erosion and sediment control measures directed at minimising disturbance of land, minimising water flow through the site and filtering, trapping or detaining sediment. Also include measures to maintain and monitor controls as well as rehabilitation strategies.
- Describe waste water treatment measures that are appropriate to the type and volume of waste water and are based on a hierarchy of avoiding generation of waste water; capturing all contaminated water (including stormwater) on the site; reusing/recycling waste water; and treating any unavoidable discharge from the site to meet specified water quality requirements.
- Outline pollution control measures relating to storage of materials, possibility of accidental spills (eg preparation of contingency plans), appropriate disposal methods, and generation of leachate.
- Describe hydrological impact mitigation measures including:
  a) site selection (avoiding sites prone to flooding and waterlogging, actively eroding or affected by deposition)
  b) minimising runoff
  c) minimising reductions or modifications to flow regimes
  d) avoiding modifications to groundwater.
- Describe groundwater impact mitigation measures including:

a) site selection
b) retention of native vegetation and revegetation
c) artificial recharge
d) providing surface storages with impervious linings
e) monitoring program.

- Describe geomorphological impact mitigation measures including:
  a) site selection
  b) erosion and sediment controls
  c) minimising instream works
  d) treating existing accelerated erosion and deposition
  e) monitoring program.
- Any proposed monitoring should be undertaken in accordance with the *Approved Methods for the Sampling and Analysis of Water Pollutants in NSW* (DEC 2004).

5. Soils and contamination

Describe baseline conditions

- Provide any details (in addition to those provided in the location description - Section C) that are needed to describe the existing situation in terms of soil types and properties and soil contamination.

Assess impacts

- Identify any likely impacts resulting from the construction or operation of the proposal, including the likelihood of:
  a) disturbing any existing contaminated soil
  b) contamination of soil by operation of the activity
  c) subsidence or instability
  d) soil erosion
  e) disturbing acid sulfate or potential acid sulfate soils.

Describe management and mitigation measures

- Describe and assess the effectiveness or adequacy of any soil management and mitigation measures during construction and operation of the proposal including:
  a) erosion and sediment control measures
  b) proposals for site remediation – see *Managing Land Contamination, Planning Guidelines SEPP 55 – Remediation of Land* (Department of Urban Affairs and Planning and Environment Protection Authority, 1998)
  c) proposals for the management of these soils – see *Assessing and Managing Acid Sulfate Soils,* Environment Protection Authority, 1995 (note that this is the only methodology accepted by the DEC).

6. Waste and chemicals

Describe baseline conditions

- Describe any existing waste or chemicals operations related to the proposal.

Assess impacts

- Assess the adequacy of proposed measures to minimise natural resource consumption and minimise impacts from the handling, transporting, storage, processing and reprocessing of waste and/or chemicals.
- Reference should be made to *Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-Liquid Wastes* (EPA, 1999).

Describe management and mitigation measures

- Outline measures to minimise the consumption of natural resources.
- Outline measures to avoid the generation of waste and promote the re-use and recycling and reprocessing of any waste.
- Outline measures to support any approved regional or industry waste plans.

7. Cumulative impacts

- Identify the extent that the receiving environment is already stressed by existing development and background levels of emissions to which this proposal will contribute.
- Assess the impact of the proposal against the long term air, noise and water quality objectives for the area or region.
- Identify infrastructure requirements flowing from the proposal (eg water and sewerage services, transport infrastructure upgrades).
- Assess likely impacts from such additional infrastructure and measures reasonably available to the proponent to contain such requirements or mitigate their impacts (eg travel demand management strategies).

F. List of approvals and licences

- Identify all approvals and licences required under environment protection legislation including details of all scheduled activities, types of ancillary activities and types of discharges (to air, land, water).

G. Compilation of mitigation measures

- Outline how the proposal and its environmental protection measures would be implemented and managed in an integrated manner so as to demonstrate that the proposal is capable of complying with statutory obligations under DEC licences or approvals (eg outline of an environmental management plan).
- The mitigation strategy should include the environmental management and cleaner production principles which would be followed when planning, designing, establishing and operating the proposal. It should include two sections, one setting out the program for managing the proposal and the other outlining the monitoring program with a feedback loop to the management program.

H. Justification for the Proposal

- Reasons should be included which justify undertaking the proposal in the manner proposed, having regard to the potential environmental impacts.

ATTACHMENT B: EIS REQUIREMENTS FOR
Bombala Hard Rock Quarry

ASSESSMENT OF FLORA AND FAUNA ISSUES

Introduction

The *Environmental Planning and Assessment Act (1979)* (*EP&A Act*) requires that proponents of a development/activity and the Consent/Determining Authorities adequately assess the impact on flora and fauna by a development or activity in any Environmental Impact Assessment (EIA) documents.

Australian flora and fauna comprise many endemic taxa and are therefore unique in the world. Although a proposed development site may be disturbed by various land-uses, any native vegetation, including remnants, riparian and wetland areas, is of significant natural heritage value. The area of vegetation and habitat at the proposed site may provide an area of high biological diversity, high conservation value or may not be well represented or protected elsewhere. It may also act as a corridor or migratory route for wildlife, drought refuge habitat or have other important values. Native vegetation including wetland, riparian and remnant environments provide significant areas of habitat for fauna. Therefore, any development in such areas should fully consider the impact on fauna and its habitat, including modification, fragmentation, reduction in size, loss of connectivity and edge effects.

Because of the reasons outlined above, the NSW community places a high value on those areas of native vegetation that remain. Careful planning should precede any development that involves further vegetation clearance or other significant impact within areas of native vegetation.

Threatened Species and the 'Test of Significance'

The concurrence of the Director-General of the Department of Environment and Conservation (DEC) is required for all development on land that is, or is a part of, critical habitat, or development that is likely to significantly affect a threatened species, population, or ecological community, or its habitat. Accordingly, the requirements of the DEC regarding flora and fauna relate to sections 5A and 78A(8)(b) of the *EP&A Act.*

A comprehensive EIA must include a detailed flora and fauna survey, some typical requirements of which are provided in the section "General Flora and Fauna Considerations". If, during a flora or fauna assessment or survey, threatened species, populations or ecological communities, or their habitats are found or are likely to occur in the area, the proponents must undertake a 'Test of Significance' as outlined in section 5A of the *EP&A Act.* This test is a statutory mechanism undertaken to determine whether any development is likely to have a significant impact upon threatened species, populations or ecological communities, or their habitats. The *Threatened Species Conservation Act (1995) (TSC Act)* contains lists of threatened species, which are divided into 5 categories – those presumed extinct, endangered species, endangered populations, endangered ecological communities and vulnerable species. The *TSC Act* also allows for the declaration of critical habitat, key threatening processes and the preparation of both Recovery Plans and Threat Abatement Plans. These listings and plans must be considered as part of the EIA process.

Species Impact Statements

Following a threatened species assessment via the 'Test of Significance', it may be necessary to prepare a Species Impact Statement (SIS) in accordance with the *TSC Act.*

If a SIS is required, the applicant for the development consent or the proponent of the activity must request from the Director-General of the DEC, the requirements concerning the form and content of the SIS. The SIS must then be prepared in accordance with these requirements and provided to the Director-General. General SIS requirements are described in the *TSC Act*, however, requirements specific for each development consent must be sought.

General Flora and Fauna Considerations

If the concurrence of the Director-General of the DEC is not required, the DEC has no formal role in the assessment of flora and fauna issues and the determination of these issues lies solely with the Consent Authority(s). Notwithstanding the above, the DEC recommends that the Consent Authority(s) requests that the following details be included in any EIA document provided by the applicant:

- detailed location map and identification of the area surveyed (including the location of photographs, transects, areas of significance etc),
- at least one of the following: a land satellite image, vegetation communities map, aerial photograph, or a remnant vegetation map,
- a complete plant list (including scientific names of those plants) of all tree, shrub, ground cover and aquatic species, categorised according to whether they are native or exotic,
- a complete list of all known and likely terrestrial and aquatic fauna species that may utilise the area for habitat, breeding and migration (eg birds, mammals, reptiles and amphibians including scientific names). It is suggested that invertebrates also be considered as they form part of the food chain for many fauna species,
- a detailed description of vegetation structure (in terms of a scientifically accepted classification system) and spatial distribution (ie. plant densities and patterning) on the site, including a vegetation map,
- describe the condition and integrity of the vegetation including a description of any past disturbance,
- an account of the likely original vegetation communities (pre-, or at early settlement), and an assessment of the likely regional distribution of the original communities,
- an assessment of whether the plant communities are adequately represented in conservation reserves or otherwise protected,
- an account of the hydrology of the area and how this relates to the dynamics of the vegetation communities,
- assessment of the importance or otherwise of the location as a corridor, migratory route or drought refuge, in relation to other remnant vegetation, riparian and wetland areas or habitat in the region,
- a list of known and likely threatened species as listed by the *TSC Act* which might occur at the site. The DEC database needs to be accessed and the likelihood of occurrence of threatened flora species determined,
- an assessment of the impacts of the proposal on flora and fauna, on-site and at the regional scale (eg siltation, water availability or drainage changes) and measures to mitigate these impacts,
- a detailed rehabilitation/management plan including a list of the plant species to be used during rehabilitation (if required),
- detail methodologies used and a list of the reference literature cited,
- a conclusion specifically addressing the components of the 'Test of Significance', and
- any other issues that may be considered relevant.

It is the responsibility of the proponent (and subsequently the consent and/or determining authorities) to determine the detail and comprehensiveness of assessment required to form legally defensible conclusions regarding the impact of the proposal. The scale and intensity of the proposed development should dictate the detail of investigation. It is important that all conclusions are supported by adequate data and that these data are clearly presented in EIA documentation.

To assist the proponent and consent authority(s) the DEC has produced a set of draft guidelines on how to conduct a satisfactory flora and fauna assessment survey titled, "Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities". These guidelines have been released for comment.

Further Site Specific Considerations

The DEC understands that a Snow Gum Grassy Woodland community potentially occurs on or near the developed site. This vegetation community is rare and is of high ecological value. Accordingly, it is currently being considered as "Endangered Ecological Community" in accordance with the *Threatened Species Conservation Act 1995.*

The flora survey carried out in support of the EIS should therefore specifically comment on the occurrence of the community.

ATTACHMENT C: EIS REQUIREMENTS FOR
Bombala Hard Rock Quarry

ASSESSMENT OF ABORIGINAL CULTURAL HERITAGE ISSUES

Legislative framework and implications for timing

A Development Application is integrated in respect of the National Parks and Wildlife Act 1974 (NPW Act) where a Consent, pursuant to Section 90 (2) (commonly referred to as a Section 90 Consent) is sought or required for the proposed development to proceed. In these circumstances, the granting (or otherwise) of the Section 90 Consent, together with the conditions of any consent will form part of the General Terms of Approval issued by the DEC.

A Section 90 Consent is required in order to destroy, deface or damage or to cause or permit the destruction or defacement of or damage to an Aboriginal object or an Aboriginal place (Section 90 (1) of the NPW Act). While the NPW Act provides for the destruction of sites this should always be considered as a last option and must therefore be well supported.

A Permit, pursuant to Section 87 (1) of the NPW Act (commonly referred to as Section 87 Permits), is required to:

- disturb or excavate any land, or cause any land to be disturbed or excavated, for the purpose of discovering an Aboriginal object; and/or
- disturb or move an Aboriginal object.

  (cf: Section 86 and 87 of the NPW Act)

Section 87 Permits are not integrated under the Environmental Planning and Assessment Act 1979 but are often required in order to fully investigate the nature and extent of Aboriginal objects for which a Section 90 Consent may be sought. Accordingly a Section 87 Permit will often be required well in advance of the submission of a Development Application.

A Section 87 Permit or a Section 90 Consent are usually subject to special conditions that require impact minimisation and salvage. Salvage is a form of mitigation by documenting in detail what is to be lost by the impact and may involve archaeological excavation and analysis, or other types of recovery and study.

Section 87 applications should be accompanied by a care and control application pursuant to Section 85A of the MPW Act.

EIS Requirements

The EIS should comprehensively assess Aboriginal Heritage issues where any ground disturbance is anticipated. This assessment must be consistent with the attached document titled "*Aboriginal Cultural Heritage and the Integrated Development Assessment Process – Information for Applicants*" ("Information for Applicants") dated 20 February 2001 (Attachment D) and should include (but not limited to):

Document that the DEC's Aboriginal Heritage Information Management System (AHIMS) has been accessed in the initial planning stage to determine if there are any already known sites which will require protection. It should be noted that the AHIMS database is not a conclusive indicator that sites exist in the development area. Information from the AHIMS database may be sourced through the AHIMS Registrar by contacting the Cultural Heritage Branch of DEC on 02 95856471.

Demonstrate that the Aboriginal community (which may include Local Aboriginal Land Councils, Native Title Groups and Elders Groups) have been consulted and have been advised about anticipated impact to sites relevant to their heritage. There also may be knowledge in the community about sites within the development area, particularly those related to oral traditions. The process of Aboriginal consultation must be maintained throughout the entire assessment procedure. Attachment E outlines the requirements for consultation in greater detail.

An archaeological survey and assessment must be undertaken by an archaeologist in accordance with NPWS guidelines contained in the "*Aboriginal Cultural Heritage: Standards and Guidelines*" that has been made widely available to archaeologists undertaking this work. This archaeological assessment must be included in the EIS in final form. DEC requires three additional copies of the final archaeological assessment.

When undertaking this assessment the significance of the sites must also be assessed. The archaeological survey must determine the sites where disturbance can be avoided. Note that damage or destruction of some sites may be unacceptable or that special safeguards may be required.

Test excavations are often needed to verify the location of aboriginal sites. Such excavations need to be undertaken prior to the lodgment of Development Application and in accordance with a Section 87 Permit.

Before lodging the Development Application, Section 91 cards must be referred directly to the DEC and must **not** be submitted with the EIS.

Effect of not fully documenting Aboriginal objects and Aboriginal places in the EIS

Aboriginal sites are widespread throughout New South Wales with considerable regional variation in the types of sites, their age, their contents and how they are situated on the landscape. Under the NPW Act it is an offence to knowingly destroy, deface or damage an Aboriginal place or object without a statutory consent.

Any Section 90 Consent that may be granted based on the EIS will be limited to the matters documented in the EIS. Accordingly, Section 90 Consents are specific.

Therefore, in the event that additional Aboriginal objects are identified during construction, that construction must cease immediately and the nature and extent of the objects assessed, as described above. Accordingly, to avoid delays during construction and the possibility that the development may need to be amended if a (additional) Section 90 Consent is not granted a comprehensive assessment should be undertaken.

NSW NATIONAL PARKS AND WILDLIFE SERVICE

ABORIGINAL CULTURAL HERITAGE AND THE INTEGRATED DEVELOPMENT ASSESSMENT PROCESS

INFORMATION FOR LOCAL COUNCILS

Updated 20 February 2001

The NPWS recommends that the following information be read in conjunction with the "Guide to section 79C' prepared by the Department of Urban Affairs and Planning, which outlines Council's obligation to consider Aboriginal heritage issues in determining a development application.

The NPWS has a statutory responsibility for the identification, management and conservation of Aboriginal heritage under the *National Parks and Wildlife Act 1974*. The NPWS acknowledges that it is Aboriginal people who should determine the cultural significance of Aboriginal heritage, and the NPWS has a strong commitment to working in partnership with Aboriginal people to manage and conserve Aboriginal cultural heritage. The NPWS recognises that Aboriginal cultural heritage includes both traditional and contemporary associations of Aboriginal people with the environment as well as physical sites.

Aboriginal heritage issues should be addressed upfront as part of the planning process undertaken for developments, and prior to lodgement of a development application. The NPWS requires that options for conserving Aboriginal relics within development footprints be fully explored in discussion with the Aboriginal community as part of the development assessment process. Impacts on Aboriginal relics should only be considered where there are no viable alternatives. The NPWS will require a clear demonstration that alternatives to site destruction have been fully explored.

NSW National Parks and Wildlife Service
43 Bridge Street, Hurstville NSW PO Box 1967, Hurstville NSW 2220
Telephone (02) 9585 6444 Facsimile (02) 9585 6555
Internet Email: info@npws.nsw.gov.au

When is the NPWS an approval body in the IDA process ?

The NPWS is an approval body in the IDA process when a development will impact on an Aboriginal relic or Aboriginal place, thereby requiring a consent to destroy from the Director-General of the National Parks and Wildlife Service. Threatened species, populations and/or ecological communities do not trigger the IDA process as the *Environmental Planning & Assessment (EP&A) Act 1979* and *Threatened Species Conservation Act 1995* eliminated the need for separate licensing or approvals in relation to these issues.

The NPWS is an approval body for a development application under the IDA process when:

1) A 'relic' is known to exist on the land to which the DA applies; and/or the land to which the DA applies is an Aboriginal place, immediately before the DA is made (as per s.91 (2)(a-b), *EP&A Amendment Act 1997)*; AND

2) The development proposal will destroy, deface or damage an Aboriginal 'relic' or Aboriginal place, and a consent to destroy from the Director-General of the National Parks and Wildlife Service will be required, as per section 90 of the *National Parks and Wildlife (NPW) Act 1974* (note damage to an Aboriginal relic or place may be direct damage or result from indirect impacts).

   Under the *NPW Act*, a 'relic' is defined as any deposit, object or material evidence (not being a handicraft made for sale) relating to indigenous and non-European habitation of the area that comprises NSW, being habitation both prior to and concurrent with the occupation of that area by persons of European extraction, and includes Aboriginal remains (as defined within the meaning of the NPW Act). Relics are confined to physical evidence.

   Aboriginal 'relics' are commonly referred to as Aboriginal sites.

   An "Aboriginal place" is a place which has been declared so by the Minister for the Environment because he or she believes that the place is or was of special significance to Aboriginal culture. It may or may not contain physical relics.

It should be noted that *the NPW Act* does not provide protection for spiritual areas or natural mythological areas that have no physical remains of Aboriginal occupation, unless they have been declared an 'Aboriginal place'.

For the purposes of the IDA process, the NPWS considers that an Aboriginal site ('relic') may be considered to be 'known' if:

- It is registered on the NPWS Aboriginal Sites Register; and/or
- It is an Aboriginal site known to the Aboriginal community; and/or
- It is located during surveys (eg: archaeological, anthropological) or test excavations conducted prior to lodgement of the DA.

How to obtain information about known Aboriginal sites

In order to obtain information about the location of known sites it is necessary to:

- Consult with Aboriginal community groups to identify the location of Aboriginal sites. The community groups may be aware of Aboriginal sites that have not been registered with NPWS.
- Contact the Aboriginal Sites Registrar at NPWS and request a site search to obtain a listing of registered sites. The Register only includes those Aboriginal sites which have been reported to NPWS. **Attachment 1** provides general information on the Aboriginal Sites Register, and a site search request form.
- Undertake an assessment of the known Aboriginal site/s and/or undertake survey of the subject land to locate Aboriginal sites. Test excavations may be required as part of this investigation to verify the location, extent and/or geomorphic context of Aboriginal sites. Such excavations need to be undertaken **before** the DA is submitted. A permit is required from NPWS for such investigation and if all information is attached to the application the processing time is approximately 8 weeks.

How to find out whether land contains a gazetted Aboriginal place

An Aboriginal place may be considered known if it has been declared by the Minister, and gazetted. Information on whether a proposed development site contains an Aboriginal place may be obtained by contacting the NPWS Aboriginal Sites Register (refer **Attachment 1**).

Information required by the NPWS to provide general terms of approval

In responding to requests for general terms of approval under the IDA process, the NPWS requires the <u>same</u> level of information to make an 'in-principle' decision as to whether to issue its general terms of approval as it would require to make a decision on the subsequent Section 90 consent application. In order for the NPWS to be in a position to provide its general terms of approval, all issues regarding conservation and site management need to be resolved upfront.

The NPWS does not require that a Section 90 consent application be submitted with the Integrated Development Application. The NPWS will issue its general terms of approval to the consent authority, and these terms of approval are incorporated into the development consent. Once the development consent is granted, the proponent has up to three years to apply to the NPWS for a Section 90 consent. The NPWS is then bound to issue the Section 90 consent in accordance with the development consent conditions.

In providing general terms of approval, the NPWS will require some administrative information from Council and information on the development proposal and Aboriginal heritage values of the relic and/or Aboriginal place from the applicant, as follows:

1.0 ADMINISTRATIVE INFORMATION REQUIRED FROM COUNCIL

1.1 A clear indication from Council that the development application is being assessed under the integrated development assessment (IDA) process and therefore will, or is likely to require subsequent approvals from the NPWS with respect to Aboriginal heritage. Where possible, Council should include the reasons why it has reached this conclusion. If Council is unsure whether a subsequent approval from the NPWS is required, it is suggested that Council seek advice from the NPWS.

1.2 A clear statement from Council as to whether Council also wishes the NPWS to provide advice on flora, fauna and threatened species values and/or potential impacts on adjoining NPWS reserves with respect to the development proposal.

1.3 A clear statement of the time frames for comment, including:
- The date of receipt of the DA; and
- The date that general terms of approval must be back with Council (assuming that no additional information is required).

1.4 A list of other approval bodies to which the integrated development application has been referred.

1.5 A fee of $250 will be charged by the NPWS to process the application. This fee should be paid by cheque, made out to the National Parks and Wildlife Service, and <u>must</u> be attached to the application. If the cheque is not attached to the application, the NPWS will return the development application immediately upon receipt, and will not process the application until the fee is paid, in accordance with Schedule 1, Part 9, Division 1 (103)(3).

The $250 fee is solely for processing of the application. The applicant may be required to pay additional fees to the NPWS, such as a fee for obtaining a site search of the NPWS Aboriginal Sites Register, and a fee for processing an application for consent to destroy an Aboriginal site.

2.0 INFORMATION ON THE DEVELOPMENT AND ABORIGINAL CULTURAL HERITAGE

The NPWS requires two types of information from the applicant:

- <u>Aboriginal cultural heritage assessment</u> which involves consultation with the Aboriginal community groups. The NPWS is committed to working in partnership with the Aboriginal community groups in the management of Aboriginal sites and requires community assessment of any Aboriginal site management.
- <u>Archaeological assessment</u> which involves the assessment of Aboriginal sites and their management based on archaeological heritage criteria.

Council should give the applicant the NPWS's "Information for applicants' document to assist applicants in preparing their integrated development application. When Council refers a DA to the NPWS, Council should ensure the completeness of the applicant's information according to the requirements outlined below.

A flowchart is shown in **Attachment 2** that outlines the process for assessing the Aboriginal heritage values of an area to enable a decision to be made as to whether a development application will be an integrated development application for Aboriginal sites. It is essential that the outcomes of the Aboriginal cultural assessment and the technical assessment are integrated.

2.1 Aboriginal Cultural Heritage Assessment

Aboriginal sites can be the physical remains of Aboriginal occupation of an area or alternatively, an area that has particular meaning for Aboriginal people, for example, spiritual areas or natural mythological areas. It is important to consider that Aboriginal heritage is not only valuable to Aboriginal people but also to those people who are interested in learning from the early inhabitants of Australia. Proposed developments that alter landscapes can impact on these various types of Aboriginal sites.

Assessment of the cultural values of Aboriginal sites and places to the Aboriginal community is an important part of the assessment process, and the Aboriginal Cultural Heritage Assessment report (discussed below) <u>is</u> required by the NPWS in order for it to consider whether to issue general terms of approval.

2.1.1 <u>Aboriginal Community Group/s Consultation</u>

Applicants should contact (as early as possible) local Aboriginal community groups, including Local Aboriginal Land Councils, any known Tribal Elders Corporations and Native Title Claimants to ensure that proper consultation processes are carried out. Local Aboriginal community groups will require time to consider a proposal and to discuss any issues with its members, and sufficient time must be allowed for this to occur.

The purpose of Aboriginal participation in the assessment process is:

- To notify the local Aboriginal people in sufficient detail and in a timely manner about activities or developments which may impact on Aboriginal heritage, so that their concerns and possible options for action can be identified on a fully informed basis;
- To ensure that Aboriginal people who hold cultural knowledge, including native title holders or applications, are able to contribute to the assessment process in ways that are culturally acceptable to them;
- To identify locations and cultural values of Aboriginal sites and places of significance to the Aboriginal community that may be affected by the proposal so that potential impacts can be avoided wherever possible; and
- To identify whether there are culturally acceptable mitigative measures when impacts are considered to be unavoidable by the applicant.

It is essential that applicants provide NPWS with documentation from the Aboriginal community groups regarding their views and recommendations for actions.

The Environmental Planning and Assessment Regulation 2000 (cl. 111) allows 46 days (from the date of DA lodgement with the consent authority) for the Director-General of the National Parks and Wildlife to undertake any further Aboriginal community consultation, if the Director-General of the NPW considers that such consultation is required before the Director-General can make a decision concerning the general terms of approval, and consultation commences within 25 days after the date on which the DA is forwarded to the Director-General.

2.1.2 Aboriginal Cultural Heritage Assessment Report

The report should contain:

1. Information on the nature, timing and location of consultation, including the identification of individuals and/or groups consulted and copies of any correspondence from those individuals and/or groups;
2. A statement of the Aboriginal community group/s understanding of the values of the known Aboriginal site/s and/or Aboriginal place located on the development site. This may include social, spiritual, historic, and archaeological values.
3. A statement of the Aboriginal community groups response to the development and their recommendations (if any) for mitigation of impacts and/or conservation of known Aboriginal sites and/or Aboriginal place/s.

The results of this assessment must be integrated with the technical (archaeological) assessment and provide the basis for the final assessment of Aboriginal heritage values and recommendations for management options. The NPWS will also require a clear demonstration in the development application of how the proponent proposes to address any issues which have been raised as part of the Aboriginal cultural assessment, and whether this is acceptable to the Aboriginal community.

To obtain a list of Land Councils and Native Title claimants contact:

NSW State Aboriginal Land Council
PO Box W125
PARRAMATTA NSW 2150
Ph: (02) 9689 4444

Department of Aboriginal Affairs
Level 5, 83 Clarence Street
SYDNEY NSW 2000
Ph: (02) 9290 8700

2.2 Archaeological Assessment

The NPWS requires the information summarised below to evaluate reports on the assessment of Aboriginal sites. Further detail on this is located in the NPWS' *"Aboriginal Cultural Heritage Standards and Guidelines Kit" 1997*, which sets out NPWS requirements for reporting on Aboriginal sites and assessments (refer **Attachment 3** for information on this kit). The assessment of individual Aboriginal sites and the development of management strategies may not require that all of the categories under the following list of information requirements are addressed, however, their relevance needs to be considered for each proposal.

The assessment of Aboriginal sites should be directed towards their conservation and protection. While the *NPW Act* provides for the destruction of sites, this option should always be considered as a last option and must be well supported.

2.2.1 Locational Context:

- description of location of study
- legislative context
- cadastral context (eg: Lot, DP)

- identification of any associated Aboriginal cultural heritage studies undertaken in the study area

2.2.2 Description of Development Impact

- type of development
- extent of direct impacts
- extent of potential indirect impacts (eg: run-off, increased visitation)
- flexibility of project design
- staging and how this might effect present or future management decisions

2.2.3 Assessment Context

- the brief for the work being undertaken for this particular project
- objectives of the assessment

2.2.4 Archaeological Context

- targeted review of known archaeology of region and previous work in the study area to identify range of expected archaeological evidence relative to the project and landscape
- type/s of Aboriginal sites
- **synthesis** and **evaluation** of this information to identify archaeological issues. This will provide the basis for defining the archaeological assessment and management context relevant to this study, and the development of appropriate management options, with protection/conservation being the primary consideration. It should be noted that a summary of previous work is not adequate.

2.2.5 Landscape Context

- description of landscape classification and land units being used for the study (at the different levels of landscape, landscape unit, landform, topographic unit)
- identification of any paleo-features
- assessment of how the landscape context and previous land surface change is relevant to the study
- assessment of how the landscape relates to models of site location and archaeology (as per synthesis above), and development of a framework for assessing the sites and landscapes within the study area
- identification of areas of archaeological sensitivity

The landscape analysis may need to include a geomorphic study to ensure that significant features are identified and considered in the overall assessment (e.g.: paleofeatures with the potential to include older sites).

2.2.6 Condition of Landsurface

- identify previous land surface impacts across the study area, with the view to assessing whether sites may be buried such as campsites, burials, and the integrity of the landsurface in those locations
- description of ground surface conditions and supporting tabulated data (for surveys)

- assessment of how the landsurface conditions have revealed, concealed, destroyed, impacted on or preserved archaeological evidence and how this relates to archaeological potential, the condition of Aboriginal sites and the geomorphology in these contexts

2.2.7 Methodology for Investigation
- description of input from the Aboriginal community to the method proposed for undertaking the study
- the proposed field methodology, such as type of sampling strategies and survey coverage (this should be targeted to the objectives of the study)
- description of the scope and method of recording and analysis by which the objectives of the study will be achieved
- the method whereby a clear and supportable significance assessment will be undertaken a supportable rationale for any proposed test excavations
- the program of work
- rationale for any variation in the methods adopted
- test excavation methodology, if relevant

2.2.8 Survey Coverage Data
- description of survey coverage and the effectiveness of that coverage for detecting potentially buried Aboriginal sites (this needs to be fully described and evaluated within the context of the objectives and the study plan. Specific methods are detailed in the NPWS Standards & Guidelines Kit)

2.2.9 Analysis and Reporting
- detailed Aboriginal site description/s including tabulated data summarising site content and any analysis, as per the NPWS Guidelines
- comprehensive evaluation of the study results (for potentially buried archaeological deposits this includes incorporating the information on archaeological potential and the reliability of survey coverage)
- results of test excavations, if relevant

Diagrams and photos are considered to be an essential component of archaeological reporting.

2.2.10 Archaeological Significance Assessment
- the significance criteria and attributes used for the assessment need to be fully supported by the information presented on the archaeological and landscape context of the site/s (e.g.: representativeness, items and landscape elements considered to be rare, information potential, social/historical values). The criteria for assessment need to be measurable.

2.2.11 Conclusions of the Study
- evaluation of potential impacts on known Aboriginal sites and areas of
- archaeological sensitivity and potential (if relevant)
- establish clear relationship between significance assessment and impacts
- consideration of cumulative impact of development on comparable sites and landscapes at both a local and regional level

- consideration of various management options, **specifically identification of conservation options**, including on-site conservation and compensatory areas (for larger scale projects)
- description of mitigation works required for specific sites to be impact on

2.2.12 Management Options
- recommendations for conservation and other management options based on the results of the archaeological report and discussions with the land owner / manager and the Aboriginal community group/s
- incorporation of management options from Aboriginal community group/s where these relate to the management options being proposed for sites or places

The following maps are required as a minimum (more detailed specifications are set out in the NPWS Guidelines). Mapping should be at the same scale throughout the report.
- location of study area (1:25,000 map series where available, more detailed maps are useful additions)
- development layout if known, flexible components of design if applicable
- locations of previous survey undertaken and sites recorded (referred to in text)
- (for surveys) survey coverage data showing location and extent of different methods used
- land units and topographic information used
- land surface history highlighting the location and boundaries of the disturbed and intact deposits
- Aboriginal site locations

A comprehensive glossary of terms used should also be provided.

What happens if an Aboriginal site is found on the land after a development application is lodged or a development consent is granted ?

It is possible that an 'unknown' Aboriginal site could be identified on the land subsequent to the grant of development consent by Council or DUAP. The NPWS strongly advises that an adequate assessment of Aboriginal heritage values of the land be carried out prior to lodgement of the DA, so that this situation does not arise. However, in the event that this does occur, all works on or adjacent to the Aboriginal site must cease, and the applicant must seek a consent to destroy the relic from the Director-General of NPWS. A development consent granted under the *EP&A Amendment Act* does not equate to a Section 90 consent issued under the *NPW Act*. A consent to destroy an Aboriginal site must be granted pursuant to the *NPW Act* before an Aboriginal site or Aboriginal place can be destroyed. Failure to obtain this consent may result in prosecution.

Further Information

The National Parks and Wildlife Service has a Cultural Heritage Division which manages Aboriginal heritage. The Division includes 4 geographic units which deal with on- and off-park conservation planning and assessment issues. These boundaries are shown on **Attachment 4.**

For further information on these requirements, please contact the Aboriginal Heritage Unit in your area:

Manager, Central Aboriginal Heritage Unit
Cultural Heritage Division
NSW National Parks and Wildlife Service
PO Box 1967
HURSTVILLE NSW 2040

Ph: (02) 9585 6674
Fax: (02) 9595 6442

Manager, Northern Aboriginal Heritage Unit
Cultural Heritage Division
NSW National Parks and Wildlife Service
Locked Bag 914
COFFS HARBOUR NSW 2450

Ph: (02) 6659 8245
Fax: (02) 6651 6187

Manager, Southern Aboriginal Heritage Unit
Cultural Heritage Division
NSW National Parks and Wildlife Service
PO Box 2115
QUEANBEYAN NSW 2620

Ph: (02) 6298 9736
Fax: (02) 6298 4281

Manager, Western Aboriginal Heritage Unit
Cultural Heritage Division
NSW National Parks and Wildlife Service
PO Box 1007
DUBBO NSW 2830

Ph: (02) 6883 5345
Fax: (02) 6884 9382

THE ABORIGINAL SITES REGISTER OF NSW
GENERAL INFORMATION

The National Parks and Wildlife Service maintains the Aboriginal Sites Register of NSW. The Register includes a computer database and site recording cards for all recorded Aboriginal sites in NSW, in addition to a database index of archaeological reports and a library of these reports. Information from the Register may be made available for a variety of uses.

What information is available?

Information relating to recorded Aboriginal sites in a particular area may be made available upon request. The information is generally available in the form of a standard report from the Register database. This report lists all recorded sites within and/or surrounding the area of interest, with each record including the site identifying number, site type, site location and Australian Map Grid co-ordinates, date of recording and the name of the recorder of the site.

If the area of interest is particularly large (e.g.. a river catchment), a Data Licence Agreement may be required. This agreement is a legal contract document between the Director-General of the National Parks and Wildlife Service and a named client, and is designed to ensure that any data supplied under the agreement is used appropriately.

In some cases, written support from the relevant Local Aboriginal Land Council may be required before information can be provided from the Register.

How is the data provided?

Site information will generally be provided as a standard computer print out, however, digital computer formats on disk may be available for specific purposes.

Is there a charge for data?

The cost for supply of a standard report is $30 per search area. An urgent database search may be conducted for $60. More complex reports may incur an additional charge.

In particular circumstances there may be no charge for a report (e.g.. for Aboriginal Land Councils, research purposes etc.). The waiving of any charge requires discussion with the Aboriginal Sites Registrar.

There is no charge imposed for a Data Licence Agreement, however, any data supplied under a Licence Agreement will generally be charged at the current "cost of transfer".

Are there any limitations in the data?

It is essential to note that a report from the Register does not represent a comprehensive list of all Aboriginal sites in a specified area. A report lists recorded sites only. In any given area there may be a number of undiscovered and/or unrecorded sites. As a result of this limitation, and the fact that all Aboriginal sites are protected under NSW legislation, the NPWS may recommend that a survey for Aboriginal sites is conducted where development is proposed.

Locational details are recorded as grid references. It is important to note that there *may* be errors in these recordings. If accurate site locations are required it may be necessary to confirm the locations on the ground.

If the information provided is to be used for ongoing purposes, it is recommended that regular updates are obtained as new records are continually being added to the database.

How to obtain Aboriginal sites data

To obtain information about recorded Aboriginal sites, a written request should be forwarded to the Aboriginal Sites Registrar (a request form is available if required). All requests must include;

- Company/organisation name (if applicable)
- Contact name, phone number and address details
- Purpose for which the information is required
- Copy of a topographic map with the area of interest clearly marked
- A cheque for $30 per search area, made out to the NPWS (unless other arrangements have been made with the Registrar)

Applications should be forwarded to:

The Aboriginal Sites Registrar
Cultural Heritage Division
NPWS
PO Box 1967
Hurstville, NSW 2220. **or fax (02) 9585 6466**

Further information

For further information about the Aboriginal Sites Register, please contact the Aboriginal Sites Registrar (02 9585 6471, fax 02 9585 6466).

ATTACHMENT 2

PROCESS

1. Development proposal.

2. Investigative studies and assessments. This could include: Aboriginal heritage, flora and fauna, hydrology, air, noise, social / economic etc.

3. For Aboriginal heritage, information is required about:

4. Information sources:
NB: Test excavations may be required. This requires a permit from NPWS, allow 8 weeks for processing.

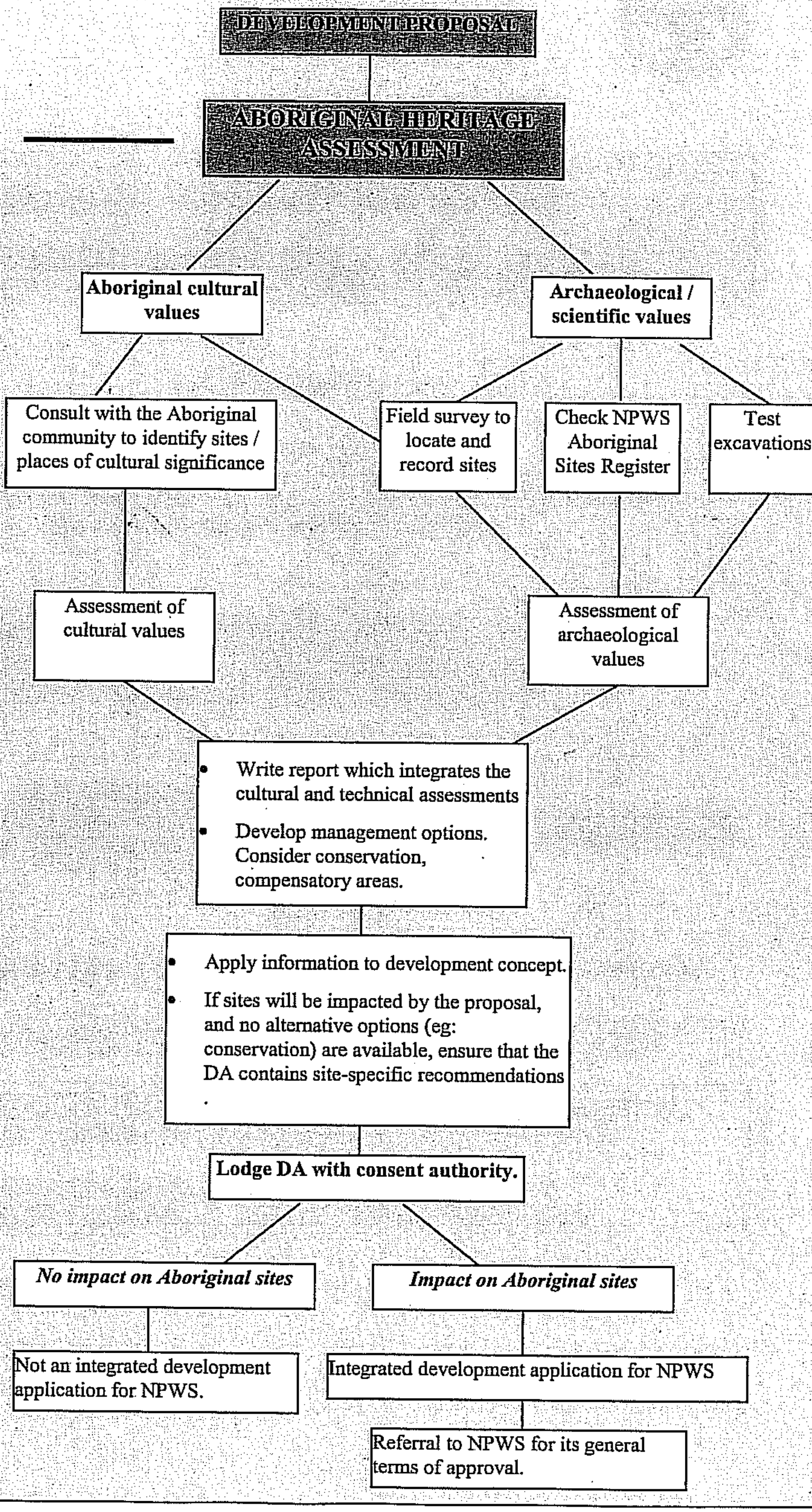
5. Undertake assessment

6. Prepare report and recommend management options.

7. Apply this and information from other assessments to development concept and finalise development proposal. Avoiding impact on sites is the preferred strategy.

8. Lodgement of DA with consent authority

9. DA is an IDA if development will impact on Aboriginal sites.



ATTACHMENT 3

Aboriginal Cultural Heritage
Standards and Guidelines Kit

comprising

Guidelines for Aboriginal Consultants

These *Guidelines* aim to clarify for Aboriginal consultants the type of reporting required for heritage assessments. The *Guidelines* reflect the Service's commitment to partnership with Aboriginal stakeholders in protecting and managing Aboriginal cultural heritage.

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Standards Manual for Archaeological Practice in Aboriginal Heritage Management

The *Standards Manual* sets out current best practices in this diverse and developing field. The *Manual* encourages archaeological methodology to be relevant to the management context. It has been developed in partnership with the professional community and will be supplemented by regular updates.

•

Guidelines for Archaeological Survey Reporting

These *Guidelines* set out in detail the requirements of NPWS for survey reports submitted by archaeologists. The object is to enhance the comparability of survey reports as well as to promote transparency and predictability in the industry by making clear the needs and expectations of NPWS as the reviewing agency.

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Guidelines for Aboriginal Heritage Impact Assessment in the Exploration & Mining Industries

These *Guidelines* provide industry-specific advice to applicants of exploration and mining ventures. They were prepared by NPWS in co-operation with the NSW Minerals Council and the NSW Department of Mineral resources.

To obtain a copy of this valuable kit please send a cheque for $70 made out to NPWS to:
Cultural Heritage Division, NPWS, PO Box 1967, Hurstville NSW 2220
Enquires to:
Denis Byrne (02)9585 6571 *denis.byrne@npws.nsw.gov.au*
Anthony English (02)9585 6464 *anthony.english@npws.nsw.gov.au*

NSW NATIONAL PARKS AND WILDLIFE SERVICE

ABORIGINAL CULTURAL HERITAGE AND THE INTEGRATED DEVELOPMENT ASSESSMENT PROCESS

INFORMATION FOR APPLICANTS
20 February 2001

This information is presented to assist you to lodge an integrated development application with your local council. Part 4 of *Environmental Planning and Assessment Act 1979* has recently been amended. The new *Environmental Planning and Assessment Amendment Act 1997* provides a single system for the development, building and subdivisions aspects of a proposal, and involves the linking of some approvals granted by State government agencies under other environmental legislation. Development proposals which require an approval or licence from one or more of these State agencies (refer to section 91 of the *EP&AA Act)* are known as an integrated approval. The basis of the IDA process involves applicants providing up-front the information necessary for agencies or approval bodies to determine if they will give the general terms of approval necessary for granting additional approvals.

The National Parks and Wildlife Service (NPWS) is one of the State government agencies which has been included in the IDA process, in relation to its responsibilities for Aboriginal relics and Aboriginal places under Section 90 of the *National Parks and Wildlife Act 1974.* Under Section 90, it is an offence to knowingly destroy, deface or damage a relic or Aboriginal place without the consent of the Director-General of the National Parks and Wildlife Service.

The NPWS acknowledges that it is Aboriginal people who should determine the cultural significance of Aboriginal heritage, and the NPWS has a strong commitment to working in partnership with Aboriginal people to manage and conserve Aboriginal cultural heritage. The NPWS recognises that Aboriginal cultural heritage includes both traditional and contemporary associations of Aboriginal people with the environment as well as physical sites.

NSW National Parks and Wildlife Service
43 Bridge Street, Hurstville NSW PO Box 1967, Hurstville NSW 2220
Telephone (02) 9585 6444 Facsimile (02) 9585 6555
Internet Email: info@npws.nsw.gov.au

Aboriginal heritage issues should be addressed upfront as part of the planning process undertaken for developments, and prior to lodgement of a development application. The NPWS requires that options for conserving Aboriginal relics within development footprints be fully explored in discussion with the Aboriginal community as part of the development assessment process. Impacts on Aboriginal relics should only be considered where there are no viable alternatives. The NPWS will require a clear demonstration that alternatives to site destruction have been fully explored.

When is the NPWS an approval body in the IDA process ?

The NPWS is an approval body in the IDA process when a development will impact on an Aboriginal relic or Aboriginal place, thereby requiring a consent to destroy from the Director-General of the National Parks and Wildlife Service. Threatened species, populations and/or ecological communities do not trigger the IDA process as the *Environmental Planning & Assessment (EP&A) Act 1979* and *Threatened Species Conservation Act 1995* eliminated the need for separate licensing or approvals in relation to these issues.

The NPWS is an approval body for a development application under the IDA process when:

1) A 'relic' is known to exist on the land to which the DA applies; and/or the land to which the DA applies is an Aboriginal place, immediately before the DA is made (as per s.91 (2)(a-b), *EP&A Amendment Act 1997);* AND

2) The development proposal will destroy, deface or damage an Aboriginal 'relic' or Aboriginal place, and a consent to destroy from the Director-General of the National Parks and Wildlife Service will be required, as per section 90 of the *National Parks and Wildlife (NPW) Act 1974* (note damage to an Aboriginal relic or place may be direct damage or result from indirect impacts).

   Under the *NPW Act*, a 'relic' is defined as any deposit, object or material evidence (not being a handicraft made for sale) relating to indigenous and non-European habitation of the area that comprises NSW, being habitation both prior to and concurrent with the occupation of that area by persons of European extraction, and includes Aboriginal remains (as defined within the meaning of the NPW Act). Relics are confined to physical evidence.

   Aboriginal 'relics' are commonly referred to as Aboriginal sites.

   An "Aboriginal place" is a place which has been declared so by the Minister for the Environment because he or she believes that the place is or was of special significance to Aboriginal culture. It may or may not contain physical relics.

It should be noted that *the NPW Act* does not provide protection for spiritual areas or natural mythological areas that have no physical remains of Aboriginal occupation, unless they have been declared an 'Aboriginal place'.

For the purposes of the IDA process, the NPWS considers that an Aboriginal site ('relic') may be considered to be 'known' if:

- It is registered on the NPWS Aboriginal Sites Register; and/or

- It is an Aboriginal site known to the Aboriginal community; and/or
- It is located during surveys (eg: archaeological, anthropological) or test excavations conducted prior to lodgement of the DA.

How do I find out if there is an Aboriginal site on the land ?

To find out whether the land you want to develop contains known Aboriginal site/s or an Aboriginal place, you need to:

- Consult with the Aboriginal community groups to identify the location of Aboriginal sites. They may be aware of sites that have not been registered with NPWS.
- Contact the Aboriginal Sites Registrar at NPWS and request a site search to obtain a listing of registered Aboriginal sites. The Register only includes those Aboriginal sites which have been reported to NPWS. **Attachment 1** provides general information on the Aboriginal Sites Register, and a site search request form.
- Undertake an assessment of the known Aboriginal site/s and/or undertake survey of the subject land to locate Aboriginal sites. Test excavations may be required as part of this investigation to verify the location of Aboriginal sites. Such excavations need to be undertaken <u>before</u> the DA is submitted. A permit is required from NPWS for such investigation and if all information is attached to the application the processing time is 8 weeks.

Once you have this information, you need to assess whether the development proposal will impact upon an Aboriginal site or an Aboriginal place. While the *NPWS Act* provides for the destruction of Aboriginal sites, this should always be considered as a last option, and in-situ conservation is the preferred option.

How to find out whether land contains a gazetted Aboriginal place

An Aboriginal place may be considered known if it has been declared by the Minister, and gazetted. Information on whether a proposed development site contains an Aboriginal place may be obtained by contacting the NPWS Aboriginal Sites Register (refer **Attachment 1**).

What information do I need to include with my development application ?

You need to clearly state in your development application to Council whether your proposal would impact on a known Aboriginal site or an Aboriginal place. The flowchart in **Attachment 2** outlines the process for assessing the Aboriginal heritage values of an area to allow you to determine whether your development application will be an integrated development application for Aboriginal sites. It is essential that the outcomes of the Aboriginal cultural assessment and the technical assessment are integrated. The results of the Aboriginal heritage assessment must be applied to define potential development constraints, and the development concept should these constraints into account. The development application should clearly indicate whether Aboriginal sites will be impacted or not, and if so, what is proposed for each of the impacted sites (this might include salvage excavations, collection of artefacts etc).

If the IDA process is triggered through the presence of known Aboriginal site/s and/or an Aboriginal place that would be impacted by a proposed development, Council will contact the NPWS seeking its general terms of approval. In order to provide general terms of approval the NPWS will need the same level of information required to make the actual decision.

Applicants need to include two types of information in their IDA application:

1. Aboriginal cultural heritage assessment which involves consultation with Aboriginal community groups. The NPWS is committed to working in partnership with Aboriginal community groups in the management of sites and requires community assessment of any Aboriginal sites.
2. Archaeological assessment which involves the assessment of Aboriginal sites and their management based on archaeological heritage criteria.

This information from each of these must be integrated to provide the basis for the final assessment of Aboriginal heritage values and recommendations for management options.

The following advice sets out the NPWS information requirements in more detail. Not all applications will attract the same information requirements. As some of this information is of a technical nature, the NPWS suggests that you consider engaging a reputable archaeologist to assist in the preparation of an IDA.

The NPWS advises that it does not require that a Section 90 consent application be submitted with the Integrated Development Application. The proponent will however be required to apply to the NPWS for a Section 90 consent within three years of the granting of development consent. This is explained in more detail below.

2.1 Aboriginal Cultural Heritage Assessment

Aboriginal sites can be the physical remains of Aboriginal occupation of an area or alternatively, an area that has particular meaning for Aboriginal people, for example, spiritual areas or natural mythological areas. It is important to consider that Aboriginal heritage is not only valuable to Aboriginal people but also to those people who are interested in learning from the early inhabitants of Australia. Proposed developments that alter landscapes can impact on these various types of Aboriginal sites.

Assessment of the cultural values of Aboriginal sites and places to the Aboriginal community is an important part of the assessment process, and the Aboriginal Cultural Heritage Assessment report (discussed below) is required by the NPWS in order for it to consider whether to issue general terms of approval.

2.1.1 Aboriginal Community Group/s Consultation

Applicants should contact (as early as possible) local Aboriginal community groups, including Local Aboriginal Land Councils, any known Tribal Elders Corporations and Native Title Claimants to ensure that proper consultation processes are carried out. Local Aboriginal community groups will require time to consider a proposal and to discuss any issues with its members, and sufficient time must be allowed for this to occur.

The purpose of Aboriginal participation in the assessment process is:

- To notify the local Aboriginal people in sufficient detail and in a timely manner about activities or developments which may impact on Aboriginal heritage, so that their concerns and possible options for action can be identified on a fully informed basis;
- To ensure that Aboriginal people who hold cultural knowledge, including native title holders or applications, are able to contribute to the assessment process in ways that are culturally acceptable to them;
- To identify locations and cultural values of Aboriginal sites and places of significance to the Aboriginal community that may be affected by the proposal so that potential impacts can be avoided wherever possible; and
- To identify whether there are culturally acceptable mitigative measures when impacts are considered to be unavoidable by the applicant.

It is essential that applicants provide NPWS with documentation from the Aboriginal community groups regarding their views and recommendations for actions.

The Environmental Planning and Assessment Regulation 2000 (cl. 111) allows 46 days (from the date of DA lodgement with the consent authority) for the Director-General of the National Parks and Wildlife to undertake any further Aboriginal community consultation, if the Director-General of the NPW considers that such consultation is required before the Director-General can make a decision concerning the general terms of approval, and consultation commences within 25 days after the date on which the DA is forwarded to the Director-General.

2.1.2 Aboriginal Cultural Heritage Assessment Report

The report should contain:

1. Information on the nature, timing and location of consultation, including the identification of individuals and/or groups consulted and copies of any correspondence from those individuals and/or groups;
2. A statement of the Aboriginal community group/s understanding of the values of the known Aboriginal site/s and/or Aboriginal place located on the development site. This may include social, spiritual, historic, and archaeological values.
3. A statement of the Aboriginal community groups response to the development and their recommendations (if any) for mitigation of impacts and/or conservation of known Aboriginal sites and/or Aboriginal place/s.

The results of this assessment must be integrated with the technical (archaeological) assessment and provide the basis for the final assessment of Aboriginal heritage values and recommendations for management options. The NPWS will also require a clear demonstration in the development application of how the proponent proposes to address any issues which have been raised as part of the Aboriginal cultural assessment, and whether this is acceptable to the Aboriginal community.

To obtain a list of Land Councils and Native Title claimants contact:

NSW State Aboriginal Land Council
PO Box W125
PARRAMATTA NSW 2150
Ph: (02) 9689 4444

Department of Aboriginal Affairs
Level 5, 83 Clarence Street
SYDNEY NSW 2000
Ph: (02) 9290 8700

2.2 Archaeological Assessment

The NPWS requires the information summarised below to evaluate reports on the assessment of Aboriginal sites. Further detail on this is located in the NPWS' *"Aboriginal Cultural Heritage Standards and Guidelines Kit" 1997*, which sets out NPWS requirements for reporting on Aboriginal sites and assessments (refer **Attachment 3** for information on this kit). The assessment of individual Aboriginal sites and the development of management strategies may not require that all of the categories under the following list of information requirements are addressed, however, their relevance needs to be considered for each proposal.

The assessment of Aboriginal sites should be directed towards their conservation and protection. While the *NPW Act* provides for the destruction of sites, this option should always be considered as a last option and must be well supported.

2.2.1 Locational Context:

- description of location of study
- legislative context
- cadastral context (eg: Lot, DP)
- identification of any associated Aboriginal cultural heritage studies undertaken in the study area

2.2.2 Description of Development Impact

- type of development
- extent of direct impacts
- extent of potential indirect impacts (eg: run-off, increased visitation)
- flexibility of project design
- staging and how this might effect present or future management decisions

2.2.3 Assessment Context

- the brief for the work being undertaken for this particular project
- objectives of the assessment

2.2.4 Archaeological Context

- targeted review of known archaeology of region and previous work in the study area to identify range of expected archaeological evidence relative to the project and landscape
- type/s of Aboriginal sites
- **synthesis** and **evaluation** of this information to identify archaeological issues. This will provide the basis for defining the archaeological assessment and management context

relevant to this study, and the development of appropriate management options, with protection/conservation being the primary consideration. It should be noted that a summary of previous work is not adequate.

2.2.5 Landscape Context

- description of landscape classification and land units being used for the study (at the different levels of landscape, landscape unit, landform, topographic unit)
- identification of any paleo-features
- assessment of how the landscape context and previous land surface change is relevant to the study
- assessment of how the landscape relates to models of site location and archaeology (as per synthesis above), and development of a framework for assessing the sites and landscapes within the study area
- identification of areas of archaeological sensitivity

The landscape analysis may need to include a geomorphic study to ensure that significant features are identified and considered in the overall assessment (e.g.: paleofeatures with the potential to include older sites).

2.2.6 Condition of Landsurface

- identify previous land surface impacts across the study area, with the view to assessing whether sites may be buried such as campsites, burials, and the integrity of the landsurface in those locations
- description of ground surface conditions and supporting tabulated data (for surveys)
- assessment of how the landsurface conditions have revealed, concealed, destroyed, impacted on or preserved archaeological evidence and how this relates to archaeological potential, the condition of Aboriginal sites and the geomorphology in these contexts

2.2.7 Methodology for Investigation

- description of input from the Aboriginal community to the method proposed for undertaking the study
- the proposed field methodology, such as type of sampling strategies and survey coverage (this should be targeted to the objectives of the study)
- description of the scope and method of recording and analysis by which the objectives of the study will be achieved
- the method whereby a clear and supportable significance assessment will be undertaken a supportable rationale for any proposed test excavations
- the program of work
- rationale for any variation in the methods adopted
- test excavation methodology, if relevant

2.2.8 Survey Coverage Data

- description of survey coverage and the effectiveness of that coverage for detecting potentially buried Aboriginal sites (this needs to be fully described and evaluated within the context of the objectives and the study plan. Specific methods are detailed in the NPWS Standards & Guidelines Kit)

2.2.9 Analysis and Reporting

- detailed Aboriginal site description/s including tabulated data summarising site content and any analysis, as per the NPWS Guidelines
- comprehensive evaluation of the study results (for potentially buried archaeological deposits this includes incorporating the information on archaeological potential and the reliability of survey coverage)
- results of test excavations, if relevant

Diagrams and photos are considered to be an essential component of archaeological reporting.

2.2.10 Archaeological Significance Assessment

- the significance criteria and attributes used for the assessment need to be fully supported by the information presented on the archaeological and landscape context of the site/s (e.g.: representativeness, items and landscape elements considered to be rare, information potential, social/historical values). The criteria for assessment need to be measurable.

2.2.11 Conclusions of the Study

- evaluation of potential impacts on known Aboriginal sites and areas of
- archaeological sensitivity and potential (if relevant)
- establish clear relationship between significance assessment and impacts
- consideration of cumulative impact of development on comparable sites and landscapes at both a local and regional level
- consideration of various management options, **specifically identification of conservation options**, including on-site conservation and compensatory areas (for larger scale projects)
- description of mitigation works required for specific sites to be impact on

2.2.12 Management Options

- recommendations for conservation and other management options based on the results of the archaeological report and discussions with the land owner / manager and the Aboriginal community group/s
- incorporation of management options from Aboriginal community group/s where these relate to the management options being proposed for sites or places

The following maps are required as a minimum (more detailed specifications are set out in the NPWS Guidelines). Mapping should be at the same scale throughout the report.

- location of study area (1:25,000 map series where available, more detailed maps are useful additions)
- development layout if known, flexible components of design if applicable
- locations of previous survey undertaken and sites recorded (referred to in text)
- (for surveys) survey coverage data showing location and extent of different methods used
- land units and topographic information used
- land surface history highlighting the location and boundaries of the disturbed and intact deposits
- Aboriginal site locations

A comprehensive glossary of terms used should also be provided.

Subsequent to the grant of development consent.

Please note that while you may have been granted a development consent, you are still required to apply to the NPWS for a Section 90 consent to destroy an Aboriginal site and/or Aboriginal place. You have up to three (3) years to apply to the NPWS for a consent to destroy an Aboriginal site or an Aboriginal place. This will involve the submission of an application to the NPWS and the payment of a fee to have the application assessed. For more information about how to applying for a consent to destroy, contact the relevant NPWS office (see below).

What happens if an Aboriginal site is found on the land after a development application is lodged or a development consent is granted ?

It is possible that an 'unknown' Aboriginal site could be identified on the land over which a development application has been lodged or development consent has been granted. The NPWS strongly advises that an adequate assessment of Aboriginal heritage values of the land is carried out prior to lodgement of the DA, so that this situation does not arise. However, in the event that this does occur, all works on or adjacent to the Aboriginal site must cease, and you must identify a conservation option to project the Aboriginal site or seek a consent to destroy the Aboriginal site from the Director-General of NPWS. A development consent granted under the *EP&A Act* does not equate to a Section 90 consent issued under the NPW Act. A consent to destroy an Aboriginal site must be granted pursuant to the *NPW Act* <u>before</u> an Aboriginal site or Aboriginal place can be destroyed. Failure to obtain this consent may result in prosecution.

Fees

The NPWS will charge a fee of $250 to process the development application for an integrated approval. This fee should be paid by cheque and attached to the integrated development application. The cheque should be made out the National Parks and Wildlife Service.

This fee is only for the processing of an integrated development application. You may be required to pay separate fees to the NPWS to obtain a site search from the NPWS Aboriginal Sites Register, and/or a fee if you apply to the NPWS for an application for consent to destroy an Aboriginal site.

Contacts

The National Parks and Wildlife Service has a Cultural Heritage Division which manages Aboriginal heritage. The Division includes 4 geographic units which deal with on- and off-park conservation planning and assessment issues. These boundaries are shown on **Attachment 4.**

For further information on these requirements, please contact the Aboriginal heritage unit in your area:

Manager, Central Aboriginal Heritage Unit

Manager, Northern Aboriginal Heritage Unit

Cultural Heritage Division
NSW National Parks and Wildlife Service
PO Box 1967
HURSTVILLE NSW 2040

Ph: (02) 9585 6674
Fax: (02) 9595 6442

Cultural Heritage Division
NSW National Parks and Wildlife Service
Locked Bag 914
COFFS HARBOUR NSW 2450

Ph: (02) 6659 8245
Fax: (02) 6651 6187

Manager, Southern Aboriginal Heritage Unit
Cultural Heritage Division
NSW National Parks and Wildlife Service
PO Box 2115
QUEANBEYAN NSW 2620

Ph: (02) 6298 9736
Fax: (02) 6298 4281

Manager, Western Aboriginal Heritage Unit
Cultural Heritage Division
NSW National Parks and Wildlife Service
PO Box 1007
DUBBO NSW 2830

Ph: (02) 6883 5345
Fax: (02) 6884 9382

ATTACHMENT 1

THE ABORIGINAL SITES REGISTER OF NSW
GENERAL INFORMATION

The National Parks and Wildlife Service maintains the Aboriginal Sites Register of NSW. The Register includes a computer database and site recording cards for all recorded Aboriginal sites in NSW, in addition to a database index of archaeological reports and a library of these reports. Information from the Register may be made available for a variety of uses.

What information is available?

Information relating to recorded Aboriginal sites in a particular area may be made available upon request. The information is generally available in the form of a standard report from the Register database. This report lists all recorded sites within and/or surrounding the area of interest, with each record including the site identifying number, site type, site location and Australian Map Grid co-ordinates, date of recording and the name of the recorder of the site.

If the area of interest is particularly large (e.g.. a river catchment), a Data Licence Agreement may be required. This agreement is a legal contract document between the Director-General of the National Parks and Wildlife Service and a named client, and is designed to ensure that any data supplied under the agreement is used appropriately.

In some cases, written support from the relevant Local Aboriginal Land Council may be required before information can be provided from the Register.

How is the data provided?

Site information will generally be provided as a standard computer print out, however, digital computer formats on disk may be available for specific purposes.

Is there a charge for data?

The cost for supply of a standard report is $30 per search area. An urgent database search may be conducted for $60. More complex reports may incur an additional charge.

In particular circumstances there may be no charge for a report (e.g.. for Aboriginal Land Councils, research purposes etc.). The waiving of any charge requires discussion with the Aboriginal Sites Registrar.

There is no charge imposed for a Data Licence Agreement, however, any data supplied under a Licence Agreement will generally be charged at the current "cost of transfer".

Are there any limitations in the data?

It is essential to note that a report from the Register does not represent a comprehensive list of all Aboriginal sites in a specified area. A report lists recorded sites only. In any given area there may be a number of undiscovered and/or unrecorded sites. As a result of this limitation, and the fact that all Aboriginal sites are protected under NSW legislation, the NPWS may recommend that a survey for Aboriginal sites is conducted where development is proposed.

Locational details are recorded as grid references. It is important to note that there *may* be errors in these recordings. If accurate site locations are required it may be necessary to confirm the locations on the ground.

If the information provided is to be used for ongoing purposes, it is recommended that regular updates are obtained as new records are continually being added to the database.

How to obtain Aboriginal sites data

To obtain information about recorded Aboriginal sites, a written request should be forwarded to the Aboriginal Sites Registrar (a request form is available if required). All requests must include;

- Company/organisation name (if applicable)
- Contact name, phone number and address details
- Purpose for which the information is required
- Copy of a topographic map with the area of interest clearly marked
- A cheque for $30 per search area, made out to the NPWS (unless other arrangements have been made with the Registrar)

Applications should be forwarded to:

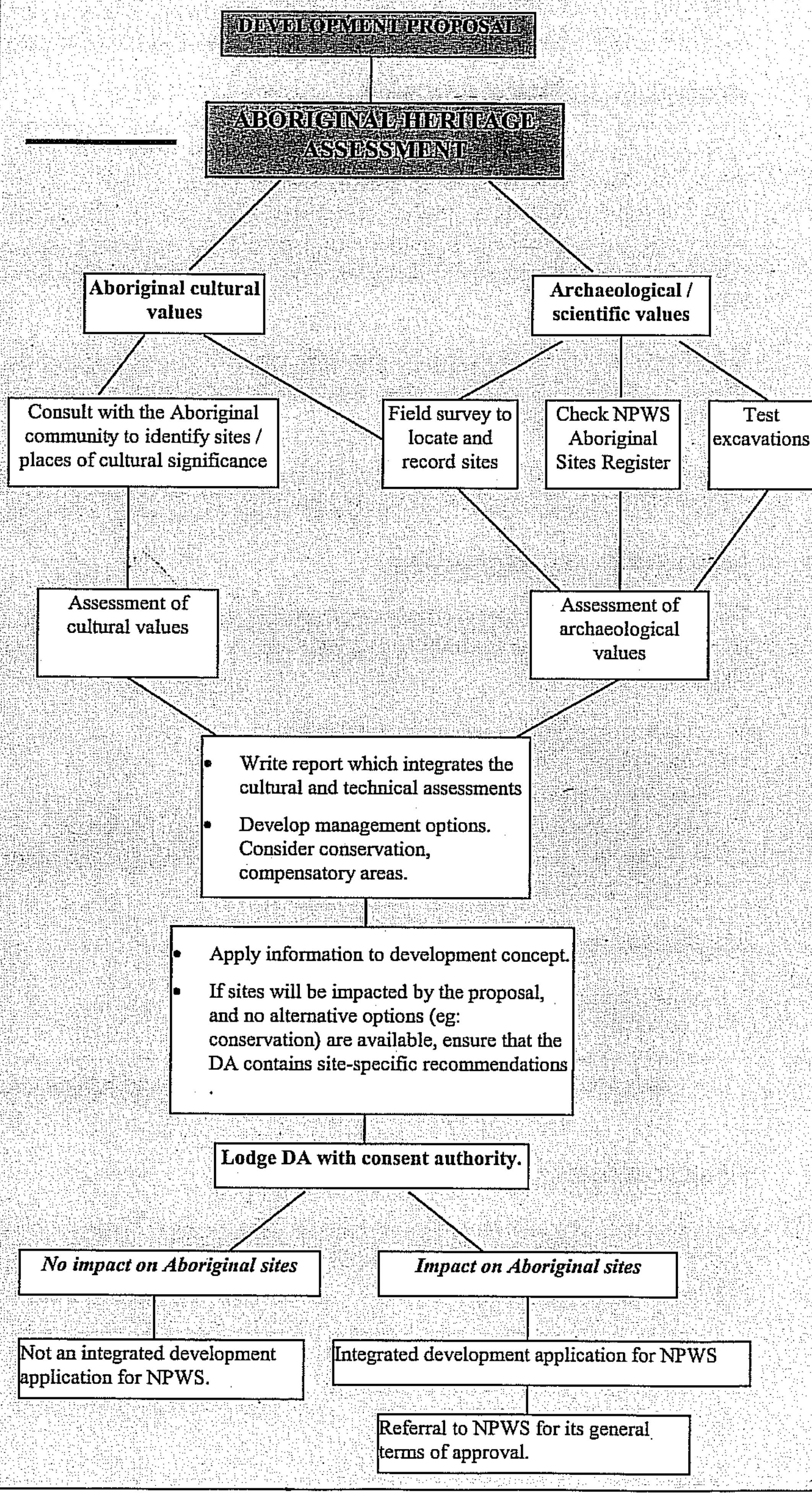
The Aboriginal Sites Registrar
NPWS
PO Box 1967
Hurstville, NSW 2220. **or fax (02) 9585 6466**

Further information

For further information about the Aboriginal Sites Register, please contact the Aboriginal Sites Registrar (02 9585 6471, fax 02 9585 6466) or the Database Co-ordinator (02 9585 6843, fax 02 9585 6466

PROCESS

1. **Development proposal.**
2. **Investigative studies and assessments. This could include: Aboriginal heritage, flora and fauna, hydrology, air, noise, social / economic etc.**
3. **For Aboriginal heritage, information is required about:**
4. **Information sources:** ***NB: Test excavations may be required. This requires a permit from NPWS, allow 8 weeks for processing.***
5. **Undertake assessment**
6. **Prepare report and recommend management options.**
7. **Apply this and information from other assessments to development concept and finalise development proposal. Avoiding impact on sites is the preferred strategy.**
8. **Lodgement of DA with consent authority**
9. **DA is an IDA if development will impact on Aboriginal sites.**



ATTACHMENT 3

Aboriginal Cultural Heritage
Standards and Guidelines Kit

comprising

Guidelines for Aboriginal Consultants

These *Guidelines* aim to clarify for Aboriginal consultants the type of reporting required for heritage assessments. The *Guidelines* reflect the Service's commitment to partnership with Aboriginal stakeholders in protecting and managing Aboriginal cultural heritage.

•

Standards Manual for Archaeological Practice in Aboriginal Heritage Management

The *Standards Manual* sets out current best practices in this diverse and developing field. The *Manual* encourages archaeological methodology to be relevant to the management context. It has been developed in partnership with the professional community and will be supplemented by regular updates.

•

Guidelines for Archaeological Survey Reporting

These *Guidelines* set out in detail the requirements of NPWS for survey reports submitted by archaeologists. The object is to enhance the comparability of survey reports as well as to promote transparency and predictability in the industry by making clear the needs and expectations of NPWS as the reviewing agency.

•

Guidelines for Aboriginal Heritage Impact Assessment in the Exploration & Mining Industries

These *Guidelines* provide industry-specific advice to applicants of exploration and mining ventures. They were prepared by NPWS in co-operation with the NSW Minerals Council and the NSW Department of Mineral resources.

To obtain a copy of this valuable kit please send a cheque for $70 made out to NPWS to:
Cultural Heritage Services Division, NPWS, PO Box 1967, Hurstville NSW 2220
Enquires to
Denis Byrne (02)9585 6571 *denis.byrne@npws.nsw.gov.au*
Anthony English (02)9585 6464 *anthony.english@npws.nsw.gov.au*
Daphne Siu (02) 9586 6642

Department of
Environment and Conservation (NSW)

National Parks and Wildlife Act 1974:
Part 6 Approvals

Interim Community Consultation Requirements for Applicants

1. The Department of Environment and Conservation (DEC) respects and acknowledges the role of Aboriginal people in the management and protection of their cultural heritage.

2. These interim guidelines are to guide persons seeking an approval under Part 6 of the National Parks and Wildlife Act 1974.

3. DEC has developed these interim guidelines to clarify and reaffirm the intent of its policies regarding the requirements for consultation by proponents with members and representatives of Aboriginal communities.

4. These interim guidelines seek to be clear as to what the parties involved in this process should expect and, in doing so, seek to be workable and fair to all parties.

5. DEC is committed to developing a more detailed guideline to replace this interim guideline, based on consultation with the Aboriginal community and other stakeholders in 2005.

Department of Environment and Conservation (NSW)
59-61 Goulburn Street, Sydney NSW 2000
PO Box A290, Sydney South NSW 1232
Phone: (02) 9995 5000
Phone: 131 555 (NSW only – information and publication requests)
Fax: (02) 9995 5999
Email: info@environment.nsw.gov.au
Website: www.environment.nsw.gov.au

ISBN 1 74137 106 6
DEC 2005/04
December 2004

Part A: Scope and introduction

This is a document focusing on the requirements for engaging with the Aboriginal community as part of the preparation of an application for a consent or permit under Part 6 of the *National Parks and Wildlife Act 1974*.

Input from the Aboriginal community is an essential part of assessing the significance of those Aboriginal objects likely to be impacted by an activity. Hence DEC requires proponents to undertake consultation with the Aboriginal community as an integral part of the impact assessment.

This document replaces all previous DEC or NPWS policy or procedural documents relating to Aboriginal community consultation connected with Part 6 approvals. It applies to all applications lodged from 1 January 2005.

Statutory framework

Why does DEC manage Aboriginal cultural heritage? Where does it get its authority?

The *National Parks and Wildlife Act* 1974 (NPW Act) is the primary legislation regulating the protection of Aboriginal heritage through the administration of Part 6 of the NPW Act. DEC administers the NPW Act.

Part 6 of the Act provides protection for Aboriginal objects and Aboriginal places.

- An **Aboriginal object** is any deposit, object or material evidence (not being a handicraft made for sale) relating to Aboriginal habitation of the area that comprises NSW, being habitation before or concurrent with the occupation of that area by persons of non-Aboriginal extraction, and includes Aboriginal remains (as defined within the meaning of the NPW Act).
- An **Aboriginal place** is a place which has been declared so by the Minister administering the NPW Act because he or she believes that the place is or was of special significance to Aboriginal culture. It may or may not contain Aboriginal objects.[1]

DEC responsibilities under part 6 of the NPW Act are triggered where an activity is likely to impact on Aboriginal objects (also referred to as sites) and declared Aboriginal places. Such an activity requires the approval of the Director General of DEC under section 87 or section 90 of

[1] Aboriginal places are those that have been gazetted in accordance with section 84 of the NPW Act. It should be noted that the NPW Act does not provide protection for spiritual areas or natural resource areas that have no physical evidence of Aboriginal occupation or use, unless they have been declared an Aboriginal place.

the NPW Act.[2] Section 91 of the Act requires that DEC be notified by any person who is aware of the location of an Aboriginal object within a reasonable time after discovery of that object.

The decision whether or not to issue a consent under section 90 and/or a permit under section 87 of the NPW Act is the responsibility of the Director General of DEC. It is the responsibility of the proponent to supply sufficient information to enable the Director General to make a decision.

Why DEC requires consultation

DEC recognises that:

- Aboriginal heritage has both cultural and scientific/archaeological significance and that both should be the subject of assessment to inform its decision-making
- Aboriginal people are the primary determinants of the significance of their heritage
- Aboriginal community involvement needs to occur early in the assessment process to ensure that their values and concerns are taken fully into account, and so that their own decision-making structures are able to function
- information arising out of consultation allows the consideration of Aboriginal community views about significance and impact, as well as the merits of management or mitigation measures to be considered in an informed way.

Hence, when administering its approval functions under the NPW Act, DEC requires applicants to consult with the Aboriginal community about the Aboriginal cultural heritage values (cultural significance) of Aboriginal objects and places within the area being considered for development.

However, community consultation is not a sign-off or approval process. The NPW Act establishes the Director General of DEC as the decision-maker. DEC recognises that its decisions will not always be consistent with the views of the Aboriginal community and that there may not always be agreement within the Aboriginal community. However, DEC will take into account all relevant information it receives as part of its decision-making process.

The community consultation process ensures Aboriginal communities have the opportunity to improve assessment outcomes by:

- influencing the design of the assessment of cultural and scientific significance
- providing relevant information regarding the cultural significance values of the objects/places
- contributing to the development of cultural heritage management recommendations

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[2] A DEC section 87 permit is required to disturb, move and or take possession of an Aboriginal object or disturb land for the purpose of discovering an Aboriginal object. A DEC section 90 consent is required to destroy, damage or deface an Aboriginal object or Aboriginal place. In the Act, these are collectively referred to as 'approvals'.

- providing comment on draft assessment reports prior to their submission.

Summary of the roles of the parties

Proponent

Initiates the proposal; seeks the views of the Aboriginal community about methodologies; gathers cultural and archaeological information; uses this information to assess its significance; undertakes assessment of potential impact; gathers the views of the Aboriginal community about potential impacts and the mitigation of these; and provides the results to DEC in a report to accompany applications for approval.

Aboriginal community

Members of the Aboriginal community are the primary determinants of the significance of their heritage. They may participate in the process through comment on the assessment methodology, contributing cultural knowledge and commenting on cultural significance of potential impacts and/or mitigation measures. These comments are provided through the assessment process conducted by the proponent.

DEC

Is the decision-maker; reviews information from the proponents, including information about the views and knowledge provided by the Aboriginal community; and makes a decision to grant or not grant approval (with or without conditions).

Service providers

Various parties with specialist skills or knowledge can be engaged by proponents to help them fulfil their responsibilities. Services provided can include Aboriginal assessment and advisory services and archaeological services.

Part B: Consultation requirements

In reviewing applications for consents and permits, DEC will look to see that the following consultation requirements have been met.

1: Notification and registration of interests

The proponent or their consultant[3] (referred to as 'the proponent' below) must actively seek to identify stakeholder groups or people wishing to be consulted about the project and invite them to register their interest.

To this end, it will be sufficient for the proponent to provide written notification to:

(a) the bodies listed below –

- Local Aboriginal Land Council(s)
- Registrar of Aboriginal Owners
- Native Title Services,
- local council(s)
- Department of Environment and Conservation[4], and

(b) via an advertisement in the local print media.

The notification must set out details of the proposal and invite registrations from interested groups or individuals. A closing date for registration of interest must also be included. The time allowed should reflect consideration of the project's size and complexity, but must in all cases allow at least 10 working days to respond.

The proponent must record all registrations received in writing before the closing date. DEC requires the proponent to include all parties that have registered their interest in Step 2 below. Respondents that do not register by the due date may still participate in the consultation process in Step 3.

2: Preparation for the assessment (design)

Proponents are required to undertake a cultural assessment and a scientific/archaeological assessment. These assessments are then to be integrated into a single Cultural Heritage Assessment Report.

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[3] Proponents may engage consultants to assist them. These could be Aboriginal or non-Aboriginal persons with the appropriate expertise.
[4] Address correspondence to Executive Director Operations, Department of Environment and Conservation, PO Box A290, Sydney South NSW 1232.

The proponent must present and/or provide the proposed methodology for the cultural and archaeological assessment to the registered stakeholders. The stakeholders are then provided with a reasonable time (at least 21 days) to review and provide feedback to the proponent, including identification of issues/areas of cultural significance that might affect, inform or refine the methodology. Comments should be provided in writing, or may be sought verbally in a meeting with the registered respondents. In either case they should be documented in the proponent's assessment report.

The design of the cultural assessment must consider the following factors:

- notifying Aboriginal people in sufficient detail about activities which may impact on Aboriginal heritage, so that their concerns can be identified
- providing the opportunity for Aboriginal people who hold knowledge to contribute to the assessment process
- identifying objects and places of significance to the Aboriginal community that may be impacted by the proposal so that these impacts can be avoided wherever possible
- identifying whether there are culturally acceptable mitigation measures when impacts are considered to be unavoidable by the proponent.

The consultant must consider any comments provided and explain in the final report how those comments were considered in finalising the methodology. DEC does not require that the proponent remunerate individuals or groups providing feedback on proposed cultural or archaeological methodology.

3: Drafting, review and finalisation of the Cultural Heritage Assessment Report

The proponent must execute their finalised assessment methodology and then produce a draft assessment report on the cultural and archaeological significance of the values that may be impacted by the proposal. The report must:

- detail the objects and places identified and how they will be impacted by the development
- detail the consultation undertaken and how comments received at various times were considered
- include management and mitigation recommendations drawing on both information provided by the stakeholders and the results of the cultural and archaeological assessments.

Once the draft report is completed, notice of its availability must be provided to all the registered stakeholders identified in Step 1, and the Local Aboriginal Land Council (even if not registered) for comment.

Any additional stakeholders who have identified themselves to the proponent in writing after Step 1 must also be notified that the draft report is available and their comments invited.

After considering the comments received the consultant/proponent must then finalise the report, demonstrating how comments received have been considered and submit it to DEC for consideration with their application.

DEC decision

On receipt of sufficient information from the applicant, DEC will proceed to make its decision. The outcome of decision-making will be either the granting or refusal of the application(s), with or without conditions. If consent is approved then, in imposing any conditions, DEC will take into account the views of the Aboriginal stakeholders as reflected in the Cultural Heritage Assessment Report.

DEC does not seek to consult directly with the Aboriginal community in relation to the issuing of consents under Part 6 of the NPW Act. This is because it requires the proponent to provide it with the views of and information from interested parties. In making its decision, however, DEC will also consider any other relevant information that has been provided to it.

Part C: Provision of Aboriginal assessment and advisory services

In addition to providing feedback on the proposed methodology, registered stakeholders may lodge offers to provide Aboriginal assessment and advisory services to the proponent for the cultural assessment and/or the archaeological assessment.

In meeting DEC requirements, the proponent should expect that offers to participate in the archaeological assessment will detail skills and experience in one or more of the following:

- field identification and survey techniques (including confirmation of physical ability to undertake fieldwork)
- cultural knowledge
- ability to assist in communicating the results of the survey back to the stakeholders for the assessment of cultural values and significance and returning advice on their response to the proponent.

The number of Aboriginal people that a proponent might engage in the archaeological assessment will depend on the scale and nature of the project, and should provide a balance of field experience and cultural knowledge. DEC anticipates that in some instances there will be multiple offers from suitably qualified, skilled or experienced Aboriginal people. DEC does not require all such people to be engaged, as the number and type of service providers to be engaged is a matter for proponents to determine. The focus should be on improving the outcome of the assessment process and may require some form of competitive selection by the proponent.

DEC does not have or seek a role in the determination of fees or other terms of engagement for service providers. This is a contractual matter between the proponent and service providers. However, it is recommended that the proponent should ensure that the engagement of service providers is through a written agreement or contract that addresses all of the following:

- the services to be provided
- roles and responsibilities of the parties
- payment terms.

The above arrangements mirror DEC expectations regarding engagement of scientific/archaeological services.

R.G. Pol/14

Our Ref: 47DA6 (05/2567)

Contact: Ireen Bonham (4221 2523)

Your Ref: DGR ID No: 181

Major Development Assessment
Department of Planning
GPO Box 39
SYDNEY 2001

10 MAY 2006

SHIRE OF BOMBALA – ENVIRONMENTAL IMPACT STATEMENT (EIS). BOMBALA HARD ROCK QUARRY.

Dear Sir

I refer to your letter dated 20 December 2005 regarding the request for information relating to the preparation of an Environmental Impact Statement (EIS) for the subject proposal. The RTA appreciates the opportunity to comment and apologises for the delay in responding. A copy of this letter has also been sent to ERM.

The information provided regarding the subject proposal is limited and it is therefore difficult to adequately assess those issues that should be included in the Environmental Impact Statement (EIS). However, as the impact that any development may have on the safety and efficiency of the road network is the RTA's primary concern, the EIS must include detailed traffic and transport analysis (in accordance with the RTA's Guide to Traffic Generating Developments (Table 2.1). In particular, the following points should be addressed in the EIS:

- The impacts of any additional vehicles on the road network, including significant intersections, should be analysed in detail in terms of existing crash information and in terms of estimated future risks of crashes.
- Improvements required to ameliorate impacts on the safety of road use should be identified
- Improvements required to safely accommodate the additional vehicles on the identified routes in terms of capacity, widths and turning paths should also be identified. Both the junction of SH19 and MR91 and High Lake and Pipe Clay Springs Roads have been identified as junctions that will need design changes.
- Details of the types of vehicles in terms of weight and configuration should be included.
- Also required is an analysis of the expected increase in wear and tear caused by the additional vehicles over the life of the proposed facility on the surface of the roads affected.
- Assessment of the impact of construction traffic, if any, on the safety & efficiency of the road network.

Major Development Assessment
Department of Planning

- The developer should consider the environmental impacts of any proposed roadworks.
- Any improvements made to the road network as a result of a development should be funded through contributions made by the developer.

Upon completion of the Environmental Impact Statement the RTA would appreciate if a copy could be forwarded for our consideration. If you have any questions regarding the above please contact Ireen Bonham on 42 212523.

Yours faithfully

For Trish McClure
Manager, Road Safety and Traffic Management
Southern Operations and Services

CC – ERM
Building C
33 Saunders Street
PYRMONT 2009

Annex C

Community Newsletters

Bombala Quarry Stakeholder Newsletter

November 2005




Boral is proud to service the Bombala community through the recent mobilisation of quarry operations at Bombala Quarry.

Community relations are an important part our business. Boral's aim is to ensure that the community is seen as an important stakeholder in the businesses' operations and is considered in decision making.

In the past two weeks, Boral has endeavoured to identify, and meet with all Bombala Quarry stakeholders in order to identify any issues that may have arisen during the first few weeks of operation and to discuss potential expansion of the quarry operations in future years. On behalf of Boral, I would like to thank all stakeholders who have so generously given their time to discuss the Bombala Quarry operation.

The aim of the Stakeholder Engagement process is:

- to provide identified stakeholders with accurate and timely information about Boral's plans (information);
- to actively seek stakeholders' views on Boral's plans and operations (consultation);
- to work directly with stakeholders to ensure that their views are continuously taken into account and to provide regular feedback to them (involvement); and/or
- to work in collaboration with stakeholders in order to achieve mutually beneficial outcomes (partnership).

As part of the process, Wes Martini, Boral Country's Business Development Manager will maintain regular contact with Stakeholders and provide details of any imminent events.

Regulatory Issues for Bombala Quarry

Bombala Quarry currently operates under and existing consent that permits extraction up to 30,000 cubic metres, or approximately 78,000 tonnes per annum. The crushing operation is licensed separately to a mobile crushing contractor.

Following consultation with the NSW Department of Environment and Conservation (DEC), formerly EPA NSW, Boral have agreed to move towards simplifying the licenses and consents for the Bombala Quarry operation into one single licence.

Accordingly, Boral will apply to the DEC for an on site crushing licence for 30,000 to 100,000 tonnes per annum, which will require lodgement of a Development Application (DA) and supporting Environmental Impact Statement (EIS)

Next Steps

In early December, Boral will mobilise a test drill rig to Bombala to drill and sample the rock deposit in and around the quarry. This will allow development of a long term quarry plan for the site.

Boral have written to the NSW Department of Planning to seek guidance on what should be contained within any EIS supporting a DA application for the site. Once this information is received, preparation of an EIS will commence. This will require various field assessments and studies. Prior to any study commencing, Boral will advise all stakeholders.

In is a condition of any EIS that an archaeological assessment be undertaken, including consultation with local indigenous communities. Consequently, Boral will advertise in the local press inviting any recognised indigenous groups to register their interest prior to any formal studies being undertaken.

In the first three months of 2006, the EIS will be prepared and Boral will discuss outcomes of relevant studies with all stakeholders and seek their feedback prior to finalising the EIS.

Subject to satisfactory outcomes, Boral aim to lodge a DA and licence application by mid-2006.

Bombala Quarry – Key Personnel

Bombala Quarry Production Manager

Tom Behrens
P.O. Box 42
Pambula NSW 2549
Phone 6495 6644
Fax 6495 7396
Mobile 0401 896606

Eden-Monaro Area Manager

David Durrant
P.O. Box 42
Pambula NSW 2549
Phone 6495 6644
Fax 6495 7396
Mobile 0427 500024

Stakeholder Issues, Regulatory and Environmental

Wes Martini
NSW Country Business Development Manager
Environment Overlay Manager
P.O. Box 42
Wentworthville, NSW 2145
Phone: 9033 5050
Fax: 9033 5059
Mobile: 0401 895 876

Bombala Quarry Stakeholder Newsletter

February 2006

Happy New Year to all Bombala Quarry stakeholders. On behalf of the Boral team, I hope that you had an enjoyable Christmas break.

I hope by now you have met our quarry production manager, Tom Behrens. Please feel free to contact him (or me) if you have any queries or issues, no matter how small. We will always endeavour to do what we can to assist.

In this second quarterly stakeholder newsletter, we bring you news of further studies and events that will take place in the coming months and weeks in and around the Bombala Quarry.

Recent modifications to acoustic bunding

Following commencement of operations in November, it became apparent that noise generated by the primary crusher on site was having an adverse impact on some residences.

In December 2005, Boral commissioned Heggies Australia to undertake a comprehensive acoustic audit of the operation, including placement of noise loggers near affected homes. In mid December, the existing acoustic bunds surrounding the crushing plant were substantially enlarged and further modelling was undertaken to accurately model the operational impacts.

A final copy of the Heggies report was received in early February, confirming that acoustic impacts have been substantially reduced. We remain committed to further improving acoustic amenity as the quarry is re-organised over the next year. If you would like to further discuss the Heggies report, please feel free to contact me.

Exploratory Drilling in and around the site

In late December Boral's geologist, Grenville Pollington explored the Bombala site and surrounds to quantify the extent of the quarry deposit and to plan the future extraction process for the site. Thanks to all those residents who allowed Grenville and his team to access their properties for drilling.

Initial results are favourable and Grenville is currently developing a quarry extraction plan for the site which will guide the future development direction of the quarry. We aim to have the plan completed in April 2006 and will consult with stakeholders prior to finalising the plan.

Planning and Studies to Support the Environmental Impact Statement (EIS)

ERM Australia have been engaged to prepare the EIS that will ultimately support the final consent application for the Bombala Quarry. The project leader is Alex McDonald, he will be visiting Bombala in the next few weeks and will aim to contact all stakeholders whilst in the area.

Imminent field Surveys

There will be regular survey activity in and around the Bombala Quarry during March and April 2006.

In is a condition of any EIS that an archaeological assessment be undertaken, including consultation with local indigenous communities. Boral have recently advertised in the local press inviting any recognised indigenous groups to register their interest prior to any formal studies being undertaken. The archaeological studies should commence in early March and fieldwork will take around two weeks.

An ecology survey to identify significant flora and fauna in and around the site is likely to be scheduled around the 13-17 February. This study will include night surveys, so do not be alarmed if you see spotlights during the evening during this period. Alex will contact local residents personally in advance of the study commencing.

Further noise measurement and air quality modelling is likely to take place in March.

I look forward to catching up with you in late February. In the meantime, if you have any issues, please feel free to call me on 0401 875 876.

Regards,

Wes Martini

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Bombala Quarry Stakeholder Newsletter

June 2006

Hello to all Bombala Quarry stakeholders. Over the last few months we have been working hard on finalising the various studies and reports that will ultimately make up the Environmental Impact Statement (EIS) that will support our development application for ongoing operation of the Bombala Quarry.

You may recall that we had planned to have an initial draft ready for stakeholder review by mid to late May. We are now aiming to have a final draft of the EIS document ready for mailing to stakeholders by the middle of July 2006, with further consultation and discussion planned for late July.

The main reason the EIS preparation process has taken much longer than first planned is the additional noise mitigation measures undertaken after consultation with residents and subsequent re-modelling of the acoustic impacts for surrounding areas. To ensure that the acoustic revised models provided in the EIS were accurate, the project team elected to undertake additional site specific testing to compare actual results with the acoustic modelling. The additional testing confirmed that the models are accurate.

Recent modifications to acoustic bunding.

Following relocation of the Jaw crusher into the quarry pit, and construction of additional bunding, acoustic impacts to surrounding areas have improved.

As quarry overburden becomes available, additional acoustic bunding will be constructed along the High Lake Road and Pipe Clay Springs Road intersection. Further work in this area will be undertaken in the next three weeks.

We will continue to work with residents to refine the production process and eliminate noise if this is possible.

Drilling and Blasting Activities

Drilling and Blasting activity is presently underway on site and is expected to be completed by Tuesday 4th July. All residents will be notified prior to blasts taking place, and air blast pressure and ground vibration readings will be taken at key locations to ensure compliance.

Quarry planning

Following the exploratory drilling earlier this year, a ten stage quarry development and extraction plan has been finalised for the site. The next stage of the consultation process is discussion with stakeholders prior to finalising the plan. A copy of the plan will be sent to each stakeholder with the draft copy of the EIS.

Finalisation of the EIS and Development Application

Copies of the Draft EIS will be sent out by mid July. Stakeholders have the option of receiving the document in bound, hard copy from, or electronically, on CD-Rom. I will contact each stakeholder prior to mailing to determine their preference.

I look forward to catching up with you in late July. In the meantime, if you have any issues, please feel free to call me on 0401 875 876.

Regards,

Wes Martini

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Annex D

Flora And Fauna Listings

Table D.1 Flora Species Recorded on Site

FAMILY/Scientific Name	Common Name
APIACEAE	
Hydrocotyle peduncularis	
ASTERACEAE	
Brachycome multifida	cut-leaved daisy
Brachycome sp.	cut-leaved daisy
Calotis sp.	daisy
Cassinia sp.	
Gnaphalium sphaericum	cudweed
Helichrysum scorpioides	
* *Hypochaeris radicata*	flatweed
Pseudognapalium luteo-album	
**Sonchus oleraceus*	common sowthistle
* *Taraxacum officinale*	dandelion
BRASSICACEAE	
* *Brassica rapa* ssp. *sylvestris*	wild turnip
CAMPANULACEAE	
Wahlenbergia communis	tufted bluebell
CARYOPHYLLACEAE	
* *Petrorhagia nanteuilii*	
CONVOLVULACEAE	
Convolvulus erubescens	
CYPERACEAE	
Eleocharis gracilis	
FABACEAE	
FABOIDEAE	
Glycine tabacina	
* *Trifolium arvense*	haresfoot clover
* *Trifolium repens*	white clover
MIMOSOIDEAE	
Acacia longifolia	Sydney golden wattle
LAMIACEAE	
* *Marrubium vulgare*	horehound
Mentha pilegium	
MORACEAE	
Morus sp.	Mulberry
MYRTACEAE	
Eucalyptus pauciflora	snow gum
Eucalyptus viminalis	ribbon gum
PLANTAGINACEAE	
* *Plantago lanceolata*	plantain
POACEAE	
* *Bromus* sp.	brome
Austrostipa nodosa	
Dichanthium sericeum subsp. *sericeum*	Queensland bluegrass
* *Eleusine indica*	crowsfoot grass
* *Holcus lanatus*	Yorkshire fog
Hordeum sp.	barley grass
* *Lolium multiflorum*	Italian ryegrass
* *Panicum maximum* var. *maximum*	guinea grass
Panicum sp.	panic
* *Phalaris aquatica*	phalaris
Sorghum sp	
Themeda australis	kangaroo grass
POLYGONACEAE	

FAMILY/Scientific Name	Common Name
* *Rumex* sp.	dock
PRIMULACEAE	
* *Anagallis arvensis*	scarlet pimpernel
ROSACEAE	
**Malus* sp.	crabapple
**Prunus* sp.	plum
**Pyrus* sp.	pear
* *Rosa rubiginosa*	sweet briar
* *Rubus ulmifolius*	blackberry
SOLANACEAE	
* *Solanum nigrum*	black-berry nightshade
URTICACEAE	
* *Urtica dioica*	stinging nettle

Table D.2 Likelihood of Threatened Flora and Fauna Occurring in the Site

Common/Scientific Name	Status TSC	Status EPBC	Preferred Habitat	Likelihood of Occurrence
Plants				
Calotis glandulosa	V	V	Found in subalpine grassland (dominated by *Poa* spp.), natural temperate grassland (dominated by *Themeda australis*) and snow gum (*Eucalyptus pauciflora*) woodlands on the Monaro and Shoalhaven area.	High likelihood of occurrence.
Rutidosis leiolepis	V	V	Found in scattered populations on the Monaro, and in low subalpine plains of Kosciuszko National Park. Grows on basalt, granite and sedimentary substrates in natural temperate grassland on the Monaro.	High likelihood of occurrence.
Westringia kydrensis	E	E	Occurs in heath on rocky granite or quartzite soils at Kydra Reefs, south-east of Cooma.	Low likelihood of occurrence based on the lack of heath and quartzite soils.
Dodonaea procumbens	V	V	Found in the dry areas of the Monaro, between Michelago and Dalgety. Occurs mostly in natural temperate grassland or snow gum woodland on or near vertically-tilted shale outcrops.	Moderate likelihood of occurrence.
Thesium australe	V	V	Found in damp sites in association with Kangaroo Grass (*Themeda australis*).	Moderate likelihood of occurrence.
Birds				
Stagonopleura guttata diamond firetail	V	-	Found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum *Eucalyptus pauciflora* Woodlands.	Moderate to high likelihood of occurrence.
Callocephalon fimbriatum	V	-	In summer, generally found in tall mountain forests and	Low to moderate likelihood of

Common/Scientific Name	Status TSC	Status EPBC	Preferred Habitat	Likelihood of Occurrence
gang-gang cockatoo			woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter, may occur at lower altitudes in drier more open eucalypt forests and woodlands, and often found in urban areas. May also occur in sub-alpine snow gum woodland and occasionally in temperate rainforests.	occurrence.
Melanodryas cucullata cucullata hooded robin	V	-	Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas.	Moderate likelihood of occurrence.
Ninox strenua powerful owl	V	-	Wet and dry sclerophyll forests, nesting (large tree hollows) and roosting in dense forest areas or dense gullies.	Moderate likelihood of hunting on site. No suitable sized roosting or nesting hollows available.
Lathamus discolor swift parrot	E	E	Migratory species frequenting eucalypt forest and woodland, following winter flowering eucalypts (eg. swamp mahogany). Breeds in Tasmania.	Moderate likelihood of seasonal foraging.
Xanthomyza phrygia regent honeyeater	E	E, M	Nomadic species following rich sources of nectar, primarily winter flowering species.	Moderate likelihood of seasonal foraging.
Rostratula australis Australian painted snipe	V	V	Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber.	Low likelihood due to limited availability of preferred habitat.
Hirundapus caudacutus (white-throated needletail)	-	M	Generalist. Often associated with coastal and mountain regions of eastern Australia.	Moderate likelihood of aerial hunting above the site.
Monarcha melanopsis (black-faced monarch)	-	M	Species prefers rainforest, wet sclerophyll and denser eucalypt forests, damp gullies, and mangroves.	Low likelihood of occurrence based on lack of preferred habitat.
Myiagra cyanoleuca (satin	-	M	Species prefers forest, particularly thick gullies.	Low likelihood of occurrence based on

Common/Scientific Name	Status TSC	Status EPBC	Preferred Habitat	Likelihood of Occurrence
flycatcher)				lack of preferred habitat.
Rhipidura rufifrons (rufous fantail)	-	M	Species prefers rainforest.	Low likelihood of occurrence based on lack of preferred habitat.
Haliaeetus leucogaster (white-bellied sea-eagle)	-	M	Species prefers large rivers, lakes, coastal seas and reservoirs.	Low likelihood of occurrence based on lack of preferred habitat.
Mammals				
Pseudomys fumeus smoky mouse	E	E	Appears to prefer heath habitat on ridge tops and slopes in sclerophyll forest, heathland and open-forest from the coast to sub-alpine regions of up to 1800 metres, but sometimes occurs in ferny gullies.	Low likelihood due to limited availability of preferred habitat.
Dasyurus maculatus tiger quoll	V	E	Wide range of forested habitats including rainforest, open forest, coastal heath, riparian forest. Nests in caves, hollow logs or tree hollows.	Low to moderate likelihood of occurrence based on the open and disturbed nature of the site.
Petaurus australis yellow-bellied glider	V	-	Occur in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. Feed primarily on plant and insect exudates, including nectar, sap, honeydew and manna with pollen and insects providing protein.	Low likelihood of occurrence based on the lack of tall eucalypt forest.
Phascolarctos cinereus koala	-	V	Forests typically on high nutrient soils characterised by presence of preferred feed trees.	Low likelihood based on the absence of preferred feed trees.
Potorous tridactylus tridactylus long-nosed potoroo	V	V	Inhabits coastal heaths and dry and wet sclerophyll forests. Dense understorey with occasional open areas is an essential part of habitat, and may consist of grass-trees, sedges, ferns or heath, or	Low likelihood of occurrence based on the absence of preferred habitat.

Common/Scientific Name	Status TSC	Status EPBC	Preferred Habitat	Likelihood of Occurrence
			of low shrubs of tea-trees or melaleucas. A sandy loam soil is also a common feature.	
Pteropus poliocephalus grey-headed flying-fox	V	V	Forages on fruits, blossoms and nectar of eucalypts. In early summer roosts in large groups (camps) in forests or mangroves.	Moderate to high likelihood of season foraging. No suitable roosting habitat available.
Mormopterus norfolkensis eastern freetail-bat	V	-	Prefers tree hollows, crevices, under bark, caves and buildings for roosting, eucalypt wet and dry forest, woodland and rainforest for foraging.	Moderate to high likelihood, recorded on site.
Miniopterus schreibersii eastern bentwing-bat	V	-	Prefer mainly caves for breeding (also man-made structures such as culverts) and a range of eucalypt forest and woodland for foraging.	Moderate to high likelihood, recorded on site
Myotis adversus large-footed myotis	V	-	Roosts in caves, tunnels, tree hollows and dense vegetation associated with permanent, slow flowing water bodies.	Moderate to high likelihood, recorded on site
Frogs				
Heleioporus australiacus giant burrowing frog	V	V	Most common on the Sydney sandstone. Found in heath, woodland and open forest with sandy soils. Will travel several hundred metres to creeks to breed.	Low likelihood of occurrence based on the lack of preferred habitat.
Litoria aurea green and golden bell frog	V	V	In NSW the species occupies disturbed habitats and breeds largely in ephemeral ponds.	Low to moderate likelihood of occurrence based on the lack of preferred habitat.
Litoria castanea yellow-spotted tree frog	V	V	It occurs along permanent rocky streams with thick fringing vegetation associated with eucalypt woodlands and heaths among sandstone outcrops.	Low likelihood of occurrence based on the lack of preferred habitat.
Reptiles				
Delma impar	V	V	Occurs in the Southern Tablelands, the South Western Slopes. Habitat dominated by perennial, tussock-forming grasses such as	Moderate to high likelihood of

Common/Scientific Name	Status TSC	Status EPBC	Preferred Habitat	Likelihood of Occurrence
striped legless lizard			kangaroo grass, spear-grasses, poa tussocks and occasionally wallaby grasses.	occurrence.
Endangered Ecological Communities				
natural temperate grasslands of the Southern Tablelands of NSW and the Australian Capital Territory	E	E	Generally occurs on the fertile lower parts of the landscape where resources such as water and nutrients are abundant, but tree growth is restricted by periodic drying or waterlogging, frosting, or where exposure and soil conditions limit tree growth on other substrates.	Low likelihood of occurrence.
lowland grassy woodland in the south east corner bioregion - preliminary listing	E	-	Occurs in rainshadow areas receiving 700 to 1100mm mean annual rainfall within the south coast of NSW. Vegetation is supported by soil derived from granitic substrates, acid volcanic, alluvial and fine grained sedimentary substrates. Vegetation is characterised by an open canopy, grassy and herbaceous continuous groundcover and occasional shrub stratum.	Recorded on site.
upland wetlands of the New England Tablelands and the Monaro Plateau	E	E	The wetlands have small local catchments, and range from shallow and temporary to near-permanent wetlands. Vegetation is usually a combination of sedges, rushes, spike-rushes, grasses and other aquatic plants, occurring either on the shores of open water or extending across shallow or dry wetland beds.	Low likelihood of occurrence.

Status EPBC Act 1999: V = Vulnerable; E = Endangered; M = Migratory

Status TSC Act 1995: V = Vulnerable; E = Endangered

Annex E

Air Quality Impact Assessment

DRAFT REPORT

Boral Resources Pty Ltd

Bombala Quarry Expansion - Environmental Impact Assessment

Air Quality Impact Assessment

June 2006

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GLOSSARY

DEC	Department of Environment and Conservation
BoM	Bureau of Meteorology
ha	hectare
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10 microns.
TSP	Total suspended particulates
tpa	Tonnes per annum
Km/hr	Kilometres per hour
^oC	Degrees celcius
mm	millimetres
USEPA	United States Environmental Protection Authority
NPI	National Pollutant Inventory
EET	Emission Estimation Technique
glc	Ground Level Concentration
t	tonne
kL	kilolitre
CO_{2-e}	carbon dioxide equivalents
NSW	New South Wales
$PM_{2.5}$	Particulate Matter less than 2.5 microns
$g/m^2/month$	grams per square metre per month
$\mu g/m^3$	micrograms per cubic metre
%	percentage
EPA	Environment Protection Authority
NEPM	National Environment Protection Measure
kg/year	kilogram per year

1 INTRODUCTION

1.1 BACKGROUND

Environmental Resources Management Australia (ERM) was commissioned by Boral Resources Country Pty Ltd (Boral) to evaluate potential air emissions as a result of the proposed expansion of the Bombala Quarry in New South Wales (NSW).
This report quantitatively assesses particulate impacts at sensitive receptors in the vicinity of the quarry, based on existing and expected future air emissions.

The air quality assessment has been carried out in accordance with the NSW Department of Environment and Conservation (DEC) approved methods for dispersion modelling (NSW DEC, 2005). The NSW DEC approved dispersion model, AUSPLUME v 6.0, has been used to predict impacts at sensitive receptors.

1.2 SCOPE OF WORK

The scope of works incorporates the following;

- site visit by an Environmental Scientist;
- assessment of air quality issues including Total Suspended Particulates (TSP), Particulate Matter with an aerodynamic diameter less than 10 microns (PM_{10}) and deposited dust. The air quality assessment is based on a Level 2 assessment as described by the NSW DEC;
- evaluation of the existing conditions at the site, based on information obtained from the Bureau of Meteorology, the NSW DEC and Boral;
- development of a suitable meteorological data file for use in plume dispersion modelling;
- review of the legislative and regulatory framework relevant to the proposed project;
- plume dispersion modelling;
- comparison of predicted particulate matter concentrations at sensitive receptors with nominated assessment criteria; and
- possible site-specific ameliorative measures to be considered as part of the proposal, based on the outcomes of the air quality assessment.

2 *PROJECT AND SITE DESCRIPTION*

2.1 *SUBJECT SITE*

2.1.1 *Site Location*

The Bombala Quarry is located off Pipe Clay Springs Road, approximately 5 kilometres from the centre of Bombala. The site location is shown in *Figure 1, Annex A.*

2.1.2 *Surrounding Land Uses*

The existing air quality in the locality of Bombala is that of a rural area, with minor industry and residential areas. The site is surrounded by rural land, with three residences located within a 3km radius. The dominant land use in the area is sheep grazing, which along with forestry plantations, are the areas primary resource. The location of the nearby residences is shown in *Figure 2, Annex A.*

2.1.3 *Topography*

Bombala is in the Monaro region of the Southern Tablelands of NSW. This area is characterised by broad valley floors with undulating to low relief and low bordering hills. The area occurs between an altitude of 610 and 915 metres above sea level (ACT Commissioner for the Environment, 2004).

2.2 *PROJECT DESCRIPTION*

2.2.1 *Overview*

The Bombala Quarry currently has approval to process up to 50,000 tonnes per annum. It is proposed to increase this rate to 100,000 tonnes per annum, based on an extraction area of approximately 8 hectares and an approximate life of 20 years. The quarry extension will progress through 10 stages of extraction, likely to last approximately 20 years.

Figure 3, Figure 4 and Figure 5, Annex A show the existing quarry and the proposed extension plans during Stage 3 and Stage 8, which are the stages assessed in this assessment.

2.2.2 *Quarry Operation*

Prior to drilling and blasting, overburden is removed using an excavator. A truck is employed if overburden needs to be moved a significant distance, but generally overburden is pushed a small distance by the excavator. Rock product is loosened by drilling and blasting, then loaded to a dump truck using an excavator. The dump truck transports the rock to a raw feed stockpile, where an additional excavator loads the product to a primary jaw crusher. Following crushing the product is transported by conveyors to a series of secondary crushers and screens to produce the various size fractions required for commercial use.

2.3 *POTENTIAL AIR QUALITY ISSUES*

Particulate matter emissions will arise from the operation of the quarry as a result of land clearing, blasting, processing, transporting and stockpiling activities. Emission sources from the Bombala Quarry will be fugitive in nature (ie not able to be collected by passing through a chimney, stack or vent) and influenced by weather patterns, especially wind speed and wind direction, and the level of moisture contained in the product. Typically, particulate matter is characterised by its size. Particulate size ranges assessed in this report are TSP, PM_{10} and $PM_{2.5}$.

In addition exposure to crystalline silica poses a potential health risk. The hard rock resource at the Bombala Quarry has been analysed and found to contain no free silica, therefore silica has not been considered further in this report. The sampling report confirming that the basalt is free of silica can be seen in *Annex B*.

2.4 *APPROACH TO ASSESSMENT*

2.4.1 *Choice of Model*

AUSPLUME is the current NSW DEC approved regulatory model for most applications in NSW. AUSPLUME has been used in this assessment for the following reasons;

- Impacts within 10 kilometres from the quarry are the only impacts being considered in the assessment; and
- Coastal effects and complex terrain are of no concern.

The quarry operations have been represented by a series of area sources. Each source was a combination of all dust emissions from activities in the area.

2.4.2 *Emission Estimation*

Emissions from particulate generating activities have been quantified using published emission factors. In the first instance emission factors were derived from equations given in various chapters of the US Environment Protection Agency (US EPA, 2006) AP-42 Compilation of Emission Factors[1]. If an equation was not provided, or input information was not available, default emission factors provided in AP-42 were used. Finally, if these were not available, equations or default emission factors were sourced from the National Pollutant Inventory Emission Estimation Technique Manuals[2]. Default emission factors from the NSW Mineral Council[3] were used as a last resort when no other suitable emission factors could be derived.

2.4.3 *Plume Depletion*

When pollutants are emitted from a source, they disperse vertically into the air. Particles also settle towards the ground under the influence of gravity. AUSPLUME can simulate the deposition of particles to the ground due to dry deposition (as a result of gravity, turbulence and the nature of the ground surface) or wet deposition (due to rain). AUSPLUME can also simulate plume depletion, where particles are removed from the air as they are deposited. The plume depletion function has not been used in the modelling assessment. This is a conservative assumption as it assumes that all particles emitted from the source remain in the plume, leading to a higher ground level concentration at sensitive receptors. In reality this is not the case, as heavier particles will deposit closer to the source.

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[1] US EPA (2006), Compilation of Air Pollutant Emission Factors AP-42 Fourth Edition, United States Environmental Protection Agency.

[2] National Pollutant Inventory (2006), Emission Estimation Technique Manuals, Department of Environment and Heritage.

[3] NSW Minerals Council (2000) *Technical Paper, Particulate Matter and Mining Interim Report*

3 DISPERSION METEOROLOGY

3.1 METEOROLOGY

The meteorology experienced at the site plays a major role in determining the location and the degree of offsite impacts. Air dispersion modelling using AUSPLUME requires information about the dispersion characteristics of the area. In particular, data is required on wind direction, wind speed, temperature, atmospheric stability[4] and mixing height[5].

Dispersion modelling requires the preparation of a suitable meteorological file. ERM engaged the services of PDS Multimedia and Consultancy Service (PDS) to develop an AUSPLUME meteorological file suitable for the Bombala project area. Meteorological data obtained from the Bombala Bureau of Meteorology, which is located approximately 10 kilometres to the south of Bombala site, included;

- Wind Speed (km/hr);
- Wind Direction;
- Ambient Temperature (°C);
- Dew Point; and
- Surface Pressure.

In addition to these parameters, additional information is required to determine atmospheric stability class and mixing height. Parameters such as the variation of wind direction, cloud cover and solar radiation can be used to determine stability class and mixing heights. Cloud cover data for night time periods was only available for the Sydney area (approximately 500km north east of Bombala), as no BoM stations in the vicinity of Bombala measure this parameter. Day time stability was calculated from total solar radiation, therefore it is only the night time stability that has been calculated from data

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[4] Stability categories are used as indicators of atmospheric turbulence and the dispersive potential of the atmosphere. The Pasquill-Gifford stability class scheme defines atmospheric stability in seven classes, A – very unstable, B – unstable, C – slightly unstable, D – neutral, E – slightly stable and F – very stable conditions.

[5] Mixing height is defined as the height of the turbulent layer of air above the earths surface into which air emissions will be well mixed. The height of this layer varies according to convective turbulence (through heating of the ground) or mechanical turbulence (wind blowing over rough ground). The air layer above the mixing height is stable.

obtained from Sydney. Cloud cover was not available from any areas closer than Sydney.

The meteorological file developed was for the year of 2004 and 100 per cent of data was available for this year. This approach is considered to best represent the meteorology in the area. Information as to the derivation of the meteorological file can be seen in *Annex C*.

3.1.1 Local Climatic Conditions

Table 3.1 presents data for temperature, humidity and rainfall from the Bombala BoM station. This data has been obtained from the weather station located approximately 10 kilometres south of Bombala at the property 'Lillianfel'. This is distinct from the BoM weather station located in Therry St, Bombala, which has been used elsewhere in this assessment. This data has been obtained from monthly averages of readings taken at 9am and 3pm daily. Monthly averages of maximum and minimum temperatures are also presented. Rainfall data consists of mean monthly rainfall and the average number of raindays per month.

Temperature

On average January is the warmest month at Bombala with a mean monthly maximum temperature of 24.6°C. The coolest month is July with a mean monthly minimum temperature of 0°C.

Humidity

December is on average the month with the lowest relative humidity, with an average daily relative humidity of 64 per cent. June is the month with the highest relative humidity, with an average daily relative humidity of 76 per cent.

Rainfall

The mean annual rainfall over the measured period of 109 years has been 494.6mm. The mean number of raindays annually over the measured period has been 110. November is on average the wettest month with a monthly average of 63.5mm, while August has been the driest month with 22.3mm.

Table 3.1 Temperature, Humidity and Rainfall Data for Bombala

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
9 am Mean Temperature and Relative Humidity													
Temperature (°C)	16.0	15.0	12.7	10.1	6.7	4.1	3.4	4.8	8.6	11.1	12.6	15.2	10.0
Humidity (%)	76.7	81.0	86.5	85.1	86.7	86.9	86.0	82.0	77.3	74.6	77.6	75.3	81.3
3 pm Mean Temperature and Relative Humidity													
Temperature (°C)	22.5	22.5	19.8	16.5	12.7	10.2	9.6	11.1	13.4	15.4	18.0	21.0	16.1
Humidity (%)	53.3	52.3	56.4	56.2	63.6	64.1	62.7	55.1	55.1	56.8	57.4	53.1	54.0
Mean daily max temperature (°C)	24.6	24.2	21.5	18.2	14.2	11.1	10.8	12.3	15.2	17.2	20.0	23.3	17.7
Mean daily min temperature (°C)	10.4	10.4	8.4	5.3	2.7	0.6	0	0.3	3.0	5.1	6.7	8.9	5.1
Mean monthly rainfall (mm)	44.6	48.4	45.9	33.8	29.9	28	38.9	22.3	34.4	53.4	63.5	51.3	494.6
Mean no. of raindays	11.5	10.0	12.3	14.5	14.5	11.4	12.6	12.2	14.0	12.5	12.9	10.4	109.7

1. Station number 070328 Latitude 37 Deg 00 Min Longitude 149 Deg 14 Min
2. Source - Bureau of Meteorology, Commonwealth of Australia.

3.1.2 *Windrose Summary*

Windroses for the Bombala area are shown in *Annex D* . It can be seen that;

- On an annual basis the predominant wind direction is from the northwest, with contributions from the north, east and south west directions.
- During the summer months winds are predominantly from the southeast, north and east directions;
- During the autumn months, winds are predominantly from the northwest, with contributions from the north and west directions;
- During the winter months, winds are predominantly from the northwest direction, with smaller contributions from the west and the north; and
- During the spring months, winds are predominantly from the west, northwest and southwest

3.1.3 *Stability Class*

Table 3.2 shows the frequency of occurrence of the different stability classes expected in the area.

Table 3.2 Frequency of Stability Class Occurrences

Stability Class	Percentage
A	1
B	4
C	12
D	53
E	14
F	15

1. Class A refers to unstable conditions where dispersion occurs rapidly. Class F refers to stable conditions such as those during the night where dispersion is slow. Classes B, C, D and E relate to intermediate dispersion conditions.

The frequencies of E and F stability classes (29%) indicate that conditions in the Bombala area would be such that emissions from the quarry would disperse slowly for a significant period of the time. E and F classes predominantly occur during the early hours of the morning when the sky is clear and an inversion[6] is present.

[6] An inversion refers to a situation when the normal temperature patterns in the atmosphere are reversed. This causes a situation where little or no mixing occurs and air emissions disperse slowly.

3.2 *AMBIENT AIR QUALITY*

3.2.1 *Overview*

The Bombala area is sparsely populated, with an estimated population of 2,545 people (ACT Commissioner for the Environment, 2004). The area enjoys generally clean air, due to a lack of heavy industry and high concentrations of vehicles. Pollutant loadings are low and usually dispersed, although inversions can occur on some winter nights, thus trapping pollutants close to ground level.

A review of the National Pollutant Inventory (NPI) was undertaken for the Bombala area. This review did not identify any major industry in the area and it is likely that the quarry will form the dominant source of air emissions. One facility reported to the NPI in the reporting period, a petroleum depot which emitted low levels of pollutants such as Volatile Organic Compounds.

3.2.2 *Background Levels*

Discussion with the Sydney and Queanbeyan offices of the NSW DEC have indicated that there is no continuous ambient air monitoring carried out in the Bombala region by their departments. In addition, the DEC was not aware of any monitoring carried out by private companies in the region. The DEC *Approved Methods for the Modelling and Assessment of Air Pollution in NSW, 2005*, stipulate that contemporaneous hourly average meteorological and pollutant monitoring data are required for a background assessment. This approach was not possible given that no continuous dust monitoring data is available for the project area. On that basis, the conventional approach (and ERM's) to assessment of air quality impacts from the proposal is to add the predicted incremental impact of the project to background levels and to compare the result with the relevant air quality goal. This approach is referred to as a cumulative assessment.

Monitoring is unusual in rural areas except in those towns subject to large industrial sources. The NSW Minerals Council[7] indicates that based on a limited dataset, PM_{10} concentrations in a rural town will generally be a long term average of below 20 $\mu g/m^3$ except in situations such as dust storms or bushfires. This if further verified by studying ambient air monitoring data from NSW DEC rural monitoring locations, where the measured ambient levels (for 2004) were from 17 – 25 $\mu g/m^3$.[8] *Table 3.3* displays the average PM_{10} monthly concentrations recorded in four rural locations in NSW.

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[7] NSW Minerals Council (2000) *Technical Paper, Particulate Matter and Mining Interim Report*

[8] NSW DEC Quarterly Air Quality Monitoring Reports - Quarter 1, Quarter 2, Quarter 3 and Quarter 4 (2004)

In addition, air quality monitoring results for PM_{10} carried out by the Victorian Environment Protection Authority in rural areas of Victoria indicate that ambient levels of PM_{10} are in the 15 – 18 μg/m^3 range. Air quality at these rural centres was monitored for one to two years sequentially and average results can be seen in *Table 3.4.*

Table 3.3 PM_{10} Monitoring Results ($\mu g/m^3$) for 2004 – NSW DEC Rural Air Monitoring Stations

Monitoring Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yearly Average
Albury	-	25	34	28	22	12	11	11	11	13	14	13	17.6
Tamworth	18	20	18	24	21	18	20	23	24	24	23	-	21.2
Wagga Wagga	25	33	44	41	36	16	18	16	15	17	20	19	25
Bathurst	20	22	25	32	27	8	10	11	13	12	13	16	17.4

1. Data obtained from NSW DEC Quarterly Air Quality Monitoring Reports for 2004, www.dec.nsw.gov.au

Table 3.4 Average PM_{10} Results - Victorian Rural Areas

Rural Area	PM_{10} $\mu g/m^3$	Year
Shepparton	18	2003-04
Ballarat	16	2002-03
Bendigo	15	2000-01

1. Data obtained from Victoria EPA Publication number 992 'Airborne Particle Monitoring at Shepparton, December 2003– December 2004'

It can be seen that ambient air concentrations of PM_{10} in the studied rural areas are in the range of 15 µg/m^3 - 25 µg/m^3. In the absence of site specific data, an average of the values contained in *Table 3.3* and *Table 3.4* has been used to estimate background concentrations. The background concentration to be used for PM_{10} is therefore 18.6 µg/m^3.

Assuming that 39% of TSP is in the PM_{10} range[9] the background level for TSP (annual emissions) to be used in the assessment is 46 µg/m^2. Additionally 4.68% of TSP is in the $PM_{2.5}$ range, therefore a background level of 2.1 µg/m^2 has been assumed for $PM_{2.5}$.

In addition, assessment against 24hr PM_{10} and $PM_{2.5}$ concentrations is required. As this data is not readily available, the approach adopted provides for 24hr averages at the residences should be less than the National Environment Protection Measure 24hr average guideline of 50µg/m^3 (PM_{10}) and 25µg/m^3 ($PM_{2.5}$) in ambient air.

Deposited dust monitoring has not been carried out at the quarry site. Deposited dust data is available for a hard rock quarry located in Tweed NSW[10]. An annual average dust deposition value of 2 g/m^2/month was recorded at monitors in this area. It is likely that background deposited dust levels in the vicinity of the Bombala are less than this value, as the measurements taken in the Tweed Quarry area were influenced by two quarry sites. However, this background level has been used as a conservative estimation of dust deposition levels in the Bombala area.

Therefore the background levels employed in this assessment are;

- Annual average TSP of 46 µg/m^2;
- Annual average PM_{10} of 18.6 µg/m^2;
- Annual average $PM_{2.5}$ of 2.2 µg/m^2; and
- Annual average dust deposition of 2 g/m^2/month.

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[9] NSW Minerals Council (2000) *Technical Paper, Particulate Matter and Mining Interim Report*

[10] Holmes Air Sciences (2005), Air Quality Impact Assessment, Tweed Quarry.

4 AIR QUALITY LEGISLATION AND ASSESSMENT GUIDELINES

4.1 OVERVIEW

This section provides information on the air quality criteria used to assess the impact of emissions from the proposal. Ground level concentrations (glcs) predicted from plume dispersion modelling are compared with the assessment criteria.

4.2 NSW DEC PARTICULATE MATTER IMPACT ASSESSMENT CRITERIA

Impact Assessment Criteria are published by the DEC in their document *'Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in New South Wales, 2005'*. These criteria incorporate the National Environment Protection Measure (NEPM) goals. The impact assessment criteria for relevant pollutants are detailed below in *Table 4.1*. These are the criteria against which the proposal will be assessed. It is important to note that the impact assessment criteria refer to cumulative emissions, not just the pollutants from the quarry. Therefore existing background levels must be combined with predicted impacts to allow for assessment of impacts against the criteria.

The NEPM values for $PM_{2.5}$ are not applied on a project basis in NSW, but are long term reporting goals.

Table 4.1 Particulate Matter Impact Assessment Criteria

Pollutant	Averaging Period	Concentration	Agency
Total Suspended Particulates (TSP)	Annual	90 µg/m³	NSW DEC
Particles less than 10 micron (PM_{10})	24 hour	50µg/m³	NSW DEC
	Annual	30µg/m³	NSW DEC
Particles less than 2.5 micron ($PM_{2.5}$)			NEPM
	Annual	8 µg/m³	
	24 hour	25 µg/m³	NEPM
Deposited Dust	Monthly	4 g/m² /month	NSW DEC
	Monthly	An increase of no more than 2 g/m²/month	NSW DEC

1. Sources: Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (2005) and NEPM (Ambient Air Quality) http://www.ephc.gov.au/nepms/air/air_nepm.html.

5 EMISSIONS ESTIMATIONS

5.1 OVERVIEW

Particulate emissions will arise from the following activities at the quarry;

- Stripping of overburden;
- Drilling and blasting of rock;
- Loading product to haul and road trucks;
- Crushing and screening;
- Dumping of material to stockpiles by front end loaders (FEL) and conveyors;
- Wheel generated dust from road trucks, haul trucks and mobile equipment; and
- Wind generated dust from exposed areas and stockpiles.
- Emissions have been estimated using published emission factors for the existing quarry operations and Stage 3 and Stage 8 of the proposed quarry expansion.

Emissions from both stages have been estimated based on an annual output of 100,000 tonnes and a quarry operating schedule of 6 days per week (approximately 302 working days a year, not including public holidays) and 10 hours per day. This is a conservative assumption as the quarry generally only operates five days a week throughout the year. Wind erosion has been modelled as occurring 24 hours a day, 365 days a year.

Estimated particulate emissions from existing and proposed activities at the quarry are presented in *Table 5.2, Table 5.3 and Table 5.4*. The estimates have been based on the implementation of controls such as watering of unsealed surfaces and water suppression on crushing and screening equipment. A control factor of 50% has been applied to roads and unsealed surfaces, based on the assumption that a low level of watering (less than 1 L/m^2/hr) will occur[11]. It has been estimated that crushing equipment has dust control with

[11] National Pollutant Inventory (2001) Emission Estimation Technique Manual for Mining Version 2.3, December 2001

50% efficiency and screening equipment has dust control with 50% efficiency[12,13].

Particulate exhaust emissions from mobile equipment are expected to be a minor contributor of overall particulate emissions from the site, due to the small fleet onsite. Additionally, emission factors for quarrying activities have been derived from measurements that cover all PM_{10} emissions associated with a unit operation, including exhaust emissions. Therefore adding exhaust emissions to the fugitive emissions would involve some double counting and overestimation of emissions[14].

5.2 *PARTICLE SIZE DISTRIBUTION*

A study on the particle size distribution of dust from open cut coal mines in the Hunter Valley was undertaken by the NSW State Pollution Control Commission (now DEC) in 1986. This study indicated that 39.1% of TSP was in the PM_{10} size range and 4.68% was in the $PM_{2.5}$ size range[11]. This particle size distribution has been used to estimate $PM_{2.5}$ emissions from calculated emissions of TSP.

The following particle size distribution (*Table 5.1*) has been used to characterise particulate emissions. It has been assumed that particulate matter in excess of 30 microns will deposit at a short range from the source. On the basis that the receptors are at a distance of a few hundred metres, coarser fractions have not been included.

Table 5.1 Mean Particle Size Distribution – Hunter Valley

Range (micron)	Mass Fraction	Mean Particle Size in range (micron)
0-2.5	0.0468	1.2
2.5 - 10	0.3442	7
10-30	0.609	20

1. NSW Minerals Council, 2000

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12 US EPA (2004) Crushed Stone Processing and Pulverised Mineral Processing, Chapter 11.19.2 of the Compilation of Air Pollutant Emission Factors AP-42 Fourth Edition, United States Environmental Protection Agency.

13 National Pollutant Inventory (2001) Emission Estimation Technique Manual for Mining Version 2.3, December 2001

14 NSW Minerals Council (2000) *Technical Paper, Particulate Matter and Mining Interim Report*

It has been assumed that the quarry will predominantly handle aggregates that have an estimated particle density of 2.6 g/ml.

Estimated emissions have been provided below in *Table 5.3* for each particulate matter generating activity. Details of calculations and emission factors are presented in *Annex E.*

Table 5.2 Estimated Dust Emissions – Existing Quarry

Activity	TSP Emission Rate (kg/year)	PM_{10} Emission Rate (kg/year)	$PM_{2.5}$ Emission Rate (kg/year)
Stripping of overburden	6,240	1,440	292
Drilling	2.4	1.2	0.11
Blasting	17.5	9.1	0.82
Loading to haul truck	1,250	600	59
Haulage from quarry to processing area	428	123	20
Dumping to crushing hopper	1,250	600	59
Primary Crushing	135	60	6.3
Secondary Crushing	135	60	6.3
Tertiary Crushing	108	71	5.1
Screening	413	142	19
Dumping to stockpiles	1,250	600	59
Wind Erosion from Stockpiles	625	108	29
Wind Erosion from Quarry Pit	2015	1007	94
FEL working in stockpile area	1,450	700	68
Loading to road trucks	1,250	600	59
Haulage offsite	21,200	5,889	992
TOTAL	**37,769**	**12,010**	**1,768**

Table 5.3 Estimated Dust Emissions – Stage 3

Activity	TSP Emission Rate (kg/year)	PM_{10} Emission Rate (kg/year)	$PM_{2.5}$ Emission Rate (kg/year)
Stripping of Overburden	12,057	2,975	579
Drilling	2.4	1.2	0.11
Blasting	17.5	9.1	0.82
Loading to haul truck	2,500	1,200	117
Haulage from quarry to processing area	995	285	47
Dumping to crushing hopper	2,500	1,200	117
Primary Crushing	270	120	13
Secondary Crushing	270	120	13
Tertiary Crushing	216	96	10
Screening	1,250	541	59
Dumping to stockpiles	2,500	1200	117
Wind Erosion from Stockpiles	2,982	1,490	140
Wind Erosion from Quarry Pit	7,898	3,949	370
FEL working in stockpile area	2,900	1,400	136
Loading to road trucks	2,500	1400	117
Haulage offsite	42,401	11,778	1984
TOTAL	**81,259**	**27,764**	**3,820**

Table 5.4 Estimated Dust Emissions – Stage 8

Activity	TSP Emission Rate (kg/year)	PM_{10} Emission Rate (kg/year)	$PM_{2.5}$ Emission Rate (kg/year)
Stripping of overburden	12,057	2,975	579
Drilling	2.4	1.2	0.11
Blasting	17.5	9.1	0.82
Loading to haul truck	2,500	1,200	117
Haulage from quarry to processing area	622	178	29
Dumping to crushing hopper	2,500	1,200	117
Primary Crushing	270	120	13
Secondary Crushing	270	120	13
Tertiary Crushing	216	96	10
Screening	1,250	541	59
Dumping to stockpiles	2,500	1200	117
Wind Erosion from Stockpiles	3,707	1,854	173
Wind Erosion from Quarry Pit	18,536	9,268	867
FEL working in stockpile area	2,900	1,400	136
Loading to road trucks	2,500	1400	117
Haulage offsite	41,313	11,476	1933
TOTAL	**91,161**	**33,038**	**4,281**

6 PREDICTION OF IMPACTS

6.1 MODELLING PARAMETERS

6.1.1 *Roughness Height*

The surface roughness of the area over which the plume is dispersing will affect the surface-generated turbulence and hence the vertical and, to a lesser extent, the horizontal dimensions of the plume.

The roughness height selected for the purpose of the modelling is that of rolling rural. This parameter was selected based on the fact that the quarry is located in an area surrounded by agricultural land. AUSPLUME Version 6.0 allows the user to simulate this by the choice of 0.4 metres.

6.1.2 *Terrain Effects*

AUSPLUME only accounts for terrain effects from elevated stack emission points. As such, due to the site related emission points being area sources and not stacks, terrain effects could not be assessed as part of the impact assessment. It is not considered that the terrain surrounding the quarry is of enough significance to significantly influence the dispersion of pollutants from the quarry.

6.1.3 *Receptor Locations*

Receptor Locations

A Cartesian grid has been set-up with SW corner at and 700990E and 5915434N with gridded receptors at regularly spaced intervals of 100m, covering an area of 3.0 kilometres by 3.0 kilometres.

Discrete Receptors

The discrete receptors have been chosen to represent nearby potential residences and other sensitive areas. Details of the sensitive receptors are shown in *Table 6.1*. The location of discrete receptors can be seen in *Figure 2, Annex A.*

Table 6.1 Sensitive Receptor Details

Receptor ID	Description	Location (AMG coordinates)
1	Helmer Residence	701932E, 5916442N
2	McInnes Residence	701910E, 5916661N
3	Inglewood Residence	703520E, 5916370N
1. AMG - Australian Map Grid.		

6.1.4 *Building Wakes*

Buildings will affect the flow of air around the facility and subsequent ground level concentrations by causing negative pressures on the leeward side of the buildings. When fugitive sources are affected by building wakes, emissions are pulled down to ground closer to the source resulting in higher ground level concentrations closer to the source. Building wake effects are computed only for point sources (ie a stack). Potential emissions from the proposed facility are from area sources, therefore building wake effects have not been included in the model.

6.2 *MODELLING SCENARIOS*

This section details the modelling options employed in this assessment. *Table 6.2* outlines a summary of modelling scenarios.

Two years of operation were modelled: Stage 3 and Stage 8, as well as existing operations.

Table 6.2 Summary of Modelling Scenarios

Model	Pollutant
Existing Quarry	TSP (annual average) PM_{10} (24 hr average) PM_{10} (annual average) $PM_{2.5}$ (24 hour average) $PM_{2.5}$ (annual average) Deposited Dust
Stage 3	TSP (annual average) PM_{10} (24 hr average) PM_{10} (annual average) $PM_{2.5}$ (24 hour average) $PM_{2.5}$ (annual average) Deposited Dust
Stage 8	TSP (annual average) PM_{10} (24 hr average) PM_{10} (annual average) $PM_{2.5}$ (24 hour average) $PM_{2.5}$ (annual average) Deposited Dust

7 RESULTS

7.1 MODELLING RESULTS

Dispersion modelling results have been summarised in terms of the pollutant concentrations at the nominated sensitive receptors. Predicted pollutant concentrations at each receptor are given below in *Table 7.1* – 7.6. Due to the large number of scenarios modelled, a selection of representative concentration contours have been presented in *Annex F.*

Table 7.1 Predicted glc's – Existing quarry (Annual Average)

	Quarry Contribution				**Total Predicted**			
Receptor	**TSP (ug/m³)**	**PM_{10} (g/m³)**	**$PM_{2.5}$ (µg/m³)**	**Deposited Dust (g/m2/month)**	**TSP (µg/m³)**	**PM_{10} (µg/m³)**	**$PM_{2.5}$ (µg/m³)**	**Deposited Dust (g/m2/month)**
1	1.4	0.45	0.051	0.35	47	19	2.3	2.4
2	2.0	0.60	0.094	0.51	48	19	2.3	2.5
3	0.90	0.31	0.042	0.31	47	19	2.2	2.3
Criteria	90µg/m³	30µg/m³	8 µg/m³	2 g/m²/month	90µg/m³	30µg/m³	8 µg/m³	4g/m²/month

Table 7.2 Predicted glcs – Existing Quarry (24 hour Average)

	Quarry Contribution	
Receptor	**PM_{10} (µg/m³)**	**$PM_{2.5}$ (µg/m³)**
1	8.2	1.3
2	6.7	1.1
3	2.8	0.41
Criteria	50 µg/m³	25 µg/m³

Table 7.3 Predicted glc's – Stage 3 (annual average)

	Quarry Contribution				**Total Predicted**			
Receptor	**TSP (ug/m³)**	**PM_{10} (g/m³)**	**$PM_{2.5}$ (µg/m³)**	**Deposited Dust (g/m²/month)**	**TSP (µg/m³)**	**PM_{10} (µg/m³)**	**$PM_{2.5}$ (µg/m³)**	**Deposited Dust (g/m²/month)**
1	3.7	1.6	0.17	0.84	50	20	2.4	2.8
2	5.0	2.2	0.23	1.2	51	21	2.4	3.2
3	2.4	1.0	0.11	0.80	48	20	2.3	2.8
Criteria	90µg/m³	30µg/m³	8 µg/m³	2g/m²/month	90µg/m³	30µg/m³	8 µg/m³	4g/m²/month

Table 7.4 Predicted glc's - Stage 3 (24 hour average)

	Quarry Contribution	
Receptor	**PM_{10} (μg/m³)**	**$PM_{2.5}$ (μg/m³)**
1	24.4	2.7
2	22.5	2.4
3	9.3	1.2
Criteria	50 μg/m³	25 μg/m³

Table 7.5 Predicted glc's – Stage 8 (annual average)

	Quarry Contribution				Total Predicted			
Receptor	**TSP (ug/m³)**	**PM_{10} (g/m³)**	**$PM_{2.5}$ (μg/m³)**	**Deposited Dust (g/m2/month)**	**TSP (μg/m³)**	**PM_{10} (μg/m³)**	**$PM_{2.5}$ (μg/m³)**	**Deposited Dust (g/m2/month)**
1	4.5	1.8	0.22	0.90	51	20	2.4	2.9
2	6.6	2.6	0.31	1.6	53	21	2.5	3.6
3	2.5	1.0	0.12	0.68	49	20	2.3	2.7
Criteria	90μg/m³	30μg/m³	8 μg/m³	2 g/m²/month	90μg/m³	30μg/m³	8 μg/m³	4g/m²/month

Table 7.6 Predicted glc's – Stage 8 (24 hour average)

	Quarry Contribution	
Receptor	**PM_{10} (μg/m³)**	**$PM_{2.5}$ (μg/m³)**
1	31.2	2.5
2	27.1	2.8
3	9.7	1.0
Criteria	50 μg/m³	25 μg/m³

Dust concentrations and deposition rates due to the quarry operations have been presented as dust isopleths in *Annex F.* AUSPLUME Configuration files are provided in *Annex G.*

8 DISCUSSION AND CONCLUSIONS

8.1 PREDICTED IMPACTS

8.1.1 *Total Suspended Particulates (TSP)*

The predicted ground level concentrations of TSP comply with the NSW assessment criterion of 90 µg/m^3 (annual average) at nominated sensitive receptors for existing activities, Stage 3 and Stage 8 of the quarry expansion.

8.1.2 *Particulate Matter Less Than 10 Micron (PM_{10})*

The predicted ground level concentrations of PM_{10} (24 hour average) comply with the NEPM assessment criterion of 50 µg/m^3 at sensitive receptors in the project area for the existing activities, Stage 3 and Stage 8 of the quarry expansion.

The predicted ground level concentrations of PM_{10} (annual average) comply with the NSW assessment criterion of 30 µg/m^3 at nominated sensitive receptors for the existing activities, Stage 3 and Stage 8 of the quarry expansion.

8.1.3 *Particulate Matter Less Than 2.5 Micron ($PM_{2.5}$)*

The predicted ground level concentrations of $PM_{2.5}$ (24 hour average) comply with the NEPM assessment criterion of 25 µg/m^3 at sensitive receptors in the project area for the existing activities, Stage 3 and Stage 8 of the quarry expansion.

The predicted ground level concentrations of $PM_{2.5}$ (annual average) comply with the NSW assessment criterion of 8 µg/m^3 at sensitive receptors in the project area for the existing activities and Stage 3 and Stage 8 of the proposed expansion.

8.2 DEPOSITED DUST

The predicted deposition levels (monthly average) comply with the NSW assessment criterion of 2 g/m^2/month as a maximum increase in deposited dust at sensitive receptors for existing, Stage 3 and Stage 8.

Deposition predictions have been overstated due to modelling not considering plume depletion through deposition processes. It is likely, when plume depletion is considered, predicted deposition impacts will be less than those reported.

8.3 CUMULATIVE IMPACTS

Cumulative impacts predicted as part of the Air Quality Assessment include particulate emissions from the proposed quarry expansion plus existing background levels to give a total impact for the development. Predicted cumulative particulate matter impacts must comply with the nominated NSW assessment criteria.

TSP cumulative ground level concentrations, annually averaged, comply with the NSW assessment criterion of 90 ug/m^3 at identified existing and future sensitive receptors.

The predicted cumulative ground level concentrations of PM_{10} (24 hour and annual averages) comply with the NSW assessment criterion of 50 ug/m^3 and 30 ug/m^3; respectively at existing and future sensitive receptors in the project area.

The predicted deposition levels (monthly average) for the cumulative operations comply with the NSW assessment criterion of 4 g/m^2/month as a maximum total deposited dust level at sensitive receptors for existing, Stage 3 and Stage 8.

8.4 DUST MITIGATION MEASURES

This section discusses the mitigation and control options for particulate matter to ensure levels do not affect the health and amenity of the surrounding area.

8.4.1 *Unpaved Surfaces and Vehicle Movements*

Particulate emissions from unpaved surfaces should be controlled using;

- Wet suppression;
- Revegetation of exposed surfaces where possible;
- Limiting load size to minimise spillage;
- Limiting the speed limit on unpaved surfaces to 10 km/hr; and
- Covering loads to prevent dust being released during road transport.

8.4.2 *Stockpiles*

Fine material stored in stockpiles can be subject to wind erosion at mid to high wind speeds ie generally wind speeds above 5 metres per second. Dust emissions can also occur when product is dropped onto the stockpile from conveyors or dump trucks. Options for dust control of stockpiles include;

- Wet suppression using sprinklers;
- Covering stockpiles;
- Limiting the height and the slope of the stockpile to reduce wind entrainment. A flat shallow stockpile will be subject to less wind turbulence than a tall conical shape;
- Limiting drop heights from conveyors and dump trucks; and
- The use of wind breaks such as fences, vegetation and fixtures such as shadecloth.

8.4.3 *Material Handling*

Dust emissions can occur as a result of material handling by front end loaders and other machinery. These mainly occur when the load is dropped into a truck or hopper, but can be caused by spillages during handling. Minimising emissions from material handling can include;

- Minimising drop heights; and
- Regular clean up of any spillages.

9 *STATEMENT OF LIMITATIONS*

The findings of this report are based on the Scope of Work outlined above. ERM performed the services in a manner consistent with the normal level of care and expertise exercised by members of the environmental profession. No warranties, expressed or implied, are made.

Subject to the Scope of Work, ERM's assessment is limited strictly to identifying typical environmental conditions associated with the subject property and does not evaluate structural conditions of any buildings on the subject property, nor any other issues. Although normal standards of professional practice have been applied, the absence of any identified hazardous or toxic materials on the subject property should not be interpreted as a guarantee that such materials do not exist on the Site.

This assessment is based on site inspection conducted by ERM personnel, sampling and analyses described in the report, and information provided by the property owner or other people with a knowledge of site conditions. All conclusions and recommendations made in the report are the professional opinions of the ERM personnel involved with the project and, while normal checking of the accuracy of data has been conducted, ERM assumes no responsibility or liability for errors in data obtained from regulatory agencies or any other external sources, nor from occurrences outside the scope of this project.

The information relating to the air quality conditions in this document is considered to be accurate at the date of issue. Conditions can vary across a particular site, which cannot be wholly defined by investigation. As a result, it is unlikely that the results and estimations presented in this report will represent the extremes of conditions within the site. Air quality conditions including contaminant concentrations can change in a limited period of time.

ERM Australia is not engaged in environmental auditing and reporting for the purpose of advertising sales promoting, or endorsement of any client interests, including raising investment capital, recommending investment decisions, or other publicity purposes. The client acknowledges that this report is for the exclusive use of the client, its representatives and advisers and any investors, lenders, underwriters and financiers who agree to execute a reliance letter (a copy of which can be supplied upon request), and the client agrees that ERM's report or correspondences will not be, except as set forth herein, used or reproduced in full or in parts for such promotional purposes, and may not be used or relied upon in any prospectus or offering circular.

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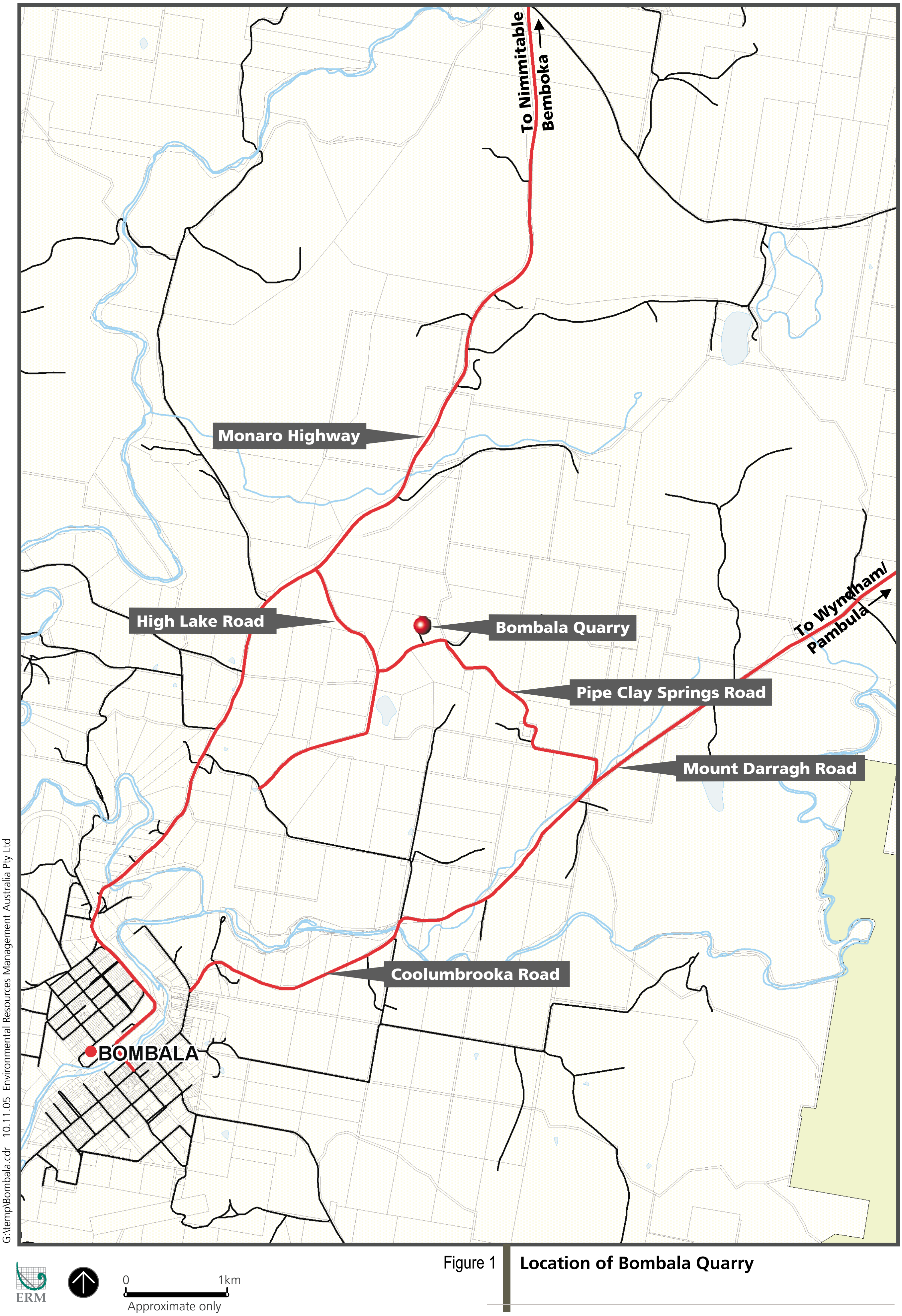
Annex A

Figures



G:\temp\Bombala.cdr 10.11.05 Environmental Resources Management Australia Pty Ltd

Figure 1 **Location of Bombala Quarry**

Environmental Resources Management Australia Pty Ltd

Legend

① Sensitive receptors

Figure 12

Location of Sensitive Receptors

Bombala Quarry

Do not Scale

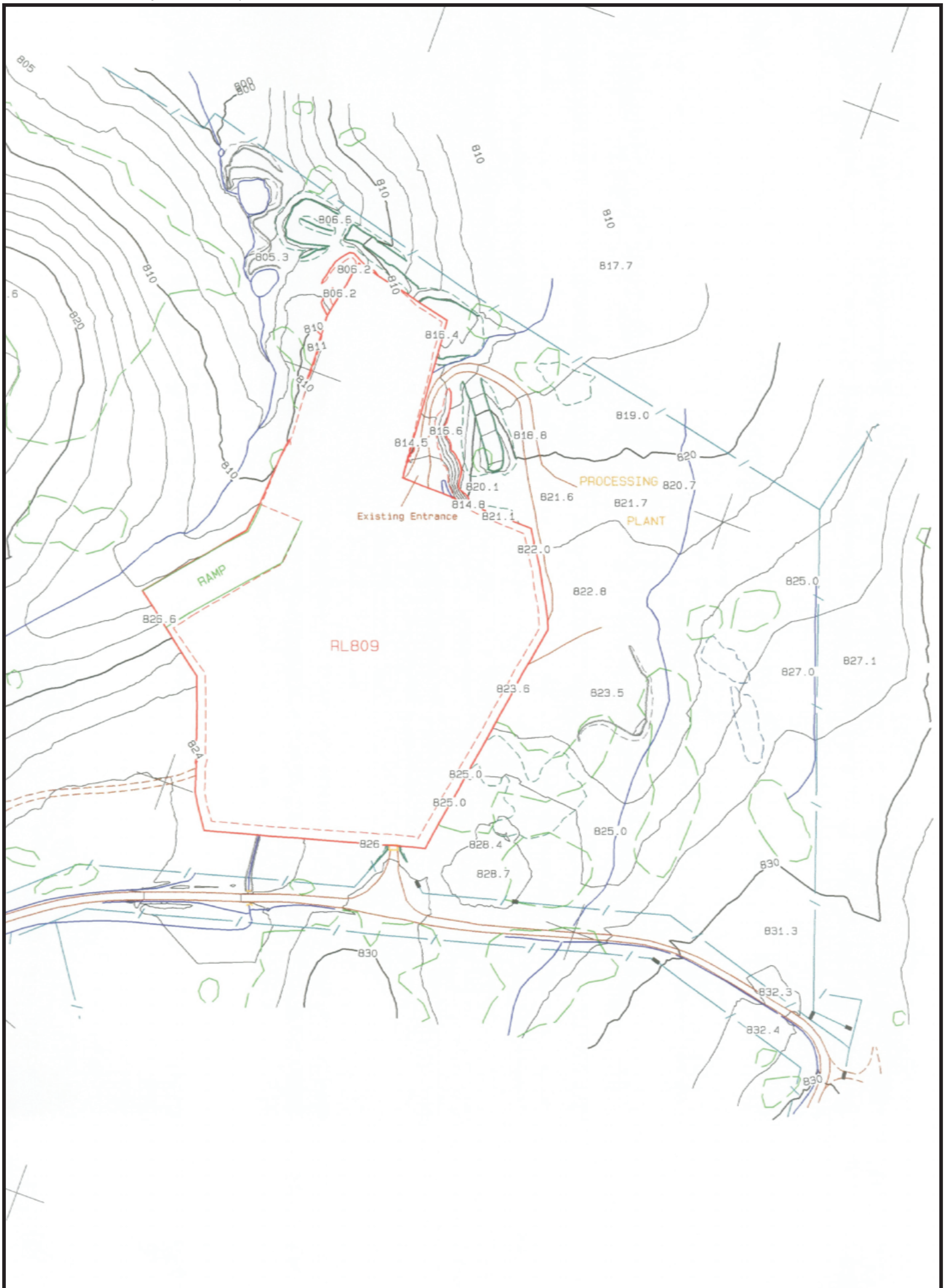
ERM

Project No:	0041010	Drawing No:	_1
Date:	11/04/06	Drawing size:	A4
Drawn by:	MTC	Reviewed by:	KM
Source:	-		

Figure 1

Existing Quarry

Bombala Quarry



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Date:	11/04/06	Drawing size:	A4
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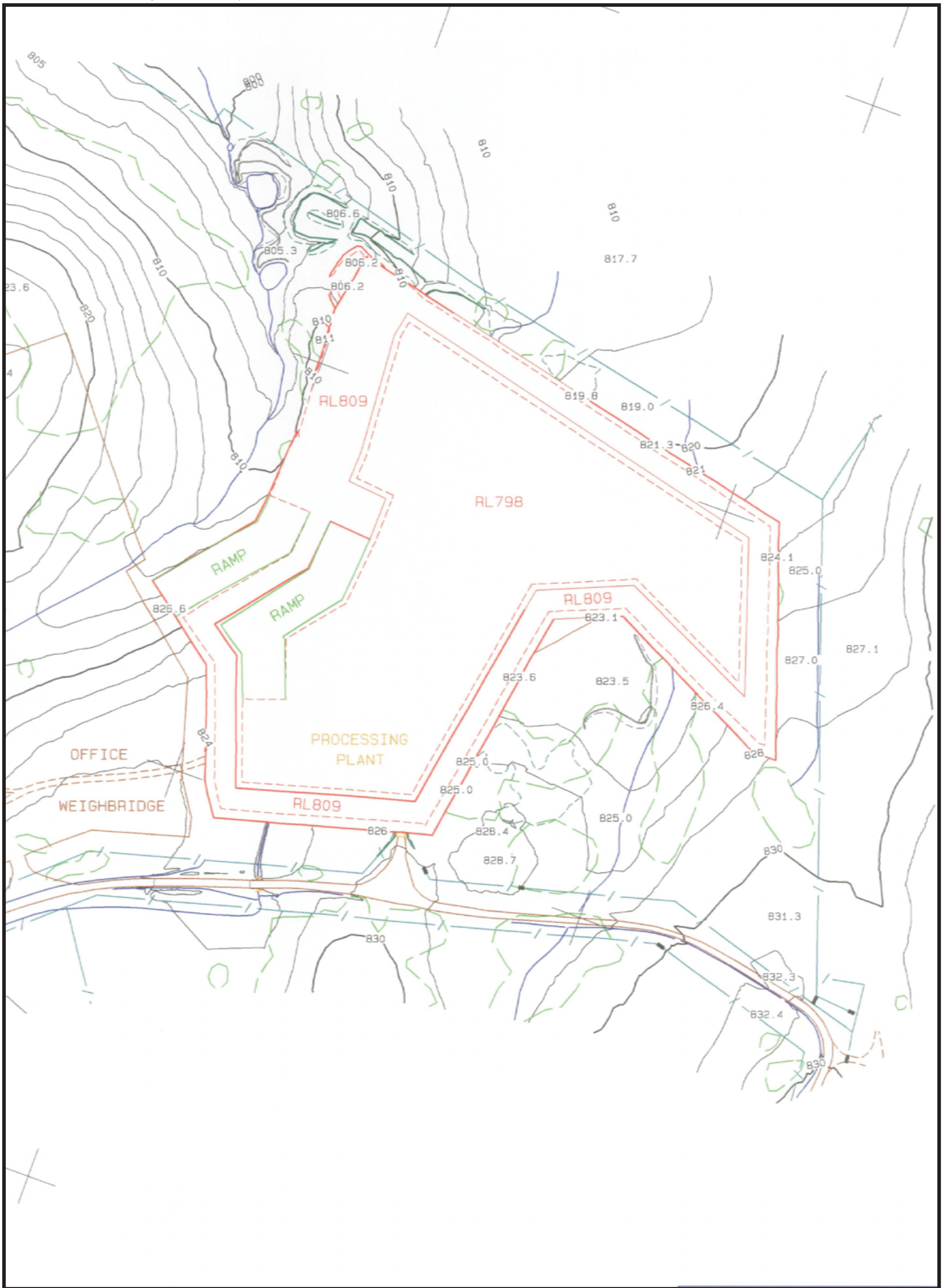
Source:	-		

Not to Scale

Figure 4

Plan - Stage 3

Bombala Quarry



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Date: 11/04/06	Drawing size: A4
Drawn by: MTC	Reviewed by: KM
Source: -	

Not to Scale

Figure 5

Plan - Stage 8

Bombala Quarry

Annex B

Quarry Resources Geological Report

Geochempet Services

ABN 65 325 709 681
PETROLOGICAL and GEOCHEMICAL CONSULTANTS

Principal: A.S. Joyce B.Sc. (Hons), Ph.D.
140 Kings Lane
MALENY Q 4552

Telephone: (07) 5494 3288

Fax: (07) 5494 3288

Email: asjoyce@bigpond.com

PETROGRAPHIC REPORT
ON A SAMPLE OF BOMBALA BASALT

prepared for

BORAL COUNTRY
CONCRETE & QUARRIES

Client Ref: G. Pollington, Wentworthville

Issued by

A.S. Joyce B.Sc.(Hons), Ph.D.
21st October, 2004.

GEOCHEMPET SERVICES, MALENY

Sample Label : Bombala Basalt Thompson's Pit, Bombala (Council Pit)
Supplied 10/09/04

Work Requested : Petrographic analysis in relation to suitability for use as road base, concrete aggregate, sealing/asphaltic aggregate, rail ballast, rip rap and marine armour rock; petrographic assessment of potential for alkali-silica reactivity; petrographic check for asbestiform minerals

Methods : Account taken of ASTM C 295 Standard Guide for *Petrographic Assessment of Aggregates for Concrete* and of the content of the 1996 joint publication of the Cement and Concrete Association of Australia and Standards Australia, entitled *Alkali Aggregate Reaction - Guidelines on Minimising the Risk of Damage to Concrete Structures in Australia*

Identification : Olivine basalt

Description :

The sample is a hand specimen of very robust, unweathered, hard, dark grey, non-porous, finely crystalline rock of basaltic appearance. There are no closely spaced joints. Fracture surfaces are irregular to subconchoidal.

An approximate mineralogical composition of the rock, expressed in volume percent and based on a brief count of 100 widely spaced points in thin section, is:

Primary Components

54%	plagioclase feldspar
21%	clinopyroxene
9%	olivine
6%	opaque oxide (magnetite and/or ilmenite)
<1%	apatite

Secondary Minerals

10%	green clay of smectite style (nontronite)
<1%	calcite

all crystals, no glass
subhedral,

In thin section the rock displays inconspicuously porphyritic, hypidiomorphic, subpoikilitic - subophitic, mildly flow-aligned, finely holocrystalline textures of basaltic style. Phenocrysts are about 1 to 2 mm in size. The groundmass has a framework of mildly flow-aligned feldspar laths (about 0.1 to 0.7 mm long), tightly interlocked in subophitic intergrowths with complexly shaped coarser grains of clinopyroxene (about 1 to 4 mm in size); other mafic minerals are smaller.

The phenocrysts are subhedral olivine, showing light alteration to green smectite clay around rims and along internal grain fractures. More olivine, similarly altered, occurs as groundmass grains. Fresh, well twinned plagioclase laths are confined to the groundmass. Faintly brownish to mauve clinopyroxene (titaniferous augite) occurs entirely as relatively coarse, fresh grains locked in robust subophitic intergrowths with plagioclase laths. Other groundmass components are fresh equant or platy opaque oxide and fresh acicular prisms of apatite. Minor, small, angular interstices are filled by green smectite clay and subordinate calcite.

Comments and Interpretations :

This sample from Thompson's Pit, Bombala may be summarised as

- **olivine basalt,** a basic volcanic rock type
- finely holocrystalline
- showing mild flow alignment of feldspar
- characterised by tough, robust subophitic intergrowth of pyroxene and feldspar
- non-porous
- unweathered
- only lightly altered (secondary mineral content amounting to 10% and mainly involving green smectite clay as a partial alteration of disseminated olivine grains
- **hard**
- **strong**

The rock is predicted to be **durable.**

The rock is interpreted to be **innocuous in relation to alkali-silica reactivity**. It lacks free silica minerals.

Thus, basalt of the type represented by the supplied specimen of Bombala basalt is predicted to be **suitable for use** as a source of **high quality road base, rail ballast, rip rap, concrete aggregate and sealing/asphaltic aggregate.**

The basalt **may well be suitable also for use as marine armour rock,** provided that blocks of sufficient size can be quarried, free of weak or weathered joints.

Free Silica Content : Nil

Asbestiform Minerals : Nil

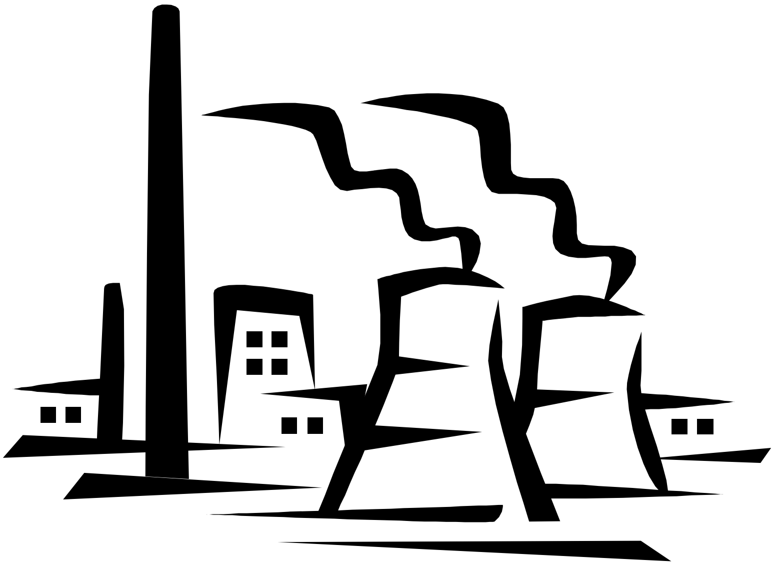
Annex C

Meteorological File Information

Report on

Bombala Input Metrological data file
For AUSPLUME

(Victoria, Regulatory Pollution Dispersion Model)



Prepared for

ERM Australia Pty Ltd

By

pDs MultiMedia and Consultancy service

pDs Consultancy **metfile@tpg.com.au**

AUSPLUME input Meteorological Data File for Bombala (NSW)

DATA Processing

Mandatory data such as wind direction, speed and ambient temperature were obtained from NSW regional office of the Bureau of Meteorology

QA/QC on Raw data

This data set was treated as follows

- Incomplete days removed
- Suspected wind stalls (both wind direction and speed) carefully examined interpolation done following a very conservative way where necessary.
- Wind Speed converted to m/s from km/h (The speed was recorded for the nearest km/h).
- Wind Direction found to be recorded in 10-degree resolution. The last digit of the wind direction has been randomised to meet air quality standard.
- Temperature and Dewpoint were checked for unusual values
- Pressure and cloud amount were checked for unusual values

Sydney (BoM) Vertical Temperature Profiles

- Gaps in vertical temperature profiles were filled with previous or following day data for the completeness.

100% data recovered for 2004.

Important Notes:

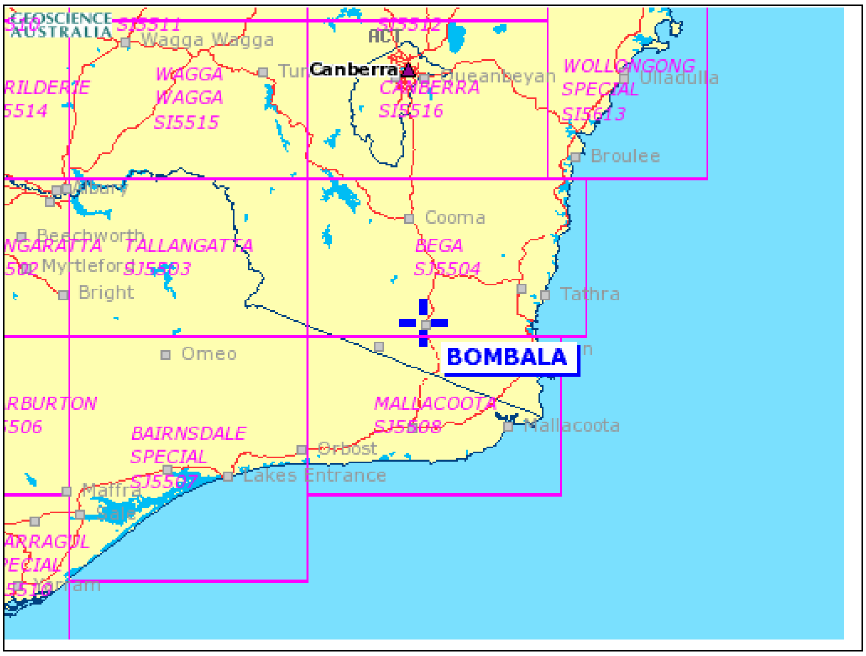
1. Sensitivity of Anemometers (not known) may not be up to air quality standard.

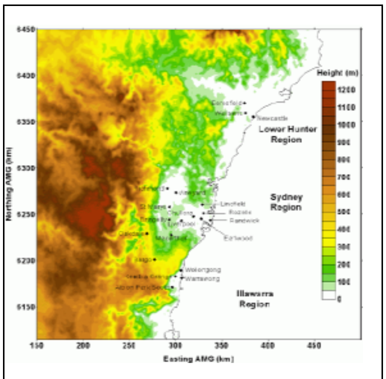
2. Zero wind speed is allowed, which may not be acceptable to older versions of AUSPLUME.

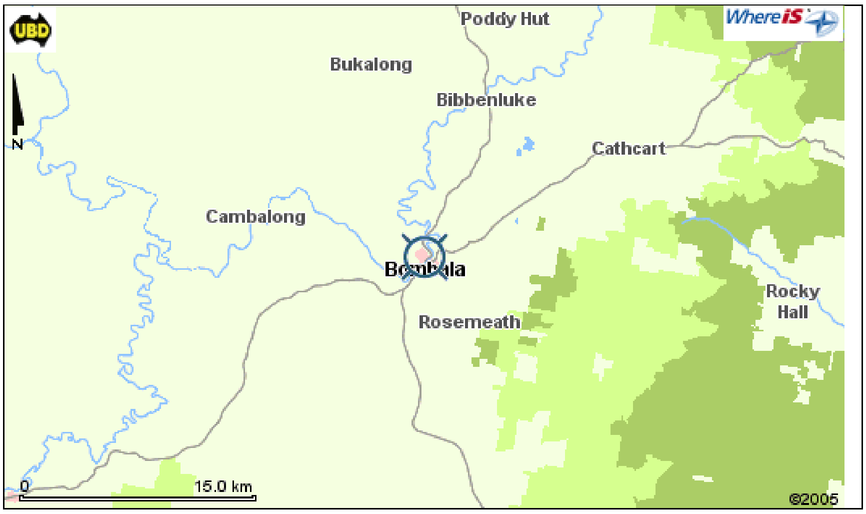
FILE INFORMATION

Bombala-NSW

STATE:	NSW
LATITUDE:	-37.00
LONGITUDE:	149.23
EASTING:	699000
NORTHING:	5912000







Data Source

1. **Bombala** AWS Data- NSW Regional Office
2. Surface data: Sydney Clouds
3. Vertical temperature Profiles-**Sydney** –National Climate Centre- Bureau of Meteorology, Melbourne.

pDs Consultancy **metfile@tpg.com.au**

Input Information

- Onsite (**Bombala**) parameters

  a. Wind speed (km/h)
  b. Wind direction
  c. Ambient Temperature (C)
  d. Dew point
  e. Surface Pressure

  Wind was measured at 10m (Anemometer Height), surface roughness assumed to be 0.4m

Offsite

- **Sydney (NSW)**
  Cloud cover (Total amount)

- **Sydney (NSW)**
  a. Vertical temperature profiles; Temperature, Dewpoint (2 profiles per day)

Standard Analysis

Data Coverage

Summer	:90	days		
Autumn	:92			
Winter	:92			
Spring	:91			
Number of days covered :365			% Coverage :100%	

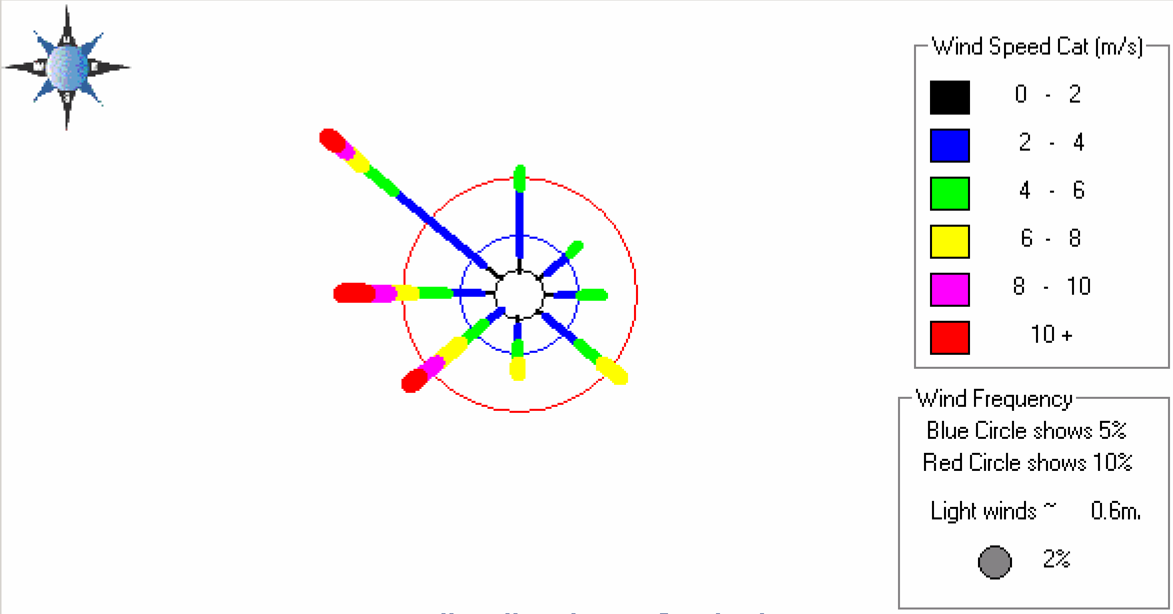
All 4 seasons are covered and Autumn, Winter and Spring well represented.

Stability Distribution

Stability Category	% Distribution	Avg Wind Speed	Avg Temperature	Avg Mixing Height
A	1 %	1.9	19.3	1392
B	4 %	2.8	15.8	1161
C	12 %	4.3	14.3	1331
D	53 %	6.	10.9	1322
E	14 %	3.2	8.4	679
F	15 %	1.8	7.5	415

Annual Wind Roses

Annual WindRoses for Bombala (NSW):2004

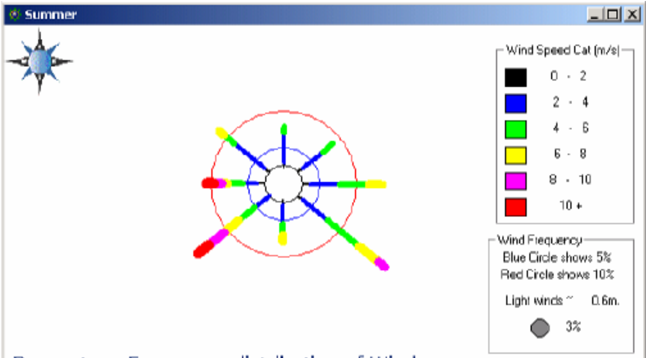


Percentage Frequency distribution of Winds

Speed Cat/Dir	NE	E	SE	S	SW	W	NW	N	Total Speed Freq
0 - 2	1.4	1.3	1.4	1.0	0.7	1.2	2.3	2.1	11%
2 - 4	3.5	2.9	4.6	2.8	3.0	3.7	11.1	7.0	39%
4 - 6	1.9	2.2	3.9	2.2	3.3	3.2	4.9	2.1	24%
6 - 8	0.5	0.7	2.1	1.1	3.1	2.8	2.7	0.7	14%
8 - 10	0.1	0.0	0.5	0.4	2.5	2.2	1.2	0.4	7%
10 +	0.0	0.0	0.0	0.1	1.7	2.0	1.4	0.2	5%
Total Dir Freq	7%	7%	13%	8%	14%	15%	23%	13%	

Seasonal Wind Roses

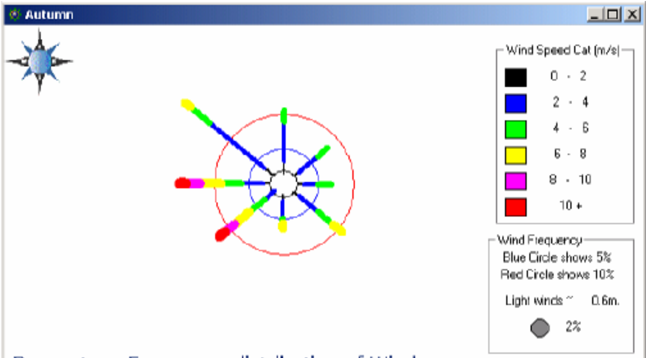
Summer



Percentage Frequency distribution of Winds

Speed Cat/Dir	NE	E	SE	S	SW	W	NW	N	Total Speed Freq
0 - 2	1.3	1.6	1.0	1.1	0.7	1.6	1.4	1.8	11%
2 - 4	4.9	4.1	5.5	3.2	3.4	2.6	6.6	5.9	36%
4 - 6	2.1	4.4	6.9	2.9	3.6	2.3	2.1	1.5	26%
6 - 8	0.8	2.1	4.3	1.2	3.8	1.5	1.3	0.2	15%
8 - 10	0.4	0.1	1.1	0.6	3.6	1.7	0.4	0.0	8%
10 +	0.0	0.0	0.1	0.0	2.6	1.0	0.4	0.0	4%
Total Dir Freq	10%	12%	19%	9%	18%	11%	12%	10%	

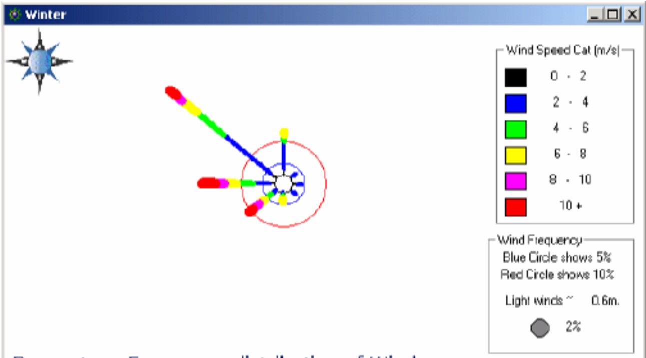
Autumn



Percentage Frequency distribution of Winds

Speed Cat/Dir	NE	E	SE	S	SW	W	NW	N	Total Speed Freq
0 - 2	1.7	1.4	1.7	1.0	0.7	1.1	2.5	2.4	13%
2 - 4	4.2	3.0	4.8	3.5	2.8	3.5	11.1	7.8	41%
4 - 6	2.2	2.0	3.6	2.0	3.6	3.1	4.3	2.3	23%
6 - 8	0.5	0.5	2.2	1.1	3.5	3.1	1.7	0.2	13%
8 - 10	0.0	0.0	0.7	0.5	2.4	2.8	0.8	0.0	7%
10 +	0.0	0.0	0.0	0.2	1.4	1.4	0.2	0.2	3%
Total Dir Freq	9%	7%	13%	8%	14%	15%	21%	13%	

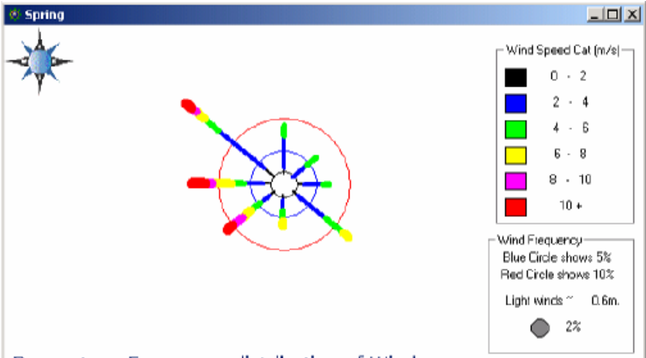
Winter



Percentage Frequency distribution of Winds

Speed Cat/Dir	NE	E	SE	S	SW	W	NW	N	Total Speed Freq
0 - 2	1.6	1.1	1.7	0.9	0.2	1.1	2.6	2.4	12%
2 - 4	1.3	1.7	2.0	1.4	2.7	4.4	16.2	8.2	38%
4 - 6	0.5	0.4	0.5	1.2	3.0	4.4	9.1	2.1	21%
6 - 8	0.0	0.0	0.1	1.1	2.3	3.2	5.1	1.4	13%
8 - 10	0.0	0.0	0.0	0.4	2.0	2.6	2.4	0.9	8%
10 +	0.0	0.0	0.0	0.2	1.3	3.1	3.0	0.1	8%
Total Dir Freq	3%	3%	4%	5%	12%	19%	38%	15%	

Spring



Percentage Frequency distribution of Winds

Speed Cat/Dir	NE	E	SE	S	SW	W	NW	N	Total Speed Freq
0 - 2	0.8	1.3	1.1	1.1	1.1	1.0	2.5	2.0	11%
2 - 4	3.5	3.1	6.2	2.9	3.0	4.0	10.5	6.2	39%
4 - 6	2.7	2.0	4.7	3.0	2.9	2.8	3.8	2.3	24%
6 - 8	0.6	0.2	2.0	1.2	2.7	3.2	2.6	0.9	13%
8 - 10	0.0	0.0	0.1	0.2	2.2	1.7	1.1	0.8	6%
10 +	0.0	0.0	0.0	0.1	1.6	2.5	1.8	0.3	6%
Total Dir Freq	8%	7%	14%	8%	14%	15%	22%	12%	

Secondary parameters

Vertical Stability

Solar Radiation for day time and Modified Pasquill Stability Class outlined in the reference, Davis and Singh, Jl of Hazardous Materials, 11 was used to determine night-time stability class. Solar radiation was theoretically calculated using off site cloud observations.

Table 1 for daytime and part of Table 2 for night-time were used.

Table 1: Stability Classification for Daytime Using Solar Radiation and Wind Speed

	Solar Radiation (W/m^2)			
Wind Speed(m/s)	≥925	≥675	≥175	< 175
< 2	A	A	B	D
< 3	A	B	C	D
< 5	B	B	C	D
< 6	C	C	D	D
≥ 6	C	D	D	D

Table 2: Modified Pasquill stability calsses

Surface Wind Speed m/s at 10m	Daytime incoming solar radiation				Within 1 h before sunset or after sunrise	Night-time cloud amount(Oktas)		
	Strong (>600)	Moderate (300-600)	Slight (<300)	Overcast		0-3	4-7	8
≤ 2	A	A-B	B	C	D	F	F	D
≤ 3	A-B	B	C	C	D	F	E	D
≤ 5	B	B-C	C	C	D	E	D	D
≤ 6	C	C-D	D	D	D	D	D	D
> 6	C	D	D	D	D	D	D	D

Mixing height

Definition:

The mixing height, the depth of the surface mixed layer is the height of the atmosphere above the ground, which is well mixed due either to mechanical turbulence or convective turbulence. The air layer above this height is stable.

The mixing height was determined by using the methodology of Benkley and Schulman (Journal of Applied Meteorology, Volume 18, 1979,pp 772-780). **Sydney** upper air observation containing temperature and moisture profiles were used to determine daytime mixing height.

Surface wind speeds and roughness are used to calculate the depth of the mechanically forced boundary layer during the night time

$MixH_m$=0.185* Ustar/Cterm

Where Ustar=.35*Usfc/Ln (Ht_{anemo}/Z_0)

Cterm = Coriolis Term =2 Ω Sin(ϕ)

Where Ω is the angular velocity of the earth
ϕ is the latitude

Ht_{anemo}= Anemometer Height, Z_0 is the roughness

Height of the convective boundary layer was determined using daytime temperature sounding (Vertical temperature and dewpoint profiles) in between sunrise and sunset. Evening or nighttime sounding for the same day is used to compensate daytime sounding to calculate convective mixing height at different daylight hours (Temperature difference at 700 hPa layer is used to allow advection). Larger value of the mechanical turbulence or convective turbulence was taken as Mixing height for the daylight hours.

Statistics of Bombala (NSW) input Meteorological data file-2004

Stability	Statistics	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
A	Max of Temp	33.0	25.0	28.0	15.0				11.0	20.0	20.0	26.0	28.0	33.0
	Min of Temp	12.0	20.0	14.0	15.0				11.0	6.0	14.0	13.0	13.0	6.0
	Average of Temp	21.3	22.6	19.8	15.0				11.0	11.8	17.0	21.8	21.4	19.3
	Max of WS	2.5	2.5	2.5	1.4				1.4	1.4	2.5	2.5	2.5	2.5
	Min of WS	1.4	1.4	1.4	1.4				1.4	0.6	1.4	1.4	1.4	0.6
	Average of WS	2.1	2.3	1.6	1.4				1.4	1.2	2.2	2.3	2.1	1.9
	Max of MixH	1911	2026	2109	1911				1386	2274	2292	2646	2400	2646
	Min of MixH	510	652	395	1911				1386	385	1710	867	1209	385
	Average of MixH	991	1141	1159	1911				1386	1317	2041	1679	1815	1392
B	Max of Temp	33.0	32.0	27.0	24.0	14.0	13.0	9.0	17.0	18.0	22.0	31.0	29.0	33.0
	Min of Temp	10.0	15.0	7.0	5.0	8.0	0.0	-2.0	0.0	2.0	7.0	10.0	9.0	-2.0
	Average of Temp	20.9	22.5	17.5	14.5	10.7	7.4	5.0	8.8	9.5	14.9	16.9	19.9	15.8
	Max of WS	4.7	4.7	4.7	4.7	1.4	1.4	1.4	4.7	4.7	4.7	4.7	4.7	4.7
	Min of WS	2.2	0.6	0.6	0.6	0.6	0.6	1.1	0.6	0.6	0.6	0.6	1.1	0.6
	Average of WS	3.7	2.9	2.8	2.6	1.0	1.0	1.4	2.2	2.6	3.2	3.0	3.4	2.8
	Max of MixH	2270	2498	2440	2661	1068	1815	1136	2567	2272	2449	2860	2484	2860
	Min of MixH	380	353	211	380	232	343	337	165	161	237	591	556	161
	Average of MixH	1153	1151	1183	1197	497	840	600	888	898	1376	1458	1423	1161
C	Max of Temp	35.0	35.0	30.0	28.0	19.0	16.0	12.0	19.0	21.0	28.0	32.0	30.0	35.0
	Min of Temp	11.0	12.0	5.0	4.0	1.0	-3.0	-3.0	-2.0	0.0	7.0	8.0	7.0	-3.0
	Average of Temp	19.5	19.8	18.1	15.1	10.0	7.5	6.2	8.2	10.6	13.5	17.4	18.5	14.3
	Max of WS	13.9	15.8	5.8	5.8	4.7	5.8	5.8	5.8	5.8	15.0	15.8	13.3	15.8
	Min of WS	2.2	2.2	2.2	1.4	1.1	2.2	2.2	1.1	1.1	1.1	2.2	0.6	0.6
	Average of WS	5.9	4.7	3.5	3.5	3.1	3.5	3.4	3.2	3.5	5.2	5.3	5.4	4.3
	Max of MixH	2757	3069	2804	2520	1966	1794	1790	2641	2497	3042	3090	2855	3090
	Min of MixH	444	469	393	386	353	380	422	333	380	206	595	649	206
	Average of MixH	1460	1331	1361	1182	879	863	935	1179	1185	1607	1630	1731	1331
D	Max of Temp	32.0	35.0	28.0	28.0	18.0	17.0	15.0	19.0	24.0	29.0	32.0	30.0	35.0
	Min of Temp	4.0	8.0	4.0	2.0	-2.0	-6.0	-6.0	-3.0	-3.0	1.0	1.0	4.0	-6.0
	Average of Temp	16.2	17.2	16.0	11.9	7.9	6.8	5.1	6.5	8.5	10.7	12.7	13.5	10.9
	Max of WS	18.1	15.0	13.3	12.2	17.5	18.6	13.9	19.4	16.9	18.6	15.0	15.3	19.4
	Min of WS	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	Average of WS	5.8	5.4	5.3	5.6	6.7	7.4	5.9	6.3	5.9	6.3	5.4	5.7	6.0
	Max of MixH	3316	3026	2751	2388	3443	3427	2699	3801	3332	3401	2984	3047	3801
	Min of MixH	200	174	127	200	311	206	232	211	153	127	200	169	127
	Average of MixH	1297	1209	1271	1222	1410	1552	1226	1350	1270	1398	1241	1334	1322
E	Max of Temp	26.0	24.0	24.0	24.0	16.0	14.0	11.0	15.0	19.0	21.0	21.0	20.0	26.0
	Min of Temp	5.0	9.0	4.0	3.0	-2.0	-5.0	-5.0	-3.0	0.0	-1.0	2.0	5.0	-5.0
	Average of Temp	13.0	14.8	12.1	10.1	6.1	3.9	3.6	4.8	6.5	8.5	9.7	11.9	8.4
	Max of WS	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7

	Min of WS	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
	Average of WS	3.0	3.0	3.0	3.0	3.5	3.4	3.3	3.4	3.3	3.0	3.1	2.7	3.2
	Max of MixH	1023	1060	1234	1392	1171	1392	1350	1286	1229	1355	1260	1102	1392
	Min of MixH	380	422	364	364	337	395	364	348	353	337	395	369	337
	Average of MixH	637	643	639	629	754	734	732	715	700	640	676	590	679
F	Max of Temp	21.0	20.0	19.0	22.0	16.0	15.0	12.0	15.0	18.0	17.0	21.0	21.0	22.0
	Min of Temp	3.0	7.0	4.0	2.0	-2.0	-5.0	-4.0	-3.0	0.0	-1.0	1.0	4.0	-5.0
	Average of Temp	12.0	13.3	11.2	9.2	5.2	3.2	2.2	3.4	4.9	8.3	9.5	10.8	7.5
	Max of WS	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
	Min of WS	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	Average of WS	1.7	1.7	1.6	1.8	2.0	1.8	1.8	1.9	1.7	1.7	2.0	1.5	1.8
	Max of MixH	649	765	643	759	997	854	907	939	791	881	775	659	997
	Min of MixH	127	127	127	127	127	127	127	127	127	127	232	127	127
	Average of MixH	392	406	377	413	467	434	421	445	396	398	457	354	415

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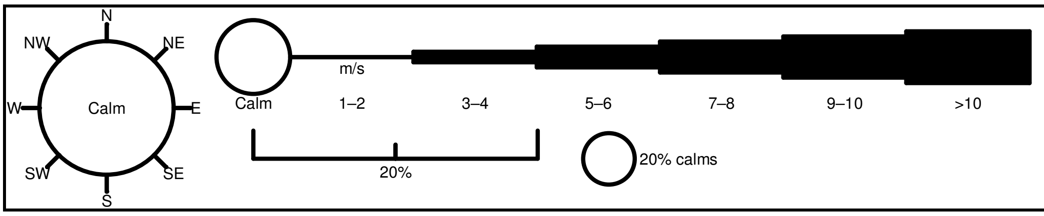
Annex D

Windroses

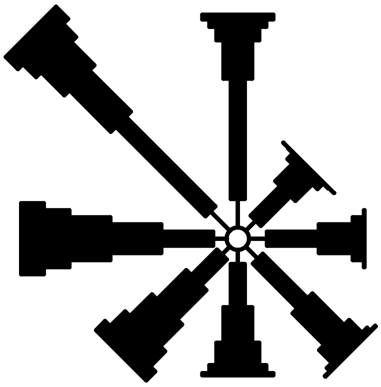
Wind Roses using data between Jan 1990 and Dec 2005 for

Bombala AWS

Site Number 070328 • Locality: Bombala • Opened Jan 1988 • Still Open • Latitude 37°00'06"S • Longitude 149°14'01"E • Elevation 760.5m



All times 42281 observations



Prepared by Climate and Consultancy Section in the Tasmania and Antarctica Regional Office of the Bureau of Meteorology. Contact us by phone on (03) 6221 2043, by fax on (03) 6221 2045, or by email on climate.tas@bom.gov.au

 Prepared on 21 February 2006

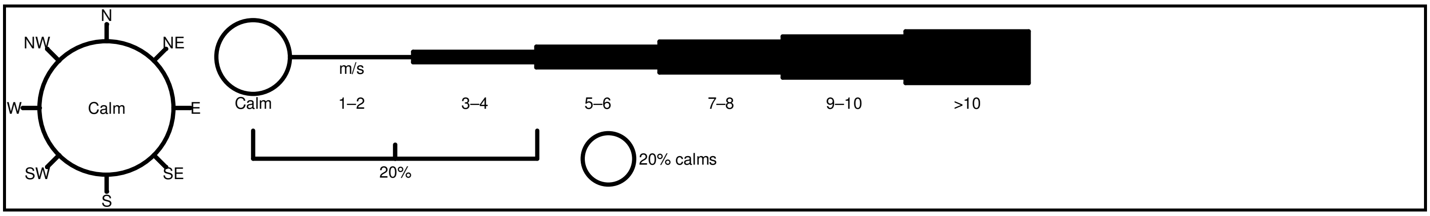
Australian Government

Bureau of Meteorology

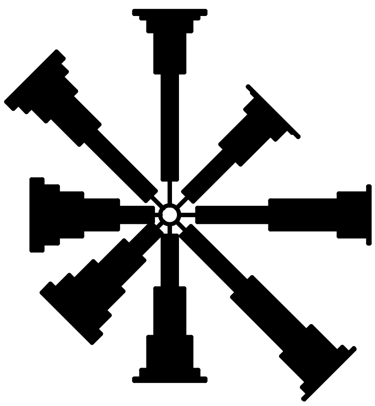
Wind Roses using data between Jan 1990 and Dec 2005 for

Bombala AWS

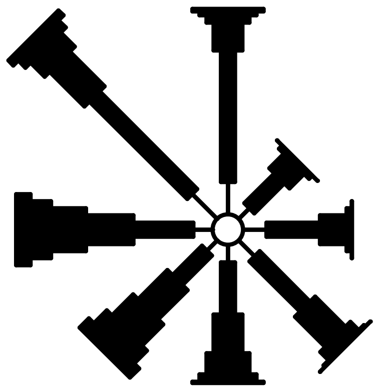
Site Number 070328 • Locality: Bombala • Opened Jan 1988 • Still Open • Latitude 37°00'06"S • Longitude 149°14'01"E • Elevation 760.5m



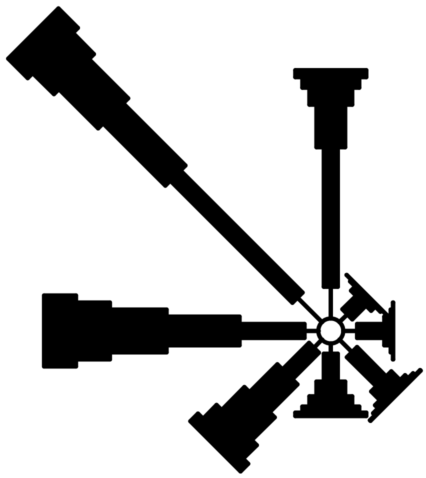
Summer 10429 observations



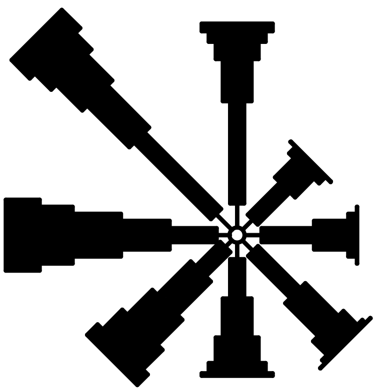
Autumn 11145 observations



Winter 10250 observations



Spring 10457 observations



Australian Government
Bureau of Meteorology

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Annex E

Emission Calculations

Emission Estimations

Source 1 - Quarry Pit

Stripping of Overburden

Stripping of overburden occurs on an infrequent basis over the year. The TSP emission factor for bulldozers on overburden from NPI EET for Mining 2001 is;

$E = 2.6 \times s^{1.2}/M^{1.3}$ kg/hr

Where M = moisture content

s = silt content

The PM_{10} emission factor equation is;

$E = 0.34 \times s^{1.5}/M^{1.4}$ kg/hr

Using soil moisture content of 2% (typical for Australian mines) and silt content of 8.3% (US EPA 2006, Table 13.2.2-1, for Stone quarrying and gravel), this gives the following estimated emissions. Stripping of overburden has assumed to be carried out for one day a week currently, increasing to two days a week in Stage 3 and Stage 8.

Table 1 Emissions from Stripping of Overburden – Existing Quarry

Source	Emission Factor		Quantity	Estimated Emissions		Emission Factor Source
	TSP	PM_{10}		TSP	PM_{10}	
Stripping overburden	13 kg/hr	3 kg/hr	480	1,440	6,240	NPI EET for Mining 2001
TOTAL kg/year				1,440	6,240	

Table 2 Emissions from Stripping of Overburden – Stage 3 and Stage 8

Source	Emission Factor		Quantity	Estimated Emissions		Emission Factor Source
	TSP	PM_{10}		TSP	PM_{10}	
Stripping overburden	13 kg/hr	3 kg/hr	960	2,975	12,057	NPI EET for Mining 2001
TOTAL kg/year				2,975	12,057	

Drilling and Blasting

Drilling activities produce dust from the mechanical action of the drill and are considered to be a relatively minor component of the overall emissions from the quarry. Estimating emissions from blasting activities is difficult given the complex and variable natures of each blast (NPI Mining EET, 2001). The US EPA does not provide a procedure for estimating blasting emissions from stone quarries because of the 'sparsity and unreliability of available tests' (US EPA AP-42, 2004). Despite these limitations, the equation below, sourced from the NPI EET for Mining 2001 has been used in the absence of any alternative reliable estimations of emissions.

The equation is;

$E = 0.00022 \times A^{1.5}$

where,

A = area blasted in square metres

E = TSP emissions in kg/blast

Emissions of PM_{10} are estimated on the basis that the PM_{10} fraction during blasting constitutes 52% of the TSP (US EPA 1998, in NPI Mining EET, 2001)

Drilling and blasting at the quarry is anticipated to be carried out approximately four times a year, with 25,000 tonnes of material liberated with each blast. The average area blasted in each blast is estimated to be 733 m^2.

Table 3 *Emissions from Drilling and Blasting – Existing Quarry, Stage 3 and Stage 8.*

Source	**Emission Factor**		**Quantity**	**Estimated Emissions**		**Emission Factor Source**
	TSP	PM_{10}		TSP	PM_{10}	
Drilling	0.59 kg/hole	0.31 kg/hole	4 holes per year	2.4 kg/year	1.2 kg/year	NPI Mining EET 2001, page 38.
Blasting	4.36 kg/blast	2.27 kg/blast	4 blasts per year	17. 5 kg/year	9.1 kg/year	NPI Mining EET 2001, page 38
TOTAL kg/year				20	10	

Loading and Haulage

Following drilling and blasting the liberated rock is loaded onto a haul truck by an excavator and transported to the raw material stockpile at the processing plant.

Emissions of dust are generated as a result of dumping material into the haul truck and wheel generated dust from the truck driving on unsealed surfaces.

Loading

The US EPA (US EPA, 1995) gives the following equation to estimate emissions from loading;

$E = k * 0.0016 \times (U/2.2)^{1.3} / (m/2)^{1.4}$

Where

E = emission factor

k = particle size multiplier (for TSP = 0.74, for PM_{10} = 0.35)

U = mean wind speed (m/s)

M = material moisture content

Mean wind speed was obtained from the Bureau of Meteorology (BoM) weather station at Bombala (3.6 m/s). A typical material moisture content for stone quarrying and processing operations was estimated to be 2.1 % (from Table 13.2.4-11 in US EPA, 1995). Applying this factor gives a value of 0.0021 kg/t for TSP and 0.0010 kg/t for PM_{10}.

A study on Australian coal mines, prepared by the National Energy Research Development and Demonstration Council (NERDCC) in 1988 obtained a TSP emission factor of 0.025 kg/t and a PM_{10} emission factor of 0.012 kg/t for PM_{10} (NPI EET for Mining 2001). It is considered that the US EPA emission factor will underestimate emissions from this activity in Australia by a factor of 5-10 (SKM, 2005). As a result the default emission factors outlined in the NPI EET for Mining 2001 have been used in this study, rather than the emission factors calculated with the US EPA loading equation, to ensure a conservative estimate is given for emissions from the quarry.

The default emission factors given in the NPI EET for Mining 2001 are 0.025 kg/yr for TSP and 0.012 kg/yr for PM_{10}.

Haulage

Haulage emissions have been estimated by using the following equation for industrial roads given in US EPA (2006).

E (kg/VKT) = k (s/12)a (W/3)b

Where E = size specific emission factor

k = 1.381 for TSP, 0.423 for PM_{10}

s = surface material silt content (%)

W = mean vehicle weight (tonnes)

a = 0.7 for TSP, 0.9 for PM_{10}

b = 0.45 for TSP and 0.45 for PM_{10}

Surface material silt content has been estimated at 8.3% (US EPA 2006, Table 13.2.2-1, for Stone quarrying and gravel processing - haul road to and from/pit). The gross vehicle weight in tonnes has been estimated at 60 tonnes.

Calculated emission factors are 4.11 kg/VKT for TSP, and 1.17 kg/VKT for PM_{10}. A 50% control factor has been applied as it is estimated that a low level of watering (less than 1 $L/m^2/hr$) (NPI Mining EET 2001) occurs on the haul road. Therefore calculated emission factors are 2.06 kg/VKT and 0.59 kg/VKT.

The haul truck currently makes approximately 3 trips to and from the pit per day, based on a 50 tonne load. It is estimated that haulage in the pit is currently approximately 1.6km per day, or 483 kilometres per year.

It has been estimated that during Stage 3 and Stage 8 the haul truck will make 7 trips to and from the pit each day, based on a 50 tonne load. There will be additional haulage during Stage 3 from the primary crusher to the processing plant, as the primary crusher is to be located away from the processing plant during this stage. It is estimated that during Stage 3 haulage in the pit will be approximately 1.6km per day, or 483 kilometres per year. For Stage 8, the maximum distance travelled will be approximately 1 kilometre, with a total distance per year of 302 kilometres.

Loading emissions from Stage 3 and Stage 8 will remain constant, however as the distance of the haul route between the pit and the processing plant will differ between the two stages, haulage emissions will vary.

Emissions from loading and hauling activities can be seen in *Table 2.*

Table 4 Loading and Haulage Emissions - Existing Quarry

Source	Emission Factor		Quantity	Estimated Emissions		Emission Factor Source
	TSP	PM_{10}		TSP	PM_{10}	
Loading to haul truck	0.025 kg/yr	0.012 kg/yr	33,000 tonnes per year	825 kg/year	396 kg/year	NPI EET for Mining 2001
Haulage from quarry to raw stockpile	2.06 kg/VKT	0.59 kg/VKT	154 km/year	317 kg/year	91 kg/year	US EPA 2006
TOTAL kg/year				1,142	487	

1. A 50% control factor has been applied to emissions from haulage as a result of watering. Area of the quarry pit source has been estimated at approximately 4,983m2.

Table 5 Loading and Haulage Emissions – Stage 3

Source	Emission Factor		Quantity	Estimated Emissions		Emission Factor Source
	TSP	PM_{10}		TSP	PM_{10}	
Loading to haul truck	0.025 kg/yr	0.012 kg/yr	100,000 tonnes per year	2500 kg/year	1200 kg/year	NPI EET for Mining 2001
Haulage from quarry to raw stockpile	2.06 kg/VKT	0.59 kg/VKT	483 km/year	995 kg/year	285 kg/year	US EPA 2006
TOTAL kg/year				3,495	1,485	

1. A 50% control factor has been applied to emissions from haulage as a result of watering. Area of the quarry pit source in Stage 3 has been estimated at approximately 19,600m2.

Table 6 Loading and Haulage Emissions – Stage 8

Source	Emission Factor		Quantity	Estimated Emissions		Emission Factor Source
	TSP	PM_{10}		TSP	PM_{10}	
Loading to haul truck	0.025 kg/yr	0.012 kg/yr	100,000 tonnes per year	2500 kg/year	1200 kg/year	NPI EET for Mining 2001
Haulage from quarry to raw stockpile	2.06 kg/VKT	0.59 kg/VKT	302 km/year	622 kg/year	178 kg/year	US EPA 2006
TOTAL kg/year				3,122	1,378	

1. A 50% control factor has been applied to emissions from haulage as a result of watering. Area of the Quarry pit in Stage 8 has been modelled at approximately 46,047 m^2.

Primary Processing

Currently, and during Stage 3, the primary processing plant will be located in the quarry pit. Emission factors for primary crushing have been taken from US EPA (2004). A 50% control factor has been applied, as dust suppression is estimated to be 50% effective due to the application of water (control factor taken from NPI EET for Mining page 6).

Table 7 Primary Crushing – Existing Quarry

Source	Emission Factor		Quantity	Estimated Emission		Emission Factor Source
	TSP	PM_{10}		TSP	PM_{10}	
Primary Crushing	0.0027 kg/tonne	0.0012 kg/tonne	33,000 tonnes per year	89 kg/year	40 kg/year	US EPA 2004
TOTAL kg/year				89	40	

1. A 50% control factor has been applied.

Table 8 Primary Crushing – Stage 3

Source	Emission Factor		Quantity	Estimated Emission		Emission Factor Source
	TSP	PM_{10}		TSP	PM_{10}	
Primary Crushing	0.0027 kg/tonne	0.0012 kg/tonne	100,000 tonnes per year	270 kg/year	120 kg/year	US EPA 2004
TOTAL kg/year				270	120	

1. A 50% control factor has been applied.

Total Emissions – Source 1 (Quarry Pit)

Table 9 Total Emissions – Existing Quarry

Source	TSP Emission (kg/year)	PM_{10} Emission (kg/year)	$PM_{2.5}$ Emission (kg/year)
Stripping of overburden	6,240	1,440	
Drilling	2.4	1.2	
Blasting	17.5	9.1	
Loading	825	396	
Haulage	317	91	
Primary Crushing	89	40	
TOTAL (kg/yr)	7,491	1977	351
TOTAL (g/sec/m^2)	**0.00014**	**0.000036**	**0.000006**

1. Emissions are based on a 10 hr per day, 302 day per year working schedule. Area of the existing quarry pit source has been estimated at approximately 4,983m2.

Table 10 Total Emissions – Stage 3

Source	TSP Emission (kg/year)	PM_{10} Emission (kg/year)	$PM_{2.5}$ Emission (kg/year)
Stripping of overburden	12,057	2,975	
Drilling	2.4	1.2	
Blasting	17.4	9.1	
Loading	2,500	1,200	
Haulage	995	285	
Primary Crushing	270	120	
TOTAL (kg/yr)	15,841	4,590	741
TOTAL (g/sec/m2)	**0.000074**	**0.000022**	**0.0000034**

1. Emissions are based on a 10 hr per day, 302 day per year working schedule. Area of the quarry pit source in Stage 3 has been estimated at approximately 19,600m2

Table 11 Total Emissions – Stage 8

Source	TSP Emission (kg/year)	PM_{10} Emission (kg/year)	$PM_{2.5}$ Emission (kg/year
Stripping of overburden	12,057	2,975	
Drilling	2.4	1.2	
Blasting	17.4	9.1	
Loading	2,500	1,200	
Haulage	622	178	
TOTAL (kg/yr)	15,199	4,363	711
TOTAL (g/sec/m^2)	**0.000030**	**0.0000087**	**0.0000014**

1. Emissions are based on a 10 hr per day, 302 day per year working schedule. Area of the Quarry pit in Stage 8 has been estimated at approximately 46,047 m2.

Source 2: Wind Erosion from the Quarry Pit

The emission factor equation for wind erosion is;

E = 1.9 (s/1.5) 365(365-p/235)(f/15) 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 is greater than 5.4 metres per second at the mean height of the stockpile.

While the emission estimation equation above is intended for estimating emissions from stockpiles, it can be used to characterise emissions from other exposed areas (NPI EET for Mining, 2003)

The silt content of the product has been estimated at 3.9% (Typical Silt and Moisture Contents of Materials at Various Industries, Table 13.2.4-1 in US EPA 1995). The number of days when rainfall is greater than 0.25mm (ie days on which rain occurs) has been estimated at 110 days per year from BoM data (Bureau of Meteorology, 2006) for Bombala. The percentage of time that wind speed is greater than 5.4 metres per second has been determined as 31% from the meteorological file used in the modelling and derived from BoM data for the Bombala area.

The calculated TSP emission factor is therefore 4043.5 kg/ha/year or 0.46 kg/ha/hr. It has been estimated that 50% of TSP is emitted as PM_{10} (NPI EET for Mining). Therefore the PM_{10} emission factor has been calculated to be 0.23 kg/ha/hr.

Wind erosion has been modelled as occurring 24 hours a day, 365 days a year.

Table 12 Wind Erosion Emissions – Existing Quarry

Source	**Emission Factor**		**Quantity**	**Estimated Emission**			**Emission Factor Source**
	TSP	PM_{10}		TSP	PM_{10}	$PM_{2.5}$	
Wind Erosion from Quarry Pit	0.46 kg/ha/hr	0.23 kg/ha/hr	0.5 ha	2,015 kg/year	1,007 kg/year	94 kg/year	US EPA 1998 in NPI EET for Mining
TOTAL g/sec/m²				**0.000013**	**0.0000064**	**0.0000006**	

1. Quarry pit area has been estimated at 4,983m2. Emissions from wind erosion occur 24 hours a day, 365 days a week

Table 13 Wind Erosion Emissions – Stage 3

Source	Emission Factor		Quantity	Estimated Emission			Emission Factor Source
	TSP	PM_{10}		TSP	PM_{10}	$PM_{2.5}$	
Wind Erosion from Quarry Pit	0.46 kg/ha/hr	0.23 kg/ha/hr	1.96 ha	7,898 kg/year	3,949 kg/year	370 kg/year	US EPA 1998 in NPI EET for Mining
TOTAL g/sec/m²				**0.000013**	**0.0000064**	**0.0000006**	

1. Quarry pit area has been estimated at 19,600m2. Emissions from wind erosion occur 24 hours a day, 365 days a week

Table 14 Wind Erosion Emissions – Stage 8

Source	Emission Factor		Quantity	Estimated Emission			Emission Factor Source
	TSP	PM_{10}		TSP	PM_{10}	$PM_{2.5}$	
Wind Erosion from Quarry Pit	0.46 kg/ha/hr	0.23 kg/ha/hr	4.6 ha	18,536 kg/year	9,268 kg/year	867 kg/year	US EPA 1998 in NPI EET for Mining
TOTAL g/sec/m²				**0.000013**	**0.0000064**	**0.0000006**	

1. Quarry pit area has been estimated at 46,047m2. Emissions from wind erosion occur 24 hours a day, 365 days a week

Source 3: Processing Area

Dumping Of Material

Material is dumped into the crushing plant by FEL from the raw feed stockpile. Material is also dumped onto stockpiles via conveyors at the end of the crushing and screening process. Emission factors for dumping and loading can be estimated using the equation available in US EPA (1995), however as discussed previously, this is likely to underestimate emissions under Australian conditions. As such, the default emissions outlined in the NPI EET for Mining 2001 have been used to estimate emissions as a result of dumping.

Table 15 Dumping of Material – Existing Quarry

Source	Emission Factor		Quantity	Estimated Emissions		Emission Factor Source
	TSP	PM_{10}		TSP	PM_{10}	
Dumping to crushing hopper	0.025 kg/yr	0.012 kg/yr	33,000 tonnes per year	825 kg/year	396 kg/year	NPI EET for Mining 2001
Dumping to stockpiles	0.025 kg/yr	0.012 kg/yr	33,000 tonnes per year	825 kg/year	396 kg/year	NPI EET for Mining 2001
TOTAL kg/year				**1,650**	**792**	

Table 16 Dumping of Material – Stage 3 and Stage 8

Source	Emission Factor		Quantity	Estimated Emissions		Emission Factor Source
	TSP	PM_{10}		TSP	PM_{10}	
Dumping to crushing hopper	0.025 kg/yr	0.012 kg/yr	100,000 tonnes per year	2500 kg/year	1200 kg/year	NPI EET for Mining 2001
Dumping to stockpiles	0.025 kg/yr	0.012 kg/yr	100,000 tonnes per year	2500 kg/year	1200 kg/year	NPI EET for Mining 2001
TOTAL kg/year				**5000**	**2400**	

Crushing and Screening

Emission factors for crushing and screening are given in US EPA (2004). A 50% control factor has been applied to emissions as dust control has been estimated at being 50% effective.

Currently, and during Stage 3 the primary crushing infrastructure will be located in the pit, at a separate location from the processing plant. As such, the primary crushing plant has been included in the quarry pit source above. It has been assumed that all product undergoes primary and secondary crushing, with 80% of the product undergoing tertiary crushing.

Table 17 Crushing and Screening Emission Estimates – Existing Quarry

Source	Emission Factor		Quantity	Estimated Emissions		Emission Factor Source
	TSP	PM_{10}		TSP	PM_{10}	
Secondary Crushing	0.0027 kg/t	0.0012 kg/t	33,000 tonnes per year	89 kg/year	40 kg/year	US EPA 2004
Tertiary Crushing	0.0027 kg/t	0.0012 kg/t	24,000 tonnes per year	65 kg/year	29 kg/year	US EPA 2004
Screening	0.0125 kg/t	0.0043 g/t	33,000 tonnes per year	413 kg/year	142 kg/year	US EPA 2004
TOTAL kg/year				567	211	

1. Control factor of 50% has been applied to the uncontrolled emission factors, as dust control is estimated at 50% effective due to application of water sprays (NPI EET for Mining page 16).
2. An area of 1,200m² has been estimated for the processing area. Processing emissions based on a 10 hr day, 302 days a year.

Table 18 Crushing and Screening Emission Estimates – Stage 3

Source	Emission Factor		Quantity	Estimated Emissions		Emission Factor Source
	TSP	PM_{10}		TSP	PM_{10}	
Secondary Crushing	0.0027 kg/t	0.0012 kg/t	100,000 tonnes per year	270 kg/year	120 kg/year	US EPA 2004
Tertiary Crushing	0.0027 kg/t	0.0012 kg/t	80,000 tonnes per year	216 kg/year	96 kg/year	US EPA 2004
Screening	0.0125 kg/t	0.0043 g/t	100,000 tonnes per year	1250 kg/year	425 kg/year	US EPA 2004
TOTAL kg/year				1736	641	

1. Control factor of 50% has been applied to the uncontrolled emission factors, as dust control estimated at 50% effective.
2. An area of 1,200m² has been estimated for the processing area. Processing emissions based on a 10 hr day, 302 days a year.

Table 19 Crushing and Screening Emission Estimates – Stage 8

Source	Emission Factor		Quantity	Estimated Emissions		Emission Factor Source
	TSP	PM_{10}		TSP	PM_{10}	
Primary Crushing	0.0027 kg/t	0.0012 kg/t	100,000 tonnes per year	270 kg/year	120 kg/year	US EPA 2004
Secondary Crushing	0.0027 kg/t	0.0012 kg/t	100,000 tonnes per year	270 kg/year	120 kg/year	US EPA 2004
Tertiary Crushing	0.0027 kg/t	0.0012 kg/t	80,000 tonnes per year	216 kg/year	96 kg/year	US EPA 2004
Screening	0.0125 kg/t	0.0043 kg/t	100,000 tonnes per year	1250 kg/year	641 kg/year	US EPA 2004
TOTAL kg/year				2006	977	

1. Control factor of 50% has been applied to the uncontrolled emission factors, as dust control estimated at 50% effective.
2. An area of 1,200m² has been estimated for the processing area. Processing emissions based on a 10 hr day, 302 days a year.

Total Emissions – Source 3 (Processing Area)

Table 20 Total Estimated Emissions - Existing Quarry

Source	TSP	PM_{10}	$PM_{2.5}$
Dumping to crushing hopper	825	396	
Dumping to stockpiles	825	396	
Secondary Crushing	89	40	
Tertiary Crushing	65	29	
Screening	413	142	
TOTAL (kg/yr)	2,217	1,003	104
TOTAL (g/sec/m2)	**0.00017**	**0.000077**	**0.0000079**

1. Emissions are based on a 10 hr per day, 302 day per year working schedule. Area of the processing area has been estimated at 1,200m2

Table 21 Total Estimated Emissions - Stage 3

Source	TSP	PM_{10}	$PM_{2.5}$
Dumping to crushing hopper	2,500	1,200	
Dumping to stockpiles	2,500	1,200	
Secondary Crushing	270	120	
Tertiary Crushing	216	96	
Screening	1,250	425	
TOTAL (kg/yr)	6,736	3,041	315
TOTAL (g/sec/m2)	**0.00052**	**0.00023**	**0.0000243**

1. Emissions are based on a 10 hr per day, 302 day per year working schedule. Area of the processing area has been estimated at 1,200m2

Table 22 Total Estimated Emissions - Stage 8

Source	TSP	PM_{10}	$PM_{2.5}$
Dumping to crushing hopper	2,500	1,200	
Dumping to stockpiles	2,500	1,200	
Primary Crushing	270	120	
Secondary Crushing	270	120	
Tertiary Crushing	216	96	
Screening	1,250	641	
TOTAL (kg/yr)	7,006	3,377	328
TOTAL (g/sec/m2)	**0.00054**	**0.00026**	**0.0000252**

1. Emissions are based on a 10 hr per day, 302 day per year working schedule. Area of the processing area has been estimated at 1,200m2

Source 4 – Product Stockpile Area – Wind Erosion

Wind Erosion from Stockpiles

Wind erosion from stockpiles has been estimated using the emission factors calculated above for Quarry Pit Wind Erosion.

Currently there is one stockpile area onsite. During Stage 3, there will be 2 main stockpile areas on site. By Stage 8, it is proposed that all stockpiles will be located in one area, to the west of the pit. During Stage 3, Stockpile Area 1 will be the dust stockpile located to the east of the pit. Stockpile 2 will be the additional product stockpile located near the existing entrance to the current pit. Wind erosion has been modelled as occurring 24 hours a day, 365 days a year.

Table 23 Wind Erosion from Stockpiles – Existing quarry

Source	Emission Factor		Quantity	Estimated Emission			Emission Factor Source
	TSP	PM_{10}		TSP	PM_{10}	$PM_{2.5}$	
Wind Erosion Stockpile Area	0.46 kg/ha/hr	0.23 kg/ha/hr	0.1 ha	403 kg/year	201 kg/year	19 kg/year	US EPA 1998 in NPI EET for Mining
TOTAL g/sec/m²				**0.000013**	**0.0000065**	**0.0000006**	

1. Wind Erosion based on 24 hours a day, 365 days a year. Area of stockpile is estimated at 1,000m² (50m x 20m)

Table 24 Wind Erosion from Stockpiles – Stage 3

Source	Emission Factor		Quantity	Estimated Emissions			Emission Factor Source
	TSP	PM_{10}		TSP	PM_{10}	$PM_{2.5}$	
Wind Erosion - Stockpile Area 1	0.46 kg/ha/hr	0.23 kg/ha/hr	0.64 ha	2,579 kg/year	1,289 kg/year	121	US EPA 1998 (in NPI EET for Mining)
Wind Erosion - Stockpile Area 2	0.46 kg/ha/hr	0.23 kg/ha/hr	0.10 ha	403 kg/year	201 kg/year	19	US EPA 1998 (in NPI EET for Mining)
TOTAL – Area 1 (g/s/m²)				**0.000013**	**0.0000065**	**0.0000006**	
TOTAL – Area 2 (g/s/m²)				**0.000013**	**0.0000065**	**0.0000006**	

1. 1. Wind Erosion based on 24 hours a day, 365 days a year.
Area of Stockpile Area 1 estimated at 6400m2 (80m x 80m). Area of Stockpile Area 2 estimated at 1000m2 (50mx20m).

Table 25 Wind Erosion from Stockpiles -Stage 8

Source	Emission Factor		Quantity	Estimated Emission			Emission Factor Source
	TSP	PM_{10}		TSP	PM_{10}	$PM_{2.5}$	
Wind Erosion from Stockpile Area	0.46 kg/ha/hr	0.23 kg/ha/hr	0.92 ha	3,737 kg/year	1,854 kg/year	175 kg/year	US EPA 1998 in NPI EET for Mining
TOTAL g/sec/m²				**0.000013**	**0.0000065**	**0.0000006**	

1. Wind Erosion based on 24 hours a day, 365 days a year. Area of stockpile is estimated at 1,000m² (50m x 20m)

Source 5 – Product Stockpile Area

FEL working on stockpiles

Emissions from this activity have been estimated using the recommended TSP emission factors for excavators/shovels and front end loaders (on coal), sourced from the NSW Minerals Council (2000, page 6-5). During Stage 3, there will be 2 main stockpile areas on site. By Stage 8, it is proposed that all stockpiles will be located in one area, to the west of the pit. During Stage 3, Stockpile Area 1 will be the dust stockpile located to the east of the pit. Stockpile 2 will be the additional product stockpile located near the existing entrance to the current pit.

Table 26 Emissions from FEL –Existing Quarry

Source	Emission Factor		Quantity	Estimated Emissions		Emission Factor Source
	TSP	PM_{10}		TSP	PM_{10}	
FEL in stockpile area	0.029 kg/tonne	0.014 kg/tonne	33,000 tonnes per year	957 kg/year	462 kg/year	NSW Minerals Council 2000
TOTAL– g/sec/m²				0.000088	0.000042	

1. Emissions based on 10 hr per day, 302 days per year working schedule.
2. Area of Stockpile area estimated at 1,000m²

Table 27 Emissions from FEL -Stage 3

Source	Emission Factor		Quantity	Estimated Emissions		Emission Factor Source
	TSP	PM_{10}		TSP	PM_{10}	
FEL in stockpile area 1	0.029 kg/tonne	0.014 kg/tonne	70,000 tonnes per year	2,030 kg/year	980 kg/year	NSW Minerals Council 2000
FEL in stockpile area 2	0.029 kg/tonne	0.014 kg/tonne	30,000 tonnes per year	870 kg/year	420 kg/year	NSW Minerals Council 2000
TOTAL – Area 1 g/sec/m²				0.000029	0.000014	
TOTAL –Area 2 g/sec/m²				0.00008	0.000039	

1. Emissions based on 10 hr per day, 302 days per year working schedule.
2. Area of Stockpile Area 1 estimated at 6400m² (80m x 80m). Area of Stockpile Area 2 estimated at 1000m² (50mx20m).

Table 28 Emissions from FEL -Stage 8

Source	Emission Factor		Quantity	Estimated Emissions		Emission Factor Source
	TSP	PM_{10}		TSP	PM_{10}	
FEL in stockpile area	0.029 kg/tonne	0.014 kg/tonne	100,000 tonnes per year	2,900 kg/year	1,400 kg/year	NSW Minerals Council 2000
TOTAL– g/sec/m²				0.00003	0.000014	

3. Emissions based on 10 hr per day, 302 days per year working schedule.
4. Area of Stockpile estimated at 9,200m²

Loading of road trucks

The default emission factors outlined in the NPI EET for Mining 2001 have been used to estimate emissions from loading of road trucks from the stockpile. Trucks will be loaded from the two stockpile areas in Stage 3, with approximately 70% of the product loaded from Area 1 and 30% loaded from Area 2.

Table 29 Loading of road trucks – Existing Quarry

Source	Emission Factor		Quantity	Estimated Emissions		Emission Factor Source
	TSP	PM_{10}		TSP	PM_{10}	
Loading to road truck	0.025 kg/yr	0.012 kg/yr	33,000 tonnes per year	825	396	NPI EET for Mining 2001
TOTAL (g/sec/m²)				0.000076	0.000036	

1. Emissions based on 10 hr per day, 302 days per year working schedule.
2. Area of Stockpiles estimated at 1,000m²

Table 30 Loading of road trucks – Stage 3

Source	Emission Factor		Quantity	Estimated Emissions		Emission Factor Source
	TSP	PM_{10}		TSP	PM_{10}	
Loading to road truck – area 1	0.025 kg/tonne	0.012 kg/tonne	70,000 tonnes per year	1750 kg/year	840 kg/year	NPI EET for Mining 2001
Loading to road truck – area 2	0.025 kg/ tonne	0.012 kg/tonne	30,000 tonnes per year.	750 kg/year	360 kg/year	NPI EET for Mining 2001
TOTAL – Area 1 (g/sec/m²)				0.00059	0.000012	
TOTAL – Area 2 (g/sec/m²)				0.000070	0.000033	

1. Emissions based on 10 hr per day, 302 days per year working schedule.
2. Area of Stockpile Area 1 estimated at 6400m² (80m x 80m) Area of Stockpile Area 2 estimated at 1000m2 (50mx20m).

Table 31 Loading of road trucks -Stage 8

Source	Emission Factor		Quantity	Estimated Emissions		Emission Factor Source
	TSP	PM_{10}		TSP	PM_{10}	
Loading to road truck	0.025 kg/yr	0.012 kg/yr	100,000 tonnes per year	2,500	1,200	NPI EET for Mining 2001
TOTAL (g/sec/m²)				0.000025	0.000012	

3. Emissions based on 10 hr per day, 302 days per year working schedule.
4. Area of Stockpiles estimated at 9,200m²

Total Emissions – Source 5 (Product Stockpile Area)

Table 32 Total Emissions – Existing

Source	TSP	PM_{10}	$PM_{2.5}$
FEL working on stockpiles	957	462	
Loading of haul trucks	825	396	83
TOTAL (kg/yr)	1,782	858	
TOTAL (g/sec/m2)	**0.00016**	**0.000079**	**0.0000074**
1. Emissions are based on a 10 hr per day, 302 day per year working schedule. Area of stockpile area estimated at 1,000m2			

Table 33 Total Emissions -Stage 3

Source	TSP	PM_{10}	$PM_{2.5}$
FEL working on stockpiles – Area 1	2030	980	
FEL working on stockpiles – Area 2	870	420	
Loading to road truck – Area 1	1750	840	
Loading to road truck – Area 2	750	360	
TOTAL (kg/yr) – Area 1	3,780	1,820	177
TOTAL (kg/yr) – Area 2	1,620	780	76
TOTAL (g/sec/m2) – Area 1	**0.000054**	**0.000026**	**0.0000025**
TOTAL (g/sec/m2) – Area 2	**0.00015**	**0.000072**	**0.000007**
1. Emissions are based on a 10 hr per day, 302 day per year working schedule. Area of Stockpile Area 1 estimated at 6400m2 (80m x 80m). Area of Stockpile Area 2 estimated at 1000m2 (50mx20m).			

Table 34 Total Emissions – Stage 8

Source	TSP	PM_{10}	$PM_{2.5}$
FEL working on stockpiles	2,900	1,400	
Loading of haul trucks	2,500	1,200	
TOTAL (kg/yr)	5,400	2,600	253
TOTAL (g/sec/m2)	**0.000054**	**0.000026**	**0.0000025**

1. Emissions are based on a 10 hr per day, 302 day per year working schedule. Area of stockpile area estimated at 9,200m2

Source 6 – Offsite Haulage

Haulage emissions have been estimated by using the following equation for industrial roads given in US EPA (2006).

E (kg/VKT) = k $(s/12)^a$ $(W/3)^b$

Where E = size specific emission factor

k = 1.381 for TSP, 0.423 for PM_{10}

s = surface material silt content (%)

W = mean vehicle weight (tonnes)

a = 0.7 for TSP, 0.9 for PM_{10}

b = 0.45 for TSP and 0.45 for PM_{10}

Surface material silt content has been estimated at 8.3% (US EPA 2006, Table 13.2.2-1, for Stone quarrying and gravel processing - haul road to and from/pit). The gross vehicle weight in tonnes has been estimated at 45 tonnes.

The calculated emission factors were 3.6 kg/VKT for TSP and 1.0 kg/VKT for PM_{10}. A control factor of 50% has been applied to emissions from roads and unsealed surfaces, based on the assumption that a low level of watering (less than 1 $L/m^2/hr$) will occur (NPI Mining EET 2001). Therefore the calculated emission factors are 1.8 kg/VKT and 0.5 VKT.

The haul road has been modelled from the Monaro Highway turnoff to the maximum distance the truck will travel for loading at the stockpiles. Currently, it has been estimated that approximately 7 round trips to and from the quarry occur each day, based on a 16 tonne load. Each round trip is estimated to be a maximum of 3.9 kilometres, therefore the total distance travelled per year is 8,245 kilometres.

It has been estimated 20 round trips to and from the quarry will occur each day during Stage 3 and Stage 8, based on a 16 tonne load. Each round trip for Stage 3 is a maximum of 3.9 kilometres, therefore the total distance travelled per year is 23,556 kilometres. For Stage 8, the maximum distance travelled in a round trip will be 3.8 kilometres, with a total distance per year of 22,952 km.

Table 35 Haulage Offsite – Existing Quarry

Source	Emission Factor		Quantity	Emission (kg/year)			Emission Factor Source
	TSP	PM_{10}		TSP	PM_{10}	$PM_{2.5}$	
Haulage offsite	1..8 kg/VKT	0.5 kg/VKT	8,245 km/year	14,841	4,123	695	US EPA 2006
TOTAL g/sec/m²				0.00018	0.000049	0.0000084	

1. 50% control factor applied to emissions as low level watering will take place.
2. Emission estimates based on a 10 hr per day, 302 days per year operating schedule. Area of road estimated at 7,800m2 (4m x 1950m).

Table 36 Haulage Offsite – Stage 3

Source	Emission Factor		Quantity	Emission (kg/year)			Emission Factor Source
	TSP	PM_{10}		TSP	PM_{10}	$PM_{2.5}$	
Haulage offsite	1..8 kg/VKT	0.5 kg/VKT	23,556 km/year	42,401	11,,778	1,984	US EPA 2006
TOTAL g/sec/m²				0.0005	0.00014	0.000023	

1. 50% control factor applied to emissions as low level watering will take place.

2. Emission estimates based on a 10 hr per day, 302 days per year operating schedule. Area of road estimated at 7,800m2 (4m x 1950m).

Table 37 Haulage Offsite – Stage 8

Source	Emission Factor		Quantity	Emission (kg/year)			Emission Factor Source
	TSP	PM_{10}		TSP	PM_{10}	$PM_{2.5}$	
Haulage from quarry to raw stockpile	1.8 kg/VKT	0.5 kg/VKT	22,952 km/year	41,313	11,476	1,933	US EPA 2006
TOTAL g/sec/m²				0.00049	0.00014	0.000023	

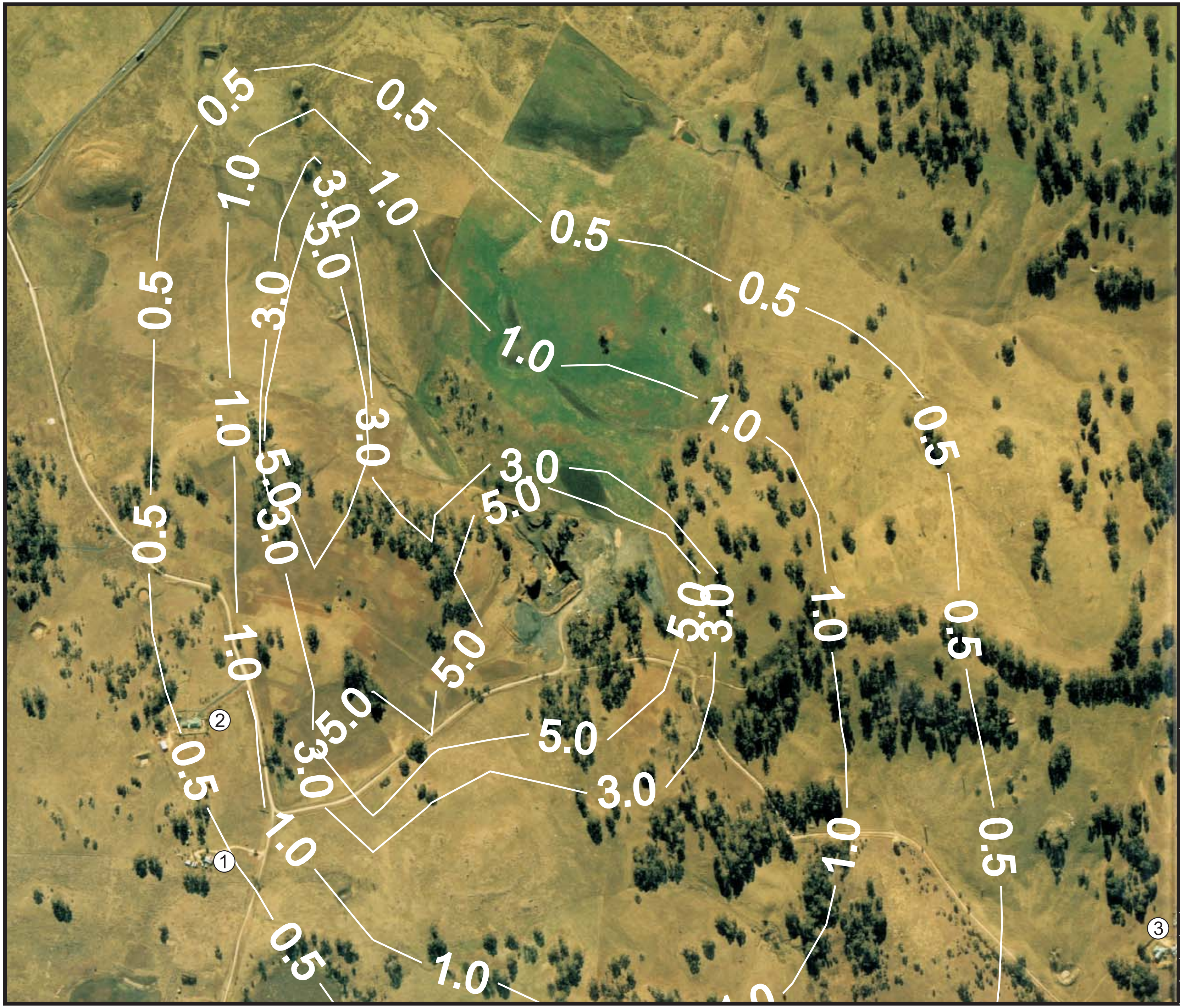
1. 50% control factor applied to emissions as low level watering will take place.

2. Emission estimates based on a 10 hr per day, 302 days per year operating schedule. Area of road estimated at 7,600m2 (4m x 1900m).

Annex F

Concentration Contours

Environmental Resources Management Australia Pty Ltd



Legend

① Sensitive receptors

Annex F Figure 1

Predicted PM_{10} GLCs ($\mu g/m^3$) - Existing Quarry (annual average)

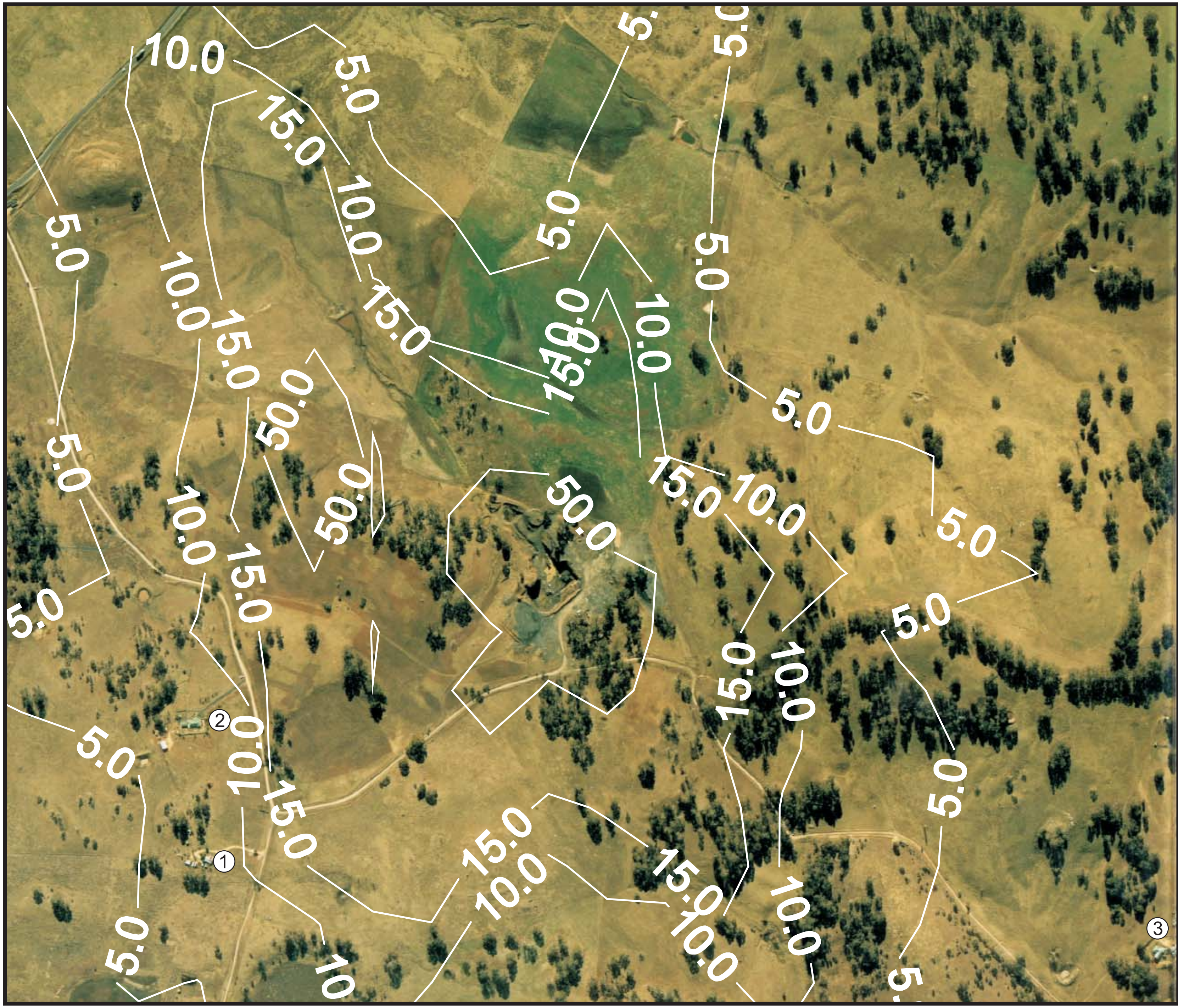
Bombala Quarry

0 150m
Approx Scale

ERM

Project No:	0041010	Drawing No:	_4
Date:	11/05/06	Drawing size:	A4
Drawn by:	MTC	Reviewed by:	KM
Source:	-		

Environmental Resources Management Australia Pty Ltd



Legend

① Sensitive receptors

Annex F Figure 2

Predicted PM_{10} GLCs ($\mu g/m^3$) - Existing Quarry (24hr average)

Bombala Quarry

0 150m

Approx Scale

ERM

Project No:	0041010	Drawing No:	_5
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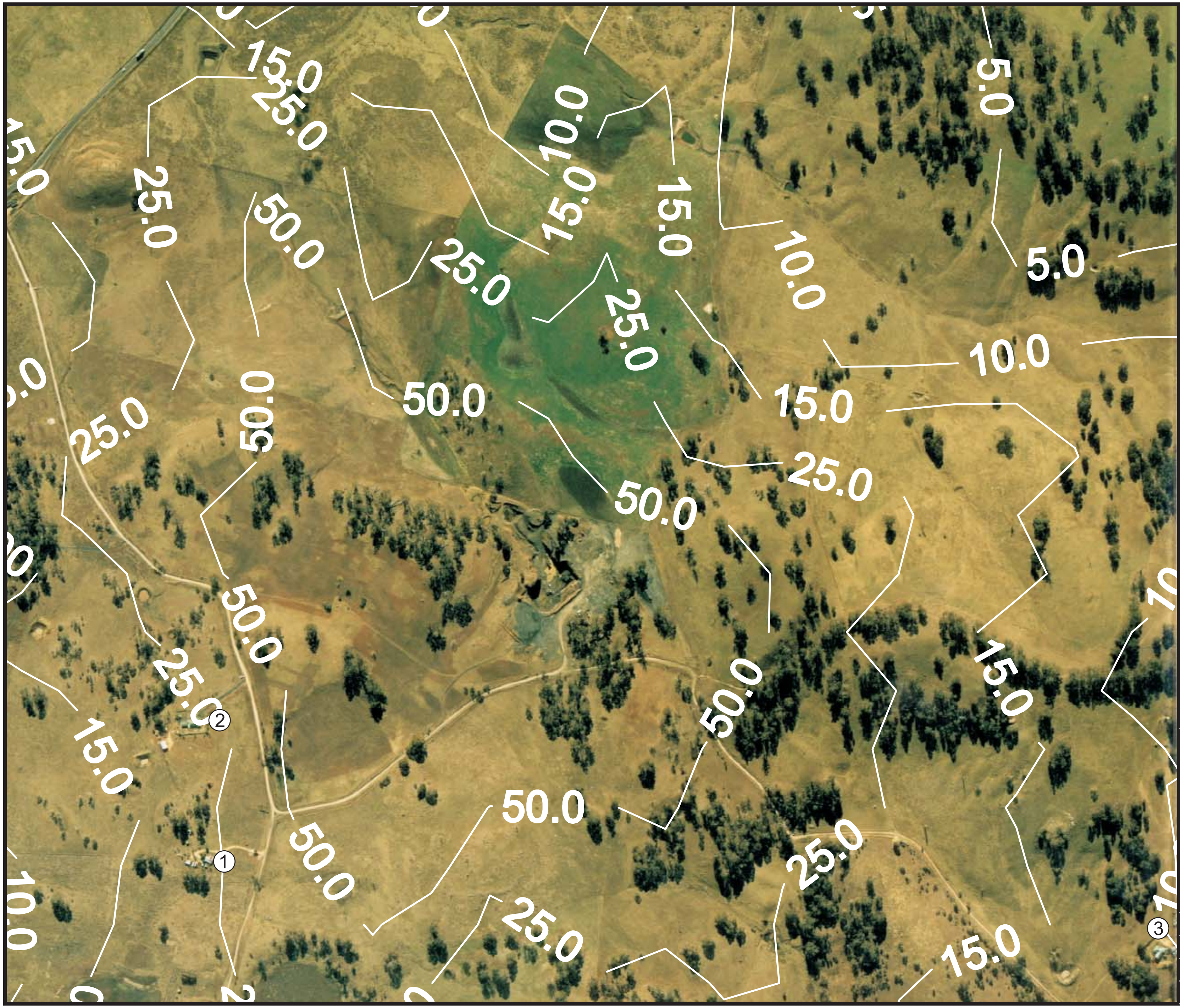
Drawn by:	MTC	Reviewed by:	KM
Source:	-		

Environmental Resources Management Australia Pty Ltd



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① Sensitive receptors

Annex F Figure 3

Predicted PM_{10} GLCs ($\mu g/m^3$) - Stage 3 (24hr average)

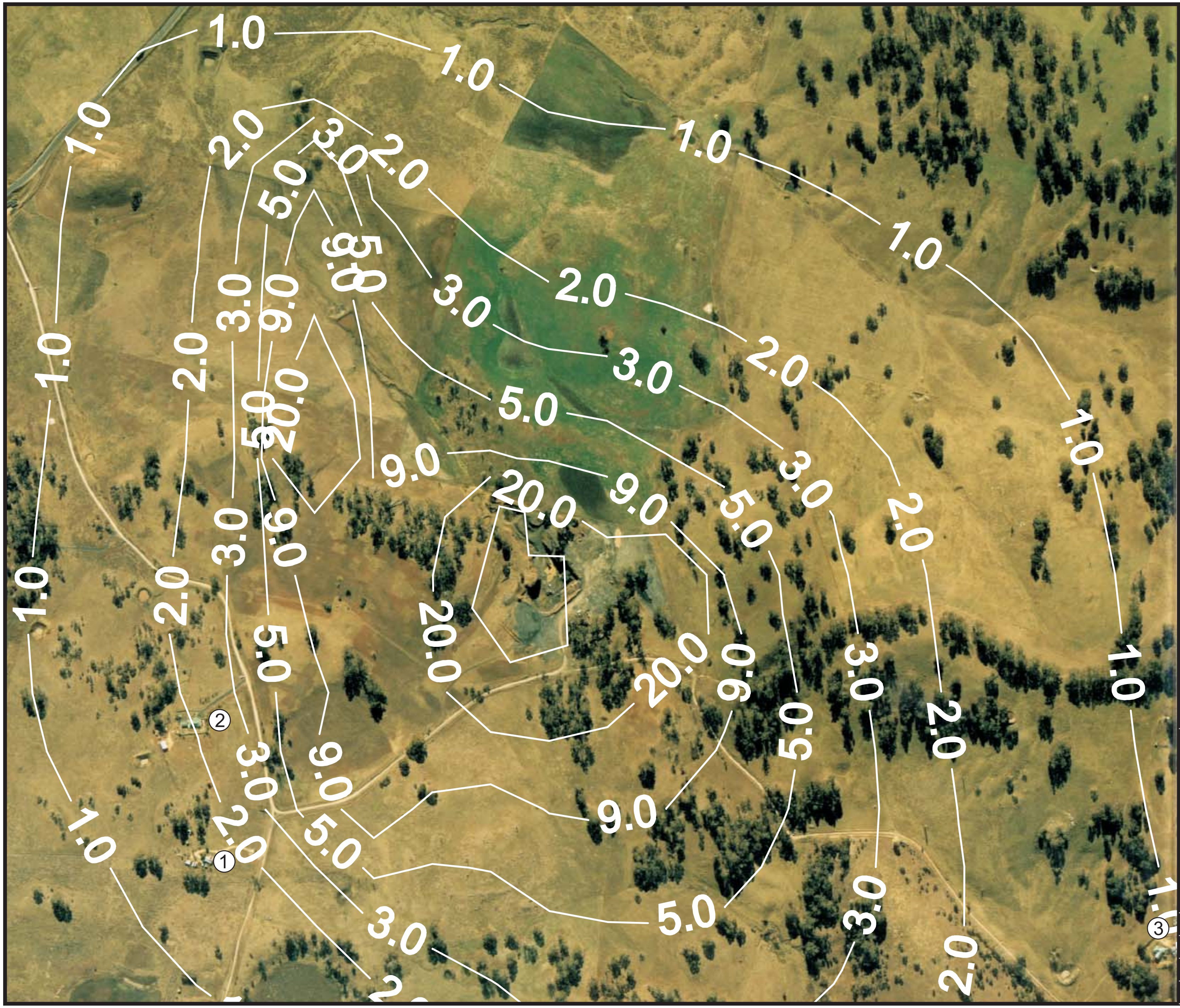
Bombala Quarry

0 150m
Approx Scale

ERM

Project No:	0041010	Drawing No:	_6
Date:	11/05/06	Drawing size:	A4
Drawn by:	MTC	Reviewed by:	KM
Source:	-		

Environmental Resources Management Australia Pty Ltd



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① Sensitive receptors

Annex F Figure 4

Predicted PM_{10} GLCs ($\mu g/m^3$) - Stage 3 (annual average)

Bombala Quarry

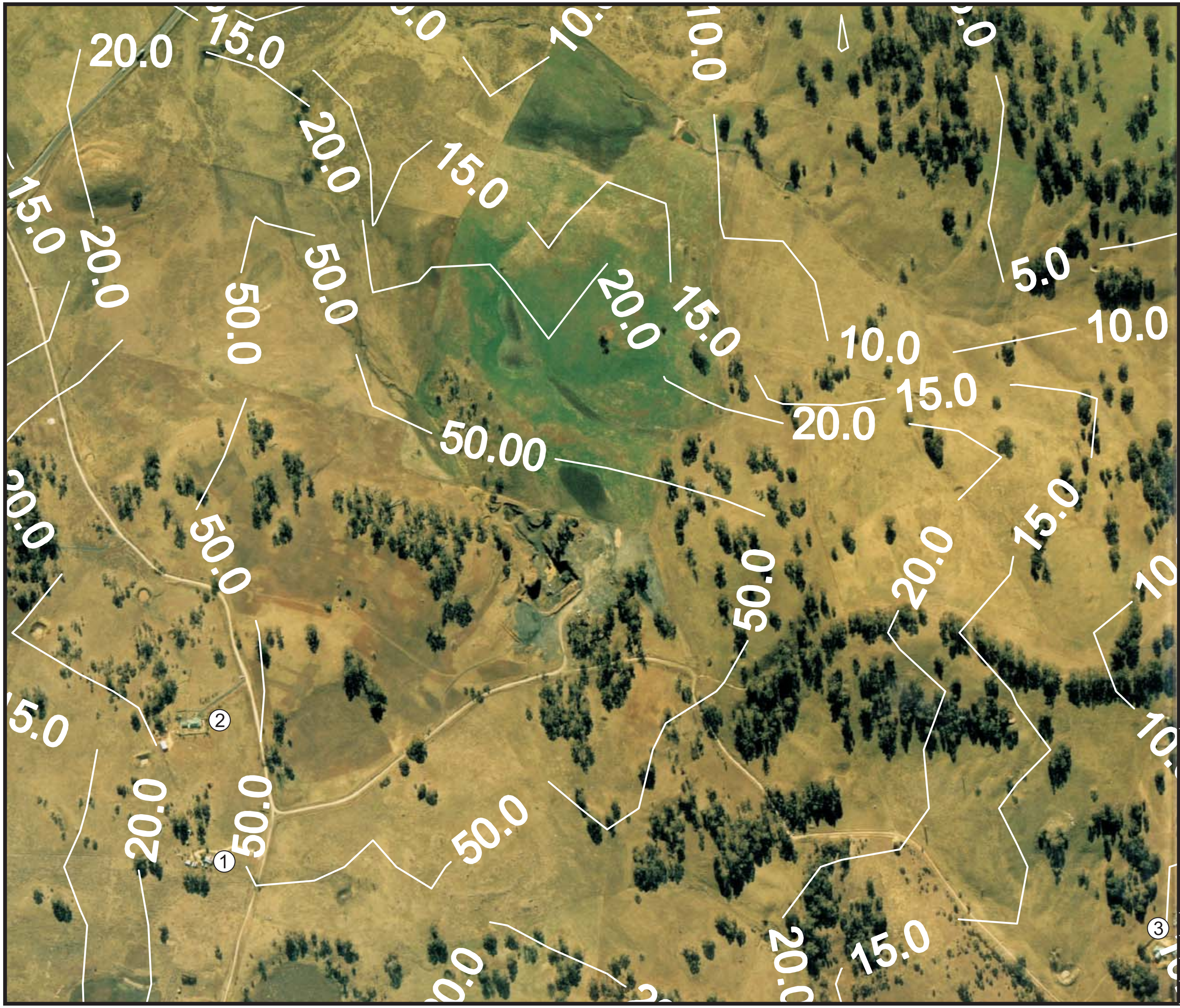
0 150m

Approx Scale

ERM

Project No:	0041010	Drawing No:	_7
Date:	11/05/06	Drawing size:	A4
Drawn by:	MTC	Reviewed by:	KM
Source:	-		

Environmental Resources Management Australia Pty Ltd



Legend

① Sensitive receptors

Annex F Figure 5

Predicted PM10 GLCs (μg/m3) - Stage 8 (24hr average)

Bombala Quarry

0 150m

Approx Scale

ERM

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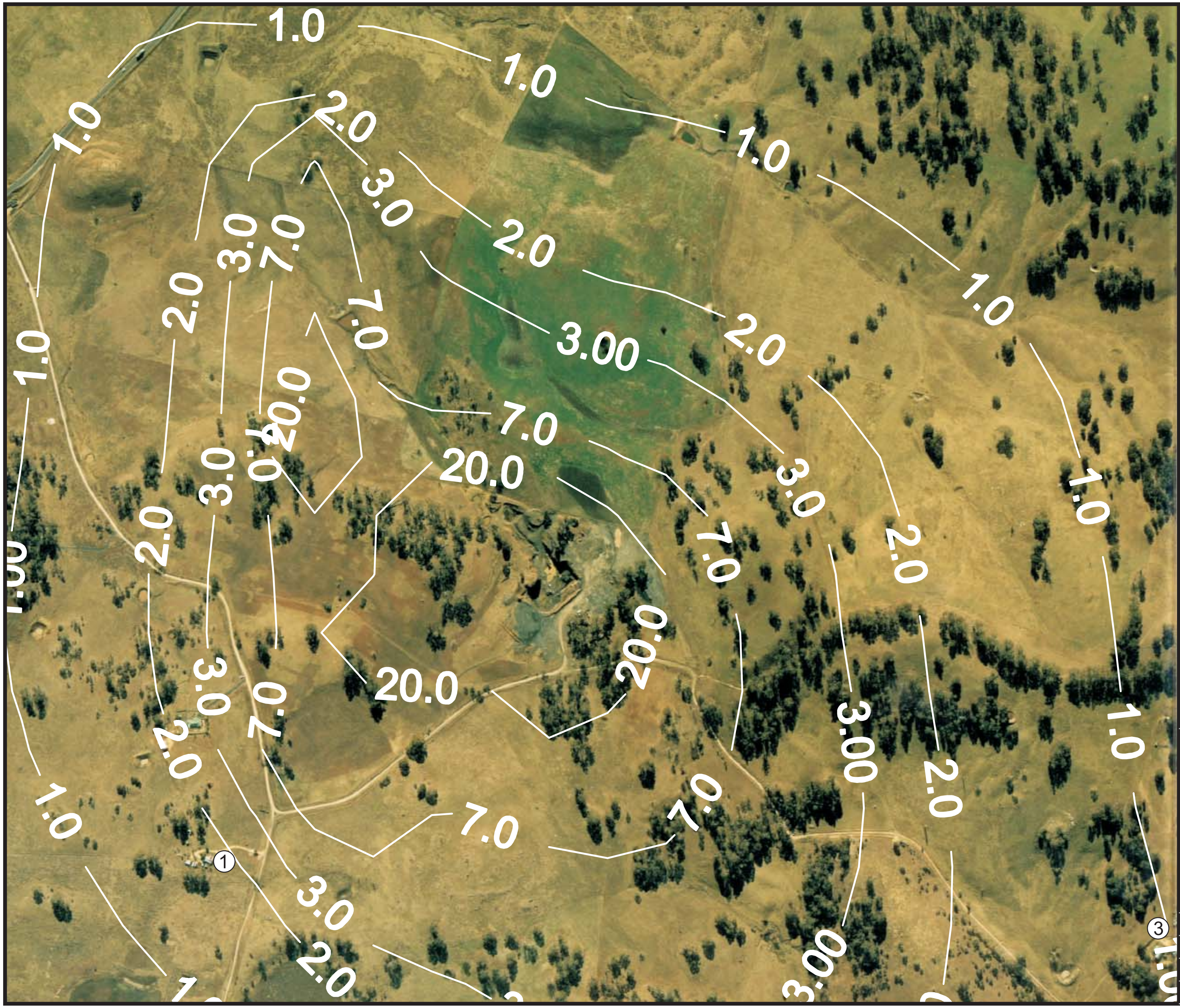
Drawn by:	MTC	Reviewed by:	KM
Source:	-		



Legend

① Sensitive receptors

Annex F Figure 6

Predicted PM10 GLCs (µg/m3) - Stage 8 (annual average)

Bombala Quarry

0 150m
Approx Scale

ERM

Project No:	0041010	Drawing No:	_9
Date:	11/05/06	Drawing size:	A4
Drawn by:	MTC	Reviewed by:	KM
Source:	-		

Annex G

AUSPLUME Configuration Files

1 ______________________________

0041010_Deposition_Stage 3

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Concentration or deposition   Dry deposition only
Emission load units   grams/second
Deposition units   milligram/m2
Units conversion factor   1.00E+03
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   0.400m
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 Rural" values (unless overridden by met. file)

AVERAGING TIMES
average over all hours

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1 ______________________________

0041010_Deposition_Stage 3

SOURCE CHARACTERISTICS

INTEGRATED AREA SOURCE: HAUL1

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
702041	5917697	0m	1190m	4m	85deg	2m	0m

Emission rates by hour of day in grams/second per square metre:

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	5.00E-04	8	5.00E-04
9	5.00E-04	10	5.00E-04	11	5.00E-04	12	5.00E-04
13	5.00E-04	14	5.00E-04	15	5.00E-04	16	5.00E-04
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

Particle Mass fraction	Particle Size (micron)	Particle Density (g/cm3)
0.0470	1.0	2.60
0.3440	7.0	2.60
0.6090	20.0	2.60

INTEGRATED AREA SOURCE: HAUL2

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
702698	5916930	0m	710m	4m	150deg	2m	0m

Emission rates by hour of day in grams/second per square metre:

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	5.00E-04	8	5.00E-04
9	5.00E-04	10	5.00E-04	11	5.00E-04	12	5.00E-04
13	5.00E-04	14	5.00E-04	15	5.00E-04	16	5.00E-04
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

Particle Mass fraction	Particle Size (micron)	Particle Density (g/cm3)
0.0470	1.0	2.60
0.3440	7.0	2.60
0.6090	20.0	2.60

INTEGRATED POLYGON AREA SOURCE: QPIT

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
702406	5917052	0m	7	2m	0m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	702406	5917052	2	702449	5917042
3	702456	5916968	4	702516	5916966
5	702522	5916814	6	702424	5916785
7	702359	5916878			

Emission rates by hour of day in grams/second per square metre:

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	7.40E-05	8	7.40E-05

9 7.40E-05 10 7.40E-05 11 7.40E-05 12 7.40E-05
13 7.40E-05 14 7.40E-05 15 7.40E-05 16 7.40E-05
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

Particle Mass fraction	Particle Size (micron)	Particle Density (g/cm3)
0.0470	1.0	2.60
0.3440	7.0	2.60
0.6090	20.0	2.60

INTEGRATED AREA SOURCE: SP1

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
702698	5916930	0m	80m	80m	180deg	2m	0m

Emission rates by hour of day in grams/second per square metre:
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 5.40E-05 8 5.40E-05
9 5.40E-05 10 5.40E-05 11 5.40E-05 12 5.40E-05
13 5.40E-05 14 5.40E-05 15 5.40E-05 16 5.40E-05
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

Particle Mass fraction	Particle Size (micron)	Particle Density (g/cm3)
0.0470	1.0	2.60
0.3440	7.0	2.60
0.6090	20.0	2.60

INTEGRATED AREA SOURCE: P

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
702542	5916925	0m	20m	60m	180deg	2m	0m

Emission rates by hour of day in grams/second per square metre:
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 5.20E-04 8 5.20E-04
9 5.20E-04 10 5.20E-04 11 5.20E-04 12 5.20E-04
13 5.20E-04 14 5.20E-04 15 5.20E-04 16 5.20E-04
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

Particle Mass fraction	Particle Size (micron)	Particle Density (g/cm3)
0.0470	1.0	2.60
0.3440	7.0	2.60
0.6090	20.0	2.60

INTEGRATED POLYGON AREA SOURCE: QPWE

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
702406	5917052	0m	7	2m	0m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	702406	5917052	2	702449	5917042
3	702456	5916968	4	702516	5916966
5	702522	5916814	6	702424	5916785
7	702359	5916878			

(Constant) emission rate = 1.30E-05 grams/second per square metre

Particle Mass fraction	Particle Size (micron)	Particle Density (g/cm3)
0.0470	1.0	2.60
0.3440	7.0	2.60
0.6090	20.0	2.60

INTEGRATED AREA SOURCE: SP2

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
702492	5916972	0m	20m	50m	160deg	2m	0m

Emission rates by hour of day in grams/second per square metre:

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	1.50E-04	8	1.50E-04
9	1.50E-04	10	1.50E-04	11	1.50E-04	12	1.50E-04
13	1.50E-04	14	1.50E-04	15	1.50E-04	16	1.50E-04
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

Particle Mass fraction	Particle Size (micron)	Particle Density (g/cm3)
0.0470	1.0	2.60
0.3440	7.0	2.60
0.6090	20.0	2.60

INTEGRATED AREA SOURCE: SP1WE

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
702698	5916930	0m	80m	80m	180deg	2m	0m

(Constant) emission rate = 1.30E-05 grams/second per square metre

Particle Mass fraction	Particle Size (micron)	Particle Density (g/cm3)
0.0470	1.0	2.60
0.3440	7.0	2.60
0.6090	20.0	2.60

INTEGRATED AREA SOURCE: SP2WE

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
702492	5916972	0m	20m	50m	160deg	2m	0m

(Constant) emission rate = 1.30E-05 grams/second per square metre

Particle Mass fraction	Particle Size (micron)	Particle Density (g/cm3)

0.0470	1.0	2.60
0.3440	7.0	2.60
0.6090	20.0	2.60

1

0041010_Deposition_Stage 3

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):
700990.m 701090.m 701190.m 701290.m 701390.m 701490.m 701590.m
701690.m 701790.m 701890.m 701990.m 702090.m 702190.m 702290.m
702390.m 702490.m 702590.m 702690.m 702790.m 702890.m 702990.m
703090.m 703190.m 703290.m 703390.m 703490.m 703590.m 703690.m
703790.m 703890.m 703990.m

and these y-values (or northings):
5915434.m 5915534.m 5915634.m 5915734.m 5915834.m 5915934.m 5916034.m
5916134.m 5916234.m 5916334.m 5916434.m 5916534.m 5916634.m 5916734.m
5916834.m 5916934.m 5917034.m 5917134.m 5917234.m 5917334.m 5917434.m
5917534.m 5917634.m 5917734.m 5917834.m 5917934.m 5918034.m 5918134.m
5918234.m 5918334.m 5918434.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	701932	5916442	0.0	0.0	3	703520	5916370	0.0	0.0
2	701910	5916661	0.0	0.0					

METEOROLOGICAL DATA : BoM AWS Data BoM SydneyAP Clouds SydneyAP Uair Surface

1

0041010_PM2.5_Existing_24hr

Concentration or deposition	Concentration
Emission rate units	grams/second
Concentration units	microgram/m3
Units conversion factor	1.00E+06
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 0.400m
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 Rural" values (unless overridden by met. file)

AVERAGING TIMES
24 hours

1

0041010_PM2.5_Existing_24hr

SOURCE CHARACTERISTICS

INTEGRATED AREA SOURCE: HAUL1

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
702041	5917697	0m	1190m	4m	85deg	2m	0m

Emission rates by hour of day in grams/second per square metre:

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 8.40E-06	8 8.40E-06
9 8.40E-06	10 8.40E-06	11 8.40E-06	12 8.40E-06
13 8.40E-06	14 8.40E-06	15 8.40E-06	16 8.40E-06
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.

INTEGRATED AREA SOURCE: HAUL2

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
702698	5916930	0m	710m	4m	150deg	2m	0m

Emission rates by hour of day in grams/second per square metre:

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 8.40E-06	8 8.40E-06
9 8.40E-06	10 8.40E-06	11 8.40E-06	12 8.40E-06
13 8.40E-06	14 8.40E-06	15 8.40E-06	16 8.40E-06
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.

INTEGRATED POLYGON AREA SOURCE: QPIT

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
702504	5916966	0m	7	2m	0m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	702504	5916966	2	702527	5916937
3	702472	5916876	4	702440	5916913
5	702463	5916932	6	702448	5916968
7	702468	5916982			

Emission rates by hour of day in grams/second per square metre:

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 6.00E-06	8 6.00E-06
9 6.00E-06	10 6.00E-06	11 6.00E-06	12 6.00E-06
13 6.00E-06	14 6.00E-06	15 6.00E-06	16 6.00E-06
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.

INTEGRATED AREA SOURCE: SP1

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
702492	5916972	0m	50m	20m	160deg	2m	0m

Emission rates by hour of day in grams/second per square metre:

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 4.10E-06	8 4.10E-06
9 4.10E-06	10 4.10E-06	11 4.10E-06	12 4.10E-06
13 4.10E-06	14 4.10E-06	15 4.10E-06	16 4.10E-06
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.

INTEGRATED AREA SOURCE: P

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
702542	5916925	0m	20m	60m	180deg	2m	0m

Emission rates by hour of day in grams/second per square metre:

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 7.90E-06	8 7.90E-06
9 7.90E-06	10 7.90E-06	11 7.90E-06	12 7.90E-06
13 7.90E-06	14 7.90E-06	15 7.90E-06	16 7.90E-06
17 7.90E-06	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.

INTEGRATED POLYGON AREA SOURCE: QPWE

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
702468	5916982	0m	7	2m	0m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	702468	5916982	2	702504	5916966
3	702527	5916937	4	702472	5916876
5	702440	5916913	6	702463	5916932
7	702448	5916968			

(Constant) emission rate = 6.00E-07 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: SP1WE

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
702492	5916972	0m	50m	20m	160deg	2m	0m

(Constant) emission rate = 6.00E-07 grams/second per square metre
No gravitational settling or scavenging.

1

0041010_PM2.5_Existing_24hr

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):
700990.m 701090.m 701190.m 701290.m 701390.m 701490.m 701590.m
701690.m 701790.m 701890.m 701990.m 702090.m 702190.m 702290.m
702390.m 702490.m 702590.m 702690.m 702790.m 702890.m 702990.m
703090.m 703190.m 703290.m 703390.m 703490.m 703590.m 703690.m
703790.m 703890.m 703990.m

and these y-values (or northings):
5915434.m 5915534.m 5915634.m 5915734.m 5915834.m 5915934.m 5916034.m
5916134.m 5916234.m 5916334.m 5916434.m 5916534.m 5916634.m 5916734.m
5916834.m 5916934.m 5917034.m 5917134.m 5917234.m 5917334.m 5917434.m
5917534.m 5917634.m 5917734.m 5917834.m 5917934.m 5918034.m 5918134.m
5918234.m 5918334.m 5918434.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	701932	5916442	0.0	0.0	3	703520	5916370	0.0	0.0
2	701910	5916661	0.0	0.0					

METEOROLOGICAL DATA : BoM AWS Data BoM SydneyAP Clouds SydneyAP Uair Surface

1 ______________________________

0041010_PM10_Stage 8_annual

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Concentration or deposition Concentration
Emission rate units grams/second
Concentration units microgram/m3
Units conversion factor 1.00E+06
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 0.400m
Adjustment for wind directional shear None

PLUME RISE OPTIONS
Gradual plume rise? Yes
Stack-tip downwash included? No
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 Rural" values (unless overridden by met. file)

AVERAGING TIMES
average over all hours

1

0041010_PM10_Stage 8_annual

SOURCE CHARACTERISTICS

INTEGRATED AREA SOURCE: HAUL1

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
702041	5917697	0m	1190m	4m	85deg	2m	0m

Emission rates by hour of day in grams/second per square metre:

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-04	8 1.40E-04
9 1.40E-04	10 1.40E-04	11 1.40E-04	12 1.40E-04
13 1.40E-04	14 1.40E-04	15 1.40E-04	16 1.40E-04
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.

INTEGRATED AREA SOURCE: HAUL2

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
702305	5917047	0m	548m	4m	120deg	2m	0m

Emission rates by hour of day in grams/second per square metre:

1 0.00E+00	2 0.00E+00	3 0.00E+00	4 0.00E+00
5 0.00E+00	6 1.40E-04	7 1.40E-04	8 1.40E-04
9 1.40E-04	10 1.40E-04	11 1.40E-04	12 1.40E-04
13 1.40E-04	14 1.40E-04	15 1.40E-04	16 1.40E-04
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.

INTEGRATED POLYGON AREA SOURCE: QP

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
702389	5917053	0m	6	2m	0m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	702389	5917053	2	702625	5917004
3	702659	5916898	4	702523	5916812
5	702426	5916784	6	702361	5916882

Emission rates by hour of day in grams/second per square metre:

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 8.70E-06	8 8.70E-06
9 8.70E-06	10 8.70E-06	11 8.70E-06	12 8.70E-06
13 8.70E-06	14 8.70E-06	15 8.70E-06	16 8.70E-06
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.

INTEGRATED POLYGON AREA SOURCE: QPWE

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
702389	5917053	0m	6	2m	0m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	702389	5917053	2	702625	5917004
3	702659	5916898	4	702523	5916812
5	702426	5916784	6	702361	5916882

(Constant) emission rate = 6.40E-06 grams/second per square metre

No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: SWE

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
702305	5917047	0m	40m	230m	180deg	2m	0m

(Constant) emission rate = 6.40E-06 grams/second per square metre

No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: SP1

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
702305	5917047	0m	40m	230m	180deg	2m	0m

Emission rates by hour of day in grams/second per square metre:

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 2.60E-05	8 2.60E-05
9 2.60E-05	10 2.60E-05	11 2.60E-05	12 2.60E-05
13 2.60E-05	14 2.60E-05	15 2.60E-05	16 2.60E-05
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.

INTEGRATED AREA SOURCE: P

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
702465	5916847	0m	20m	60m	180deg	2m	0m

Emission rates by hour of day in grams/second per square metre:

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 2.60E-04	8 2.60E-04
9 2.60E-04	10 2.60E-04	11 2.60E-04	12 2.60E-04
13 2.60E-04	14 2.60E-04	15 2.60E-04	16 2.60E-04
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.

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0041010_PM10_Stage 8_annual

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):
700990.m 701090.m 701190.m 701290.m 701390.m 701490.m 701590.m
701690.m 701790.m 701890.m 701990.m 702090.m 702190.m 702290.m
702390.m 702490.m 702590.m 702690.m 702790.m 702890.m 702990.m
703090.m 703190.m 703290.m 703390.m 703490.m 703590.m 703690.m
703790.m 703890.m 703990.m

and these y-values (or northings):
5915434.m 5915534.m 5915634.m 5915734.m 5915834.m 5915934.m 5916034.m
5916134.m 5916234.m 5916334.m 5916434.m 5916534.m 5916634.m 5916734.m
5916834.m 5916934.m 5917034.m 5917134.m 5917234.m 5917334.m 5917434.m
5917534.m 5917634.m 5917734.m 5917834.m 5917934.m 5918034.m 5918134.m
5918234.m 5918334.m 5918434.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	701932	5916442	0.0	0.0	3	703520	5916370	0.0	0.0
2	701910	5916661	0.0	0.0					

METEOROLOGICAL DATA : BoM AWS Data BoM SydneyAP Clouds SydneyAP Uair Surfa

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0041010_TSP_Stage 3_Annual

Concentration or deposition	Concentration
Emission rate units	grams/second
Concentration units	microgram/m3
Units conversion factor	1.00E+06
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	0.400m
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 Rural" values (unless overridden by met. file)

AVERAGING TIMES
average over all hours

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0041010_TSP_Stage 3_Annual

SOURCE CHARACTERISTICS

INTEGRATED AREA SOURCE: HAUL1

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
702041	5917697	0m	1190m	4m	85deg	2m	0m

Emission rates by hour of day in grams/second per square metre:

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 5.00E-04	8 5.00E-04
9 5.00E-04	10 5.00E-04	11 5.00E-04	12 5.00E-04
13 5.00E-04	14 5.00E-04	15 5.00E-04	16 5.00E-04
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.

INTEGRATED AREA SOURCE: HAUL2

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
702698	5916930	0m	710m	4m	150deg	2m	0m

Emission rates by hour of day in grams/second per square metre:

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 5.00E-04	8 5.00E-04

9 5.00E-04   10 5.00E-04   11 5.00E-04   12 5.00E-04
13 5.00E-04   14 5.00E-04   15 5.00E-04   16 5.00E-04
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.

INTEGRATED POLYGON AREA SOURCE: QPIT

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
702406	5917052	0m	7	2m	0m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	702406	5917052	2	702449	5917042
3	702456	5916968	4	702516	5916966
5	702522	5916814	6	702424	5916785
7	702359	5916878			

Emission rates by hour of day in grams/second per square metre:
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 7.40E-05   8 7.40E-05
9 7.40E-05   10 7.40E-05   11 7.40E-05   12 7.40E-05
13 7.40E-05   14 7.40E-05   15 7.40E-05   16 7.40E-05
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.

INTEGRATED AREA SOURCE: SP1

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
702698	5916930	0m	80m	80m	180deg	2m	0m

Emission rates by hour of day in grams/second per square metre:
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 5.40E-05   8 5.40E-05
9 5.40E-05   10 5.40E-05   11 5.40E-05   12 5.40E-05
13 5.40E-05   14 5.40E-05   15 5.40E-05   16 5.40E-05
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.

INTEGRATED AREA SOURCE: P

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
702542	5916925	0m	20m	60m	180deg	2m	0m

Emission rates by hour of day in grams/second per square metre:
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 5.20E-04   8 5.20E-04
9 5.20E-04   10 5.20E-04   11 5.20E-04   12 5.20E-04
13 5.20E-04   14 5.20E-04   15 5.20E-04   16 5.20E-04
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.

INTEGRATED POLYGON AREA SOURCE: QPWE

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
702406	5917052	0m	7	2m	0m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	702406	5917052	2	702449	5917042
3	702456	5916968	4	702516	5916966
5	702522	5916814	6	702424	5916785
7	702359	5916878			

(Constant) emission rate = 1.30E-05 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: SP2

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
702492	5916972	0m	20m	50m	160deg	2m	0m

Emission rates by hour of day in grams/second per square metre:

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 1.50E-04	8 1.50E-04
9 1.50E-04	10 1.50E-04	11 1.50E-04	12 1.50E-04
13 1.50E-04	14 1.50E-04	15 1.50E-04	16 1.50E-04
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.

INTEGRATED AREA SOURCE: SP1WE

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
702698	5916930	0m	80m	80m	180deg	2m	0m

(Constant) emission rate = 1.30E-05 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: SP2WE

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
702492	5916972	0m	20m	50m	160deg	2m	0m

(Constant) emission rate = 1.30E-05 grams/second per square metre
No gravitational settling or scavenging.

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0041010_TSP_Stage 3_Annual

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):
700990.m 701090.m 701190.m 701290.m 701390.m 701490.m 701590.m
701690.m 701790.m 701890.m 701990.m 702090.m 702190.m 702290.m
702390.m 702490.m 702590.m 702690.m 702790.m 702890.m 702990.m
703090.m 703190.m 703290.m 703390.m 703490.m 703590.m 703690.m
703790.m 703890.m 703990.m

and these y-values (or northings):

5915434.m 5915534.m 5915634.m 5915734.m 5915834.m 5915934.m 5916034.m
5916134.m 5916234.m 5916334.m 5916434.m 5916534.m 5916634.m 5916734.m
5916834.m 5916934.m 5917034.m 5917134.m 5917234.m 5917334.m 5917434.m
5917534.m 5917634.m 5917734.m 5917834.m 5917934.m 5918034.m 5918134.m
5918234.m 5918334.m 5918434.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	701932	5916442	0.0	0.0	3	703520	5916370	0.0	0.0
2	701910	5916661	0.0	0.0					

METEOROLOGICAL DATA : BoM AWS Data BoM SydneyAP Clouds SydneyAP Uair Surfa
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0041010_TSP_Deposition_annual

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Concentration or deposition Dry deposition only
Emission load units grams/second
Deposition units milligram/m2
Units conversion factor 1.00E+03
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 0.400m
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 Rural" values (unless overridden by met. file)

AVERAGING TIMES
average over all hours

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0041010_TSP_Deposition_annual

SOURCE CHARACTERISTICS

INTEGRATED AREA SOURCE: HAUL1

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
702041	5917697	0m	1190m	4m	85deg	2m	0m

Emission rates by hour of day in grams/second per square metre:

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 2.50E-04	8 2.50E-04
9 2.50E-04	10 2.50E-04	11 2.50E-04	12 2.50E-04
13 2.50E-04	14 2.50E-04	15 2.50E-04	16 2.50E-04
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

Particle Mass fraction	Particle Size (micron)	Particle Density (g/cm3)
0.0470	1.0	2.60
0.3440	7.0	2.60
0.6090	20.0	2.60

INTEGRATED AREA SOURCE: HAUL2

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
702698	5916930	0m	710m	4m	150deg	2m	0m

Emission rates by hour of day in grams/second per square metre:

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 2.50E-04	8 2.50E-04
9 2.50E-04	10 2.50E-04	11 2.50E-04	12 2.50E-04
13 2.50E-04	14 2.50E-04	15 2.50E-04	16 2.50E-04
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

Particle Mass fraction	Particle Size (micron)	Particle Density (g/cm3)
0.0470	1.0	2.60
0.3440	7.0	2.60
0.6090	20.0	2.60

INTEGRATED POLYGON AREA SOURCE: QPIT

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
702504	5916966	0m	7	2m	0m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	702504	5916966	2	702527	5916937
3	702472	5916876	4	702440	5916913
5	702463	5916932	6	702448	5916968
7	702468	5916982			

Emission rates by hour of day in grams/second per square metre:

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 1.50E-04	8 1.50E-04

9 1.50E-04	10 1.50E-04	11 1.50E-04	12 1.50E-04
13 1.50E-04	14 1.50E-04	15 1.50E-04	16 1.50E-04
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

Particle Mass fraction	Particle Size (micron)	Particle Density (g/cm3)
0.0470	1.0	2.60
0.3440	7.0	2.60
0.6090	20.0	2.60

INTEGRATED AREA SOURCE: SP1

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
702492	5916972	0m	50m	20m	160deg	2m	0m

Emission rates by hour of day in grams/second per square metre:

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 2.50E-04	8 2.50E-04
9 2.50E-04	10 2.50E-04	11 2.50E-04	12 2.50E-04
13 2.50E-04	14 2.50E-04	15 2.50E-04	16 2.50E-04
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

Particle Mass fraction	Particle Size (micron)	Particle Density (g/cm3)
0.0470	1.0	2.60
0.3440	7.0	2.60
0.6090	20.0	2.60

INTEGRATED AREA SOURCE: P

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
702542	5916925	0m	20m	60m	180deg	2m	0m

Emission rates by hour of day in grams/second per square metre:

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 1.70E-04	8 1.70E-04
9 1.70E-04	10 1.70E-04	11 1.70E-04	12 1.70E-04
13 1.70E-04	14 1.70E-04	15 1.70E-04	16 1.70E-04
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

Particle Mass fraction	Particle Size (micron)	Particle Density (g/cm3)
0.0470	1.0	2.60
0.3440	7.0	2.60
0.6090	20.0	2.60

INTEGRATED POLYGON AREA SOURCE: QPWE

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
702468	5916982	0m	7	2m	0m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	702468	5916982	2	702504	5916966
3	702527	5916937	4	702472	5916876
5	702440	5916913	6	702463	5916932
7	702448	5916968			

(Constant) emission rate = 1.30E-05 grams/second per square metre

Particle Mass fraction	Particle Size (micron)	Particle Density (g/cm3)
0.0470	1.0	2.60
0.3440	7.0	2.60
0.6090	20.0	2.60

INTEGRATED AREA SOURCE: SP1WE

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
702492	5916972	0m	50m	20m	160deg	2m	0m

(Constant) emission rate = 1.30E-05 grams/second per square metre

Particle Mass fraction	Particle Size (micron)	Particle Density (g/cm3)
0.0470	1.0	2.60
0.3440	7.0	2.60
0.6090	20.0	2.60

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0041010_TSP_Deposition_annual

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):
700990.m 701090.m 701190.m 701290.m 701390.m 701490.m 701590.m
701690.m 701790.m 701890.m 701990.m 702090.m 702190.m 702290.m
702390.m 702490.m 702590.m 702690.m 702790.m 702890.m 702990.m
703090.m 703190.m 703290.m 703390.m 703490.m 703590.m 703690.m
703790.m 703890.m 703990.m

and these y-values (or northings):
5915434.m 5915534.m 5915634.m 5915734.m 5915834.m 5915934.m 5916034.m
5916134.m 5916234.m 5916334.m 5916434.m 5916534.m 5916634.m 5916734.m
5916834.m 5916934.m 5917034.m 5917134.m 5917234.m 5917334.m 5917434.m
5917534.m 5917634.m 5917734.m 5917834.m 5917934.m 5918034.m 5918134.m
5918234.m 5918334.m 5918434.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	701932	5916442	0.0	0.0	3	703520	5916370	0.0	0.0
2	701910	5916661	0.0	0.0					

METEOROLOGICAL DATA : BoM AWS Data BoM SydneyAP Clouds SydneyAP Uair Surfac

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0041010_PM2.5_Stage 3_24hr

Concentration or deposition Concentration
Emission rate units grams/second
Concentration units microgram/m3
Units conversion factor 1.00E+06
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 0.400m
Adjustment for wind directional shear None

PLUME RISE OPTIONS

Gradual plume rise? Yes
Stack-tip downwash included? No
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 Rural" values (unless overridden by met. file)

AVERAGING TIMES
24 hours

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0041010_PM2.5_Stage 3_24hr

SOURCE CHARACTERISTICS

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INTEGRATED AREA SOURCE: HAUL1

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
702041	5917697	0m	1190m	4m	85deg	2m	0m

Emission rates by hour of day in grams/second per square metre:

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 2.30E-05	8 2.30E-05
9 2.30E-05	10 2.30E-05	11 2.30E-05	12 2.30E-05
13 2.30E-05	14 2.30E-05	15 2.30E-05	16 2.30E-05
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.

INTEGRATED AREA SOURCE: HAUL2

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
702698	5916930	0m	548m	4m	150deg	2m	0m

Emission rates by hour of day in grams/second per square metre:

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 2.30E-05	8 2.30E-05
9 2.30E-05	10 2.30E-05	11 2.30E-05	12 2.30E-05
13 2.30E-05	14 2.30E-05	15 2.30E-05	16 2.30E-05
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.

INTEGRATED POLYGON AREA SOURCE: QPIT

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
702406	5917052	0m	7	2m	0m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	702406	5917052	2	702449	5917042
3	702456	5916968	4	702516	5916966

5 702522 5916814 6 702424 5916785
7 702359 5916878

Emission rates by hour of day in grams/second per square metre:

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 3.40E-06	8 3.40E-06
9 3.40E-06	10 3.40E-06	11 3.40E-06	12 3.40E-06
13 3.40E-06	14 3.40E-06	15 3.40E-06	16 3.40E-06
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.

INTEGRATED AREA SOURCE: SP1

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
702698	5916930	0m	80m	80m	180deg	2m	0m

Emission rates by hour of day in grams/second per square metre:

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 2.50E-06	8 2.50E-06
9 2.50E-06	10 2.50E-06	11 2.50E-06	12 2.50E-06
13 2.50E-06	14 2.50E-06	15 2.50E-06	16 2.50E-06
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.

INTEGRATED AREA SOURCE: P

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
702542	5916925	0m	20m	60m	180deg	2m	0m

Emission rates by hour of day in grams/second per square metre:

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 2.40E-05	8 2.40E-05
9 2.40E-05	10 2.40E-05	11 2.40E-05	12 2.40E-05
13 2.40E-05	14 2.40E-05	15 2.40E-05	16 2.40E-05
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.

INTEGRATED POLYGON AREA SOURCE: QPWE

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
702406	5917052	0m	7	2m	0m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	702406	5917052	2	702449	5917042
3	702456	5916968	4	702516	5916966
5	702522	5916814	6	702424	5916785
7	702359	5916878			

(Constant) emission rate = 6.00E-07 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: SP2

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
702492	5916972	0m	20m	50m	160deg	2m	0m

Emission rates by hour of day in grams/second per square metre:

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 7.00E-05	8 7.00E-05
9 7.00E-05	10 7.00E-05	11 7.00E-05	12 7.00E-05
13 7.00E-05	14 7.00E-05	15 7.00E-05	16 7.00E-05
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.

INTEGRATED AREA SOURCE: SP1WE

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
702698	5916930	0m	80m	80m	180deg	2m	0m

(Constant) emission rate = 6.00E-07 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: SP2WE

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
702492	5916972	0m	20m	50m	160deg	2m	0m

(Constant) emission rate = 6.00E-07 grams/second per square metre
No gravitational settling or scavenging.

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0041010_PM2.5_Stage 3_24hr

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):
700990.m 701090.m 701190.m 701290.m 701390.m 701490.m 701590.m
701690.m 701790.m 701890.m 701990.m 702090.m 702190.m 702290.m
702390.m 702490.m 702590.m 702690.m 702790.m 702890.m 702990.m
703090.m 703190.m 703290.m 703390.m 703490.m 703590.m 703690.m
703790.m 703890.m 703990.m

and these y-values (or northings):
5915434.m 5915534.m 5915634.m 5915734.m 5915834.m 5915934.m 5916034.m
5916134.m 5916234.m 5916334.m 5916434.m 5916534.m 5916634.m 5916734.m
5916834.m 5916934.m 5917034.m 5917134.m 5917234.m 5917334.m 5917434.m
5917534.m 5917634.m 5917734.m 5917834.m 5917934.m 5918034.m 5918134.m
5918234.m 5918334.m 5918434.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	701932	5916442	0.0	0.0	3	703520	5916370	0.0	0.0
2	701910	5916661	0.0	0.0					

METEOROLOGICAL DATA : BoM AWS Data BoM SydneyAP Clouds SydneyAP Uair Surfac

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0041010_PM10_Stage 8_annual

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Concentration or deposition Concentration
Emission rate units grams/second
Concentration units microgram/m3
Units conversion factor 1.00E+06
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 0.400m
Adjustment for wind directional shear None

PLUME RISE OPTIONS
Gradual plume rise? Yes
Stack-tip downwash included? No
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 Rural" values (unless overridden by met. file)

AVERAGING TIMES
average over all hours

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0041010_PM10_Stage 8_annual

SOURCE CHARACTERISTICS

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INTEGRATED AREA SOURCE: HAUL1

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
702041	5917697	0m	1190m	4m	85deg	2m	0m

Emission rates by hour of day in grams/second per square metre:

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-04	8 1.40E-04
9 1.40E-04	10 1.40E-04	11 1.40E-04	12 1.40E-04
13 1.40E-04	14 1.40E-04	15 1.40E-04	16 1.40E-04
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.

INTEGRATED AREA SOURCE: HAUL2

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
702305	5917047	0m	548m	4m	120deg	2m	0m

Emission rates by hour of day in grams/second per square metre:

1 0.00E+00	2 0.00E+00	3 0.00E+00	4 0.00E+00
5 0.00E+00	6 1.40E-04	7 1.40E-04	8 1.40E-04
9 1.40E-04	10 1.40E-04	11 1.40E-04	12 1.40E-04
13 1.40E-04	14 1.40E-04	15 1.40E-04	16 1.40E-04
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.

INTEGRATED POLYGON AREA SOURCE: QP

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
702389	5917053	0m	6	2m	0m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	702389	5917053	2	702625	5917004
3	702659	5916898	4	702523	5916812
5	702426	5916784	6	702361	5916882

Emission rates by hour of day in grams/second per square metre:

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 8.70E-06	8 8.70E-06
9 8.70E-06	10 8.70E-06	11 8.70E-06	12 8.70E-06
13 8.70E-06	14 8.70E-06	15 8.70E-06	16 8.70E-06
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.

INTEGRATED POLYGON AREA SOURCE: QPWE

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
702389	5917053	0m	6	2m	0m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	702389	5917053	2	702625	5917004
3	702659	5916898	4	702523	5916812
5	702426	5916784	6	702361	5916882

(Constant) emission rate = 6.40E-06 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: SWE

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
702305	5917047	0m	40m	230m	180deg	2m	0m

(Constant) emission rate = 6.40E-06 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: SP1

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
702305	5917047	0m	40m	230m	180deg	2m	0m

Emission rates by hour of day in grams/second per square metre:

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 2.60E-05	8 2.60E-05
9 2.60E-05	10 2.60E-05	11 2.60E-05	12 2.60E-05
13 2.60E-05	14 2.60E-05	15 2.60E-05	16 2.60E-05
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.

INTEGRATED AREA SOURCE: P

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
702465	5916847	0m	20m	60m	180deg	2m	0m

Emission rates by hour of day in grams/second per square metre:

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 2.60E-04	8 2.60E-04
9 2.60E-04	10 2.60E-04	11 2.60E-04	12 2.60E-04
13 2.60E-04	14 2.60E-04	15 2.60E-04	16 2.60E-04
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.

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0041010_PM10_Stage 8_annual

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):
700990.m 701090.m 701190.m 701290.m 701390.m 701490.m 701590.m
701690.m 701790.m 701890.m 701990.m 702090.m 702190.m 702290.m
702390.m 702490.m 702590.m 702690.m 702790.m 702890.m 702990.m
703090.m 703190.m 703290.m 703390.m 703490.m 703590.m 703690.m
703790.m 703890.m 703990.m

and these y-values (or northings):
5915434.m 5915534.m 5915634.m 5915734.m 5915834.m 5915934.m 5916034.m
5916134.m 5916234.m 5916334.m 5916434.m 5916534.m 5916634.m 5916734.m
5916834.m 5916934.m 5917034.m 5917134.m 5917234.m 5917334.m 5917434.m
5917534.m 5917634.m 5917734.m 5917834.m 5917934.m 5918034.m 5918134.m
5918234.m 5918334.m 5918434.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	701932	5916442	0.0	0.0	3	703520	5916370	0.0	0.0
2	701910	5916661	0.0	0.0					

METEOROLOGICAL DATA : BoM AWS Data BoM SydneyAP Clouds SydneyAP Uair Surfac

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0041010_TSP_Deposition_annual

Concentration or deposition Dry deposition only
Emission load units grams/second
Deposition units milligram/m2
Units conversion factor 1.00E+03
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 0.400m
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 Rural" values (unless overridden by met. file)

AVERAGING TIMES
average over all hours

1

0041010_TSP_Deposition_annual

SOURCE CHARACTERISTICS

INTEGRATED AREA SOURCE: HAUL1

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
702041	5917697	0m	1190m	4m	85deg	2m	0m

Emission rates by hour of day in grams/second per square metre:

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 2.50E-04	8 2.50E-04
9 2.50E-04	10 2.50E-04	11 2.50E-04	12 2.50E-04
13 2.50E-04	14 2.50E-04	15 2.50E-04	16 2.50E-04
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

Particle Mass fraction	Particle Size (micron)	Particle Density (g/cm3)
0.0470	1.0	2.60
0.3440	7.0	2.60
0.6090	20.0	2.60

INTEGRATED AREA SOURCE: HAUL2

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
702698	5916930	0m	710m	4m	150deg	2m	0m

Emission rates by hour of day in grams/second per square metre:

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 2.50E-04	8 2.50E-04
9 2.50E-04	10 2.50E-04	11 2.50E-04	12 2.50E-04
13 2.50E-04	14 2.50E-04	15 2.50E-04	16 2.50E-04
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

Particle Mass fraction	Particle Size (micron)	Particle Density (g/cm3)
0.0470	1.0	2.60
0.3440	7.0	2.60
0.6090	20.0	2.60

INTEGRATED POLYGON AREA SOURCE: QPIT

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
702504	5916966	0m	7	2m	0m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	702504	5916966	2	702527	5916937
3	702472	5916876	4	702440	5916913
5	702463	5916932	6	702448	5916968
7	702468	5916982			

Emission rates by hour of day in grams/second per square metre:

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 1.50E-04	8 1.50E-04
9 1.50E-04	10 1.50E-04	11 1.50E-04	12 1.50E-04
13 1.50E-04	14 1.50E-04	15 1.50E-04	16 1.50E-04
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

Particle Mass fraction	Particle Size (micron)	Particle Density (g/cm3)
0.0470	1.0	2.60
0.3440	7.0	2.60
0.6090	20.0	2.60

INTEGRATED AREA SOURCE: SP1

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
702492	5916972	0m	50m	20m	160deg	2m	0m

Emission rates by hour of day in grams/second per square metre:

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 2.50E-04	8 2.50E-04
9 2.50E-04	10 2.50E-04	11 2.50E-04	12 2.50E-04
13 2.50E-04	14 2.50E-04	15 2.50E-04	16 2.50E-04
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

Particle Mass fraction	Particle Size (micron)	Particle Density (g/cm3)
0.0470	1.0	2.60
0.3440	7.0	2.60

0.6090	20.0	2.60

INTEGRATED AREA SOURCE: P

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
702542	5916925	0m	20m	60m	180deg	2m	0m

Emission rates by hour of day in grams/second per square metre:

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	1.70E-04	8	1.70E-04
9	1.70E-04	10	1.70E-04	11	1.70E-04	12	1.70E-04
13	1.70E-04	14	1.70E-04	15	1.70E-04	16	1.70E-04
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

Particle Mass fraction	Particle Size (micron)	Particle Density (g/cm3)
0.0470	1.0	2.60
0.3440	7.0	2.60
0.6090	20.0	2.60

INTEGRATED POLYGON AREA SOURCE: QPWE

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
702468	5916982	0m	7	2m	0m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	702468	5916982	2	702504	5916966
3	702527	5916937	4	702472	5916876
5	702440	5916913	6	702463	5916932
7	702448	5916968			

(Constant) emission rate = 1.30E-05 grams/second per square metre

Particle Mass fraction	Particle Size (micron)	Particle Density (g/cm3)
0.0470	1.0	2.60
0.3440	7.0	2.60
0.6090	20.0	2.60

INTEGRATED AREA SOURCE: SP1WE

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
702492	5916972	0m	50m	20m	160deg	2m	0m

(Constant) emission rate = 1.30E-05 grams/second per square metre

Particle Mass fraction	Particle Size (micron)	Particle Density (g/cm3)
0.0470	1.0	2.60
0.3440	7.0	2.60
0.6090	20.0	2.60

1 ________________________________

0041010_TSP_Deposition_annual

RECEPTOR LOCATIONS

____

The Cartesian receptor grid has the following x-values (or eastings):
700990.m 701090.m 701190.m 701290.m 701390.m 701490.m 701590.m
701690.m 701790.m 701890.m 701990.m 702090.m 702190.m 702290.m
702390.m 702490.m 702590.m 702690.m 702790.m 702890.m 702990.m
703090.m 703190.m 703290.m 703390.m 703490.m 703590.m 703690.m
703790.m 703890.m 703990.m

and these y-values (or northings):
5915434.m 5915534.m 5915634.m 5915734.m 5915834.m 5915934.m 5916034.m
5916134.m 5916234.m 5916334.m 5916434.m 5916534.m 5916634.m 5916734.m
5916834.m 5916934.m 5917034.m 5917134.m 5917234.m 5917334.m 5917434.m
5917534.m 5917634.m 5917734.m 5917834.m 5917934.m 5918034.m 5918134.m
5918234.m 5918334.m 5918434.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	701932	5916442	0.0	0.0	3	703520	5916370	0.0	0.0
2	701910	5916661	0.0	0.0					

____

METEOROLOGICAL DATA : BoM AWS Data BoM SydneyAP Clouds SydneyAP Uair Surfac

Annex F

Noise Assessment

DRAFT REPORT

Boral Quarries

Bombala Quarry
Noise Assessment

June 2006

Environmental Resources Management Australia
Building C, 33 Saunders Street
Pyrmont, NSW 2009
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GLOSSARY

A number of technical terms used in this report describe various noise levels from the mine. These are explained in ***Error! Reference source not found.***.

Term	**Description**
ABL	Assessment Background Level (ABL) is defined in the *INP* as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured L_{90} statistical noise levels.
dB(A)	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
dB(LinPeak)	The peak sound pressure level (not RMS) expressed as decibels with no frequency weighting.
L1	The noise level exceeded for 1 % of a measurement period.
L10	A noise level which is exceeded 10 % of the time. It is approximately equivalent to the average of maximum noise levels.
L90	Commonly referred to as the background noise, this is the level exceeded 90 % of the time.
Leq	The summation of noise over a selected period of time. It is the energy average noise from a source, and is the equivalent continuous sound pressure level over a given period.
Lmax	The maximum root mean squared (rms) sound pressure level received at the microphone during a measuring interval.
MIC_{8MS}	Maximum Instantaneous Charge (with a minimum 8 milli-sec delay).
Peak Particle Velocity	The maximum velocity of a particle of the transmission medium, used in assessment of vibration.
RBL	The Rating Background Level (RBL) is an overall single figure background level representing each assessment period over the whole monitoring period. The RBL is used to determine the intrusiveness criteria for noise assessment purposes and is the median of the ABL's.
RMS	Root Mean Square which is a measure of the mean displacement (velocity or acceleration) of a vibrating particle.
SI	Still isothermal (SI) refers to calm weather conditions (defined as no wind and standard temperature gradients).
sigma-theta (σ_θ)	The standard deviation of horizontal wind fluctuation.
Sound power level	This is a measure of the total power radiated by a source. The sound power of a source is a fundamental location of the source and is independent of the surrounding environment.
Temperature inversion	A positive temperature gradient. A meteorological condition where atmospheric temperature increases with altitude to some height.

The following indicates what an average person perceives about noise levels in practice:

- noise differences of less than approximately 2 dB are generally imperceptible; and
- a difference of around 10 dB seems to be a doubling or halving of loudness.

1 *INTRODUCTION*

This report was prepared for Boral Resources (Country) Pty Ltd (Boral), to assess environmental noise associated with the proposed extension of the quarry at Bombala.

Extraction in the quarry is expected to increase in ten stages over 16 to 20 years where the existing pit which is at an elevation 809m will be sunk further to 798m and eventually 789m.

The quarry has a relatively low approved extraction tonnage and Boral proposes to increase this rate to 100,000 tonnes per year of aggregate products. Extraction is expected to proceed with the same intensity as present except that the quarry is expected to be operational throughout the year as compared to current operations of six months.

This report examines the operations that occur during the initial stage and an intermediate stage of extraction and evaluates the noise emissions experienced at the nearest affected residences through noise modelling with the Environmental Noise Model (ENM) which is widely accepted as a reliable method of predicting noise levels from industrial sources.

Noise modelling conservatively assumes concurrent operation of all equipment during each stage as described in the noise modelling results section of this report. This assessment has been prepared in accordance with the EPA's *Industrial Noise Policy* (*INP*), (EPA 2000).

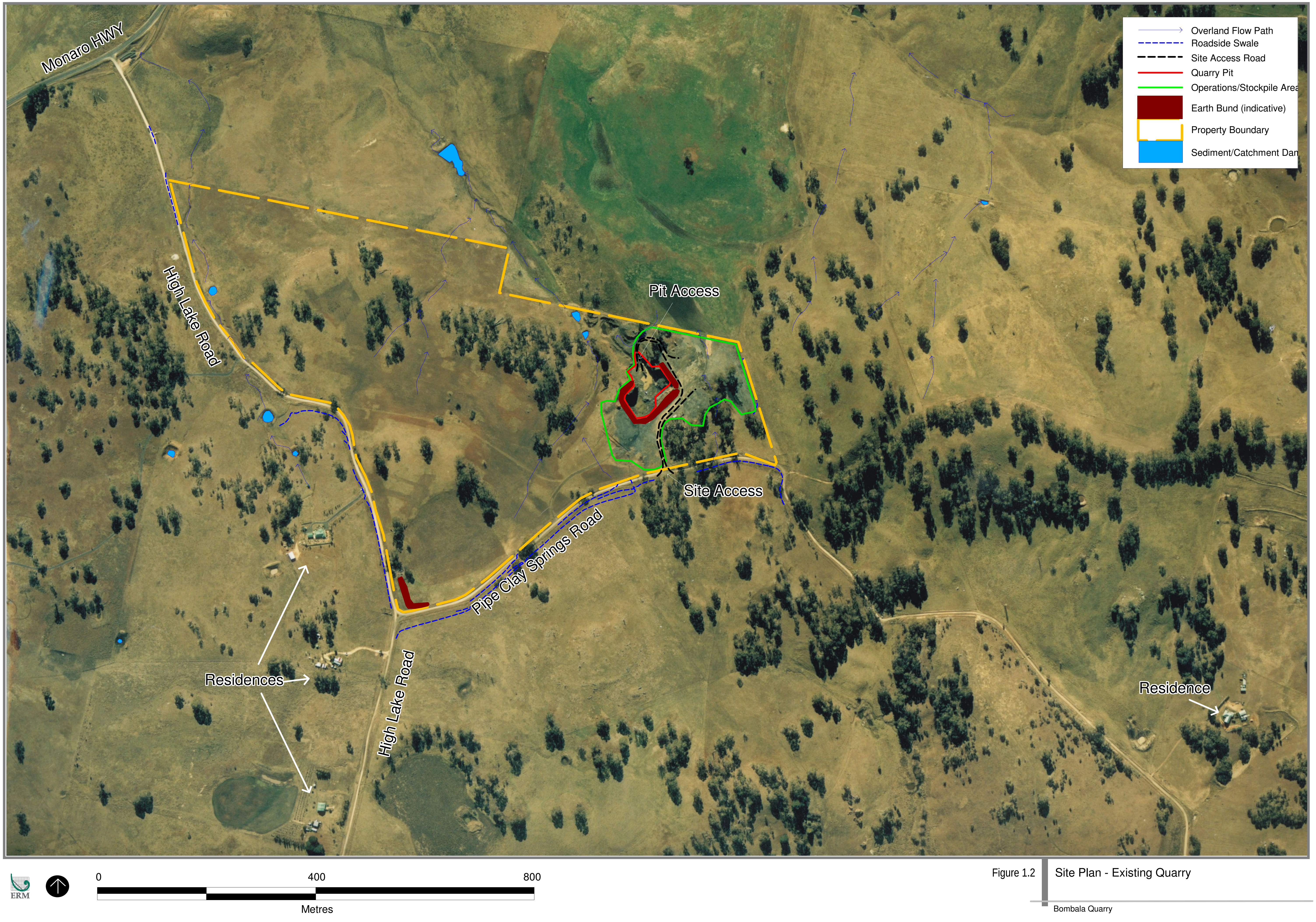


Figure 1.2 Site Plan - Existing Quarry

Bombala Quarry

2 THE EXISTING NOISE ENVIRONMENT

2.1 RESIDENTIAL RECEIVERS

Four residential properties were identified to be near enough to be potentially affected by the quarry extension. These are shown in *Table 2.1* and are illustrated in *Figure 2.1*.

Table 2.1 Receiver Locations Used for Modelling Purposes

Location		GPS Coordinates		Location from Bombala Quarry	
Resident / Residence		Easting	Northing	Compass Point	Distance, m
1	McInnes 'Oxley'	701961	5916740	WSW	560
2	Helmers 'High Lake'	702012	5916459	SW	670
3	Herron 'Gadara'	701946	5916144	SSW	950
4	Rolph 'Inglewood'	703502	5916342	SE	1180

2.2 BACKGROUND AND AMBIENT NOISE

The quarry operates from 7.00am to 5.00pm during the weekdays. No activities occur on site during the weekends. Unattended long term monitoring and short term-monitoring were used to evaluate the background and ambient noise at the receiver locations.

2.2.1 Unattended Noise Monitoring

A background and ambient noise survey was done by Heggies Australia in their report entitled 'Bombala Quarry Environmental Noise Measurements'. In this report, unattended continuous monitoring by means of a noise logger was conducted from 30th November 2005 to 9th December 2005 at the southwest boundary of the property, approximately 150 metres east of the Helmers residence. ERM obtained the raw logger data from the noise monitoring, analysed and charted it. ERM cannot verify the accuracy of the raw logger data obtained from Heggies Australia, but is convinced it is representative of background in the absence of the quarry for the evening and night periods only.

Figure 2.1 indicates the position of this monitoring location. Total summaries of the recorded data are presented in *Table 2.2*, and daily summaries and charts of the data are presented in *Annex A*.

Table 2.2 Summary of Background and Ambient Noise Levels

Location	Rating Background Level, dB(A)			Ambient Noise Level, dB(A)$L_{eq,period}$		
	Day[1]	**Evening**[1]	**Night**[1]	**Day**[1]	**Evening**[1]	**Night**[1]
Site Boundary	32[2]	32	30	52	43	40

1. Day is from 7am to 6pm; Evening is from 6pm to 10pm; and Night is from 10pm to 7am (INP).

2. The value of 32dB(A) was adopted from the evening period, as the RBL (33) attained from the logger during the day period may have been influenced by site noise.

NB. Noise data during periods of any rainfall and/or wind speeds above 5m/s were discarded.

Source: Heggies Australia (2006)

2.2.2 *Attended Noise Monitoring*

To gain an understanding of the existing noise environment ERM conducted attended noise monitoring at the receiver locations on 28th April, 2006 from 10.00am to 4.30pm during the day period when the quarry was operational. Locations which were dominated by site noise were used for noise model validation. During each measurement the contribution from the site was determined. It should be noted that in the period between the unattended noise monitoring and attended noise monitoring, i.e. December 2005 to April, 2006, the following operational and landscaping changes to the site had taken place:

- relocation of the primary crusher into the pit;
- enlargement of the earth bund adjacent to the processing plant to 8m in height; and
- placement of an earth bund in the south-western corner of the property.

Figure 2.1 shows the locations of the attended noise measurement locations. The measurements are summarised in *Table 2.3.*

Table 2.3 Summary of Existing Site Noise as Determined from Attended Measurements

	Location	Time	Duration (min)	Wind Condition (hand held anemoter)	Total Measured Noise Levels, dB(A)			Site Contribution dB(A)
					L_{eq}	L_{90}	L_{10}	
1	McInnes 'Oxley'	12:10	15	Calm	33.3	27.6	33.8	<30
		14:47	15	~>3m/s,E	52.9	41.8	51.6	48
2	Helmers 'High Lake'	11:50	15	Calm	39.1	36.4	40.8	33
		14:25	15	~2m/s,E	43.1	37.8	45.6	38
3	Herron 'Gadara'	10:38	15	Calm	38.9	34	41.2	35
		13:58	15	~1.5m/s,E	40.1	37.6	41.6	33
4	Rolph 'Inglewood'	11:19	15	Calm	39.4	36	40.8	33
		15:15	15	~1m/s,E	40.8	34.8	40.2	<30

NB. Measurements have been filtered for high frequency cricket noise.

G:\GIS\Minor Projects\0041010 Bombala\0041010 F11.1 Receiver Locations.WOR 26.05.06 Environmental Resources Management Australia Pty Ltd

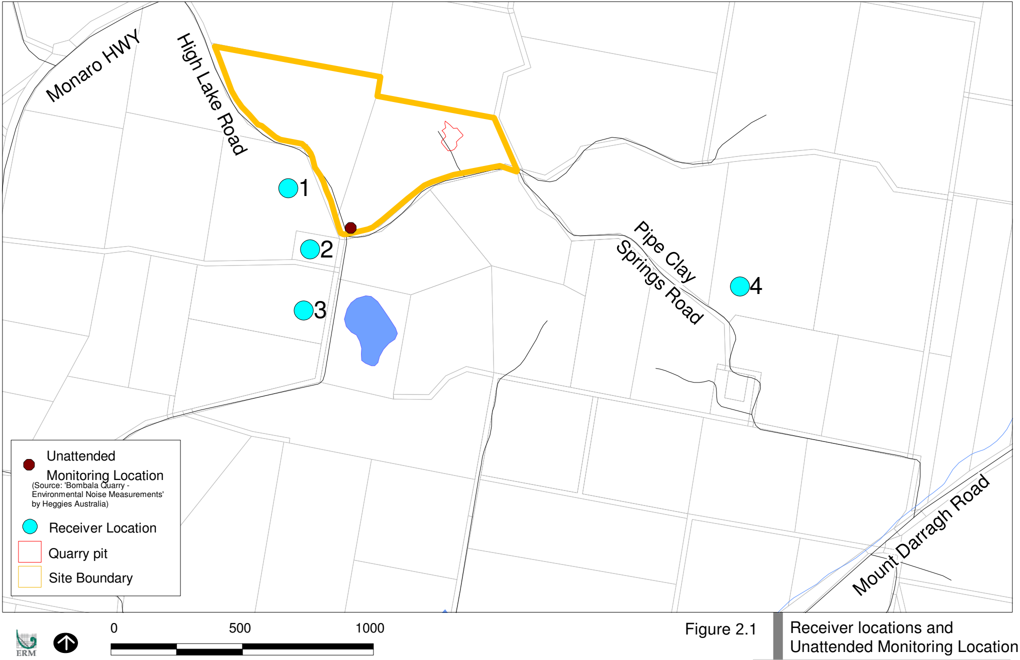


Figure 2.1

Receiver locations and Unattended Monitoring Location

Bombala Quarry

2.3 *PREVAILING WEATHER CONDITIONS*

The efficiency of noise propagation over long distances can be significantly affected by the weather conditions. Of most interest are source to receiver winds and the presence of temperature inversions as both these conditions can enhance received noise levels. To account for these phenomena the EPA in their INP specify weather analysis procedures to determine the prevalent weather conditions that enhance noise propagation with a view to determining whether they can be described as a feature of the project area.

In this study, temperature inversions are not considered as the quarry operates only during the day and temperature inversions typically occur at night.

The prevailing wind directions are to be determined in accordance with the INP which requires that winds below 3m/s with an occurrence greater than 30% be assessed. As the quarry operates only during the day, only daytime wind occurrences are relevant to this study. Daytime wind roses created from 1/1/2000 to 13/3/2006 indicate that winds below 3m/s do not occur in a particular direction for more than 30% of the time as shown in *Annex B*. Hence, noise levels under wind are not assessed in this study, although noise will be enhanced during adverse winds.

3 OPERATIONAL NOISE CRITERIA

3.1 GENERAL CRITERIA

The INP provides guidelines for assessing noise emissions from industrial facilities. Assessment criteria depend on the existing amenity of areas potentially affected by a proposed development are outlined below.

Assessment criteria for sensitive receivers near industry are based on the following objectives:

- protection of the community from excessive intrusive noise; and
- preservation of amenity for specific land uses.

In order to ensure that these objectives are met, two separate criteria are prescribed by the EPA, namely the intrusiveness criteria and the amenity criteria. A fundamental difference between the intrusiveness and the amenity criteria is that the former is applicable over 15 minutes in any period, while the latter covers the entire assessment period (day, evening and night).

3.1.1 *Intrusiveness*

The intrusiveness criterion requires that $L_{Aeq,15min}$ noise levels from a newly introduced source during the day, evening and night do not exceed the existing Rating Background Levels (RBL) by more than 5dB. This is expressed as:

$$L_{Aeq,15min} \leq RBL + 5 - K$$

where $L_{Aeq,15min}$ is the L_{eq} noise level from the source, measured over a 15 minute period and K is a series of adjustments for various noise characteristics. Where the RBL is less than 30 dB(A), a value of 30 dB(A) is used. For typical noise from a quarry, no adjustment factors are considered applicable.

Using the monitoring data obtained from the long term survey described in *Section 2.2*, the intrusiveness criteria derived for the proposed extension of the quarry are shown in *Table 3.1*.

Table 3.1 Intrusiveness Criteria for Receiver Locations

Location	$L_{eq,15min}$ Intrusiveness Noise Goals, dB(A)		
	Day	**Evening**	**Night**
Residential Receivers (1-4)	37	37	35

3.1.2 *Amenity*

The EPA's amenity criterion requires industrial noise to be within an acceptable level for the particular locality and land use. Where ambient noise is already high, the acoustic environment should not be deteriorated significantly. The strategy behind the amenity criterion is a holistic approach to noise, where all industrial noise (existing and future) received at a given receptor does not exceed the recommended goals.

Private residences potentially affected by the proposal are covered by the EPA's rural amenity categories. The EPA's definition for a rural area is:

"*an acoustical environment that is dominated by natural sounds, having little or no road traffic*".

Base amenity criteria for this category is given in *Table 3.2*. Adjustments to these target levels may apply where the environment has existing industrial noise (excluding the proposal) or high levels of road traffic noise. However, in this case such an adjustment does not apply as there are no other industrial sites in the near vicinity.

Table 3.2 EPA Base Amenity Criteria

Location	**Indicative Area**	**Time**	**Recommended L_{eq} period Noise Level dB(A)**	
			Acceptable	**Maximum**
Residential	Rural	Day	50	55
		Evening	45	50
		Night	40	45
	Suburban	Day	55	60
		Evening	45	50
		Night	40	45

3.2 PROJECT SPECIFIC NOISE GOALS

Project specific noise goals are presented in *Table 3.3*. The more stringent intrusiveness goals are the criteria that have been adopted for this assessment.

Table 3.3 Project Specific Noise Limits

	Location	$L_{eq,15minute}$ Noise Level Criteria, dB(A)		
	Residence	**Day**	**Evening**	**Night**
1	McInnes 'Oxley'	37	37	35
2	Helmers 'High Lake'	37	37	35
3	Herron 'Gadara'	37	37	35
4	Rolph 'Inglewood'	37	37	35
NB.	As the quarry operates only during the day, only the Day criterion is applicable.			

Under the provisions of the INP, specifically chapter 10, achievable noise limits for existing operations can be negotiated with the regulatory authority where measured noise levels exceed the defined project specific criteria. This is pursuant to the assessment of all reasonable and feasible mitigation measures. In the case of the Bombala Quarry site, mitigation measures been assessed and, in some cases, already implemented, including the relocation of the primary crusher into the pit and the erection of noise attenuation earth bunds on the site. The quarry plan also incorporates a noise reduction component with the relocation of the remainder of the processing plant into the pit at stage 4 of the proposed operations (i.e. 5.8 years from now) and subsequent relocation within the pit to further reduce noise levels. The current proposal includes maintaining existing plant and continuing their operation. Hence, additional mitigation measures such as upgrading of plant and equipment to achieve lower sound power levels, were considered to be cost prohibitive and not likely to reduce emissions to a large extent.

3.3 CUMULATIVE NOISE

The cumulative impact of more than one development can be compared against the base amenity criteria listed above (refer *Table 3.2*). This is consistent with the INP's holistic approach to industrial noise. However, no other industries are sufficiently near Bombala Quarry for cumulative noise to be a concern.

3.4 ROAD TRAFFIC NOISE CRITERIA

The NSW DEC Environmental Criteria for Road Traffic Noise (ECRTN) recommends external and internal traffic noise goals.

Where a local authority identifies a principal haulage route, such as Pipe Clay Springs Road and High Lake Road on the basis of Bombala Quarry's operations and ERM's observations, the policy suggests that the traffic noise criteria for the route match those for collector roads. For collector roads the ECRTN recommends the following criteria:

- DAYTIME: $L_{eq,1hr}$60dB(A); and
- NIGHT TIME: $L_{eq,1hr}$55dB(A).

For traffic noise assessment the ECRTN defines daytime and night time hours as 7am to 10pm and 10pm to 7am respectively.

Only the daytime criterion is applicable for this assessment as the quarry does not operate at night.

3.5 SLEEP DISTURBANCE

As the quarry does not operate during the night period (10pm to 7am) when the residents are adjudged to be sleeping, sleep disturbance issues are not considered in this report.

3.6 BLASTING

3.6.1 *Recommended Criteria*

Recommended criteria for the assessment of noise and vibration from blasting are provided by the Australian and New Zealand Environment and Conservation Council (ANZECC) (1990) in its publication entitled *Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration*. These criteria apply to minimise human annoyance and discomfort and were not developed to control possible structural damage. However, if ground vibration peak particle velocities (ppv) comply with criteria for minimising human annoyance and discomfort, they would also be below levels that may cause structural damage to buildings.

3.6.2 *Noise Overpressure*

ANZECC (1990) guidelines specify that air-blast overpressure should not exceed 115 dB(L_{peak}) for more than 5 % of the total number of blasts over a period of 12 months. However, the maximum level should not exceed 120 dB(L_{peak}) at any time. The dB(L_{peak}) unit of sound measurement considers the low frequency sounds which are not audible to the human ear but can be 'felt'.

3.6.3 *Ground Vibration*

The ANZECC guidelines specify that the ppv from ground vibration should not exceed 5 mm/s for more than 5% of the total number of blasts over a period of 12 months. However, the maximum level should not exceed 10 mm/s at any time. The ANZECC guidelines also recommend that a level of 2 mm/s be considered as the long-term regulatory goal for the control of ground vibration.

3.6.4 *Time and Frequency of Blasting*

The ANZECC guidelines state that blasting should generally be limited to the hours of 9.00 am to 5.00 pm Monday to Saturday and should not take place on Sundays or public holidays. The ANZECC guidelines recognise that under some circumstances or at certain mines, blasting cannot always be restricted to general working hours and achieve compliance with blast level limits. This may be due to prevailing winds being less favourable during these periods.

The guidelines recommend that when a temperature inversion is known to exist, blasting should be avoided if practical. These restrictions do not apply where the effects of blasting are not perceived at noise sensitive locations.

The guidelines recommend that except for minor blasts such as for clearing of crushers and feed chutes, blasting should generally be limited to once per day. In addition to the above criteria, general best practice procedures can be used to effectively minimise noise impacts.

4 NOISE MODELLING

4.1 MODELLING SCENARIOS

There are a total of 10 stages in which the quarry will operate progressively. In order to assess the impact of the proposed extension, 2 stages are highlighted and examined closely. They are Stage 1 where the existing quarry begins its extension and the later stage of Stage 8 whereby the extension is well underway and the quarry is nearing completion of its operation. These two scenarios have been selected for modelling as they represent the worst case scenario, i.e. the existing situation (Stage 1) and an improved scenario, with all plant located in the pit. These two stages were used as modelling scenarios in ENM. A description of both stages and the cumulative project duration at the conclusion of these stages is presented in *Table 4.1*. The modelled scenarios are graphically presented in *Annex C*.

Table 4.1 Modelled Scenarios

Stage	Description	Cumulative Project Duration (years)
1	Primary crusher in pit at RL809m; remaining plant on the surface at RL821m; 8m bund erected on the east of the pit shielding the secondary plant	0.7
8	All plant in pit at RL798m pit; haul truck and excavator in pit at RL809m.	14.8

4.2 PLANT NOISE LEVELS

All of the plant modelled as part of this assessment was measured in operation at Bombala quarry on 13th February and 28th April 2006. The measurements were used to derive the representative Sound Power Levels of the various plant. The representative noise emission levels used in modelling are summarised in *Table 4.2.*

Table 4.2 Equipment Sound Power Levels

Typical Item	Representative $L_{eq,15minute}$ Sound Power Level, dB(A)
Jaw Crusher	120 (crushing rock)
Screen 1	113
Screen 2	114
Screen 3	112
Screen 4	104
Mini-crusher 1	112
Mini-crusher 2	114
Gen-set	101
Excavator 1	114
Excavator 2	114
Haul Truck	103
Front-End Loader	104

Notes: Refer to *Annex D* for spectral data used for noise modelling

5 PREDICTED NOISE LEVELS

5.1 CALCULATION PROCEDURES

The ENM noise prediction software was used for modelling purposes. ENM takes into account distance, ground effect, atmospheric absorption and topographic detail. ENM is an EPA accepted noise prediction model as it gives consistently reliable predictions of environmental noise.

The model incorporated three-dimensional digitised ground contours for the quarry, as derived from quarry plans, and the surrounding land base topography, superimposed on each other. Plant and equipment was modelled at various locations and heights, representative of realistic operating conditions in Stage 1 and Stage 8 and chosen to represent worst case scenarios.

The noise model predicts L_{eq} noise levels, based on equipment sound power levels determined from measurements conducted at the existing operations. The results assume all plant and equipment operate simultaneously. In practice, such an operating scenario would be unlikely to occur. The results are therefore considered conservative.

In order to ascertain the accuracy of the results, validation was done by running a model with actual noise measurements under actual weather conditions.

5.2 VALIDATION

Attended measurements as provided in *Table 2.2* were used for validation. An important pre-requisite for validation is that the site noise must dominate the noise environment so that they can be compared against modelled site noise. Measurements from *Table 2.2* which satisfied this condition (i.e. at McInnes and Helmers residences) were consequently used for validation.

Wind speed and direction at 10m above the ground were obtained from the NSW Bureau of Meteorology's Bombala Station 070005 during the period of monitoring to evaluate the weather conditions during the measurements. However, ERM's wind anemometer observations on-site were relied upon to determine the weather conditions, with meteorological station's wind data used as validation of wind conditions.

A summary of the validation results are presented in *Table 5.1* below.

Table 5.1 ***Validation Summary***

	Location	Time	Duration (min)	Wind Condition	Total Measured Noise Levels, dB(A)			Measured Site Contribution dB(A)	Modelled Noise Level dB(A)
					L_{eq}	L_{90}	L_{10}		
1	McInnes 'Oxley'	14:47	15	~>3m/s,E	53	42	52	48	48
2	Helmers 'High Lake'	14:25	15	~2m/s,E	43	38	46	38	40

The ENM model predicts noise levels within an accuracy of ±2dB(A) which is deemed acceptable for this site.

5.3 NOISE MODELLING

Noise modelling was carried out for Stage 1 and Stage 8 of the extension of Bombala Quarry as detailed in *Table 4.1*. As wind is not pertinent to the noise assessment as discussed in *Section 2.3*, modelling was carried out only under calm conditions.

The modelling results are presented in *Table 5.2*.

Table 5.2 ***Noise Modelling Summary***

	Location	L_{eq},dB(A)		Project Specific Criterion
		Stage 1	Stage 8	
1	McInnes 'Oxley'	**39**	36	37
2	Helmers 'High Lake'	36	32	37
3	Herron 'Gadara'	30	28	37
4	Rolph 'Inglewood'	28	24	37

NB. Criterion exceedances are shown in bold font.

For Stage 1, the project specific criterion is met at Receiver Locations 2, 3 and 4. There is a marginal infraction of 2dB(A) at the McInnes Residence (Receiver Location 1). This is considered to be insignificant and changes in noise levels of 2dB(A) are generally not perceptible by the human ear. Also, an engineering tolerance of ±2dB(A) is generally acceptable for the purposes of noise modelling.

Given that the modelling includes the implementation of identified reasonable and feasible noise mitigation measures, the values presented in *Table 11.7* are considered to be achievable noise limits at the receiver locations, as per Chapter 10 of the INP.

The above results are for calm weather conditions. Although not assessable according to the INP, under adverse winds it is expected that quarry noise would increase in the order of 6dB to 45dB(A) at McInnes. Similar measured quarry noise levels are demonstrated in attended monitoring in *Table 11.6*. As the quarry operates during daytime hours only, and given the improvement to historic noise emissions through implementation of noise mitigation, it is not unreasonable to consider a daytime noise limit of 45 dB(A) for adverse weather conditions.

For Stage 8, the project specific criterion is met at all the receiver locations as would be expected due to additional shielding with all plant relocated to the pit at RL798m.

It can be seen that there is a decrease in noise levels from Stage 1 to Stage 8. This portrays the expected trend over the life of the quarry, as the pit becomes deeper and more plant is moved in-pit. As there is no increase in the intensity of extraction, noise levels will be progressively reduced.

5.4 CONSTRUCTION ACTIVITIES

There will be no significant construction activities that are likely to add to received noise levels at residences.

6 ROAD TRAFFIC NOISE

The haul trucks enter and leave Bombala Quarry carrying extracted material. The trucks have a fixed route and travel from Monaro Highway to High Lake Road and access Bombala Quarry through Pipe Clay Springs Road and vice versa. There are typically 16 truck movements each day. The truck movements are between 7.00am and 5.00pm Weekdays during the operational hours of the quarry.

Only McInnes residence (Receiver location 1) and Helmers residence (Receiver location 2) are adjacent to the truck route. For each residence, the assessment location is 1m from its worst-affected façade facing the road. *Section 3.4* stipulates the day criterion to be 60dB(A) L_{eq},dB.

From ERM's database of noise measurements, a truck pass-by typically creates a Sound Exposure Level(SEL) of 75dB(A) at a measurement distance of 20m. The haul trucks passing by both residences are approximately 40m from the façade of the residence and calculations were performed under a hypothetical worst case scenario of there being 16 truck movements within a 1 hour period. The noise level was calculated to be $L_{eq,1hr}$48dB(A). This complies with the criterion of $L_{eq,1hr}$60dB(A). Hence, road traffic noise due to Bombala quarry is not expected to create an adverse noise impact.

It should be noted that noise management policies are currently in place with regard to truck noise. A speed limit of 40 km/h is enforced and air brakes are not permitted to be used by the trucks as they pass both the above-mentioned residences.

7 BLASTING NOISE AND VIBRATION

Blasting is expected to occur twice in a 6 monthly period. Drilling precedes blasting and is expected to occur for approximately two weeks prior to each blast event. Blasting will occur on the surface of the highest shelf of the quarry. The distances from the pit boundary to the residences are deemed to be the minimum blast separation distance and are presented in *Table 7.1*. These distances are similar to previous blast situations.

Table 7.1 Blast Locations

	Location	Minimum Blast Separation Distance, m
1	McInnes 'Oxley'	560
2	Helmers 'High Lake'	670
3	Herron 'Gadara'	950
4	Rolph 'Inglewood'	1180

The blast design, and hence corresponding air blast overpressure and ground vibration, is within the control of operators. The site's existing blast management strategy will be used to ensure appropriate charge masses are used for blasting. Such charge masses (or maximum instantaneous charge, MIC) are presented in *Table 7.2*. These were derived from 95% formulae in Blastronics Pty Limited (1994) for monitoring data collected at mines in the area.

Table 7.2 Blasting Assessment

Blast to Location Distance, m	MIC_{8ms} to Satisfy ANZECC 95 % Overpressure Limit of 115 dB(Lin), kg	MIC_{8ms} to Satisfy Maximum Allowable Overpressure Limit of 120 dB(Lin), kg	MIC_{8ms} to Satisfy ANZECC 95% Ground Vibration Limit of 5 mm/s (ppv), kg	MIC_{8ms} to Satisfy Maximum Allowable Ground Vibration Limit of 10 mm/s (ppv), kg
500	6	26	83	215
1000	48	207	331	862
1500	163	699	745	1938

NB. These results are derived from equations contained in the *Drill and Blast Study, Mount Pleasant* prepared by Blastronics Pty Limited for CNA in September 1994

In general, blast overpressure considerations limit MIC

Blasting was monitored on 2 different occasions by Orica Explosives as blasting was carried out at the southern end of the quarry pit. Blast monitors were installed near McInnes Residence (Receiver Location 1) and Helmers Residence (Receiver Location 2). These residences were the nearest residences to the quarry pit. Trigger levels on the blast monitors were set to 115 dB(Lin) for air blast overpressure and 5mm/s for ground vibration. Blasting did not trigger off either monitor on both occasions. Thus, blasting is not expected to create an adverse impact on the residences surrounding the quarry.

The blasting conducted was considered typical of blasting to be carried out throughout the life of the quarry. The intensity of the blasts is not expected to increase as the blasts carried out previously achieved the desired effect required. The blasting details were documented in blast summary reports by Orica Explosives. These reports are presented in *Annex E*.

8 MITIGATION MEASURES

Several noise mitigation measures are currently in place in Bombala Quarry and will continue to be employed throughout the proposed expansion operation. These measures are summarised as follows:

- the operating hours of the quarry are restricted from 7am to 5pm to prevent noise emissions during the evening and night and potential sleep disturbance to the residents;
- blasting occurs only four times per year and adequate notification is provided to the residents;
- noise and vibration from blasting is monitored through the use of blast monitors, to ensure acceptable limits are maintained;
- a speed limit of 40km/h for trucks on Pipe Clay Springs Road and High Lake Road;
- prohibiting haul trucks from using compression braking on Pipe Clay Springs Road and High Lake Road; and
- an 8m earth bund adjacent to the plant out-of-pit, provides shielding to residences to the west from noise from the out-of-pit plant.

Noise experienced at sensitive receivers is expected to be progressively reduced as the quarry expansion proceeds, through implementation of the following measures:

- plant is to be progressively moved in-pit;
- plant will be relocated to greater pit depths throughout the life of the quarry;
- the earth bund adjacent to the pit will be progressively increased in height; and
- no additional noise producing activities, plant or equipment will be introduced at the site.

9 CONCLUSION

This study considered the potential noise impacts of the extension of Bombala Quarry.

The study had the following features:

- long term ambient noise survey;
- noise criteria derived in accordance with the EPA's INP;
- meteorological data analysed in accordance with the EPA's INP;
- sound power levels for all equipment measured under operational conditions at the quarry; and
- noise modelling for Stage 1 and Stage 8 of the extension of the quarry that predicted the noise levels at the 4 receiver locations

Noise assessment under windy conditions was not deemed to be necessary as wind roses indicated that wind speeds below 3m/s occurred for less than 30 percent of the time, in accordance with the EPA's INP. Noise modelling found that in Stage 1 of the proposed quarry expansion, stipulated noise goals were met at all receiver locations except the McInnes residence. A marginal insignificant exceedence of 2dB occurred at the McInnes residence. In Stage 8, noise levels complied with stipulated criteria at all receiver locations and were lower than for Stage 1, as the pit was deeper and all the plant was located in-pit at this deeper level.

Conservative calculations of road traffic noise associated with Bombala Quarry found that levels complied with stipulated criteria at potentially affected residences.

Noise and vibration from blasting complied with criteria for minimising human annoyance and discomfort. Blasting only occurs 4 times per year and is currently being monitored to ensure acceptable limits are maintained. This will continue in the future.

In conclusion, implementation of the noise mitigation measures outlined in *Section 8* means that noise levels at the receiver locations are expected to be controlled so as not to have an adverse effect at identified receiver locations, and are reduced progressively throughout the proposed Bombala Quarry expansion.

REFERENCES

Environment Protection Authority of NSW (January 2000), Industrial Noise Policy.

Environment Protection Authority (1994), Environmental Noise Control Manual (ENCM).

Environment Protection Authority of NSW (May 1999), Environmental Criteria for Road Traffic Noise (ECRTN).

Australian and New Zealand Environment and Conservation Council (ANZECC) (1990), "Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration".

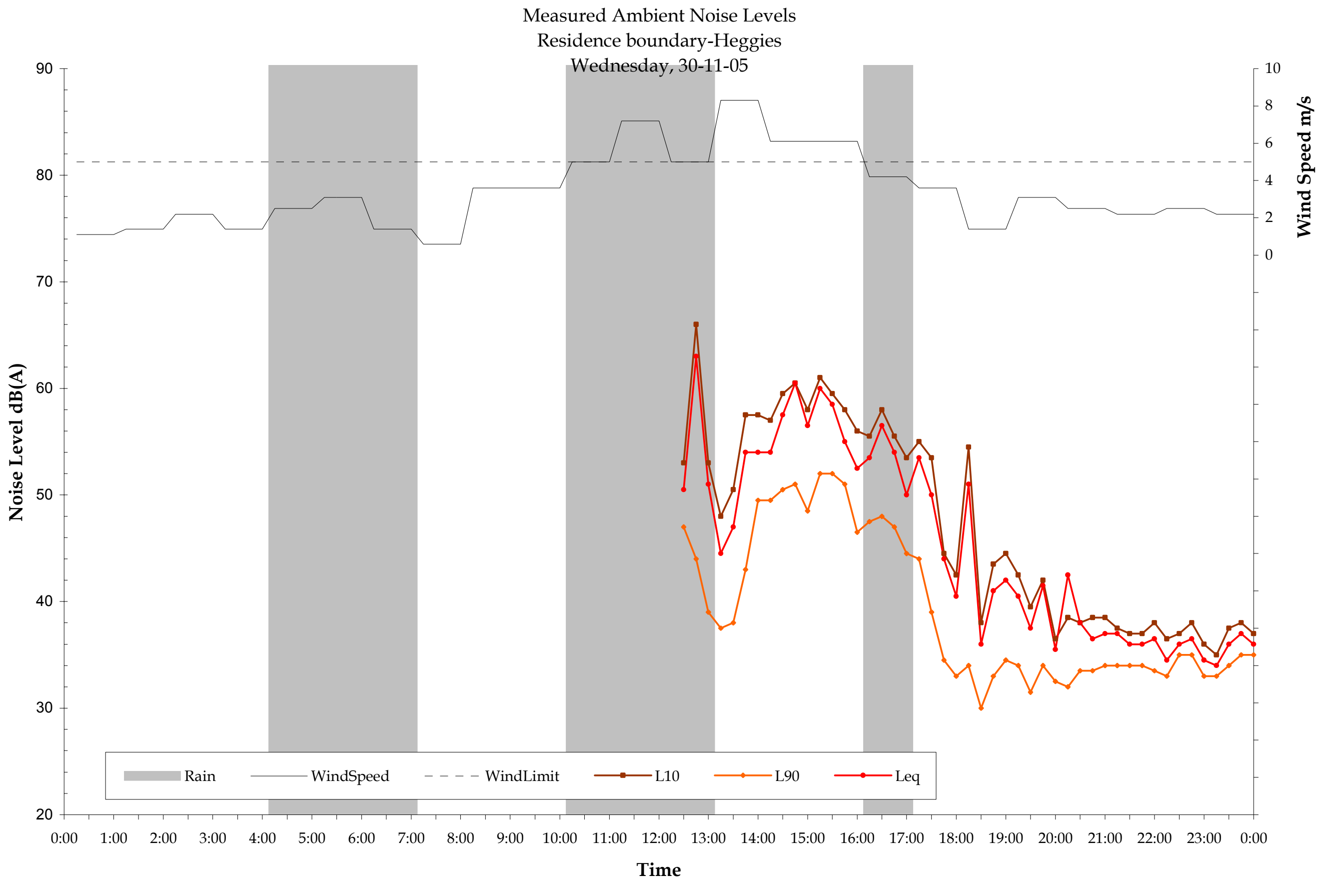
RTA Technology, Environmental Noise Model (ENM), Windows Version 3.06.

Blastronics Pty Ltd Drill & Blast Study, Mount Pleasant, prepared for CNA in September 1994.

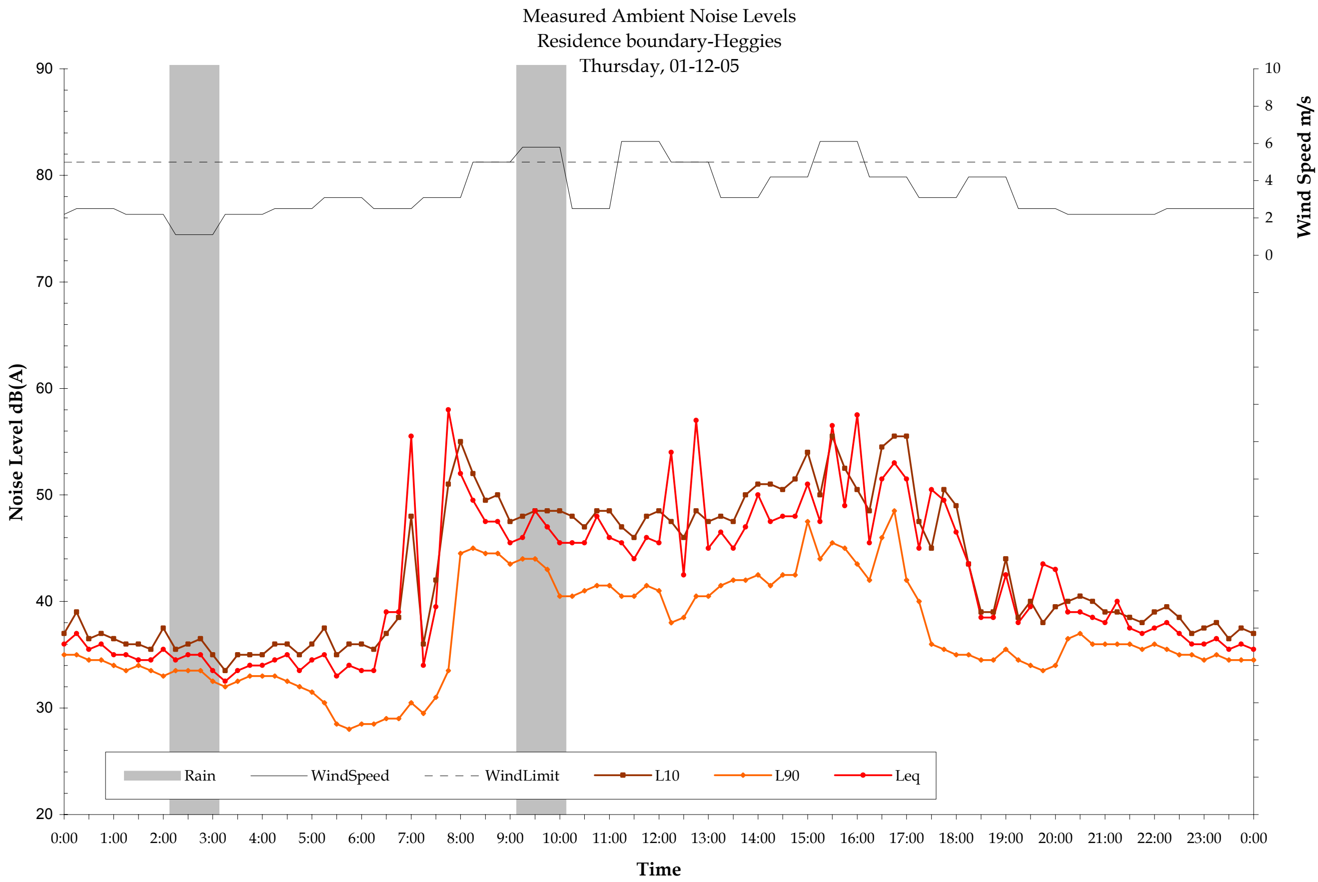
Heggies Australia (February 2006), Bombala Quarry Environmental Noise Measurements

Annex A

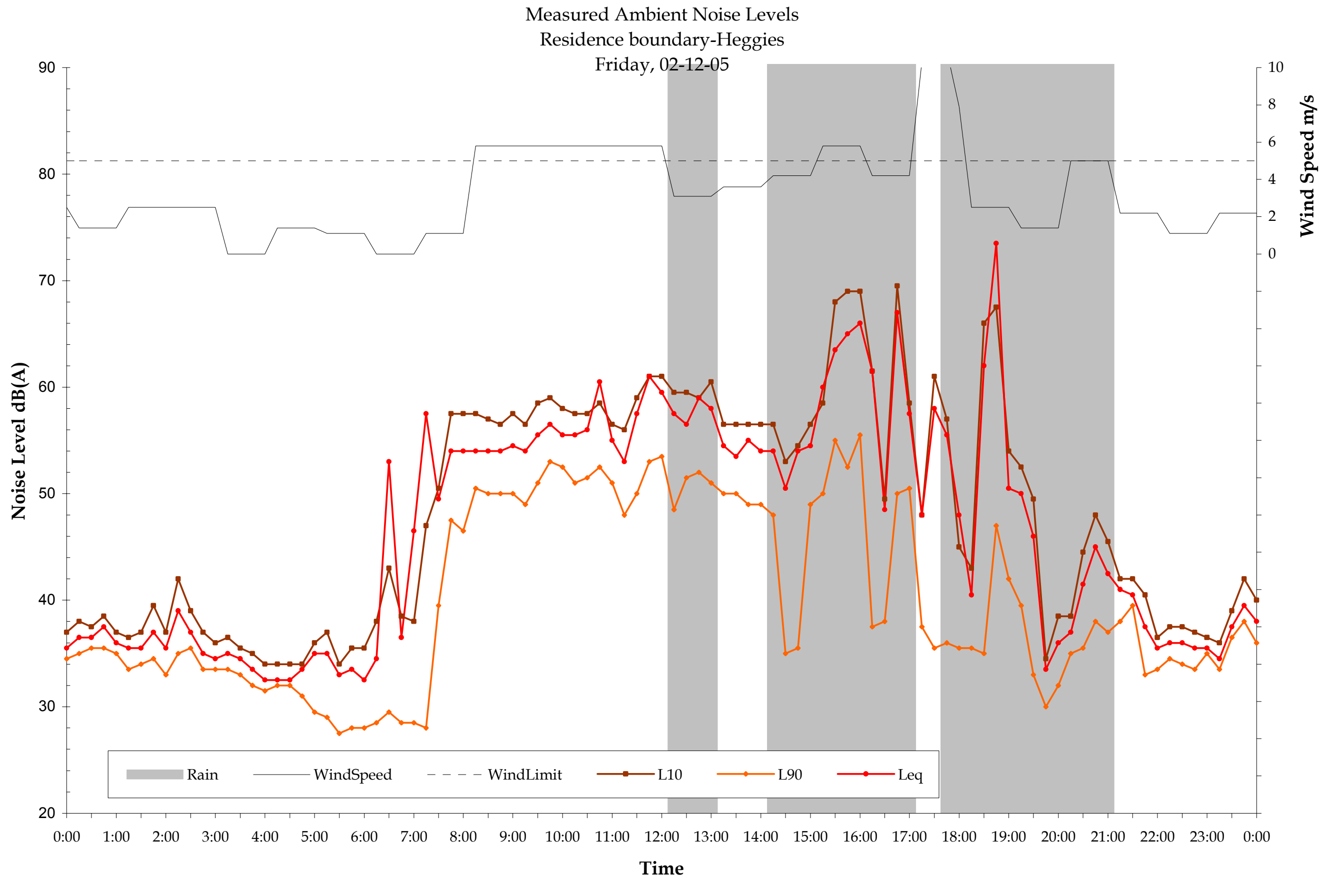
Unattended Monitoring Data



Measured Ambient Noise Levels
Residence boundary-Heggies
Wednesday, 30-11-05
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
L10
L90
Leq



Measured Ambient Noise Levels
Residence boundary-Heggies
Thursday, 01-12-05
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
L10
L90
Leq



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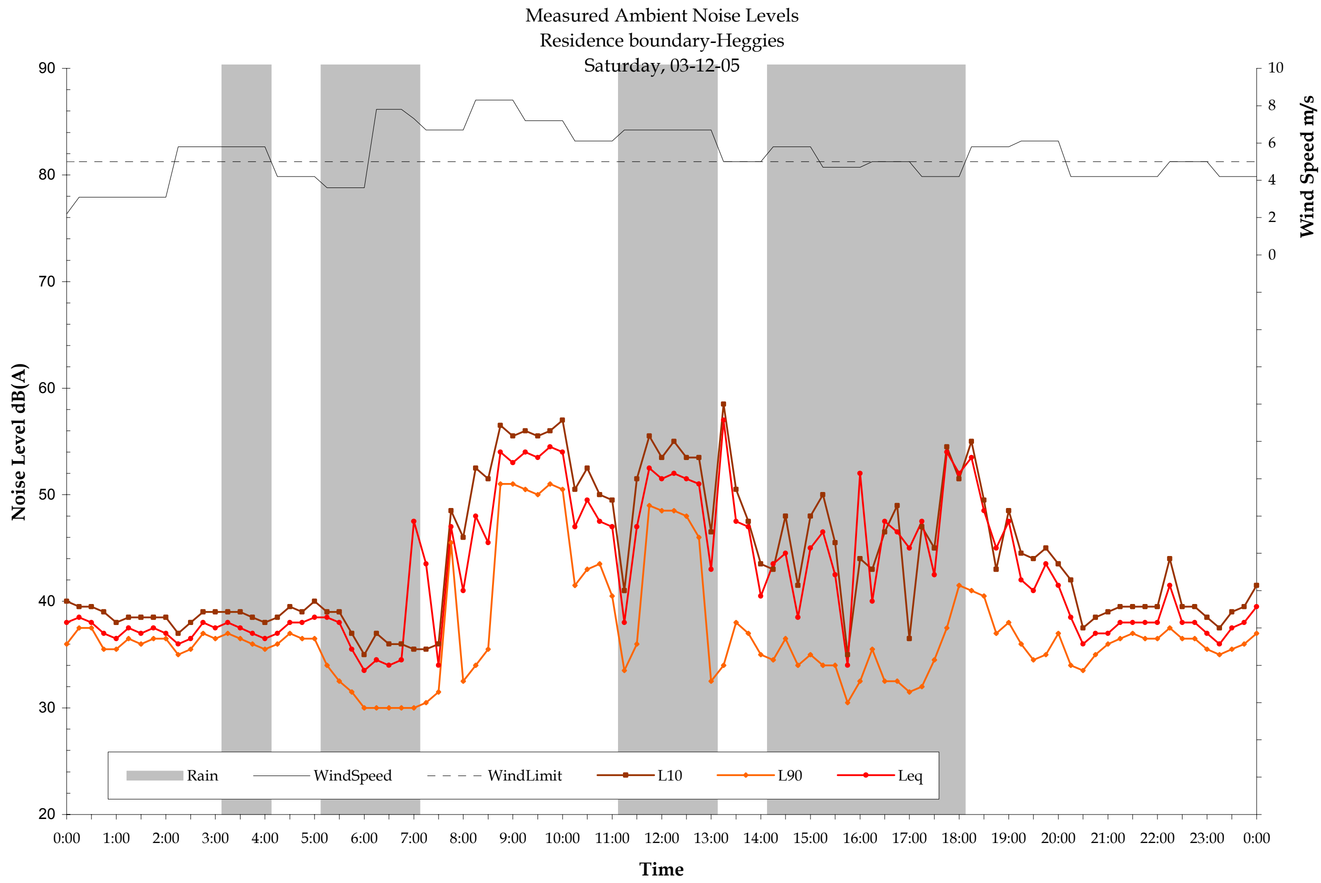
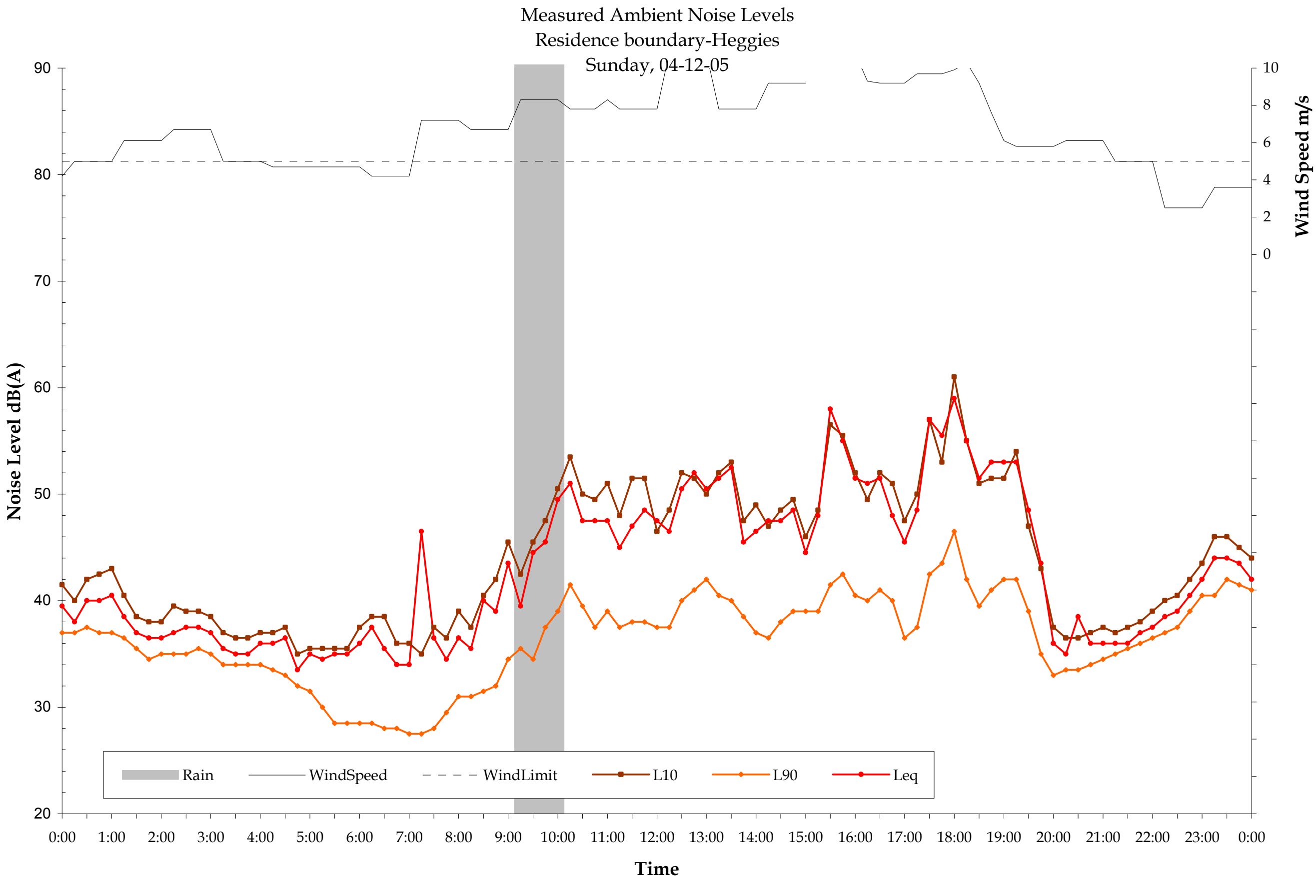
Residence boundary-Heggies
Friday, 02-12-05
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
L10
L90
Leq



Measured Ambient Noise Levels
Residence boundary-Heggies
Saturday, 03-12-05
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
L10
L90
Leq


Measured Ambient Noise Levels
Residence boundary-Heggies
Sunday, 04-12-05
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
L10
L90
Leq
90
80
70
60
50
40
30
20
10
8
6
4
2
0
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
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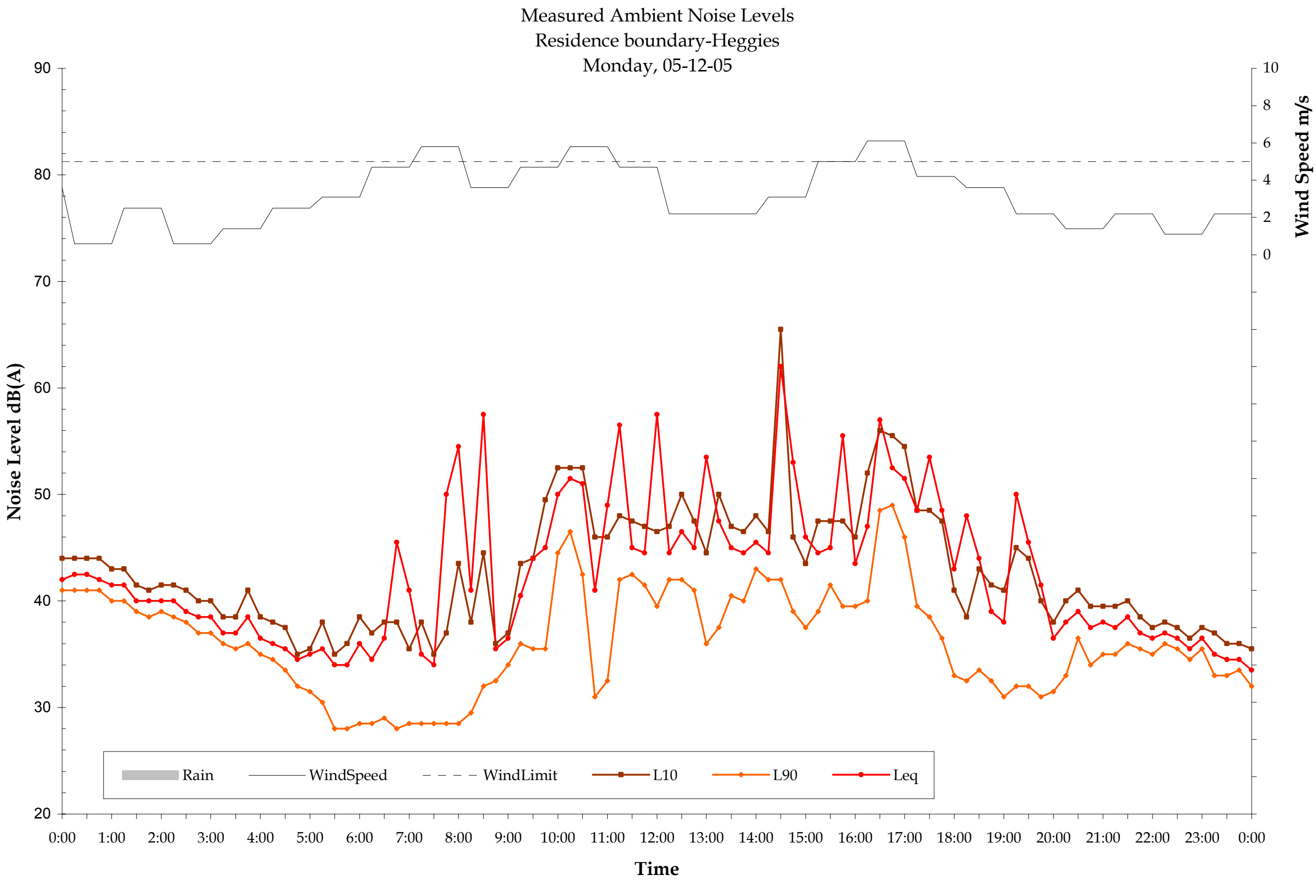
22:00
23:00
0:00


Measured Ambient Noise Levels
Residence boundary-Heggies
Monday, 05-12-05
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
L10
L90
Leq
90
80
70
60
50
40
30
20
10
8
6
4
2
0
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
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11:00
12:00
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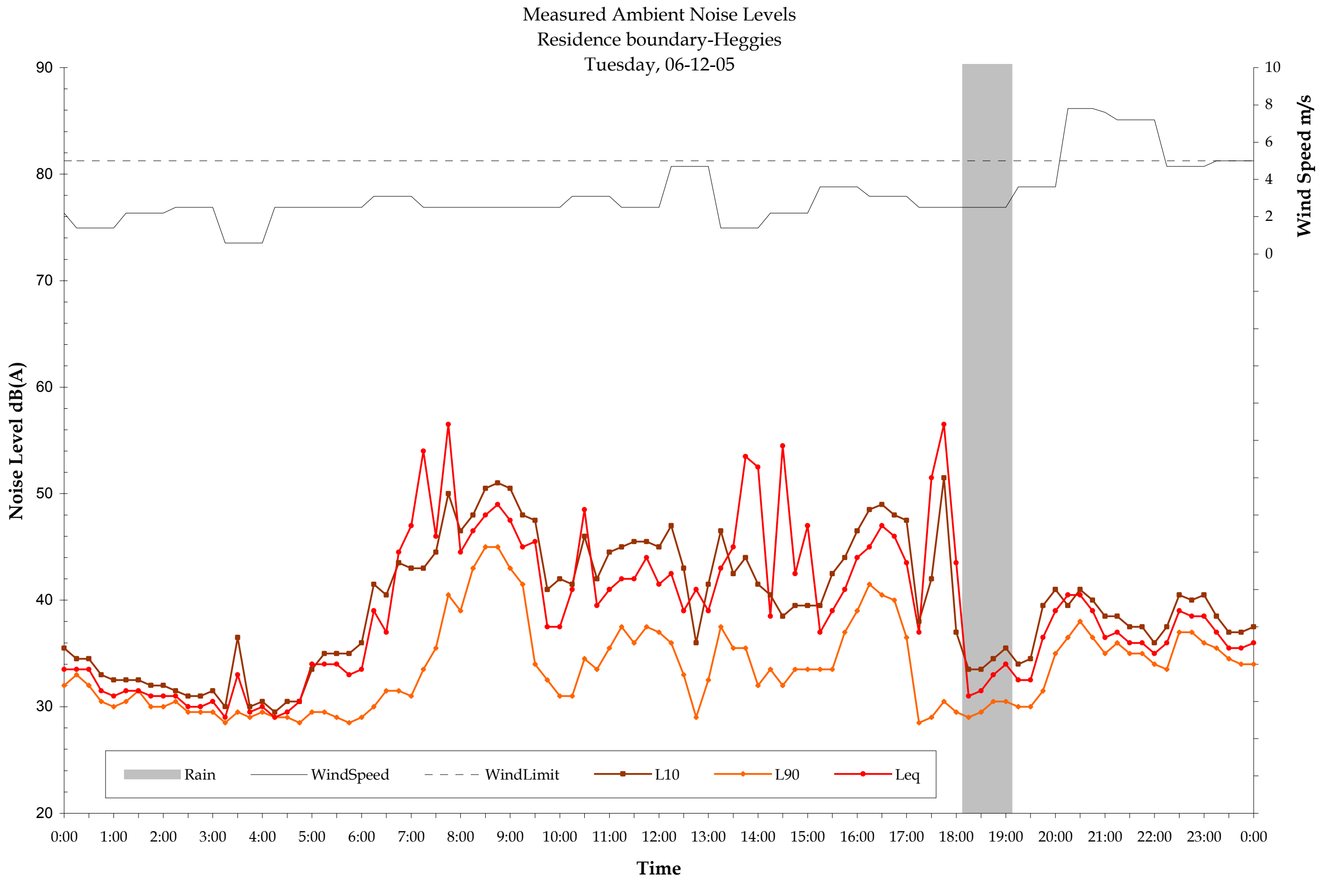
22:00
23:00
0:00


Measured Ambient Noise Levels
Residence boundary-Heggies
Tuesday, 06-12-05
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
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L90
Leq
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
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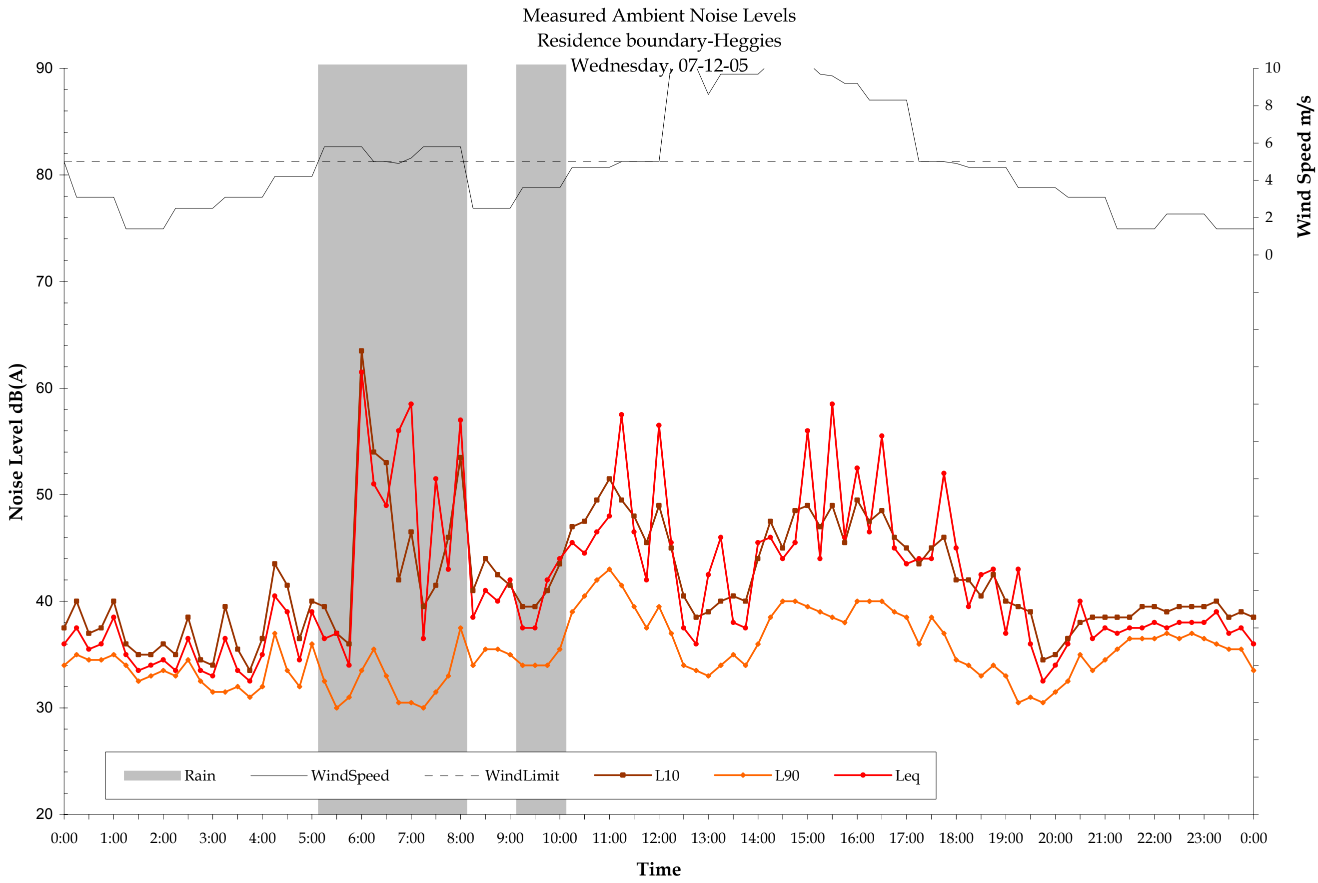
22:00
23:00
0:00


Measured Ambient Noise Levels
Residence boundary-Heggies
Wednesday, 07-12-05
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
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L90
Leq
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
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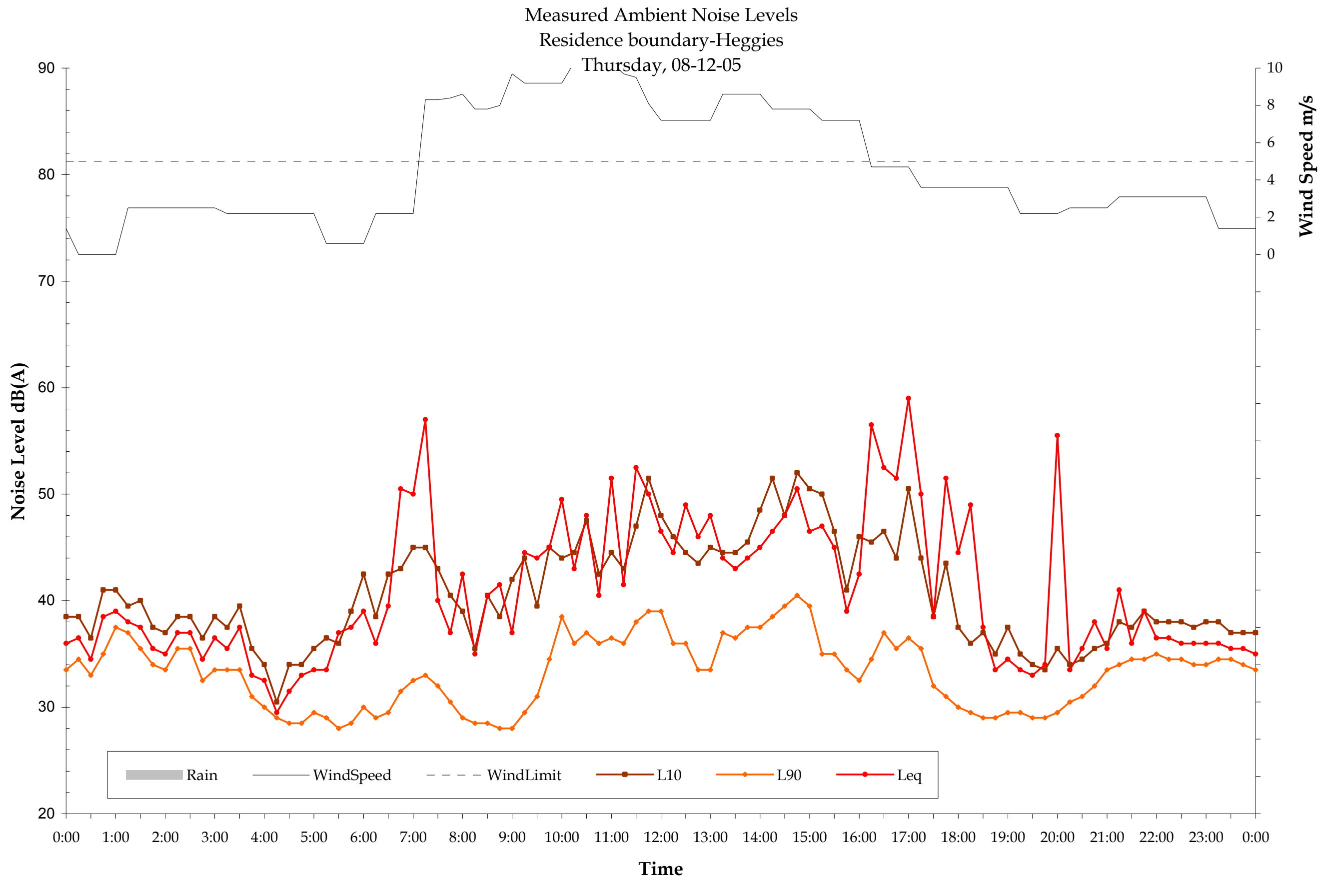
Measured Ambient Noise Levels
Residence boundary-Heggies
Thursday, 08-12-05
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
L10
L90
Leq
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
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17:00
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20
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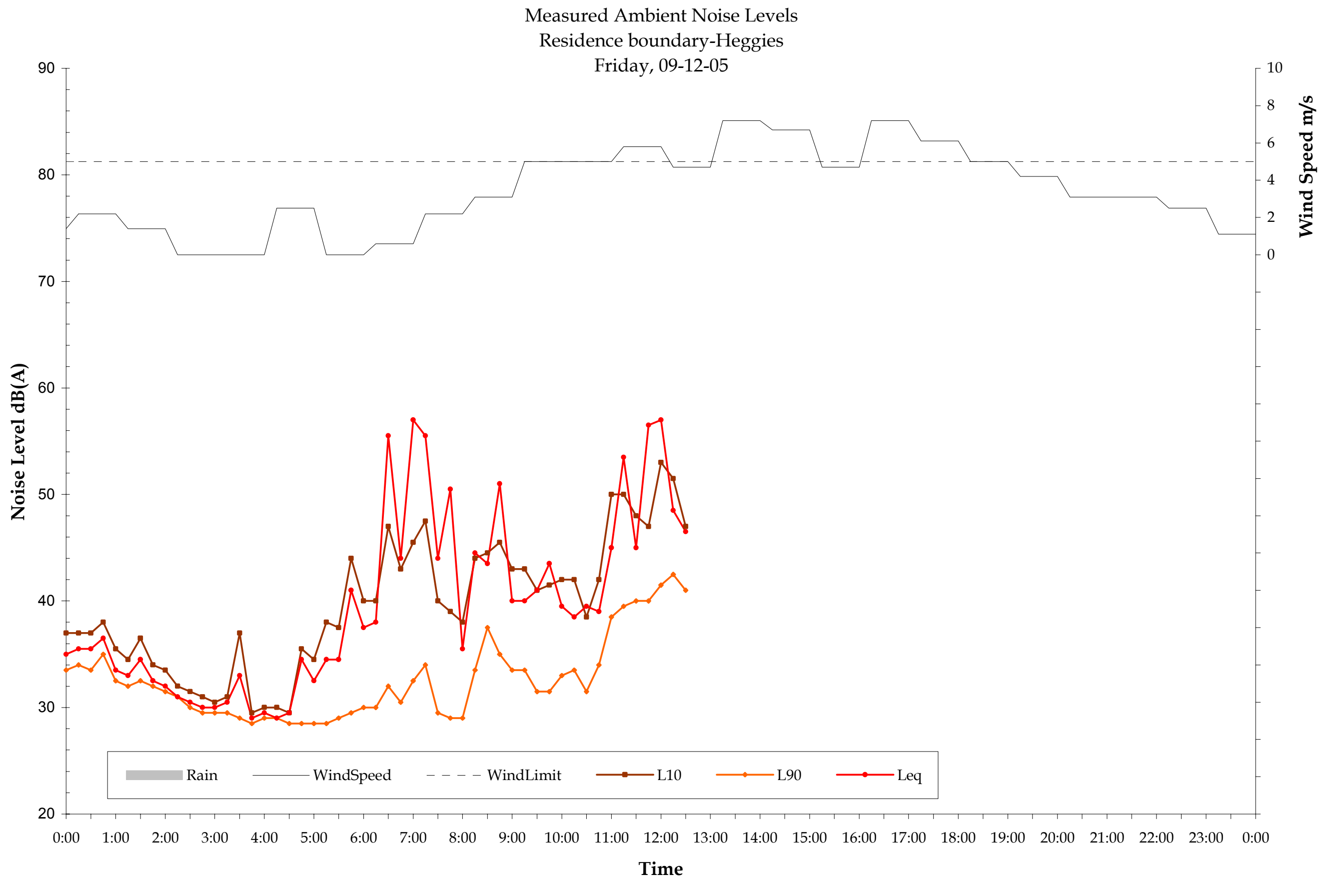
60
70
80
90
0
2
4
6
8
10


Measured Ambient Noise Levels
Residence boundary-Heggies
Friday, 09-12-05
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
L10
L90
Leq
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
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17:00
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2
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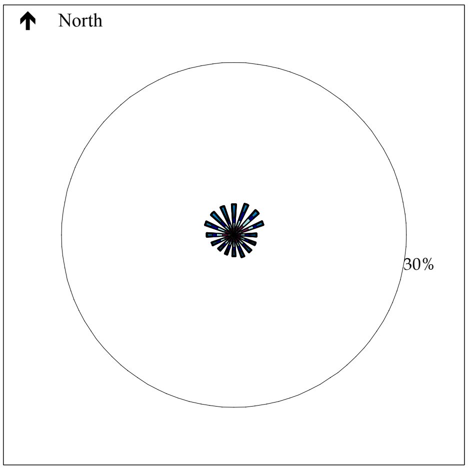
8
10

Annex B

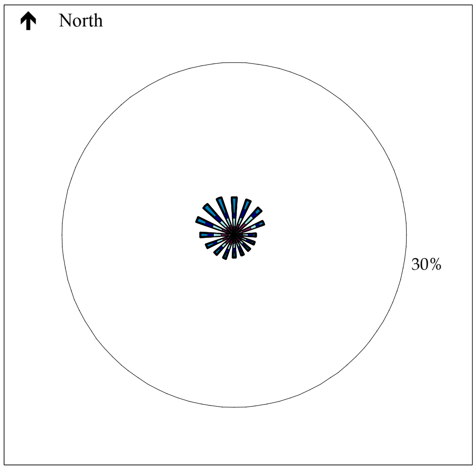
Vector Wind Roses Annual Hourly Wind Analysis

Day

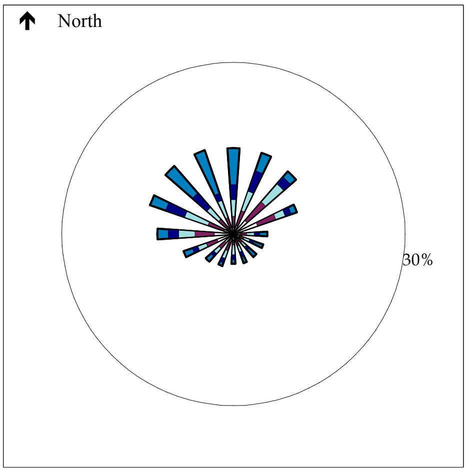
Summer



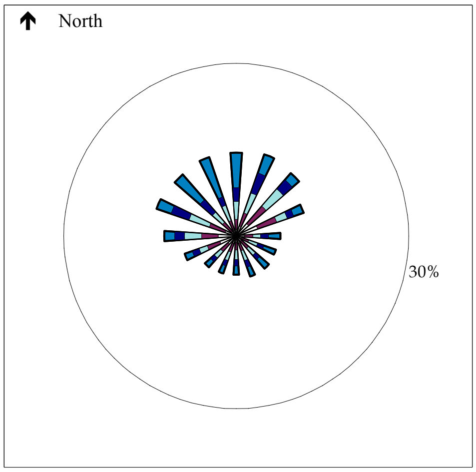
Spring



Winter



Autumn

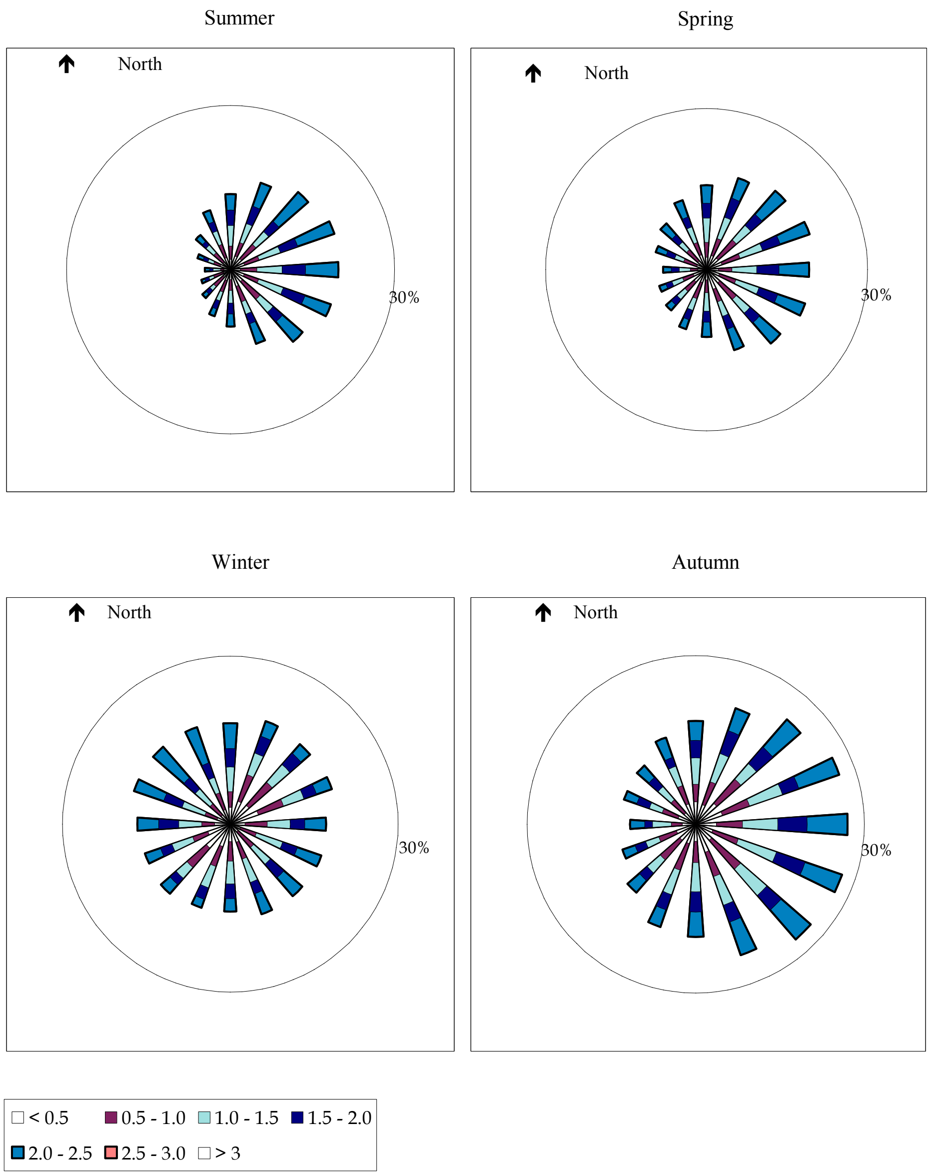


□ < 0.5 ■ 0.5 - 1.0 ■ 1.0 - 1.5 ■ 1.5 - 2.0
■ 2.0 - 2.5 ■ 2.5 - 3.0 □ > 3

Data Source: Bombala Station, Bureau of Meteorology
Data Range: 15 min, 01-01-00 to 13-03-06

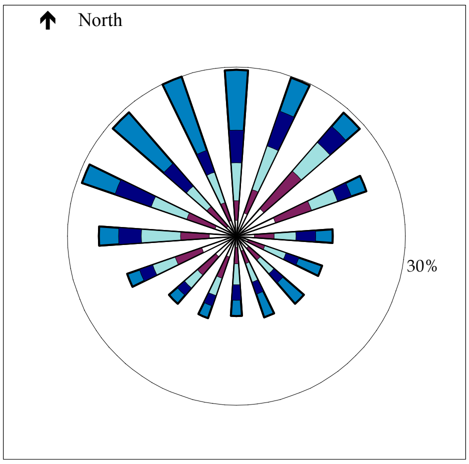
The segments of each arm represent the six valid wind speed classes, with increasing windspeed from the centre outwards.
The length of each arm represents the vector components (for each direction) of wind speeds 3m/s or below as a proportion of the total time for the period .
The circle represents the 30% occurrence threshold.

Evening

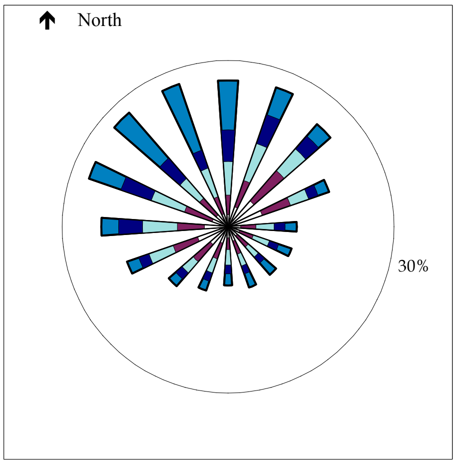

Summer
North
30%
Spring
North
30%
Winter
North
30%
Autumn
North
30%
< 0.5
0.5 - 1.0
1.0 - 1.5
1.5 - 2.0
2.0 - 2.5
2.5 - 3.0
> 3

Night

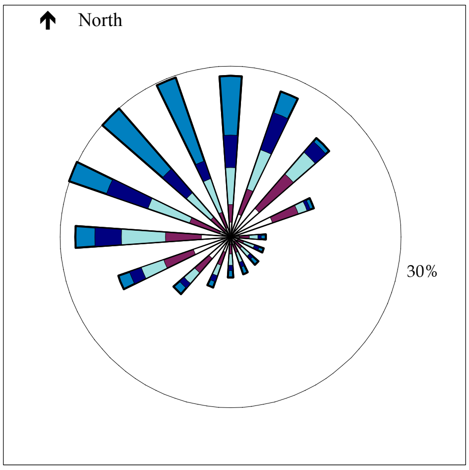
Summer



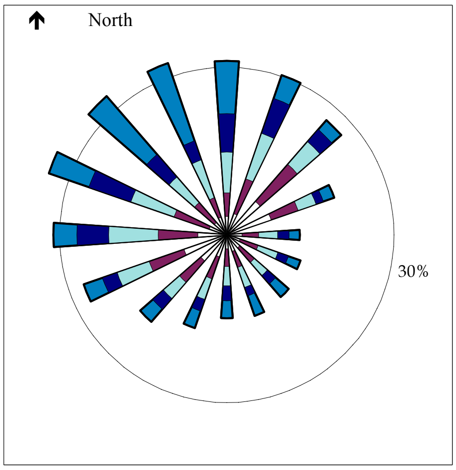
Spring

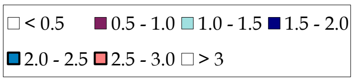


Winter



Autumn

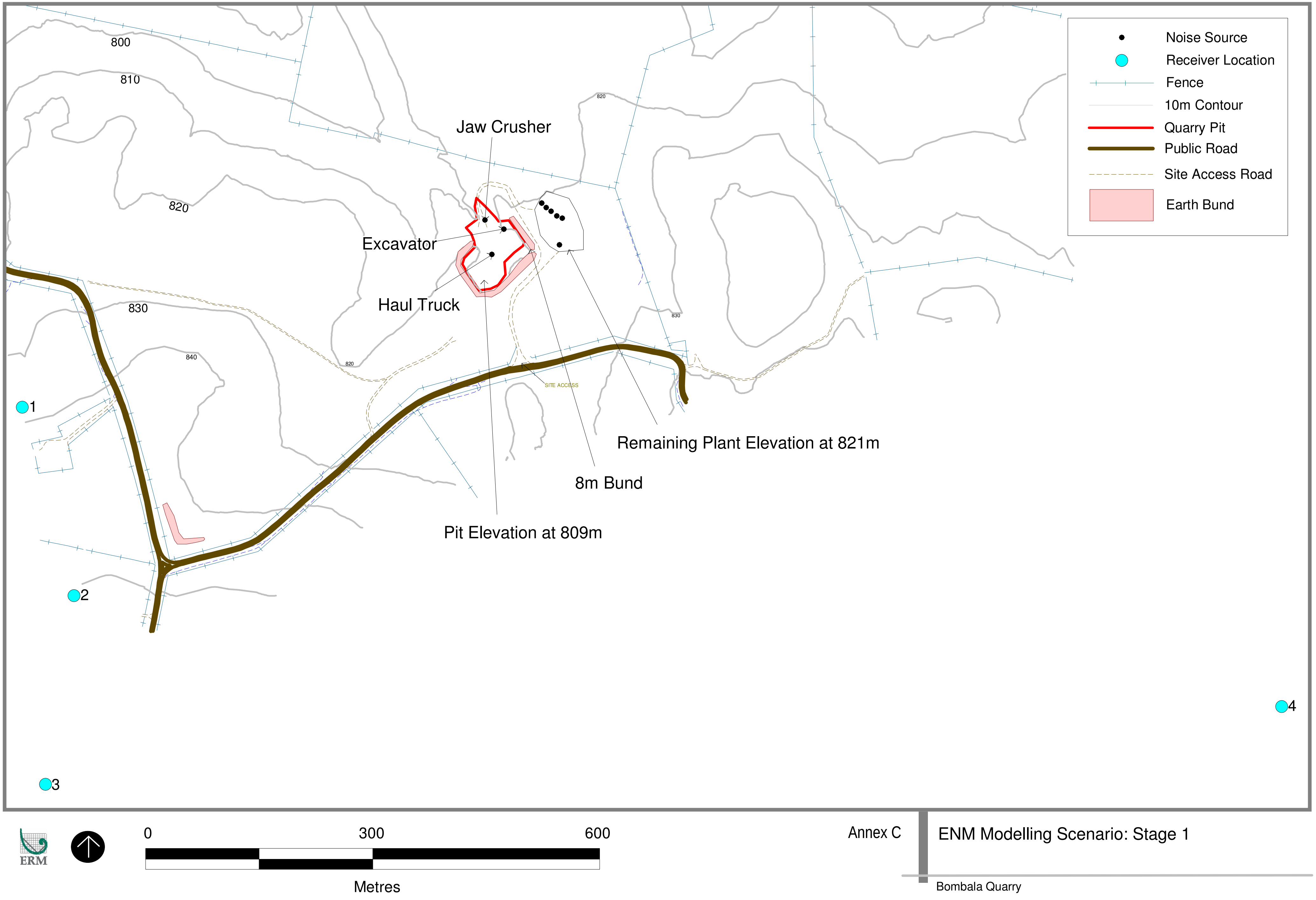




Annex C

Noise Modelling Scenarios

G:\GIS\Minor Projects\0041010 Bombala\0041010 Annex C ENM Modelling Scenario Stage1.WOR 30.05.06 Environmental Resources Management Australia Pty Ltd

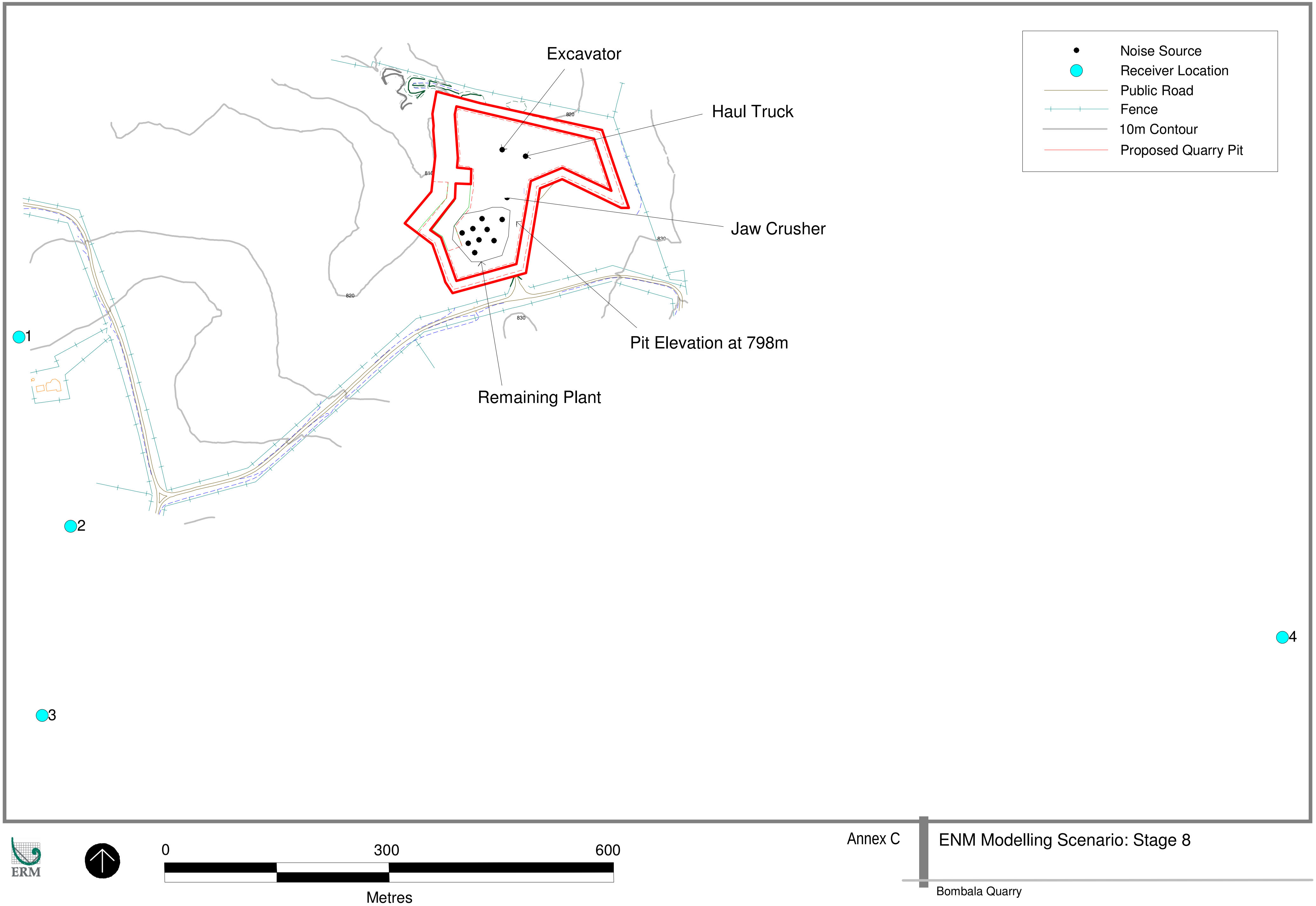


Annex C

ENM Modelling Scenario: Stage 1

Bombala Quarry

G:\GIS\Minor Projects\0041010 Bombala\0041010 Annex C ENM Modelling Scenario Stage8.WOR 30.05.06 Environmental Resources Management Australia Pty Ltd



Annex C

ENM Modelling Scenario: Stage 8

Bombala Quarry

Annex D

Sound Power Spectral Data

Table D.1 Sound Power Spectral Data, dB

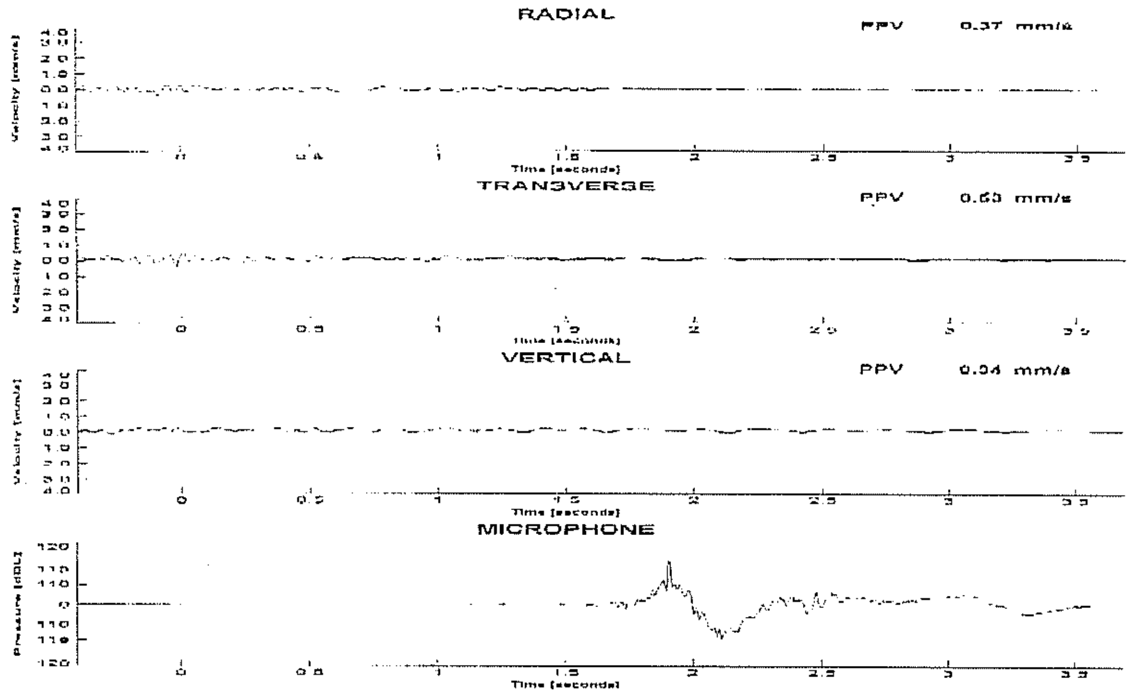
No.		25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	12500	16000	20000	Linear	A-Weighted
1	Front End Loader	98	102	102	95	101	99	95	95	96	96	91	93	96	98	95	97	94	94	93	92	91	90	88	86	84	81	85	86	0	0	110	104
2	Excavator	102	104	101	100	99	103	112	98	99	107	101	98	101	102	97	98	97	97	98	97	108	107	103	99	104	98	94	97	0	0	118	114
3	Mini-crusher 1	88	88	96	94	95	100	98	100	99	97	99	101	106	105	103	102	102	103	104	106	105	103	100	98	96	94	91	88	0	0	116	114
4	Mini-crusher 2	93	95	98	99	101	104	100	104	102	102	100	98	102	102	101	101	101	102	101	101	100	99	98	96	95	93	89	87	0	0	115	112
5	Screen 1	85	88	91	90	93	96	94	97	96	91	93	92	92	93	92	91	92	93	92	93	93	92	93	95	91	89	88	86	0	0	107	104
6	Screen 2	87	89	95	95	97	101	97	99	96	95	96	96	97	100	99	100	99	100	101	102	103	102	100	98	95	93	91	89	0	0	113	112
7	Screen 3	89	89	94	97	98	100	100	104	100	99	98	102	105	103	104	103	104	104	104	104	104	103	100	98	97	97	95	93	0	0	116	114
8	Screen 4	89	92	99	100	103	102	101	102	101	100	99	99	104	103	102	103	102	102	103	103	103	103	101	99	97	96	92	89	0	0	115	113
9	Generator Set	100	90	97	100	106	117	99	101	99	98	96	94	98	92	89	91	89	88	87	86	85	83	80	78	76	73	70	66	0	0	118	101
10	Jaw crusher	99	101	104	105	107	110	106	110	108	108	106	104	108	108	107	107	107	108	107	107	106	105	104	102	101	99	95	93	6	6	121	118

Annex E

Blast Summaries

Bombala

Time:	15:08:22	Monitor Location:	bombala2
Date:	21 Sep 2005	Blast No/Id:	.



BLAST SUMMARY

Pattern Type	: .	Max. Inst. Charge	: .
Pattern Size (m)	: .	Explosive (Type & Weight)	
Designed Tonnage	: .	a) .	
Bench Height (m)	: .	b) .	
Number of Rows	: .	c) .	
Number of Holes	: .	Delay Type - .	
Blasthole Dia. (mm)	: .	- Average Interval (ms):	.
Stemming (m)	: .	- Duration (ms)	: .
Sub Drill	: .		

PPV (-35Hz)	**: 0.53 mm/s**	**PPV (+35Hz)**	**: 0.12 mm/s**
Peak Vector Sum Velocity	**: 0.56 mm/s**	**Peak Overpressure**	**: 117.1 dBL**

Comments & Observations

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Monitoring conducted by: Jake ....

(Orica Limited:Orica Limited)

Checked by: Macca ....

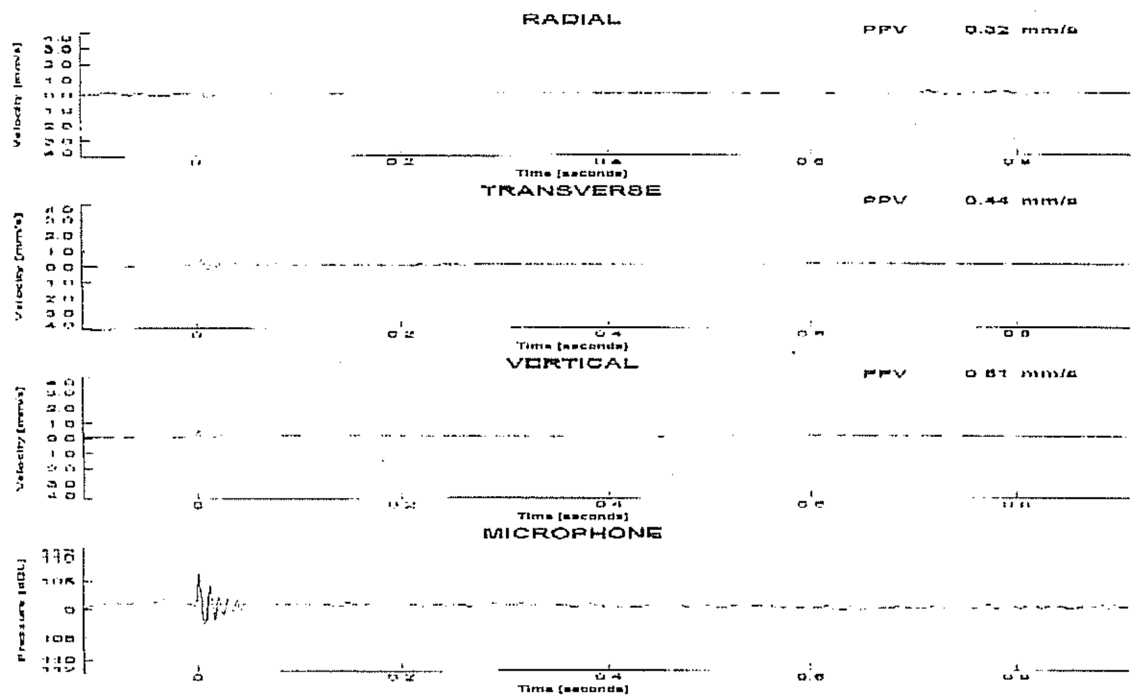
µMX Serial Number: 0355 — Last Calibration: 30 Aug 2004

EL 2.0 Templates\QLD EPP Standard.rtt — Bombala\U0355 - 2005-09-21 15.08.22 - 1.qwf

Bombala

Time: 1308
Date: 30 sep 2005

Monitor Location: Western house
Blast No/Id: .



BLAST SUMMARY

Pattern Type : .
Pattern Size (m) : .
Designed Tonnage : .
Bench Height (m) : .
Number of Rows : .
Number of Holes : .
Blasthole Dia. (mm) : .
Stemming (m) : .
Sub Drill : .

Max. Inst. Charge : .
Explosive (Type & Weight)
a) .
b) .
c) .
Delay Type - .
- Average Interval (ms): .
- Duration (ms) : .

PPV (-35Hz)	**: 0.51 mm/s**	**PPV (+35Hz)**	**: 0.32 mm/s**
Peak Vector Sum Velocity	**: 0.60 mm/s**	**Peak Overpressure**	**: 106.8 dBL**

Comments & Observations

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.slight easterly winds

.

Monitoring conducted by: **.Andrew Mckenna.................................**
(Orica Limited;Orica Limited)

Checked by: ....**Andrew Mckenna....................................**

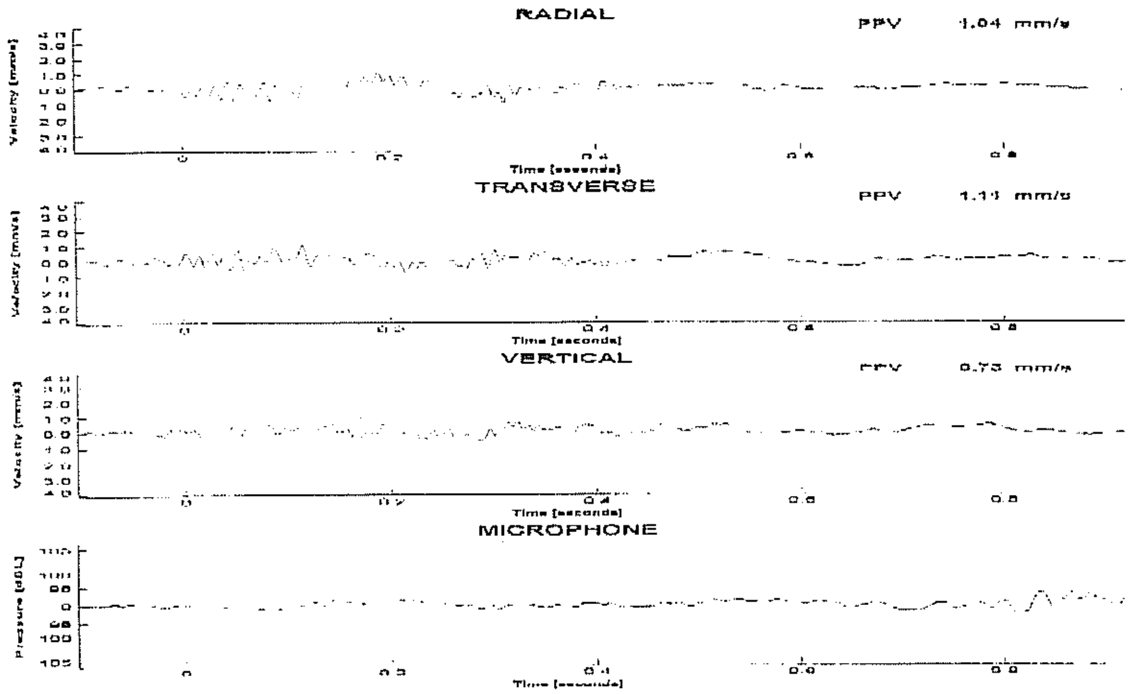
μMX Serial Number: **0546** Last Calibration: **26 Oct 2004**

EL:2.0 Templates\QLD EPP Standard.rtl

Bombala

Time: 15:08:23
Date: 21 Sep 2005

Monitor Location: Bombala
Blast No/Id: .



BLAST SUMMARY

Pattern Type	: .	Max. Inst. Charge :	.
Pattern Size (m)	: .	Explosive (Type & Weight)	
Designed Tonnage	: .	a) .	
Bench Height (m)	: .	b) .	
Number of Rows	: .	c) .	
Number of Holes	: .	Delay Type - .	
Blasthole Dia. (mm)	: .	- Average Interval (ms):	.
Stemming (m)	: . .	- Duration (ms) :	.
Sub Drill	: .		

PPV (-35Hz) : 1.11 mm/s
Peak Vector Sum Velocity : 1.11 mm/s
PPV (+35Hz) : 0.92 mm/s
Peak Overpressure : 91.6 dBL

Comments & Observations

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Monitoring conducted by: ......Jake...... (Orica Limited:Orica Limited)

Checked by: ......Macca......

μMX Serial Number: 0546

Last Calibration: 26 Oct 2004

EL:2.0 Templates\QLD EPP Standard.rtl

Bombala\U0546 - 2005-09-21 15.08.23 - 1.qwf

Annex G

Heritage Assessment

DRAFT REPORT

Boral Resources (Country) Pty Ltd

Bombala Quarry
Heritage Assessment

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Pyrmont, NSW 2009
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Facsimile +61 2 8584 8800
www.erm.com

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1 INTRODUCTION

1.1 PROJECT BACKGROUND

Environmental Resources Management Australia (ERM) was commissioned by Boral Resources (Country) Pty Ltd to prepare a heritage assessment for the proposed extension to Bombala Quarry. The proponent proposes to expand the area currently used to extract basalt for gravel.

This report presents the results of archaeological survey and Aboriginal and historical consultation conducted between January and May 2006.

1.2 ASSESSMENT AIM AND OBJECTIVES

The overall aim of this assessment was to contribute to the Environmental Impact Statement (EIS) by investigating, assessing and providing management recommendations for any heritage within the project land, and identifying the potential impact that the proposed development will have on heritage within the proposed extension. To achieve these aims the following objectives were established:

- to consult with the local Aboriginal community and the local historical society as to the specific social value of the land;
- to understand the regional research context of any heritage objects or places on the land;
- to identify and record any heritage objects and places on the land;
- to assess the significance of these heritage objects and places on the land;
- to assess the impact of the proposed development on Aboriginal and historical heritage values;
- to prepare recommendations on the management of Aboriginal heritage values in consultation with the local Aboriginal community; and
- to prepare recommendations on the management of historical heritage values following consultation with the local historical society.

1.3 *STUDY AREA*

The Bombala Quarry is located wholly within the local government area of Bombala, approximately six kilometres northeast of the village of Bombala, which is situated in the south-eastern region of New South Wales, 504 kilometres south west of Sydney and 81km south of Cooma (*Figure 1.1*). It lies within the headwaters of a tributary of Shoemakers Creek which flows into Bombala River, which forms part of the headwaters of the Snowy River Catchment.

The site is accessed via Clay Pipe Springs Road, which can be accessed either via High Lake Road off the Monaro Highway to the north or via Mount Darragh Road to the south. Clay Pipe Springs Road and High Lake Road also service a small number of rural properties.

Boral currently lease the site from John and Pam Thompson. The site is 42 hectares and comprises two land parcels, identified as Lot 229 and Lot 230 of Deposited Plan 756819. The quarry operations currently occupy 4 hectares of Lot 230 and will be expanded to approximately 7.6 hectares. The quarry and surrounding area is shown in *Figure 1.2*.

1.4 *STRUCTURE OF THIS REPORT*

Chapter 2 provides environmental, historical and archaeological contextual information.

Chapter 3 describes the assessment methodology employed.

Chapter 4 outlines the results of the field survey.

Chapter 5 provides an assessment of the construction impact on potential heritage in the study area.

Chapter 6 details the consultation process.

Chapter 7 lists legislation guiding heritage management.

Chapter 8 includes heritage management recommendations.

1.5 *PROJECT TEAM*

Jenna Lamb (ERM Archaeologist) conducted the heritage field survey, authored the report, and took all photographs. Neville Baker (ERM Heritage Team Leader) completed the technical review of the report. Four representatives of the Aboriginal community participated in the fieldwork on the day of the survey: Bobby Maher and Aaron Taylor from the Eden Local Aboriginal Land Council (Eden LALC), and Tony Boye and Amanda Schubert from the Ngarigu Native Title group (Ngarigu).

G:\GIS\Minor Projects\0041010 Bombala\Site Location.wor 03.05.06 Environmental Resources Management Australia Pty Ltd

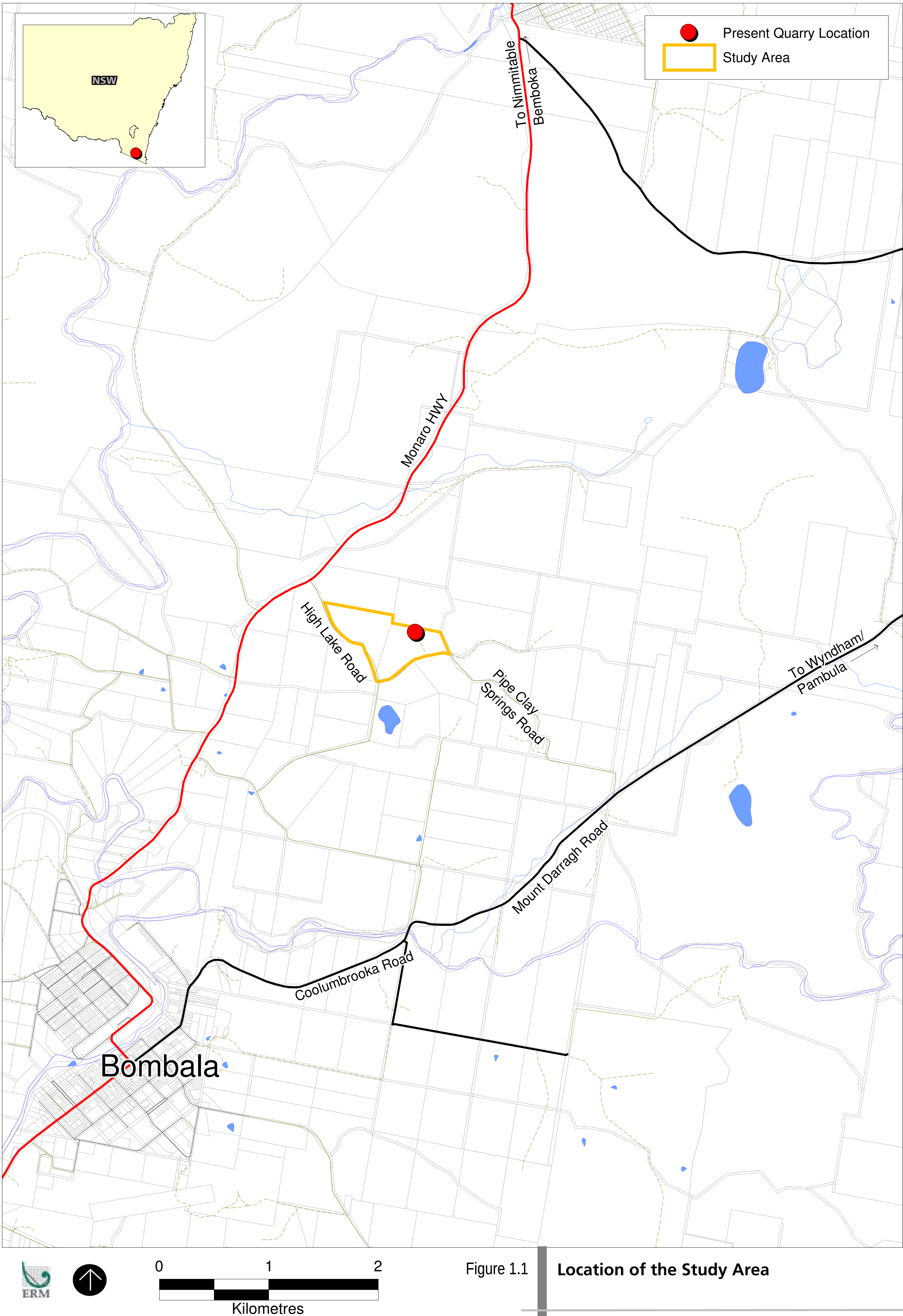

Figure 1.1

Location of the Study Area

Bombala Quarry

G:\GIS\Minor Projects\0041010 Bombala\Heritage\Existing Quarry.wor 11.05.06 Environmental Resources Management Australia Pty Ltd

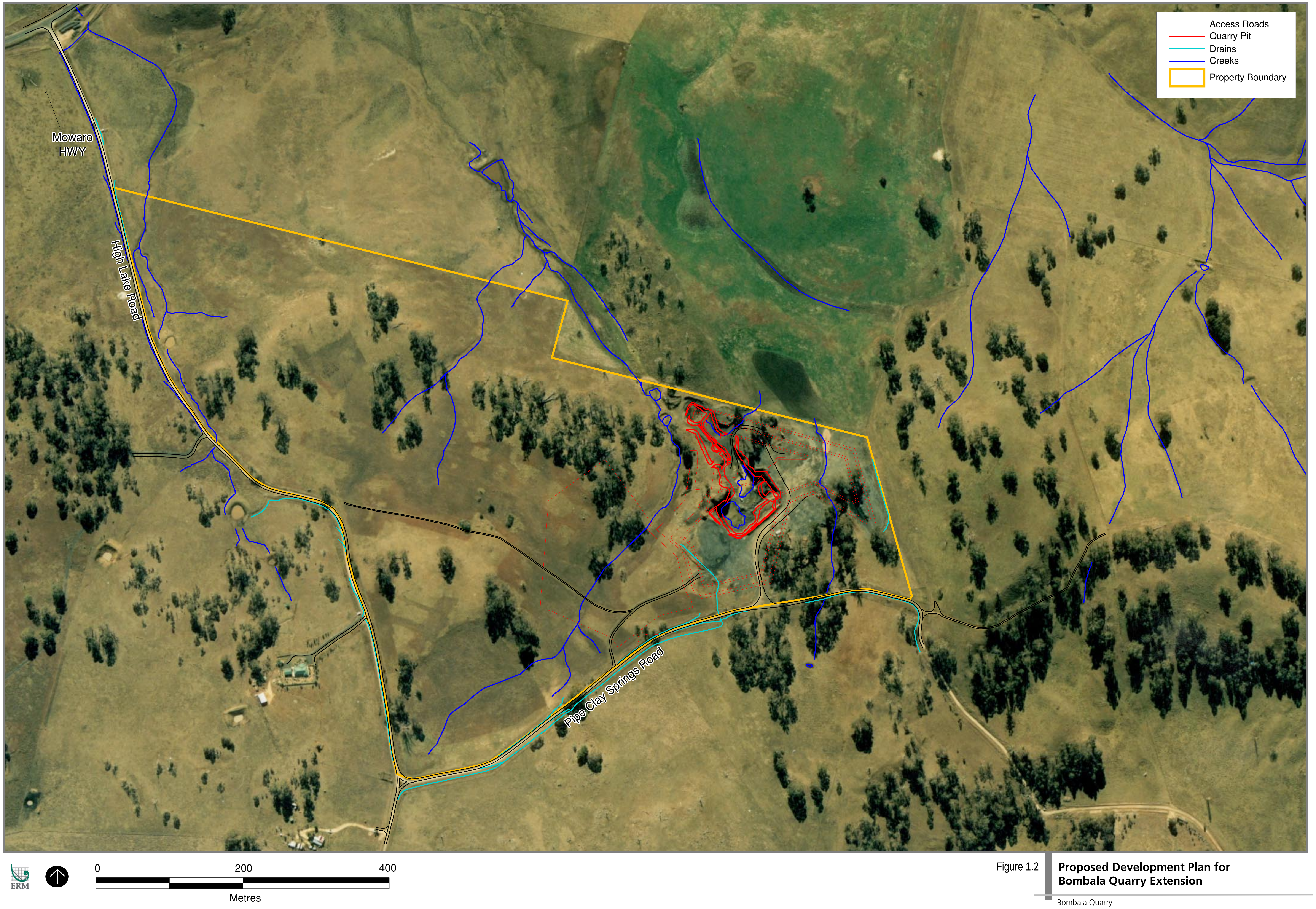

Figure 1.2 **Proposed Development Plan for Bombala Quarry Extension**

Bombala Quarry

2 BACKGROUND

2.1 ENVIRONMENTAL CONTEXT

2.1.1 Terrain

Bombala is located in the tablelands area of the Monaro, which generally occur between altitudes of 610 and 915 metres above sea level. The topography is characterised by broad valley floors with undulating to low relief, and low bordering hills, with extensive colluvial and fan slope deposits. Some of the hills have flat crests that are indicative of plateau basalt flows. Terrain in the study area itself varies from undulating to low relief, sloping from a ridge at its eastern end down to the west, to the gully of the drainage line, then cresting to the west. Overall, the study area generally slopes to the north east.

2.1.2 Drainage

A second order tributary of Shoemakers Creek is the main drainage line in the study area. This tributary joins Shoemakers Creek approximately 1.5 km to the north west. The presence of this tributary allows for the existence of open sites, although the intermittent nature of the second order watercourse, being one of the less reliable of water sources in the area, suggests that stone artefacts would only be sparsely scattered, reflecting occasional travel through the area but no substantial camping activities.

2.1.3 Disturbance

The study area has previously been used for farming activities and thus there is evidence of ploughing over part of the land (*Photograph 2.1*) and an old fenceline (*Photograph 2.2*). Nineteenth and twentieth century rubbish has also been spread over part of the area by the ploughing, and included fragments of glass, ceramic and metal. This ploughing has resulted in a fair amount of the ground surface remaining exposed for survey, although the level of disturbance in the area suggests that sites will have been disturbed or destroyed if originally present.

The activities of the present quarry have also disturbed parts of the land, with piles of gravel product around parts of the study area, a fence around the outside boundary of the property, and the construction of noise barriers (gravel piles) in the eastern corner. The road at the south of the property is Pipe Clay Springs Road, and dirt vehicle tracks occur inside the property boundary at the south and east.

Photograph 2.1 Evidence of ploughing along the south eastern side of the property, showing fence at top left corner (facing south west).

Photograph 2.2 Remains of old fenceline beside drainage line (facing north).

2.1.4 *Land Use*

As mentioned above, the land was previously used for agricultural activities, and currently is being quarried in the eastern corner. Land use is in the immediately surrounding area is predominantly rural residential.

2.1.5 *Geology*

The geology of the majority of the tablelands area of the Monaro is dominated by plateau basalt flows of Cainozoic age. These have formed dark and clay rich soil. The predominant soil in the study area is a shallow loam, described as a red-brown clayey topsoil directly related to the basaltic bedrock below. Some raw stone material types were seen in the study area, these being predominantly basalt, as well as some quartz and granite. Loose basalt stones were also found to have been turned up from beneath the ground surface by ploughing, as indicated by large scratch marks on many. No substantial stone outcrops were noted above the ground surface, which indicates that shelter sites, axe grinding grooves and stone engraving/art sites are unlikely to be found in the study area. However, the presence of basalt in current quarrying operations indicates that Aboriginal quarry sites may be found here.

2.1.6 *Vegetation*

The study area is predominantly moderately covered with grasses, with ploughed areas being more sparsely grassed. A stand of lowland grassy woodland occurs on the site and introduced fruit trees are associated with the ruins of the house. Some of these trees had hollows (mostly from fire), and some were seen to be fairly mature, which allows for the possibility of scarred trees being present in the study area.

2.1.7 *Implications For Archaeology*

The environmental context outlined above has a number of implications for archaeology in the study area. Firstly, the presence of some mature trees and water sources within the study area allow for the possibility of scarred trees or open sites occurring here (see *Table 2.1*), however, as the water sources are fairly unreliable (they were dry at the time of the survey) open sites are not likely to be dense in artefacts. Secondly, the lack of substantial stone outcrops denotes that shelter sites, axe grinding grooves and stone engraving/art sites are unlikely to be found in the study area, but the presence of basalt indicates that Aboriginal quarry sites may be found (*Table 2.1*). The ploughing and other disturbance that has occurred also means that if any large Aboriginal sites are present in the study area, they are likely to be located during the field survey, although the level of disturbance in the area suggests that any such sites will not have remained intact, and small sites are likely to have been destroyed, if originally present.

Table 2.1 Aboriginal Archaeological Site Types

Site types	Definition
Open sites [stone artefact scatters]	Open sites, also known as open campsites, are usually indicated by surface scatters of stone artefacts and sometimes fire blackened stones and charcoal. Where such sites are buried by sediment they may not be noticeable unless exposed by erosion or disturbed by modern activities.
Shelter sites	Sandstone shelters and overhangs were used by Aboriginal people to provide campsites sheltered from the rain and sun. The deposits in such sites are commonly very important because they often contain clearly stratified material in a good state of preservation.
Grinding grooves	Grooves resulting from the grinding of stone axes or other implements are found on flat areas of suitable sandstone. They are often located near waterholes or creek beds as water is necessary in the sharpening process. In areas where suitable outcrops of rock were not available, transportable pieces of sandstone were used.
Quarries	These are areas where stone was obtained for flaked artefacts or ground-edge artefacts, or where ochre was obtained for rock paintings, body decoration or decorating wooden artefacts.
Art sites	Aboriginal paintings, drawings and stencils are commonly to be found where suitable surfaces occur in sandstone shelters and overhangs. These sites are often referred to as rock shelters with painted art. Rock engravings, carvings or peckings are also to be found on sandstone surfaces both in the open and in shelters. These are referred to as rock engraving sites.
Scarred trees	Scarred trees bear the marks of bark and wood removal for utilisation as canoes, shields, boomerangs or containers. It is commonly very difficult to confidently distinguish between Aboriginal scars and natural scars or those made by Europeans.
Burial sites	Burials may be of isolated individuals, or they may form complex burial grounds.
Stone arrangements, carved trees and ceremonial grounds	These site types are often interrelated. Stone arrangements range from simple cairns or piles of rocks to more elaborate arrangements; patterns of stone laid out to form circles and other designs, or standing slabs of rock held upright by stones around the base. Carved trees are trees with intricate geometric or linear patterns or representations of animals carved into their trunks. Ceremonial grounds and graves were often marked by such trees. Bora grounds are a common type of ceremonial site and they are generally associated with initiation ceremonies. They comprise two circles, generally edged with low banks of earth but sometimes of stone, a short distance apart and connected by a path.

1. Definitions from Hughes (1984:44-46).

Table from ERM 2004

2.1.8 *Regional Aboriginal Archaeological Context*

Bombala is located in the south Monaro area of New South Wales (which includes the south east forests), and a number of investigations of this region have been undertaken by archaeologists. The substantial antiquity of Aboriginal use of south east NSW has been shown by Lampert (1971, in Packard 1991), who dated Aboriginal deposit at Burrill Lake to 21,000 years BP (Before Present), by Flood *et al.* (1987, in Packard 1991), who dated deposit at Birrigai Rockshelter in the ACT to 21,000 BP, and by Flood (1980, in Packard 1991), who dated deposit at Cloggs Cave in East Gippsland to 17,000 BP.

Lewis (1976, in Navin 1990) and Geering (1981, 1982a and 1982b) completed surveys along the Snowy River south of Dalgety (70 km north west of Bombala) which located many sites. These sites were mostly artefact scatters, and they tended to be found on gentle slopes above flood level. Geering's (1982b) survey located 53 open artefact scatters, five isolated finds and a number of scarred trees. Flakes and cores were the most commonly found artefact types, with unifacial pebble tools, scrapers and hammerstones/anvils the most common implements. Quartz, hornsfels, quartzite, silcrete and river pebble were the main raw materials.

A hearth and associated artefacts located on a small knoll overlooking the Snowy River was excavated by Chapman (1976), who also surveyed a large area around Lake Jindabyne (approximately 80 km from the study area) and located sites on slopes and along drainage lines (including the Snowy River), with the largest sites located close to major water sources (Chapman 1977). Artefacts were often made of worked river pebbles, and included ground edged, uniface and bifacial tools. Silcrete was also a major raw material used for tools. Chapman (1982) also surveyed an area at East Jindabyne and found sites with silcrete and river pebble artefacts, located at the break or base of slopes, near substantial streams.

In 1982, Djekic found six scarred trees, four artefact scatters and two isolated finds along a proposed transmission line between Cooma (80 km north of Bombala) and Jindabyne, and Geering (1982c) collected 720 artefacts from one of these sites. Silcrete, quartzite, river pebbles, quartz and fine-grained volcanic stone artefacts were found, in the form of hammerstones, backed blades, bifacial and unifacial tools, scrapers, waste flakes and debitage.

Investigations along the proposed Berridale (roughly 80 km north west of Bombala) to Lake Jindabyne water pipeline route by Koettig (1989) and Silcox (1990) located six artefact scatters and six isolated finds. Most sites were found on slopes, with some on crests, spurs, knolls, saddles and creek banks, and silcrete and quartz were the main raw materials.

Gallard (1975, in Navin 1990) surveyed parts of the shore of Lake Jindabyne (approximately 100 km north west of Bombala) and the Snowy River, and located 37 sites, most of which were artefact scatters, with eight being hearths. These sites were located on foreshores, spurs, ridges and crests.

Packard (1990) surveyed an area proposed for a sewerage scheme at East Jindabyne, and located two artefact scatters, one with 19 artefacts (quartz and silcrete flaked artefacts, including one blade and one core) located on a gentle slope, and one with more than 40 artefacts (mainly quartz, as well as silcrete, cherts, moss agate and river pebble flaked artefacts including a geometric microlith, multi-platform core, uniface and bipolar tools) located on a low ridge.

Navin (1990) surveyed an area in East Jindabyne proposed for a housing estate and located 11 artefact scatters (low to medium density) and seven isolated finds located on ridges (crests, shoulders and sides), on knolls, saddles and along the drainage line. Silcrete and quartz were the predominant raw materials, and river pebbles and some other stone materials were also noted.

Byrne's (1981, 1983, 1984, in Packard 1991) work in the Five Forests and Wandella-Dampier Forests indicated that ridgelines were the landform upon which sites were most likely to be found, although ease of access and suitability for camping may have been a contributing factor to this result, and Packard (1991) suggests that in open forested areas sites may be more dispersed, or more linear in pattern in denser forest areas. He also notes that most sites in forested lands south and west of Bega (such as Bombala) were found along creeks and rivers and close to swamps (ie. in valleys), rather than on ridgelines (Feary 1986, 1988, and Hall 1991, in Packard 1991). Sites have also been located on ridgelines and spurs/slopes, but not as frequently as along water courses in valleys, and most sites in the South East Forests area were low-density open artefact scatters spread out over large areas, with some stone quarries, stone arrangements and scarred trees also recorded (Packard 1991). In the adjacent Southern Uplands area, including Jindabyne, Geering [1982b] notes that art sites, rock quarries, burials, ceremonial grounds, stone arrangements and scarred trees have also been recorded along with the predominant open artefact scatters. Quartz is the predominant raw material type, with flaked pieces and flakes being the most common artefact types and cores and retouched artefacts being quite rare (Packard 1991).

Aboriginal occupation along the adjacent South Coast region has been dated from Pambula Lake (Sullivan 1984, in Packard 1991), Bass Point (Sullivan 1987, in Packard 1991) and Disaster Bay (Colley 1989, in Packard 1991). Pambula Lake has been dated to 1,200 BP, Bass Point to 740 BP and Disaster Bay to 460 BP. These sites are all situated in coastal environments and show that Aboriginal occupation of the region continued through to European contact. Apart from middens and open sites, other sites recorded in the region include rockshelters with art, rockshelters with archaeological deposit, stone quarries, stone arrangements and scarred trees. Burials may be located in the soft sandy soils, possibly in association with middens or open sites.

2.1.9 *Local Aboriginal Archaeology*

A search of the Aboriginal Heritage Information Management System (AHIMS) Aboriginal Sites Database at DEC within an area roughly 4 km by 4 km centred on the study area was undertaken on 25 January 2006. The search revealed that no sites had been recorded within this area.

2.1.10 *Implications For The Study Area – Predictive Model Of Site Location*

Bombala is located in the tablelands region of the Monaro, which is characterised by broad valley floors and low bordering hills overlying plateau basalt flows. Packard (1991; in a study of the south east forests area including Bombala) predicts that in a tableland landform:

> Sites will be widely dispersed across the landscape although they will be found commonly on slightly elevated ground near rivers, streams and swamps. Sites will also be located to take advantage of shelter. Site preservation will depend mostly on local geomorphic conditions and recent land-use. There is a chance for stratified sites in sediment trap areas around drainage lines although valley in-fill may mean the sites are deeply buried.

Johnson (1991) predicts that open sites are most likely to be found on level or gently sloping ground, rather than on steeper slopes, and Lewis (1975) also predicts that flat or gently sloping land that is well drained (above flood level) but close to water will most likely have open artefact scatters. Johnson (1991) also predicts that in this region artefact scatters are most likely to occur, as well as a background scatter of isolated artefacts, that shelter sites would be rare but may be associated with burials (which also may be associated with stone arrangements), that scarred trees may be found but carved trees and ceremonial grounds were highly unlikely, although stone arrangements and bora rings are perhaps more likely.

The landform, geological characteristics and established pattern of local Aboriginal site occurrence all suggest that stone artefact scatters or isolated finds will occur within the study area. Stone artefact scatters are the most common site type in the region and are most likely to occur, probably in close proximity to water, although they are unlikely to be dense because the water source in the study area is not a major reliable source. Isolated finds can also potentially occur, particularly along the water course, on flats and on hill slopes.

Scarred trees are possible as some mature trees exist in the study area. Carved trees, on the other hand, are extremely rare in the Monaro region and hence are unlikely to occur.

The presence of a drainage line and underlying basalt means that grinding grooves, engravings or other stone based sites may occur, although a lack of this stone above the ground surface would preclude these sites being found during a survey. The lack of stone overhangs and caves means that shelter sites (with art or deposit) will not be found in the study area. Quarry sites are possible owing to the presence of a suitable stone outcrop, although basalt is generally not the preferred stone source for Aboriginal stone artefacts.

Stone arrangements, bora grounds and earth circles are unlikely to be found in the study area because of its disturbed nature. Burials are usually located along water courses and in soft sand or on hill tops/ridges, so it is possible that burials may be located along the drainage line, but the fairly low-lying and hence flood-prone nature of the drainage line make this possibility fairly unlikely. Further, there is no indication that burials are more likely to occur in this area than in any of the surrounding localities.

This predictive model for the study area should be considered within the wider local area, where major artefact concentrations are anticipated along the major water courses such as the Bombala and Coolumbooka Rivers. These major reliable water sources would have attracted more intensive camping use leading to development of larger archaeological sites from "overprinting" of camping and activity events. In contrast, the study area itself with its ephemeral, often dry drainage line, would have been subject to fairly low-intensity activity events dispersed over a wide area.

2.1.11 Regional Historical Context

Bombala is an Aboriginal name, meaning "meeting of the waters". The post-contact development of Bombala appears to have begun in the 1840s with the main part of the settlement located on the northern side of Bombala River. The first store and inn was built in 1843 on the southern side of the River in Timor Street, and was owned by William Hamilton. A police officer was first stationed at Bombala in 1847-8 and the Post Office was established in 1849. The township of Bombala was approved by the Governor and a notification placed in the Government Gazette on 18 September 1849, with the first crown land sale occurring on 20 November 1850.

By 1851 a population of 980 (613 men and 367 women) was reported for Bombala in the Census, and in 1852 goldfields were established in the surrounding area at Bendoc and Delegate. The Bombala Times newspaper was established in 1863, and this was also the year that the National School opened. The first bank operated in 1866 from a house in Caveat Street.

Houses of some substance began to be built in the late 1860s and the first two storey buildings in Bombala were built in the 1870s. Bombala's Telegraph Office was officially opened on 1 December 1878.

By 1890 (26 November) Bombala had been proclaimed a Municipality. Bombala Telephone Exchange opened on 4 August 1910 and the railway operated in Bombala from 1921 (9 December) to 1990. Bombala was the most southern railway town in NSW.

The earliest Parish map available for the study area dates to 1894 and lists the owner of the land (Lot 230 on DP 756819) as John Comben Jnr. The owner remained the same through the 1905, 1914 and 1922 Bombala Parish maps, but the 1928 and 1936 maps listed the owner as The Commonwealth Banking Company of Sydney Ltd (Lot 230).

There are a number of heritage-listed items in Bombala on the Australian Heritage Places (AHP) listings. However, most of these sites are located in the township of Bombala (the quarry site being approximately 5 km away) and no items are listed within the study area.

3 METHODOLOGY

The assessment of Aboriginal and historic heritage issues for Bombala Quarry involved undertaking a number of tasks, which are outlined below.

3.1 BACKGROUND RESEARCH AND REGISTER SEARCHES

3.1.1 Aboriginal Heritage

The main method used in background research involved a review of relevant archaeological reports lodged in the DEC Archaeological Reports Catalogue at Hurstville. The relevant register for Aboriginal sites is the DEC's Aboriginal Heritage Information Management System (AHIMS) Aboriginal Sites Database, which was searched before field survey began in order to ascertain the types and frequency of sites in the area.

3.1.2 Historic Heritage

Background research into the historic heritage of the area involved examinations of the local historic Parish maps, and online research into the names that appeared on those maps in the locality of the study area. Historic place searches were also made of the following heritage registers:

- Register of the National Estate;
- National Heritage List;
- State Heritage Register;
- State Heritage Inventory;
- RTA Heritage Register; and
- Bombala Local Environmental Plan Heritage Items Schedule 1990.

3.2 *CONSULTATION*

3.2.1 *Aboriginal Heritage*

Aboriginal heritage is a broad concept encompassing language, stories, ceremony and places with physical evidence of Aboriginal occupation. From the outset of this investigation ERM acknowledged the possibility that Aboriginal heritage values may be present in many forms including, but not limited to, those values directly related to the presence of Aboriginal archaeological sites.

The investigation of Aboriginal heritage values not related to archaeological sites relied on contact with local Aboriginal community groups for advice. Although previous assessments had not flagged "non-archaeological" heritage values relating to the study area, this assessment did not discount the possibility that previously unrecognised values may exist. The method adopted to explore this issue was an invitation to the two local Aboriginal groups (Eden LALC and Ngarigu) to participate in survey work and identify any heritage issues on the land.

3.2.2 *Historic Heritage*

Consultation was undertaken with the Bombala & District Historical Society to establish whether any known heritage values were associated with the property. The Society was offered the opportunity to contribute any knowledge they had about the land or those associated with it.

3.3 *FIELD SURVEY AND RECORDING*

The field survey was conducted in light of the responses from the Aboriginal and historic communities (see *Chapter 6* for the results of the consultation), and pursued particularly the identification of Aboriginal and historical heritage values relating to archaeological sites. Field survey methods were adopted to pursue the discovery of new archaeological sites, ensure their accurate recording and provide sufficient background information to provide an assessment of cultural significance to the extent that surface survey allows.

Therefore, field survey of the entire proposed development area was completed by one ERM archaeologist (Jenna Lamb) and two representatives from each of the two above-mentioned Aboriginal groups (Bobby Maher and Aaron Taylor from Eden LALC, and Tony Boye and Amanda Schubert from Ngarigu). Each of the different landforms identified in the study area were covered in the survey, namely slopes, ridge tops and creek banks. Survey focussed particularly on areas of visibility, the water course, trees, any surface stone that may contain art or engraving, and European structures visible on the ground.

4 *RESULTS*

No Aboriginal or historical sites were located within the boundaries of the study area.

4.1 *FIELDWORK CONSTRAINTS AND OPPORTUNITIES*

The survey was limited to some extent by the grass cover that was present over parts of the study area. It is estimated that approximately 30% of the ground of the study area was visible (see *Annex A* for the Effective Coverage Table), which is quite reasonable for a heritage survey. Covering grass was no longer than ten centimetres in length, and in many areas the ground had been ploughed, exposing sections of the ground surface. In light of these constraints, the survey focused particularly on the patches of visible ground, the drainage line, the trees, and any surface stone that may contain art or engraving. No surface stone was located within the study area (only individual stones brought up to the surface by ploughing and which exhibited impact marks). Some mature native trees occurred in the study area but none of these were scarred or carved. Also, it appears that the majority of the study area has been previously disturbed (see *Section 2.1.3*), and this disturbance combined with the reasonable visibility indicates that artefacts from any large, intact Aboriginal heritage sites would have been located during the survey.

4.2 *DISCUSSION*

No Aboriginal or historical sites were found within the study area. The eroded exposures in the study area provided a "window" into the topsoil archaeological content. The absence of artefacts from these eroded and extensive exposures can be regarded as an indication of the archaeological paucity of the study area.

An assessment of the impact on Aboriginal and historical heritage in the study area is provided in the following chapter.

5 IMPACT ASSESSMENT

A reasonable assessment of archaeological potential based on the surface evidence suggests that there will be low potential to impact to any undetected subsurface Aboriginal or historical heritage material. The level of disturbance and visibility indicated that artefacts from any large, intact subsurface Aboriginal heritage sites would have been located during the survey, as would large historic sites.

6 CONSULTATION

6.1 ABORIGINAL CONSULTATION

Aboriginal consultation is required for any assessment of Aboriginal heritage. The DEC has released the Interim Community Consultation Requirements guideline (2004) for Aboriginal consultation in relation to any study that might eventually be used to support an application under Part 6 of the National Parks & Wildlife Act 1974 (i.e. Section 90 consents to destroy sites and Section 87 permits to collect/investigate). The interim guideline sets out a process of inviting Aboriginal groups to register interest as a party to consultation (including local press advertisement), seeking responses on proposed assessment methodology, and seeking comment on proposed assessments and recommendations. The interim guideline requires proponents to allow 10 working days for Aboriginal groups to respond to invitations to register, then 21 days for registered Aboriginal parties to respond to a proposed assessment methodology, and then allows 10 days for groups to review a draft report and comment on the results and management recommendations made.

The consultation for the proposed extension of Bombala Quarry has been carried out in accordance with the DEC guidelines. A local press advertisement, a notice of Aboriginal consultation, requesting individuals and groups interested in being consulted on this project to write to ERM, was run in the Bombala Times newspaper on January 25, 2006. No responses to this advertisement were received from Aboriginal groups or individuals.

Requests for lists of relevant Aboriginal groups or individuals for the Bombala area were also sent to the Register of Aboriginal Owners, Bombala Shire Council and the DEC, and a search of the National Native Title Tribunal was carried out on 16 January 2006. One active claimant application was found for the Bombala LGA, named “Ngarigu”. Native Title is extinguished in all land that is freehold or was freehold in the past. Therefore, all freehold land in NSW can not be claimed by Native Title applicants. As the study area is freehold land, Native Title is extinguished, but such claims in the area are useful for identifying Traditional Owner groups, regardless of land tenure.

The two Aboriginal groups and individuals identified (along with four government authorities) were contacted by fax, letter or telephone regarding the heritage assessment, and invited to be consulted and involved in the study. The Eden Local Aboriginal Land Council and the Ngarigu Native Title group were also invited to provide one community representative to participate in the survey of the study area, and to comment on Aboriginal heritage issues. No Aboriginal heritage issues with the study area were identified by these two groups.

Details of the Aboriginal consultation regarding the heritage assessment are provided in *Annex B*.

6.2 *HISTORIC CONSULTATION*

Contact made with the local historical society, Bombala & District Historical Society, found that the Society knew of no issues with historic heritage in the study area.

7 *RELEVANT LEGISLATION*

Aboriginal cultural heritage in NSW is protected by the *National Parks and Wildlife Act 1974*. Land managers are required to consider the effects of their activities or proposed development on the environment under several pieces of legislation, principally the *Environmental Planning & Assessment Act 1979*. Cultural heritage, which includes Aboriginal and historical heritage, is subsumed within the definition of "environment". Commonwealth legislation protecting Aboriginal/indigenous heritage may also apply to indigenous heritage places in NSW in certain circumstances. Key legislation is summarised below.

7.1 *NATIONAL PARKS AND WILDLIFE ACT 1974 (NSW)*

All Aboriginal objects within the state of New South Wales are protected under Part 6, and particularly Section 90, of the *National Parks and Wildlife Act 1974 (NPW Act)*.

Under Section 5 of the *NPW Act*, "Aboriginal object" means any deposit, object or material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of the area that comprises New South Wales, being habitation before or concurrent with (or both) the occupation of that area by persons of non-Aboriginal extraction, and includes Aboriginal remains.

Sites of traditional significance that do not necessarily contain archaeological materials may be gazetted as "Aboriginal places" and are protected under Section 84 of the *NPW Act*. This protection applies to all sites, regardless of their significance or land tenure. Under Section 90, a person who, without first obtaining the consent of the Director-General of the DEC, knowingly destroys, defaces or damages, or knowingly causes or permits the destruction or defacement of or damage to, an Aboriginal object or Aboriginal place is guilty of an offence.

Amendments introduced by the *National Parks & Wildlife Amendment Act 2001* which strengthen the provisions of Section 90 (eg. removing the term "knowingly") have yet to commence.

The DEC is the responsible authority, with the Director-General of that department the consent authority where a permit or application is required.

7.2 *HERITAGE ACT 1977 (NSW)*

The *Heritage Act 1977* protects the natural and cultural history of NSW with emphasis on non-Indigenous cultural heritage. It provides automatic statutory protection to 'relics'. The *Act* defines a 'relic' as:

> *Any deposit or material evidence relating to the settlement of the area that comprises NSW, not being an aboriginal settlement, which is 50 or more years old.*

Sections 139-145 of the *Act* prevent the excavation or disturbance of land known or likely to contain 'relics', except in accordance with an excavation permit issued by the Heritage Council of NSW (or in accordance with a gazetted exception under Section 139(4) of the *Act*). The study area does not contain historical features and is thus not subject to these provisions.

7.3 *ABORIGINAL AND TORRES STRAIT ISLANDER HERITAGE PROTECTION ACT 1984 (COMMONWEALTH)*

The *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* protects areas and/or objects which are of significance to Aboriginal people and which are under threat of destruction. The Act can, in certain circumstances override state and territory provisions, or it can be implemented in circumstances where state or territory provisions are lacking or are not enforced. A significant area or object is defined as one that is of particular importance to Aboriginal people according to Aboriginal tradition. The Act must be invoked by or on behalf of an Aboriginal or Torres Strait Islander or organisation. No Aboriginal areas or objects were identified within the study area and thus it is not subject to the provisions of this Act.

8 *MITIGATION MEASURES*

This draft report is to be provided to those organisations that have registered their interest for comment and input into significance assessment and management and mitigation recommendations.

As no Aboriginal sites have been identified on the property, and the study area has minimal potential for subsurface heritage material, no further Aboriginal heritage work is recommended. A precautionary approach will be adopted and the following mitigation measures implemented:

- site personnel undertaking the proposed construction works be instructed that under the *National Parks and Wildlife Act 1974,* it is an offence to knowingly deface, destroy or damage, or permit the defacement, destruction or damage of, an Aboriginal place or relic without first having the written consent of the Director-General; and

- if any Aboriginal heritage material is discovered, works must cease in the area, and DEC and the relevant Aboriginal groups must be informed. Works must not continue without the written consent of the NSW DEC.

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Annex A

Effective Coverage Table

Table A.1 Effective Coverage

Location	Area (ha)	Exposure (%)	Visibility (%)	Exposure Area (ha)	Effective Coverage
Ridge (east)	2	55	60	0.66	33%
Eastern slope	4	45	55	0.99	24.75%
Gully/drainage line	1	40	30	0.12	12%
Western slope	6	50	60	1.8	30%
Crest	2	50	65	0.65	32.5%
ALL	**15**			**4.22**	**28.13%**

Annex B

Aboriginal Consultation Log

NOTIFICATION

Table B.1 Outgoing Communications

Date	*Organisation/group/individual*	*Contact Name*	*Details*
16/01/06	National Native Title Tribunal	Website	Searched for Native Title claims in Bombala LGA and found one claim active since 19 December 2005, being Ngarigu.
16/01/06	National Native Title Tribunal	N/A	Rang to ask for contact details of Ngarigu group.
17/01/06	DEC	Fiona Hamilton	Faxed a request for a list of groups to be consulted for this project.
17/01/06	Register of Aboriginal Owners	Adam Black	Faxed a request for a list of groups to be consulted for this project.
17/01/06	Bombala Shire Council	N/A	Faxed a request for a list of groups to be consulted for this project.
17/01/06	Eden Local Aboriginal Land Council	Penny Stewart	Faxed a request for a list of groups to be consulted for this project.
17/01/06	Ngarigu (Native Title group)	Ellen Mundy	Faxed a request for a list of groups to be consulted for this project.
17/01/06	Bombala Times	N/A	Faxed details of advert requesting expressions of interest - advert printed in paper on the 25th.
17/01/06	Eden Local Aboriginal Land Council	Penny Stewart	Rang to see whether fax was received as an error message was given when sent. No-one answered.
18/01/06	Bega Local Aboriginal Land Council	N/A	Rang to see whether Bombala was in their boundaries. Said they would ask their sites officer.

Date	*Organisation/group/individual*	*Contact Name*	*Details*
18/01/06	Eden Local Aboriginal Land Council	Penny Stewart	Rang to see whether fax number I had was correct. Left message to this effect.
18/01/06	Bega Valley Sewerage Program	Linden Edgell	Emailed to ask if they had accurate contact details for the Eden LALC.
24/01/06	Bega Valley Sewerage Program	Linden Edgell	Fax of information to discuss with Eden LALC.
24/01/06	Eden LALC	Bobby Maher	Faxed a request for a list of groups to be consulted for this project.
24/01/06	Eden LALC	Bobby Maher	Phone call to check that fax was received. Bobby said he was not at the office but would ring tomorrow if it hadn't arrived or if there were any problems.
03/02/06	Eden LALC	Bobby Maher	Fax with proposed methodology, fieldwork details and payment information, and map of study area.
03/02/06	Ngarigu	Ellen Mundy	Letter with proposed methodology, fieldwork details and payment information, and map of study area.
09/02/06	Ngarigu	Tony Boye	Phone call to see if letter was received. Tony said he hadn't received it and asked if I could email it. Tony said he would talk with Ellen about the letter.
09/02/06	Ngarigu	Tony Boye	Email with proposed methodology, fieldwork details and payment information, and map of study area.
09/02/06	Ngarigu	Tony Boye	Email with more specific detail of the survey, going step by step through the process we propose.
14/02/06	Eden LALC	Bobby Maher	Phone call to check that the Eden LALC representatives had high visibility vests and sturdy boots. Bobby said they did and said he or Aaron would be at the quarry for the survey.
14/02/06	Ngarigu	Tony Boye	Phone call to check if Ngarigu representatives had high visibility vests and sturdy boots, and insurance certificates. Tony said they did have the clothing and were waiting on NRMA to provide them with the certificates.

Date	*Organisation/group/individual*	*Contact Name*	*Details*
14/02/06	Eden LALC	Bobby Maher	Left message asking if Bobby would be able to bring insurance certificates to the survey for our records.
22/02/06	Eden LALC	Bobby Maher	Fax describing consultation process and how we found out about Ngarigu from the National Native Title Tribunal. Mentioned I'd spoken with Tony Boye and Ellen Mundy.

Table B.2 Incoming Communications

Date	*Organisation/group/individual*	*Contact Name*	*Details*
17/01/06	Register of Aboriginal Owners	Adam Black	Fax received with search results for the Register of Aboriginal Owners: no Registered Aboriginal Owners.
18/01/06	Bombala Shire Council	Sarah K	Email received saying Eden LALC or Bega LALC should be contacted.
18/01/06	Bega Valley Sewerage Program	Linden Edgell	Email saying she was out in the field but would send me the accurate contact details for the Eden LALC when she returned to the office.
19/01/06	Ngarigu	Tony Boye/Ellen Mundy	Phone call in response to initial consultation letter, saying they would like to be consulted. Said Ellen and Debbie Mundy had done a lot of work in the area and organized the Native Title claim, and were particularly interested in a pathway running to Cathcart and near Bombala. Said they'd be interested in knowing about any artifacts found at the quarry and what happens to them, particularly during the development, but they are not interested in opposing the development. Ellen said that Ngarigu would like to be involved in the survey and she assumed that the Eden LALC would also be involved. I said I would send her a methodology letter in the next couple of weeks.
24/01/06	Bega Valley Sewerage Program	Linden Edgell	Phone call asking if I could send her some information for the Eden LALC for when she tried to ring.
24/01/06	Bega Valley Sewerage Program	Linden Edgell	Email saying she'd spoken with Bobby Maher, Cultural Heritage Officer for the Eden LALC who said they cover the Bombala area with regards heritage assessments. Linden said she would fax him the information on the survey, and listed his phone and fax numbers.
09/02/06	Ngarigu	Tony Boye	Email in response to my email, asking if there were any additional details of the methodology, and saying that Tony or Ellen would represent Ngarigu for the field visit.
16/02/06	Eden LALC	Bobby Maher	Insurance certificates given to me for survey.

Date	*Organisation/group/individual*	*Contact Name*	*Details*
21/02/06	Ngarigu	Tony Boye	Letter in response to the methodology and survey, concluding that the survey found no obvious signs of indigenous habitation and disrupting the current activities may not be warranted without some definitive indicators. Said that they would be interested in any signs of the strata exposed in further open cut quarrying, and mentioned that eagle was seen, which is an important totem to the group.
22/02/06	Eden LALC	Bobby Maher	Phone call asking if we had any details on the Native Title group, and how we found out about them (ie our consultation process). I said that I would fax him some more details.

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February 21st 2006

Attention Jenna Lamb

Dear Jenna,

Thankyou for involving the Ngarigu in your Heritage assessment of the Boral Quarry site in Bombala and please do not hesitate to contact us at any time.

Methodology

Due to our interest in the area of the Ngarigu Dialect Boundary, we would like to know if any objects have been found over the life of the Quarry and perhaps canvas the locals as to what items may have already been retrieved by interested locals.

We should all ensure during this process that there is respect given to the pioneer history and their families. We, the Ngarigu representatives, would like to encourage the sharing of information and bring back some of the co-operation between black and white cultures that influenced the development of the local region.
There are aspects of this process that can be in the very spirit of reconciliation and a shared pride of a shared local history.

Considering the site at Bunyan near Cooma there is potential for late Pleistocene evidence or at least perhaps sites, which could reflect, migrations after the ice melt.

Of more modern interest is the potential to get an insight into relationships and perhaps transits between the Ngarigu on the Monaro, the Yuin and the Gippsland tribes.

It is also of interest that the local Bombala and Maclaughlin Rivers were used as 'gateways or a 'corridor' to the lower Snowy, Byadbo and Currawong.

The site is also on the fringes of 'tomahawk' and escarpment tribes and there maybe some minor differences in materials.
Seasonal migrational deposits may be possible if food remnants are established.

Set out on page two is a brief overview of our aspect of the survey.

Inspection Report Thursday February 16th 2006 9:00 am

Staff; Tony Boyé and Amanda Schubert

We arrived at the Boral site from Pipeclay Spring Road, off the Pambula Road out of Bombala.

As I did not have a compass I refer to the Gate as the Southern boundary of the site, my apologies for any confusion.

The site, 100 acres, has the highest point as the western boundary and slopes with two watercourses eastward. The two water flows dissect the block, a hundred and fifty metres (or so) apart and flow towards the east.

The northern boundary is also on a slope.

Across the block, running north south are two ridges, which appear to have had rubble added over the years including some waste.

We first spread out along the southern boundary to the right of (and behind) the office and along the eastern fence as far as the workings allowed.
We then moved back through the gully behind the office back to the open cut.

We then spread out and moved through the ploughed patches leading up to the northern boundary, which is also the top ridge of the site.
There are a number of crushed basalt stockpiles of varying grades, particularly along the northern border and these extend toward the original homestead and fruit trees.
There is also a seepage well, down from the home to the east, which is filled in and this would be worth digging out if Boral where agreeable.

We then spread out through the ploughed field southward between the two ridges.
At the northern edge of the open cut we turned eastward spread out through the first water course and up the slope to the north. I walked down the watercourse.
There is a thick layer of basalt clay, a result I would assume of the leaching of the piles up the slope.
The watercourse is still quite damp and would be a reasonable torrent with rain I would think.
There are some deep pools (soaks) along the course.
This and the other water run off, seem to congregate further down the vale where there appears to be permanent lagoons, a source of bush tucker.

At the eastern fence line we turned northward following, some pink marker stakes.
This took us along the eastern gradient of the second, south north ridge, and up the slope toward the end of the survey markers. I wondered if this was the limit of the basalt knoll?
There were quite a number of test holes visible in this area.

On the northwestern route up the slope there is a smaller watercourse with fewer and smaller pools and soaks similar to the parallel watercourse.
At the peak of the northern part of the ridge it slopes downward to the north, northeast.

We turned around and headed southward towards the entrance and open cut.
Along this ridge there is a lot of material which appears not to be original landform and is full of bottles, cans and signs of European settlement, some very, very recent.

Back at the Office Bobby and Aaron, from Eden Land Council decided that there was no point in continuing and that no sites required further investigation.
I asked Jenna if there was anything else that needed doing and she said that was the end of our part of the survey.

Ecology

When we first arrived I asked Tom Behrena, site Production Manager, if they had found anything on site previously and if there was any wildlife.
He said they had found some metal axe heads but no cultural items, plenty of rabbits and an Eagle, female he thought.
When we went out, the Eagle (Bunjil, an important totem) circled overhead.
This is of great significance for the Ngarigu. Perhaps not on this hundred acres, but close.

It was also pleasant to see some native geraniums, pink and white flowers, maybe a sort of night shade, still managing to survive. I am not sure there are not remnants of farm and vegetable crops as well.
I am sure the settlers would have enjoyed the cascading ponds with white lilies.

I was also surprised at the girth of most of the trees left standing.
They appear to be old enough to have seen signs of Aboriginal contact.
There is one tree along the lower, more eastern ridge, which is burnt in a style I have seen before.
In this case I think it is more likely to be part of rubbish disposal.

Conclusion

It appears from this survey that there are no obvious signs of indigenous habitation.
Considering the farming and quarry surface disruption it would take an extensive survey to be conclusive. The results may not warrant disrupting the current activities without some definite indicators.
We would however be interested in any signs in the strata that may be exposed in further extensions to the open cut.

As I said before we are interested in modern, recent and ancient occupation of the Monaro.

The Ngarigu Currawong Clan would like to thank ERM and Boral for their commitment to preserving Aboriginal Culture and adding to the rich traditions that are part of the Monaro.

Kind Regards,

Boyé

Tony Boyé

for Debbie and Ellen Mundy

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