GENESIS XERO WASTE

Mail: PO Box 1040, Mascot NSW 1460 | Site: Honeycomb Drive, Eastern Creek | P: 9832 3333 | W. dadi.com.au

ThaQuarry Pty Ltd &

ACN 114 843 453 Pty Ltd

Genesis Xero Waste Facility

Spoil Management Plan

Section 75W application to modify Project Approval No. 06_0139 (MOD 5)

Pre-sort Enclosure

September 2015
Reference: SMP 010915

1. INTRODUCTION

The Proponents of the land are ACN 114 843 453 (**ACN**) and ThaQuarry Pty Ltd (ABN 65 119 533 372) (**ThaQuarry**).

The Land to which the Application applies is identified as Lot 1 of DP 1145808 and is owned by ACN. The land adjacent to the east of Lot 1 was formerly identified as Lot 4 of DP 1145808 is now identified as 8/1200048 and is owned by ThaQuarry. Both lots are the subject of Project Approval No. 06_0139.

1.1 The Modification Application

In March 2015 the Proponent submitted to the Department of Planning and Environment a Section 75W application to modify Project Approval No. 06_0139 (**MOD 5**) which was granted on 22 November 2009 pursuant to Section 75J of the Environmental Planning and Assessment Act 1979 (the Act).

MOD 5 proposes the construction of an additional Pre-Sort Enclosure (**PSE**) neighbouring the existing Materials Processing Centre (MPC) to improve the efficiency of on-site operations and to reduce the amount of waste that ends up in landfill.

2. OBJECTIVES

This document constitutes the Spoil Management Plan (**SMP**) for the Pre-Sort Enclosure.

This SMP has been developed to address the issues raised in a letter from the Environment Protection Authority (**EPA**) dated 10 July 2015. In addition, the Department of Planning and Environment (**DPE**) has requested further information in relation to how the spoil from the earthworks will be managed at the Premises.

Issues to address

The preparation of a Spoil Management Plan that is to include details about:

1. The type of material that is being excavated for the PSE.
2. The volume of the spoil to be moved.
3. The timeframe for how long the surplus spoil will be stored at the Premises.
4. The expected timeframe for the work.
5. How the Proponent intends to identify the surplus spoil from other material stored at the Premises.
6. Any temporary stockpiles.
7. How the Proponent will prevent the contamination of the surplus spoil from other material at the Premises.
8. Information about the erosion and sediment controls that will be implemented by addressing dust emissions and sediment tracking.
9. Final uses/disposal options.
10. Potential impacts and proposed mitigation measures.

The objectives of this SMP are:

- To address the issues raised by the abovementioned government departments.
- To describe the role, responsibility, authority and accountability of all key personnel involved in the spoil management for this project.
- To describe how environmental performance will be monitored and managed.
- To describe all activities to be undertaken on the site during construction phase;
- To describe the work program outlining relevant timeframes that must be met during construction;
- To detail statutory and other obligations that must be met during construction;
- To detail what incident management procedures will be in place during construction; and
- To be made available for public viewing after approval from the Director-General.

3. COMPLIANCE WITH OBJECTIVES

Table 1 lists the requirements of the EPA and the DPE in relation to the management of spoil on the Premises as outlined above. The table provides a summary of where the issues are identified and addressed in this SMP to satisfy the government departments.

Table 1: Requirements and details of where requirement is addressed in this SMP.

Requirement	Section that addresses requirement
The type of material that is being excavated for the PSE.	Refer to Section 10.2
The volume of the spoil to be moved.	Refer to Section 10.3.7
The timeframe for how long the surplus spoil will be stored at the Premises.	Refer to 10.3.6
The expected timeframe for the work.	Refer to 10.3.6
How the Proponent intends to identify the surplus spoil from other material stored at the Premises.	Refer to Section 10.3.5 and Annexure D
Any temporary stockpiles.	Refer to Section 10.3.5
How the Proponent will prevent the contamination of the surplus spoil from other material at the Premises.	Refer to Section 10.3.5
Information about the erosion and sediment controls that will be implemented by addressing dust emissions and sediment tracking.	Refer to Section 10.4
Final uses/disposal options.	Refer to Section 10.3.5-6
Potential impacts and proposed mitigation measures.	Refer to Section 10.4 to 10.6

4. PROJECT DESCRIPTION

Dial A Dump (EC) Pty Ltd, the license holder of EPL no's. 20121 and 13426, operates a major Resource Recovery Facility (RRF) and general solid waste (non-putrescible) landfill facility. The RRF includes a Materials Processing Centre (MPC) and a Waste Transfer Station commonly known and referred to as the 'Genesis Xero Waste Facility' or 'Genesis' at Honeycomb Drive, Eastern Creek. EPL 20121 specifically regulates the MPC operations and related materials. The Project also includes the operation of a general solid waste (non-putrescible) landfill. EPL 13426 specifically regulates the landfill operation.

The waste transfer facility opened 8 June 2012. Mixed or comingled building and demolition waste is transported by truck to the facility where it is unloaded within the MPC. In accordance with approved environmental management strategies for the facility, preliminary sorting of materials for processing takes place within the MPC.

MOD 5 will see the creation of an additional MPC type building called the Pre-sort Enclosure (**PSE**). The PSE will be a completely enclosed building that will allow the further sorting of loads that arrive at the Facility. Larger items will be extracted from the comingled waste stream prior to entering the automated plant.

The addition of the PSE will improve the function and the efficiency of the existing operation by increasing the productivity of the MPC and increasing the amounts of recycled and reused material through improved extraction from exiting waste streams which will further reduce landfill on site. In particular, the PSE will provide an opportunity to increase the rate of recovery of commercial and industrial waste.

The PSE will be located entirely on Lot 1 DP 1145808 to the south of the existing MPC. The PSE itself will be 180.85 metres long by 51.535 metres wide. The warehouse ridge level will be 15.135 metres high. Refer to Pre Sort Centre Site Plan (Drawing No. DA/A 101 Issue F) at **Appendix A.**

There will be three phases for the construction works:

1. Bulk earthworks;
2. Construction of PSE;
3. Commissioning.

This SMP addresses only Stage 1 Bulk Earthworks.

The hours of operation approved in the Project Approval No. 06_0139 allow construction works to be undertaken Monday to Friday 7:00am to 6:00pm, Saturdays 8:00am to 4:00pm and nil on Sundays and public holidays. All bulk earthworks will be undertaken during the normal operating hours of the Genesis Facility, 7:00am to 5:00pm Monday to Friday and 8:00am to 4:00pm on Saturdays.

Bulk earthworks are expected to be completed within 10 weeks of commencement.

Plant and equipment that will be used during earthworks includes loaders, excavators, bulldozer, compacter, crushers, screens and stackers.

5. SPOIL MANAGEMENT PLAN (SMP)

This SMP is designed to provide a works specific overview of the environmental matters related to the MOD 5 development works at Genesis Xero Waste Facility, Eastern Creek NSW.

Documents that are cited and referred to in this SMP:

- S75W Modification 5 Pre-Sort Enclosure application prepared by Urbis, March 2015
- Axis Architectural drawings
- AT&L Civil Engineers drawings
- Douglas Partners Report on Preliminary Contamination Assessment on Stockpiled Material and General Land Quality
- Noise Impact Assessment by Environmental Resources Management Australia
- Air Quality – Odour and Dust report by Holmes Air Sciences

The Environmental Management Strategy (EMS) for the Site prepared on behalf of the Proponent to comply with the requirements of the original Consent Conditions and approved by the Department of Planning and Infrastructure, is referred to throughout this SMP and remain applicable to the development site.

6. CONSTRUCTION PHASES IDENTIFIED IN THIS SPOIL MANAGEMENT PLAN

Stage 1 – Bulk Earthworks

7. SITE MANAGEMENT

Proponent's Site Manager (SM) Rodney Johnson

Proponent's Environmental Consultant (EC) Environconsulting Services Pty Ltd

Contact Details are:

Position	Name	Phone	Email
Site Manager	Rodney Johnson	0408 919 562	rodneyjohnson@dadi.com.au
Environmental Consultant	Environconsulting Services Pty Ltd	0409 538 812	pablog@ecs.sydney
Managing Director	Ian Malouf	(02) 9519 9999	ianmalouf@dadi.com.au
General Counsel	Christopher Biggs	(02) 9519 9999	chrisbiggs@dadi.com.au

8. SITE ENVIRONMENTAL RESPONSIBILITY

Directors and Executive Management

The Directors and executive management shall:

- Comply with the requirements of all applicable environmental laws, regulations, legislations, licenses, development consents and adopt practices that reflect commitment to the protection of the environment.
- Adhere to the principles of sustainable development.
- Conduct regular audits of the operations and apply results of audits and reviews to continually improve processes and implement control measures that will mitigate environmental threats.
- Provide employees with training, induction, information, resources and responsibilities necessary to achieve environmental objectives and targets.
- Evaluate environmental technology and processes for best practices and improve on the Landowners commitment to environmental management through a process of innovation and revision.

Site Manager and Environmental Consultant

The Site Manager (SM) and the Environmental Consultant (EC) will be jointly responsible:

- To ensure the project is delivered in compliance with all administrative and environmental requirements.
- To ensure that the required records/documents are signed off.
- To ensure that the works are carried out in accordance with this SMP.
- To ensure appropriate corrective action is taken when required.
- Ensure that all environmental monitoring required to be carried out pursuant to the Site's Environmental Protection License No's. 20121 and 13426, the original Project Approval and the EMS is continued and monitored appropriately.

Sub-contractor

Subcontractors may be engaged and will be managed by the SM. The subcontractor will be responsible for carrying out their brief as established by the SM in order to meet the responsibilities of the Proponent and obligations pursuant to this SMP.

Site visitors and site customers

Site visitors and customers will have no access to the bulk earthworks area.

Emergency Management Procedure

Emergency Management Procedures are to be conducted as per instructions from the SM or relevant authority, as appropriate. The Pollution Incident Response Management Plan applicable to the Genesis Site is to be followed. Any incidents are to be recorded on the Incident Management Register. This document will be forwarded to the SM for record and appropriate action and reporting. The responsible Manager is to isolate the problem, contact emergency services (if required) and notify the Work Health and Safety Committee and SM.

Sydney Water	132 092	Telstra Cable Damage	132 203	Poison Information Centre	131 126
Ambulance	000	Environment Line	131 555	Public Health Emergencies	9391 9000
Energy Australia	133 466				

9. PLANNING AND ZONING APPROVALS

Part 3A Ministerial Consent dated 22 November 2009 including subsequent modifications.

State Environmental Planning Policy (State and Regional Development) 2011 (NSW)

10. PROJECT STAGE 1 - Bulk Earthworks

Stage 1 Bulk Earthworks

Commence	:	Within one week of receiving approval
Status	:	Awaiting approval
Expected conclusion	:	Within 10 weeks of commencement for the main bulk earthworks

The purpose of the early works is to:

- Establish ground levels for a building pad principally for the Pre-sort Enclosure;
- Outline and prepare roads for paving and for drainage corridors; and
- Rearrange ground levels within the project area.

10.1 Development Site Location

The location of the MOD 5 development site is set out in Axis Architectural's Pre Sort Centre Site Plan (**Annexure A**). Bulk earthworks are required to prepare the development area for the construction of the Pre-sort Enclosure. The winning of material for screening and re-use will take place within the current project area. As such, construction activities will be contained by the western amenity berm reducing the impact of the project on the amenity of the surrounding area.

10.2 Composition of Material

In 2006, Douglas Partners prepared a report entitled Report on Preliminary Contamination Assessment on Stockpiled Material and General Land Quality (**Annexure B**). This report demonstrated that the composition of material in the development area consists of brown silty top soil and silty clay with some ironstone gravel. It was concluded that the stockpile material could be considered VENM and would be suitable for off-site re-use as fill. The material will henceforth be referred to as overburden material. As detailed below, throughout the bulk earthworks phases, samples will be taken continuously and assessed to ensure that the composition of the material is suitable for re-use.

10.3 Procedure

10.3.1 Overview

The area designated for the bulk earthworks and construction of the PSE forms part of the project area covered by Project Approval No. 06_0139.

On 23 December 2011 the Department of Planning and Infrastructure approved an Environmental Management Strategy for the carrying out of bulk earthworks within the project area and for the

construction of two onsite detention basins (OSDs) outside of the Project area. The works currently proposed are the same works covered by that previous Plan. This SMP is an adjunct and an update of the Environmental Management Plan dated November 2011.

10.3.2 Process

Before bulk earthworks commence, the development area will be established by;

- Removing all vegetation from the area to be excavated;
- Installing silt fences and other erosion and sediment control measures;
- Establishing working benches at staggered heights to allow the material to flow downhill between machines.

10.3.3 Bulk Earthworks

The Proponent will conduct cut and fill earthworks in accordance with AT&L's Bulk Earthworks Cut and Fill Plan, Drawing No. DAC003 that appears at **Annexure C**.

Excavators will win the material from the berm, blend the material to ensure consistency and then load it into the crusher. The crusher will process the material and discharge it to the screen. Oversize rock material (if any) will be placed to one side in a stockpile. Stackers will be used to stockpile the screened material. A loader will be used subsequently to load the material into vehicles.

10.3.4 Equipment

The following machinery and plant will be used to conduct the earthworks and process the material;

- CAT972 loader
- CAT320 excavator
- CAT345 excavator
- Kleeman Impact Crusher
- Kleeman MS15 Screen
- Various stackers.

10.3.5 Excavated overburden material

It is anticipated that primarily the material won from the existing berm will, after screening and testing, be suitable for sale.

No mixing of overburden material with other material on site will occur due to the separation of the temporary stockpiles of surplus overburden material from other stockpiles on site. Further, no overburden material will come into contact with waste as the screened material will remain in situ in the area generally marked on the plan at **Annexure D**. All such material will kept in the designated area and thereby

separated from existing stockpiles on site which are located to the north of the site at the Segregated Materials Area [SMA]. Upon sale it will be loaded onto outbound trucks then weighed at the weighbridge before exiting the site.

During the bulk earthworks phase, samples will be taken on a continuous monitoring basis to ensure the quality of the material is of a suitable nature for re-use on site.

In the event that contaminated material is discovered (i.e. material that is found to be unsuitable for sale), the Proponent will, after weighing, send the material directly to landfill in accordance with the Environmental Protection Licenses applicable to the Site.

10.3.6 Timeframe

It is expected that 1,500 tonnes of material will be able to be processed per day, 5 days per week.

No overburden material will be stockpiled on the Site for longer than 12 weeks.

It is expected that the bulk earthworks will be completed within 10 weeks of commencement.

However, the timetable for earthworks and subsequent construction is driven by a range of commercial factors including the requirement to comply with the EPA approved milestones in the PSE project plan. If during processing it appears that the processed material is not being sold at a fast enough rate so as to completely clear the building area then material won will be relocated to the area shown on the drawing at **Annexure E**. The berm will be reshaped so as to maintain its minimum required height.

AT&L have calculated that if necessary, all material to be excavated from the PSE site could be relocated between the two OSDs west of the amenity berm and placed so as to ensure compliance with the drainage requirements specified by Blacktown City Council. Refer to AT&L Soil Management and Sediment Control Plan, Drawing No. SKC004 (**Annexure E**).

Any relocated material will not be placed in uncontrolled stockpiles in this position, rather it will be placed and compacted in the place indicated with a gradient between 1- 3 % to ensure controlled stormwater drainage to the existing detention basins with sediment controls.

10.3.7 Amount of material

It is expected that there will be 123,300 m^3 of overburden material excavated for this project. (AT&L's Bulk Earthworks Cut and Fill Plan, Drawing No. DAC003, **Annexure C**).

10.4 Erosion and Sediment Controls

Bulk earthworks are only to be commenced upon the successful establishment of erosion and sediment controls.

The proximity of the southern OSD ensures adequacy of water supply at all times for dust mitigation. The winning of material for screening and re-use will take place within the current project area and so will be protected by the western amenity berm.

The following erosion and sediment controls shall be implemented:

- undertake regular wetting down of exposed construction areas to limit sediment migration. Construction areas include but are not limited to embankment and excavation areas;
- rehabilitate or revegetate earthwork areas on completion or where prompt revegetation cannot be completed, implement erosion control measures including siltation fencing until revegetation is completed;
- limit flow velocities in drainage systems by implementing sediment and waste collection barriers in order to minimise possible scouring and to encourage precipitation of particulates in run off;
- maintain vegetation in and adjacent to drainage lines;
- remove silt build-up following large storm events;
- provide an access track where practicable, along the toe of embankments to allow access for maintenance;
- conduct a detailed site inspection after a significant rain event to confirm that erosion control safeguards are working effectively;
- conduct regular inspections of all soil erosion safeguards to ensure they are working effectively;
- prior to major surface disturbance install drainage structures for waterways, catch drains which intercept flow, and sediment traps and basins to allow existing water flows to pass through the disturbed areas without mixing with unfiltered run-off from the disturbed areas. Construct graded contour drains or diversion channels around disturbed areas to ensure that all stormwater is directed away from disturbed areas;
- keep sedimentation basin in a drawn-down state by preferential use of the water by tankers for dust suppression;
- monitor and test water quality if required;
- install silt fences and hay bales where required downstream of disturbed areas, base of embankments, existing drainage lines, earthworks stockpiles;
- inspect silt fences daily to confirm that they are not partially buried and still in good condition;
- wash out concrete delivery vehicles and wash down plant items a minimum of 20m from stormwater drainage systems and natural water courses; and
- fuel and service all plant / equipment on a safe area away from any water course.

10.5 Noise Monitoring

Prior to construction works for the development of the whole site, noise modelling was undertaken for the construction phase and reported in the Noise Impact Assessment undertaken by Environmental Resources Management Australia in August 2008 (**Annexure F**).

It was concluded that construction noise was not expected to exceed the relevant criteria. Construction activities for the current MOD 5 application are significantly less than those undertaken for the original site development.

It is highly unlikely that MOD 5 construction noise levels will exceed those predicted in the 2008 report. The Proponent will continue to undertake noise monitoring pursuant to Environmental Protection License No. 20121 and monitor the outcome.

10.6 Air Quality Monitoring and Dust Management

The impact on air quality was considered in the Air Quality – Odour and Dust report by Holmes Air Sciences (**Annexure G**) for the construction works for the development of the whole site.

It was stated that it was not realistically possible to quantify the impacts of dust using dispersion modelling. Numerous dust mitigation measures were identified to reduce dust emissions. Similar to the original development, construction works will be undertaken behind earthen berms.

The construction works for the MOD 5 application are significantly less that those undertaken for the construction of the site and are to be undertaken in a significantly shorter amount of time. The same mitigation measures used in the original construction will be used in the MOD 5 development to manage dust. The Proponent will also continue to undertake air quality monitoring pursuant to Environmental Protection Licence No. 20121 and monitor the results.

Air quality and dust mitigation and monitoring measures to minimise particulate matter emissions during the construction phase will include:

- use of water carts and watering of exposed surfaces when necessary;
- minimising dust generating activities on days of extreme unfavourable weather conditions when there is a high risk of dust generation e.g. dry, windy conditions;
- defining of trafficked areas;
- imposition of site vehicle speed limits;
- stabilising exposed areas as quickly as possible;
- remove mud from wheels and bodies of haulage equipment before they enter roads;
- visually observe dust emissions and take required action to mitigate.

The implementation of these measures will be the responsibility of the SM.

10.7 Mitigation of Impacts

All of the measures addressed in sections 10.4 to 10.6 will be implemented on Site as a matter of priority. This will be the responsibility of the SM and the EC. The sediment and erosion control measures, the noise monitoring and the air quality and dust monitoring are expected to satisfactorily mitigate any potential impacts to the amenity of the surrounding area.

Annexure A

Axis Architectural's Pre Sort Centre Site Plan

existing one way traffic flow to remain - existing traffic flow unaffected to pre sort centre

existing facility buildings shown shaded

PRE SORT CENTRE

PROPOSED PRE SORT CENTRE FACILITY
proposed pre sort centre building with surrounding hard stand areas

SITE PLAN
1 : 400 scale

DO NOT SCALE OF DRAWING - DIMENSIONS & LEVELS TO BE VERIFIED PRIOR TO COMMENCEMENT OF WORK WITH FIGURED DIMENSIONS IN PREFERENCE TO SCALED DIMENSIONS.
MATERIALS AND WORKMANSHIP TO BE IN STRICT ACCORDANCE WITH ALL RELEVANT S.A.A. STANDARDS, BCA AND LOCAL AUTHORITIES REQUIREMENTS.

Scale 1 : 2000

Issue	Date	Amendment
A	31/10/14	issued for authority approval
B	09/12/14	issued for authority approval
C	12/12/14	building location adjusted to suit topography
D	19/02/15	site boundary by Genisis Xero Waste site highlighted in red
E	19/02/15	total site boundary highlighted in blue
F	16/03/15	boundary through pit excluded in existing Genisis Xero Waste recycling site

Notes

AXIS ARCHITECTURAL
4 / 112 Cronulla Street, Cronulla NSW 2230
p + 02 9523 7858 / m + 0414 954 495
e + daniel@axisarchitects.com.au
AXIS ARCHITECTURAL Pty Ltd - ABN 18 008 183 376
Nominated Architect - Daniel McDonald NSW AIA No. 7197

Project
PRE SORT CENTRE BUILDING
HONEYCOMB DRIVE, EASTERN CREEK. NSW

Client
GENISIS XERO WASTE

Drawing
PRE SORT CENTRE SITE PLAN

Drawn	Date	Project No	Drawing No	Issue
AA	October 2014	141002	DA / A 101	F

Scale 1 : 2000 @ A3

Annexure B

Douglas Partners Report on Preliminary Contamination Assessment on Stockpiled Material and General Land Quality

Douglas Partners
Geotechnics • Environment • Groundwater

Integrated Practical Solutions

REPORT ON PRELIMINARY CONTAMINATION ASSESSMENT ON STOCKPILED MATERIAL AND GENERAL LAND QUALITY

LIGHT HORSE BUSINESS CENTRE (LHBC)
QUARRY ROAD
EASTERN CREEK

Prepared for
DIAL A PRODUCT PTY LTD

Project 43756A
April 2006

Douglas Partners
Geotechnics • Environment • Groundwater

REPORT ON PRELIMINARY CONTAMINATION ASSESSMENT ON STOCKPILED MATERIAL AND GENERAL LAND QUALITY

LIGHT HORSE BUSINESS CENTRE (LHBC) QUARRY ROAD EASTERN CREEK

Prepared for
DIAL A PRODUCT PTY LTD

Project 43756A
April 2006

Douglas Partners Pty Ltd
ABN 75 053 980 117

96 Hermitage Road
West Ryde NSW 2114
Australia

PO Box 472
West Ryde NSW 1685

Phone (02) 9809 0666
Fax (02) 9809 4095
sydney@douglaspartners.com.au

EXECUTIVE SUMMARY

This report details the methodology and results of a Preliminary Contamination Assessment of Stockpiled Material conducted by Douglas Partners Pty Ltd (DP) at Quarry Road, Eastern Creek, New South Wales.

The subject site, Site A, is a 15 ha sub-section of a larger site owned by Dial A Product Pty Ltd (Site B), which includes Hanson Quarry (formerly Pioneer Quarry). Site A is overlain with an overburden stockpile material from the quarry. It is understood that this material is to be removed from the site and the area subdivided into allotments for commercial/ industrial land-use.

A review of available site history and previous environmental reports undertaken by others indicates that Site A and the surrounding area was used for agricultural purposes prior to the development of the quarry in the 1950's. By 1970 an extensive quarry pit had been excavated to the east of the site and office buildings, plants and stockpiled material were located to the south of the quarry. A significant volume of overburden, presumably from the quarry, had been placed on the northern portion of Site A. By 1986 the stockpile had been extended to the southern portion of Site A.

An excavator was used to excavate twenty one test pits at the site. Test pits at Locations 1 to 16 and 21 were in stockpiled material and those at Locations 17-20 were in natural in-situ material along the western portion of the subject site. The stockpiled material sourced as Virgin Excavated Natural Material (VENM) from the quarry area typically comprised grey-black ripped sandstone and mudstone filling, cobble and boulder inclusions and brown gravely clay filling with sandstone cobble inclusions. The in-situ natural material comprised brown silty top soil underlain by silty clay with some ironstone gravel.

The analytical results indicate that the heavy metal and PAH concentrations of the overburden stockpile material are within Australian background ranges. It is noted that one sample (15/0.8-1.0) recorded a concentration of nickel (100 mg/kg) above the NSW DEC provisional phototoxicity-based investigation levels (60 mg/kg), but within the DEC Health based investigation levels for residential use (600 mg/kg). The observed nickel concentration is consistent with those in materials collected from the adjacent quarry in a previous investigation undertaken by ADI (1998). In addition, it is noted that nickel is a

common element in basic igneous rocks with local dolerites understood to have levels >360 mg/kg, with chromium, >550 mg/kg, and copper >100 mg/kg.

The analytical results were found to be below the adopted threshold criteria for both the stockpile and the in-situ materials. On this basis, the stockpiled material can be considered to be VENM and is considered suitable for off-site re-use as fill. However, the assessment of the stockpile was limited to the top 2.8 m of the stockpile and accordingly if material different to that described in the test pit logs, or if material showing signs of contamination (identified by odours, stains, or anthropogenic inclusions) is encountered additional testing shall be required. Not withstanding, it is recommended that additional samples are collected and analysed on a regular basis (and prior to removal) as the stockpile is progressively excavated for any off site re-use.

The preliminary analysis of in-situ material indicates that the site is suitable for commercial/ industrial use. However, following the removal of the stockpiled material it is recommended that additional field work and laboratory analysis and reporting are undertaken to a level commensurate with the site area intended for redevelopment and according to relevant published guidelines.

Douglas Partners
Geotechnics · Environment · Groundwater

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CFK:jlb
Project 43756A
7 April 2006

REPORT ON
PRELIMINARY CONTAMINATION ASSESSMENT OF STOCKPILED MATERIAL AND GENERAL LAND QUALITY
QUARRY ROAD, EASTERN CREEK

1. INTRODUCTION

This report details the methodology and results of a Preliminary Contamination Assessment of Stockpiled Material conducted by Douglas Partners Pty Ltd (DP) at Archbold Road, Eastern Creek, New South Wales. The investigation was commissioned by Mr Ian Malouf of Dial A Product Pty Ltd.

The subject site, Site A, is a 15 ha sub-section of a larger site owned by Dial A Product Pty Ltd (Site B), which includes Hanson Quarry (formerly Pioneer Quarry). Site A is overlain with an overburden stockpile material from the quarry. It is understood that this material is to be removed from the site and the area subdivided into allotments for commercial/ industrial land-use.

The scope of the current assessment was to:

- Conduct a site history review; and
- Sample and analyse the in-situ sub-soils and the stockpile at a total of 21 locations. A detailed scope of works is provided in Section 2.

The objective of the Preliminary Assessment was to provide advice on the quality of the stockpiled material for re-use on or off the site and the suitability of the site for commercial use.

The current investigation has been carried out concurrently with a geotechnical investigation. The geotechnical findings are reported separately in a *Report on Geotechnical Investigation*, March 2006 by DP (Project 43756).

2. SCOPE OF WORKS

The scope of the current assessment comprised the following: -

- Undertake a site history search including a review of historical aerial photograph records, historical title deeds, Council records (s149(2)) certificate and a search of the NSW Department of Environment and Conservation (DEC) register for Notices issued under the Contaminated Land Management Act;
- Review available environmental information with reference to local soils and geology. Obtain and review Department of Natural Resources (DNR) groundwater bore records for the surrounding area (1 km);
- Review previous environmental investigations undertaken on the site;
- Excavate twenty one shallow test pits, using an excavator to a depth of 2.0 -3.0 m. Collect soil/filling samples at nominal depths of 0.3 - 0.5 m, 0.8 - 1.0 m and 1.8 - 2.0 m, or at signs of contamination. An additional 10% duplicates were collected for quality assurance and quality control (QA/ QC) requirements;
- Screen all samples collected with a photoionisation detector (PID) to detect the presence of volatile organic compounds;
- Conduct laboratory analysis on 26 selected samples (including 10% QA/ QC) at a NATA accredited analytical laboratory for a combination of the following potential contaminants:
  - Heavy metals (As, Cd, Cr, Cu, Pb, Hg, Ni, Zn);
  - Petroleum hydrocarbons (TPH) and mono - aromatic hydrocarbons (BTEX);
  - Polycyclic Aromatic Hydrocarbons (PAH);
  - Polychlorinated Biphenyls (PCB);
  - Organochlorine Pesticides (OCP);
  - Organophosphate Pesticides (OPP); and

- Phenols.

- Store remaining soil samples not analysed for a period of one month pending the need for further analysis;
- Completion of a Preliminary Contamination Assessment Report, providing general comments on:
  - the level of contamination in the insitu subsoils and stockpile,
  - the likely suitability of the site for commercial use; and
  - the quality of the stockpiled material for re-use on or off the site.

The scope of the site assessment activities and consulting services undertaken by DP were limited to those detailed in the proposal dated 20 January 2006 and by the accompanying conditions of engagement.

3. SITE DESCRIPTION

3.1 Site Location

The property is located on Archbold Road, Eastern Creek. It is approximately 15 ha in area and is located in the local government area of Blacktown. The site forms a portion of Lot 2 DP 262213 within the Parish of Melville, County of Cumberland.

The surrounding area is largely agricultural, with some industrial site use. The M4 Motorway is located to the north of the site and the former Australia's Wonderland site is located to the east. A site location map and site plan is provided as Appendix A.

3.2 Site Description

The site is a roughly rectangular shaped land parcel located in the south-west corner of the larger Dial A Product Pty Ltd site. The site fronts Archbold Road to the west and a quarry pit is located to the east. A stand of remnant bushland is located to the north of the site.

The majority of the site is overlain by a large stockpile estimated to comprise in excess of 1 million m^3 of material originally sourced from the quarry. The overburden stockpile is 30 m in height and is vegetated with grasses. It is understood that the material from the quarry was excavated as Virgin Excavated Natural Material (VENM) and transported directly to the overburden stockpile for storage. On this basis, the material is described as VENM sourced material.

The remaining portion of the site, fronting Archbold Road, is vegetated with grasses and scattered trees. An unsealed road provides access around the stockpile and on top of stockpile. An old explosives bunker with a bituminous concrete slab is located on the eastern portion of the stockpile. It is understood that this area was used to store fertilisers for the explosives required as part of the adjacent quarry operation.

A site plan is provided as Drawing 1 (Appendix A). Selected photographs of the site are attached in Appendix A.

3.3 Proposed Development

It is understood that the overburden stockpile is to be excavated and exported off-site to the nearby Austral bricks site, and the area subdivided into allotments for commercial / industrial land-use. Details are not known at this stage.

4. REGIONAL GEOLOGY AND HYDROGEOLOGY

Reference to the Sydney 1:100 000 Geological Series Sheet indicates the site is underlain by Bringelly Shale from the Wianamatta Group. Bringelly Shale generally comprises shale, carbonaceous claystone, claystone, laminate, fine to medium grain lithic sandstone and rare coal. The adjacent quarry is found in an intrusive (igneous) plug of dolerite and breccia rocks which may have caused localised metamorphism of the shale rocks.

Groundwater was not encountered during the current investigation. Given the close proximity to the adjacent quarry which is understood to extend approximately 180 m below the surrounding ground level, it is considered that groundwater beneath the site would be at significant depth and flow eastward into the quarry. It is likely that groundwater levels would have been significantly lowered due to quarrying activities.

A NSW Department of Natural Resources (DNR, formerly Department of Land and Water Conservation) groundwater bore search was conducted for the site on 21 February 2006 (Table 1). The DNR bore search results are provided in Appendix B. Nine bores have been constructed within a radius of 4 km from the site for a variety of authorised purposes and proposed uses included aquaculture, irrigation, monitoring and waste disposal. The final depth of the bores varied from 6.0 to 217.9 m below ground level. Information regarding groundwater occurrence was available for only three of the bores in which the standing water level was measured between 2.10 to 33.5 m below ground level.

Table 1 – Summary of Groundwater Bores

Groundwater Bore	Standing Water Level (bgl) (m)	Depth of Bore (m)	Water Quality	Purpose Of Bore	
				Authorized	Intended
GW018361	33.50	217.9	-	Aquaculture/ Waste disposal	Waste Disposal
GW028414	3.90	6.00	-	Irrigation	Irrigation
GW028415	2.10	7.60	Brackish	Irrigation	Irrigation
GW101082	-	40.30	-	Monitoring bore	Test bore
GW101085	-	99.30	-	Monitoring bore	Test bore
GW101086	-	69.70	-	Monitoring bore	Test bore
GW102674	-	69.70	Brackish (4,400 mg/ L salinity)	Monitoring bore	Test bore
GW103953	-	9.90	-	Monitoring bore	Monitoring bore
GW103954	-	9.90	-	Monitoring bore	Monitoring bore

5. SITE HISTORY

5.1 Title Deeds

A 100-year historical land title deed search of the site was conducted at the Lands Title Office (LTO). Determination of the ownership or occupancy of the property, including company names, can assist in the identification of previous land uses and therefore establish potentially contaminating activities.

A summary of the records with the owner/occupier details and the possible site uses is presented in Table 2. The full title deed records and the Deposit Plan for the site are included in Appendix C.

Table 2 – Summary of Title Deed Search

Date	Owner/ Occupier	Occupation	Possible Site Use	Identifier
As to that part marked 1 on the attached cadastre				
06.12.1909	Thomas Baker	Tanner	Agricultural	Book 895 No. 803
03.05.1955	Burfield Pty Limited *(Now Ray Fitzpatrick Pty Limited)*		Quarry	2/ 262213
As to those parts marked 2 & 3 on the attached cadastre				
09.03.1917	Elizabeth Sarah Baker	Married Woman	Agricultural	Book 1102 No. 994
29.08.1946	William Thomas Gillett Baker	Grazier	Agricultural	Book 1995 No. 998
03.05.1955	Burfield Pty Limited *(Now Ray Fitzpatrick Pty Limited)*		Quarry	2/ 262213
Search continued as to the whole of the subject land				
12.09.2005	# ACN 114 843 453 Pty Limited		Quarry	2/ 262213

Current Registered Proprietor

5.2 Aerial Photographs

Aerial photographs from 1947, 1951, 1970, 1986, and 2002 were obtained from the NSW Department of Lands Office. The aerial photographs are presented in Appendix D. These aerial photos were studied to determine the likely past uses of the site, particularly those of a potentially contaminating nature. The findings are summarised below.

1947 Aerial Photograph: The subject site, Site A, and the majority of the surrounding area was open grassland, indicating agricultural land use. To the north of the subject site, land had been cleared of native vegetation and sub-divided into paddocks that had been tilled. A

small stand of remnant woodland was located adjacent to the northern portion of Site A. A small creek is located to the south of the site orientated from south-east to the north-west toward Ropes Creek in the west. Local infrastructure included present day Archbold Road to the west of the site and The Great Western Highway to the north. A number of small residential farm buildings are also present in the surrounding area.

1970 Aerial Photograph: The adjacent site to the east had commenced open-cut quarry operations by this time. A large pit had been excavated and infrastructure including office buildings, plant and extensive stockpiles were located to the south of the quarry area (current location of an asphalt plant). The northern half of subject site, Site A, had been overlain with a large stockpile of material excavated from the quarry. A drainage pathway is visible from the stockpiled material flowing in a westerly direction from the site. Two small shed style buildings were present to the south of the stockpile. A bund-like wall, constructed of soil and rock, surrounded the sheds; it is considered that these sheds may have been used for storage of explosives. The surrounding area remained agricultural at this time.

1986 Aerial Photograph: The quarry located to the east of the site had been extended laterally and vertically from the 1970 aerial photograph. The present day asphalt plant is present to the south of the quarry. The footprint of the overburden stockpile material located on Site A had also been expanded to the southern portion of the site. Four sheds were present on the stockpile with bund-like walls of soil and rock surrounding the perimeter, possibly used for the storage of explosives for quarry operations. Two larger sheds had been developed to the north-east of the stockpile. The small pocket of remnant woodland located to the north of the subject site remained unchanged at this time. The M4 Motorway had been constructed by this time, running in an east west direction to the north of the site. To the north of the M4 a residential area had been developed, whilst to the north-west earthworks had been undertaken for the development of a commercial/ industrial area.

2002 Aerial Photograph: The subject site appeared to relatively unchanged at this time. The four sheds noted in 1986 aerial photograph had been removed from the stockpile. The surrounding area remained relatively unchanged. The area to the north-west of the site had been developed as a commercial/ industrial area.

5.3 Regulatory Notices Search

Public Register – *Protection of the Environment Operations Act*, 1997

Hanson Construction Material is currently licensed by the DEC to undertake Concrete Batching and hard-rock gravel quarrying at the site (licence number 5073). The licence details monitoring requirements and acceptable limits for discharges to land and water. It is noted that a pollution reduction program has been undertaken to reduce the Total Suspended Solids and pH of water that is discharged from the site.

The DEC has registered four notices and one non-conformance for the site summarised below:

- Non-conformance on 12/10/2001. Related to two blasts that exceeded over-pressure levels;
- Notice of Licence Variation (1025278), 27/06/2003. Variation of licence to include concrete batching plant;
- Notice of Licence Variation (1028667), 12/11/03. References to the EPA changed to DEC;
- Notice of Licence Variation (103853) 18/06/2004. The licensee requested that the monitoring requirements for the 'final dam' be changed from weekly to monthly. This change was accepted by the DEC;
- Notice of Licence Variation (1041638) 26/11/2004. The licensee requested an extension of the monitoring period to obtain information regarding wet weather overflow data, part of a pollution reduction programme. The licensee was required to further monitor water in the dam.

Pioneer Road Services, located to the south-west of Site A, is licensed by the DEC (licence number 494) to undertake bitumen pre-mix or hot mix production and crushing, grinding or separating works at the asphalt plant. No notices or non-compliances have been issued under this licence.

Public Register – *Contaminated Land Management Act*, 1997

No Notices or Orders to investigate or remediate have been issued for the site under the *Contaminated Land Management Act*, 1997.

5.4 Blacktown City Council Section 149(2) Certificate

The Section 149 Planning Certificate for the site issued by Blacktown City Council was reviewed as part of this assessment and is provided in Appendix E. There are no notices issued on the site under the Contaminated Land Management Act, 1997.

6. REVIEW OF PREVIOUS INVESTIGATIONS

A number of environmental investigations have been undertaken on Lot 2 in DP 262213. Initially a series of three studies were conducted by ADI Services for Environmental Management Australia Pty Ltd on behalf of Ray Fitzpatrick Pty Ltd. For convenience, ADI Services divided the entire site (Lot 2 DP262213) into three areas; viz. Area 1 (northern portion - woodland / forested region), Area 2 (Central portion stockpile and western portion of the quarry) and Area 3 (southern portion – open grassland) (Appendix F). The subject site, Site A, is located within Area 2. The following environmental reports have been prepared by ADI:

- *Stage 1 Environmental Assessment of Pioneer Concrete (NSW) Wallgrove Quarry*, December 1994 by Australian Defence Industries Services (ADI Services);
- *Stage 2 Environmental Assessment of Areas 1 and 3 Wallgrove Quarry*, March 1994, by Australian Defence Industries Services (ADI Services); and
- *Stage 3 Environmental Assessment of Pioneer Concrete (NSW) Wallgrove Quarry*, April 1998 by Australian Defence Industries Services (ADI Services).

In addition, other consultants prepared a Phase 1 (desktop) Investigation and a Review of Previous Environmental Reports on Lot 2 DP 262213 which were completed in 2004, and are listed below.

- *Phase 1 Investigation for Lot 2 (DP262213), Archbold Road, Eastern Creek, NSW*, October 2004 by CH2M Hill Australia Pty Ltd (CH2MHILL); and
- *Lot 2 Deposit Plan (DP) 262213 Archbold Road, Eastern Creek, NSW – Review of Previous Environmental Reports*, December 2004, Environmental Resources Management Australia (ERM).

It is noted that the assessments focused on the whole of Lot 2 DP 262213, whilst this report is concerned with a 15 ha portion of the Lot located in the central west of the site fronting Archbold Road. A summary of the previous investigations is presented in the following sections.

6.1 Stage 1 Environmental Assessment of Pioneer Concrete (NSW) Wallgrove Quarry, December 1994 by Australian Defence Industries Services (ADI Services).

The report focused on Areas 1 and 3 located to the north and south of the subject site (Site A). A review of the report revealed:

- That the property had been used as grazing land, as a quarry for road base material and a portion of the site has been used as an asphalt plant;
- A number of potentially contaminated areas were identified, including areas affected by runoff from the quarry overburden stockpile (located on Site A) and the asphalt stockpiles and fines discharged from the dewatering basin into drainage lines, creeks and the local groundwater;
- Settled fines from the dewatering basin were typically disposed to landfill, however, it is noted that this material may have been disposed on the overburden stockpile at times; and

- The potential contaminants identified were heavy metals, oils, bitumen, lime, flocculants, cleaning agents, fuels, petroleum hydrocarbons, and PAHs.

A sampling regime was recommended by ADI to assess whether the identified receptors within Area 1 and 3 had been contaminated by Pioneer operations in Area 2.

6.2 *Stage 2 Environmental Assessment of Areas 1 and 3 Wallgrove Quarry,* March 1995, by Australian Defence Industries Services (ADI Services).

The Stage 2 assessment comprised the sampling regime recommended by ADI in the Stage 1 assessment. The sampling regime included the collection and laboratory analysis of soil/sediment from dams, drainage lines and creeks that were identified in the Stage 1 assessment as potential receptors of contaminated material due to quarry and asphalt plant operations. A number of 'background' sediment samples were also collected. In addition groundwater monitoring wells were installed to assess groundwater contamination.

The findings of the Stage 2 Investigation include:

- Sediment samples collected from the drainage lines (sourced from the northern end of the stockpile and down-gradient of the asphalt plant), the southern dam (located to the south of Site A), and the Eastern dam (located down-gradient of equipment storage area) were found to contain chromium, nickel, barium and manganese concentrations above the adopted guideline threshold (ANZECC *Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites,* 1992);
- TPH, BTEX and PAH were not detected in the sediment/soil samples analysed, with the exception of three locations down-gradient of the asphalt plant; and
- Surface water and groundwater was found to be within the adopted guideline values (ANZECC *Australian Water Quality Guidelines for Fresh and Marine Waters,* 1992), with the exception of manganese exceedances attributed to natural high levels of manganese in the surrounding area.

6.3 Stage 3 Environmental Assessment of Pioneer Concrete (NSW) Wallgrove Quarry, April 1998 by Australian Defence Industries Services (ADI Services).

The Stage 3 Environmental Assessment was conducted on Area 2. The assessment involved soil sampling, sediment sampling, surface water sampling (Bob's dam) of the quarry area, including the Pioneer Road Services Site and the overburden stockpile material. Groundwater sampling from wells located at the surrounding southern section of the site (Area 3) (installed as part of the Stage 2 investigation) was also undertaken.

A review of the Stage 3 ADI Services report revealed:

- Areas with the Pioneer Road Services section of the site were found to be significantly affected with TPH, ethyl-benzene and zinc. The contaminated areas were in close vicinity of the workshop area, the bitumen laboratory, the tank farm and the kerosene wash down area. TPH concentrations were detected at hotspot concentrations;
- Samples collected from the overburden stockpile (Site A) were found to contain concentrations of heavy metals consistent with 'background samples' collected from Area 3, which was assessed to be unaffected by quarrying activities, with the exception of nickel. Nickel concentrations were elevated in comparison with the 'background samples', but consistent with two natural breccia samples collected from the adjacent quarry. In addition no waste material was noted in the stockpile and no TPH or PAH was detected in the samples;
- Surface water samples were detected to contain concentrations of Cu, Pb, Zn, Cd, Cr and Ni exceeding the ANZECC (1992) guidelines for the protection of aquatic ecosystems; and
- Groundwater monitoring wells installed in Area 3 as part of the Stage 2 investigation were re-sampled. The groundwater quality was found to have improved since the 1995 monitoring, and the results were within the adopted guideline, with the exception of one exceedance of Zn (75 µg/L). However, it is noted that current guidelines (ANZECC 2000) allow for the calculation of hardness-adjusted trigger values. Accordingly, it is likely considered that the groundwater sourced from shale would be 'hard' and that the hardness-adjusted trigger value would be above the recorded concentration of zinc.

During the field work no signs of waste material were noted in the overburden stockpiled material. The samples were compared with 'background' samples collected from Area 3, located to the south of Site A, which has remained unaffected by quarrying activities. With the exception of nickel concentrations, the overburden samples were found to be consistent with contaminant concentrations found in the 'background' samples. However, it is noted that the elevated nickel concentrations in the overburden stockpile samples were found to be consistent with the nickel concentration of two breccia samples collected from the adjacent quarry. These nickel concentrations are likely to be characteristic of the natural materials in question.

6.4 Phase 1 Investigation for Lot 2 (DP262213), Archbold Road, Eastern Creek, NSW, October 2004 by CH2M Hill Australia Pty Ltd (CH2MHILL)

A 'desktop' Phase 1 Contamination Assessment was conducted on Lot 2 in DP 262213 by CH2MHILL for Clayton Utz Solicitors in October 2004. The main findings of the CH2MHILL report were:

- The site history indicated the southern half of the site appeared to have been unaffected by industrial activity and was occasionally used for grazing, however the central portion of the site (Area 2) may have been subject to contamination from quarrying activities, such as oil spills and machinery operation;
- An asphalt production plant has been in operation in the south-east portion of the site since the early 1960's. The site walk-over assessment indicated that contamination associated with bituminous material (PAHs, phenols, semi-volatile aromatic compounds) would be confined within a small area of the site;
- Given that much of the site is open-grassland used for grazing, illegal dumping might have taken place on the site (including the overburden stockpile); and
- Asbestos based materials may be present in parts of the plant building infrastructure and in waste dumps on site (site surrounding south-east of the site) where the plant was dismantled.

The report concluded that the majority of the Lot 2 DP 262213 poses a low potential for residual contamination to be present, with the exception of the asphalt plant. However,

CH2MHILL recommended soil and/or groundwater sampling if the site usage changed, including redevelopment or sale. In addition it is noted that the ADI reports listed above were not made available to CH2MHILL, and subsequently the results of the previous assessments were not included in CH2MHILL's assessment.

6.5 Lot 2 Deposit Plan (DP)262213 Archbold Road, Eastern Creek, NSW – Review of Previous Environmental Reports, December 2004, Environmental Resources Management Australia (ERM).

This brief letter report was prepared by ERM for Valad Property Group Pty Ltd, to provide a summary of potential environmental risks for land sale purposes. The report did not include a site assessment and was limited to a 'desktop' review of three reports completed by ADI in 1995 and 1998 and the CH2MHILL 2004 report.

The report concluded the following:

- Contaminated areas were associated with discrete locations within the Pioneer Road Services section of the site;
- That elevated heavy metal concentrations in the soil can be attributed to high regional background concentrations, and from sediment runoff associated with the quarry. In addition, the heavy metal concentrations were typically within relevant site assessment guidelines (NEPM 1999 see section 8.1 of this report Guideline 1);
- Groundwater sampling, limited to five locations did not indicate significant contamination and that an elevated zinc concentration can be attributed to elevated regional background ranges.

7. POTENTIAL CONTAMINANTS

Based on the available site information, the potential for contamination associated with Site A is assessed to be low. The potential contaminants identified during the site history review and site inspection are:

- *Previous agricultural activities.* Impacts may be related to the use of fertiliser, and pesticides. Aerial photographs show that the site was cleared and vacant and graziers owned the site between 1909 to 1955 period. It is possible that the land was once cultivated. The associated contaminants may include pesticides, including organochlorine pesticides, and heavy metals (arsenic, chromium, zinc and mercury) from fertilisers eg. super-phosphates. It is envisaged, however, that these contaminants, if present, would most likely be confined only to the near surface horizon;
- *Dumping of contaminated waste on the overburden stockpile:* A range of potentially contaminated material may have been deposited on the stockpile including, building rubble, asbestos contaminated waste, waste from the asphalt plant located on the adjacent site, fines from the quarry tailings dam, and machinery waste, including waste oil and fuel. The associated contaminants of concern include heavy metals, TPH, BTEX, PAHs, solvents and asbestos.

8. ASSESSMENT CRITERIA

8.1 Site Assessment Criteria

The Environmental Soil Quality Guideline 'Background Ranges', as given in the Schedule B(1) NEPC Guideline on the *Investigation Levels for Soil and Groundwater* (1999), have been referenced to assess whether the concentration of analytes in the VENM sourced material compares with typical Australian background ranges (Guideline 1, Table 3) and is therefore consistent with VENM material.

The lower of the Health-based [soil] investigation levels (column 1) for residential sites with accessible soils, and the provisional phytotoxicity-based investigation levels for sandy loams (column 5), as specified in NSW Department of Environment and Conservation (DEC) (formerly the Environmental Protection Agency) *Guidelines for the NSW Site Auditors Scheme (1998).* The most sensitive land-use category has been selected as comparative criteria for the VENM sourced material to determine whether contamination has occurred (Guideline 2, Table 3). The NSW DEC *Guidelines for Assessing Service Station Sites (1994)* have been referenced for total petroleum hydrocarbon guidelines.

In addition the soil contaminant Threshold Concentrations for Commercial and Industrial Sites are based of the NSW EPA *Contaminated Sites Guidelines for the NSW Site Auditor Scheme* (1998) column 4, Health - based Investigation Levels for Commercial and Industrial sites and have been included for reference (Guideline 3, Table 3) as it is understood that the site is intended for future industrial land-use.

These Site Assessment Criteria are given in Table 3.

Table 3 – Site Assessment Criteria

Substance	Australian Background Ranges Guideline 1	HIL Lower guideline value (HIL) and (PPIL) Guideline 2	HIL Commercial / Industrial Guideline 3
As	1-50	20	500
Cd	1	3	100
Cr*	5-1000	400	60%
Cu	2-100	100	5000
Pb	2-200	300	1500
Hg	0.03	1	75
Ni	5-500	60	3000
Zn	10-300	200	35000
C_6 - C_9	-	65[1]	65[1]
C_{10} – C_{36}	-	1000[1]	1000[1]
Benzene	0.05-1.0	1[1]	1[1]
Ethyl Benzene	-	3.1[1]	3.1[1]
Toluene	-	1.4[1]	1.4[1]
Xylene	-	14[1]	14[1]
PAH (Total)	0.95-5.0[2]	20	20
Benzo(a)pyrene	-	1	5
DDT	-	200	1000
Heptachlor	-	10	50
Aldrin + Dieldrin	-	10	50
Chlordane	-	50	250
Phenol	-	70	42500
PCBs	-	10	20

Notes:

Guideline 1 Schedule B(1) NEPC Guideline on the *Investigation Levels for Soil and Groundwater* (1999), Background ranges.

Guideline 2 NSW EPA *Contaminated Sites Guidelines for the NSW Site Auditor Scheme* (1998) column 1 and 5, Health - based Investigation Levels for Residential with gardens and provisional phytotoxicity based investigation levels for sandy loams. The lowest value has been selected as the threshold concentration.

Guideline 3 NSW EPA *Contaminated Sites Guidelines for the NSW Site Auditor Scheme* (1998) column 4, Health - based Investigation Levels for Commercial and Industrial sites

1. NSW EPA *Contaminated Sites Guidelines for Assessing Service Station Sites (1994).*
2. ANZECC *Guidelines for the Assessment and Management of Contaminated Sites* (1992).

Guideline 3 levels have been provided for reference only as the appropriate criteria for commercial/ industrial sites. The objective of this preliminary assessment of stockpiled and in-situ material has been to assess the characteristics against the lowest guideline threshold criteria, (i.e. Guideline 2), which would allow for any type of land-use from a contamination perspective.

9. FIELD INVESTIGATION

9.1 Sample Location Rationale

The sampling location and selection rationale were designed according to the known site information and to achieve representative coverage of the site area. A total of twenty one sampling locations were chosen for the current assessment. Seventeen of the sample locations were located on the overburden stockpiled material. The remaining four locations were located on the western portion of the site in natural in-situ material, in order to obtain preliminary information on the sub - surface conditions at the site.

The stockpile sampling locations (Locations 1 - 16 and 21) and the soil sampling locations (Locations 17 - 20) are provided in Drawing 1 of Appendix A.

9.2 Sampling Methodology

The field investigation comprised sampling from twenty one test pits. Environmental sampling was performed according to standard operating procedures outlined in the DP *Field Procedures Manual*. All sampling data were recorded on DP chain of custody sheets (Appendix G), and the general sampling and sample management procedures comprised:

- The use of disposable sampling equipment to reduce the potential for cross-contamination to occur between samples;
- Transferring samples into laboratory - prepared glass jars, capping immediately and ensuring headspace within the sample jar is minimised;

- Collection of 10% replicate samples for QA/ QC purposes;
- Labelling of sample containers with individual and unique identification, including project number, sample location and sample depth (where applicable); and
- Placement of the sample jars into a cooled, insulated and sealed container for transport to the laboratory.

A sub - sample was collected in a sealed zip - lock bag for each of the environmental samples collected. These samples were screened with a photoionisation detector (PID) to screen for the presence of volatile organic compounds in the soil. The PID was calibrated with isobutylene gas at 94.5 ppm.

9.3 Analytical Rationale

The selection of soil samples chosen for laboratory analysis was based on field observation, odour and PID response. The analytical regime for the soil samples selected for analysis is shown in Table 4. A total of 26 selected samples (including 3 replicate samples for QA/QC) were analysed for various combinations of the contaminants of concern (refer to Table 3). Envirolab Services Pty Ltd, a laboratory accredited by the National Association of Testing Authorities (NATA), was engaged to conduct the sample analysis.

Table 4 - Analytical Scheme

Sample ID	Heavy Metals	TPH	BTEX	PAH	PCB	OCP	OPP	Total Phenol
Stockpiled material								
1/ 0.3 – 0.5	✓	✓	✓	✓	-	-	-	-
3/ 1.8 - 2.0	✓	✓	✓	✓	-	-	-	-
BD1 140206	✓	-	-	-	-	-	-	-
4/ 0.8 - 1.0	✓	✓	✓	✓	-	-	-	-
5/ 0.3 - 0.5	✓	✓	✓	✓	✓	✓	✓	✓
6/ 1.8 - 2.0	✓	✓	✓	✓	-	-	-	-
7/ 0.3 - 0.5	✓	✓	✓	✓	✓	✓	✓	✓
8/ 1.8 - 2.0	✓	✓	✓	✓	✓	-	-	-
BD2 140206	✓	-	-	-	-	-	-	-
9/ 0.8 - 1.0	✓	✓	✓	✓	-	-	-	-
10/ 0.3 - 0.5	✓	✓	✓	✓	✓	✓	✓	✓
10/ 1.8 - 2.0	✓	✓	✓	✓	-	-	-	-
11/ 0.8 - 1.0	✓	✓	✓	✓	-	-	-	-
12/ 0.3 - 0.5	✓	✓	✓	✓	-	-	-	-
13/ 0.8 - 1.0	✓	✓	✓	✓	✓	✓	✓	✓
14/ 0.3 - 0.5	✓	✓	✓	✓	-	-	-	-
15/ 0.8 - 1.0	✓	✓	✓	✓	✓	✓	✓	✓
16/ 0.8 - 1.0	✓	✓	✓	✓	-	-	-	-
BD6 140206	✓	-	-	-	-	-	-	-
21/ 0 - 0.3	✓	✓	✓	✓	✓	✓	✓	✓
21/ 0.8 – 1.0	✓	✓	✓	✓	✓	✓	✓	✓
In-situ material								
17/ 0.3 - 0.5	✓	✓	✓	✓	✓	✓	✓	✓
17/ 0.8 - 1.0	✓	✓	✓	✓	-	-	-	-
18/ 0.3 - 0.5	✓	✓	✓	✓	✓	✓	✓	✓
19/ 0.8 - 1.0	✓	✓	✓	✓	-	-	-	-
20/ 0.3 - 0.5	✓	✓	✓	✓	✓	✓	✓	✓

BD1 140206 Denotes blind duplicate of sample 3/ 1.8 – 2.0
BD2 140206 Denotes blind duplicate of sample 8/ 1.8 - 2.0
BD6 140206 Denotes blind duplicate of sample 16/ 0.8 - 1.

10. RESULTS OF INVESTIGATION

10.1 Field Observations

A 23 tonne excavator (provided by the client, Dial A Product Pty Ltd) was used to excavate twenty one test pits over the site. The test pit excavation was undertaken under the direction of an environmental scientist who set out the test pit locations and logged the overburden soils. Test pits at Locations 1 to 16 and 21 were in stockpile material and those at Locations 17-20 were in natural in-situ material along the western portion of the subject site. A detailed description of the sampling can be found in Section 8.2, Sampling Methodology.

Overburden Stockpile (Locations 1 – 16, 21)

The field work at the above locations encountered stockpiled VENM sourced material from the adjacent quarry. The stockpiled material comprised:

- Grey-black ripped sandstone and mudstone filling, cobble and boulder inclusions; and
- Brown gravely clay filling with sandstone cobble inclusions.

In-situ Natural Material (Locations 17 – 20)

The field work at the above locations typically encountered the following conditions:

Top soil: The top soil contained a mixture of brown silt with rootlets to 200 mm depth.

Natural Material: The natural material is a mixture of light grey mottled red brown silty clay and brown silty sandy clay, with some ironstone gravel.

Details of the conditions encountered at each test location are given in Appendix G, together with notes defining classification methods and descriptive terms. A summary of the materials encountered in the overburden stockpile and in-situ natural material is presented in Table 5 below.

Table 5 - Summary of Material Encountered

Location	Depth	Material Description
1- 16 and 21	-	- Grey-black ripped sandstone and mudstone filling, cobble and boulder inclusions; and - Brown gravely clay filling with sandstone cobble inclusions.
17-20	0 – 0.2	Top soil – brown silt with rootlets
	0.2 – 0.6	Silty clay - yellow brown mottled silty clay, with trace fine gravel
	0.6 - 2.2	Silty clay – red brown mottled silty clay, some ironstone gravel
	>1.5 – 2.4	Siltstone – extremely weathered, light grey siltstone. Shale – extremely weathered, grey shale and siltstone.

10.2 Total Photoionisable Compounds (TOPIC) Results

PID results are indicated on the bore logs and test pit logs for the in - situ material and indicated on the record of samples for the stockpile material and are presented in Appendix G. The photoionisation detector (PID) indicated that all PID readings were below 6 ppm, indicating the absence of volatile compounds in the soil samples.

10.3 Laboratory Analysis

10.3.1 Results of Laboratory Analysis

The results of laboratory analysis for the stockpiled material (Appendix H) are presented in the following tables:

Table 6 – Results of Laboratory Analysis of Stockpile Material for Heavy Metals

Table 7 – Results of Laboratory Analysis of Stockpile Material for TPH and BTEX;

Table 8 – Results of Laboratory Analysis of Stockpile Material for OCP and OPP; and

Table 9 – Results of Laboratory Analysis of Stockpile Material for PCB, PAH and total Phenolics.

Table 6 – Results of Laboratory Analysis of Stockpile Material for Heavy Metals

Sample ID	As (mg/ kg)	Cd (mg/ kg)	Cr (mg/ kg)	Cu (mg/ kg)	Pb (mg/ kg)	Hg (mg/ kg)	Ni (mg/ kg)	Zn (mg/ kg)
Overburden Stockpile								
1/ 0.3 – 1.0	5.4	<1	12	43	16	<0.1	32	81
3/ 1.8 -2.0	8	<1	35	42	20	<0.1	38	74
BD1 140206	5.9	<1	31	38	17	<0.1	35	72
4/ 0.8 – 1.0	8.3	<1	24	42	17	<0.1	32	71
5/ 0.3 – 0.5	6.5	<1	12	48	17	<0.1	21	75
6/ 1.8 – 2.0	6.5	<1	21	48	21	<0.1	30	68
7/ 0.3 – 0.5	7.8	<1	18	47	18	<0.1	26	68
8/ 1.8 – 2.0	4.9	<1	28	37	16	<0.1	43	66
BD2 140206	6.7	<1	27	34	14	<0.1	43	66
9/ 0.8 – 1.0	6.1	<1	31	45	17	<0.1	36	78
10/ 0.3 – 0.5	5.9	<1	11	48	17	<0.1	24	77
10/ 1.8 – 2.0	7.9	<1	19	24	18	<0.1	13	50
11/ 0.8 – 1.0	<4	<1	11	50	19	<0.1	25	90
12/ 0.3 – 0.5	4.2	<1	13	38	19	<0.1	25	73
13/ 0.8 – 1.0	6.4	<1	33	42	17	<0.1	37	68
14/ 0.3 – 0.5	7.7	<1	28	33	15	<0.1	31	69
15/ 0.8 – 1.0	<4	<1	150	38	10	<0.1	**100**	65
16/ 0.8 – 1.0	7.8	<1	24	40	15	<0.1	30	63
BD6 140206	7.7	<1	28	43	17	<0.1	34	68
21/ 0 - 0.3	5.9	<1	22	42	18	<0.1	32	62
21/ 0.8 – 1.0	5.5	<1	17	44	17	<0.1	24	79
In-situ Natural Material								
17/ 0.3 - 1.0	7.3	<1	21	26	26	<0.10	13	46
17/ 0.8 -1.0	9.1	<1	18	44	33	<0.10	12	56
18/ 0.3 – 0.5	6.9	<1	21	28	19	<0.10	10	31
19/ 0.8 – 1.0	13	<1	9.1	37	11	<0.10	6	33
20/ 0.3 – 0.5	15	<1	17	39	24	<0.10	22	88
Guideline 1	**1 – 50**	**1**	**5 – 1000**	**2 – 100**	**2 – 200**	**0.03**	**5 – 500**	**10 - 300**
Guideline 2	**20**	**3**	**400**	**100**	**300**	**1**	**60**	**200**

Notes:
Guideline 1 and 2 - Refer to Table 3 of the report
BD1 140206 Denotes blind duplicate of sample 3/ 1.8 – 2.0
BD2 140206 Denotes blind duplicate of sample 8/ 1.8 - 2.0
BD6 140206 Denotes blind duplicate of sample 16/ 0.8 - 1.0
Bold Exceeds Guideline 2.

Table 7 – Results of Laboratory Analysis of Stockpile Material for TPH & BTEX

Sample ID	Total Petroleum Hydrocarbons (TPH)				Monocyclic Aromatic Hydrocarbons (BTEX)			
	C_6 - C_9 (mg/ kg)	C_{10} - C_{14} (mg/ kg)	C_{15} - C_{28} (mg/ kg)	C_{29} - C_{36} (mg/ kg)	Benzene (mg/ kg)	Toluene (mg/ kg)	Ethyl benzene (mg/ kg)	Xylene (mg/ kg)
Overburden Stockpile								
1/ 0.3 – 1.0	<25	<50	<100	<100	<1.0	<1.0	<1.0	<1.0
3/ 1.8 -2.0	<25	<50	<100	<100	<1.0	<1.0	<1.0	<1.0
4/ 0.8 – 1.0	<25	<50	<100	<100	<1.0	<1.0	<1.0	<1.0
5/ 0.3 – 0.5	<25	<50	<100	<100	<1.0	<1.0	<1.0	<1.0
6/ 1.8 – 2.0	<25	<50	<100	<100	<1.0	<1.0	<1.0	<1.0
7/ 0.3 – 0.5	<25	<50	<100	<100	<1.0	<1.0	<1.0	<1.0
8/ 1.8 – 2.0	<25	<50	<100	<100	<1.0	<1.0	<1.0	<1.0
9/ 0.8 – 1.0	<25	<50	<100	<100	<1.0	<1.0	<1.0	<1.0
10/ 0.3 – 0.5	<25	<50	<100	<100	<1.0	<1.0	<1.0	<1.0
10/ 1.8 – 2.0	<25	<50	<100	<100	<1.0	<1.0	<1.0	<1.0
11/ 0.8 – 1.0	<25	<50	<100	<100	<1.0	<1.0	<1.0	<1.0
12/ 0.3 – 0.5	<25	<50	<100	<100	<1.0	<1.0	<1.0	<1.0
13/ 0.8 – 1.0	<25	<50	<100	<100	<1.0	<1.0	<1.0	<1.0
14/ 0.3 – 0.5	<25	<50	<100	<100	<1.0	<1.0	<1.0	<1.0
15/ 0.8 – 1.0	<25	<50	<100	<100	<1.0	<1.0	<1.0	<1.0
16/ 0.8 – 1.0	<25	<50	<100	<100	<1.0	<1.0	<1.0	<1.0
21/ 0 - 0.3	<25	<50	<100	<100	<1.0	<1.0	<1.0	<1.0
21/ 0.8 – 1.0	<25	<50	<100	<100	<1.0	<1.0	<1.0	<1.0
In-situ Natural Material								
17/ 0.3 - 1.0	<25	<50	<100	<100	<1.0	<1.0	<1.0	<1.0
17/ 0.8 -1.0	<25	<50	<100	<100	<1.0	<1.0	<1.0	<1.0
18/ 0.3 – 0.5	<25	<50	<100	<100	<1.0	<1.0	<1.0	<1.0
19/ 0.8 – 1.0	<25	<50	<100	<100	<1.0	<1.0	<1.0	<1.0
20/ 0.3 – 0.5	<25	<50	<100	<100	<1.0	<1.0	<1.0	<1.0
Guideline 1	NA	NA			0.05– 1.0	NA	NA	NA
Guideline 2	65	1000			1	1.4	3.1	1.4

Notes:
Guideline 1 and 2 - Refer to Table 3 of the report
Bold Exceeds Guideline 2.
NA Not Applicable

Table 8 – Results of Laboratory Analysis of Stockpile Material for OCP and OPP

Sample ID	Organochlorine Pesticides (OCP)					OPP (mg/ kg)
	Aldrin (mg/ kg)	Dieldrin (mg/ kg)	Chlordane (mg/ kg)	DDD+DDE+ DDT (mg/ kg)	Heptachlor (mg/ kg)	
Overburden Stockpile						
5/ 0.3 – 0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
7/ 0.3 – 0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
8/ 1.8 – 2.0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
10/ 0.3 – 0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
13/ 0.8 – 1.0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
15/ 0.8 – 1.0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
21/ 0 - 0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
21/ 0.8 – 1.0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
In-situ Natural Material						
17/ 0.3 - 1.0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
18/ 0.3 – 0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
20/ 0.3 – 0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Guideline 1	NA		NA	NA	NA	NA
Guideline 2	**10**		**50**	**200**	**10**	**NA**

Notes:
Guideline 1 and 2 - Refer to Table 3 of the report
Bold Exceeds Guideline 2.
NA Not Applicable

Table 9 – Results of Laboratory Analysis of Stockpile Material for PCB, PAH and total Phenolics

Sample ID	Total PCB (mg/ kg)	Benzo(a) pyrene (mg/ kg)	PAH (mg/ kg)	Total Phenolics (mg/ kg)
Overburden Stockpile				
5/ 0.3 – 0.5	<0.1	<0.050	<0.1	<5.0
7/ 0.3 – 0.5	<0.1	<0.050	<0.1	<5.0
8/ 1.8 – 2.0	<0.1	<0.050	<0.1	<5.0
10/ 0.3 – 0.5	<0.1	<0.050	<0.1	<5.0
13/ 0.8 – 1.0	<0.1	<0.050	<0.1	<5.0
15/ 0.8 – 1.0	<0.1	<0.050	<0.1	<5.0
21/ 0 - 0.3	<0.1	<0.050	<0.1	<5.0
21/ 0.8 – 1.0	<0.1	<0.050	<0.1	<5.0
In-situ Natural Material				
17/ 0.3 - 1.0	<0.1	<0.050	<0.10	<5.0
18/ 0.3 – 0.5	<0.1	<0.050	<0.10	<5.0
20/ 0.3 – 0.5	<0.1	<0.050	<0.10	<5.0
Guideline 1	NA	NA	**0.95-5.0**	NA
Guideline 2	**10**	**1**	**20**	**70**

Notes:
Guideline 2 - Refer to Table 3 of the report
Bold Exceeds Guideline 2.
NA Not Applicable

10.4 QA/QC Procedures and Results

Quality assurance/quality control procedures comprised an integral part of this Preliminary Assessment, and included both field and laboratory QA/QC procedures (see Appendix I).

11. DISCUSSION

11.1 Review of Available Site History Information

The 1947 aerial photograph shows that the subject site and surrounding area was largely open grassland, with the exception of the area to the north east which was divided into paddocks that had been tilled. The results of the title deeds search illustrate that the site was used for agricultural purposes, probably grazing, up until 1955.

Lot 2 DP 262213 was purchased by Burfield Pty Limited (later known as Ray Fitzpatrick Pty Limited) in 1955. The subject site, Site A, is a portion of Lot 2 DP 262213, located in the central, western portion of the Lot. A quarry commenced operation on the eastern half of Lot 2 DP 262213 and the adjacent property to the east, Lot 1 DP 400697, in the 1950's.

By 1970 an extensive quarry pit had been excavated to the east of the site and office buildings, plants and stockpiled material were located to the south of the quarry. A significant volume of overburden, presumably from the quarry, had been placed on the northern portion of Site A. In the 1986 aerial photograph the quarry had been extended both laterally and vertically. In addition, the stockpiled material on Site A had extended to the southern portion of Site A.

The site appeared relatively unchanged in the 2002 aerial photograph with the exception of the removal of small sheds which are believed to have stored explosives for quarrying activities. It is understood that the quarry has been operational since the 1950's and it is considered that overburden was placed on the stockpile since the commencement of quarrying activities.

The potential contaminants associated with the site are:

- Fertilisers and pesticides associated with agricultural activities; and
- Heavy metals, TPH, BTEX, PAHs, solvents and asbestos, associated with the dumping of material on the overburden stockpile.

A number of environmental assessments have been undertaken on the surrounding quarry area by other consultants, assessing the potential of quarry activities to impact the surrounding area. A sampling and analytical regime was undertaken by others which comprised the collection of soil and surface water samples from drainage lines, reservoirs and soil samples from locations surrounding the quarry site. The results indicated that sediment samples along drainage lines and reservoirs contained heavy metal concentrations above the adopted guideline threshold. It is noted that Quarry operators Hanson Operations, have undertaken a pollution reduction programme with the DEC that monitored the waters discharging from the site and no 'Notices' have been issued regarding this matter.

Following the above mention investigation, additional fieldwork was undertaken at discrete locations on the quarry site, including the asphalt plant, Pioneer Road Services section, the overburden stockpile (Site A) and the quarry pit. The results indicated that significant contamination occurred at discrete locations, including the workshop area, the tank farm and the kerosene wash down area. These contaminated areas are not located within Site A, the area being assessed in this current investigation.

No signs of waste material were noted on the overburden stockpiled material during ADI's 1998 investigation. The samples were compared with 'background' samples collected from Area 3, located to the south of Site A, which has remained unaffected by quarrying activities. With the exception of nickel concentrations, the overburden samples were found to be consistent with contaminant concentrations found in the 'background' samples from Area 3. However, it is noted that the elevated nickel concentrations in the overburden stockpile samples were found to be consistent with the nickel concentration of two natural breccia samples collected from the adjacent quarry.

11.2 Overburden Stockpile Assessment

The analytical results indicate that the heavy metal and PAH concentrations of the overburden stockpile material, that was sourced as VENM from the quarry area are within Australian background ranges.

It is noted that one sample (15/0.8-1.0) recorded a concentration of nickel (100 mg/kg) above the NSW DEC provisional phototoxicity-based investigation levels (60 mg/kg). However, it is noted that the nickel concentration is within the DEC Health based investigation levels for residential use (600 mg/kg).

The elevated nickel concentration is consistent with the nickel concentration of material collected from the adjacent quarry in the Stage 2 investigation by ADI (1998). On this basis, the nickel concentration 100 mg/kg in sample 15/0.8-1.0 is considered to be representative of background concentrations of natural material sourced from the adjacent quarry. Nickel is a common element in basic igneous rocks with local dolerites understood to have levels >360 mg/kg, with chromium >550 mg/kg, and copper >100 mg/kg.

The selected samples analysed for TPH, BTEX, PCB, PAH, OCP, OPP and phenol were found to be below laboratory quantification limits, indicating that the VENM-sourced material, located within the top 2.8 m of the stockpile, has not been contaminated during handling or whilst stored on the stockpile.

No signs of anthropogenic inclusions were noted at the time of field work and on this basis, asbestos was not analysed.

11.3 Preliminary Assessment of In-situ material

The concentration of selected samples analysed for heavy metals were found to be within the Site Assessment Criteria for residential sites with accessible soil. On this basis, the subsurface soils analysed are not considered to be contaminated.

The soil samples submitted for laboratory analysis reported TPH, PAH, BTEX, OCP, OPP, PCB and Phenols concentrations below the practical quantification limit. Hence the concentrations for all of these compounds were within the Site Assessment Criteria for residential sites with accessible soils.

12. CONCLUSIONS

The analytical results were found to be below the adopted threshold criteria for both the stockpile and the in-situ material. On this basis, the stockpiled material, which was sourced as VENM from the quarry is considered suitable for off-site re-use as VENM fill. However, it is noted that the assessment of the stockpile was limited to the top 2.8 m of the stockpile. If material different to that described in the test pit logs, or if material showing signs of contamination (identified by odours, stains, or anthropogenic inclusions) is encountered additional testing shall be required. Irrespective it is recommended that additional samples are collected and analysed on a regular basis (and prior to removal) as the stockpile is progressively excavated for any off site use.

The preliminary analysis of in-situ material indicates that the site is suitable for commercial/ industrial use. However, following the removal of the stockpiled material it is recommended that additional field work and laboratory analysis and reporting are undertaken to a level commensurate with the site area intended for redevelopment and according to relevant published guidelines.

13. LIMITATIONS OF THIS REPORT

The scope of the site assessment activities and consulting services undertaken by DP were limited to those detailed in the proposal dated 20 January 2006 and by the accompanying conditions of engagement.

DP's assessment is necessarily based upon the result of a limited site investigation and the restricted programme of surface and subsurface sampling, screening and chemical testing which was set out in the proposal. DP cannot provide unqualified warranties with regards to contamination nor does DP assume any liability for site conditions not observed or accessible during the time of the investigations.

Despite all reasonable care and diligence, the ground conditions encountered and concentrations of contaminants measured may not be representative of conditions between the locations sampled and investigated. In addition, site characteristics may change over time due to activities such as spillages of contaminating substances. These changes may occur subsequent to DP's investigations and assessment.

This report, its associated documentation and the information herein have been prepared solely for the use of Dial A Product Pty Ltd. Any reliance assumed by third parties on this report shall be at such parties' own risk.

DOUGLAS PARTNERS PTY LTD

Reviewed by

Catherine Karpiel
Environmental Scientist

Lindsay Rockett
Senior Associate

J M Nash
Principal

APPENDIX A
Notes Relating to This Report
Site Drawing and Photographs

Douglas Partners
Geotechnics · Environment · Groundwater

NOTES RELATING TO THIS REPORT

Introduction

These notes have been provided to amplify the geotechnical report in regard to classification methods, specialist field procedures and certain matters relating to the Discussion and Comments section. Not all, of course, are necessarily relevant to all reports.

Geotechnical reports are based on information gained from limited subsurface test boring and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are based on Australian Standard 1726, Geotechnical Site Investigations Code. In general, descriptions cover the following properties - strength or density, colour, structure, soil or rock type and inclusions.

Soil types are described according to the predominating particle size, qualified by the grading of other particles present (eg. sandy clay) on the following bases:

Soil Classification	Particle Size
Clay	less than 0.002 mm
Silt	0.002 to 0.06 mm
Sand	0.06 to 2.00 mm
Gravel	2.00 to 60.00 mm

Cohesive soils are classified on the basis of strength either by laboratory testing or engineering examination. The strength terms are defined as follows.

Classification	Undrained Shear Strength kPa
Very soft	less than 12
Soft	12—25
Firm	25—50
Stiff	50—100
Very stiff	100—200
Hard	Greater than 200

Non-cohesive soils are classified on the basis of relative density, generally from the results of standard penetration tests (SPT) or Dutch cone penetrometer tests (CPT) as below:

Relative Density	SPT "N" Value (blows/300 mm)	CPT Cone Value (q_c — MPa)
Very loose	less than 5	less than 2
Loose	5—10	2—5
Medium dense	10—30	5—15
Dense	30—50	15—25
Very dense	greater than 50	greater than 25

Rock types are classified by their geological names. Where relevant, further information regarding rock classification is given on the following sheet.

Sampling

Sampling is carried out during drilling to allow engineering examination (and laboratory testing where required) of the soil or rock.

Disturbed samples taken during drilling provide information on colour, type, inclusions and, depending upon the degree of disturbance, some information on strength and structure.

Undisturbed samples are taken by pushing a thin-walled sample tube into the soil and withdrawing with a sample of the soil in a relatively undisturbed state. Such samples yield information on structure and strength, and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

Details of the type and method of sampling are given in the report.

Drilling Methods.

The following is a brief summary of drilling methods currently adopted by the Company and some comments on their use and application.

Test Pits — these are excavated with a backhoe or a tracked excavator, allowing close examination of the in-situ soils if it is safe to descent into the pit. The depth of penetration is limited to about 3 m for a backhoe and up to 6 m for an excavator. A potential disadvantage is the disturbance caused by the excavation.

Large Diameter Auger (eg. Pengo) — the hole is advanced by a rotating plate or short spiral auger, generally 300 mm or larger in diameter. The cuttings are returned to the surface at intervals (generally of not more than 0.5 m) and are disturbed but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers, and is usually supplemented by occasional undisturbed tube sampling.

Continuous Sample Drilling — the hole is advanced by pushing a 100 mm diameter socket into the ground and withdrawing it at intervals to extrude the sample. This is the most reliable method of drilling in soils, since moisture content is unchanged and soil structure, strength, etc. is only marginally affected.

Continuous Spiral Flight Augers — the hole is advanced using 90—115 mm diameter continuous spiral flight augers which are withdrawn at intervals to allow sampling or in-situ testing. This is a relatively economical means of drilling in clays and in sands above the water

table. Samples are returned to the surface, or may be collected after withdrawal of the auger flights, but they are very disturbed and may be contaminated. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively lower reliability, due to remoulding, contamination or softening of samples by ground water.

Non-core Rotary Drilling — the hole is advanced by a rotary bit, with water being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from 'feel' and rate of penetration.

Rotary Mud Drilling — similar to rotary drilling, but using drilling mud as a circulating fluid. The mud tends to mask the cuttings and reliable identification is again only possible from separate intact sampling (eg. from SPT).

Continuous Core Drilling — a continuous core sample is obtained using a diamond-tipped core barrel, usually 50 mm internal diameter. Provided full core recovery is achieved (which is not always possible in very weak rocks and granular soils), this technique provides a very reliable (but relatively expensive) method of investigation.

Standard Penetration Tests

Standard penetration tests (abbreviated as SPT) are used mainly in non-cohesive soils, but occasionally also in cohesive soils as a means of determining density or strength and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, "Methods of Testing Soils for Engineering Purposes" — Test 6.3.1.

The test is carried out in a borehole by driving a 50 mm diameter split sample tube under the impact of a 63 kg hammer with a free fall of 760 mm. It is normal for the tube to be driven in three successive 150 mm increments and the 'N' value is taken as the number of blows for the last 300 mm. In dense sands, very hard clays or weak rock, the full 450 mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form.

- In the case where full penetration is obtained with successive blow counts for each 150 mm of say 4, 6 and 7

  as 4, 6, 7
  N = 13

- In the case where the test is discontinued short of full penetration, say after 15 blows for the first 150 mm and 30 blows for the next 40 mm

  as 15, 30/40 mm.

The results of the tests can be related empirically to the engineering properties of the soil.

Occasionally, the test method is used to obtain samples in 50 mm diameter thin walled sample tubes in clays. In such circumstances, the test results are shown on the borelogs in brackets.

Cone Penetrometer Testing and Interpretation

Cone penetrometer testing (sometimes referred to as Dutch cone — abbreviated as CPT) described in this report has been carried out using an electrical friction cone penetrometer. The test is described in Australian Standard 1289, Test 6.4.1.

In the tests, a 35 mm diameter rod with a cone-tipped end is pushed continuously into the soil, the reaction being provided by a specially designed truck or rig which is fitted with an hydraulic ram system. Measurements are made of the end bearing resistance on the cone and the friction resistance on a separate 130 mm long sleeve, immediately behind the cone. Transducers in the tip of the assembly are connected by electrical wires passing through the centre of the push rods to an amplifier and recorder unit mounted on the control truck.

As penetration occurs (at a rate of approximately 20 mm per second) the information is plotted on a computer screen and at the end of the test is stored on the computer for later plotting of the results.

The information provided on the plotted results comprises: —

- Cone resistance — the actual end bearing force divided by the cross sectional area of the cone — expressed in MPa.
- Sleeve friction — the frictional force on the sleeve divided by the surface area — expressed in kPa.
- Friction ratio — the ratio of sleeve friction to cone resistance, expressed in percent.

There are two scales available for measurement of cone resistance. The lower scale (0—5 MPa) is used in very soft soils where increased sensitivity is required and is shown in the graphs as a dotted line. The main scale (0—50 MPa) is less sensitive and is shown as a full line.

The ratios of the sleeve friction to cone resistance will vary with the type of soil encountered, with higher relative friction in clays than in sands. Friction ratios of 1%—2% are commonly encountered in sands and very soft clays rising to 4%—10% in stiff clays.

In sands, the relationship between cone resistance and SPT value is commonly in the range:—

q_c (MPa) = (0.4 to 0.6) N (blows per 300 mm)

In clays, the relationship between undrained shear strength and cone resistance is commonly in the range:—

q_c = (12 to 18) c_u

Interpretation of CPT values can also be made to allow estimation of modulus or compressibility values to allow calculation of foundation settlements.

Inferred stratification as shown on the attached reports is assessed from the cone and friction traces and from experience and information from nearby boreholes, etc. This information is presented for general guidance, but must be regarded as being to some extent interpretive. The test method provides a continuous profile of engineering properties, and where precise information on soil classification is required, direct drilling and sampling may be preferable.

Hand Penetrometers

Hand penetrometer tests are carried out by driving a rod into the ground with a falling weight hammer and measuring the blows for successive 150 mm increments of penetration. Normally, there is a depth limitation of 1.2 m but this may be extended in certain conditions by the use of extension rods.

Two relatively similar tests are used.

- Perth sand penetrometer — a 16 mm diameter flat-ended rod is driven with a 9 kg hammer, dropping 600 mm (AS 1289, Test 6.3.3). This test was developed for testing the density of sands (originating in Perth) and is mainly used in granular soils and filling.
- Cone penetrometer (sometimes known as the Scala Penetrometer) — a 16 mm rod with a 20 mm diameter cone end is driven with a 9 kg hammer dropping 510 mm (AS 1289, Test 6.3.2). The test was developed initially for pavement subgrade investigations, and published correlations of the test results with California bearing ratio have been published by various Road Authorities.

Laboratory Testing

Laboratory testing is carried out in accordance with Australian Standard 1289 "Methods of Testing Soil for Engineering Purposes". Details of the test procedure used are given on the individual report forms.

Bore Logs

The bore logs presented herein are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable, or possible to justify on economic grounds. In any case, the boreholes represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes, the frequency of sampling and the possibility of other than 'straight line' variations between the boreholes.

Ground Water

Where ground water levels are measured in boreholes, there are several potential problems;

- In low permeability soils, ground water although present, may enter the hole slowly or perhaps not at all during the time it is left open.
- A localised perched water table may lead to an erroneous indication of the true water table.
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report.
- The use of water or mud as a drilling fluid will mask any ground water inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water observations are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Engineering Reports

Engineering reports are prepared by qualified personnel and are based on the information obtained and on current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal (eg. a three storey building), the information and interpretation may not be relevant if the design proposal is changed (eg. to a twenty storey building). If this happens, the Company will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface condition, discussion of geotechnical aspects and recommendations or suggestions for design and construction. However, the Company cannot always anticipate or assume responsibility for:

- unexpected variations in ground conditions — the potential for this will depend partly on bore spacing and sampling frequency
- changes in policy or interpretation of policy by statutory authorities
- the actions of contractors responding to commercial pressures.

If these occur, the Company will be pleased to assist with investigation or advice to resolve the matter.

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, the Company requests that it immediately be notified. Most problems are much more readily resolved when conditions are exposed than at some later stage, well after the event.

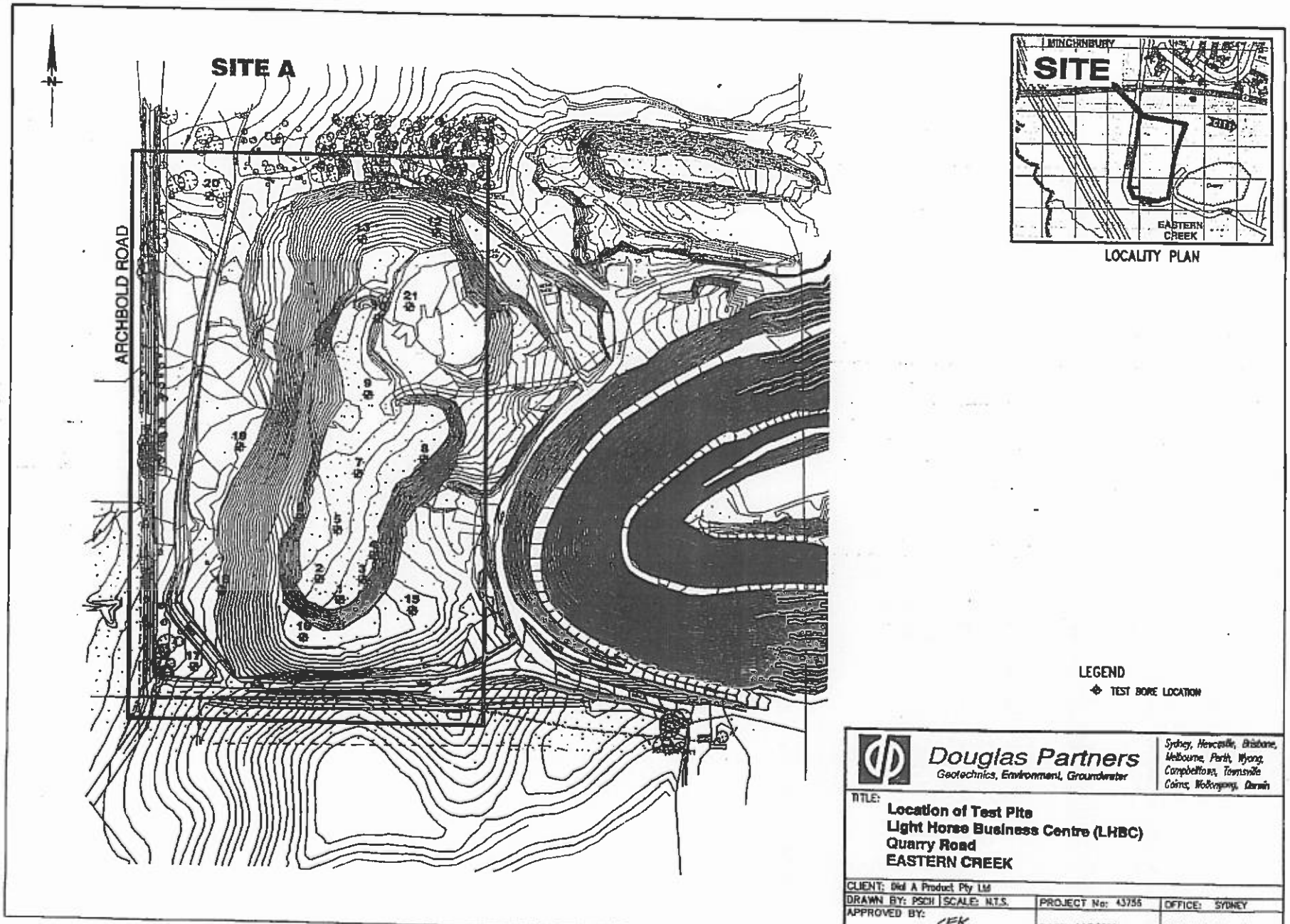
Reproduction of Information for Contractual Purposes

Attention is drawn to the document "Guidelines for the Provision of Geotechnical Information in Tender Documents", published by the Institution of Engineers, Australia. Where information obtained from this investigation is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section

is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. The Company would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The Company will always be pleased to provide engineering inspection services for geotechnical aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.



Douglas Partners
Geotechnics, Environment, Groundwater

Sydney, Newcastle, Brisbane, Melbourne, Perth, Wyong, Campbelltown, Townsville Cairns, Wollongong, Darwin

TITLE:
Location of Test Pits
Light Horse Business Centre (LHBC)
Quarry Road
EASTERN CREEK

CLIENT: Dial A Product Pty Ltd		
DRAWN BY: PSCH SCALE: N.T.S.	PROJECT No: 43755	OFFICE: SYDNEY
APPROVED BY: CFK	DATE: 14.3.2008	DRAWING No: 1

P:\43756 EASTERN CREEK, Preliminary Contamination and Geotechnical Assessment, RO\Drawings\43756-1.dwg, 4/7/2008 2:57:41 PM

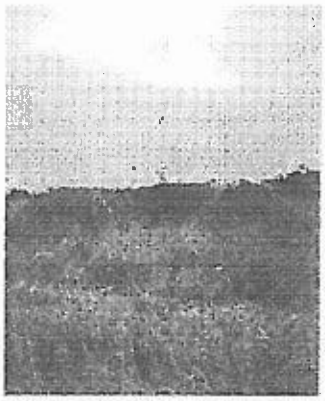


Photo 1 - Bunker

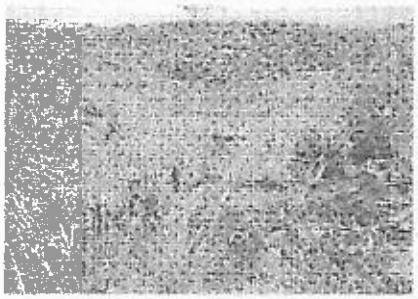


Photo 2 - Bunker 2

Photo 3 - Northern portion of stockpile large bunker

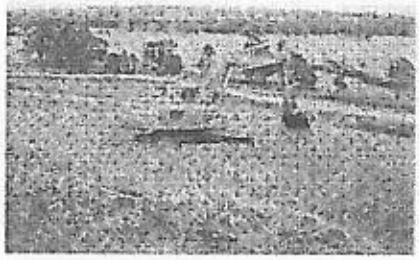


Photo 4 - Test Pit 6 Location

Photo 5 - Location of Test Pit 8

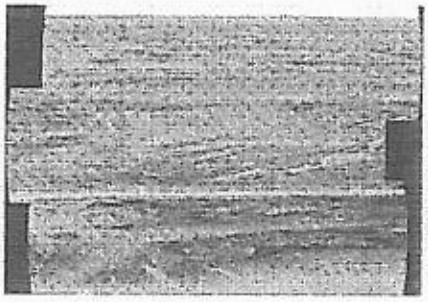


Photo 6 - Quarry face Panoramic - top to bottom

Project Name: Fresh Stockpile & Preliminary Contamination Assessment Project Address: Arnold Road Project Suburb/Location: Eastern Creek		Project 43756A	March 2006	Plate 1

Douglas Partners
Geotechnics · Environment · Groundwater

Date/Time :21-Feb-2006 08:10 AM
User :STANNER
Report :RMGW001D.QRP
Executable :S:\GS\PROD32\Ground.exe
Exe Date :18-Apr-2005
System :Groundwater
Database :Edbp

NSW Government
DEPARTMENT OF NATURAL RESOURCES

DEPARTMENT OF NATURAL RESOURCES
Work Summary

GW018361 *Converted From HYDSYS*

License :10BL010545

Work Type :Bore open thru rock
Work Status :(Unknown)
Construct. Method :Cable Tool
Owner Type :Private

Authorised Purpose(s)
AQUACULTURE
WASTE DISPOSAL

Intended Purpose(s)
WASTE DISPOSAL

Commenced Date :
Completion Date :01-Jan-1961
Final Depth : 217.90 m
Drilled Depth : 217.90 m

Contractor Name :
Driller :

Property : - N/A
GWMA :603 - SYDNEY BASIN
GW Zone : -

Standing Water Level :
Salinity : (Unknown)
Yield :

Site Details

Site Chosen By

County
Form A :CUMBERLAND
Licensed :CUMBERLAND

Parish
ROOTY HILL
ROOTY HILL

Portion/Lot DP
161
PT 21

Region :10 - SYDNEY SOUTH COAST
River Basin :212 - HAWKESBURY RIVER
Area / District :

CMA Map :9030-2N
Grid Zone :56/1

PROSPECT
Scale :1:25,000

Elevation :
Elevation Source :(Unknown)

Northing :6259575
Easting :300510

Latitude (S) :33° 47' 6"
Longitude (E) :150° 50' 43"

GS Map :0056D4 AMG Zone :56

Coordinate Source :GD,ACC.MAP

Construction

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Threaded Steel	0.00	12.10	203			Suspended in Clamps

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

(No Water Bearing Zone Details Found)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Stratigraphy	Comments
0.00	14.02	14.02	Topsoil Clay	Basalt	
14.02	16.45	2.43	Basalt	Shale	
16.45	45.72	29.27	Shale Grey	Shale	
45.72	60.96	15.24	Shale Light Grey	Shale	
60.96	61.56	0.60	Shale Grey	Basalt	
61.56	64.00	2.44	Basalt	Shale	
64.00	72.54	8.54	Shale Black	Shale	
72.54	92.04	19.50	Shale Grey	Sandstone	
92.04	99.06	7.02	Sandstone	Shale	
99.06	137.16	38.10	Shale Grey	Shale	
137.16	150.87	13.71	Shale Grey	Sandstone	
150.87	194.46	43.59	Sandstone White	Shale	
194.46	195.68	1.22	Shale Grey	Sandstone	
195.68	217.62	21.94	Sandstone White	Shale	
217.62	217.93	0.31	Shale Grey		

Pumping Tests - Summaries

Pumping Test Type	Date	Duration (hr)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By
Single-Rate Pumping Test	01-Jan-1961	3.00	33.50		0.38		Bailer			

Pumping Tests - Readings

Pumping Test Type	Date	Time (mins)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By

(No Pumping Test Reading Details Found)

Chemical Treatment

Treatment	Method	Duration	Success

(No Chemical Treatment Details Found)

DEPARTMENT OF NATURAL RESOURCES
Work Summary

GW018361 *Converted From HYDSYS*

Development

Method	Time Taken	Other Development Method

(No Development Details Found)

Remarks

*** End of GW018361 ***

DEPARTMENT OF NATURAL RESOURCES
Work Summary

GW028414 *Converted From HYDSYS*

License :10BL020250

Work Type :Well
Work Status :Supply Obtained
Construct. Method :Rotary
Owner Type :Private

Authorised Purpose(s)	Intended Purpose(s)
IRRIGATION	IRRIGATION

Commenced Date :
Completion Date :01-Mar-1966
Final Depth : 6.00 m
Drilled Depth : 6.10 m

Contractor Name :
Driller :

Property : - N/A
GWMA :603 - SYDNEY BASIN
GW Zone : -

Standing Water Level :
Salinity : (Unknown)
Yield :

Site Details

Site Chosen By

County	Parish	Portion/Lot DP
Form A :CUMBERLAND	MELVILLE	14
Licensed :CUMBERLAND	MELVILLE	3 752041

Region :10 - SYDNEY SOUTH COAST
River Basin :212 - HAWKESBURY RIVER
Area / District :

CMA Map :9030-2N PROSPECT
Grid Zone :56/1
Scale :1:25,000

Elevation :
Elevation Source :(Unknown)

Northing :6259470
Easting :298550

Latitude (S) :33° 47' 8"
Longitude (E) :150° 49' 27"

GS Map :0056D4 AMG Zone :56

Coordinate Source :GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Concrete Cylinder	0.00	0.00	1219			(Unknown)

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
5.90	5.90	0.00	Fractured	3.90					(Unknown)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	3.66	3.66	Clay		
3.66	6.10	2.44	Shale Soft Broken	Shale	
6.10	6.11	0.01	Shale Grey Hard	Shale	

Pumping Tests - Summaries

Pumping Test Type	Date	Duration (hr)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By
Single-Rate Pumping Test	01-Mar-1966		3.90				(Unknown)			

Pumping Tests - Readings

Pumping Test Type	Date	Time (mins)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By

(No Pumping Test Reading Details Found)

Chemical Treatment

Treatment	Method	Duration	Success

(No Chemical Treatment Details Found)

Development

Method	Time Taken	Other Development Method

(No Development Details Found)

Remarks

*** End of GW028414 ***

DEPARTMENT OF NATURAL RESOURCES
Work Summary

GW028415 *Converted From HYDSYS*

License :10BL020249

Work Type :Well
Work Status :Supply Obtained
Construct. Method :(Unknown)
Owner Type :Private

Authorised Purpose(s)	Intended Purpose(s)
IRRIGATION	IRRIGATION

Commenced Date :
Completion Date :01-Mar-1966

Final Depth : 0.00
Drilled Depth : 7.60 m

Contractor Name :
Driller :

Property : - N/A
GWMA :603 - SYDNEY BASIN
GW Zone : -

Standing Water Level :
Salinity : Brackish
Yield :

Site Details

Site Chosen By

County	Parish	Portion/Lot DP
Form A :CUMBERLAND	ROOTY HILL	106
Licensed :CUMBERLAND	ROOTY HILL	18 752052

Region :10 - SYDNEY SOUTH COAST
River Basin :212 - HAWKESBURY RIVER
Area / District :

CMA Map :9030-2N PROSPECT
Grid Zone :56/1
Scale :1:25,000

Elevation :
Elevation Source :(Unknown)

Northing :6260200
Easting :296985

Latitude (S) :33° 46' 44"
Longitude (E) :150° 48' 27"

GS Map :0056D4 AMG Zone :56

Coordinate Source :GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Backfill	Backfill	0.00	7.60	1066			
1	1	Casing	Concrete Cylinder	-0.90	-0.90	1066			(Unknown)

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
3.00	4.80	1.80	Unconsolidated						(Unknown)
7.40	7.40	0.00	Fractured						(Unknown)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	0.61	0.61	Loam Sandy		
0.61	3.05	2.44	Clay	Clay	
3.05	4.88	1.83	Gravel Clayey Sandy	Gravel	
4.88	7.62	2.74	Shale Soft Broken Water Supply	Shale	
7.62	7.64	0.02	Shale Gray Hard	Shale	

Pumping Tests - Summaries

Pumping Test Type	Date	Duration (hr)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By
Single-Rate Pumping Test	01-Mar-1966		2.10				(Unknown)			

Pumping Tests - Readings

Pumping Test Type	Date	Time (mins)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By

(No Pumping Test Reading Details Found)

Chemical Treatment

Treatment	Method	Duration	Success

(No Chemical Treatment Details Found)

Development

Method	Time Taken	Other Development Method

(No Development Details Found)

Remarks

*** End of GW028415 ***

DEPARTMENT OF NATURAL RESOURCES
Work Summary

GW101082

License :10BL157654

Work Type :Bore
Work Status :(Unknown)
Construct. Method :Percussion
Owner Type :

Authorised Purpose(s): MONITORING BORE
Intended Purpose(s): TEST BORE

Commenced Date :
Completion Date :27-May-1996
Final Depth : 40.30 m
Drilled Depth :

Contractor Name :INTERTECH DRILLING
Driller :

Property : - N/A
GWMA : -
GW Zone : -

Standing Water Level : 12.43 m
Salinity :
Yield :

Site Details

Site Chosen By	County	Parish	Portion/Lot DP
	Form A : Licensed :CUMBERLAND	MELVILLE	93 838541

Region :10 - SYDNEY SOUTH COAST
River Basin :
Area / District :

CMA Map :
Grid Zone :
Scale :

Elevation :
Elevation Source :

Northing :6255728
Easting :296006.995

Latitude (S) :33° 49' 8"
Longitude (E) :150° 47' 47"

GS Map :
AMG Zone :56

Coordinate Source :

Construction

Negative depths indicate Above Ground Level;H-Hole,P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	40.30	150			Other
1	1	Casing	P.V.C.	-1.02	40.30	50			C; 0-28m
1	1	Opening	Screen	30.40	39.30	.4			(Unknown); PVC Class 18
1		Annulus	(Unknown)	0.00	0.00				(Unknown); GS: 2mm

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

(No Water Bearing Zone Details Found)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments

(No Drillers Log Details Found)

Pumping Tests - Summaries

Pumping Test Type	Date	Duration (hr)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By

(No Pumping Test Summary Details Found)

Pumping Tests - Readings

Pumping Test Type	Date	Time (mins)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By

(No Pumping Test Reading Details Found)

Chemical Treatment

Treatment	Method	Duration	Success

(No Chemical Treatment Details Found)

Development

Method	Time Taken	Other Development Method

(No Development Details Found)

Remarks

Bore is called BH4-R.

*** End of GW101082 ***

DEPARTMENT OF NATURAL RESOURCES
Work Summary

GW101085

License :10BL157654

Work Type :Bore
Work Status :(Unknown)
Construct. Method :Percussion
Owner Type :

Authorised Purpose(s)
MONITORING BORE

Intended Purpose(s)
TEST BORE

Commenced Date :
Completion Date :30-May-1996

Final Depth : 99.30 m
Drilled Depth :

Contractor Name :INTERTECH DRILLING
Driller :

Property : - N/A
GWMA : -
GW Zone : -

Standing Water Level :
Salinity :
Yield :

Site Details

Site Chosen By

County
Form A :
Licensed :CUMBERLAND

Parish
MELVILLE

Portion/Lot DP
93 838541

Region :10 - SYDNEY SOUTH COAST
River Basin :
Area / District :

CMA Map :
Grid Zone :

Scale :

Elevation :
Elevation Source :

Northing :6255599
Easting :295752.456

Latitude (S) :33° 49' 12"
Longitude (E) :150° 47' 37"

GS Map :

AMG Zone :56

Coordinate Source :

Construction

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	99.30	158			Other
1	1	Casing	P.V.C.	-0.37	99.30	50			
1	1	Opening	Screen	79.50	97.30	.4			(Unknown); PVC
1		Annulus	(Unknown)	77.00	97.30				(Unknown); GS: 2mm

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

(No Water Bearing Zone Details Found)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments

(No Drillers Log Details Found)

Pumping Tests - Summaries

Pumping Test Type	Date	Duration (hr)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By

(No Pumping Test Summary Details Found)

Pumping Tests - Readings

Pumping Test Type	Date	Time (mins)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By

(No Pumping Test Reading Details Found)

Chemical Treatment

Treatment	Method	Duration	Amount

(No Chemical Treatment Details Found)

Development

Method	Time Taken	Other Development Method

(No Development Details Found)

Remarks

Form A Remarks:
Bore called BH-16B

*** End of GW101085 ***

DEPARTMENT OF NATURAL RESOURCES
Work Summary

GW101086

License :10BL157654

Work Type :Bore
Work Status :(Unknown)
Construct. Method :Percussion
Owner Type :

Authorised Purpose(s)
MONITORING BORE

Intended Purpose(s)
TEST BORE

Commenced Date :
Completion Date :29-May-1996

Final Depth :
Drilled Depth :

69.70 m

Contractor Name :INTERTECH DRILLING
Driller :

Property : - N/A
GWMA : -
GW Zone : -

Standing Water Level :
Salinity :
Yield :

Site Details

Site Chosen By

County
Form A :
Licensed :CUMBERLAND

Parish
MELVILLE

Portion/Lot DP
93 838541

Region :10 - SYDNEY SOUTH COAST
River Basin :
Area / District :

CMA Map :
Grid Zone :

Scale :

Elevation :
Elevation Source :

Northing :6255568
Easting :295753.12

Latitude (S) :33° 49' 13"
Longitude (E) :150° 47' 37"

GS Map :

AMG Zone :56

Coordinate Source :

Construction

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

#	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	69.70	158			Other
2	1	Casing	P.V.C.	-0.79	69.70	50			
3	1	Opening	Screen	49.90	67.70	50			(Unknown); PVC; A: .4mm
4		Annulus	(Unknown)	47.00	67.70				(Unknown); GS: 2mm

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

(No Water Bearing Zone Details Found)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments

(No Drillers Log Details Found)

Pumping Tests - Summaries

Pumping Test Type	Date	Duration (hr)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By

(No Pumping Test Summary Details Found)

Pumping Tests - Readings

Pumping Test Type	Date	Time (mins)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By

(No Pumping Test Reading Details Found)

Chemical Treatment

Treatment	Method	Duration	Success

(No Chemical Treatment Details Found)

Development

Method	Time Taken	Other Development Method

(No Development Details Found)

Remarks

Form A Remarks:
Bore called BH-16A.

*** End of GW101086 ***

DEPARTMENT OF NATURAL RESOURCES
Work Summary

GW102674

License :10BL152917

Work Type :Bore
Work Status :(Unknown)
Construct. Method :Rotary
Owner Type :

Authorised Purpose(s): MONITORING BORE
Intended Purpose(s): MONITORING BORE

Commenced Date :
Completion Date :25-Aug-1993
Final Depth : 69.70 m
Drilled Depth : 71.90 m

Contractor Name :ENGINEERING EXPLORATION
Driller : Williams, Roy

Property : - N/A
GWMA : -
GW Zone : -

Standing Water Level :
Salinity : 4,400.00 mg/L
Yield :

Site Details

Site Chosen By

County: Form A : Licensed :CUMBERLAND
Parish: MELVILLE
Portion/Lot DP: 91 838541

Region :10 - SYDNEY SOUTH COAST
River Basin :
Area / District :

CMA Map :
Grid Zone :
Scale :

Elevation :
Elevation Source :

Northing :6255589
Easting :295263.794
Latitude (S) :33° 49' 12"
Longitude (E) :150° 47' 18"

GS Map :
AMG Zone :56
Coordinate Source :GIS - Geographic Information System

Construction

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	36.00	100			(Unknown)
1		Hole	Hole	36.00	39.00	96			Cable Tool
1		Hole	Hole	39.00	71.90	100			(Unknown)
1	1	Casing	P.V.C.	0.00	21.00	50			C: 0-15m
1	1	Casing	(Unknown)	24.00	29.90				
1	1	Casing	(Unknown)	41.70	47.60				
1	1	Casing	(Unknown)	50.50	56.40				
1	1	Casing	(Unknown)	59.40	65.30				
1	1	Casing	(Unknown)	68.20	68.70				
1	1	Opening	Screen	21.00	23.90	50			PVC; A: .4mm; Screwed
1	1	Opening	Screen	29.90	32.80				A: .4mm; Screwed
1	1	Opening	Screen	38.70	41.70				A: .4mm; Screwed
1	1	Opening	Screen	47.60	50.50				A: .4mm; Screwed
1	1	Opening	Screen	56.40	59.40				A: .4mm; Screwed
1	1	Opening	Screen	65.30	68.20				A: .4mm; Screwed
1		Annulus	(Unknown)	15.00	69.70				Graded

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

(No Water Bearing Zone Details Found)

Drillers Log

From (m)	To (m)	Thickness	Drillers Description	Geological Material	Comments
0.00	2.00	2.00	SHALE/GREY/BROWN	Siltstone	
2.00	9.00	7.00	SILTSTONE/SHALE	Shale	
9.00	12.00	3.00	SHALE/SILTSTONE	Siltstone	
12.00	25.00	13.00	SILTSTONE/SANDSTONE/SHALE	Sandstone	
25.00	32.00	7.00	SANDSTONE/SILTSTONE/SHALE	Siltstone	
32.00	37.40	5.40	SILTSTONE, SHALE	Shale	
37.40	40.00	2.60	SHALE, CARBONACEOUS	Siltstone	
40.00	48.00	8.00	SILTSTONE/SHALE	Shale	
48.00	53.00	5.00	SHALE/SILTSTONE/SANDSTONE	Shale	
53.00	56.00	3.00	SHALE	Sandstone	
56.00	60.00	4.00	SANDSTONE/SILTSTONE	Shale	
60.00	71.90	11.90	SHALE/SILTSTOIRE		

Pumping Tests - Summaries

Pumping Test Type	Date	Duration (hr)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By

(No Pumping Test Summary Details Found)

Pumping Tests - Readings

Pumping Test Type	Date	Time (mins)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By

(No Pumping Test Reading Details Found)

DEPARTMENT OF NATURAL RESOURCES
Work Summary

GW102674

Chemical Treatment

Treatment	Method	Duration	Success

(No Chemical Treatment Details Found)

Development

Method	Time Taken	Other Development Method

(No Development Details Found)

Remarks

***** End of GW102674 *****

DEPARTMENT OF NATURAL RESOURCES
Work Summary

GW103953

License :10BL156670

Work Type :Bore
Work Status :(Unknown)
Construct. Method :Auger
Owner Type :

Authorised Purpose(s)
MONITORING BORE

Intended Purpose(s)
MONITORING BORE

Commenced Date :
Completion Date :21-Jan-1993

Final Depth : 9.90 m
Drilled Depth : 10.50 m

Contractor Name :ENGINEERING EXPLORATION P/L
Driller : Amaval, R

Property : - N/A
GWMA : -
GW Zone : -

Standing Water Level :
Salinity :
Yield :

Site Details

Site Chosen By
Other

County
Form A :CUMBERLAND
Licensed :CUMBERLAND

Parish
MELVILLE
MELVILLE

Portion/Lot DP
LOT80 DP106143
LOT80 DP106143

Region :10 - SYDNEY SOUTH COAST
River Basin :
Area / District :

CMA Map :
Grid Zone :

Scale :

Elevation :
Elevation Source :

Northing :
Easting :

Latitude (S) :
Longitude (E) :

GS Map :

AMG Zone :

Coordinate Source :

Construction

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	10.05	100			Auger
1	1	Casing	P.V.C.	-0.30	9.90				C-,1-,Jm
1	1	Opening	Screen	6.90	9.90	50			PVC

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

(No Water Bearing Zone Details Found)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	1.50	1.50	CLAYEY SILT	Marginal Sand	
1.50	5.00	3.50	SILTY CLAY TO CLAYEY SILT	Silty Clay	
5.00	10.50	5.50	SHALE, GREY	Shale	

Pumping Tests - Summaries

Pumping Test Type	Date	Duration (hr)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By

(No Pumping Test Summary Details Found)

Pumping Tests - Readings

Pumping Test Type	Date	Time (mins)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By

(No Pumping Test Reading Details Found)

Chemical Treatment

Treatment	Method	Duration	Success

(No Chemical Treatment Details Found)

Development

Method
Other

Time Taken

Other Development Method

Remarks

*** End of GW103953 ***

DEPARTMENT OF NATURAL RESOURCES
Work Summary

GW103954

License :10BL156670

Work Type :Bore
Work Status :(Unknown)
Constructi. Method :Auger
Owner Type :

Authorised Purpose(s)
MONITORING BORE

Intended Purpose(s)
MONITORING BORE

Commenced Date :
Completion Date :29-Oct-1993

Final Depth : 9.90 m
Drilled Depth : 9.00 m

Contractor Name :ENGINEERING EXPLORATION P/L
Driller : Amaval, R

Property : - N/A
GWMA : -
GW Zone : -

Standing Water Level :
Salinity :
Yield :

Site Details

Site Chosen By
Other

County
Form A :CUMBERLAND
Licensed :CUMBERLAND

Parish
MELVILLE
MELVILLE

Portion/Lot DP
LOT80 DP106143
LOT80 DP106143

Region :10 - SYDNEY SOUTH COAST
River Basin :
Area / District :

CMA Map :
Grid Zone :

Scale :

Elevation :
Elevation Source :

Northing :
Easting :

Latitude (S) :
Longitude (E) :

GS Map :

AMG Zone :

Coordinate Source :

Construction

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	9.00	100			Auger
1	1	Casing	P.V.C.	-0.30	9.00	50			C-1.3m
1	1	Opening	Screen	6.00	9.00	50			PVC

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

(No Water Bearing Zone Details Found)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	1.50	1.50	CLAYEY SILT	Sandy Sand	
1.50	4.50	3.00	SILTY CLAY TO CLAYEY SILT	Silty Clay	
4.50	9.00	4.50	SHALE	Shale	

Pumping Tests - Summaries

Pumping Test Type	Date	Duration (hr)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By

(No Pumping Test Summary Details Found)

Pumping Tests - Readings

Pumping Test Type	Date	Time (mins)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By

(No Pumping Test Reading Details Found)

Chemical Treatment

Treatment	Method	Duration	Success

(No Chemical Treatment Details Found)

Development

Method
Other

Time Taken

Other Development Method

Remarks

*** End of GW103954 ***

*** End of Report ***

APPENDIX C
Title Deed Search Records

ACN: 093 398 611
ABN: 61 093 412 474

Peter S. Hopley Pty Limited
Legal Searchers

1 Boronia Avenue
Mount Annan , NSW , 2567
Mobile: 0412 199 304
Fax 9233 4590 (Attn Box 29)

SUMMARY AS TO OWNERS.

Property: Archbold Road, Eastern Creek

Description: - Lot 2 D.P. 262213

As to that part marked 1 on the attached cadastre

06.12.1909	Thomas Baker *(Tanner)*	Book 895 No. 803
03.05.1955	Burfield Pty Limited *(Now Ray Fitzpatrick Pty Limited)*	2/262213

For search continued as to this part, See Page 2

As to those parts marked 2 & 3 on the attached cadastre

09.03.1917	Elizabeth Sarah Baker *(Married Woman)*	Book 1102 No. 994
29.08.1946	William Thomas Gillett Baker *(Grazier)*	Book 1995 No. 998
03.05.1955	Burfield Pty Limited *(Now Ray Fitzpatrick Pty Limited)*	2/262213

For search continued as to this part, See Page 2

email: grolly1@bigpond.net.au

21/02/2006

ACN: 093 398 611
ABN: 61 093 412 474

Peter S. Hopley Pty Limited
Legal Searchers

1 Boronia Avenue
Mount Annan , NSW , 2567
Mobile: 0412 199 304
Fax 9233 4590 (Attn Box 29)

Search continued as to the whole of the subject land

12.09.2005	# ACN 114 843 453 Pty Limited	2/262213

 # Current Registered Proprietor

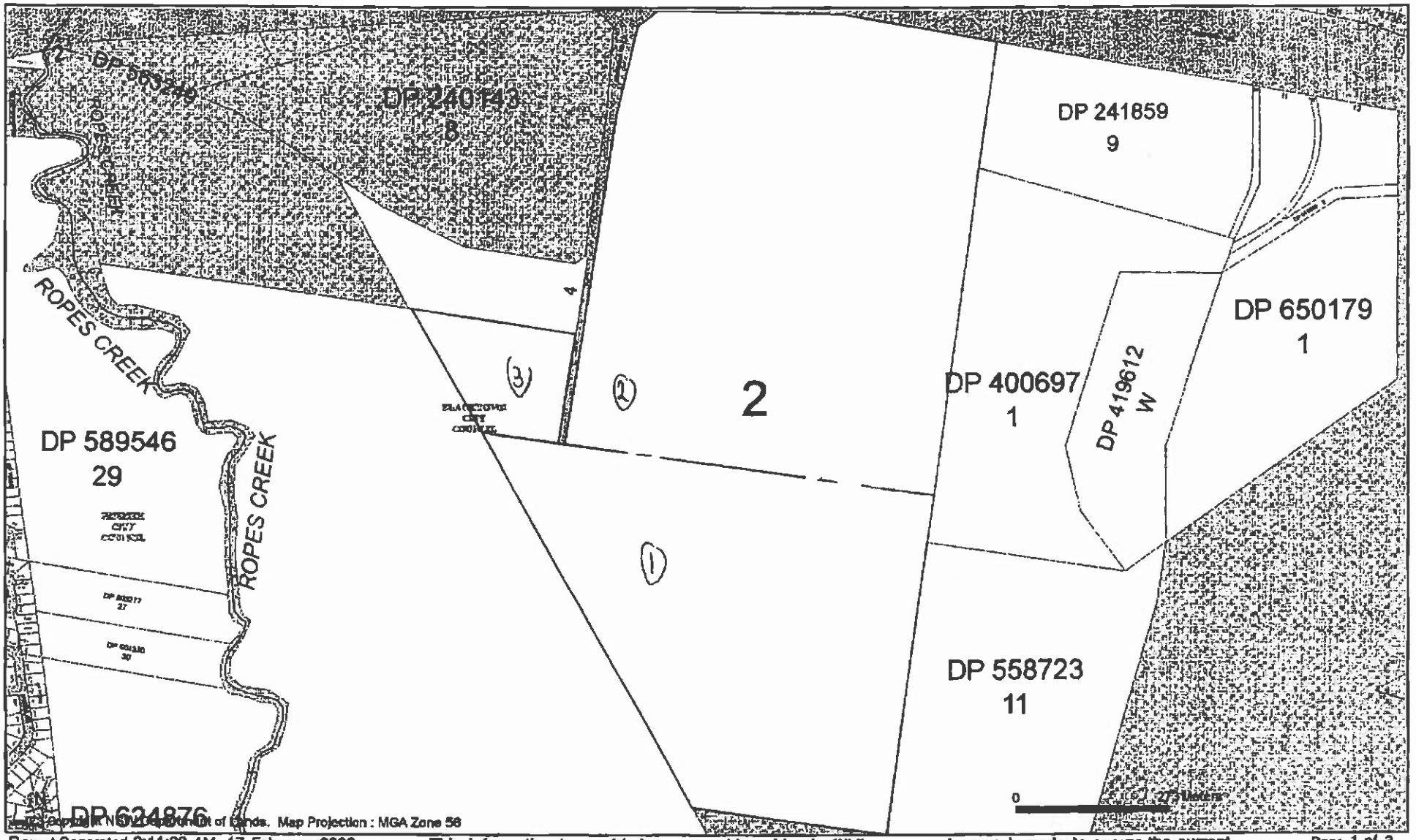
Department of Lands
Reliable from the ground up

Cadastral Records Enquiry Report

Box : 29

Requested Parcel : Lot 2 DP 262213 **Identified Parcel** : Lot 2 DP 262213

Locality : EASTERN CREEK **LGA** : BLACKTOWN **Parish** : MELVILLE **County** : CUMBERLAND



 Map Projection : MGA Zone 56

Report Generated 9:11:26 AM, 17 February, 2006

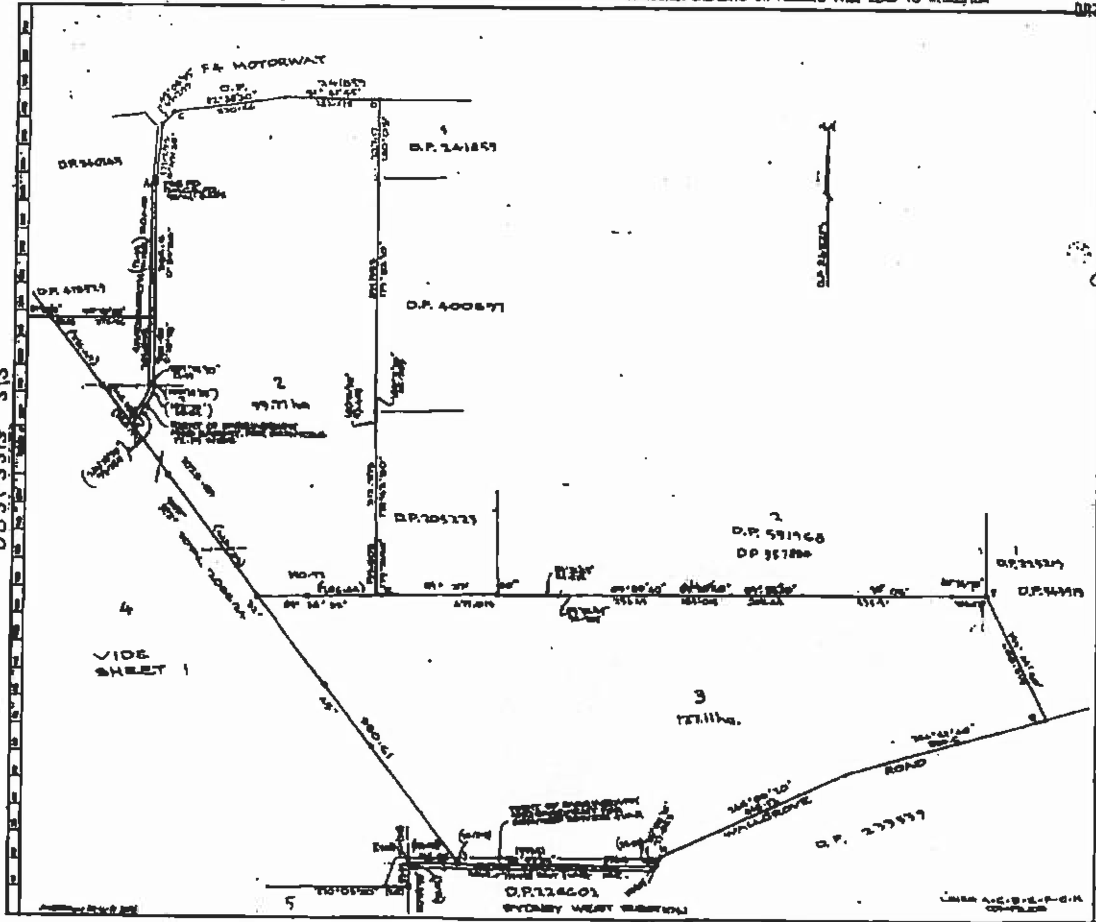
This information is provided as a searching aid only. While every endeavour is made to ensure the current cadastral pattern is accurately reflected, the Registrar General cannot guarantee the information provided

PLAN / FORM 3. To be used in conjunction with Plan Form 2

WARNING: CREASING OR FOLDING WILL LEAD TO REJECTION

• OFFICE USE ONLY

DP262213



DP 262213

10.3.1982

This is sheet 2 of my plan in 2 sheets

Surveyor registered under Surveyors Act 1929.

This is sheet 2 of the plan of 2 sheets

Signatures and seals only.

Reduction Scale is 1:5000

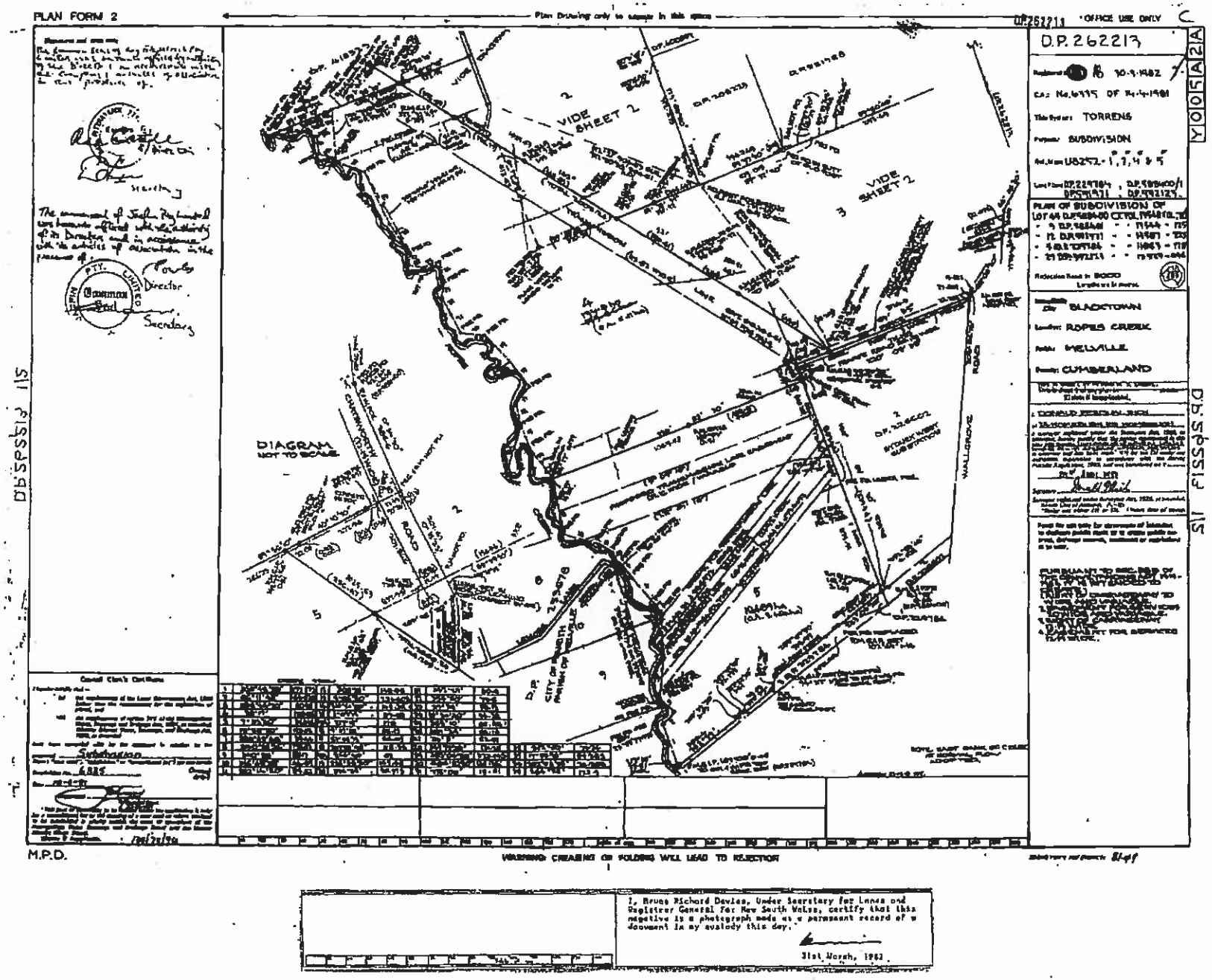
Lengths are in metres

Plan Drawing only to appear in this space

DP262213 S/S

I, Bruce Richard Davies, Under Secretary for Lands and Registrar General for New South Wales, certify that this negative is a photograph made as a permanent record of a document in my custody this day.

31st March, 1982.



NEW SOUTH WALES

Appln. No.52818

13544 Fol. 125

EDITION ISSUED

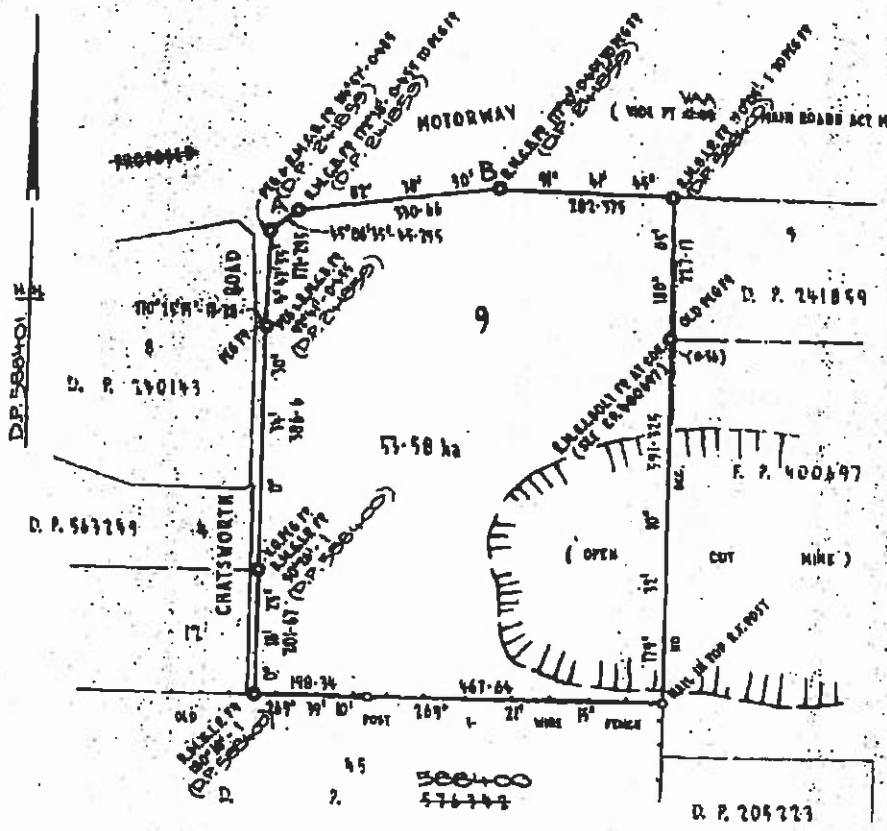
6 2 1978

I certify that the person described in the First Schedule is the registered proprietor of the undermentioned estate in the land within described subject nevertheless to such exceptions encumbrances and interests as are shown in the Second Schedule.

Registrar General.

PLAN SHOWING LOCATION OF LAND

LENGTHS ARE IN METRES



ESTATE AND LAND REFERRED TO

Estate in Fee Simple in Lot 9 in Deposited Plan 588401 at Bupes Creek in the Municipality of Blacktown Parish of Melville and County of Cumberland being part of Portion 14 granted to William Cox (Junior) on 17-8-1819.

FIRST SCHEDULE

RAY FITZPATRICK PTY. LIMITED.

SECOND SCHEDULE

1. Reservations and conditions, if any, contained in the Crown Grant above referred to.
2. Book 2603 No.79 Lease to Ray Fitzpatrick Quarries Pty.Limited. Date of expiry 14-2-1979.

Vol. 13544 Fol. 125

CT. 10-4.91
DP 262213

FIRST SCHEDULE (continued)

REGISTERED PROPRIETOR	INSTRUMENT NATURE	INSTRUMENT NUMBER	INSTRUMENT DATE	ENTERED	Signature of Registrar General
NEW CERTIFICATE(S) OF TITLE ISSUING ON DP262213 — NO CHANGE TO BE REGISTERED WITHOUT REFERENCE TO DEALINGS BRANCH					

SECOND SCHEDULE (continued)

INSTRUMENT NATURE	INSTRUMENT NUMBER	DATE	PARTICULARS	ENTERED	Signature of Registrar General	CANCELLATION
	DP262213	30.3.1982	Interests created pursuant to Section 88B Conveyancing Act, 1919, by the registration of Deposited Plan 262213	30.3.1982	[signature]	
			This Deed is cancelled as to whole. New Certificates of Title have issued on 02-4-1982 for lots in Deposited Plan No 262213 as follows: Lots 1 to 5 Vol. 14786 Fol. 1 to 5 respectively. [signature] REGISTRAR GENERAL			

NOTE: ENTRIES RULED THROUGH AND AUTHENTICATED BY THE SEAL OF THE REGISTRAR GENERAL ARE CANCELLED

NEW SOUTH WALES

Appln. No.52819

Vol. 13548 Fol. 70

EDITION ISSUED

9 2 1970

I certify that the person described in the First Schedule is the registered proprietor of the undermentioned estate in the land within described subject nevertheless to such exceptions encumbrances and interests as are shown in the Second Schedule.

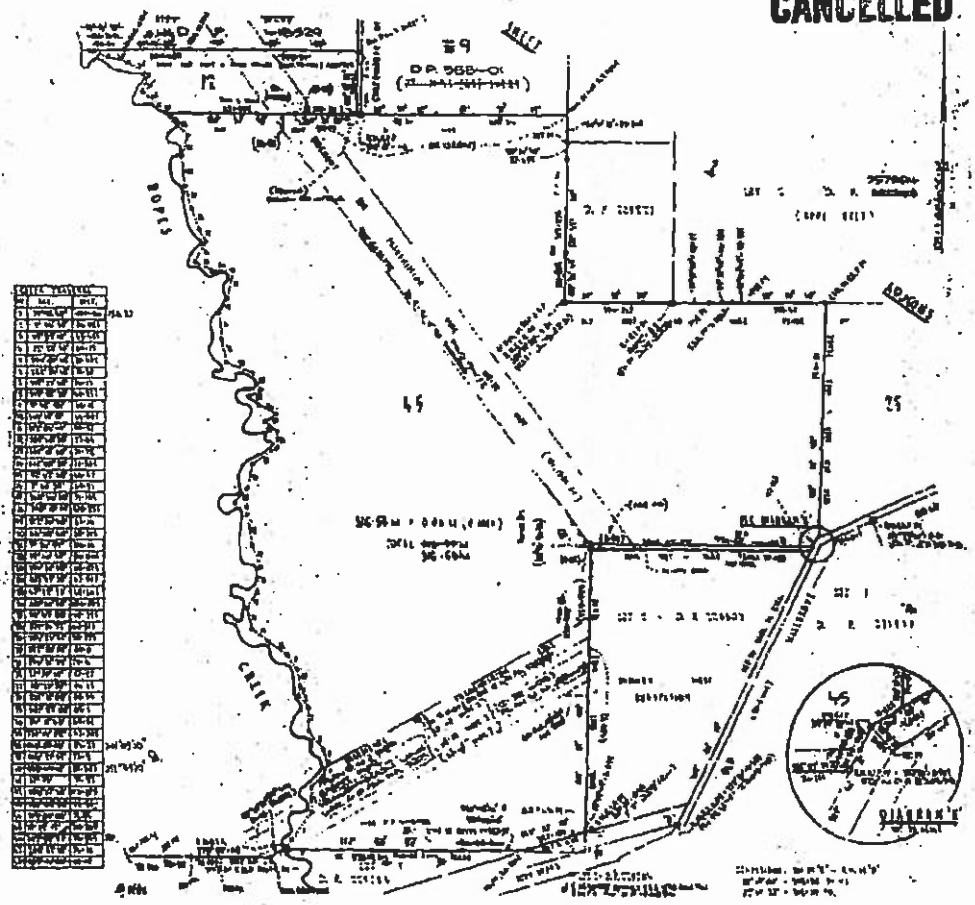
Registrar General.

(Page 1) Vol. 13548 Fol. 70

PERSONS ARE CAUTIONED AGAINST ALTERING OR ADDING TO THIS CERTIFICATE OR ANY NOTIFICATION HEREON

PLAN SHOWING LOCATION OF LAND

LENGTHS ARE IN METRES



ESTATE AND LAND REFERRED TO

Estate in Fee Simple in Lot 45 in Deposited Plan 588400 at Ropes Creek in the Municipality of Blacktown Parish of Melville and County of Cumberland being part of Portion 45 granted to John Thomas Campbell on 17-8-1819.

FIRST SCHEDULE

BAY FITZPATRICK PTY. LIMITED.

SECOND SCHEDULE

1. Reservations and conditions, if any, contained in the Crown Grant above referred to.
2. Book 2603 No.79 Lease to Bay Fitzpatrick Quarries Pty.Limited. Date of expiry 14-2-1979.
3. Notification in Government Gazette 30-6-1961 folio 1941. Easement for transmission line affecting the part of the land above described shown so burdened in Deposited Plan 588400.
4. Notification in Government Gazette 16-8-1963 folio 2389. Easement for transmission line affecting the part of the land above described shown so burdened in Deposited Plan 588400.
5. Notification in Government Gazette 16-10-1964 folio 3205. Easement for transmission line affecting the part of the land above described shown so burdened in Deposited Plan 588400.

NOTE: ENTRIES RULED THROUGH AND AUTHENTICATED BY THE SEAL OF THE REGISTRAR GENERAL ARE CANCELLED.

Vol. 12548 Fol. 20

CT. 10.9.81

DP262213

FIRST SCHEDULE (continued)

REGISTERED PROPRIETOR	INSTRUMENT NATURE	INSTRUMENT NUMBER	INSTRUMENT DATE	ENTERED	Signature of Registrar General

NEW CERTIFICATES OF TITLE ISSUED AS TO DP262213
NO DEALINGS TO BE REGISTERED WITHOUT REFERENCE TO DEALING BRANCH

SECOND SCHEDULE (continued)

NATURE	INSTRUMENT NUMBER	INSTRUMENT DATE	PARTICULARS	ENTERED	Signature of Registrar General	CANCELLATION		
	DP262213	30.3.1982	Interests created pursuant to Section 88B Conveyancing Act, 1919, by the registration of Deposited Plan 262213	30.3.1982				
			First Deed is cancelled as to Lot 5					
			New Certificates of Title have issued on 22-4-1982					
			for lots in DP262213 Plan No DP262213 as follows:					
			Lots 4 to 5 Vol. 14216 Fol. 200 to 201 respectively.					
			REGISTRAR GENERAL					

(Page 2 of 2 pages)

NOTE: ENTRIES RULED THROUGH AND AUTHENTICATED BY THE SEAL OF THE REGISTRAR GENERAL ARE CANCELLED

NEW SOUTH WALES

Vol. 13507 Fol. 223

Appln. No.53178

EDITION ISSUED

6 12 1977

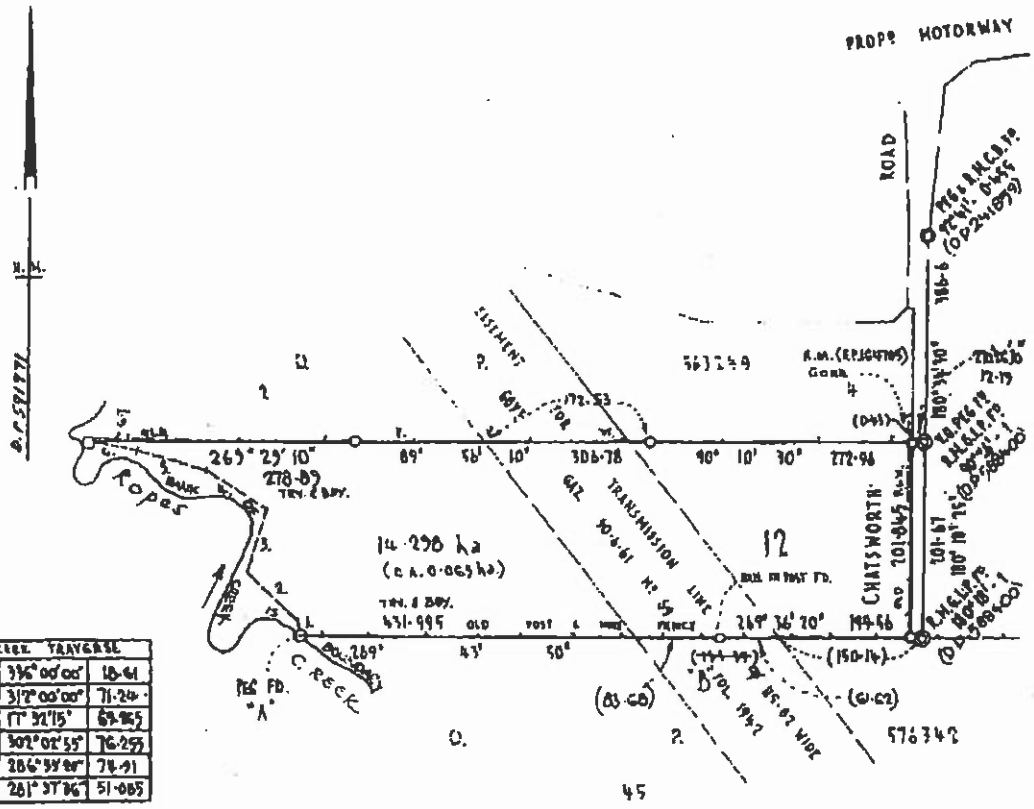
(Page 1) Vol. 13507 Fol. 223

I certify that the person described in the First Schedule is the registered proprietor of the undermentioned estate in the land within described subject nevertheless to such exceptions encumbrances and interests as are shown in the Second Schedule.

Registrar General.

PLAN SHOWING LOCATION OF LAND

LENGTHS ARE IN METRES



CREEK TRAVERSE		
1	336° 00' 00"	18-41
2	317° 00' 00"	71-24
3	17° 32' 15"	69-965
4	302° 01' 55"	76-255
5	286° 39' 00"	74-91
6	261° 37' 30"	51-085

ESTATE AND LAND REFERRED TO

Estate in Fee Simple in Lot 12 in Deposited Plan 591971 at Ropes Creek in the Municipality of Blacktown Parish of Melville and County of Cumberland being part of Portion 14 granted to William Cox (Junior) on 17-8-1819.

FIRST SCHEDULE

RAY FITZPATRICK PTY. LIMITED.

SECOND SCHEDULE

1. Reservations and conditions, if any, contained in the Crown Grant above referred to.
2. Book 2603 No.79 Lease to Ray Fitzpatrick Quarries Pty. Ltd. Expiry dated 14-2-1979.
3. Notification in Government Gazette 30-6-1961 Folio 1942. Easement for Transmission Line affecting the part of the land above described shown so burdened in Deposited Plan 591971.

Vol. 15907 Fol. 229

CT. 10-9-81
DP262213

FIRST SCHEDULE (continued)

REGISTERED PROPRIETOR	INSTRUMENT NATURE	INSTRUMENT NUMBER	INSTRUMENT DATE	ENTERED	Signature of Registrar General

NEW CERTIFICATE OF TITLE ISSUED DP262213
AS DEALING TO BE REGISTERED WITHOUT REFERENCE TO
DEPOSIT BRANCH

SECOND SCHEDULE (continued)

NATURE	INSTRUMENT NUMBER	INSTRUMENT DATE	PARTICULARS	ENTERED	Signature of Registrar General	CANCELLATION		
	DP262213	30·3·1982	Interests created pursuant to Section 888 Conveyancing Act, 1919, by the registration of Deposited Plan 262213	30·3·1982				

This Deed is cancelled as to WHOLE
New Certificates of Title have issued on 22-4-1982
for lots in Deposited Plan No. 262213 as follows:
Lots 2 to 5 inclusive in Vol. 15907 Fol. 229 to Vol. 15907 Fol. 232 respectively.

REGISTRAR GENERAL

(Page 2 of 2 pages)

NOTE: ENTRIES RULED THROUGH AND AUTHENTICATED BY THE SEAL OF THE REGISTRAR GENERAL ARE CANCELLED

NEW SOUTH WALES

Appln. Nos. 52818 & 52819

Prior Titles Vol.13544 Fol.125
Vol.13548 Fol. 70
Vol.13507 Fol.223

726 Fol. 222

EDITION ISSUED

23 4 1982

I certify that the person described in the First Schedule is the registered proprietor of the undermentioned estate in the land within described subject nevertheless to such exceptions encumbrances and interests as are shown in the Second Schedule.

CANCELLED

Registrar General.

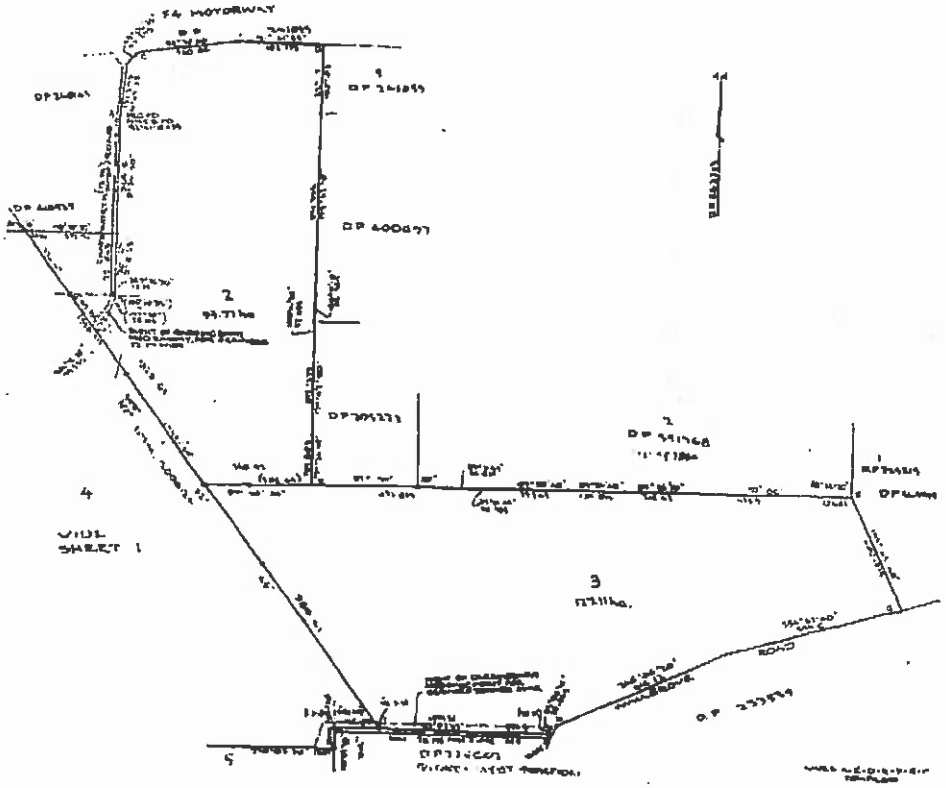
SEE AUTO FOLIO

PERSONS ARE CAUTIONED AGAINST ALTERING OR ADDING TO THIS CERTIFICATE OR ANY NOTIFICATION HEREON

14726 Fol. 222 (Page 1) Vol.

PLAN SHOWING LOCATION OF LAND

LENGTHS ARE IN METRES



ESTATE AND LAND REFERRED TO

Estate in Fee Simple in Lot 2 in Deposited Plan 262213 at Ropes Creek in the City of Blacktown Parish of Melville and County of Cumberland being part of Portion 14 granted to William Cox (Junior) on 17-8-1819 and part of Portion 45 granted to John Thomas Campbell on 17-8-1819.

FIRST SCHEDULE

RAY FITZPATRICK PTY. LIMITED.

SECOND SCHEDULE

GAY 1. Reservations and conditions, if any, contained in the Crown Grants above referred to.
RC(SB) 2. DP262213 Right of carriageway affecting the part of the land above described shown so burdened in the plan hereon.
EG(SB) 3. DP262213 Easement for services affecting the part of the land above described shown so burdened in the plan hereon.

NOTE: ENTRIES RULED THROUGH AND AUTHENTICATED BY THE SEAL OF THE REGISTRAR GENERAL ARE CANCELLED

RG 2/64

Vol. 14726 Fol. 222

94137C 4.81 D. West, Government Printer

FIRST SCHEDULE (continued)

REGISTERED PROPRIETOR	Registrar General

SECOND SCHEDULE (continued)

	PARTICULARS	Registrar General	CANCELLATION
1	T646462 Lease to Pioneer Concrete (N.S.W.) Pty. Limited. Expires 31-12-2004. Registered 28-7-1983		

NOTATIONS AND UNREGISTERED DEALINGS

C.T. 7.7.83 T646462 Lse J 224

NOTE: ENTRIES RULED THROUGH AND AUTHENTICATED BY THE SEAL OF THE REGISTRAR GENERAL ARE CANCELLED

LegalStream Australia Pty Ltd

ABN: 60 002 601 498
Level 10, 135 King Street, SYDNEY NSW 2000, AUSTRALIA * DX654, SYDNEY
Tel: (02) 9231 0122 Fax: (02) 9233 6411 www.legalstream.com.au

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Information Broker

LAND AND PROPERTY INFORMATION NEW SOUTH WALES - HISTORICAL SEARCH

SEARCH DATE
21/2/2006 6:21PM

FOLIO: 2/262213

First Title(s): SEE PRIOR TITLE(S)
Prior Title(s): VOL 14726 FOL 222

Recorded	Number	Type of Instrument	C.T. Issue
5/6/1987		TITLE AUTOMATION PROJECT	LOT RECORDED FOLIO NOT CREATED
6/8/1987		CONVERTED TO COMPUTER FOLIO	FOLIO CREATED CT NOT ISSUED
21/5/1996		AMENDMENT: LOCAL GOVT AREA	
23/12/1996	2716424	VARIATION OF LEASE	EDITION 1
19/6/1998	5067558	DEPARTMENTAL DEALING	
9/11/2004	AB78884	REQUEST	EDITION 2
23/12/2004	AB183817	CAVEAT	
16/3/2005	AB222195	MORTGAGE	EDITION 3
12/9/2005	AB760521	WITHDRAWAL OF CAVEAT	
12/9/2005	AB760522	DISCHARGE OF MORTGAGE	
12/9/2005	AB760523	TRANSFER	
12/9/2005	AB760524	MORTGAGE	
12/9/2005	AB760525	MORTGAGE	EDITION 4

*** END OF SEARCH ***

archbold road PRINTED ON 21/2/2006

LAND AND PROPERTY INFORMATION NEW SOUTH WALES - TITLE SEARCH

FOLIO: 2/262213

SEARCH DATE	TIME	EDITION NO	DATE
21/2/2006	6:21 PM	4	12/9/2005

LAND

LOT 2 IN DEPOSITED PLAN 262213
AT ROPES CREEK
LOCAL GOVERNMENT AREA: BLACKTOWN
PARISH OF MELVILLE COUNTY OF CUMBERLAND
TITLE DIAGRAM: DP262213

FIRST SCHEDULE

ACN 114 843 453 PTY LIMITED (T AB760523)

SECOND SCHEDULE (5 NOTIFICATIONS)

1. RESERVATIONS AND CONDITIONS IN THE CROWN GRANT(S)
2. DP262213 RIGHT OF CARRIAGEWAY AFFECTING THE PART(S) SHOWN SO BURDENED IN THE TITLE DIAGRAM
3. DP262213 EASEMENT FOR SERVICES AFFECTING THE PART(S) SHOWN SO BURDENED IN THE TITLE DIAGRAM
4. AB760524 MORTGAGE TO VALAD FUNDS MANAGEMENT LIMITED
5. AB760525 MORTGAGE TO VALAD COMMERCIAL MANAGEMENT LIMITED

NOTATIONS

UNREGISTERED DEALINGS: L AC54545 L AC54546 L AC54547
L AC54548 L AC54549.

*** END OF SEARCH ***

archbold road PRINTED ON 21/2/2006

APPENDIX D
Aerial Photographs

Photo 1 - 1947 Aerial

Project Name	Preliminary Contamination Assessment of Stockpiled Quarry Overburden and General Land Quality	Project	March	Plate
		43766A	2006	1
Project Address	Archbold Road			
Project Suburb/Location	Eastern Creek			

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Photo 2 - 1970 Aerial

Project Name	Preliminary Contamination Assessment of Stockpiled Quarry Overburden and General Land Quality	Project	March	Plate
		43756A	2006	2
Project Address	Archbold Road			
Project Suburb/Location	Eastern Creek			

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Photo 3 - 1986 Aerial

Project Name	Preliminary Contamination Assessment of Stockpiled Quarry Overburden and General Land Quality	**Project**	**March**	**Plate**
		43756A	**2006**	**3**
Project Address	Archbold Road			
Project Suburb/Location	Eastern Creek			

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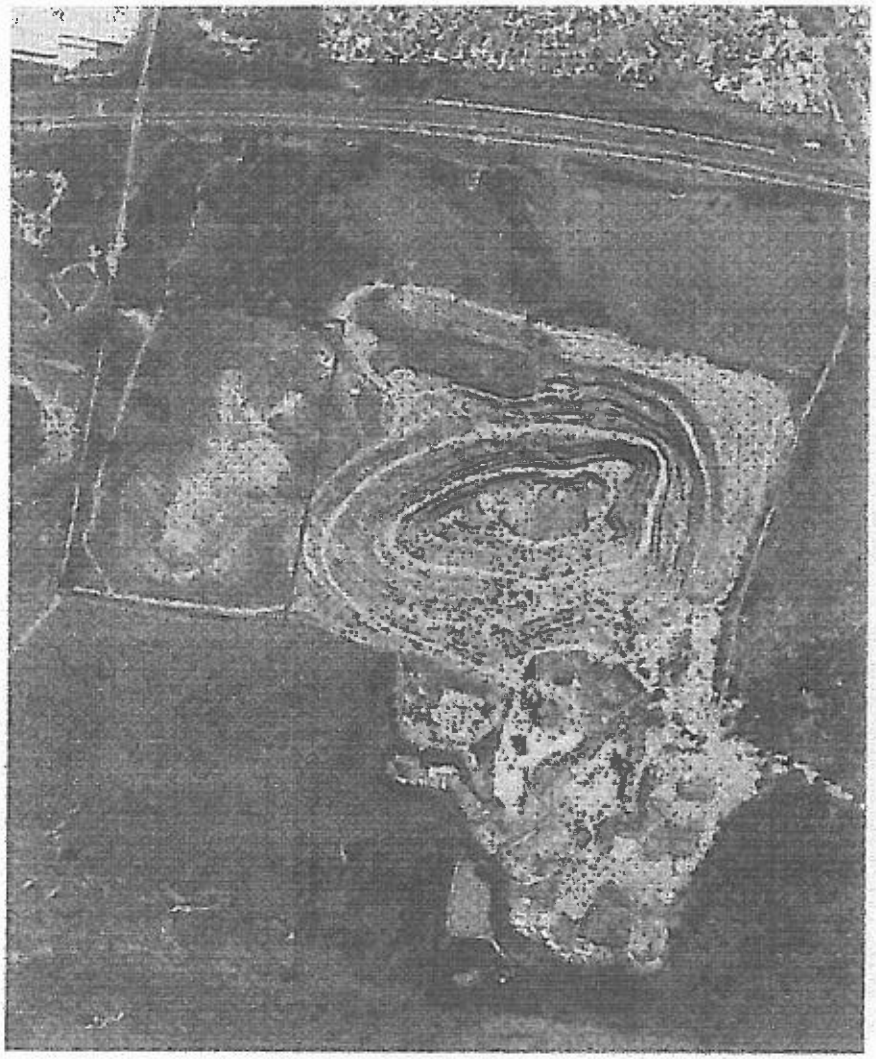

Photo 4 - 2002 Aerial Photograph

Project Name	Preliminary Contamination Assessment of Stockpiled Quarry Overburden and General Land Quality	Project	March	Plate
		43756A	2006	4
Project Address	Archbold Road			
Project Suburb/Location	Eastern Creek			

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APPENDIX E
Section 149 Planning Certificate

Blacktown City Council

PLANNING CERTIFICATE UNDER SECTION 149

ENVIRONMENTAL PLANNING AND ASSESSMENT ACT, 1979

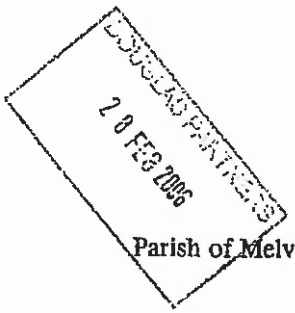
Certificate No: 06-1004
Date: 27 FEB 2006
Page: 1 of 7
Enquiries: Ms Lucic
Applicants Ref:

Applicant CATHERINE KARPIEL
PO BOX 472
WEST RYDE NSW 1685

Property LOT 2 DP 262213

ARCHBOLD ROAD,

Suburb EASTERN CREEK



Parish of Melville

NOTE: [redacted]

PART A
PRESCRIBED INFORMATION PROVIDED PURSUANT TO SECTION 149(2) OF THE EPA ACT 1979

NOTE: The following information is provided pursuant to Section 149(2) of the Environmental Planning & Assessment (EPA) Act 1979 as prescribed by Schedule 4 of the EPA Regulation 2000 and is applicable as of the date of this certificate.

1. RELEVANT STATE ENVIRONMENTAL PLANNING POLICIES (INCLUDING DRAFT POLICIES), REGIONAL ENVIRONMENTAL PLANS (INCLUDING DRAFT PLANS), LOCAL ENVIRONMENTAL PLANS (INCLUDING DRAFT PLANS) AND DEVELOPMENT CONTROL PLANS

1.1 Local Environmental Planning Instruments

As at the date of this certificate the abovementioned land is not affected by Blacktown Local Environmental Plan 1988.

1.2 Development Control Plans

As at the date of this certificate the abovementioned land is not affected by Blacktown Development Control Plan 1992.

1.3 Relevant State Environmental Planning Policies (including Draft Policies) or Regional Environmental Plans (including Draft Plans)

General Manager Per:

State Environmental Planning Policy - 1 - Development Standards and Draft State Environmental Planning Policy (Application of Development Standards) 2004

State Environmental Planning Policy (SEPP) No. 1 gives Councils the power to vary standards and approve development in some situations. Currently the Department of Planning is reviewing the SEPP and a draft SEPP called draft State Environmental Planning Policy (Application of Development Standards) 2004 was exhibited from 10 May to 18 June 2004. One change proposed would make developers and Councils more accountable. When applicants use SEPP 1, they must provide sufficient evidence that proposed development meets the objectives of the local plan. Local communities will be more certain about the quality of development in their area. Another change would affect rural areas. Farmland will be protected and unintended development will be prevented in rural, environment protection and water catchment areas.

State Environmental Planning Policy - 4 - Development Without Consent and Miscellaneous and Complying Development

This Policy allows relatively simple or minor changes of land or building use and certain types of development without the need for formal Development Applications. The types of development covered in the Policy are outlined in the Policy.

State Environmental Planning Policy - 6 - Number of Storeys in a Building

This Policy sets out a method for determining the number of storeys in a building, to prevent possible confusion arising from the interpretation of various environmental planning instruments.

State Environmental Planning Policy - 11 - Traffic Generating Developments

State Environmental Planning Policy No. 11 rationalises consultation required in relation to traffic-generating developments. The Policy establishes the Roads and Traffic Authority as the sole traffic management authority to be consulted, and ensures it is given the opportunity to make a representation on a Development Application before the local Council decides whether to approve a proposal. The Policy is being reviewed to remove requirements for unnecessary consultations.

State Environmental Planning Policy - 19 - Bushland in Urban Areas

This Policy protects and preserves bushland within certain urban areas, as part of the natural heritage or for recreational, educational and scientific purposes. The Policy is designed to protect bushland in public open space zones and reservations, and to ensure that bush preservation is given a high priority when local environmental plans for urban development are prepared.

State Environmental Planning Policy - 32 - Urban Consolidation (Redevelopment of Land)

This Policy states the Government's intention to ensure that urban consolidation objectives are met in all urban areas throughout the State. The Policy focuses on the redevelopment of urban land that is no longer required for the purpose it is currently zoned or used and encourages local councils to pursue their own urban consolidation strategies to help implement the aims and objectives of the policy. Councils will continue to be responsible for the majority of rezonings. The Policy sets out guidelines for the Minister to follow when considering whether to initiate a regional environmental plan (REP) to make particular sites available for consolidated urban redevelopment. Where a site is rezoned by an REP, the Minister will be the consent authority.

State Environmental Planning Policy - 33 - Hazardous and Offensive Development

This policy provides new definitions for 'hazardous industry', 'hazardous storage establishment', 'offensive industry' and 'offensive storage establishment'. The definitions apply to all planning instruments, existing and future. The new definitions enable decisions to approve or refuse a development to be based on the merit of proposal. The consent authority must careful consider the specifics the case, the location and the way in which the proposed activity is to be carried out. The Policy also requires specified matters to be considered for proposals that are 'potentially hazardous' or 'potentially offensive' as defined in the policy. For example, any application to carry out a potentially hazardous or potentially offensive development is to be advertised for public comment, and applications to carry out potentially hazardous development must be supported by a preliminary hazard analysis (PHA). The Policy does not change the role of Councils as consent authorities, land zoning, or the designated development provisions of the Environmental Planning and Assessment Act 1979.

State Environmental Planning Policy - 34 - Major Employment Generating Industrial Development

This Policy promotes and coordinates the orderly and economic use and development of land, and the economic welfare of State, by facilitating certain types of major employment-generating industrial development of State significance; and the carrying out of labour-intensive rural industrial development of State significance.

State Environmental Planning Policy - 37 - Continued Mines and Extractive Industries

This Policy provides for the continued operation of mines and extractive industries that lawfully commenced without development consent before planning controls came into force and which cannot operate in future without obtaining consent. The Policy sets a 3 month registration period and a 2 year moratorium during which operations may continue without development consent, provided certain limitations and restrictions are complied with, and establishes environmental impact assessment provisions which are to be followed when seeking approval to operate after the end of the moratorium period.

State Environmental Planning Policy - 55 - Remediation of Land

The Policy introduces state-wide planning controls for the remediation of contaminated land. The policy states that land must not be developed if it is unsuitable for a proposed use because it is contaminated. If the land is unsuitable, remediation must take place before the land is developed. The Policy makes remediation permissible across the State, defines when consent is required, requires all remediation to comply with standards, ensures land is investigated if contamination is suspected, and requires Councils to be notified of all remediation proposals. To assist Councils and developers, the Department, in conjunction with the Environment Protection Authority, has prepared Managing Land Contamination: Planning Guidelines.

State Environmental Planning Policy - 59 - Central Western Sydney Economic and Employment Area

This Policy rezones land in the central-west of Sydney for employment and residential purposes and regional open space. The Policy provides a framework for detailed planning and development on a precinct-by-precinct basis. It promotes employment, providing for major warehousing and industrial, high-tech and research facilities that have good access to road freight networks, including the M4 motorway an the Western Sydney orbital.

State Environmental Planning Policy - 64 - Advertising and Signage

State Environmental Planning Policy No. 64 - Advertising and Signage (SEPP 64) aims to improve the amenity of urban and natural settings by managing the impact of outdoor advertising. The Policy responds to growing concerns from the community, the advertising industry and local government that existing controls and guidelines were not effective. SEPP 64 offers the comprehensive provisions and consistent approach needed. SEPP 64 Advertising and Signage: Explanatory Information should be read in conjunction with the policy.

State Environmental Planning Policy - 66 - Integration of Land Use and Transport (Draft)

This draft Policy aims to ensure that urban structure, building forms, land use locations, development designs, subdivision and street layouts help achieve the following planning objectives:

(a) improving accessibility to housing, employment and services by walking, cycling, and public transport,

(b) improving the choice of transport and reducing dependence solely on cars for travel purposes,

(c) moderating growth in the demand for travel and the distances travelled, especially by car,

(d) supporting the efficient and viable operation of public transport services,

(e) providing for the efficient movement of freight.

Sydney Regional Environmental Plan No. 9 - Extractive Industry Sydney Region

This plan aims to protect the viability of extractive resources in the Sydney Metropolitan Area by ensuring consideration is given to the impact of encroaching development.

2. ZONING AND LAND USE UNDER RELEVANT ENVIRONMENTAL PLANNING INSTRUMENTS

(a) The abovementioned land is subject to the provisions of State Environmental Planning Policy No. 59 - Central Western Sydney Economic and Employment Area and is zoned:

Employment Lands

(b) The land does not include or comprise a critical habitat. Critical habitat refers to habitat that is critical to the survival of endangered species, populations or ecological communities. Areas of critical habitat are declared under Part 3 of the Threatened Species Conservation Act 1995 and Part 7A of the Fisheries Management Act 1994.

(c) The land is not within a conservation area.

(d) This land does not contain an item of environmental heritage under the protection of Blacktown Local Environmental Plan 1988.

3. DECLARED STATE SIGNIFICANT DEVELOPMENT

The land to which this certificate applies has not been the subject of any application to carry out development on the land which was, at the time the application for the certificate was lodged, the subject of a notice by the Minister under section 76A(7)(b) of the Act declaring the development to be State Significant development.

4. COASTAL PROTECTION

The land is not affected by the operation of Section 38 or 39 of the Coastal Protection Act, 1979.

5. MINE SUBSIDENCE

The land has not been proclaimed to be a mine subsidence district within the meaning of Section 15 of the Mine Subsidence Compensation Act, 1961.

6. ROAD WIDENING AND ROAD REALIGNMENT

Blacktown Local Environmental Plan 1988 and Blacktown Development Control Plan 1992 nominate preferred road patterns throughout the City.

The land is not affected by road widening/road realignment under Division 2 of Part 3 of the Roads Act 1993 and/or Blacktown Local Environmental Plan 1988.

7. COUNCIL AND OTHER PUBLIC AUTHORITY POLICIES ON HAZARD RISK RESTRICTIONS

Council has not adopted, by resolution, any policies to restrict the development of the land by reason of the likelihood of landslip, bushfire, tidal inundation, subsidence or acid sulphate soils. Although the Council has not adopted a specific policy to restrict development on bush fire prone land, it is bound by bush fire legislation and the "Planning for Bushfire Protection Guidelines", produced by the NSW Rural Fire Service and the then PlanningNSW, which may restrict development. In this regard, refer to point 11 below.

Council has adopted by resolution a policy on contaminated land which may restrict the development of this land. This policy is implemented when zoning or land use changes are proposed on lands which have previously been used for certain purposes or have the potential to be affected by such purposes undertaken on nearby lands. Council's records may not be sufficient to determine all previous uses to which this land may have been put or determine all activities which may have taken place on this land. Consideration of Council's adopted policy and the application of provisions under the relevant State legislation and guidelines is warranted.

The land the subject of this Certificate has not been identified, based on flood inundation maps prepared by Council, as subject to flooding during a flood with a 1% or 1 in 100 chance of occurring in a given year. Therefore, the land the subject of this Certificate is not affected by Council's Floodplain Management Policy.

8. LAND RESERVED FOR ACQUISITION

Clauses 17, 17A and 18 of Blacktown Local Environmental Plan 1988 provide for the acquisition of certain land zoned 5(a), 5(b), 5(c), 6(a) or 6(c) by a public authority.

9. SECTION 94 CONTRIBUTIONS PLANS

Council currently levies Section 94 Contributions for facilities and services. The further development of the subject land may incur such contribution.

10. MATTERS ARISING UNDER THE CONTAMINATED LAND MANAGEMENT ACT 1997

(a) The land to which the certificate relates is not within land declared to be an **investigation area** or **remediation site** under Part 3 of that Act.

(b) The land to which the certificate relates is not subject to an **investigation order** or a **remediation order** within the meaning of that Act.

(c) The land to which the certificate relates is not the subject of a voluntary investigation proposal (or voluntary remediation proposal) the subject of the Environment Protection Authority's agreement under section 19 or 26 of that Act.

(d) The land to which the certificate relates is not the subject of a **site audit statement** within the meaning of Part 4 of that Act.

11. BUSHFIRE PRONE LAND

The Rural Fires and Environmental Assessment Legislation Amendment Act 2002, which came into force on 1 August 2002, introduces development provisions for bush fire prone land which is shown on Bush Fire Prone Land Maps. Under the provisions of the Rural Fires and Environmental Assessment Legislation Amendment Act 2002, "bush fire prone land" is land that has been designated by the Commissioner of the NSW Rural Fire Service as being bush fire prone, as well as those bush fire prone areas within 100m of a high or medium bush fire hazard (Category 1 Type Vegetation) or within 30m of a low bush fire hazard (Category 2 Type Vegetation) and which are recorded so on a Bush Fire Prone Land Map. The land the subject of this certificate has been identified on Council's Bush Fire Prone Land Map as being

clear of any bush fire prone land

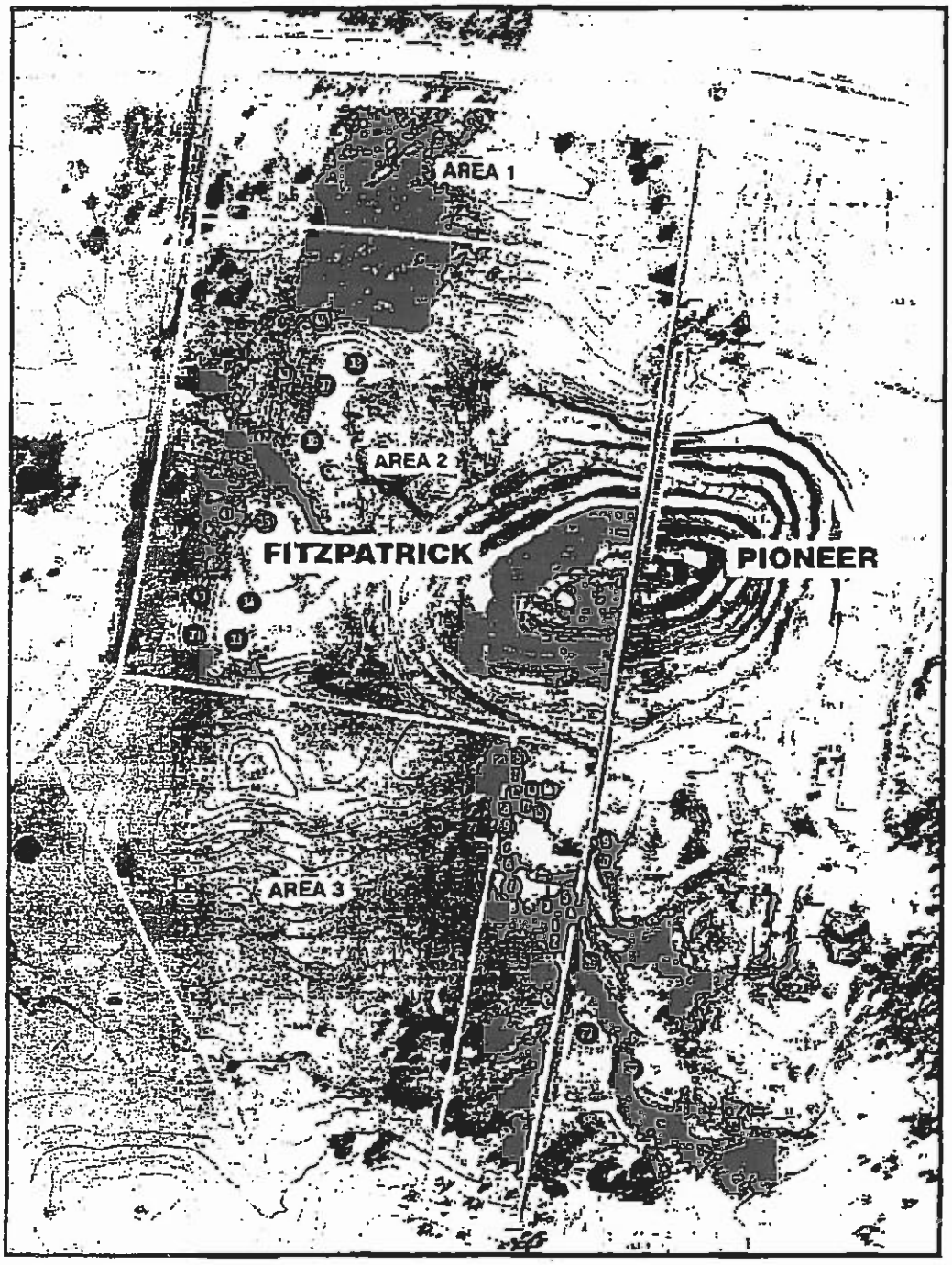
On land that is bush fire prone, certain development may require further consideration under section 79BA or section 91 of the Environmental Planning and Assessment Act 1979 and under section 100B of the Rural Fires Act 1997 with respect to bush fire matters.

General Manager

Per: _____

End of Certificate

APPENDIX F
ADI 1994 – Site Plan Areas 1-3



NOTE : ALL SAMPLING LOCATIONS WERE GIVEN THE PREFIX "WQ" BY ADI.

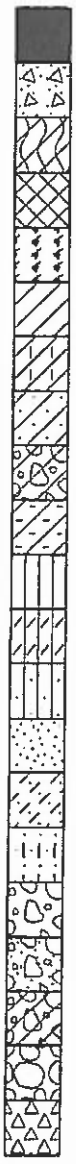
FIGURE 2

SCALE N/A	ADI Limited MAJOR PROJECTS GROUP Level 6, Westfield Towers 100 William Street East Sydney NSW 2011 PH (02) 9916 4900 FAX (02) 9358 5768	CLIENT PIONEER CONCRETE SERVICES P/L	TITLE AERIAL PHOTO SHOWING ALL SOIL/SEDIMENT AND SURFACE WATER SAMPLING LOCATIONS	DWG No. 204.0.2
DATE 7/5/98				JOB No. E00055
FILE 204-2.CDR				REV. No.

APPENDIX G
Test Bore Report Sheets

GRAPHIC SYMBOLS FOR SOIL & ROCK

SOIL



- BITUMINOUS CONCRETE
- CONCRETE
- TOPSOIL
- FILLING
- PEAT
- CLAY
- SILTY CLAY
- SANDY CLAY
- GRAVELLY CLAY
- SHALY CLAY
- SILT
- CLAYEY SILT
- SANDY SILT
- SAND
- CLAYEY SAND
- SILTY SAND
- GRAVEL
- SANDY GRAVEL
- CLAYEY GRAVEL
- COBBLES/BOULDERS
- TALUS

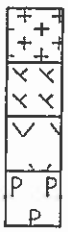
SEDIMENTARY ROCK

- BOULDER CONGLOMERATE
- CONGLOMERATE
- CONGLOMERATIC SANDSTONE
- SANDSTONE FINE GRAINED
- SANDSTONE COARSE GRAINED
- SILTSTONE
- LAMINITE
- MUDSTONE, CLAYSTONE, SHALE
- COAL
- LIMESTONE

METAMORPHIC ROCK

- SLATE, PHYLITTE, SCHIST
- GNEISS
- QUARTZITE

IGNEOUS ROCK



- GRANITE
- DOLERITE, BASALT
- TUFF
- PORPHYRY

TEST PIT LOG

CLIENT: Dial A Product Pty Ltd
PROJECT: Light Horse Business Centre
LOCATION: Quarry & Archbold Roads, Eastern Creek

SURFACE LEVEL: 89.1 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: TP1
PROJECT No: 43756
DATE: 14 Feb 06
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
89	0.0	FILLING - poorly compacted, grey-black ripped sandstone and mudstone filling, dry, with cobble and boulder inclusions to 500mm in size		D	0.0		PID<3ppm		
					0.3				
				D	0.8		PID<2ppm		
					1.0				
	1.2	FILLING - poorly to moderately compacted, brown gravelly clay filling, dry to moist, trace sand, sandstone cobble inclusions		D	1.8		PID<3ppm		
87	2.0	Pit discontinued at 2.0m			2.0				

RIG: 20T Excavator

LOGGED: Blinman

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Test pit levels determined by survey

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U,	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials: RB
Date: 23/3/06

Douglas Partners
Geotechnics · Environment · Groundwater

TEST PIT LOG

CLIENT: Dial A Product Pty Ltd
PROJECT: Light Horse Business Centre
LOCATION: Quarry & Archbold Roads, Eastern Creek

SURFACE LEVEL: 87.5 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/–

PIT No: TP2
PROJECT No: 43756
DATE: 14 Feb 06
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
	0.0	FILLING - poorly to moderately compacted, grey black ripped sandstone and mudstone filling, dry to moist, with cobble and boulder inclusions to 800mm in size		D	0.0		PID<3ppm		5 10 15 20
				B	0.3				
					0.5				
				D	0.6		PID<3ppm		
	1				1.0				1
	1.2	FILLING - moderately compacted, yellow brown and red brown silty clay filling, moist to wet, medium plasticity fines, trace sand		B	1.4				
				D	1.8		PID<3ppm		
	2				2.0				2
	2.3	Pit discontinued at 2.3m							
	3								3
	4								4

RIG: 20T Excavator
LOGGED: Blinman

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Test pit levels determined by survey

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U$_x$	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date: 23/3/06

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TEST PIT LOG

CLIENT: Dial A Product Pty Ltd
PROJECT: Light Horse Business Centre
LOCATION: Quarry & Archbold Roads, Eastern Creek

SURFACE LEVEL: 89.2 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: TP3
PROJECT No: 43756
DATE: 14 Feb 06
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
	0	FILLING - poorly compacted, grey black ripped sandstone and mudstone filling, dry, cobble and boulders inclusions to 1m in size		D	0.3		PID<2ppm		
					0.5				
				D	0.8		PID<3ppm		
	1				1.0				1
	1.4	FILLING - poorly to moderately compacted, brown gravelly clay filling, moist, medium plasticity fines, trace sand, cobble and boulder inclusions to 40mm in size		B	1.6				
				D*	1.8		PID<3ppm		
	2 2.0	Pit discontinued at 2.0m			2.0				2
	3								3
	4								4

RIG: 20T Excavator

LOGGED: Blinman

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Test pit levels determined by survey

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U,	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date: 23/3/06

Douglas Partners
Geotechnics • Environment • Groundwater

TEST PIT LOG

CLIENT: Dial A Product Pty Ltd
PROJECT: Light Horse Business Centre
LOCATION: Quarry & Archbold Roads, Eastern Creek

SURFACE LEVEL: 89.4 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/–

PIT No: TP4
PROJECT No: 43756
DATE: 14 Feb 06
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
		FILLING - poorly compacted, ripped sandstone and mudstone filling, dry, cobble and boulder inclusions to 1m in size, generally less than 0.6m in size		D	0.3		PID<3ppm		
					0.5				
				D	0.8		PID<3ppm		
	1.0	FILLING - poorly to moderately compacted, yellow brown gravelly clay filling, dry to moist, cobble and boulder inclusions to 300mm in size			1.0				
	1.2	FILLING - poorly compacted, grey black ripped sandstone and mudstone filling, dry, cobbles and boulders to 1.2m but generally less than 0.6m in size							
				D	1.8		PID<3ppm		
	2.3	Pit discontinued at 2.3m			2.0				

RIG: 20T Excavator

LOGGED: Bilnman

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Test pit levels determined by survey

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U,	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials: KB
Date: 28/2/06

Douglas Partners
Geotechnics · Environment · Groundwater

TEST PIT LOG

CLIENT:	Dial A Product Pty Ltd	**SURFACE LEVEL:** 86.9 AHD	**PIT No:** TP5
PROJECT:	Light Horse Business Centre	**EASTING:**	**PROJECT No:** 43756
LOCATION:	Quarry & Archbold Roads, Eastern Creek	**NORTHING:**	**DATE:** 14 Feb 06
		DIP/AZIMUTH: 90°/--	**SHEET** 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
	0	FILLING - poorly compacted, grey black ripped sandstone and mudstone filling, dry to moist, cobble and boulder inclusions to 0.8m but generally less than 0.5m in size		D	0.3		PID<3ppm		
					0.5				
				D	0.8		PID<3ppm		
	1				1.0				1
	2	FILLING - poorly to moderately compacted, orange brown gravelly clay filling, moist, medium plasticity fines, cobble and boulder inclusions to 0.3m in size		D	2.4		PID<3ppm		2
	2.6	Pit discontinued at 2.6m			2.6				
	3								3
	4								4

RIG: 20T Excavator **LOGGED:** Blinman

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Test pit levels determined by survey

☐ Sand Penetrometer AS1289.6.3.3

☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U$_x$	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials: RB
Date: 23/3/06

Douglas Partners
Geotechnics · Environment · Groundwater

TEST PIT LOG

CLIENT: Dial A Product Pty Ltd
PROJECT: Light Horse Business Centre
LOCATION: Quarry & Archbold Roads, Eastern Creek

SURFACE LEVEL: 80.6 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/–

PIT No: TP6
PROJECT No: 43756
DATE: 14 Feb 06
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
		FILLING - poorly to moderately compacted, brown gravelly clay filling, dry to moist, sandstone cobble and boulder inclusions		D	0.3		PID<4ppm		
					0.5				
				D	0.8		PID<5ppm		
					1.0				
	1.2	FILLING - poorly compacted, grey ripped mudstone filling, dry, sandstone cobble and boulder inclusions to generally 0.3m in size							
				D	1.8		PID<5ppm		
					2.0				
	2.4	Pit discontinued at 2.4m							

RIG: 20T Excavator
LOGGED: Blinman

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Test pit levels determined by survey

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U$_x$	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date: 23/3/06

Douglas Partners
Geotechnics · Environment · Groundwater

TEST PIT LOG

CLIENT: Dial A Product Pty Ltd
PROJECT: Light Horse Business Centre
LOCATION: Quarry & Archbold Roads, Eastern Creek

SURFACE LEVEL: 87.7 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: TP7
PROJECT No: 43756
DATE: 14 Feb 06
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
87	0.0	FILLING - poorly compacted, grey black ripped sandstone and mudstone filling, dry, cobble and boulder inclusions to 0.6m but generally less than 0.6m in size. Voids evident in test pit sides		D	0.3		PID<4ppm		
					0.5				
				D	0.8		PID<4ppm		
	1				1.0				1
86				D	1.8		PID<4ppm		
	2				2.0				2
	2.0	FILLING - poorly to moderately compacted, brown gravelly clay filling, dry, medium plasticity, sandstone cobbles to 0.2m in size							
	2.3	Pit discontinued at 2.3m							
85	3								3
84	4								4
83									

RIG: 20T Excavator
LOGGED: Bilnman

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Test pit levels determined by survey

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U$_x$	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date: 23/3/06

Douglas Partners
Geotechnics · Environment · Groundwater

TEST PIT LOG

CLIENT: Dial A Product Pty Ltd
PROJECT: Light Horse Business Centre
LOCATION: Quarry & Archbold Roads, Eastern Creek

SURFACE LEVEL: 89.6 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: TP8
PROJECT No: 43756
DATE: 14 Feb 06
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
89	0	FILLING - poorly compacted, grey black ripped sandstone and mudstone filling, dry to moist, cobble and boulder inclusions to 1.0m but generally less than 0.6m in size		D	0.3		PID<3ppm		5 10 15 20
					0.5				
				D	0.8		PID<4ppm		
88	1			B	1.0				1
					1.2				
87	2			D*	1.8		PID<4ppm		2
					2.0				
	2.4	Pit discontinued at 2.4m							
86	3								3
85	4								4

RIG: 20T Excavator
LOGGED: Blinman

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Test pit levels determined by survey

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U$_{x}$	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date: 22/3/06

Douglas Partners
Geotechnics · Environment · Groundwater

TEST PIT LOG

CLIENT: Dial A Product Pty Ltd
PROJECT: Light Horse Business Centre
LOCATION: Quarry & Archbold Roads, Eastern Creek

SURFACE LEVEL: 86.3 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: TP9
PROJECT No: 43756
DATE: 14 Feb 06
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
86		FILLING - poorly compacted, grey black ripped sandstone and mudstone filling, dry, cobble and boulder inclusions to 0.8m but generally less than 0.5m in size. Some clay bands present		D	0.3 0.4		PID<4ppm		
	1			D	0.8 1.0		PID<3ppm		1
				D	1.6 1.8		PID<4ppm		
85	2 2.0	Pit discontinued at 2.0m							2
	3								3
84									
	4								4
83									

RIG: 20T Excavator
LOGGED: Bilnman

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Test pit levels determined by survey

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U,	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▽ Water level

CHECKED
Initials:
Date: 23/3/06

Douglas Partners
Geotechnics · Environment · Groundwater

APPENDIX I
Quality Assurance/Quality Control Procedures and Results

Douglas Partners
Geotechnics · Environment · Groundwater

QA/ QC PROCEDURES AND RESULTS

The field QC procedures for sampling as prescribed in Douglas Partners *Field Procedures Manual* were followed at all times during the validation assessment. Field sampling comprised replicate sampling, at a rate of approximately one replicate sample for every ten original samples.

Relative Percentage Difference

The field QC comprised the collection of at least 10% replicate samples during the course of sampling. In total, sixty eight soil samples were obtained from the subject site, four of which were replicate samples. A total of five soil samples were selected for laboratory analysis and no duplicate soil samples were collected. However, twenty one stockpile samples were selected for laboratory analysis, of which three were replicate samples. The replicate samples were analysed for heavy metals and the comparative results of analysis are included in Table 1l. Relative Percentage Differences (RPD) were calculated as an assessment of the result consistency.

A measure of the consistency of results is derived by the calculation of relative percentage differences (RPD's) for replicate samples. Generally, an RPD of ± 30% is considered acceptable by the EPA, however, certain exceptions apply. The RPD's, which were calculated using the heavy metal concentrations, are tabulated below.

Table 1l – Comparative Results of Replicate Sample Analysis for Heavy Metals

Sample ID	Arsenic	Cadmium	Chromium^	Copper	Lead	Mercury	Nickel	Zinc
3/ 1.8 -2.0	8	<1	35	42	20	<0.1	38	74
BD1 140206	5.9	<1	31	38	17	<0.1	35	72
RPD %	**30.2**	-	12.1	10.0	16.2	-	8.2	2.7
8/ 1.8 – 2.0	4.9	<1	28	37	16	<0.1	43	66
BD2 140206	6.7	<1	27	34	14	<0.1	43	66
RPD %	**31.0**		3.6	8.5	13.3		0.0	0.0
16/ 0.8 – 1.0	7.8	<1	24	40	15	<0.1	30	63
BD6 140206	7.7	<1	28	43	17	<0.1	34	68
RPD %	1.3		15.4	7.2	12.5		12.5	7.6

All the RPD results for heavy metals fall within the typical acceptable range (± 30%), with the exception arsenic from samples 3/ 1.8 - 2.0 and 8/ 1.8 – 2.0. The calculated RPD exceeding the acceptability range is not, however, considered to be of significant concern due to the generally low levels of arsenic detected (relative to the adopted guideline levels), the low actual differences in concentration and the generally heterogenous nature of the material. It is therefore considered that the results indicate an acceptable consistency between the samples and their replicates and indicates that suitable field sampling methodology was adopted and laboratory precision was achieved.

Laboratory QA/ QC Procedures

The analytical laboratory is accredited by the National Association of Testing Authorities (NATA) and is required to conduct in - house QA/ QC procedures. These are normally incorporated into every analytical run and include the following: -

Reagent Blank

A reagent blank sample is prepared and analysed at the beginning of every analytical run, following calibration of the analytical apparatus. The laboratory results for reagent blanks for soil analysis indicated that concentrations of all analytes were below respective laboratory practical quantitation (detection) limits. These results are included in the laboratory report in Appendix H.

Spike Recovery

Spike recovery tests were conducted by adding a known amount of a particular analyte or analytes prior to analysis, and then treating the spiked sample in exactly the same manner as all other samples. The recovery results indicate the proportion of the known concentration of the target analytes which were detected during analysis. Spike recovery results are included in the laboratory report in Appendix H. The spike recovery results all fell within the acceptable range thus the results are considered to be acceptable.

Annexure C

AT&L Bulk Earthworks Cut and Fill Plan, Drawing No. DAC003

HWE CUT & FILL LEGEND

Lower_value		Upper_value	Colour
-15.5	to	-14.0 m	
-14.0	to	-14.5 m	
-14.5	to	-13.0 m	
-13.0	to	-12.5 m	
-12.5	to	-12.0 m	
-12.0	to	-11.5 m	
-11.5	to	-11.0 m	
-11.0	to	-10.5 m	
-10.5	to	-10.0 m	
-10.0	to	-9.5 m	
-9.5	to	-9.0 m	
-9.0	to	-8.5 m	
-8.5	to	-8.0 m	
-8.0	to	-7.5 m	
-7.5	to	-7.0 m	
-7.0	to	-6.5 m	
-6.5	to	-6.0 m	
-6.0	to	-5.5 m	
-5.5	to	-5.0 m	
-5.0	to	-4.5 m	
-4.5	to	-4.0 m	
-4.0	to	-3.5 m	
-3.5	to	-3.0 m	
-3.0	to	-2.5 m	
-2.5	to	-2.0 m	
-2.0	to	-1.5 m	
-1.5	to	-1.0 m	
-1.0	to	-0.5 m	
-0.5	to	0 m	
0	to	0.5 m	
0.5	to	1.0 m	
1.0	to	1.5 m	
1.5	to	2.0 m	
2.0	to	2.5 m	

TOTAL CUT/FILL

TOTAL	CUT	127,200m³
	FILL	3,900m³
SURPLUS SPOIL		123,300m³

NOTES

EARTHWORKS VOLUMES DENOTED ARE APPROXIMATE ONLY AND HAVE BEEN CALCULATED BETWEEN THE EARTHWORKS SURFACE LEVEL (300mm BELOW FINISHED SURFACE LEVEL) AND THE EXISTING SURFACE LEVEL. THE VOLUMES DO NOT TAKE INTO ACCOUNT THE FOLLOWING :-

1. STRIPPING AND STOCKPILING OF EXISTING TOP SOIL
2. BULKING FACTORS OF REMOVED CUT
3. REMOVAL OF EXISTING BUILDING SLABS AND PAVEMENTS
4. REMOVAL AND/OR REMEDIATION OF ANY EXISTING UNCONTROLLED FILL
5. PROPOSED LANDSCAPING
6. STORMWATER AND UTILITIES TRENCHING
7. EXISTING DAMS OR WATER BODIES WHERE BY THE BASE HAS NOT BEEN SURVEYED DUE TO THE PRESENCE OF WATER AT TIME OF SURVEY

Issue	Description	Date
C	REISSUED FOR APPROVAL	27-08-15
B	ISSUED FOR APPROVAL	03-03-15
A	ISSUED FOR APPROVAL	15-12-14

100mm on Original

Bar Scales

0 20 40 60 80m

1 : 750 @ A1 1 : 1000 @ A3

Client: GENESIS XERO WASTE

Scales	1 : 500
Grid	MGA
Height Datum	AHD
Drawn	FX
Designed	FX
Checked	AM
Approved	

Project: PRE SORT CENTRE EASTERN CREEK

Title: BULK EARTHWORKS CUT AND FILL PLAN

Civil Engineers and Project Managers
at&l
Suite 702, 154 Pacific Hwy
St Leonards NSW 2065
ABN 98 130 882 405
Tel: 02 9438 1777
Fax: 02 9460 8413
www.atl.net.au
info@atl.net.au

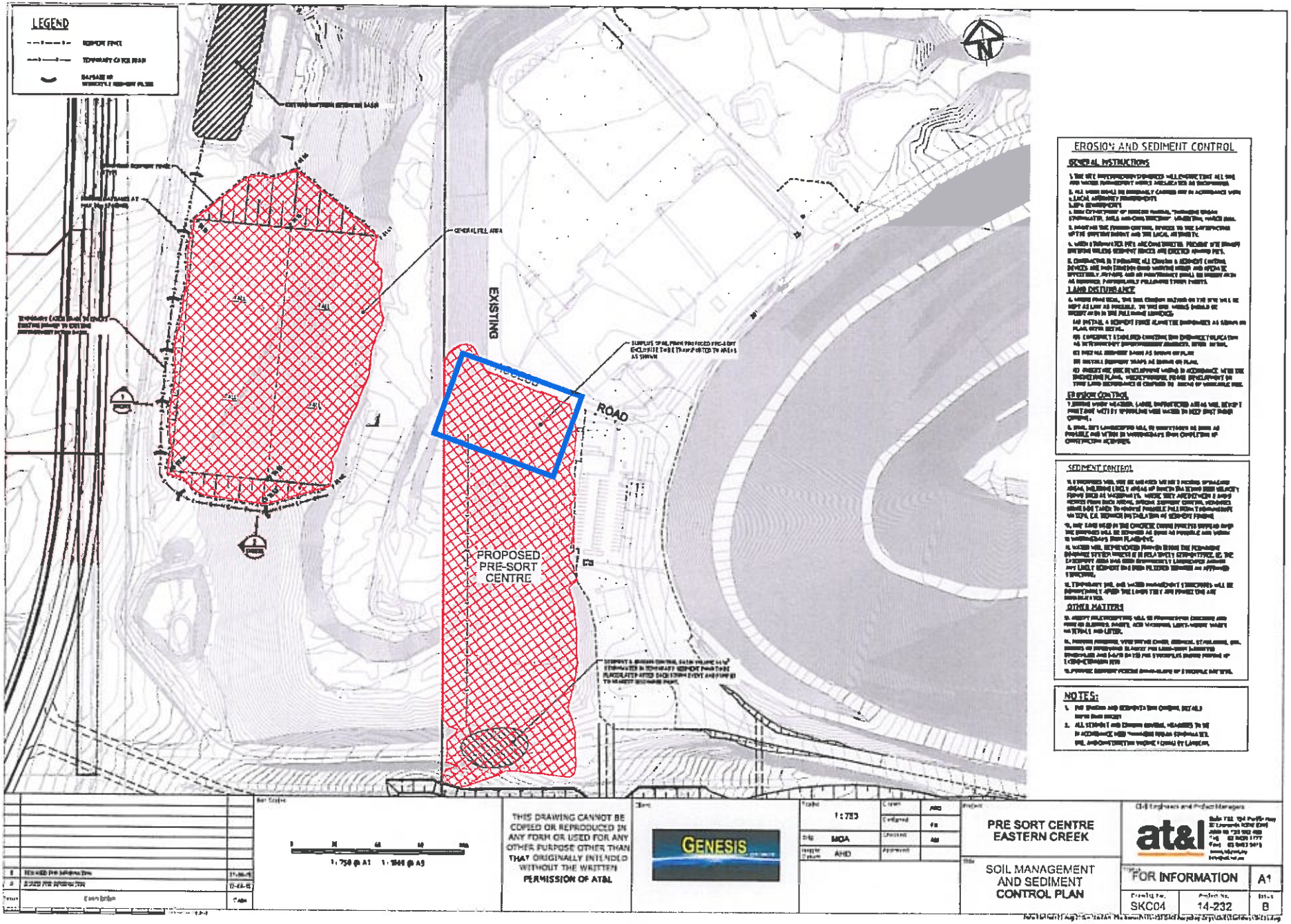
Status		
FOR APPROVAL		A1
Drawing No.	Project No.	Issue
DAC003	14-232	C

Date Plotted: 27 Aug 2015 - 10:29AM File Name: F:\14-232 DADI Recycling\Dngs\Civil\DA-Drawings\DAC003.dwg

Annexure D

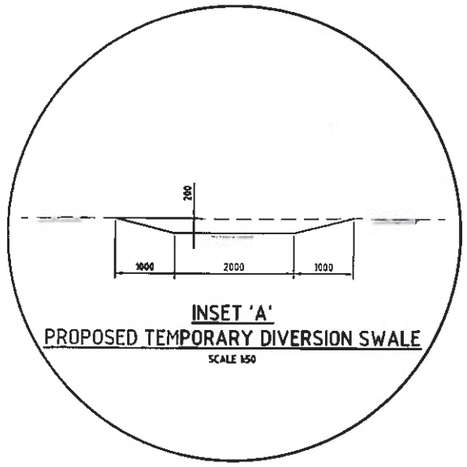
Location of temporary stockpile

Annexure D

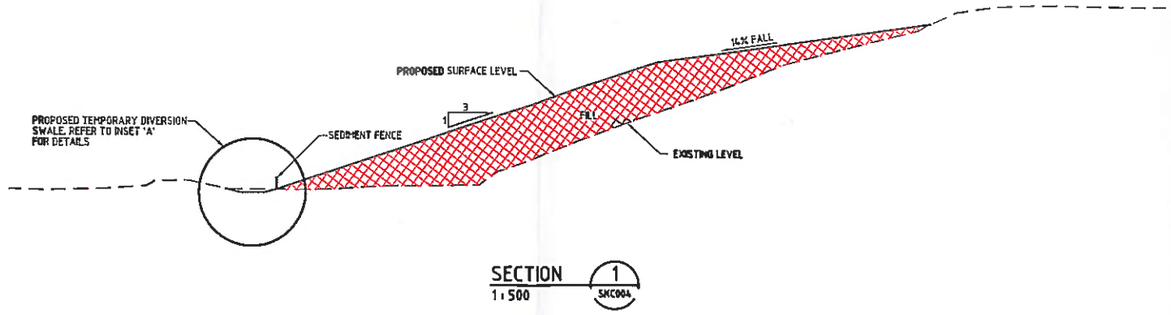

LEGEND
EXISTING
ROAD
PROPOSED PRE-SORT CENTRE
EROSION AND SEDIMENT CONTROL
GENERAL INSTRUCTIONS
LAND DISTURBANCE
EROSION CONTROL
SEDIMENT CONTROL
OTHER MATTERS
NOTES:
THIS DRAWING CANNOT BE COPIED OR REPRODUCED IN ANY FORM OR USED FOR ANY OTHER PURPOSE OTHER THAN THAT ORIGINALLY INTENDED WITHOUT THE WRITTEN PERMISSION OF AT&L
GENESIS
PRE SORT CENTRE EASTERN CREEK
SOIL MANAGEMENT AND SEDIMENT CONTROL PLAN
FOR INFORMATION
A1
SKC04
14-232
B

Annexure E

AT&L Soil Management and Sediment Control Plan, Drawing No. SKC004



INSET 'A'
PROPOSED TEMPORARY DIVERSION SWALE
SCALE 1:50



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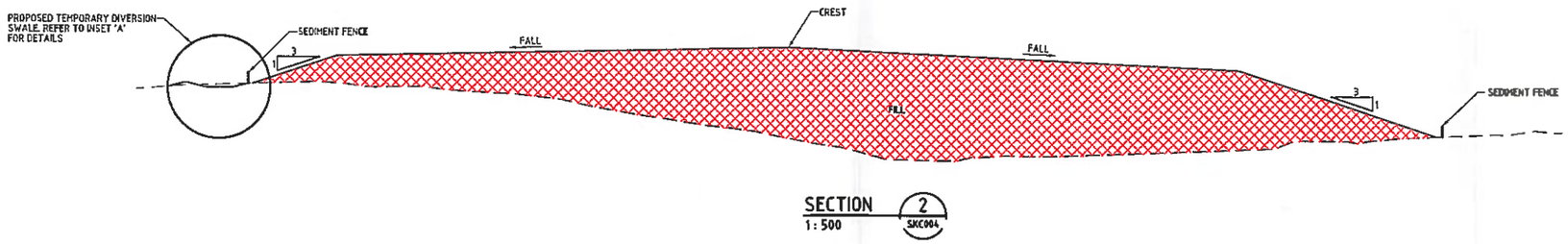


SECTION 2
1:500 SKC004

Issue	Description	Date
B	ISSUED FOR INFOTHATION	27-08-15
A	ISSUED FOR INFORMATION	12-08-15

100mm on Original

Bar Scales
0 1 2 3 4 5m
1:50 @ A1 1:100 @ A3
0 10 20 30 40 50m
1:500 @ A1 1:1000 @ A3

Client: GENESIS KERO WASTE

Scales	AS SHOWN
Grid	MGA
Height Datum	AHD
Drawn	ASD
Designed	FX
Checked	AM
Approved	

Project: PRE SORT CENTRE EASTERN CREEK

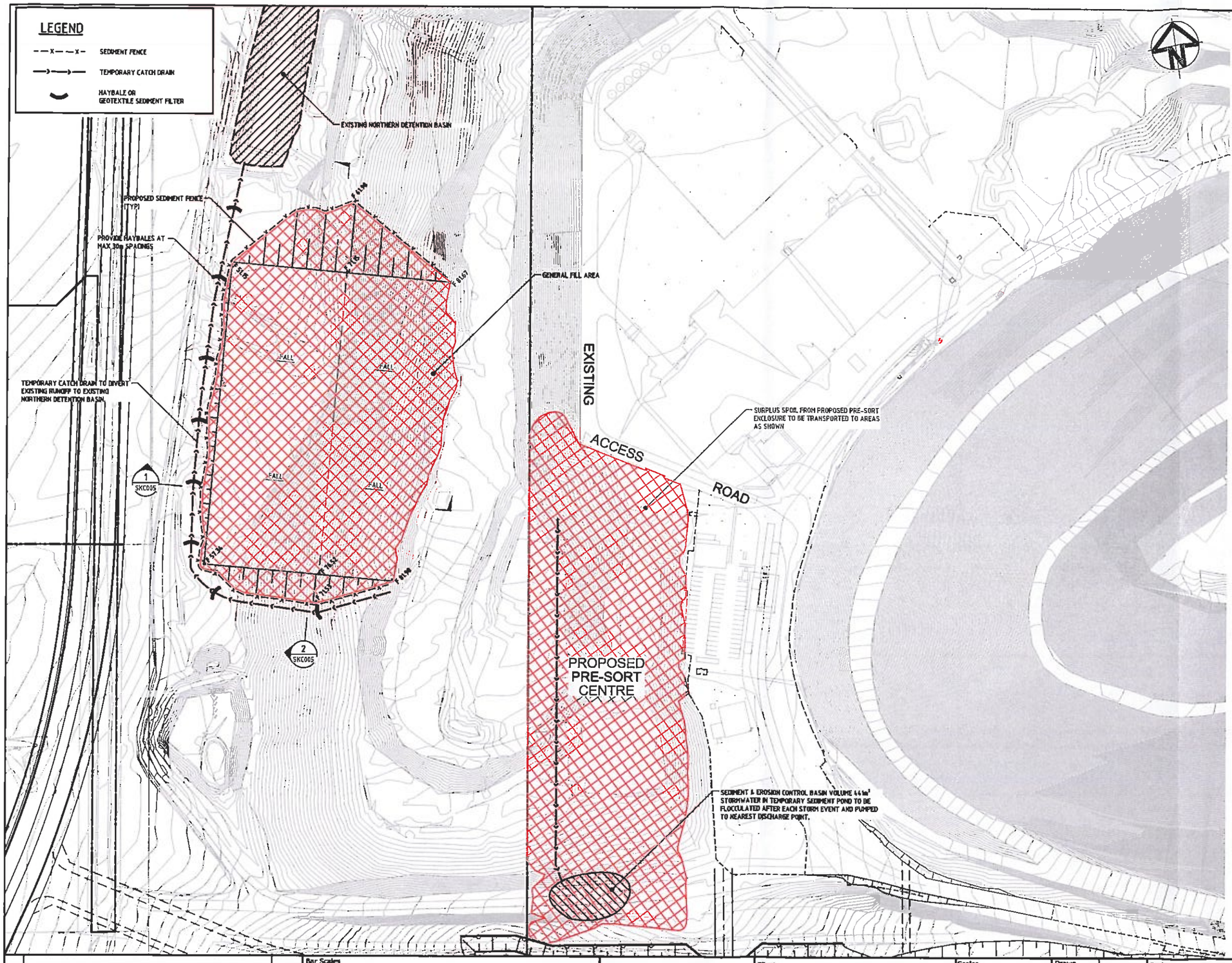
Title: SPOIL MANAGEMENT AND SEDIMENT CONTROL PLAN CROSS SECTIONS

Civil Engineers and Project Managers
at&l
Suite 702, 154 Pacific Hwy
St Leonards NSW 2065
ABN 98 130 882 405
Tel: 02 9439 1777
Fax: 02 9460 5413
www.atl.net.au
info@atl.net.au

Status: FOR APPROVAL | A1

Drawing No.	Project No.	Issue
SKC05	14-232	B

Date Plotted: 27 Aug 2015 - 10:41AM File Name: F:\14-232 DADI Recycling\Drgs\Civil\Sketches\SKC05.dwg



EROSION AND SEDIMENT CONTROL

GENERAL INSTRUCTIONS

1. THE SITE SUPERINTENDENT/ENGINEER WILL ENSURE THAT ALL SOIL AND WATER MANAGEMENT WORKS ARE LOCATED AS DOCUMENTED.

2. ALL WORK SHALL BE GENERALLY CARRIED OUT IN ACCORDANCE WITH
a. LOCAL AUTHORITY REQUIREMENTS
b. EPA REQUIREMENTS
c. NSW DEPARTMENT OF HOUSING MANUAL "MANAGING URBAN STORMWATER: SOILS AND CONSTRUCTION", 4th EDITION, MARCH 2004.

3. MAINTAIN THE EROSION CONTROL DEVICES TO THE SATISFACTION OF THE SUPERINTENDENT AND THE LOCAL AUTHORITY.

4. WHEN STORMWATER PITS ARE CONSTRUCTED, PREVENT SITE RUNOFF ENTERING UNLESS SEDIMENT FENCES ARE ERECTED AROUND PITS.

5. CONTRACTOR IS TO ENSURE ALL EROSION & SEDIMENT CONTROL DEVICES ARE MAINTAINED IN GOOD WORKING ORDER AND OPERATE EFFECTIVELY. REPAIRS AND OR MAINTENANCE SHALL BE UNDERTAKEN AS REQUIRED, PARTICULARLY FOLLOWING STORM EVENTS.

LAND DISTURBANCE

6. WHERE PRACTICAL, THE SOIL EROSION HAZARD ON THE SITE WILL BE KEPT AS LOW AS POSSIBLE. TO THIS END, WORKS SHOULD BE UNDERTAKEN IN THE FOLLOWING SEQUENCE:
(A) INSTALL A SEDIMENT FENCE ALONG THE BOUNDARIES AS SHOWN ON PLAN. REFER DETAIL.
(B) CONSTRUCT STABILISED CONSTRUCTION ENTRANCE TO LOCATION AS DETERMINED BY SUPERINTENDENT/ENGINEER. REFER DETAIL.
(C) INSTALL SEDIMENT BASIN AS SHOWN ON PLAN
(D) INSTALL SEDIMENT TRAPS AS SHOWN ON PLAN.
(E) UNDERTAKE SITE DEVELOPMENT WORKS IN ACCORDANCE WITH THE ENGINEERING PLANS. WHERE POSSIBLE, PHASE DEVELOPMENT SO THAT LAND DISTURBANCE IS CONFINED TO AREAS OF WORKABLE SIZE.

EROSION CONTROL

7. DURING WINDY WEATHER, LARGE, UNPROTECTED AREAS WILL BE KEPT MOIST (NOT WET) BY SPRINKLING WITH WATER TO KEEP DUST UNDER CONTROL.

8. FINAL SITE LANDSCAPING WILL BE UNDERTAKEN AS SOON AS POSSIBLE AND WITHIN 20 WORKING DAYS FROM COMPLETION OF CONSTRUCTION ACTIVITIES.

SEDIMENT CONTROL

9. STOCKPILES WILL NOT BE LOCATED WITHIN 2 METRES OF HAZARD AREAS, INCLUDING LIKELY AREAS OF CONCENTRATED OR HIGH VELOCITY FLOWS SUCH AS WATERWAYS. WHERE THEY ARE BETWEEN 2 AND 5 METRES FROM SUCH AREAS, SPECIAL SEDIMENT CONTROL MEASURES SHOULD BE TAKEN TO MINIMISE POSSIBLE POLLUTION TO DOWNSLOPE WATERS, E.G. THROUGH INSTALLATION OF SEDIMENT FENCING.

10. ANY SAND USED IN THE CONCRETE CURING PROCESS (SPREAD OVER THE SURFACE) WILL BE REMOVED AS SOON AS POSSIBLE AND WITHIN 10 WORKING DAYS FROM PLACEMENT.

11. WATER WILL BE PREVENTED FROM ENTERING THE PERMANENT DRAINAGE SYSTEM UNLESS IT IS RELATIVELY SEDIMENT FREE, I.E. THE CATCHMENT AREA HAS BEEN PERMANENTLY LANDSCAPED AND/OR ANY LIKELY SEDIMENT HAS BEEN FILTERED THROUGH AN APPROVED STRUCTURE.

12. TEMPORARY SOIL AND WATER MANAGEMENT STRUCTURES WILL BE REMOVED ONLY AFTER THE LANDS THEY ARE PROTECTING ARE REHABILITATED.

OTHER MATTERS

13. ACCEPTABLE RECEPTORS WILL BE PROVIDED FOR CONCRETE AND MORTAR SLURRIES, PAINTS, ACID WASHINGS, LIGHT-WEIGHT WASTE MATERIALS AND LITTER.

14. PROVIDE MULCHING, VEGETATIVE COVER, CHEMICAL STABILISERS, SOIL BINDERS OR IMPERVIOUS BLANKET FOR LONG-TERM (>28DAYS) STOCKPILING AND (>5/10 DAYS) FOR STOCKPILES DURING MONTHS OF EXTREME EROSION RISK

15. PROVIDE SEDIMENT FENCING DOWN-SLOPE OF STOCKPILE BATTERS.

NOTES:

1. FOR EROSION AND SEDIMENTATION CONTROL DETAILS REFER DWG DAC021
2. ALL SEDIMENT AND EROSION CONTROL MEASURES TO BE IN ACCORDANCE WITH 'MANAGING URBAN STORMWATER, SOIL AND CONSTRUCTION VOLUME 1 (2004) BY LANDCOM.

Issue	Description	Date
B	REISSUED FOR INFORMATION	27-08-15
A	ISSUED FOR INFORMATION	12-08-15

Bar Scales
0 20 40 60 80m
1 : 750 @ A1 1 : 1000 @ A3
100mm at Original

Client: GENESIS ZERO WASTE

Scales	1 : 750
Grid	MGA
Height Datum	AHD
Drawn	ASD
Designed	FX
Checked	AM
Approved	

Project: PRE SORT CENTRE EASTERN CREEK

Title: SOIL MANAGEMENT AND SEDIMENT CONTROL PLAN

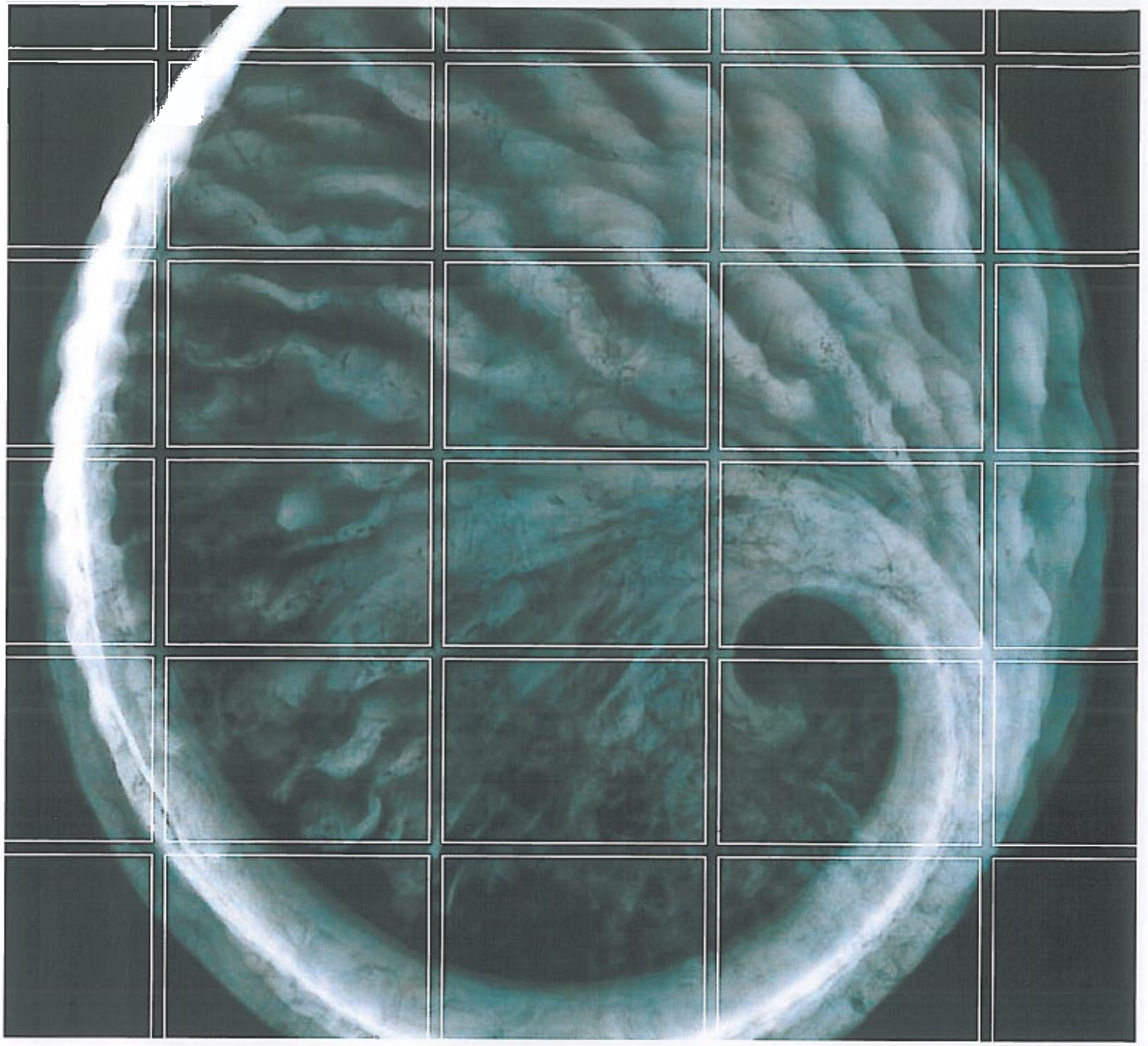
Civil Engineers and Project Managers
at&l
Suite 702, 154 Pacific Hwy
St Leonards NSW 2065
ABN 98 130 882 405
Tel: 02 9439 1777
Fax: 02 9460 9413
www.atl.net.au
info@atl.net.au

Status	
FOR INFORMATION	A1
Drawing No. SKC04	Project No. 14-232
	Issue B

Date Plotted: 27 Aug 2015 - 10:40AM File Name: P:\14-232 DAO Recycling\Dwgs\Civil\Sketches\SKC04.dwg

Annexure F

Noise Impact Assessment by Environmental Resources Management Australia



Light Horse Business Centre

Noise Impact Assessment

for ThaQuarry Pty Ltd

August 2008

Reference: 0071234 Noise

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Delivering sustainable solutions in a more competitive world

ERM

Environmental Resources Management Australia

Building C,
33 Saunders Street
Pyrmont NSW 2009
Telephone (02) 8584 8888
Facsimile (02) 8584 8800
Locked Bag 24,
Broadway NSW 2007
www.erm.com

19 August, 2008

Jacqueline Ingham
Department of Planning
23-33 Bridge Street
SYDNEY NSW 2000
AUSTRALIA

Our Reference: 0071234LO1DECC.doc

Dear Jacqueline,

RE: ADEQUACY REVIEW RESPONSE TO NOISE ISSUES

This letter provides a response to issues raised by DoP within the Adequacy review with respect to the Noise Impact Assessment (NIA) for the proposed Light Horse Business Centre. This letter is an addendum to the NIA report and should be read in conjunction with the revised report.

1. OPERATIONAL NOISE

DoP stated that: *The operational noise assessment has been based on 700,000 tpa of waste being landfilled and on 354,780 vehicles movements/annum. Please revise the assessment to identify impacts of different scenarios and justify the estimated number of vehicles movements used in the assessment.*

Comment: Traffic noise quantities associated for the development have recently been revised and confirmed as 340,200 movements (maximum). Therefore, the noise impact assessment should be considered a worst case assessment as it adopted 354,780 movements PA.

The NIA for traffic demonstrated compliance when adopting this highly conservative level of vehicle movements. It showed the project would generate noise emissions below the relevant ECRTN criteria at the nearest receivers and would not increase existing traffic noise levels by more than 2 dBA.

Traffic noise levels for 296,000 vehicle movements PA associated with the second proposed operation scenario would therefore also remain below the relevant ECRTN goals.

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2. SCHEDULING OF ACTIVITIES

DoP requested: *the inclusion of details and scheduling of activities to be undertaken after 10pm. Whilst the noise assessment states that activities after 10pm would occur once a week, the traffic assessment indicates that it would occur once every 10 weeks.*

Comment: Scheduling activities (modelled) to occur during the night period include waste handling and waste recovery and items used to assess these activities included:

o	CAT Dozer D8R	o	HITACHI AH 500 Dump Truck
o	Hitachi ZX230 Excavator	o	CAT 320 CL Excavator
o	CAT 320 CL Excavator	o	Hyster Forklift
o	IVECO T2700 Water Cart	o	Hyster Forklift
o	Hyundai 14LC7 Excavator	o	CAT996 Loader

The location of these plant items are shown in Figure 6.1 of the noise impact assessment report.

While there are discrepancies in respect of what activities occur after 10:00 pm the NIA has been conducted in accordance with the Industrial Noise Policy (INP) adopting all plant operating simultaneously over a one-fifteen minute period. Therefore the resultant outputs are a worst case night operating scenario and has been identified to comply with the night operational criteria as well as meeting the relevant Lmax sleep disturbance goals.

3. SENSITIVE RECIEVERS

DoP requested: *a map and table identifying the addresses of each of the sensitive receivers and their distance from the site.*

Comment: ERM figures identify (in particular Figure D) the localities that are potentially impacted by the proposed development; these maps have been amended to include street names and the two neighbouring schools within Erskine Park and Minchinbury.

4. NOISE LEVELS AT THE PRIMARY SCHOOLS

DoP requested: *the noise levels at James Erskine Primary and Minchinbury Primary.*

Comment: With respect to noise impacts at the two primary schools, the NIA provided noise contours for three stages of operation over the life of the development, the noise contours have been reproduced below with inclusion of these schools as receivers for clarification.

As per the INP Table 2.1, the recommended classroom internal noise levels is 35 dBA (acceptable), assuming a partially opened window which is expected to reduce noise levels by 10 dBA, the external target is 45 dB(A). The proposal's noise levels within class rooms of both schools are predicted to be well below the relevant criteria (refer to contours in Figure D of the NIA).

5. NOISE REPRESENTATIONS

DoP requested: *clarification as to why R2 located to the west of the site has been used to represent noise levels at R3-R5 north of the site.*

Comment: The existing noise environment at R3-R5 is considered to be conservatively represented by the long term measurement at R2. The R2 logger is further from the M4 motorway than the logger placed at Minchinbury, and therefore considered to be in a quieter location.

It is likely that the existing traffic noise contribution to residences along Wallgrove Road is slightly higher than the levels adopted, although potentially not as high as those for Minchinbury due to the monitoring locations angle of exposure to the M4 Motorway. Notwithstanding this, the noise impacts associated from traffic noise remain below the ECRTN criteria for day and night.

ERM has responded to the additional information requested within the Adequacy Review. Should any further information or clarification be required please contact ERM Project Manager - Chris Jack on (02) 8584 8888.

Yours sincerely,
for Environmental Resources Management Australia Pty Ltd

Oliver Muller
Senior Acoustic Scientist (MAAS)

FINAL REPORT

ThaQuarry Pty Ltd

Light Horse Business Centre

Noise Impact Assessment

August 2008

Reference: 0071234 Noise

Environmental Resources Management Australia
Building C, 33 Saunders Street
Pyrmont, NSW 2009
Telephone +61 2 8584 8888
Facsimile +61 2 8584 8800
www.erm.com

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1 INTRODUCTION

1.1 BACKGROUND

ThaQuarry Pty Ltd and ACN 114 843 453 Pty Ltd seek project approval for the construction and operation of a resource recovery facility (including a materials processing centre (MPC) and waste transfer station (WTS)), and a class 2 inert and solid waste landfill at Eastern Creek, New South Wales (NSW). Project approval is sought under Part 3A of the *Environmental Planning and Assessment Act, 1979*. The application process is to be managed on behalf of both parties by ThaQuarry Pty Ltd under the project name Light Horse Business Centre.

Environmental Resources Management Australia Pty Ltd (ERM) was engaged to undertake a noise impact assessment for the proposed resource recovery facility (RRF) and landfill facility (The 'Facility'), as part of the overall Environmental Assessment. The noise impact assessment was conducted to identify potential acoustic impacts associated with operational, construction and traffic generation activities associated with the 'Facility'.

The assessment has been conducted with reference to the Department of Environment and Climate Change (DECC) (2000) *Industrial Noise Policy* (INP), DECC (1999) *Environmental Criteria for Road Traffic Noise (ECRTN)* and DECC's constitution guidelines, formerly Chapter 171 of the (1994) *Environmental Noise Control Manual* (ENCM).

Blasting has not been included in this assessment, as there are no blasting activities associated with the Facility.

1.2 PROJECT DESCRIPTION

The facility will have the capacity to accept up to two million tones (t) of waste per annum. An estimated 50% to 80% of this material will be recovered by sorting and processing, and stored on site in stockpiles and material bays until sold. The remaining 20% to 50% will constitute "unsalvageable" material and will go to landfill in the adjoining landfill facility or be transferred off site as appropriate. A description of Project activities relevant to this assessment is provided below.

1.2.1 *Waste Handling*

The Project will include several noise generating activities associated with receival, sorting, processing, storage and on-site transportation of waste materials, focussed at the following areas (refer *Figure 1.1* for proposed site layout plan):

- inwards/ outwards weighbridge for vehicles entering the facility and one way dump truck weighbridge for loads entering the land filling area;
- raised Material Processing Centre (MPC) and Waste Transfer Station (WTS) structure; and
- drop off zone and processing/ stockpiling area.

1.2.2 *Landfill Operations*

The landfill operations associated with this facility will occur within the existing quarry void adjacent to the proposed resource recovery facility (RRF). Initial filling will take place from the south eastern corner of the quarry base at the deepest point and proceed towards the north eastern corner. Once the north eastern corner is reached, filling will proceed towards the west and continue in a north-south / south-north filling pattern. This process will be repeated until filling reaches the western end of the quarry at which time the total lift throughout the site is expected to be approximately ten metres. Filling will then occur in the same manner in the opposite direction.

To model the range of noise impacts as landfilling operations progress closer to the surface, ERM adopted three modelling scenarios being:

- Year 5 - representing the initial stage of pit filling where plant are operating deep within the pit;
- Year 13 - representing the middle stages of landfilling, with plant operating approximately half way up the pit; and
- Year 20 - representing the final stages of pit filling, with plant operating at the surface.

1.2.3 *Operating Hours*

Operations at the facility will generally be conducted seven days a week during daytime hours. Some site activity will occur during the evening period between 6:00 pm and 10:00 pm, however plant activity will be reduced slightly during this time with all plant operating except the mobile crusher and associated loader.

On occasion the RRF may receive materials after 10:00 pm, from essential works, such as millings and asphalt from road works.

For operations after 10:00 pm, only waste receival will occur, with no sorting or processing of materials to take place. For a worst case scenario, plant utilised during this time, and adopted in the assessment of night time noise, is expected to include dump trucks, watercarts, excavators, loaders (x 2) and forklifts. For the Year 20 scenario, the noise assessment has adopted loaders with a sound power level of 111 dBA to mitigate potential impacts from plant during this stage. To manage this, an acoustic audit of plant equipment should be conducted to verify the overall sound power level of plant items working on the site.

1.2.4 *Plant and Equipment*

Various mobile and stationary plant items will be used on site throughout the stages of the project, as identified below. One third octave data for all equipment modeled in this assessment is presented in *Annex A*.

Maintenance and repair activities are expected to occur within the workshop of the facility between the hours of 6:00 and 10:00 pm. However, noise sources at the workshop including hand tools, are expected to remain acoustically insignificant and have not been included in modeling for this assessment.

Waste Handling

Acoustically significant plant associated with the receival, sorting, processing, storage and transportation of waste at the site will include the following:

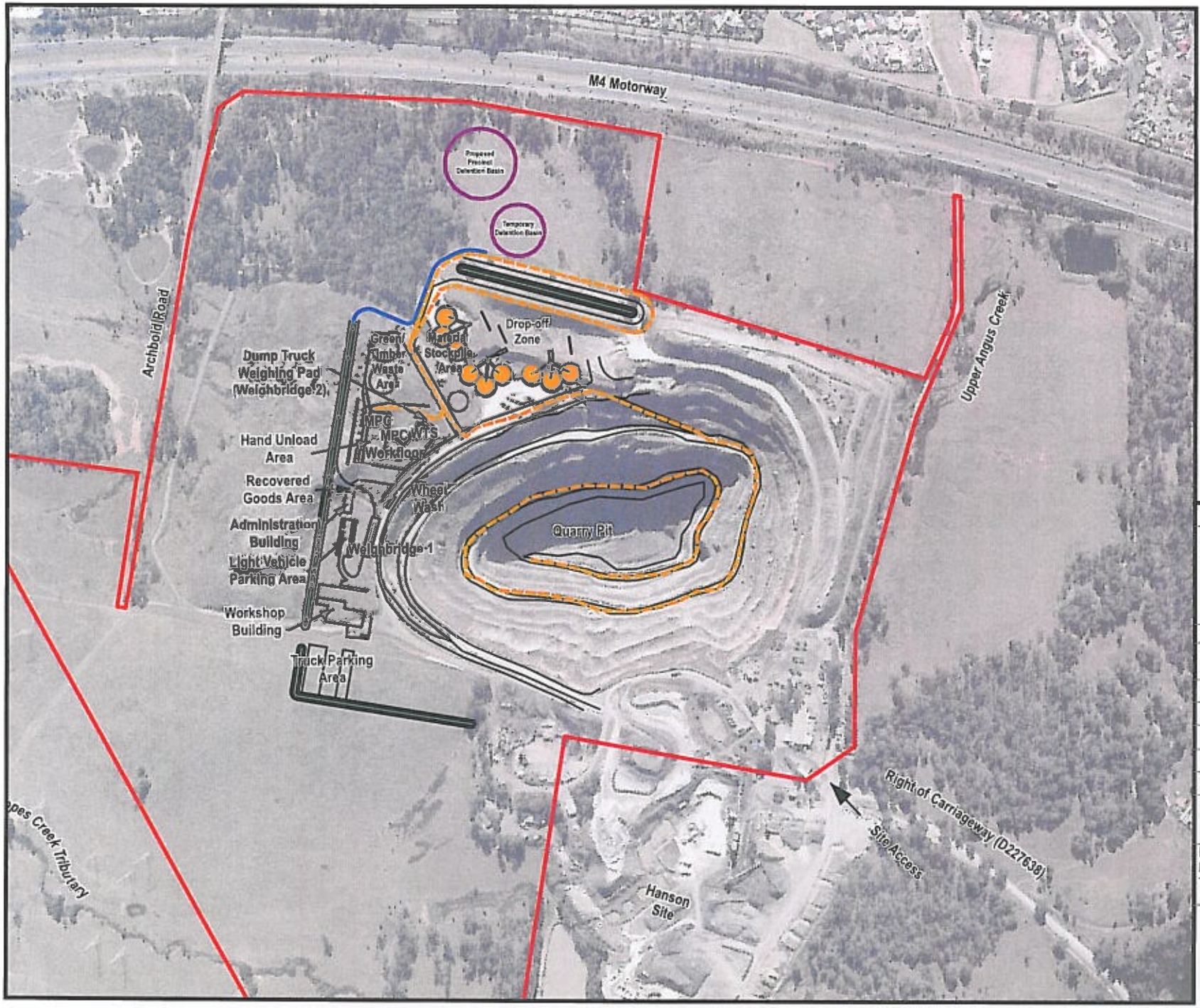
- dump trucks (3);
- water cart;
- multi purpose Hooklift Truck;
- excavators (6);
- loaders (5);
- mobile screens (3);
- mobile crusher;
- stationary crusher; and
- forklifts (2).

Landfill Operations

Acoustically significant plant associated with landfill operations for the Project will include the following:

- dump trucks (3 as above);

- water cart (as above);
- multi purpose Hooklift Truck (as above);
- excavators (as above);
- bulldozer ; and
- compactors (2).



Legend

- Visual Barrier Wall
- Dump Truck and Water Cart Route
- Site Design
- Detention Basins
- Site Boundary
- Berm

Suffix	Revisions	Date	Init
R0	From EA-09_R1	08-05-08	JS
R1	Site layout edits	19-05-08	JS
R2	Addition of Basins	18-08-08	JF

Figure 1.1
Site Layout

Client:	ThaQuarry Pty. Ltd.		
Project:	Light Horse Buisiness Centre		
Drawing No:	0071234_GIS23	Suffix No:	R2
Date:	18/08/2008	Drawing size:	A4
Drawn by:	JF	Reviewed by:	JK
Source:	VGT Environmental Compliance Solutions		
Scale:	Refer Scale Bar		

N

0 50 100 200 300 Metres

Environmental Resources Management Australia Pty Ltd
Building C, 33 Saunders St, Pyrmont, NSW 2009
Telephone +61 2 8584 8888

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Site Access

The existing site access via the two lane registered right of carriage way off Old Wallgrove Road will be used throughout construction and operations for the Project.

1.3 GLOSSARY

A number of technical terms have been used in this report and are explained in *Table 1.1*.

Table 1.1 Glossary of Terms

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 root mean squared (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.
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.
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.

2 NOISE IMPACT ASSESSMENT CRITERIA

2.1 GENERAL CRITERIA

The DECC (2000), in its INP, gives guidelines for assessing industrial facilities. Assessment criteria depend on the existing amenity of areas potentially affected by a proposed development as 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.

To meet these objectives, two separate criteria are prescribed by the DECC, 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).

2.1.1 *Assessing for 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 the Facility, no adjustment factors are considered applicable.

2.1.2 *Assessing for Amenity*

The DECC'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 and other potentially sensitive receivers potentially affected by the Project are covered by the DECC's varying amenity categories as presented in Table 2.1 of the INP and are reproduced below

Table 2.1 ***Amenity Criteria - Recommended L_{Aeq} Noise Levels from Industrial Noise Sources***

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended LAeq(Period) Noise Level (dBA)	
			Acceptable	Recommended Maximum
Residence	Rural	Day	50	55
		Evening	45	50
		Night	40	45
	Suburban	Day	55	60
		Evening	45	50
		Night	40	45
	Urban	Day	60	65
		Evening	50	55
		Night	45	50
	Urban/Industrial Interface (for existing situations only)	Day	65	70
		Evening	55	60
		Night	50	55
School classrooms - internal	All	Noisiest 1 hour period when in use	35	40
Hospital wards - internal - external	All	Noisiest 1 hour period	35 50	40 55
Place of worship - internal	All	When in use	40	45
Area specifically reserved for passive recreation (eg National Park)	All	When in use	50	55
Active recreation area (eg school playground, golf course)	All	When in use	55	60
Commercial premises	All	When in use	65	70
Industrial premises	All	When in use	70	75

Note: Monday – Saturday Daytime 7.00 am to 6.00 pm; Evening 6.00 pm to 10.00 pm; Night-time 10.00 pm to 7.00 am. On Sundays and Public Holidays, Daytime 8.00 am - 6.00 pm; Evening 6.00 pm - 10.00 pm; Night-time 10.00 pm - 8.00 am.

2.2 CONSTRUCTION NOISE

Chapter 171 of the ENCM sets out methods for determining construction criteria associated with proposed developments. *Table* 2.2 reproduces the acceptable construction noise levels. These take into account the rating background noise level (RBL) and are based on duration of the construction period that applies to nearest sensitive receivers.

Table 2.2 Construction Noise Goals

Construction Period	Acceptable LA10 Noise Level[1]
4 weeks and under	Background LA90 plus 20 dBA
4 weeks to 26 weeks	Background LA90 plus 10 dBA
Greater than 26 weeks	Background LA90 plus 5 dBA

1. Applicable between the hours of 7.00 am and 6.00 pm Monday to Friday, and 8.00 am to 1.00 pm Saturdays. For all other times construction noise must be inaudible at the receiver. No construction work is to take place on Sundays or Public Holidays.

2.3 ROAD TRAFFIC NOISE CRITERIA

The Environment Protection Authority released the ECRTN in May 1999. The policy sets out noise criteria applicable to different road classifications for the purpose of defining traffic noise impacts.

2.4 SLEEP DISTURBANCE

While the INP does not specify a criterion for assessing sleep disturbance, the ENCM (1994) recommends that $L_{1,1minute}$ noise from a source should not exceed the existing background noise by more than 15 dB. Depending on the measured background noise, the sleep disturbance criteria for the quietest location could be as low as 45 dB(A)L_1.

3 EXISTING ACOUSTICAL ENVIRONMENT

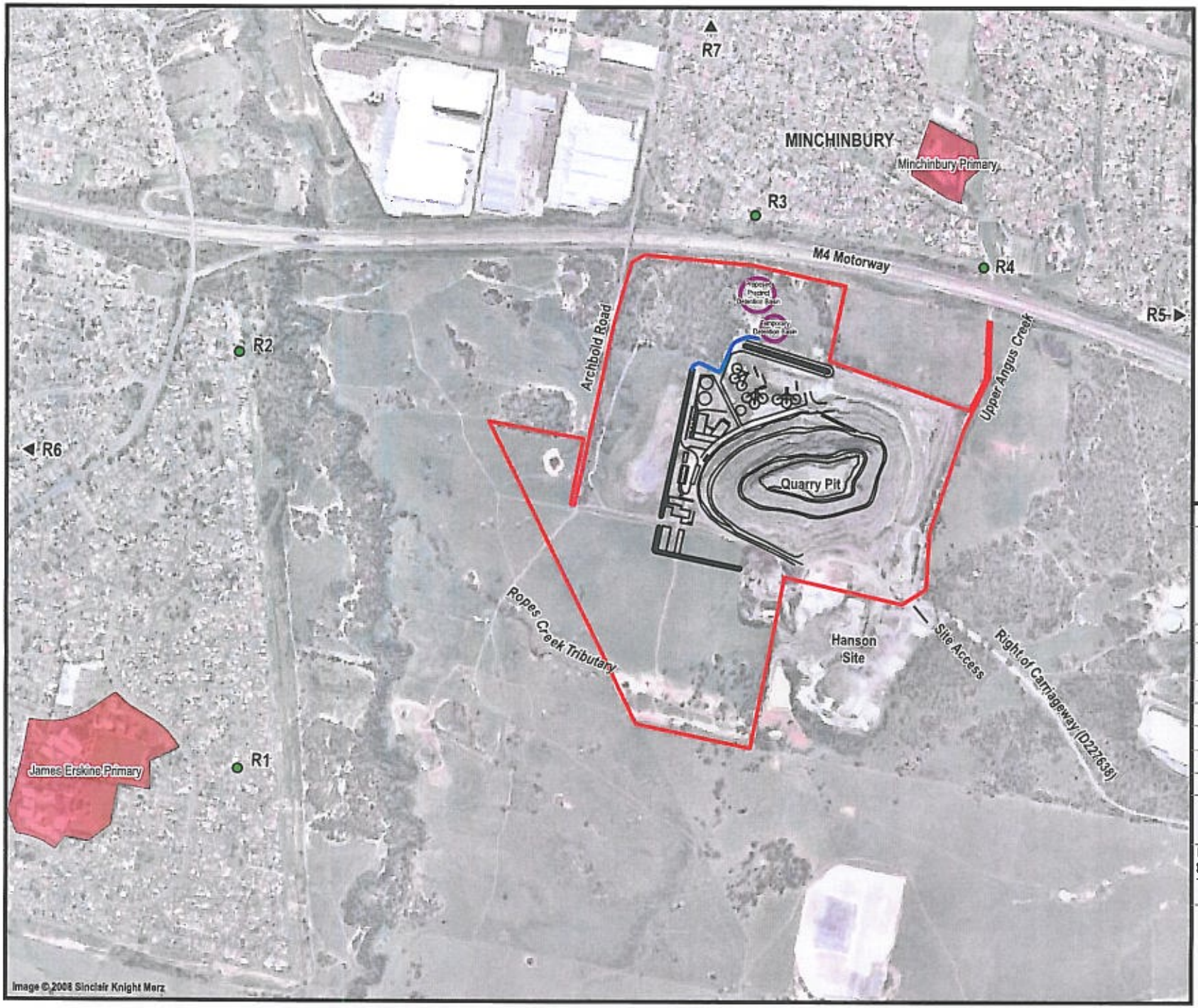
3.1 SENSITIVE RECEIVERS

Sensitive receivers surrounding the proposed facility are generally to the west in Erskine Park and to the north in Minchinbury, located in the general areas identified in *Table 3.1*. The locality map presented in *Figure 3.1* identifies the nearest residential areas and sensitive receivers adjacent to the proposed facility.

Representative monitoring and modelling assessment points were selected to represent the worst case general receivers for each area. *Table 3.1* presents the modelled receiver positions and associated representative street/roads. The monitoring locations are identified in *Section 3.2* and shown on *Figure 3.1*.

Table 3.1 ***Assessed Representative Receivers***

Area	Representative of Receivers Situated in and around:
South West Receivers Erskine Park	Residential :Weaver Street, Pollux Close, Ohio Place and Fantail Crescent Schools : Erskine Park High and James Erskine Primary Churches / Places of Worship : N/A
Western Receivers Erskine Park	Residential: Swamphen Street and Roper Road. Schools : N/A Churches/Places of Worship : N/A.
North Receivers Minchinbury	Residential : Cobbler Crescent, McFarlane Drive, Grazier Place, Tod Place, Eber Place and Bergin Place. Schools : N/A Churches/Places of Worship : N/A.
North East Receivers Minchinbury	Residential: Barrossa Drive, Minchin Drive, Swamphen Street and Roper Road. Schools : Minchinbury Public School Churches/Places of Worship : N/A.
East North East Receivers Minchinbury	Residential: Rutherglen place Agrafe Place, Tirage Place and Farrington Street.. Schools : N/A Churches/Places of Worship : N/A.



Legend

- Visual Barrier Wall
- Site Design
- Detention Basins
- School
- Site Boundary
- Receiver Location

Suffix	Revisions	Date	Init
R0	Preliminary Issue	10-01-08	JS
R1	Label rotation	11-01-08	JS
R2	Vis Boundry + Sem Change	08-05-08	JS
R3	School Locations Added	04-08-08	JF

Figure 3.1
Sensitive Receiver and Noise Monitoring Locations

Client:	ThaQuarry Pty Ltd		
Project:	Light Horse Buisiness Centre EA		
Drawing No:	0071234_GIS14	Suffix No:	R3
Date:	04/08/2008	Drawing size:	A4
Drawn by:	JF	Reviewed by:	JK
Source:	© 2007 Google TM		
Scale:	Refer Scale Bar		

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0 95 190 380 570 Meters

Environmental Resources Management Australia Pty Ltd
Building C, 33 Saunders St, Pyrmont, NSW 2009
Telephone +61 2 8584 8888

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3.2 BACKGROUND NOISE ASSESSMENT

3.2.1 *Introduction*

Acoustic instrumentation utilised during the monitoring and assessment process for this assessment complies with the requirements of AS IEC 6167, 2004 *'Electroacoustics - Sound level meters – Specifications'*. Additionally, all equipment used have current NATA or manufacturer calibration certificates. All instrumentation was calibrated before and after each measurement survey and the tolerance of each unit did not vary by more than ±0.5 dBA.

3.2.2 *Unattended Noise Monitoring*

Unattended continuous monitoring was conducted from 16 August 2007 to 5 September 2007 inclusive, at two residential locations using ARL Type EL315 environmental noise loggers. The monitoring locations were at 12 Swamphen Street, Erskine Park, NSW and 166 McFarlane Drive, Minchinbury, NSW. Atypical or anomalous data apparent in charts was also removed prior to analysis. This typically resulted in adopting the largest grouped ABL values to conservatively calculate the RBL.

A summary of the results of the background surveys, within each of the proposed operating periods of the development, are given in *Table 3.2*. The noise logging data set is presented in *Annex B*.

Table 3.2 ***Summary of Background and Ambient Noise Levels***

Location	Rating Background Level, dB(A)				Ambient Noise Level, dB(A)$L_{eq,period}$		
	Morning Shoulder[2]	Day[1]	Evening[1]	Night[1]	Day[1]	Evening[1]	Night[1]
West – Swamphen Street	38	39	39[4]	37	54	59	49
North – McFarlane Drive	44	47	47	41	55	53	51

1. Day is from 7am to 6pm; Evening is from 6pm to 10pm; and Night is from 10pm to 7am (INP).

2 The morning shoulder (6am-7am) has been adopted as the midpoint between day and night periods, in accordance with Section 3.3 of the INP to account for steadily rising background noise levels due to traffic.

3. Noise data during periods of any rainfall and/or wind speeds above 5m/s were discarded.

4 Ambient noise levels were controlled by traffic noise. An assessment of noise for high traffic areas (in accordance with Section 2.2.3 of the INP) has been undertaken and no corrections are applied, as levels are not more than 10 dB above the recommended acceptable amenity levels.

5. Adjustments are to be made to the Project Specific Noise Criteria to account for evening noise levels being 1 dBA higher than daytime, in accordance with the DECC's Application Notes for the INP.

3.2.3 *Attended Noise Monitoring*

To gain a better understanding of the existing noise environment, ERM conducted attended noise monitoring at the unattended noise monitoring locations during calm clear weather conditions, to ascertain dominate ambient noise sources and to quantify existing industrial noise contributions. For the northern receivers, due to a localised residential extraneous noise source at the time of the measurement, the attended survey location was relocated from McFarlane Drive to nearby Cobbler Crescent (representative of the area). The findings of the survey are presented in *Table 3.3*.

Table 3.3 Summary of Attended Noise Measurements

Location	Time/Date	Duration (min)	Total Measured Noise Levels, dB(A)		Industrial Noise Contribution dB(A)	Noise Sources
			L_{eq}	L_{90}		
West – Swamphen Street	09:16 16/08/07	15:00	48	44	< 44	Traffic M4 No industrial noise contribution
North – Cobbler Crescent adjacent to McFarlane Drive	15:11 16/08/07	15:00	50	47	< 47	Birds 48-55 Dogs 48 – 60 Traffic M4 48 -50 Hanson Asphalt Batching Plant noise just audible, not measurable. Minimal industrial noise contribution

Attended measurements verify that the locality surrounding the proposed facility is typical of an urban environment, as defined in Section 2.2.1 of the INP. In particular, identified noise sources that dominated measured levels included 'urban hum' that was largely traffic-related sources.

4 PROJECT SPECIFIC NOISE CRITERIA

4.1 OPERATIONAL NOISE CRITERIA

The noise emission criteria for the Project have been set in accordance with Section 4.0 of the INP. The intrusiveness and amenity design criteria have been set, based on logging measurements conducted at the nearest representative receivers to the site. Noise monitoring data from the Swamphen Street location was considered representative of the noise environment at the South West, West and South East receivers. Noise monitoring data from the McFarlane Drive location was considered representative of the North, North East and East North East receivers.

The background noise levels for setting the intrusiveness criterion have been determined in the absence of any noise from the proposed development.

The existing LAeq in the area surrounding the site is dominated by traffic and residential noise sources. Some industrial noise was just perceptible from the Hanson site (to the south east of the Project site), however no acoustic contribution was measured above the overall background noise at this location, even during breaks in traffic. Therefore this industrial contribution is estimated to be 10 dBA or greater below the measured (LA90) background noise level. The acoustical environment surrounding the site is typical of an urban environment, as it is dominated by through traffic from the M4 motorway and Great Western Highway, in particular during peak times including the evenings, where noise levels are elevated from traffic.

An assessment of transport noise in accordance with Section 2.2.3 of the INP identified that corrections to the amenity criteria to account for high traffic noise is not applicable, as levels are not more than 10 dB above the recommended acceptable amenity levels. Additionally, as there is no existing industrial noise contribution at representative receivers, no adjustment to the amenity criteria is necessary and the recommended acceptable amenity levels from Table 2.1 of the INP has been adopted as the amenity criteria.

The design goals for operational noise are given in *Table 4.1*.

Table 4.1 *Project Specific Noise Criteria*

Location	Period	Intrusiveness Criteria LAeq(15minute)	Amenity Criteria LAeq(Period)
South West Receivers	Morning Shoulder	**43 dBA**	53 dBA
	Day	**44 dBA**	60 dBA
	Evening	**44 dBA**	50 dBA
	Night	**42 dBA**	45 dBA
West Receivers	Morning Shoulder	**43 dBA**	53 dBA
	Day	**44 dBA**	60 dBA
	Evening	**44 dBA**	50 dBA
	Night	**42 dBA**	45 dBA
North Receivers	Morning Shoulder	**49 dBA**	53 dBA
	Day	**52 dBA**	60 dBA
	Evening	52 dBA	**50 dBA**
	Night	46 dBA	**45 dBA**
North East Receivers	Morning Shoulder	**49 dBA**	53 dBA
	Day	**52 dBA**	60 dBA
	Evening	52 dBA	**50 dBA**
	Night	46 dBA	**45 dBA**
East North East Receivers	Morning Shoulder	**49 dBA**	53 dBA
	Day	**52 dBA**	60 dBA
	Evening	52 dBA	**50 dBA**
	Night	46 dBA	**45 dBA**
School Receivers	When in use	45 dBA (external level -10dBA for transmission loss)	

1. Weekdays and Saturdays - Daytime 7:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm; Night 10:00 pm - 07:00 am. Sundays -Daytime 8am - 6pm; Evening 6:00pm - 8:00am; Night 10:00pm - 8:00am.
2. The INP states that these criteria have been selected to protect at least 90% of the population living in the vicinity of industrial noise sources from the adverse effects of noise for at least 90% of the time. Provided the criteria in the INP are achieved, it is unlikely that most people would consider the resultant noise levels excessive.
3. Applicable project specific design criteria are in bold and are the lower of the intrusiveness and amenity criteria in each instance. Adjustments have been made to the Project Specific Noise Criteria to account for daytime noise levels being quieter than evening periods in accordance with the DECC's Application Notes for the INP.
4. The Amenity Criteria for the morning shoulder (6am-7am) is based on the 'mid-point' between the originally derived day and night recommended acceptable noise levels to account for steadily rising background noise levels due to traffic.

4.2 CONSTRUCTION NOISE CRITERIA

The construction phase of this project is expected to occur for a period of greater than 26 weeks in duration. Therefore, in accordance with the ENCM, the construction noise goals are set to background plus 5 dBA (LA90 + 5dBA). The Project specific construction noise criteria for receivers are presented in *Table 4.2*.

Table 4.2 Construction Noise Goals (>26 week construction period)

Location	Project Specific Noise Criteria LA10(15minute)
West and South West Receivers	44 dBA
North, North East and East North East Receivers	52 dBA

1. Noise generating construction activities may only occur between the hours of 7.00 am and 6.00 pm Monday to Friday, and 8.00 am to 1.00 pm Saturdays. For all other times construction noise must be inaudible at the receiver.

4.3 ROAD TRAFFIC NOISE CRITERIA

The NSW DECC ECRTN recommends external and internal traffic noise goals. The proposed facility will be near to several major roadways including the M4 Motorway and M7 Motorway and to a lesser extent the Great Western Highway. Traffic noise impacts have been assessed for receivers located off Wallgrove Road (which is anticipated to be used by all vehicles accessing the site) and the M4 Motorway. Therefore the traffic noise impact assessment has adopted noise goals for *'land use developments with the potential to create additional traffic on arterial roads or freeways'*, in accordance with the ECRTN and reproduced in *Table 4.3*.

Table 4.3 Traffic Noise Design Goals

Location	Road Classification	Traffic Noise Goal	
		Daytime LAeq(15hour)	Night LAeq(9hour)
West and South West Receivers	Freeway/Arterial	60dBA	55dBA
North, North East and East North East Receivers			

1. Daytime: 07:00 am – 10:00 pm, Night : 10:00 pm to 07:00 am.

Further, the ECRTN identifies that traffic arising from the development should not lead to an increase in existing noise levels of more than 2 dBA.

4.4 SLEEP DISTURBANCE

Table 4.4 presents the sleep disturbance noise emission goals for this project. As outlined in *Section 2.4* of this report, these goals have been established with reference to the ENCM and are based RBL noise level recorded during the night time period at each receiver area.

Table 4.4 Sleep Disturbance Design Goals

Location	Period	Sleep Disturbance Goal (LA1(1minute))
West and & South West Receivers	Night	52 dBA
North, North East and East North East Receivers	Night	56 dBA

Noise propagation over long distances can be significantly affected by the prevailing 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 DECC's INP, specifies weather analysis procedures to be employed to determine the prevalent weather conditions that enhance noise propagation in a particular area, with a view to determining whether they can be described as a feature of the project area.

The prevailing wind directions in the area have been determined in accordance with the INP. The INP requires that winds below 3m/s with an occurrence greater than 30 per cent of the time be assessed. Wind roses created from 1 September 2005 to 10 September 2007 for the Horsley Park area have been analysed. The results of this analysis are presented in more detail and form the wind roses presented in *Annex C* of this report. Based on the results of this analysis, the relevant meteorological conditions modelled are summarised in *Table 5.1*.

Table 5.1 ***Relevant Site Specific Meteorological Parameters***

Assessment Condition	Temperature	Wind Speed / Direction	Relative Humidity	Temperature Gradient
Daytime - Calm	20°C	n/a	65%	n/a
Evening - Calm	15°C	n/a	80%	n/a
- Prevailing Winds	15°C	3m/s /SW±45°	80%	n/a
Night time - Calm	10°C	n/a	80%	n/a
- Prevailing Winds at:				
W & SW Receivers	10°C	3m/s/ SE±45°	80%	n/a
N, NE and ENE Receivers	10°C	3m/s/ S±45°	80%	n/a
- Temperature Inversion	10°C	n/a	80%	3°C/100 m

The potential for drainage flows to occur around the site have been analysed and are not relevant as Project noise sources are at a lower elevation than nearby receivers, or there is intervening topography present between the identified Project noise sources and nearby receivers.

6 NOISE MODELLING

Site operations are predicted to commence in 2008, with landfilling anticipated to continue for a period of approximately 20 years and resource recovery activities to continue indefinitely.

6.1 MODELLING SCENARIOS

As discussed in *Section 1.2.2*, three modelling scenarios were adopted, representative of Years 5, 13 and 20 of operations, to represent the potential range of impacts as landfilling operations and associated in pit equipment progresses closer to the surface.

6.2 PLANT NOISE LEVELS

Mobile plant noise emission data used in modelling for this assessment were obtained from the ERM noise emission database for relevant noise sources. Noise data for stationary plant items such as the screens and crushers were provided by the proponent. The noise emission levels used in modelling are summarised in *Table 6.1*.

Table 6.1 Equipment Sound Power Levels

Typical Item	Representative $L_{eq,15minute}$ Sound Power Level, dB(A)
CAT 740 Dump Truck	103
HITACHI AH 500 Dump Truck	106
IVECO T2700 Water Cart	105
IVECO T2700 Hooklift Truck	101
CAT 320 CL Excavator	106
Hitachi ZX230 Excavator	104
Hyundai 14LC7 Excavator	105
CAT980 Loader	115
CAT996 Loader	110
CAT Dozer D8R	113
Mobile Screens EXTEC	101

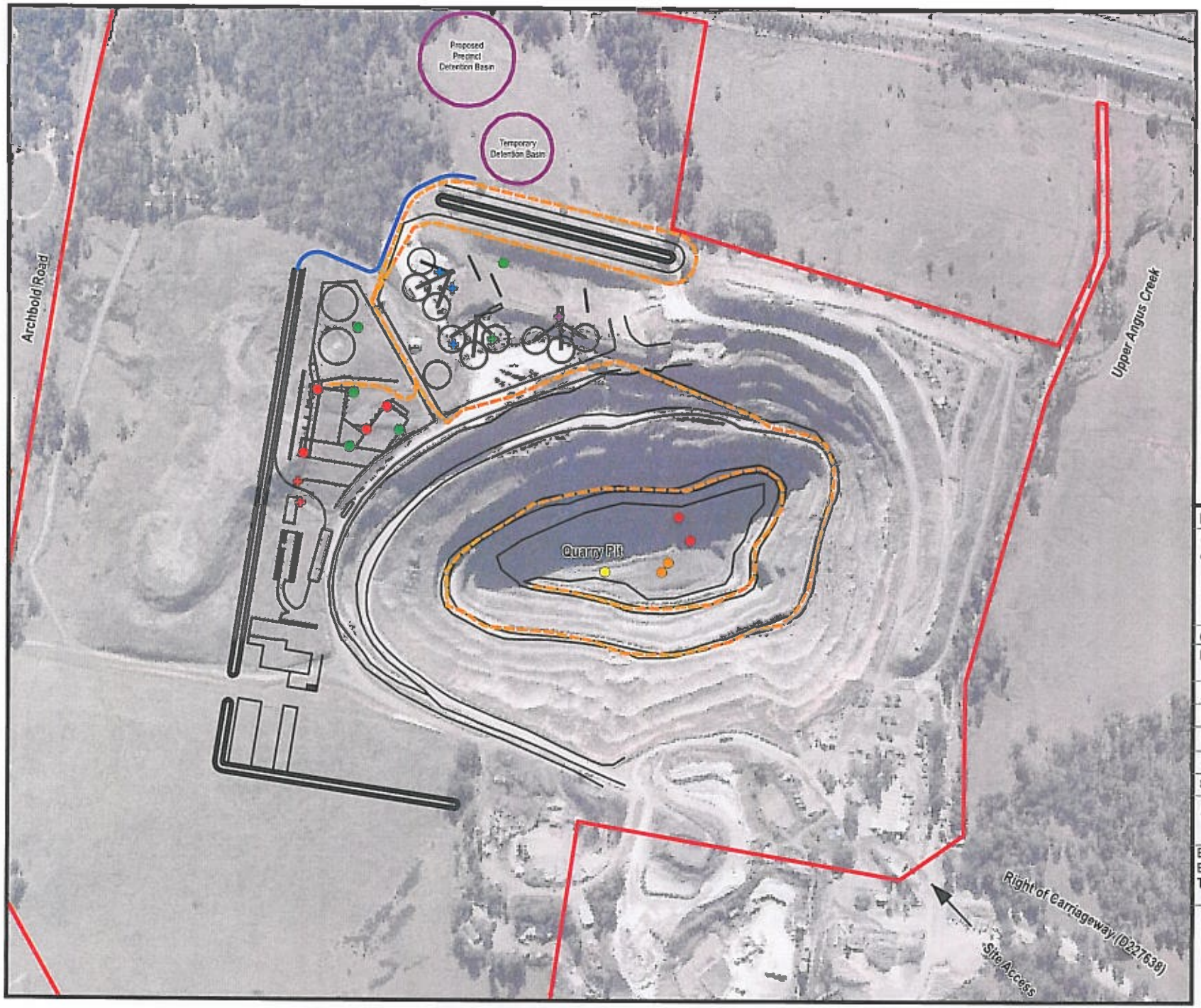
Typical Item	Representative $L_{eq,15minute}$ Sound Power Level, dB(A)
Mobile Screens KEYSTRAC	101
Mobile Crusher EXTECC12	114
Stationary Crusher	114
Hyster Forklift	103
CAT 826 Compactor	113
IVECO T2700 Water Cart2	105
Road Truck	102
Notes: Refer to *Annex D* for 1/3 octave data used for noise modelling	

6.3 *CALCULATION PROCEDURES*

ENM noise modelling software was used to assess potential noise impacts associated with the Project. ENM is a DECC accepted software package and takes into account distance, ground effect, atmospheric absorption and topographic detail.

The model incorporated three-dimensional digitised ground contours for the facility, as derived from proposed site plans (inclusive of barriers) and barriers 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 for the three representative scenarios, as indicated on *Figure 6.1*. For each scenario, noise sources were modelled in the same (x,y) positions with elevations of in pit equipment changed to represent the change in height of the landfill operations.

The noise model predicts L_{eq} noise levels, although it should be noted that this assessment has assumed that all plant and equipment operate simultaneously. In practice, such an operating scenario would be unlikely to occur and the results should therefore be considered conservatively high. Where relevant, modifying factors in accordance with Section 4 of the INP have been applied to calculations.



Legend

- Excavator
- Compactor
- Bulldozer
- Loader
- Forklift
- Mobile Crusher
- Mobile Screens
- Stationary Crusher
- Visual Barrier Wall
- Dump Truck and Water Cart Route
- Site Design
- Detention Basins
- Site Boundary

Suffix	*Revisions*	*Date*	*Init*
R0	Preliminary Issue	10-01-08	JS
R1	Equip location source change	11-01-08	JS
R2	Visual Bound+DT Route Change	08-05-08	JS

Figure 6.1

Indicative Plant and Equipment Operating Locations

Client:	ThaQuarry Pty. Ltd.		
Project:	Light Horse Buisiness Centre		
Drawing No:	0071234_GIS24_R2	Suffix No:	R2
Date:	08/05/2008	Drawing size:	A4
Drawn by:	JS	Reviewed by:	JK
Source:	VGT Environmental Compliance Solutions		
Scale:	Refer Scale Bar		

N

0 25 50 100 150 Meters

Environmental Resources Management Australia Pty Ltd
Building C, 33 Saunders St, Pyrmont, NSW 2009
Telephone +61 2 8584 8888

ERM

7 NOISE IMPACT ASSESSMENT - RESULTS AND DISCUSSION

7.1 OPERATIONAL NOISE

Three operational scenarios were modelled to determine the potential acoustic impact of the Project on the surrounding community at various stages of the development. Noise from all sources that contribute to the total noise from the proposed site operations has been assessed.

A summary of predicted noise levels at assessed representative areas adjacent to the site are provided in *Table 7.1* to *7.3*, for calm and prevailing weather conditions. ENM, noise contour maps for the worst case daytime and evening operations for Years 5, 13 and 20 of operations are provided in *Annex D*.

Table 7.1 Noise Modelling Summary – Year 5

Location	Modelled Period	Project Specific Noise Criteria LAeq	Calm LAeq	Prevailing Wind LAeq	Inversion LAeq
South West Receivers	Morning Shoulder	43 dBA	<35 dBA	N/A	36 dBA
	Day[1]	44 dBA	<35 dBA	N/A	N/A
	Evening[1]	44 dBA*	<35 dBA	<35 dBA	N/A
	Night[1]	42 dBA	<35 dBA	<35 dBA	<35 dBA
Western Receivers	Morning Shoulder	43 dBA	<35 dBA	N/A	<35 dBA
	Day[1]	44 dBA	<35 dBA	N/A	N/A
	Evening[1]	44 dBA*	<35 dBA	<35 dBA	N/A
	Night[1]	42 dBA	<35 dBA	<35 dBA	<35 dBA
North Receivers	Morning Shoulder	49 dBA	42 dBA	N/A	44 dBA
	Day[1]	52 dBA	42 dBA	N/A	N/A
	Evening[1]	50 dBA	43 dBA	45 dBA	N/A
	Night[1]	45 dBA	35 dBA	42 dBA	43 dBA
North East Receivers	Morning Shoulder	49 dBA	42 dBA	N/A	45 dBA
	Day[1]	52 dBA	41 dBA	N/A	N/A
	Evening[1]	50 dBA	42 dBA	49 dBA	N/A
	Night[1]	45 dBA	<35 dBA	44 dBA	43 dBA
East North East Receivers	Morning Shoulder	49 dBA	36 dBA	N/A	40 dBA
	Day[1]	52 dBA	37 dBA	N/A	N/A
	Evening[1]	50 dBA	37 dBA	43 dBA	N/A
	Night[1]	45 dBA	35 dBA	40 dBA	39 dBA
James Erskine Primary	When in use	45 dBA	<35 dBA	N/A	N/A
Minchinbury Primary			<45 dBA	N/A	N/A

1. Intrusive Criteria Applicable - LAeq(15minute);
2. Amenity Criteria Applicable - LAeq(Period);

* Where the PSNC for evening is greater than that of day, the day criteria has been adopted.

Table 7.2 Noise Modelling Summary – Year 13

Location	Modelled Period	Project Specific Noise Criteria LAeq	Calm LAeq	Prevailing Wind LAeq	Inversion LAeq
South West Receivers	Morning Shoulder	43 dBA	<35 dBA	N/A	37 dBA
	Day[1]	44 dBA	<35 dBA	N/A	N/A
	Evening[1]	44 dBA*	<35 dBA	<35 dBA	N/A
	Night[1]	42 dBA	<35 dBA	<35 dBA	<35 dBA
Western Receivers	Morning Shoulder	43 dBA	<35 dBA	N/A	<35 dBA
	Day[1]	44 dBA	<35 dBA	N/A	N/A
	Evening[1]	44 dBA*	<35 dBA	<35 dBA	N/A
	Night[1]	42 dBA	<35 dBA	<35 dBA	<35 dBA
North Receivers	Morning Shoulder	49 dBA	43 dBA	N/A	44 dBA
	Day[1]	52 dBA	43 dBA	N/A	N/A
	Evening[1]	50 dBA	43 dBA	45 dBA	N/A
	Night[1]	45 dBA	39 dBA	40 dBA	41 dBA
North East Receivers	Morning Shoulder	49 dBA	42 dBA	N/A	45 dBA
	Day[1]	52 dBA	42 dBA	N/A	N/A
	Evening[1]	50 dBA	42 dBA	50 dBA	N/A
	Night[1]	45 dBA	38 dBA	45 dBA	42 dBA
East North East Receivers	Morning Shoulder	49 dBA	36 dBA	N/A	40 dBA
	Day[1]	52 dBA	36 dBA	N/A	N/A
	Evening[1]	50 dBA	36 dBA	43 dBA	N/A
	Night[1]	45 dBA	36 dBA	39 dBA	39 dBA
James Erskine Primary	When in use	45 dBA	<35 dBA	N/A	N/A
Minchinbury Primary			<45 dBA	N/A	N/A

1. Intrusive Criteria Applicable - LAeq(15minute);
2. Amenity Criteria Applicable - LAeq(Period);

* Where the PSNC for evening is greater than that of day, the day criteria has been adopted.

Criteria exceedences are in bold

Table 7.3 Noise Modelling Summary – Year 20

Location	Modelled Period	Project Specific Noise Criteria LAeq	Calm LAeq	Prevailing Wind LAeq	Inversion LAeq
South West Receivers	Morning Shoulder	43 dBA	<35 dBA	N/A	40 dBA
	Day[1]	44 dBA	<35 dBA	N/A	N/A
	Evening[1]	44 dBA*	<35 dBA	<35 dBA	N/A
	Night[1]	42 dBA	<35 dBA	<35 dBA	<35 dBA
Western Receivers	Morning Shoulder	43 dBA	<35 dBA	N/A	37 dBA
	Day[1]	44 dBA	<35 dBA	N/A	N/A
	Evening[1]	44 dBA*	<35 dBA	<35 dBA	N/A
	Night[1]	42 dBA	<35 dBA	<35 dBA	<35 dBA
North Receivers	Morning Shoulder	49 dBA	44 dBA	N/A	46 dBA
	Day[1]	52 dBA	44 dBA	N/A	N/A
	Evening[1]	50 dBA	44 dBA	47 dBA	N/A
	Night[1]	45 dBA	43 dBA	45 dBA	45 dBA
North East Receivers	Morning Shoulder	49 dBA	42 dBA	N/A	45 dBA
	Day[1]	52 dBA	42 dBA	N/A	N/A
	Evening[1]	50 dBA	42 dBA	49 dBA	N/A
	Night[1]	45 dBA	42 dBA	45 dBA	45 dBA
East North East Receivers	Morning Shoulder	49 dBA	37 dBA	N/A	41 dBA
	Day[1]	52 dBA	37 dBA	N/A	N/A
	Evening[1]	50 dBA	<35 dBA	44 dBA	N/A
	Night[1]	45 dBA	37 dBA	42 dBA	40 dBA
James Erskine Primary	When in use	45 dBA	<35 dBA	N/A	N/A
Minchinbury Primary			<45 dBA	N/A	N/A

1. Intrusive Criteria Applicable - LAeq(15minute);
2. Amenity Criteria Applicable - LAeq(Period);
   Includes loader sound power level of 111 dBA for this stage

* Where the PSNC for evening is greater than that of day, the day criteria has been adopted.
Criteria exceedences are in bold

Tables 7.1 to *7.3* show that modelled noise levels for all stages of the Project operations are predicted to meet the relevant Project Specific Noise Criteria at most sensitive receivers during all meteorological conditions.

7.1.1 *Construction Noise*

Construction Equipment

Construction works for the Facility are expected to last for approximately six months. The construction noise impact assessment has adopted the items of equipment presented in *Table 7.4*, and associated noise emission data, as obtained from the ERM noise database. Modelling conservatively assumed that construction equipment is operating at the proposed location of the crushing and screening facilities, as this is the construction area located closest to potentially sensitive receivers.

Table 7.4 ***Construction Plant***

Plant and Equipment	Sound Power Level (LA10)
Compressor	94 dBA
Transit Mixer	114 dBA
Excavator	114 dBA
Crane	108 dBA
Hand tools (including grinding, hammering etc.)	108 dBA

Construction Modelling Results

The ENM model results for construction works are presented in *Table 7.5*. It can be seen that construction noise is not expected to exceed the relevant criteria at any of the assessed receivers.

Table 7.5 ***Construction Emissions Summary***

Location	Project Specific Noise Criteria LA10	Calculated LA10 (Calm)
South West Receivers	Day – 44 dBA	<30 dBA
Western Receivers	Day – 44 dBA	<30 dBA
North Receivers	Day - 52 dBA	38 dBA
North East Receivers	Day - 52 dBA	37 dBA
East North East Receivers	Day - 52 dBA	30 dBA

7.2 *ROAD TRAFFIC NOISE*

The US Environment Protection Agency's method was used to predict the LAeq noise levels from traffic travelling along Wallgrove Road and the M4 Motorway, at residences adjacent to these routes. It is an internationally accepted theoretical traffic noise prediction model which takes into account the vehicle noise levels (light and heavy), receiver offset distance, passby duration, vehicle speed, ground absorption (based on the ratio of soft ground and average height of propagation), number of vehicle movements, receiver height, truck exhaust height and the height and location of any intervening barriers.

To predict road traffic noise from the Project, it was necessary to take into account the volume of vehicles predicted to travel to and from the site. Traffic generation predictions supplied by the proponent for a worst case traffic generation scenario, whereby 80% of incoming waste is recycled and transported back off site are presented in *Table 7.6* and were used for this assessment. This scenario would result in approximately 972 vehicle movements per day from the Project.

For assessment of road traffic noise during the daytime, it was conservatively assumed that all daily movements (refer *Table 7.6*) would occur during the daytime period between 7:00am and 10:00pm. To assess worst-case impacts during the night-time, a conservative scenario was modelled, whereby one quarter of medium and heavy vehicle daily waste deliveries (approximately 120 movements) occur during the night period between 10:00pm and 7:00am. This would include deliveries during standard operating hours between 6:00am and 7:00am, as well as movements associated with the occasional delivery of waste after 10:00pm (anticipated to occur once per week).

Table 7.6 ***Vehicle Movement Distribution***

	Daily Movements		
Activity	**Light**	**Medium**	Heavy
Staff Movements	76	-	-
Subcontractors	8	-	-
Site Visitors	8	-	-
Waste Deliveries	62	166	314
Product Dispatch	62	86	182
General Deliveries (fuel, workshop and administrative supplies, service and maintenance activities etc)	4	2	2
TOTAL	**220**	**254**	**498**

For this assessment, it has been conservatively assumed that all site traffic travel along both Wallgrove Road and the M4 Motorway, in one direction to and from site. Results of the intermittent traffic noise assessment are presented in *Table 7.7*. These results show that the predicted traffic noise from existing traffic (determined from noise logger data) plus additional vehicle movements from the Project would remain below the relevant ECRTN criteria at the nearest receivers to Wallgrove Road and the M4 Motorway. Additionally it can be seen that Project traffic will not increase existing noise levels by more than 2 dBA.

Table 7.7 ***Road Traffic Noise Impacts***

Location	Existing Traffic Noise	Calculated Maximum Traffic Noise Contribution of Project	Calculated Existing + Project Traffic Noise	Noise Design Criteria
Parameter		LAeq(15hour) Day		
Wallgrove Road at 35 metres	53 dBA	51 dBA	55 dBA	60 dBA
M4 Motorway at 75 metres	54 dBA	47 dBA	55 dBA	60 dBA
Parameter		LAeq(9hour) Night		
Wallgrove Road at 35 metres	48 dBA	44 dBA	50 dBA	55 dBA
M4 Motorway at 75 metres	50 dBA	42 dBA	51 dBA	55 dBA

1. Analysis of LAeq logging data for each location was used to establish the existing traffic noise contribution for the day and night period. Logger data from McFarlane Crescent was used for the M4 traffic noise contribution, while data from the Swamphen Street logger was taken as a conservative traffic noise contribution for Wallgrove Road.

Recent information has been provided by the proponent regarding traffic volumes. Revised traffic movements are identified to be 340,200 movements PA rather than the assessed worst case of 354,780 movements PA. Therefore, noise levels presented in *Table 7.7* should be considered highly conservative. It should also be noted that traffic noise emissions comply with the ECRTN even when adopting higher traffic volumes for the site.

7.3 *SLEEP DISTURBANCE*

Although site operations will generally not occur in the night time period, approximately once per week waste may be received into the site after 10.00 pm. To assess sleep disturbance typical of night time waste receival activities, noise for the following LAmax noise sources have been calculated:

- truck start up Lmax
- truck - brake release Lmax

- heavy door slam Lmax

ENM modelling results during prevailing weather conditions are presented in *Table 7.8* for representative receivers. The modelling results indicate that maximum noise emissions during night time operations are predicted to remain below the sleep disturbance noise criteria.

Table 7.8 *Sleep Disturbance Noise Impacts*

Locality	Sleep Disturbance Noise Criteria (LA1(1minute))	Predicted Noise Level	
		Inversion LA10	Prevailing Winds LA10 (source to receiver)
South West Receivers	55 dBA	<35 dBA	35 dBA
Western Receivers	55 dBA	<35 dBA	<35 dBA
North Receivers	56 dBA	41 dBA	38 dBA
North East Receivers	56 dBA	44 dBA	45 dBA
East North East Receivers	56 dBA	<35 dBA	36 dBA

7.4 *CUMULATIVE NOISE*

The existing Hanson operations to the south east of the site are the main source of existing industrial noise in the area. Noise emissions from the proposed facility may contribute to existing industrial noise levels and potentially increase cumulative noise.

However, attended and unattended measurements identify that the existing industrial noise emissions at receivers west and the north of the proposed facility are minimal. The acoustical environment of the surrounding community is dominated by traffic from the M4 Motorway. Therefore, a cumulative impact assessment has been undertaken adopting the background noise level from the unattended loggers minus 10 dBA for the conservatively estimated industrial noise contribution from the daytime attended measurements. The cumulative impact assessment is for the worst case noise generating stage of the development, i.e. Year 20. Cumulative industrial noise levels from the facility's emissions and the existing measured industrial noise emissions are presented in *Table 7.9* for calm and noise enhancing weather conditions.

Table 7.9 *Cumulative Impacts*

Location	Amentiy Noise Criteria LAeq	Calm LAeq	Prevailing Wind LAeq	Inversion LAeq
South West Receivers	Day - 60 dBA	36 dBA	N/A	N/A
	Evening[1] - 50 dBA*	36 dBA	36 dBA	N/A
	Night[1] - 45 dBA	36 dBA	36 dBA	36 dBA
Western Receivers	Day - 60 dBA	36 dBA	N/A	N/A
	Evening[1] - 50 dBA*	36 dBA	36 dBA	N/A
	Night[1] - 45 dBA	36 dBA	36 dBA	36 dBA
North Receivers	Day - 60 dBA	45 dBA	37 dBA	N/A
	Evening[1] - 50 dBA*	45 dBA	47 dBA	N/A
	Night[1] - 45 dBA	43 dBA	45 dBA	45 dBA
North East Receivers	Day - 60 dBA	43 dBA	N/A	N/A
	Evening[1] - 50 dBA*	43 dBA	49 dBA	N/A
	Night[1] - 45 dBA	42 dBA	45 dBA	45 dBA
East North East Receivers	Day - 60 dBA	40 dBA	N/A	N/A
	Evening[1] - 50 dBA*	39 dBA	45 dBA	N/A
	Night[1] - 45 dBA	36 dBA	42 dBA	41 dBA

Table 7.9 shows that cumulative noise impacts are predicted to be negligible, remaining below the amenity noise goals during all modelled weather conditions.

Noise mitigation measures that form part of the Project design include:

- restricting normal hours of operation to 6:00 am to 10:00 pm, with landfilling operations further restricted to the hours between 6:00 am and 6:00 pm (receival of material would occur after 10:00 pm on occasion); and

- constructing impervious barriers at various positions around the facility, including 10 m high barriers to the north, north west, west and south of the main area of operations and retention of the existing earth mound to the north east of the quarry pit. These barriers are included in the noise modelling results presented in this report.

In addition, it is recommended that the following noise mitigation measures be included in a Noise Management Plan prepared for the site, potentially as part of the overall Waste Management Plan:

- all on-site, fixed and mobile diesel powered plant, excluding road vehicles, are to be correctly fitted and maintained in accordance with the manufacturer's specifications. Particular attention is to be given to engine exhaust systems and the care and maintenance of mufflers and loaders during the last stages of this proposal where plant items are nearer to the surface.

9 CONCLUSION

ERM has completed a noise impact assessment for the proposed Light Horse Business Centre at Eastern Creek, NSW.

Conservative modelling has shown that operational noise emissions are predicted to meet the relevant project specific noise criteria at all receivers during calm and prevailing meteorological conditions.

Noise emissions associated with construction activities for the Project will meet the relevant construction noise goal criteria. Sleep disturbance and cumulative noise impact due to the Project are not considered likely. Traffic noise levels are predicted to increase due to Project traffic, but remain below relevant ECRTN criteria.

REFERENCES

Calculation of Road Traffic Noise (CORTN)(1988), Department of Transport, UK.

Department of Environment and Climate Change (1994) of NSW, Environmental Noise Control Manual (ENCM).

Department of Environment and Climate Change (January 2000), Industrial Noise Policy.

Department of Environment and Climate Change (May 1999), Environmental Criteria for Road Traffic Noise (ECRTN).

RTA Technology, Environmental Noise Model (ENM), Windows Version 3.06.

Annex A

Sound Power Spectral Data

Table A.1 *Sound Power Spectral Data*

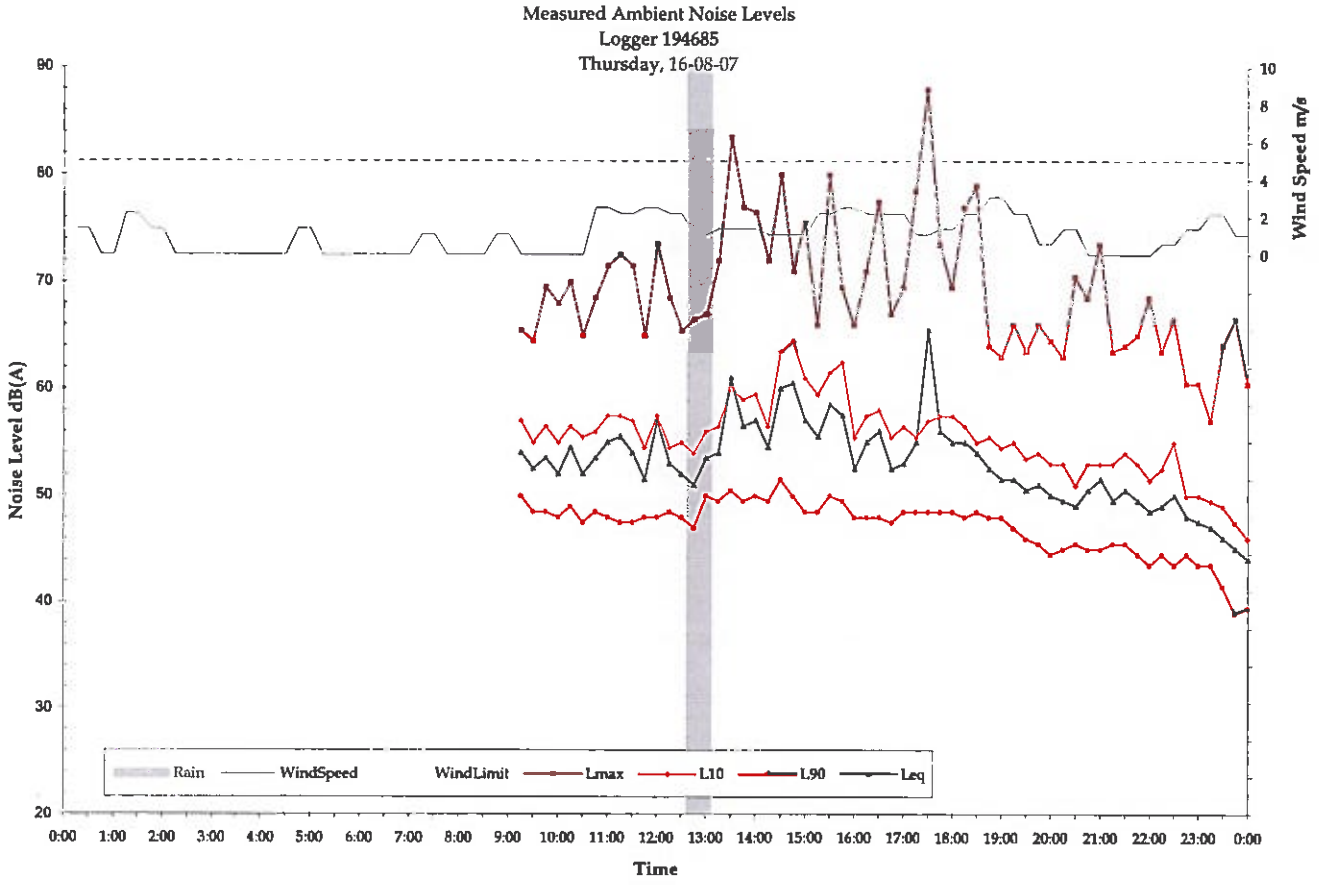
Sound Power Level Spectrum for ENM									
Noise Source	Linear Frequency (Hz)								Total
	63	125	250	500	1000	2000	4000	8000	dB(A)
CAT 740 Dump Truck	113	106	103	98	97	96	91	83	103
HITACHI AH 500 Dump Truck	116	109	106	101	100	99	94	86	106
IVECO T2700 Water Cart	111	102	102	98	99	100	92	86	105
IVECO T2700 Hooklift Truck	107	98	98	94	95	96	88	82	101
CAT 320 CL Excavator	107	110	102	104	100	97	93	88	106
Hitachi ZX230 Excavator	107	111	102	101	98	96	87	79	104
Hyundai 14LC7 Excavator	112	106	102	102	101	97	87	77	105
CAT980 Loader	113	119	117	110	108	107	101	97	115
CAT996 Loader	112	111	107	106	105	103	95	92	110
CAT Dozer D8R	112	122	109	108	106	107	103	94	113
Mobile Screens EXTEC	117	107	102	98	94	92	89	85	101
Mobile Screens KEYSTRAC	117	107	102	98	94	92	89	85	101
Mobile Crusher EXTECC12	115	114	114	111	110	107	102	96	114
Stationary Crusher	115	114	114	111	110	107	102	96	114

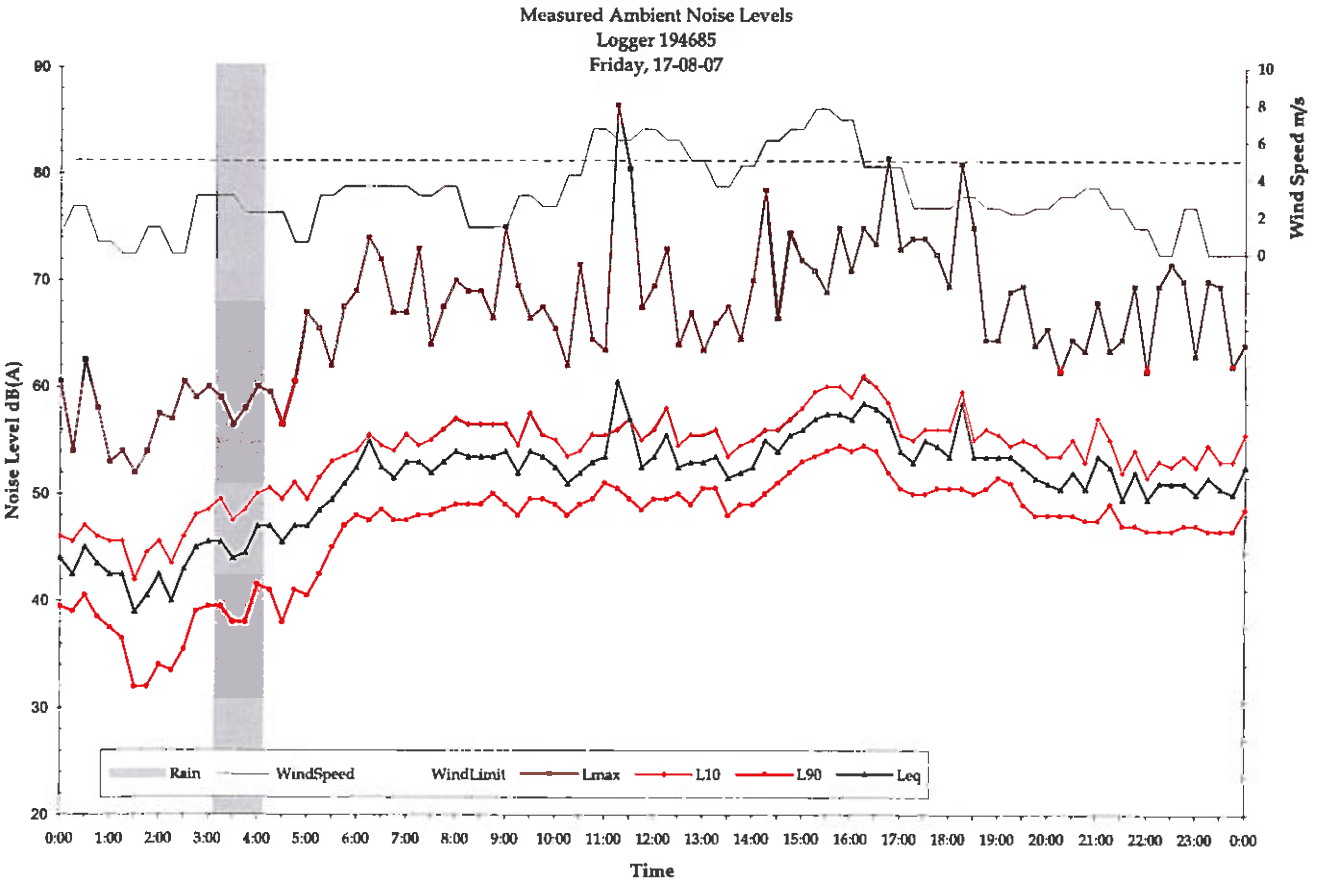
Sound Power Level Spectrum for ENM									
Hyster Forklift	92	105	102	102	95	97	91	84	103
CAT 826 Compactor	107	112	115	110	108	105	99	93	113
IVECO T2700 Water Cart2	111	102	102	98	99	100	92	86	105
Road Truck	118	114	102	95	96	99	94	89	89

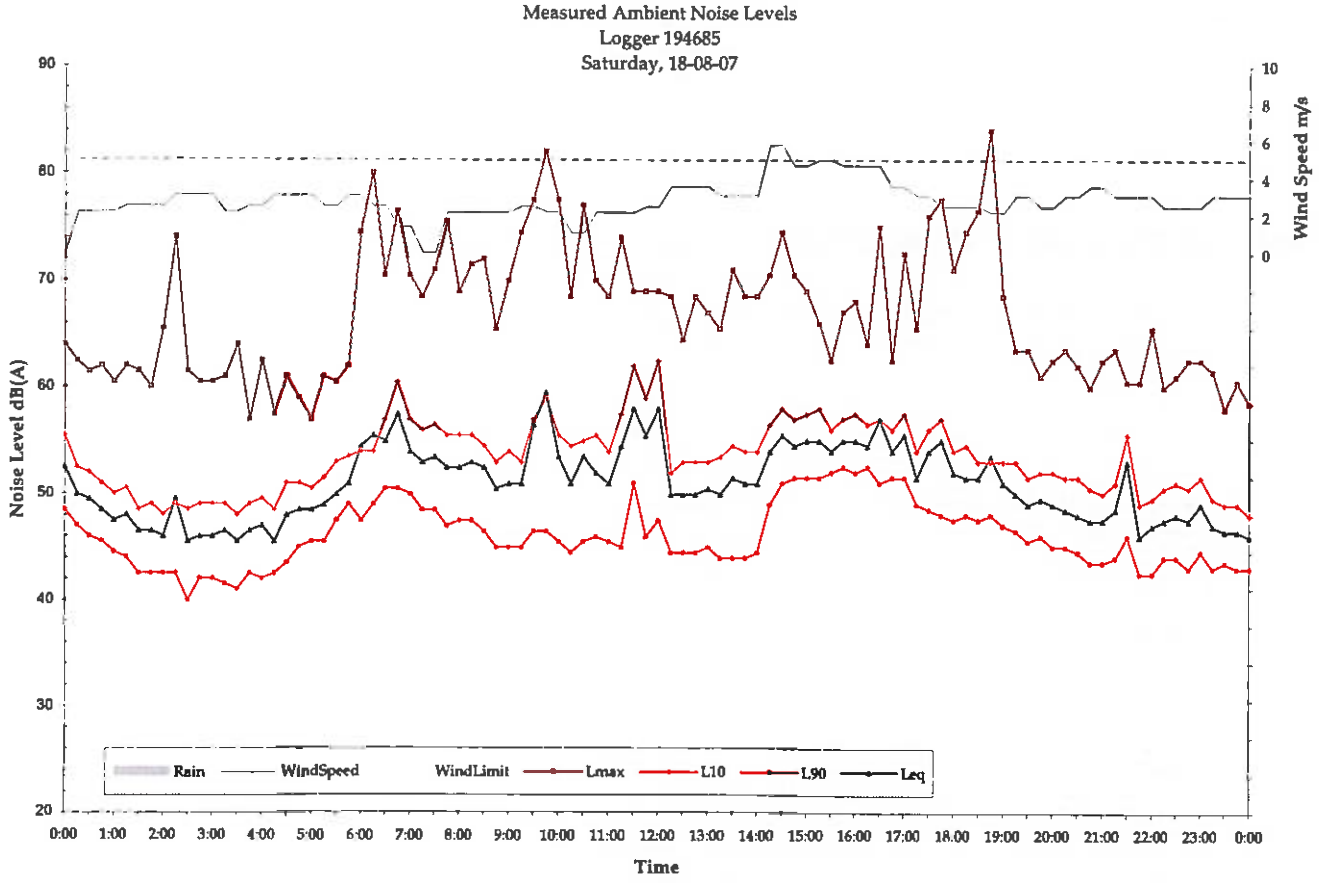
Annex B

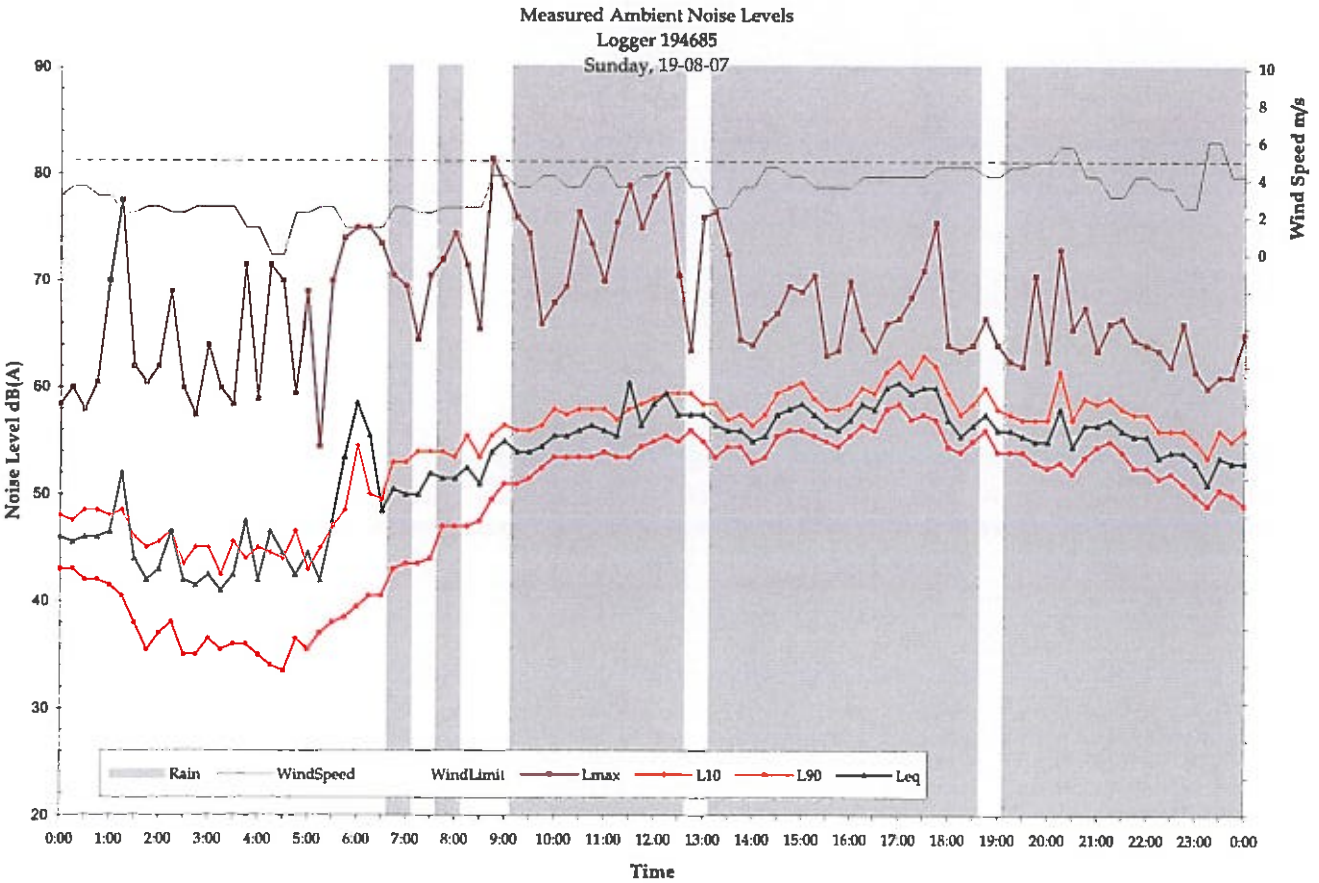
Unattended Monitoring Data

Noise Monitoring Data – 166 McFarlane Drive, Minchinbury, NSW

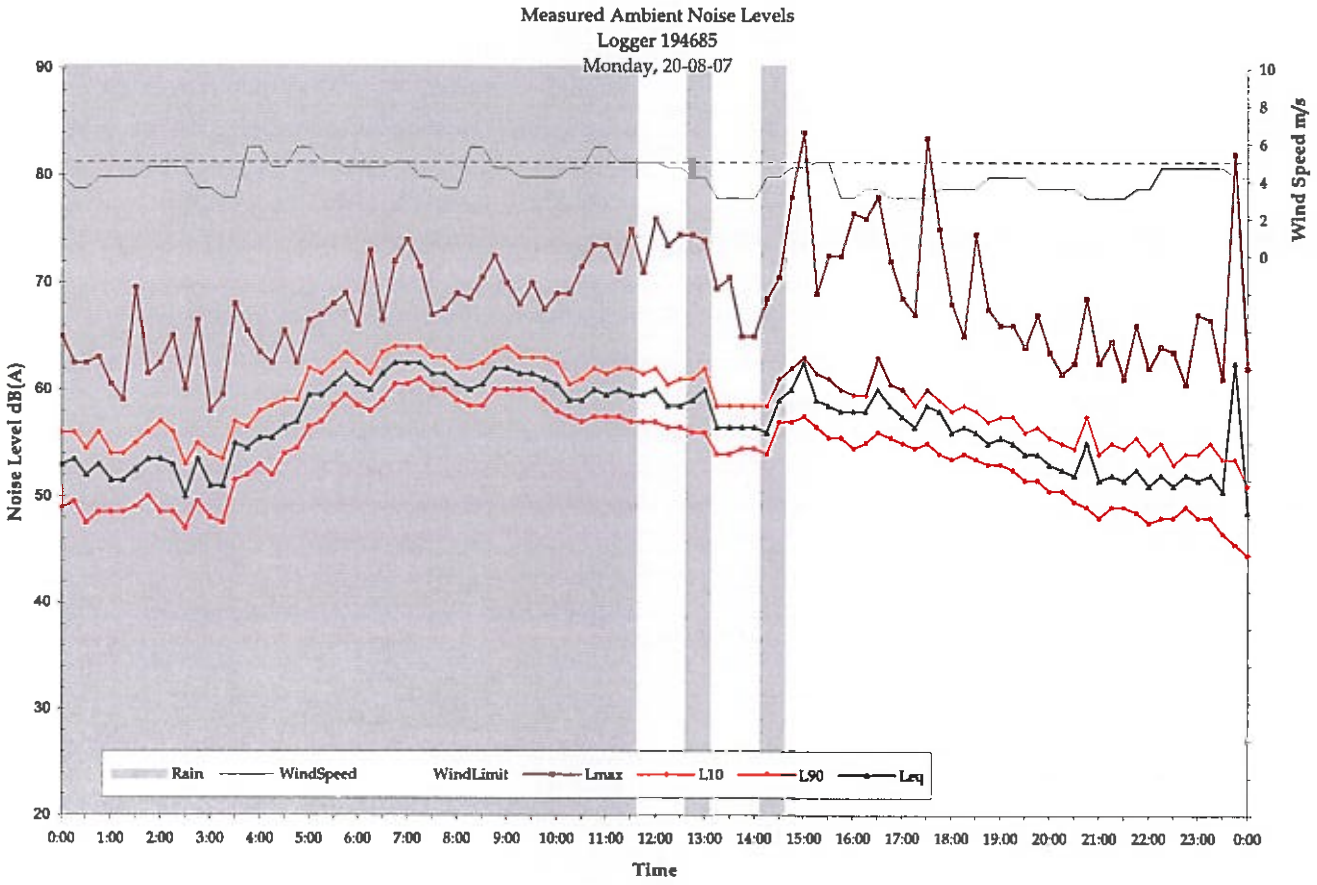


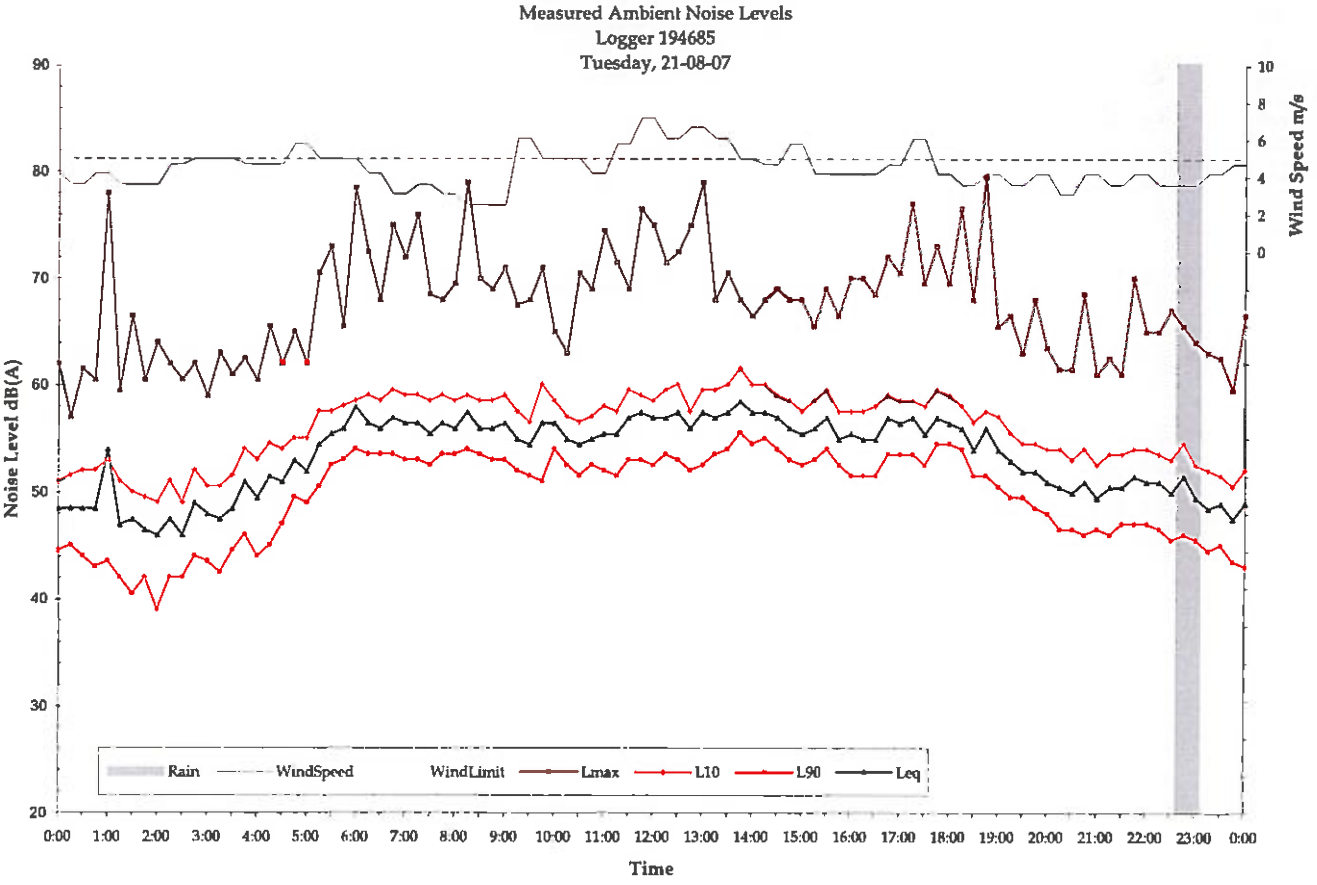


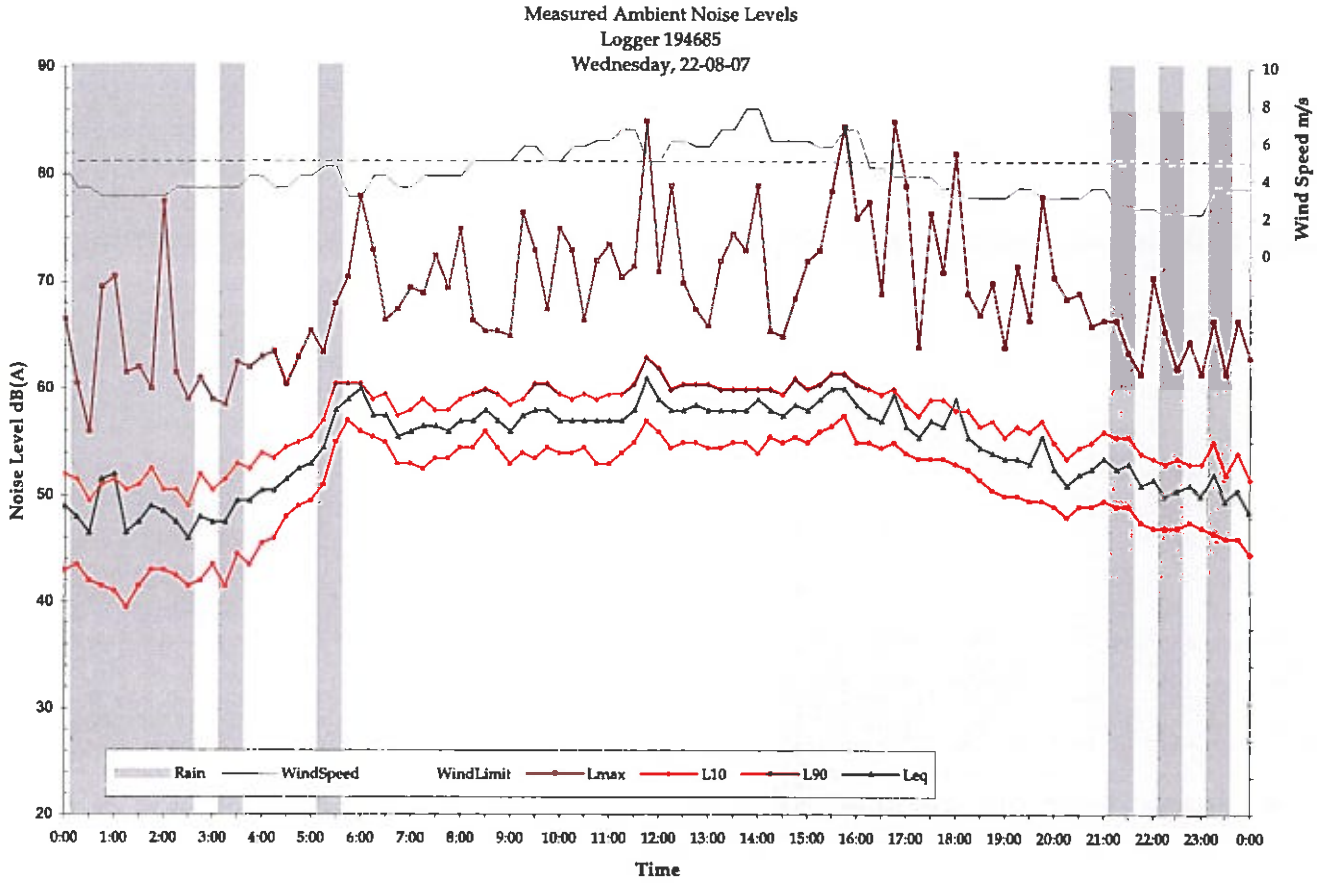

Measured Ambient Noise Levels
Logger 194685
Saturday, 18-08-07
Noise Level dB(A)
Wind Speed m/s
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq
Time

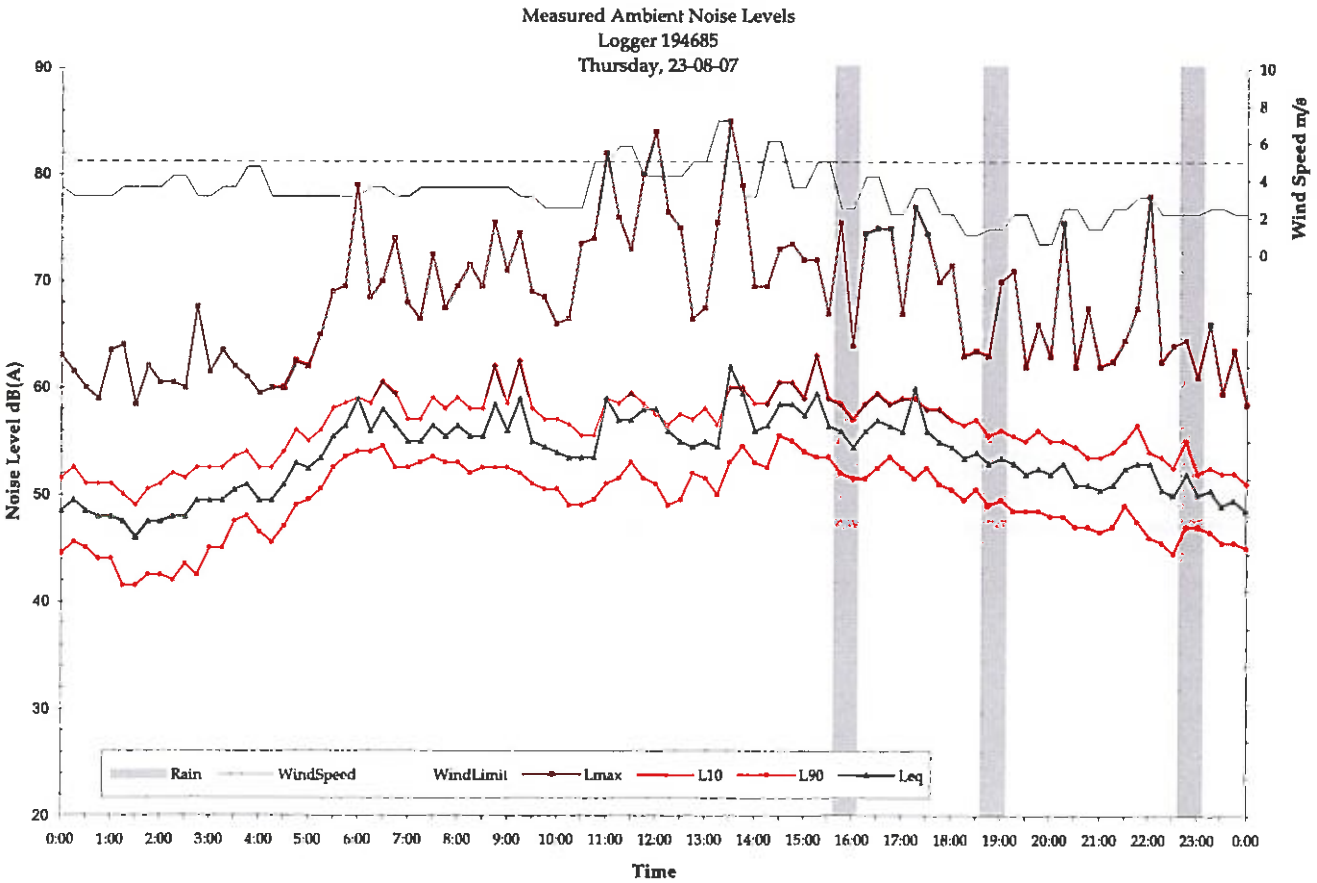

Measured Ambient Noise Levels
Logger 194685
Sunday, 19-08-07
Noise Level dB(A)
Wind Speed m/s
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq
Time

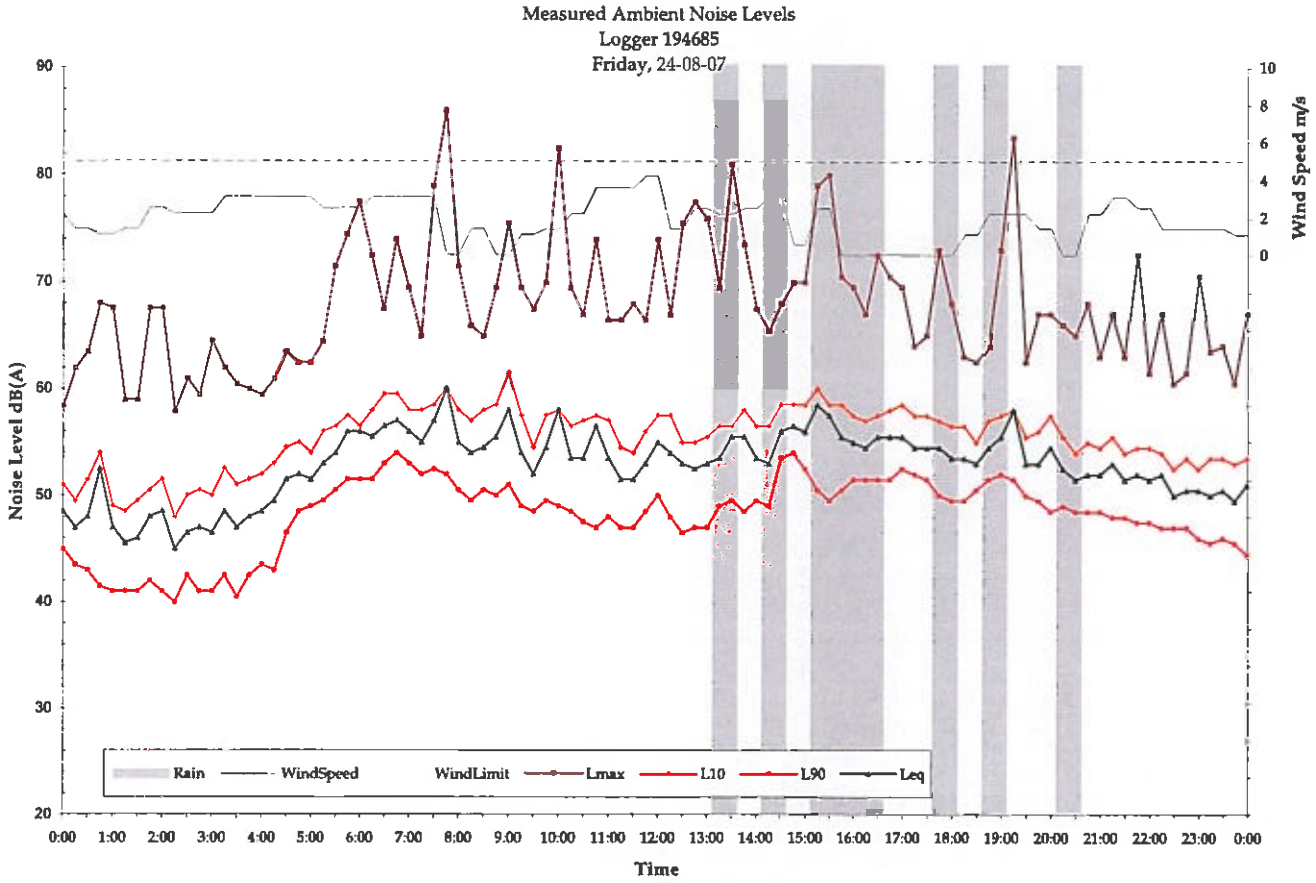
Noise Monitoring Data – 166 McFarlane Drive, Minchinbury, NSW

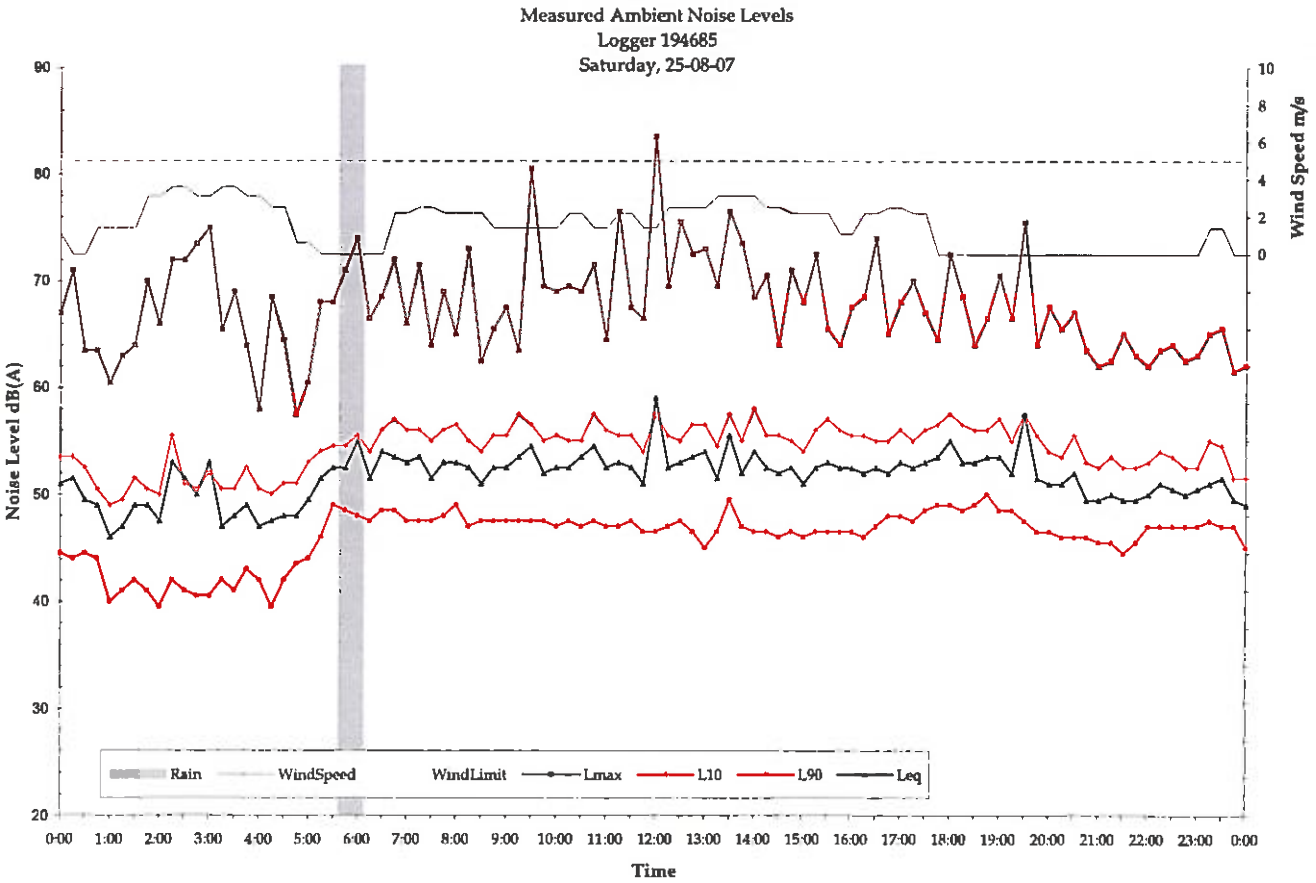




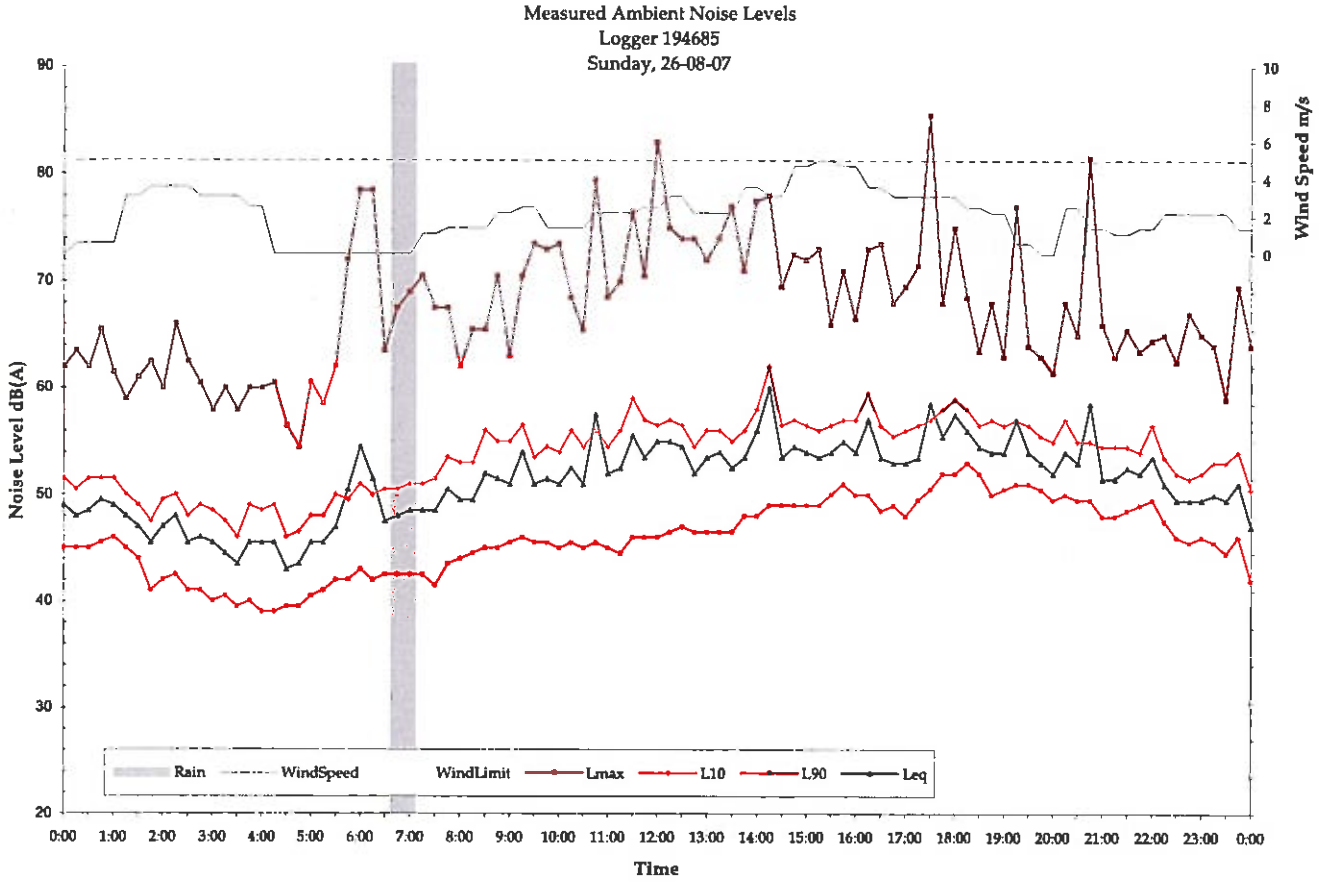

Measured Ambient Noise Levels
Logger 194685
Wednesday, 22-08-07
Noise Level dB(A)
Wind Speed m/s
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq
Time

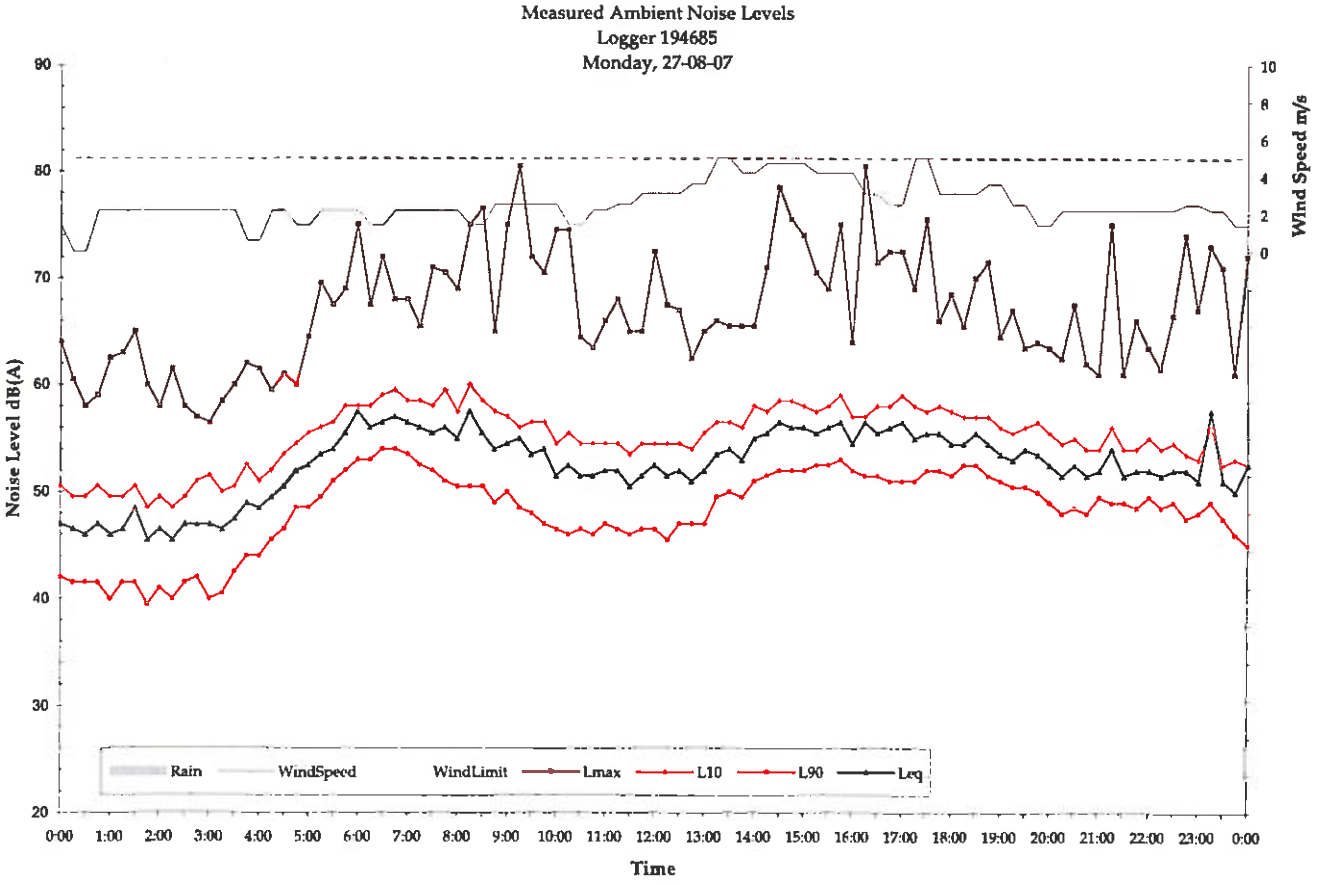

Measured Ambient Noise Levels
Logger 194685
Thursday, 23-08-07
Noise Level dB(A)
Wind Speed m/s
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq
Time

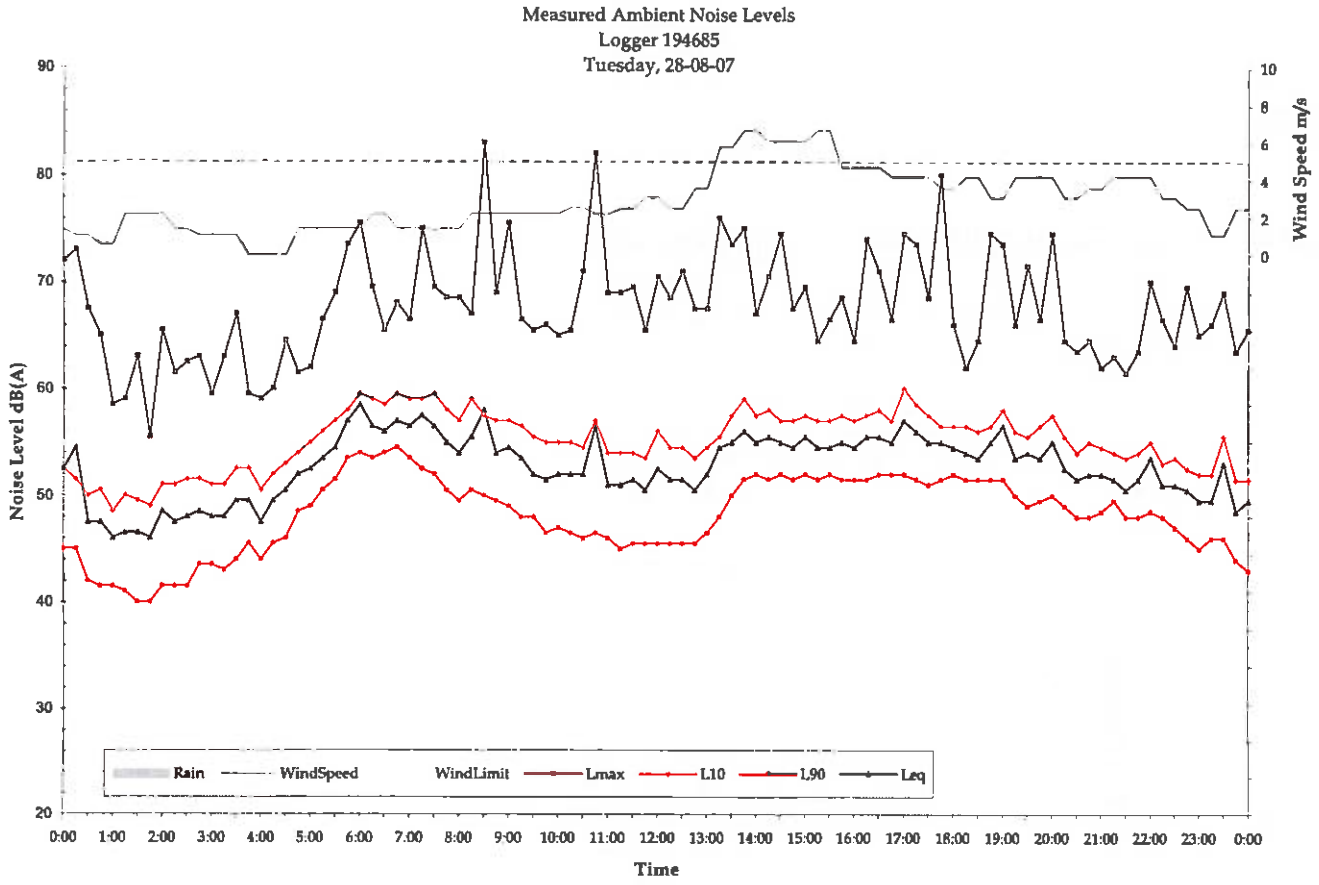

Measured Ambient Noise Levels
Logger 194685
Friday, 24-08-07
Noise Level dB(A)
Wind Speed m/s
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq
Time

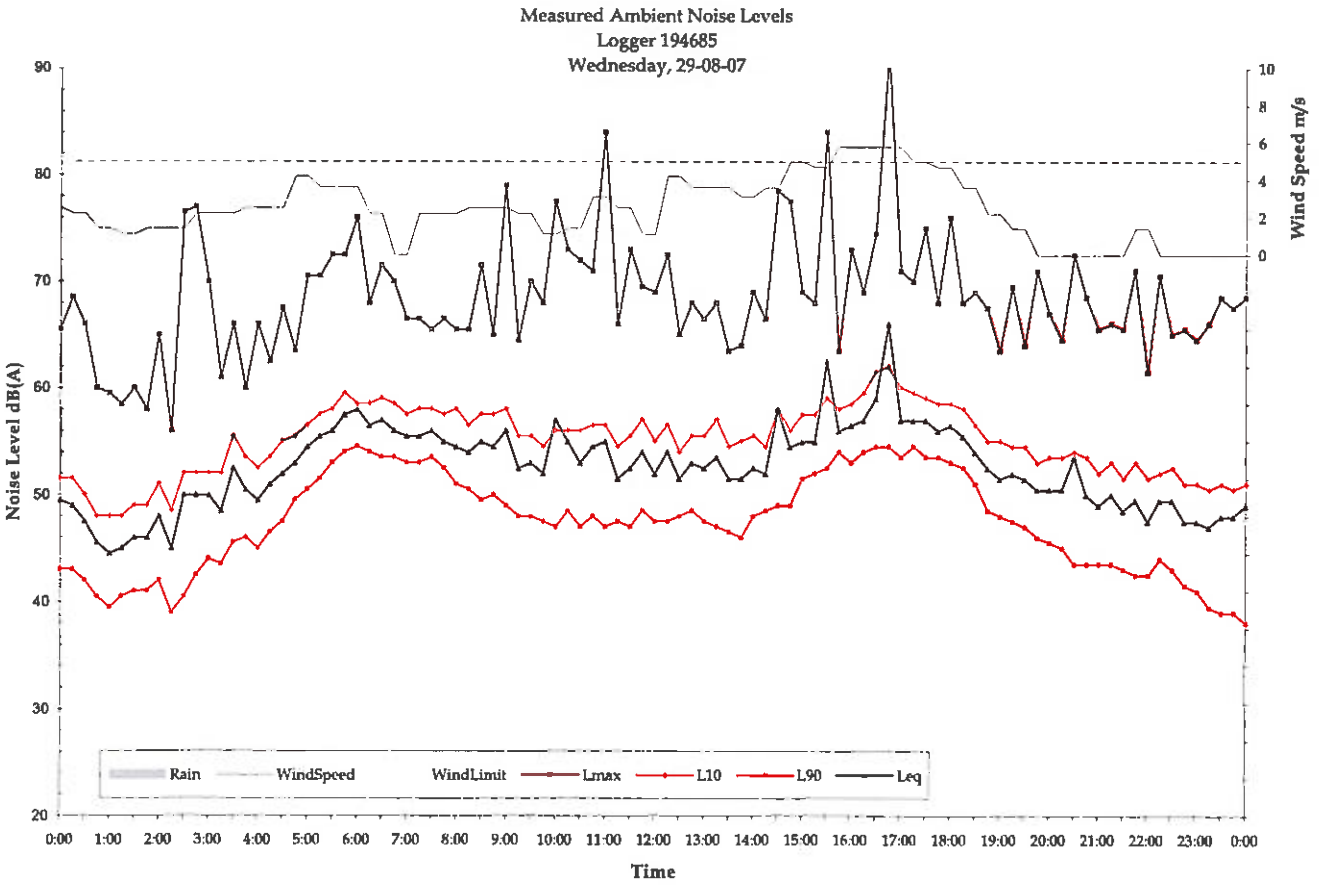

Measured Ambient Noise Levels
Logger 194685
Saturday, 25-08-07
Noise Level dB(A)
Wind Speed m/s
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq
Time

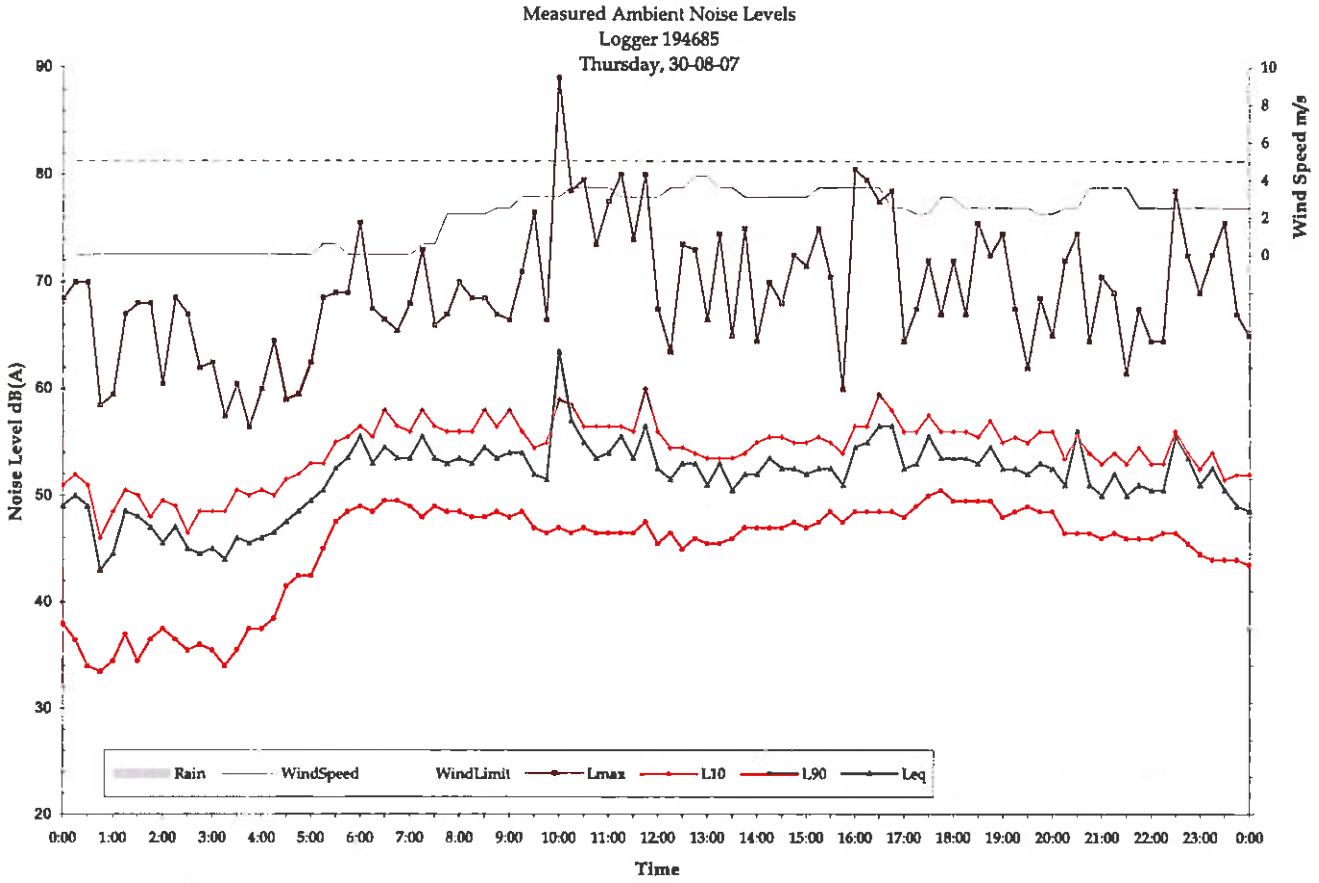
Noise Monitoring Data – 166 McFarlane Drive, Minchinbury, NSW

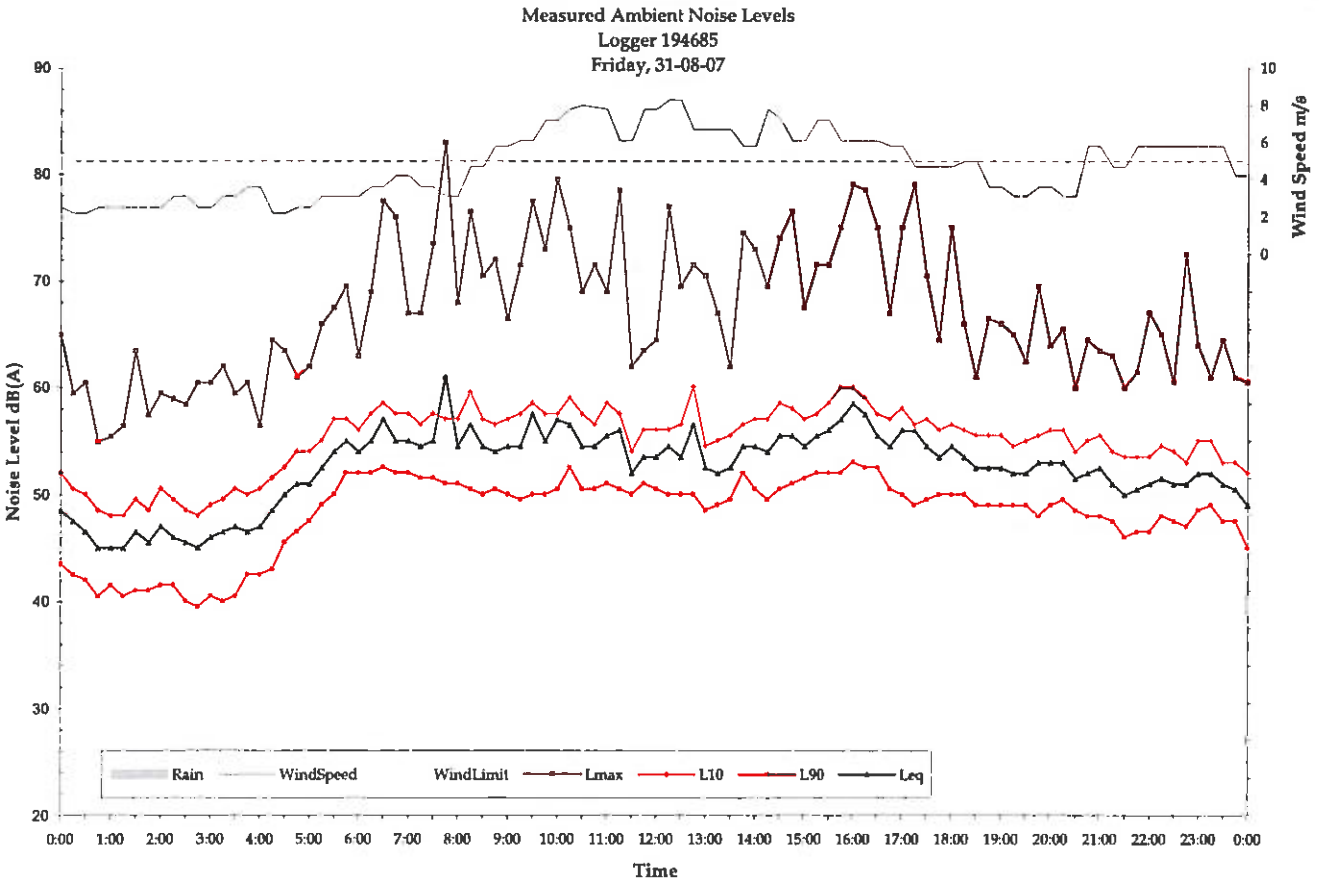




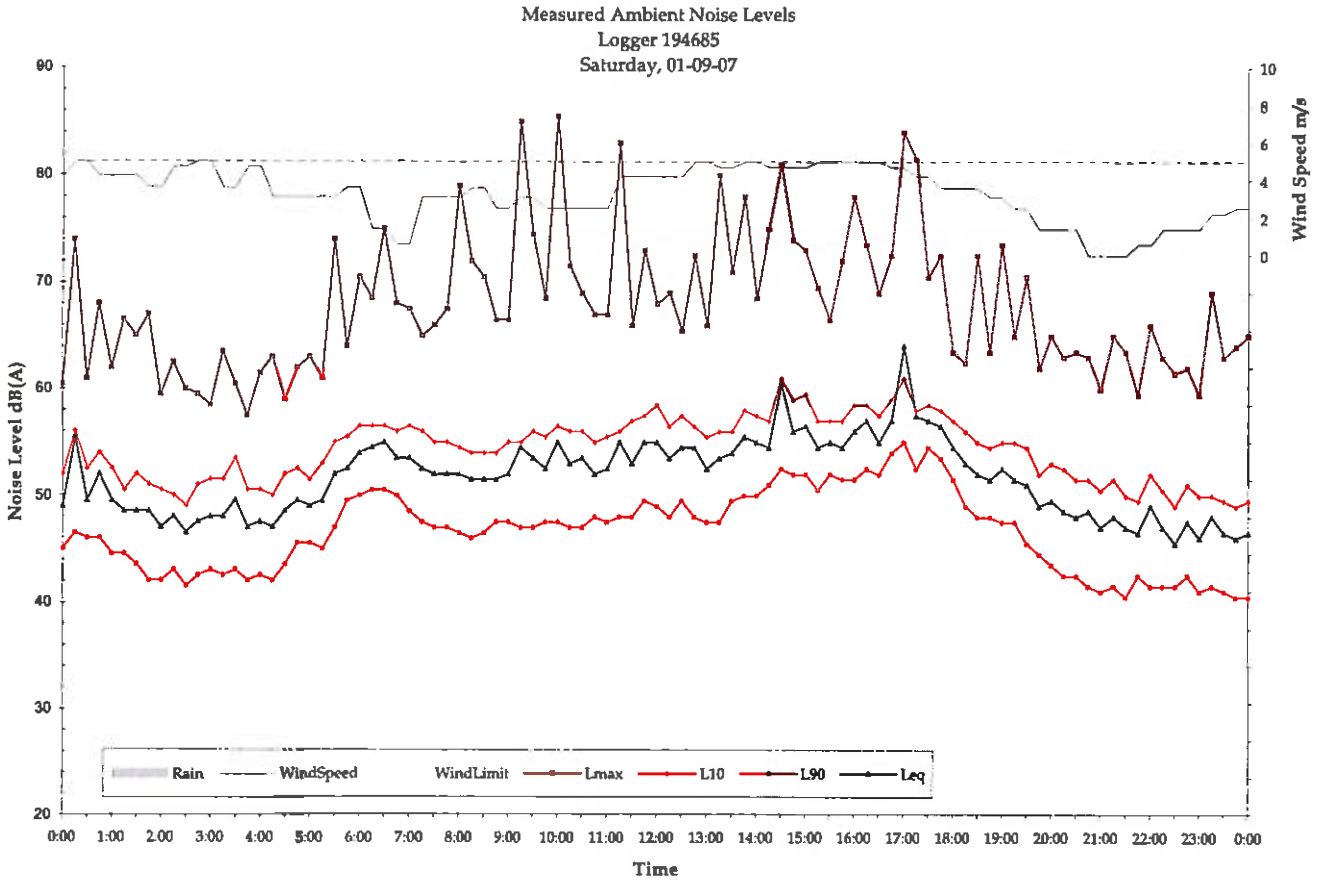

Measured Ambient Noise Levels
Logger 194685
Tuesday, 28-08-07
Noise Level dB(A)
Wind Speed m/s
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq
Time

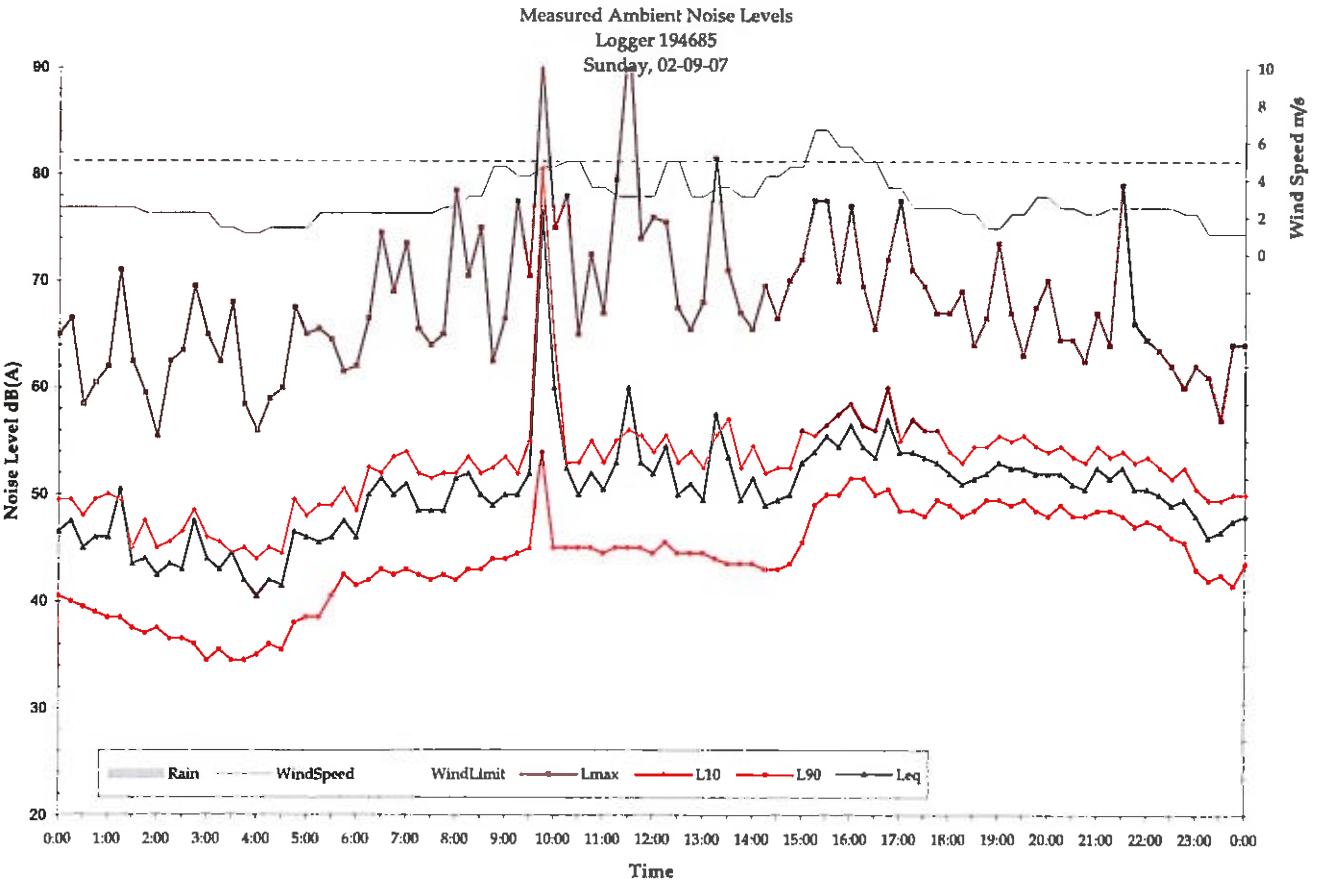

Measured Ambient Noise Levels
Logger 194685
Wednesday, 29-08-07
Noise Level dB(A)
Wind Speed m/s
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq
Time


Measured Ambient Noise Levels
Logger 194685
Thursday, 30-08-07
Noise Level dB(A)
Wind Speed m/s
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq
Time

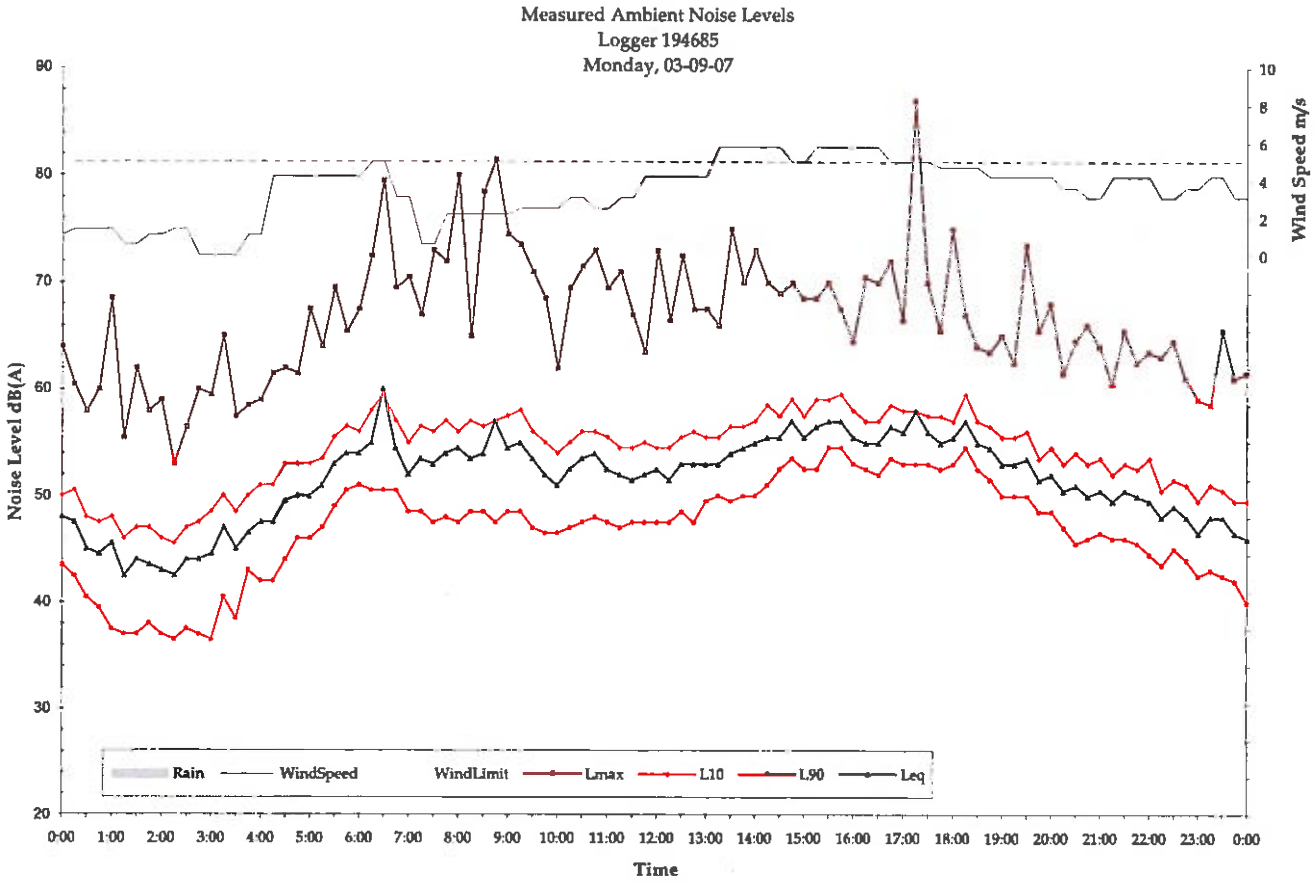

Measured Ambient Noise Levels
Logger 194685
Friday, 31-08-07
Noise Level dB(A)
Wind Speed m/s
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq
Time

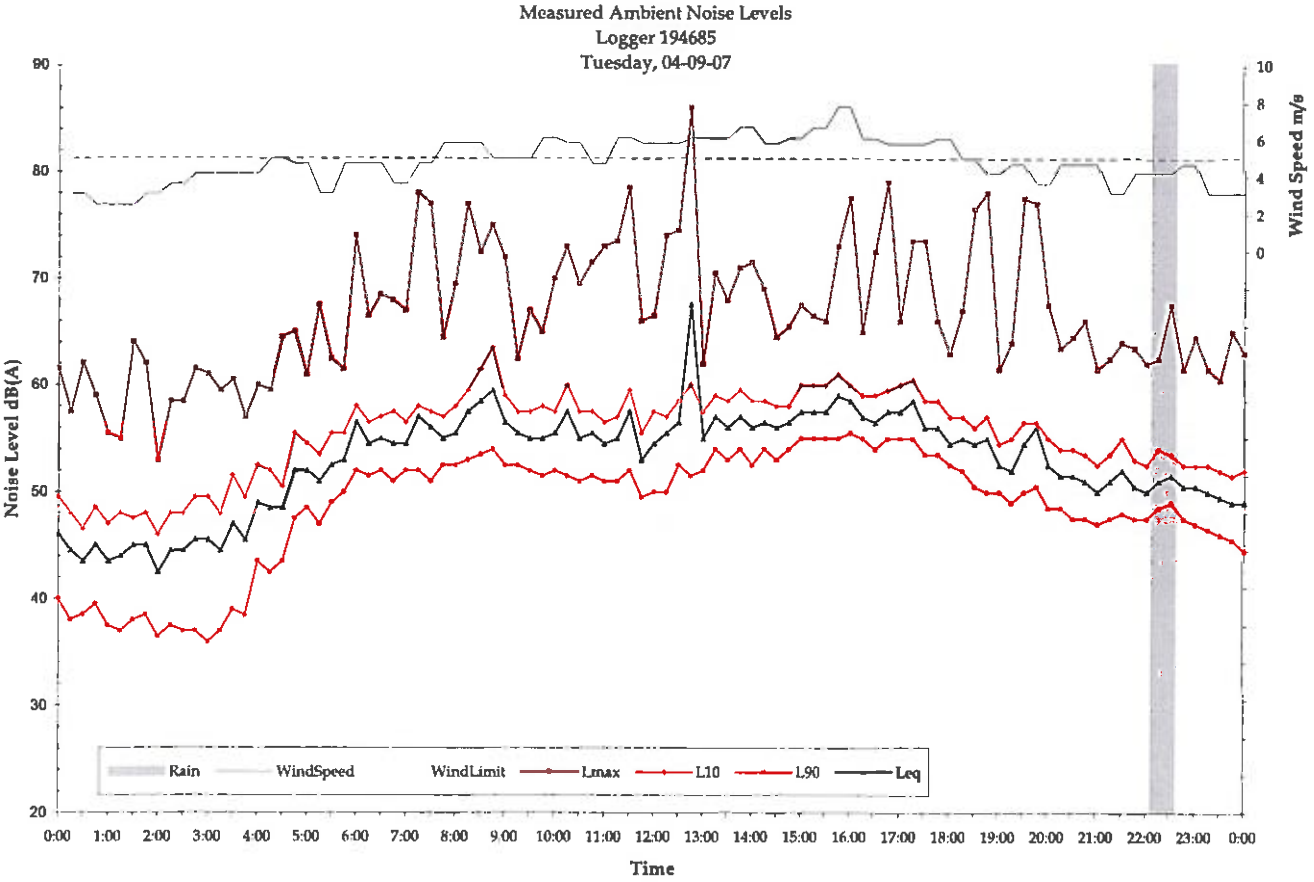
Noise Monitoring Data – 166 McFarlane Drive, Minchinbury, NSW

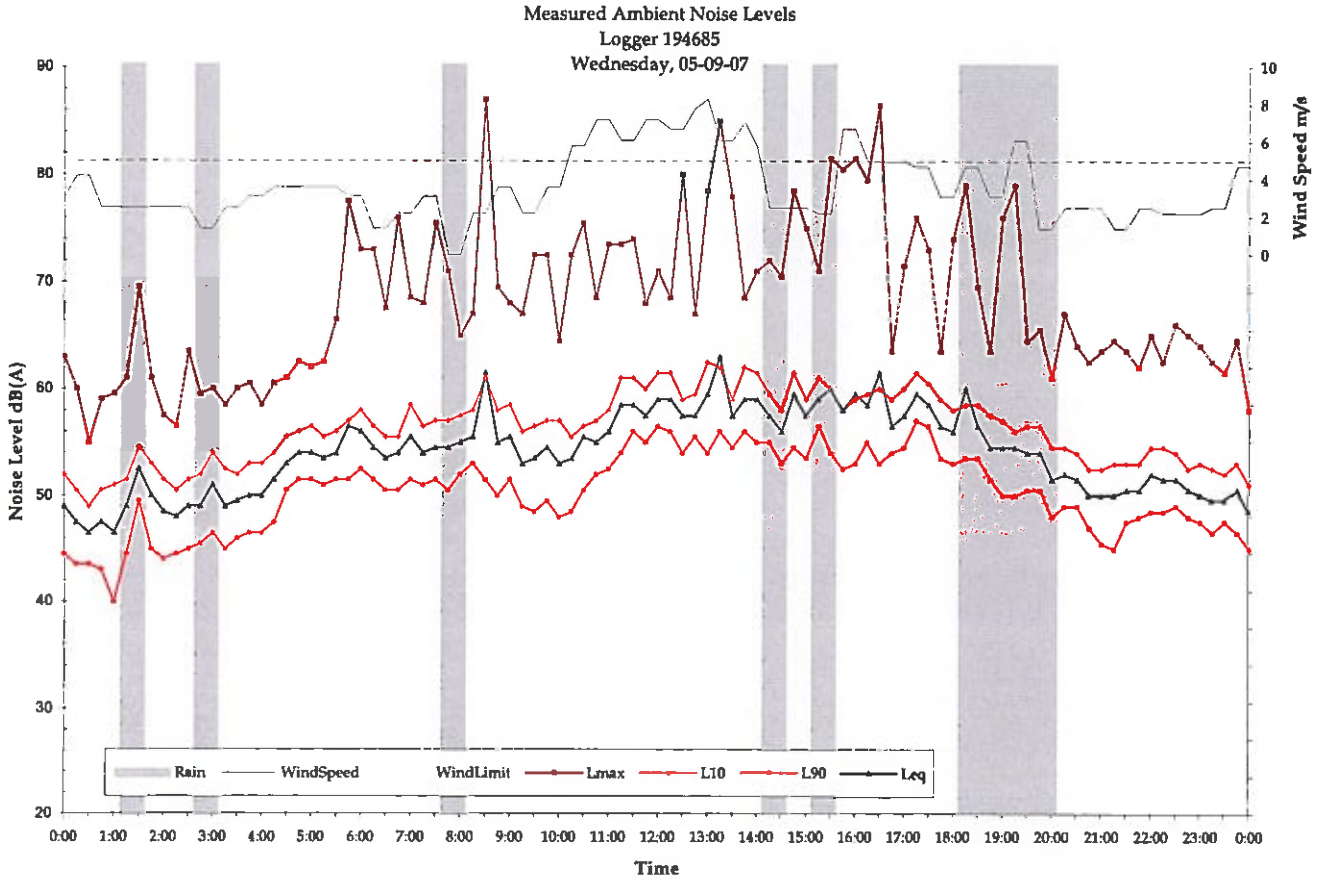


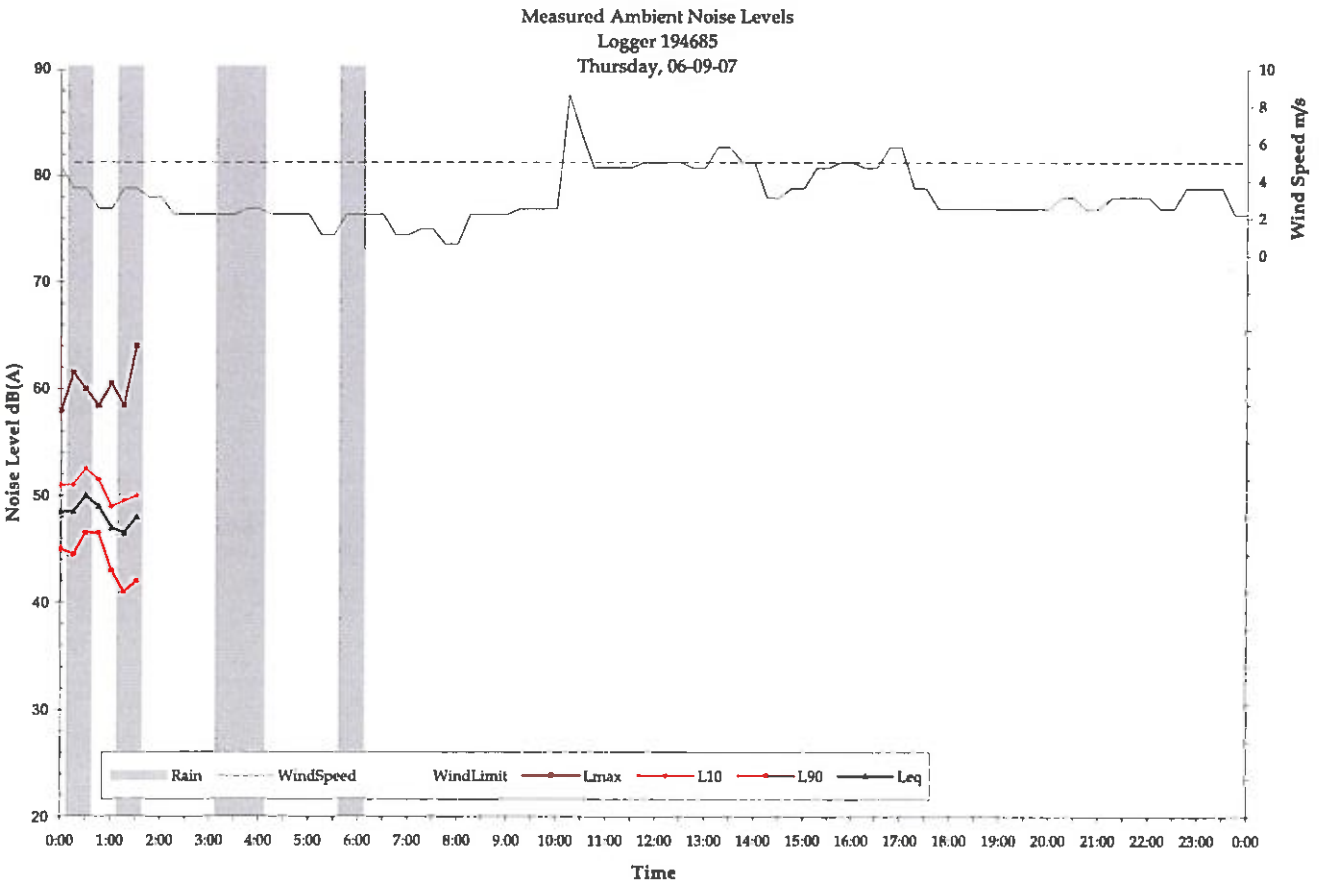


Noise Monitoring Data – 166 McFarlane Drive, Minchinbury, NSW

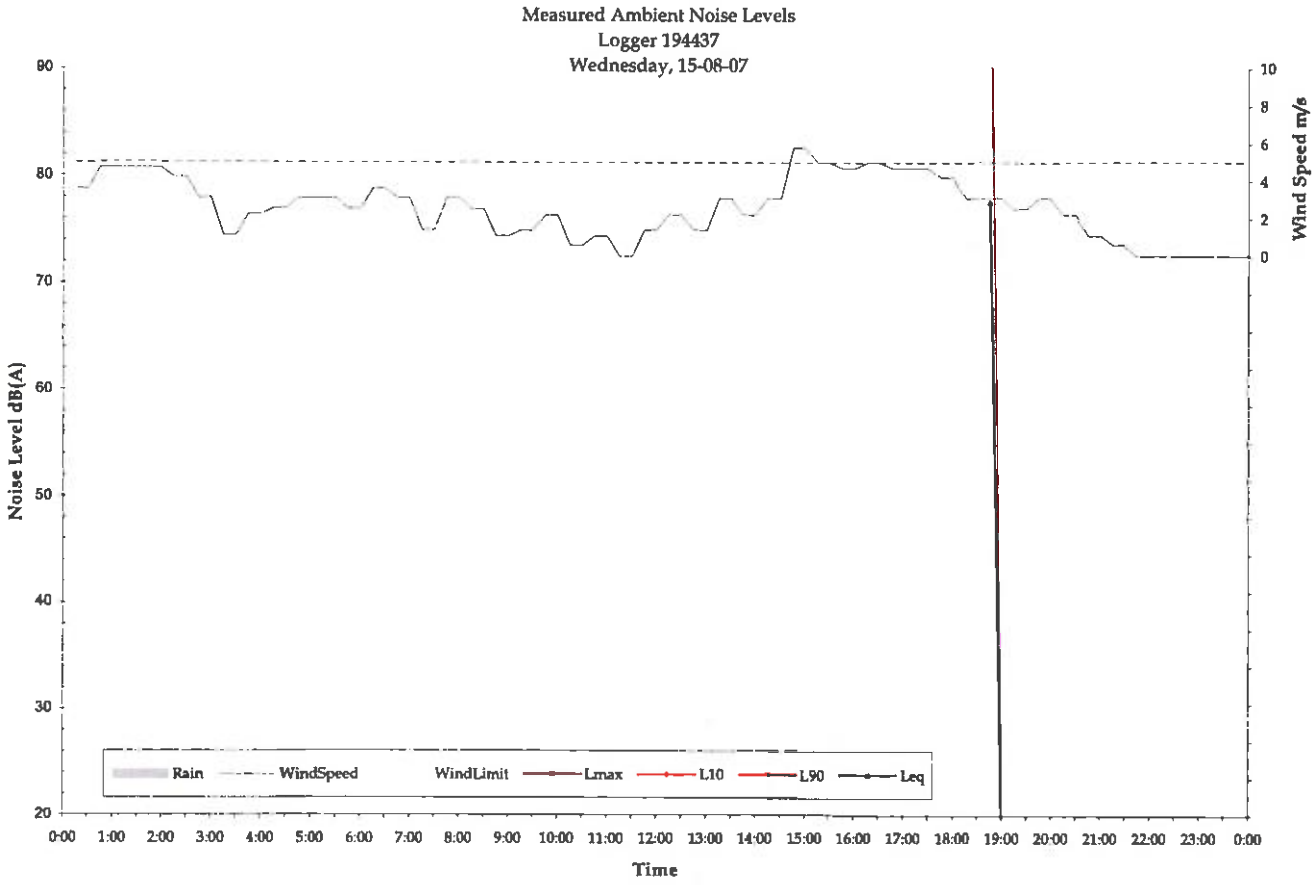


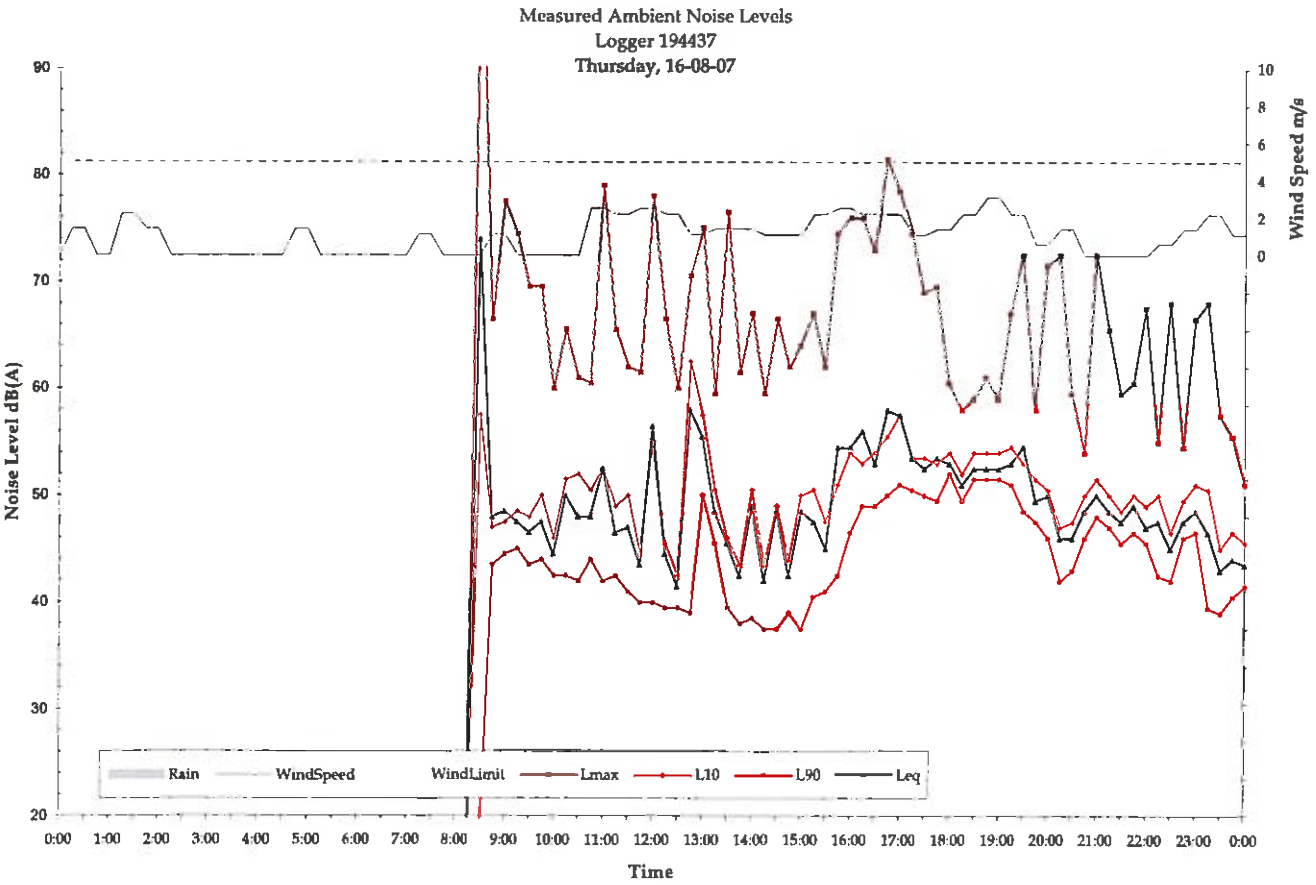



Measured Ambient Noise Levels
Logger 194685
Wednesday, 05-09-07
Noise Level dB(A)
Wind Speed m/s
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq
Time

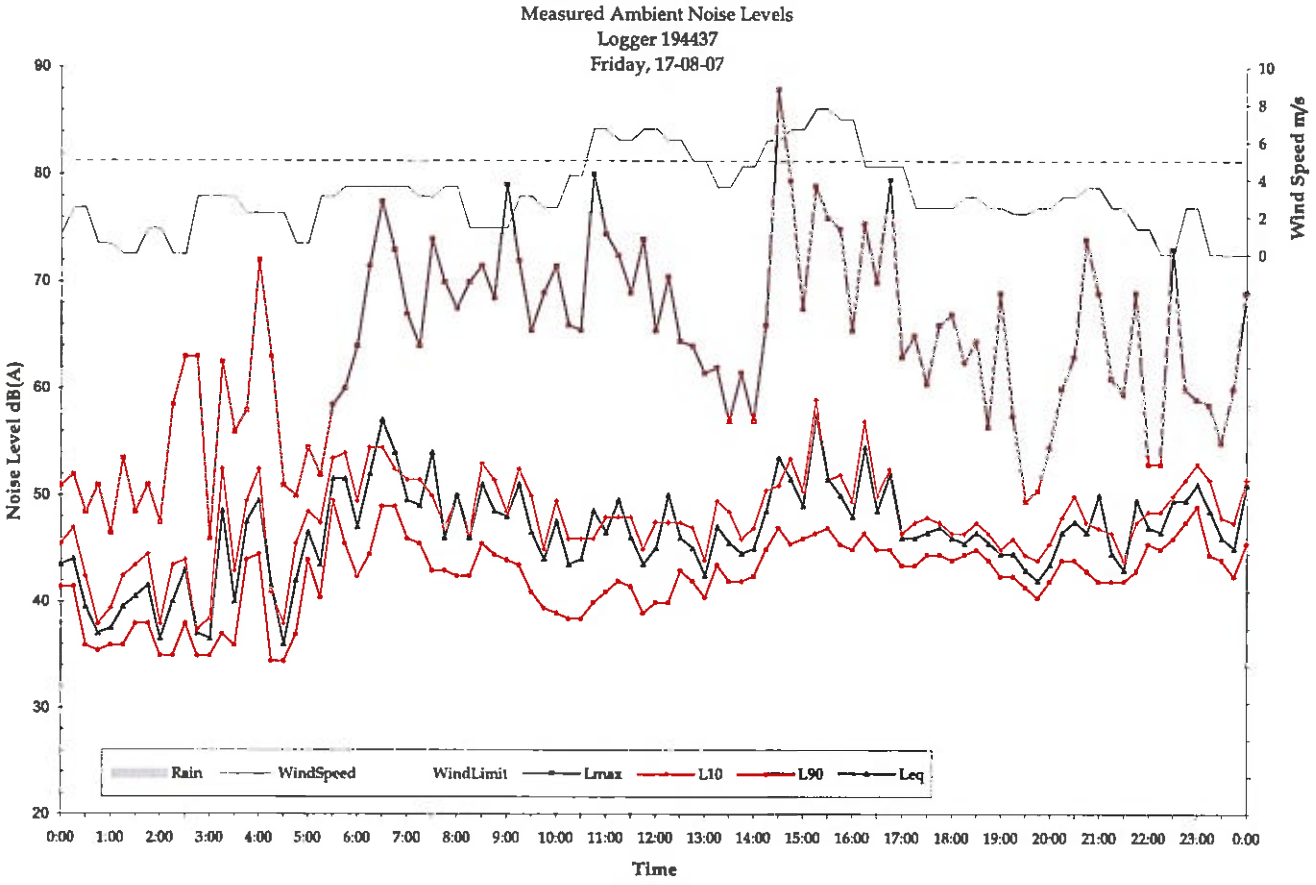

Measured Ambient Noise Levels
Logger 194685
Thursday, 06-09-07
Noise Level dB(A)
Wind Speed m/s
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq
Time

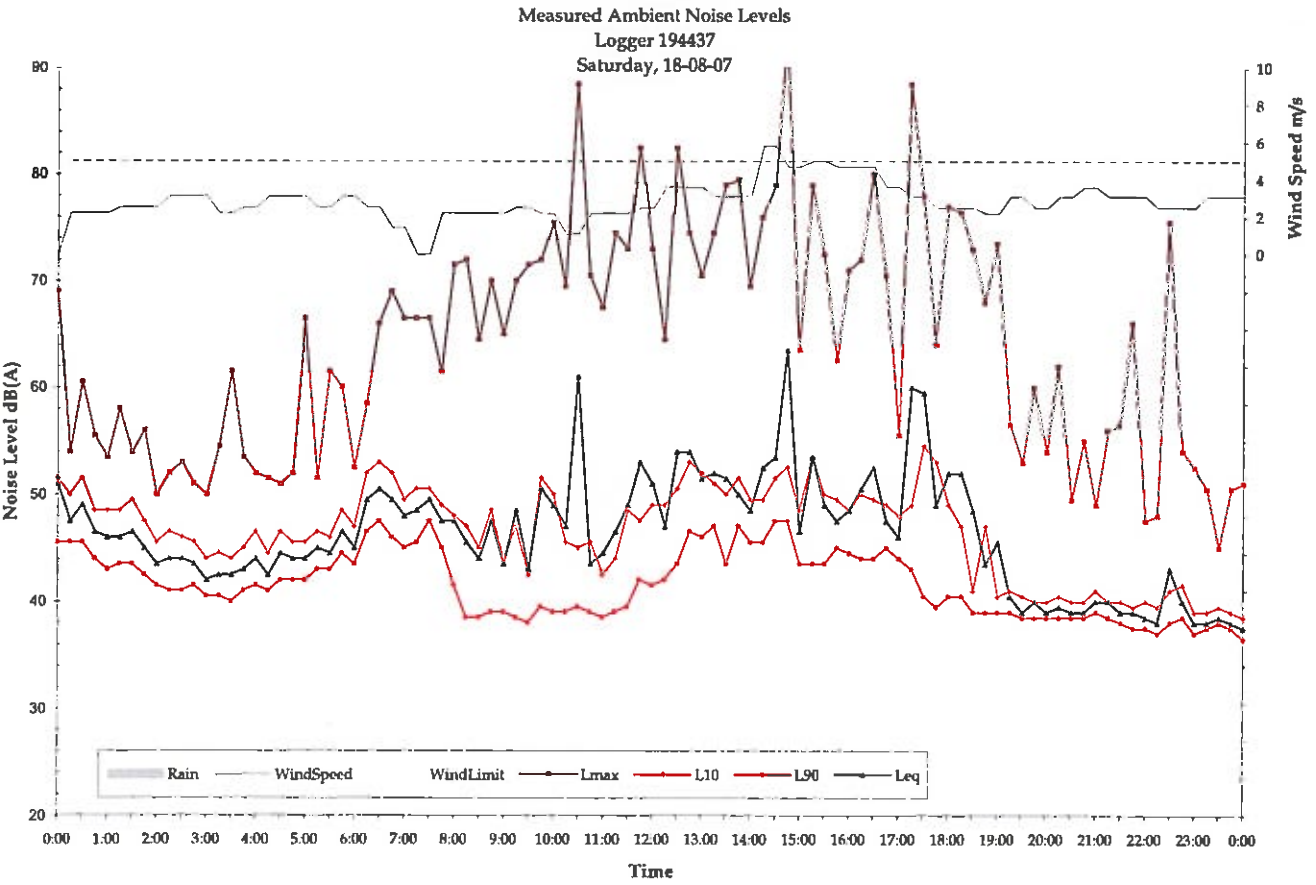
Noise Monitoring Data – 12 Swamphen Street, Erskine Park, NSW



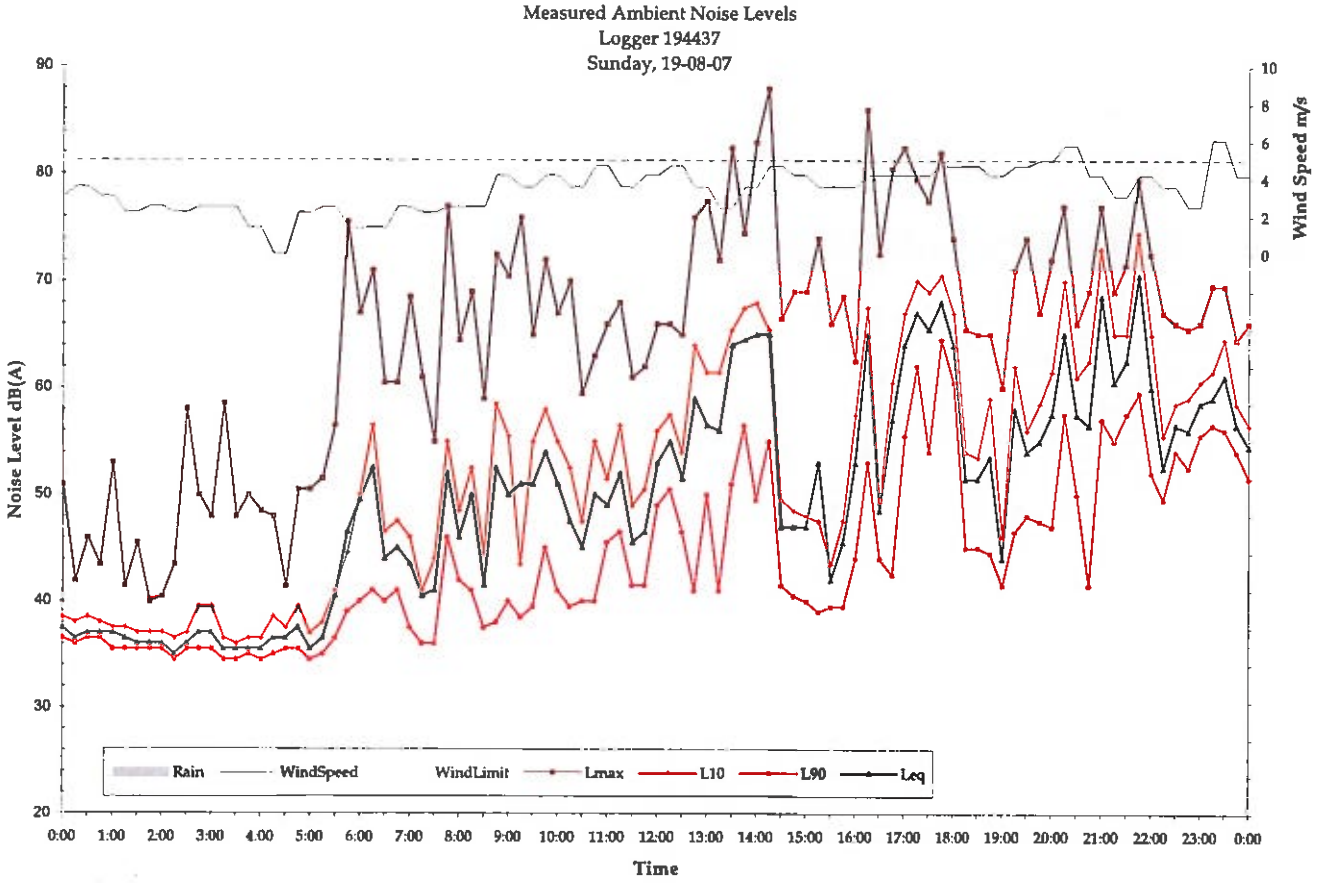


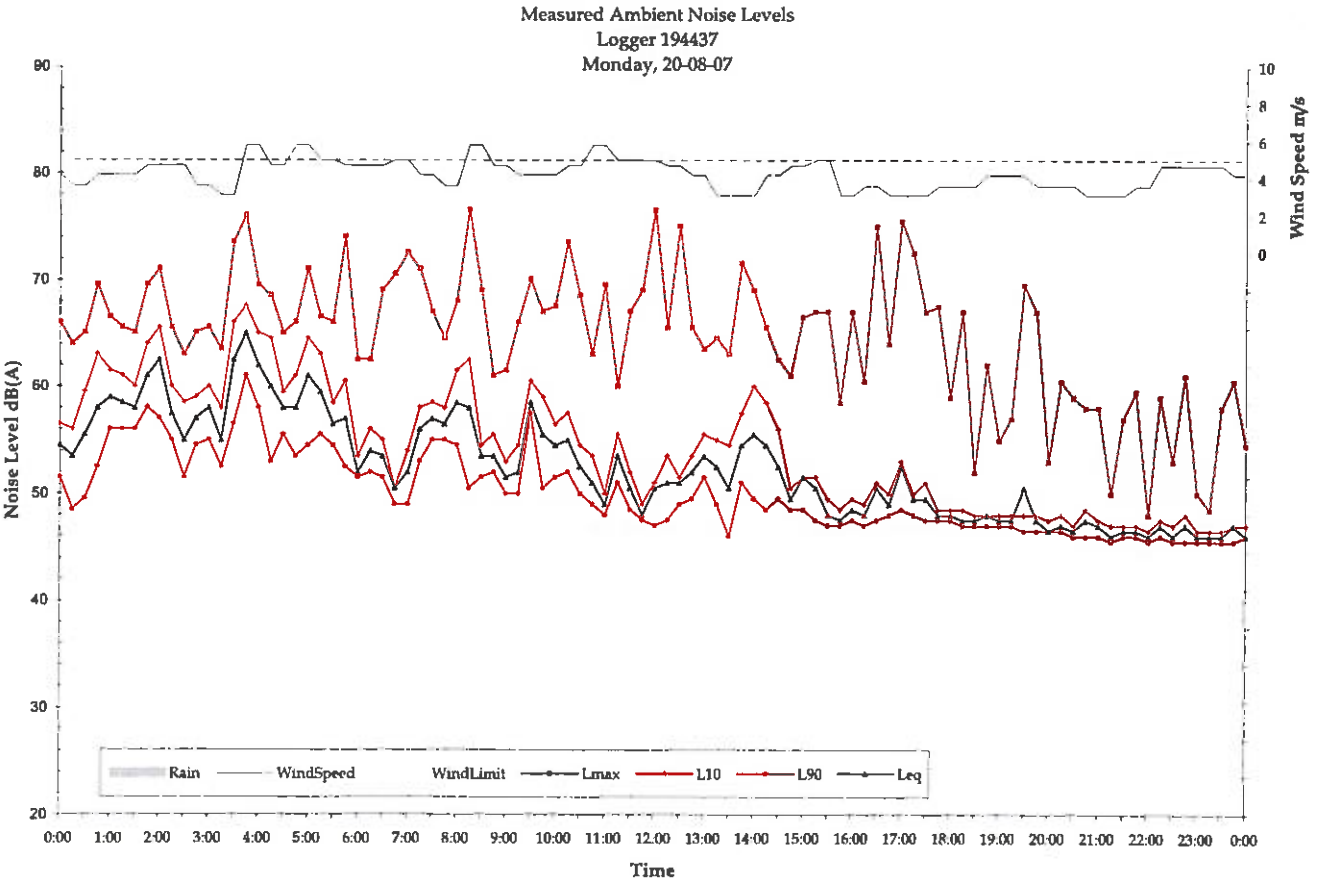
Noise Monitoring Data – 12 Swamphen Street, Erskine Park, NSW



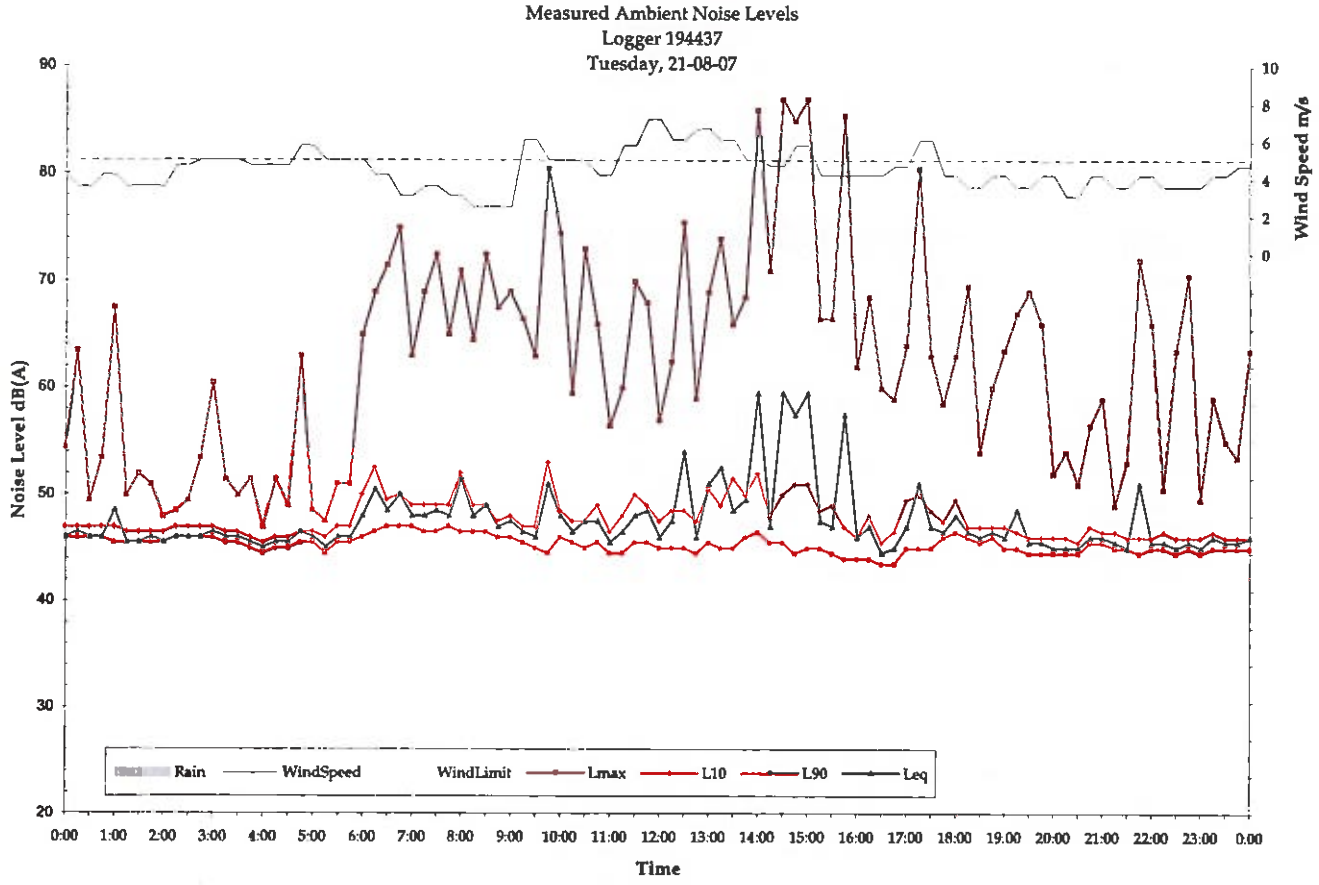


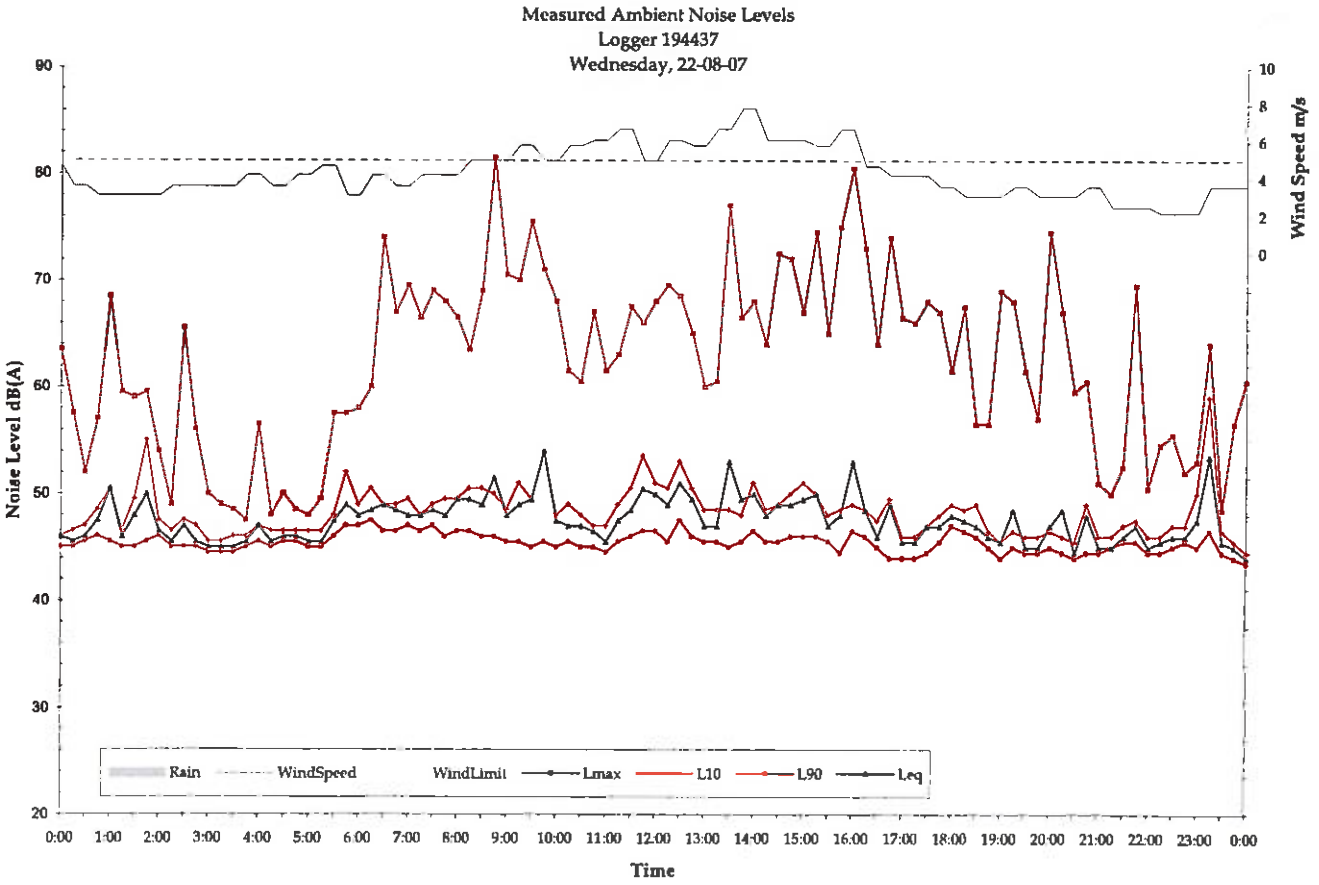
Noise Monitoring Data – 12 Swamphen Street, Erskine Park, NSW

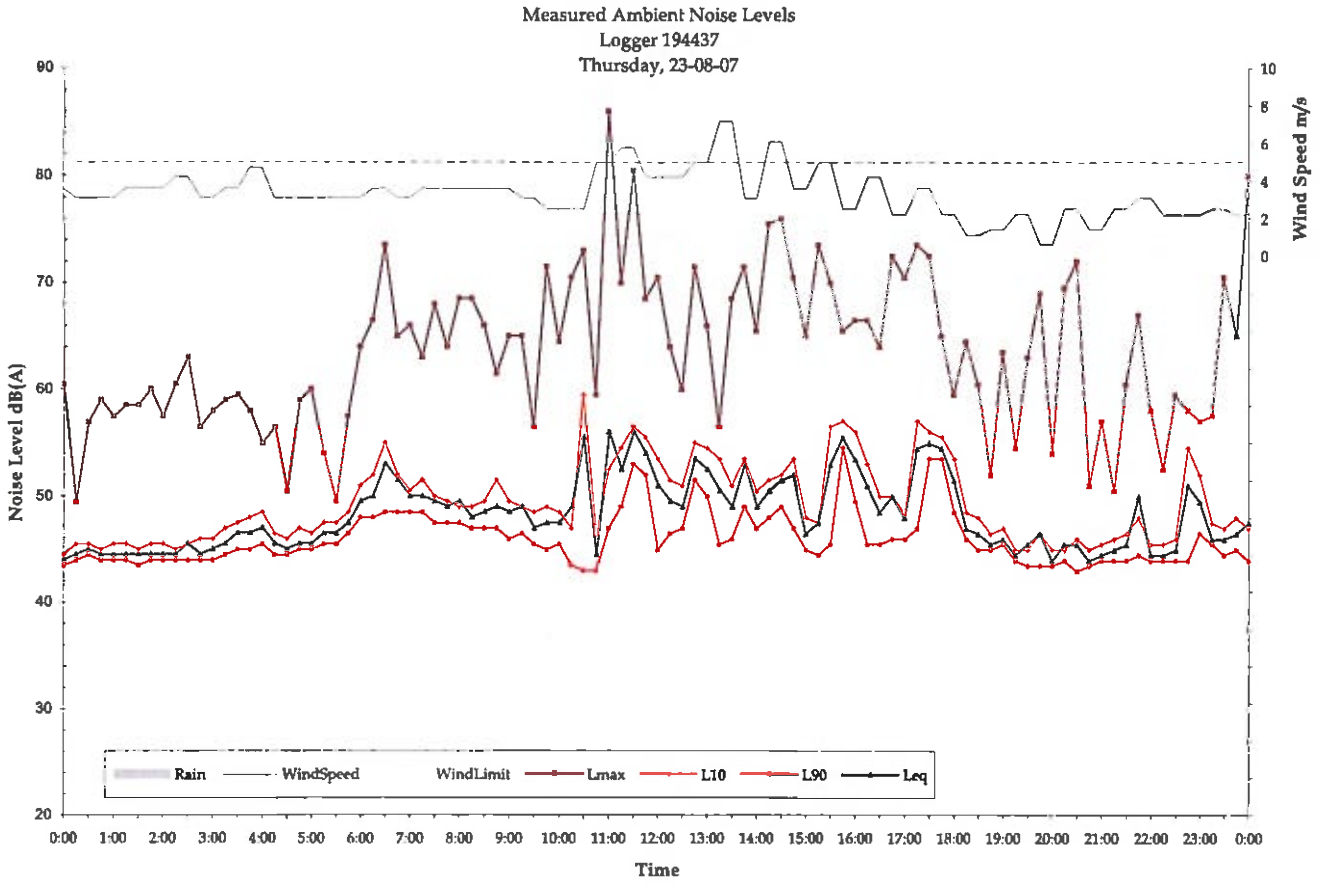


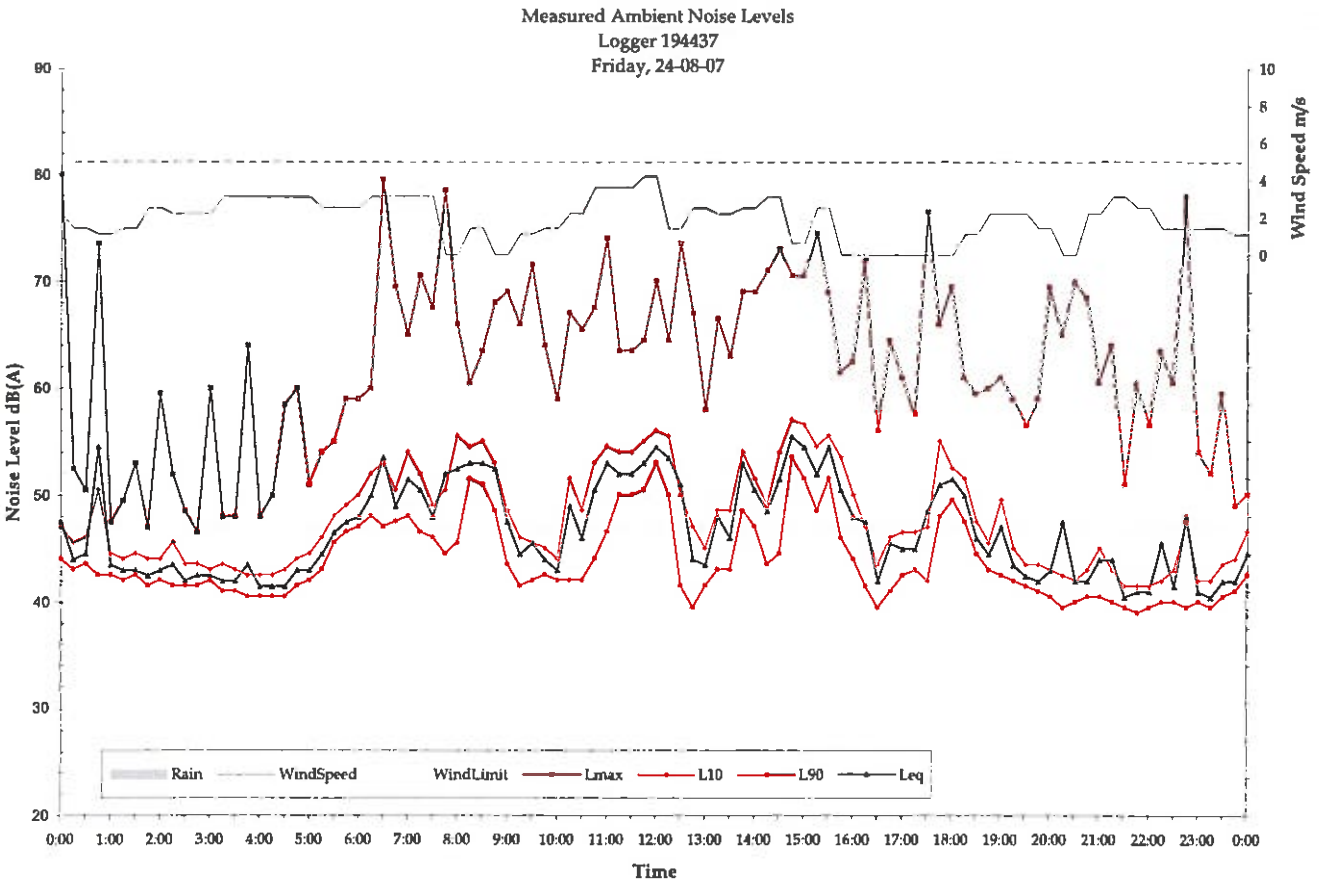


Noise Monitoring Data – 12 Swamphen Street, Erskine Park, NSW

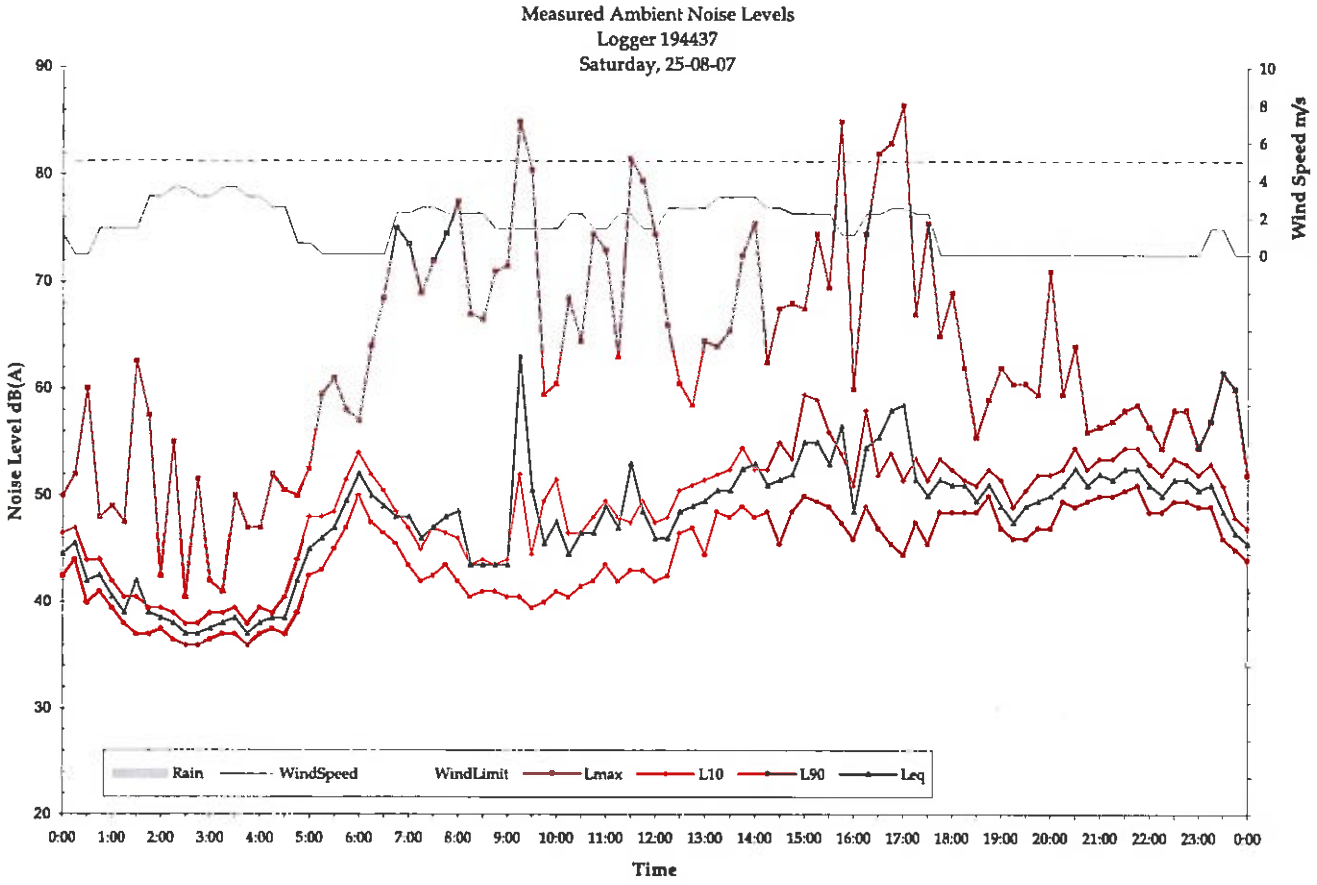


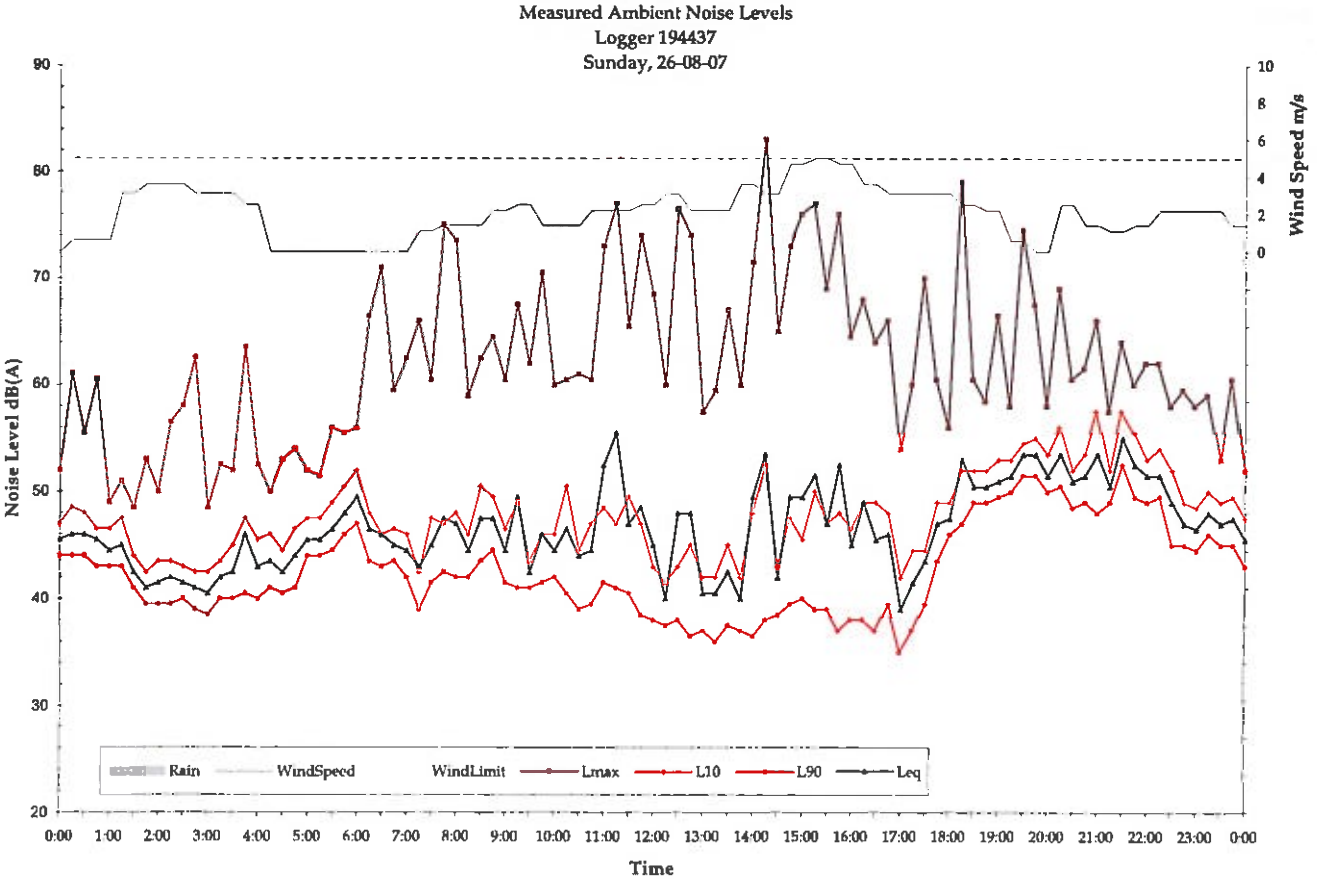



Measured Ambient Noise Levels
Logger 194437
Thursday, 23-08-07
Noise Level dB(A)
Wind Speed m/s
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq
Time

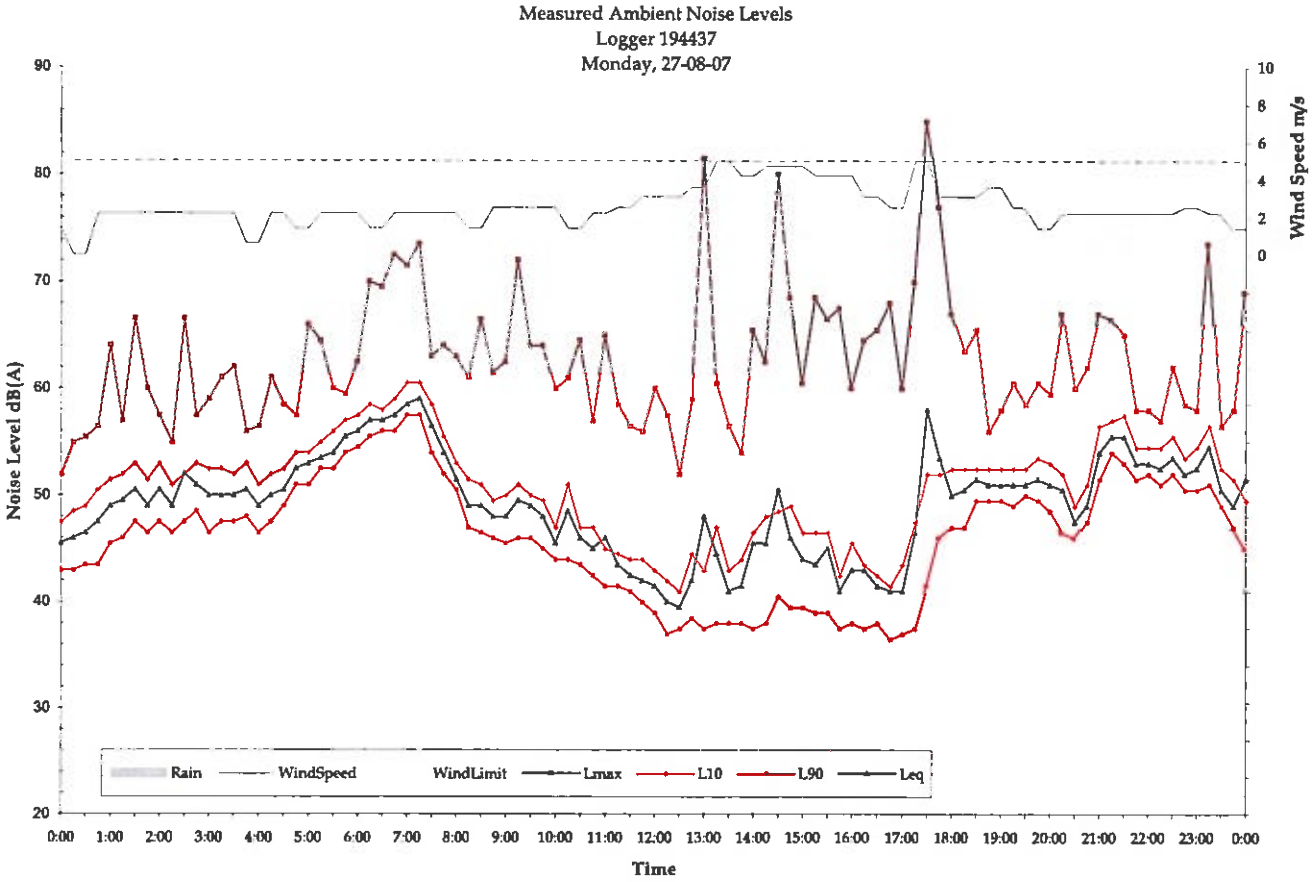

Measured Ambient Noise Levels
Logger 194437
Friday, 24-08-07
Noise Level dB(A)
Wind Speed m/s
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq
Time

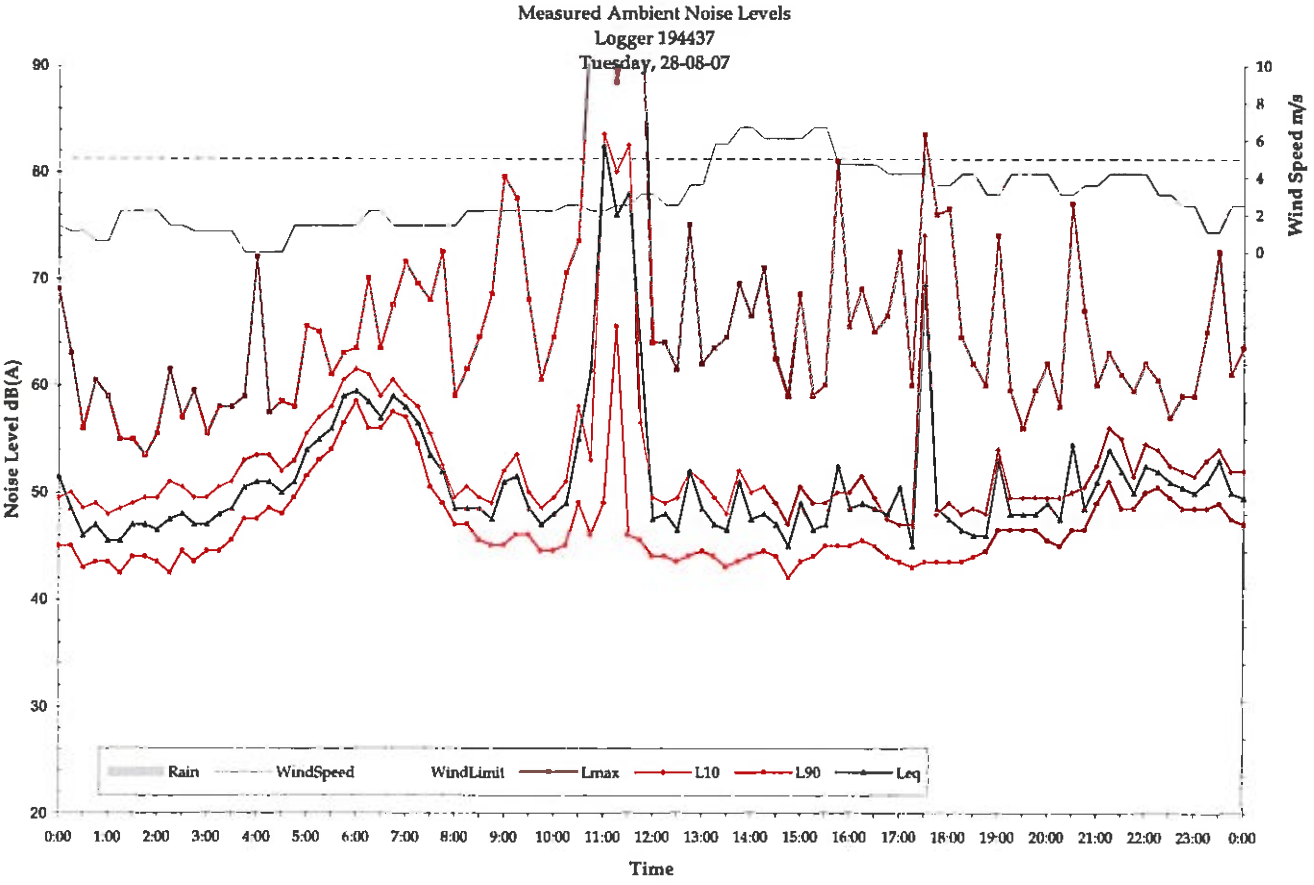
Noise Monitoring Data – 12 Swamphen Street, Erskine Park, NSW



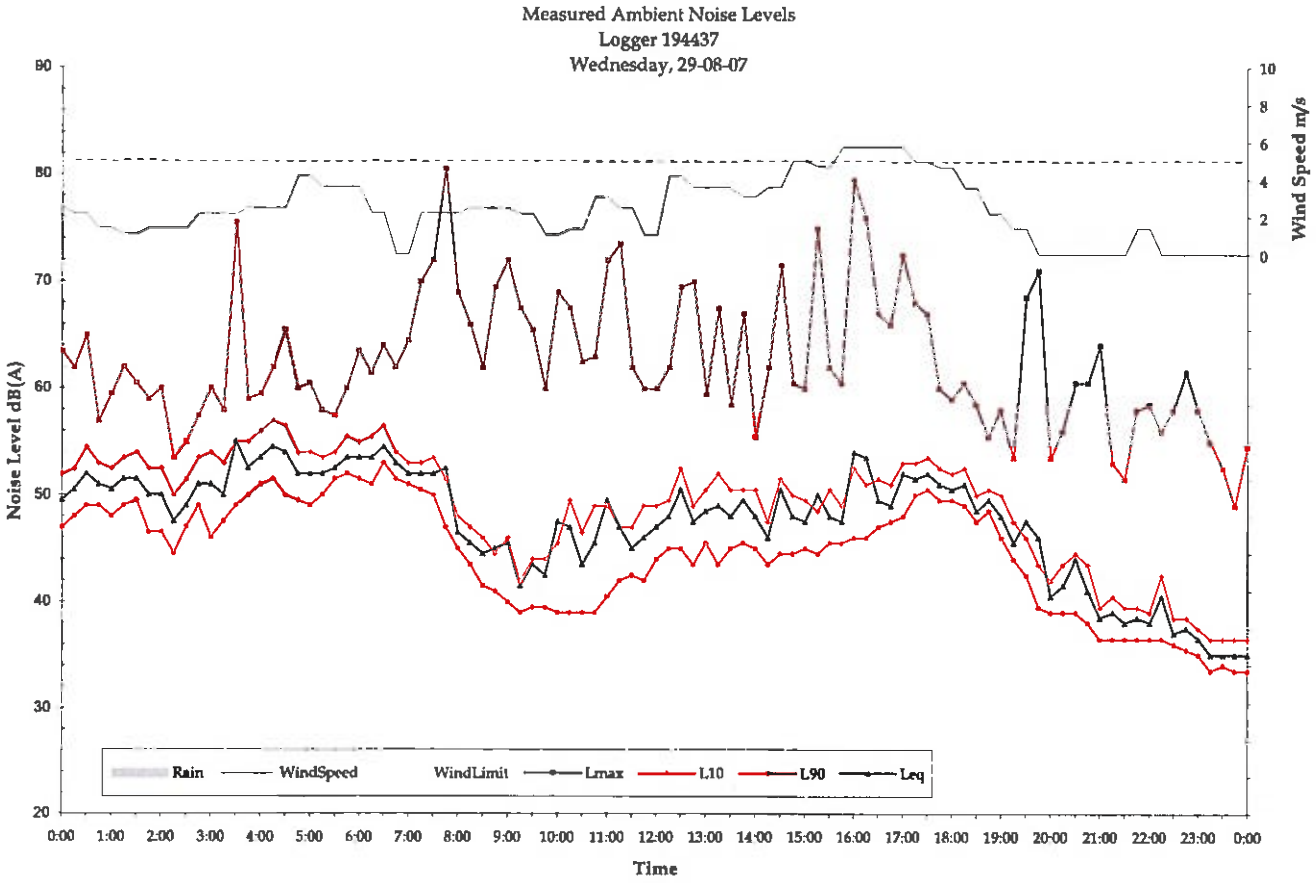


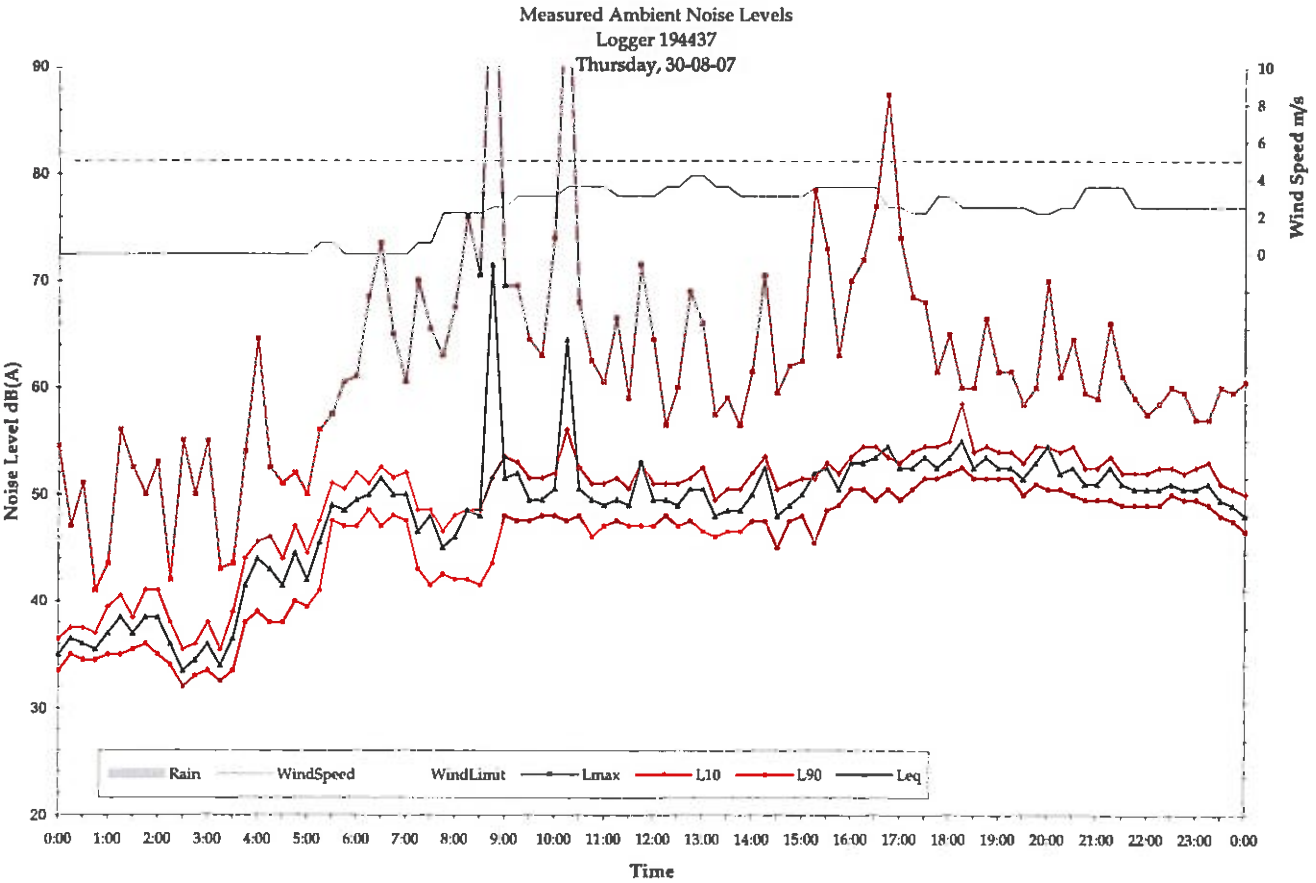
Noise Monitoring Data – 12 Swamphen Street, Erskine Park, NSW



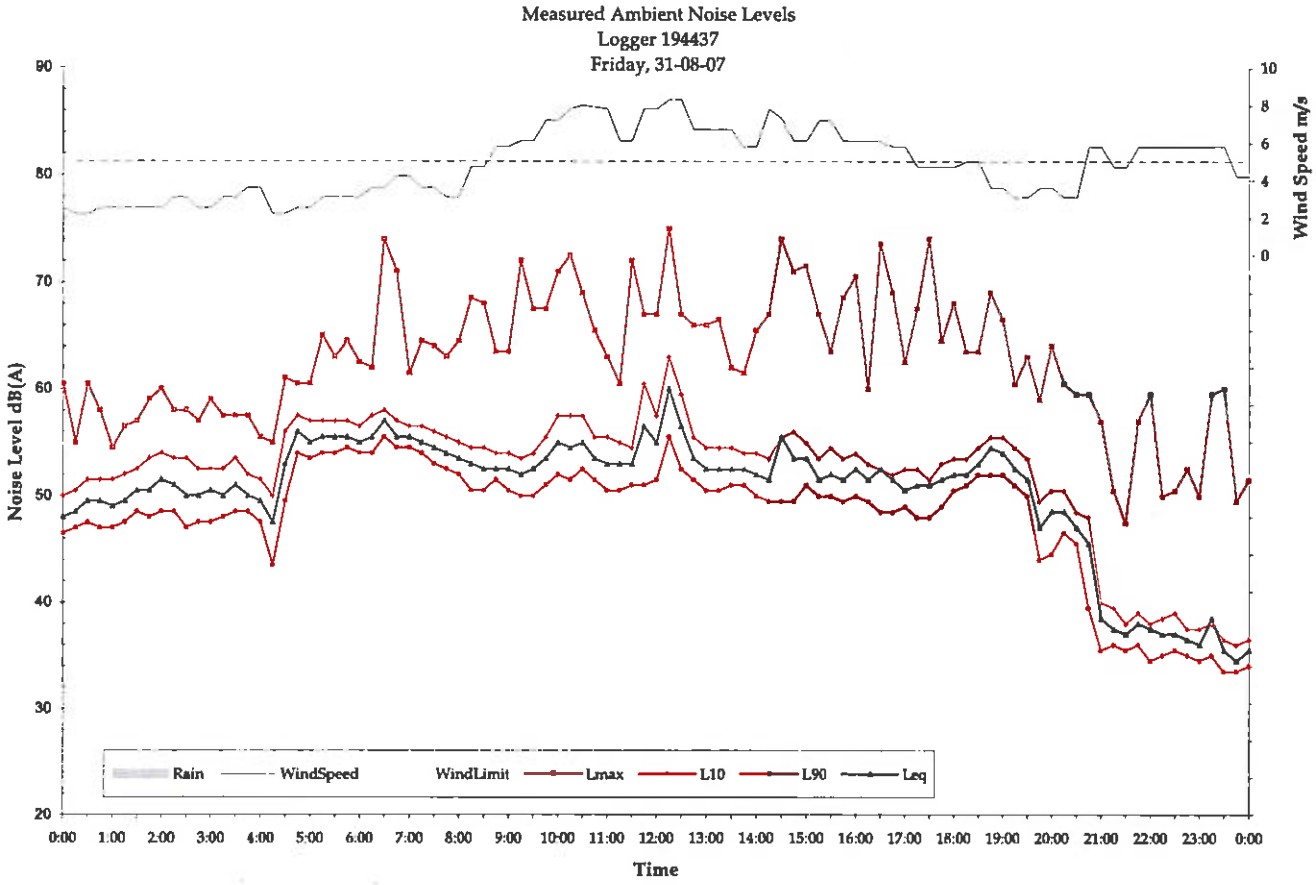


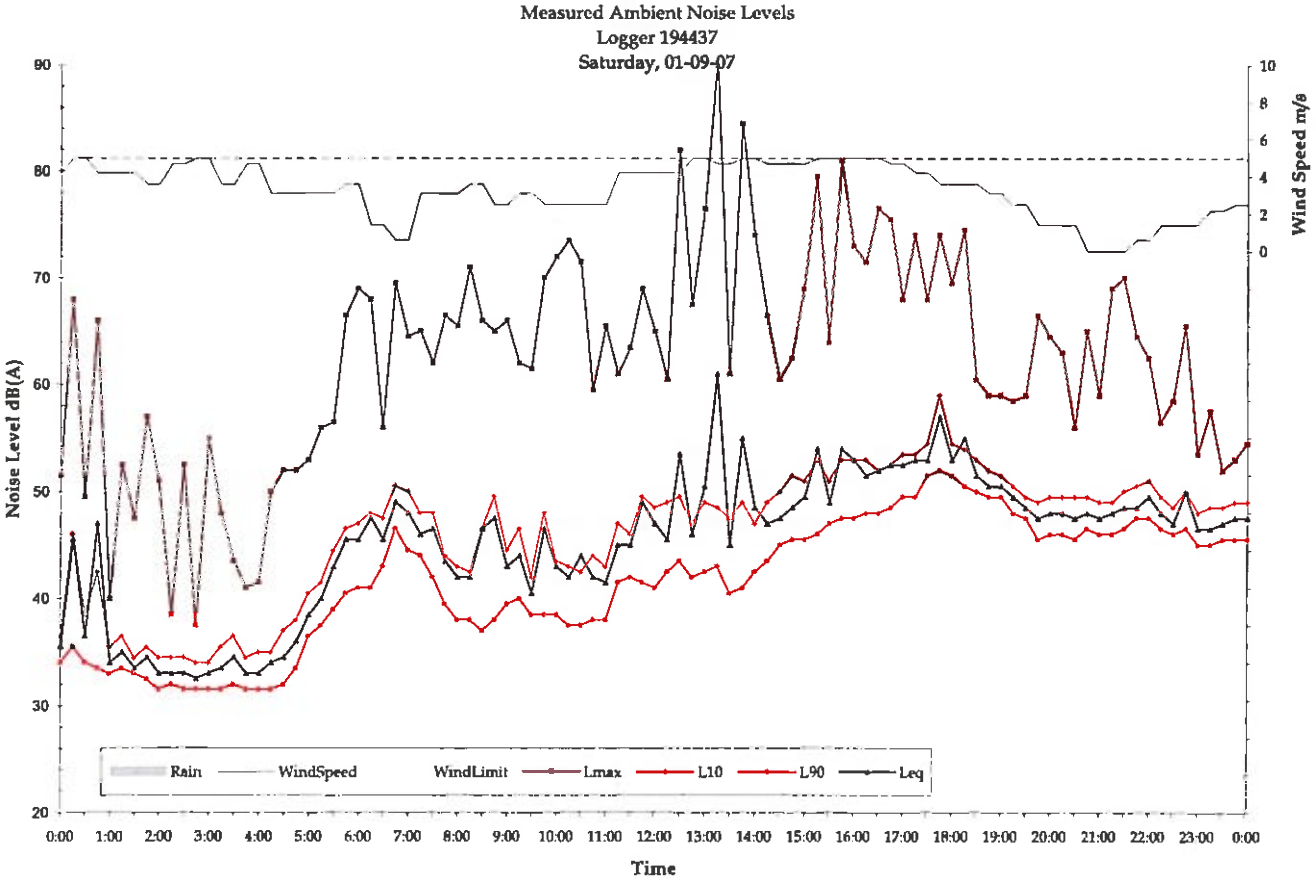
Noise Monitoring Data – 12 Swamphen Street, Erskine Park, NSW

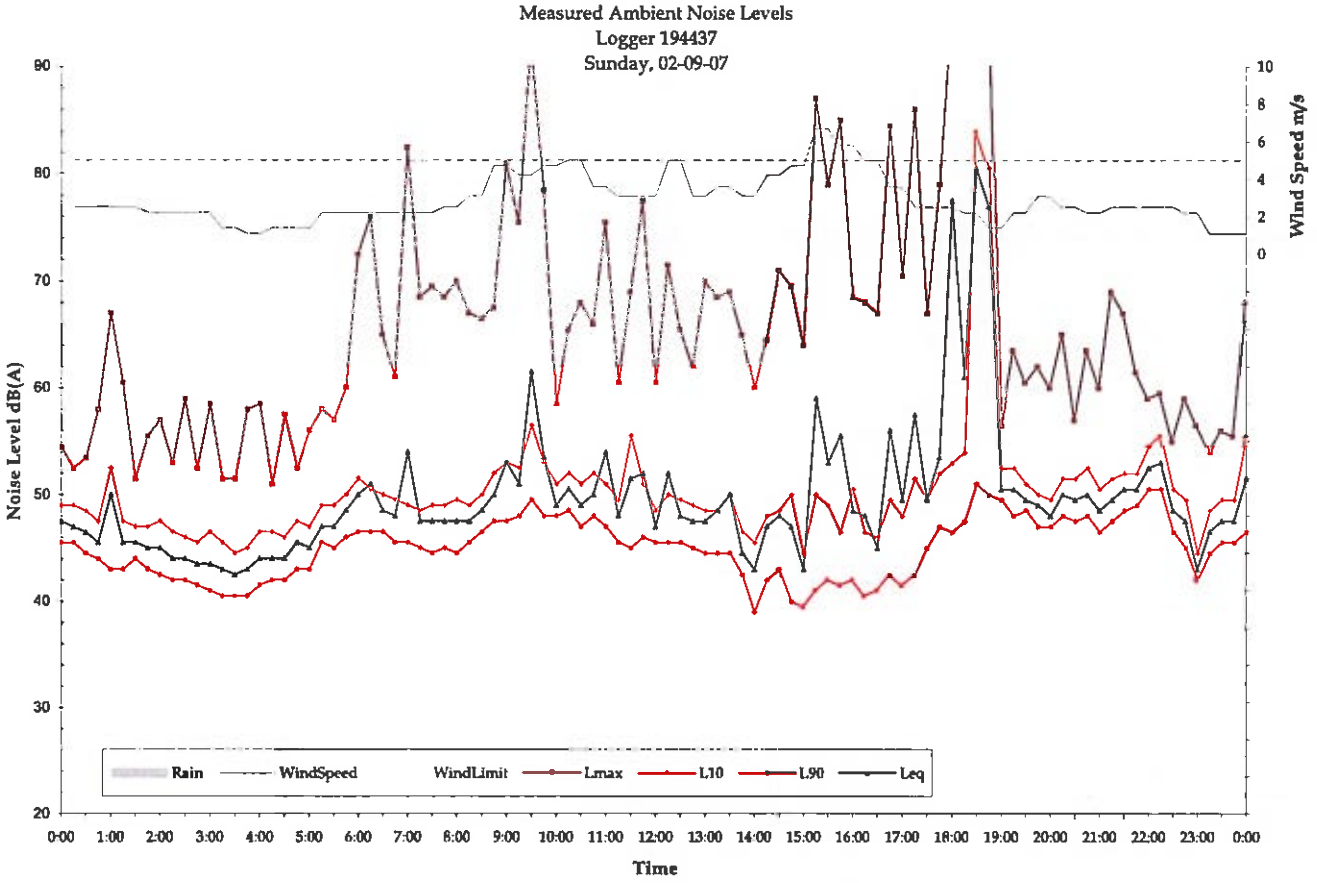


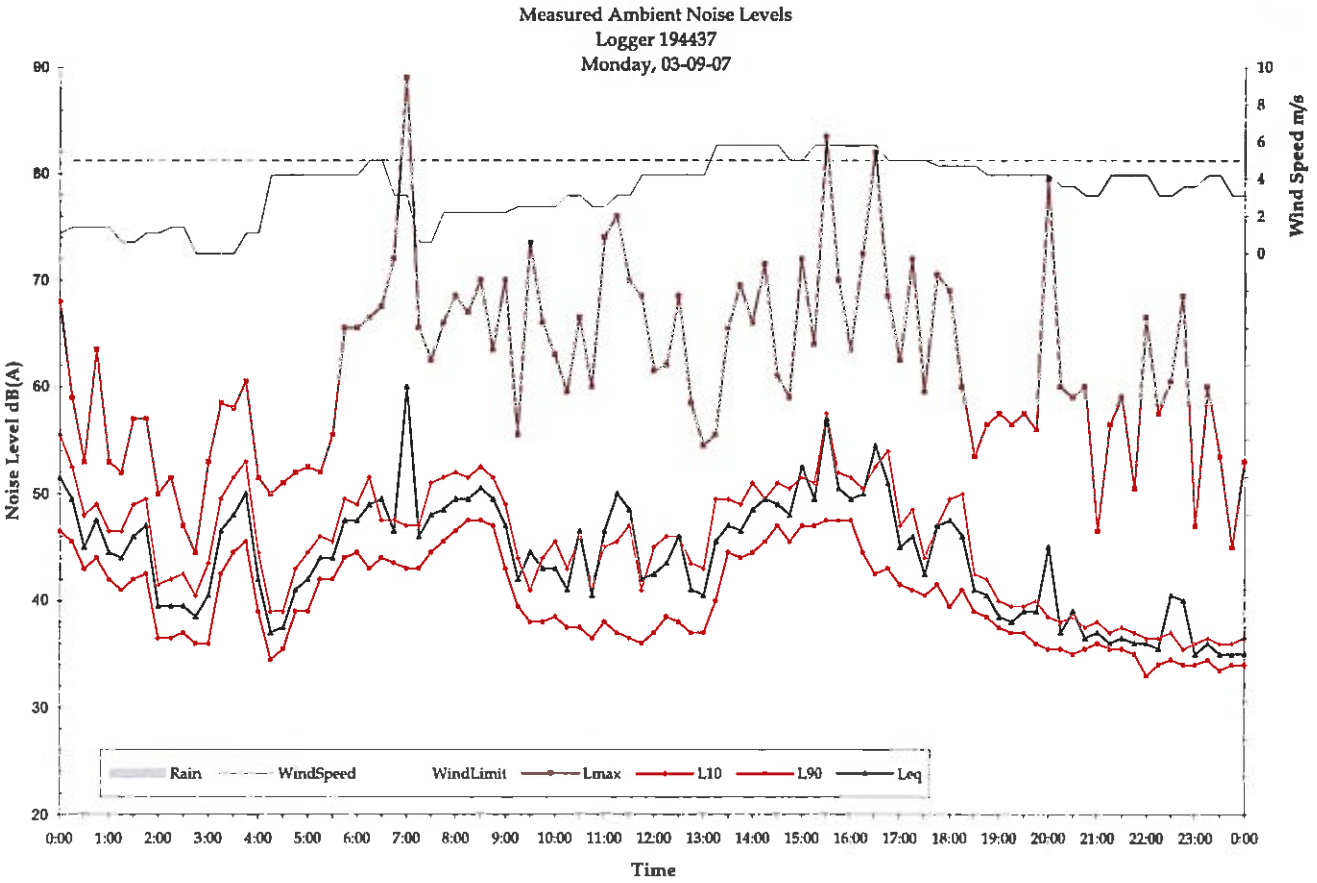


Noise Monitoring Data – 12 Swamphen Street, Erskine Park, NSW

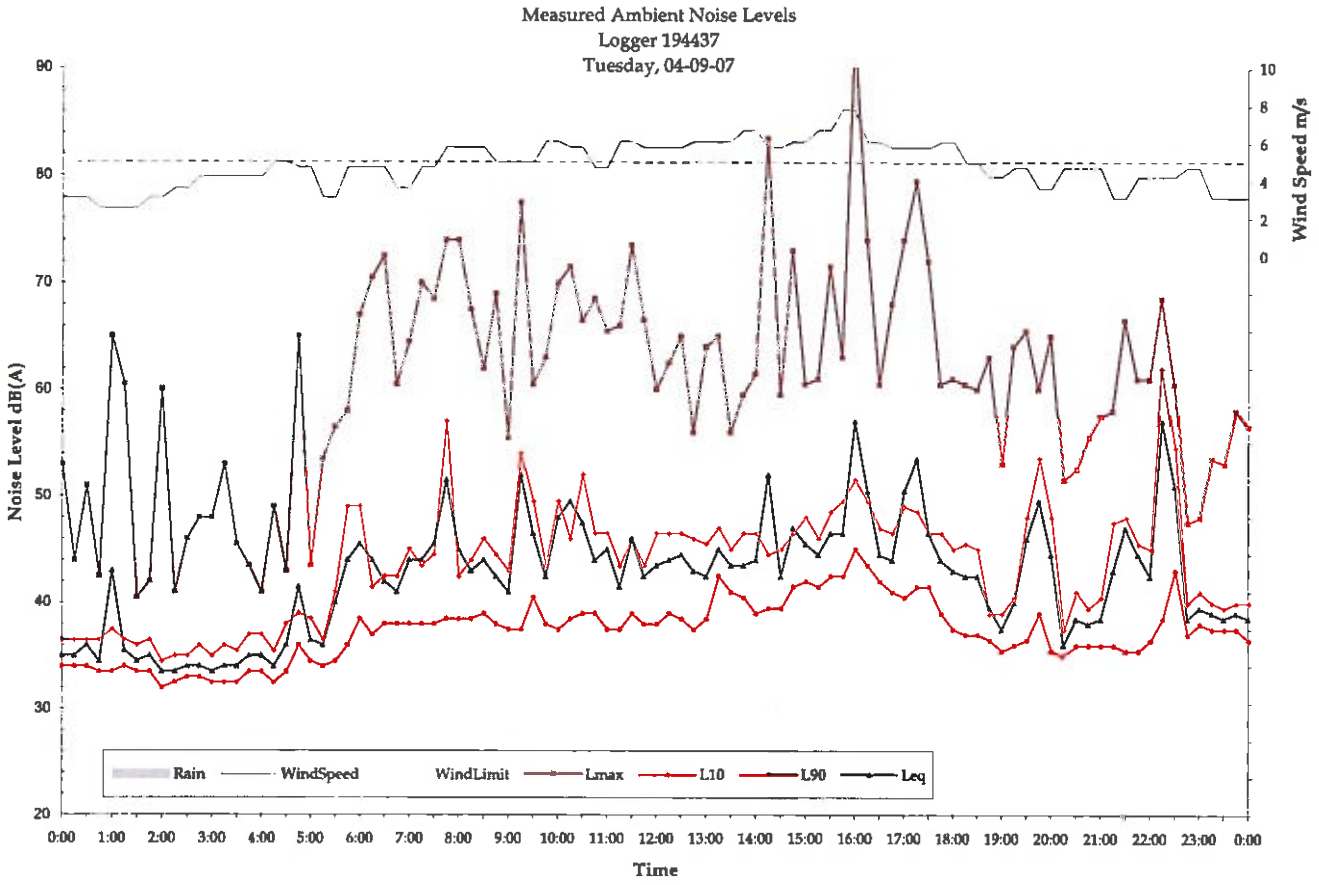


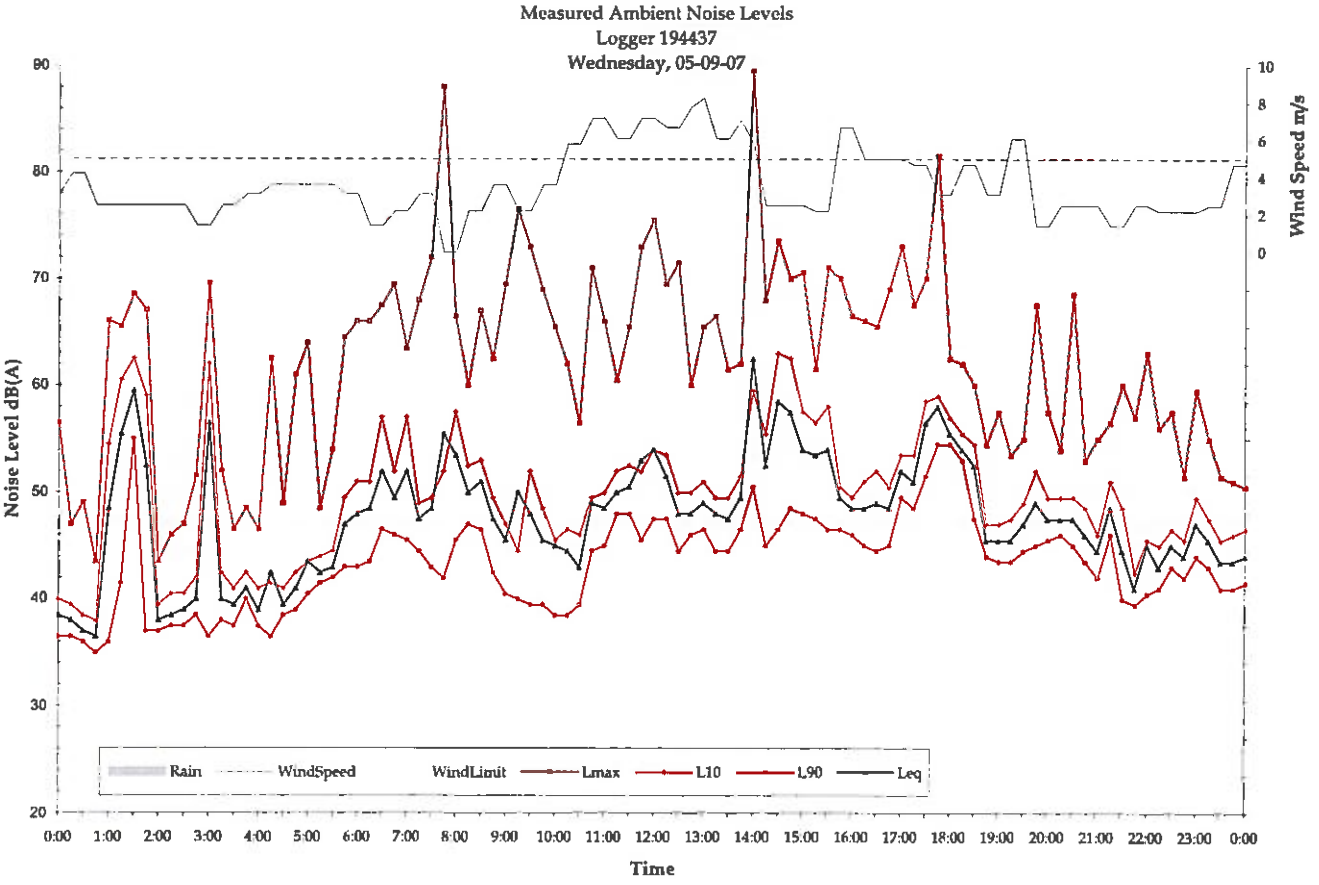



Measured Ambient Noise Levels
Logger 194437
Sunday, 02-09-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

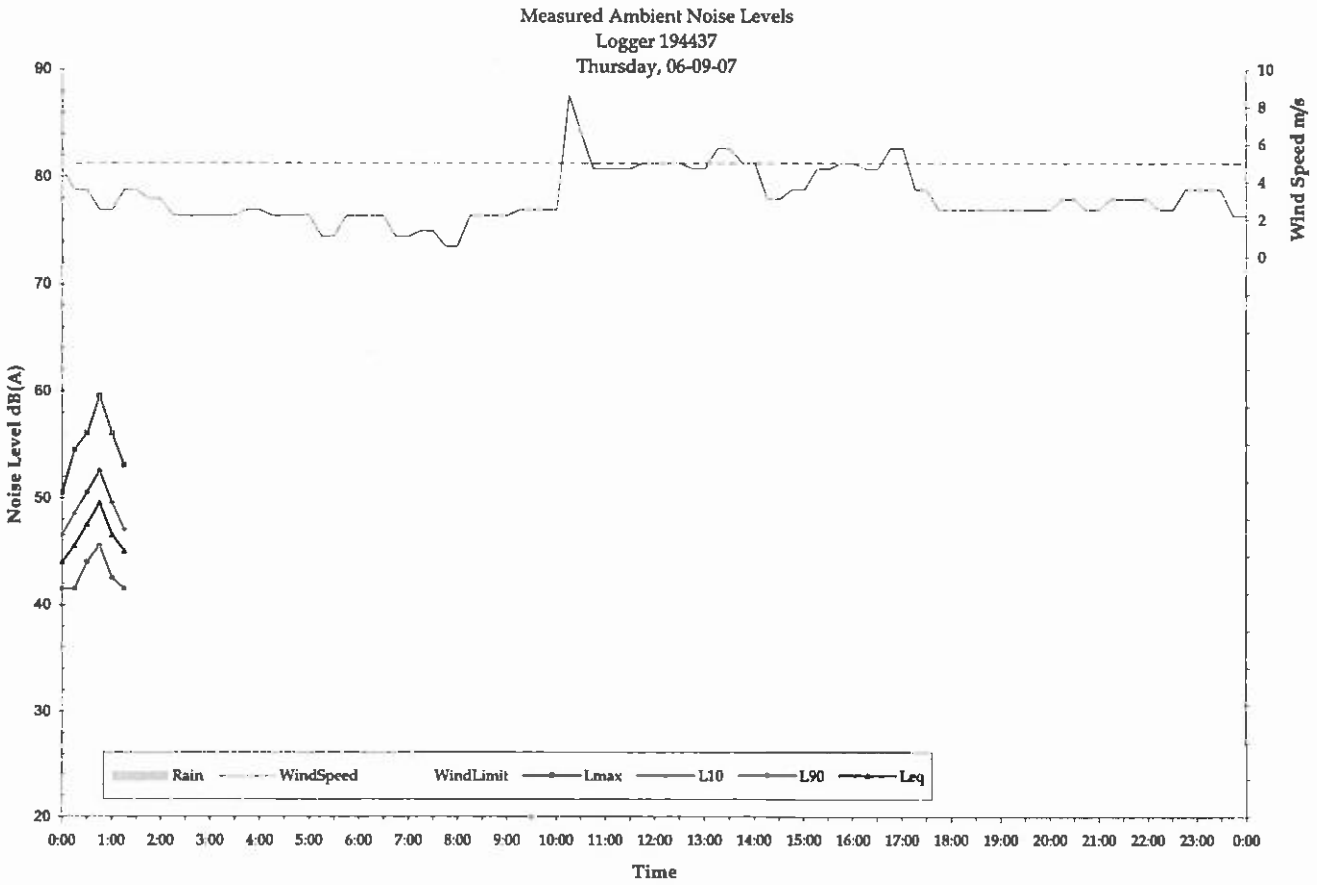

Measured Ambient Noise Levels
Logger 194437
Monday, 03-09-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

Noise Monitoring Data – 12 Swamphen Street, Erskine Park, NSW





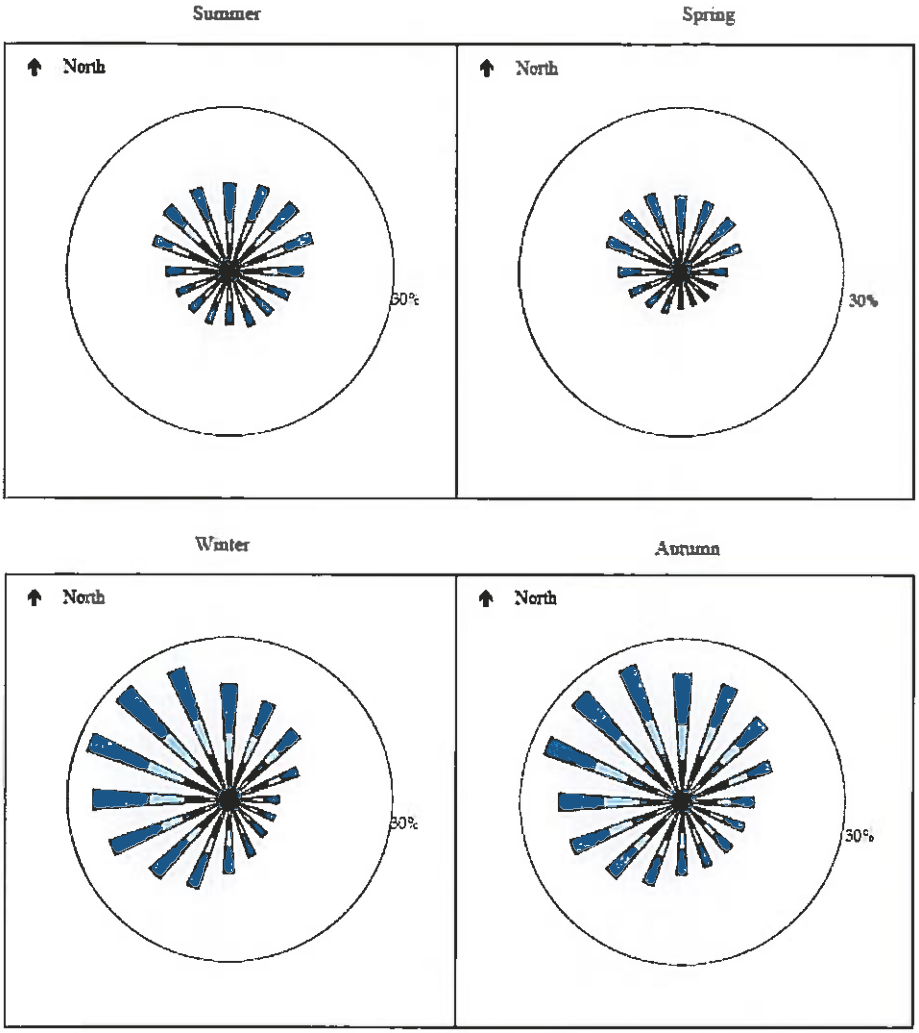
Noise Monitoring Data – 12 Swamphen Street, Erskine Park, NSW

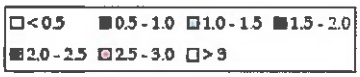


Annex C

Vector Wind Roses Annual Hourly Wind Analysis

Day

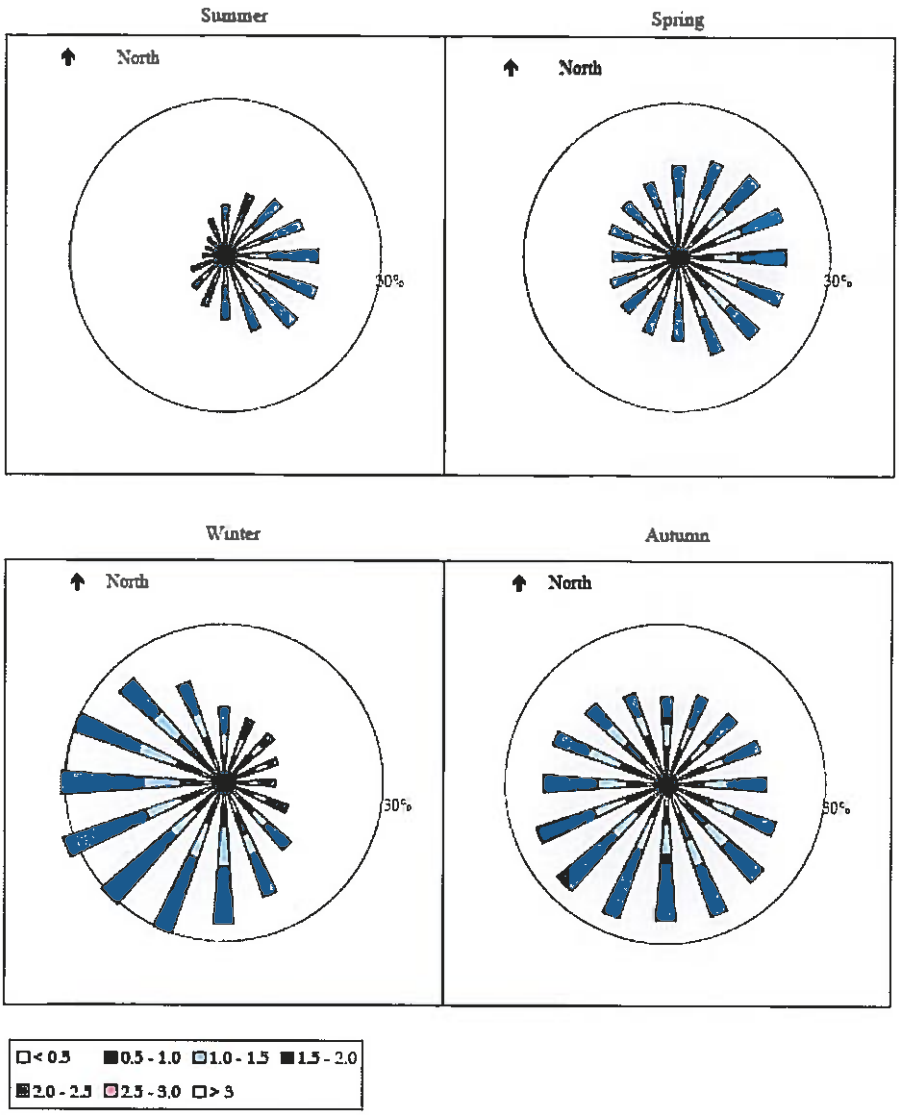




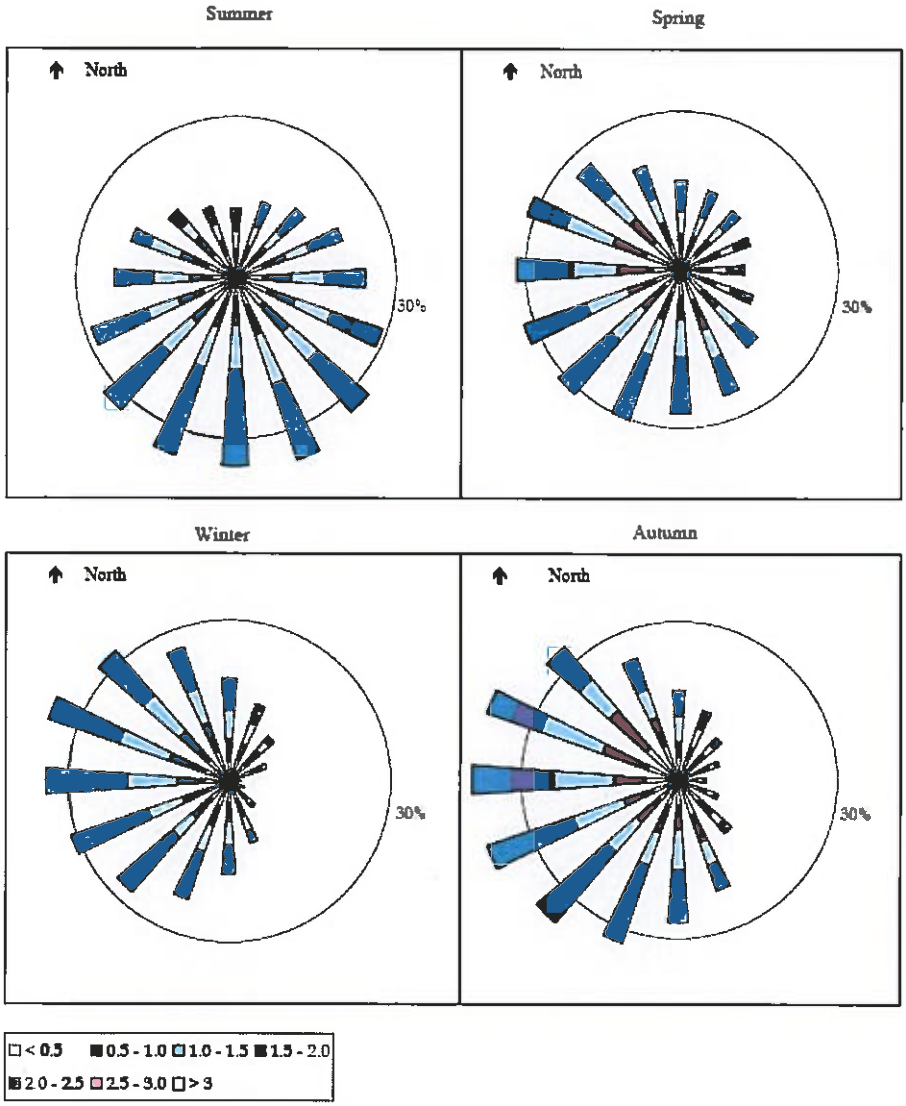
Data Source: Anvil Site at Wybong Rd
Data Range: 10 min, 01-04-02 to 30-11-03

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

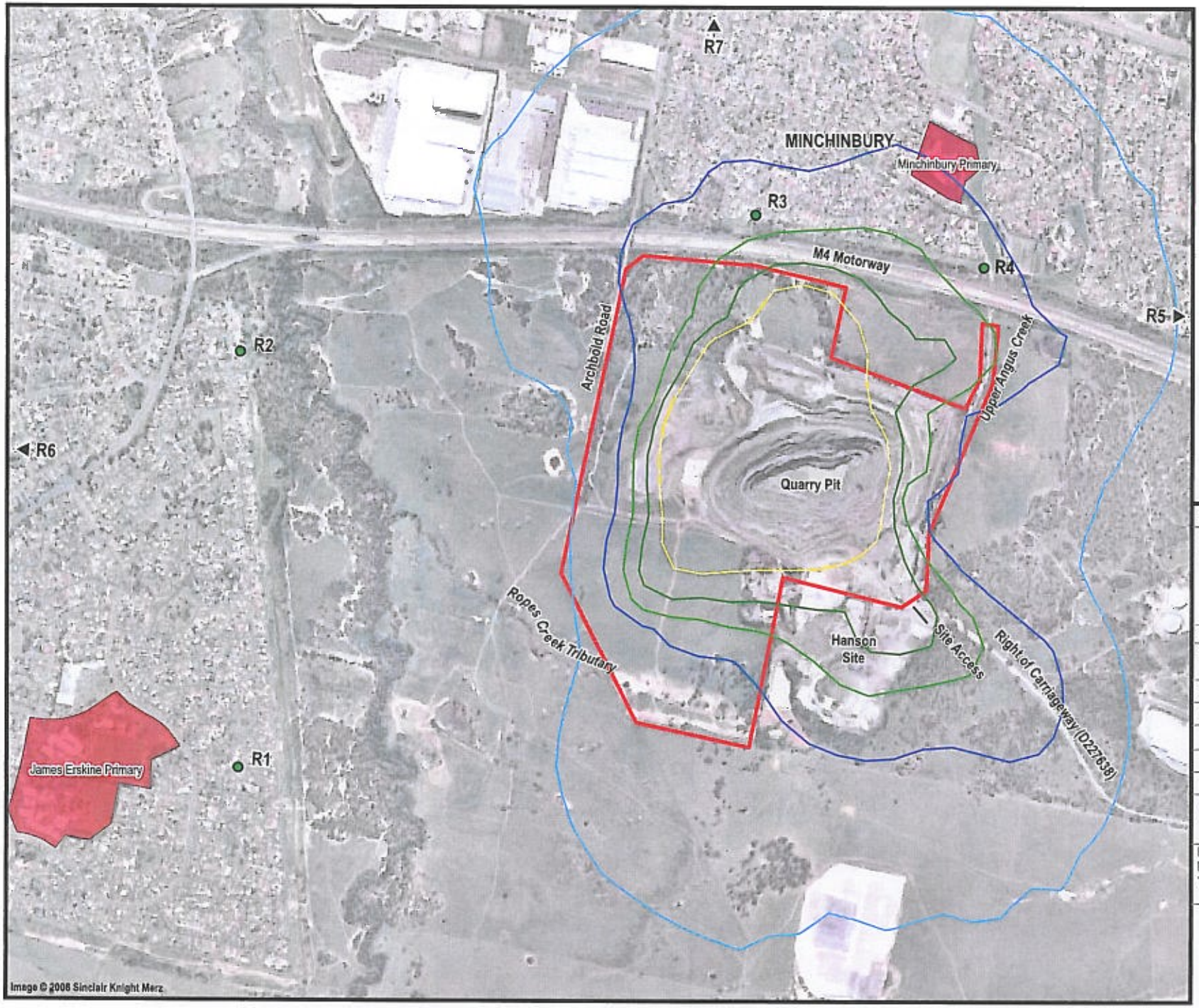

Summer
North
30%
Spring
North
30%
Winter
North
30%
Autumn
North
30%
< 0.5
0.5 - 1.0
1.0 - 1.5
1.5 - 2.0
2.0 - 2.5
2.5 - 3.0
> 3

Night


Summer
Spring
North
North
30%
30%
Winter
Autumn
North
North
30%
30%
< 0.5
0.5 - 1.0
1.0 - 1.5
1.5 - 2.0
2.0 - 2.5
2.5 - 3.0
> 3

Annex D

Noise Contours



Legend

Noise Level

- 35 dB(A)
- 40 dB(A)
- 45 dB(A)
- 50 dB(A)
- 55 dB(A)
- School
- Receiver Location
- Site Boundary

Suffix	*Revisions*	*Date*	*Init*
R0	Preliminary Issue	10-01-08	JS
R1	CTour Data Source Change	11-01-08	JS
R2	School Locations Added	01-08-08	JF

Figure D.1

$L_{eq,15minute}$ Daytime Operational Noise Levels, dB(A) - Year 5

Client:	TheQuarry Pty Ltd		
Project:	Light Horse Buisiness Centre EA		
Drawing No:	0071234_GIS11	Suffix No:	R2
Date:	01/08/2008	Drawing size:	A4
Drawn by:	JF	Reviewed by:	JK
Source:	© 2007 Google TM		
Scale:	Refer Scale Bar		

N

0 95 190 380 570 Meters

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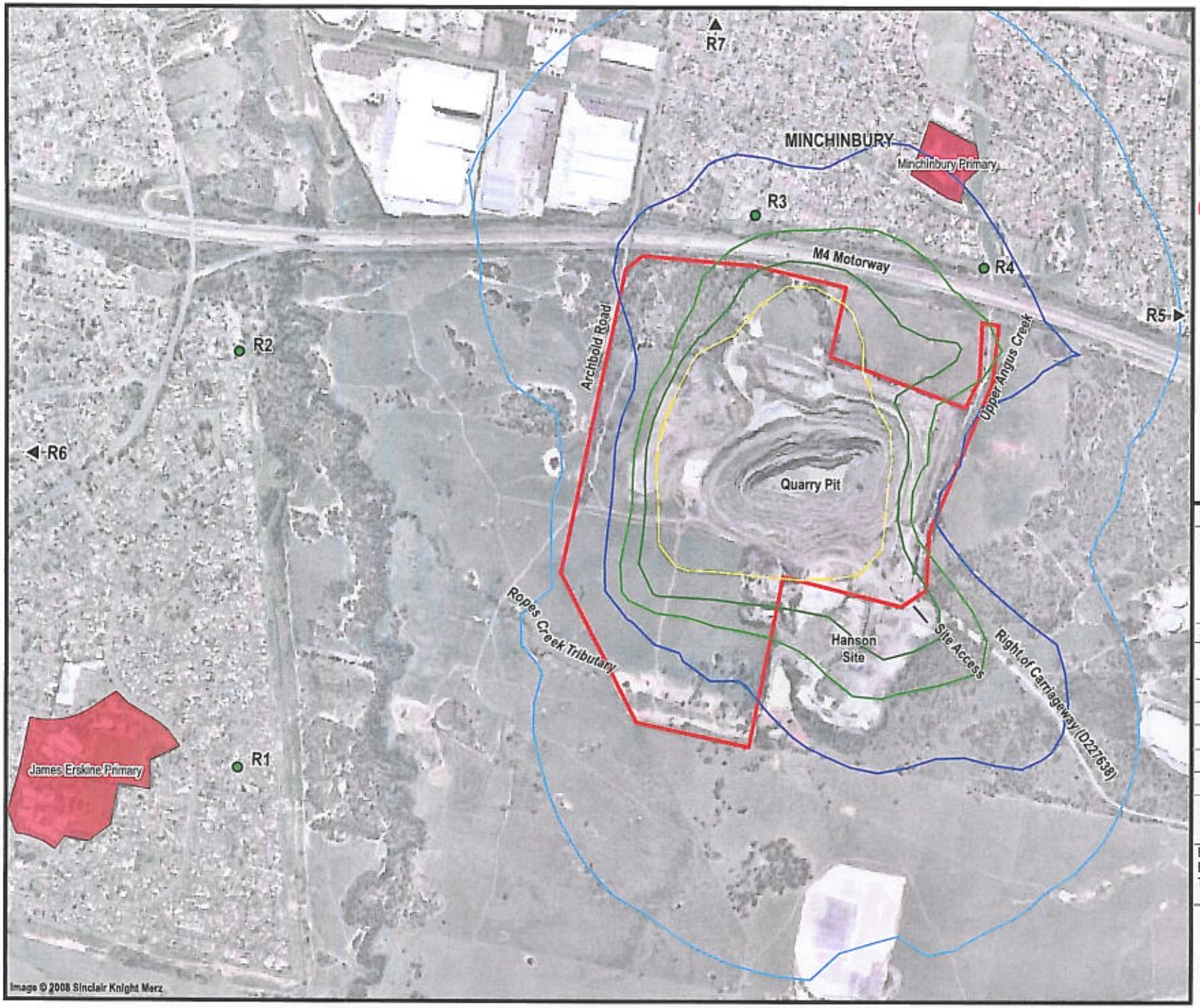
Telephone +61 2 8584 8888

ERM



Legend

Noise Level

- 35 dB(A)
- 40 dB(A)
- 45 dB(A)
- 50 dB(A)
- 55 dB(A)
- School
- Receiver Location
- Site Boundary

Suffix	Revisions	Date	Init
R0	Preliminary Issue	10-01-08	JS
R1	CTour Data Source Change	11-01-08	JS
R2	School Locations Added	04-08-08	JF

Figure D.2

$L_{eq,15minute}$ Daytime Operational Noise Levels, dB(A) - Year 13

Client:	ThaQuarry Pty Ltd		
Project:	Light Horse Buisness Centre EA		
Drawing No:	0071234_GIS12	Suffix No:	R2
Date:	04/08/2008	Drawing size:	A4
Drawn by:	JF	Reviewed by:	JK
Source:	© 2007 Google TM		
Scale:	Refer Scale Bar		

N

0 95 190 380 570 Meters

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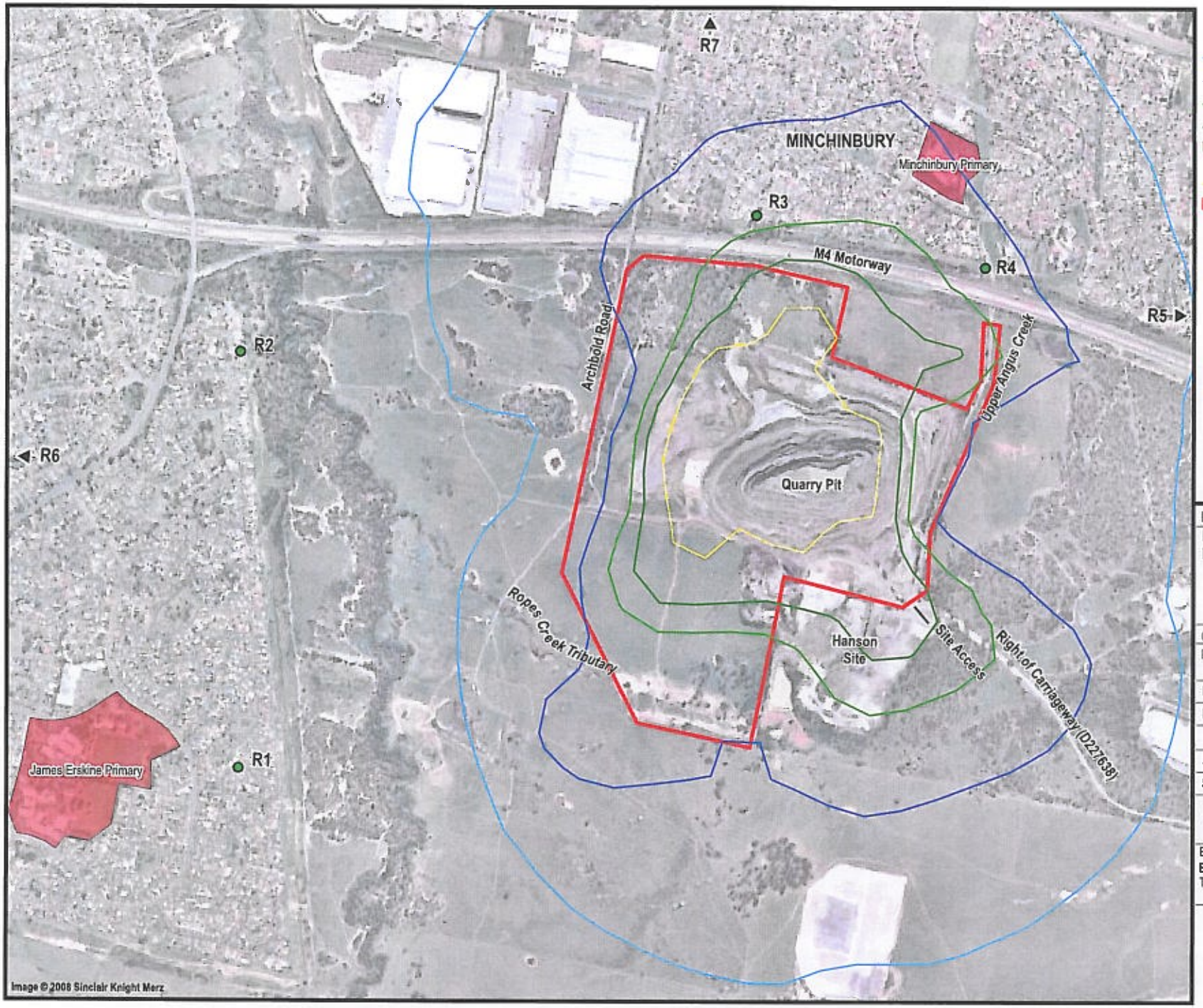
Building C, 33 Saunders St, Pyrmont, NSW 2009
Telephone +61 2 8584 8888

ERM



Legend

Noise Level

- 35 dB(A)
- 40 dB(A)
- 45 dB(A)
- 50 dB(A)
- School
- Receiver Location
- 60 dB(A)
- Site Boundary

Suffix	*Revisions*	*Date*	*Init*
R0	Preliminary Issue	10-01-08	JS
R1	CTour Data Source Change	11-01-08	JS
R2	School Locations Added	04-08-08	JF

Figure D.3

$L_{eq,15minute}$ Daytime Operational Noise Levels, dB(A) - Year 20

Client:	ThaQuarry Pty Ltd		
Project:	Light Horse Buisiness Centre EA		
Drawing No:	0071234_GIS13	Suffix No:	R2
Date:	04/08/2008	Drawing size:	A4
Drawn by:	JF	Reviewed by:	JK
Source:	© 2007 Google TM		
Scale:	Refer Scale Bar		

N

0 95 190 380 570 Meters

Environmental Resources Management Australia Pty Ltd
Building C, 33 Saunders St, Pyrmont, NSW 2009
Telephone +61 2 8584 8888

ERM

Annexure G

Air Quality – Odour and Dust by Holmes Air Sciences

AIR QUALITY – ODOUR AND DUST: LIGHT HORSE BUSINESS CENTRE DEVELOPMENT APPLICATION

4 April 2008

Prepared for
Environmental Resources Management Australia Pty Ltd

On behalf of
Light Horse Business Centre

by

Holmes Air Sciences
Suite 2B, 14 Glen St
Eastwood NSW 2122
Phone : (02) 9874 8644
Fax : (02) 9874 8904
Email : has@holmair.com.au

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1. INTRODUCTION

ThaQuarry Pty Ltd and ACN 114 843 453 Pty Ltd seek project approval for the construction and operation of a resource recovery facility (including a materials processing centre (MPC) and waste transfer station (WTS)), and a class 2 inert and solid waste landfill at Eastern Creek, in Sydney's west. Project approval is sought under Part 3A of the *Environmental Planning and Assessment Act, 1979*.

Holmes Air Sciences have been engaged by Environmental Resources Management Pty Ltd (ERM) on behalf of the proponent to assess the air quality and odour impacts of the project, as part of the overall environmental assessment. The application process is to be managed on behalf of both parties by ThaQuarry Pty Ltd under the project name Light Horse Business Centre.

A conventional approach has been adopted for this assessment which follows the procedures outlined by the NSW Department of Environment and Climate Change (DECC) in their document titled "Approved Methods for the Modelling and Assessment of Air Pollutants in NSW" (**DEC, 2005a**). The guidelines specify how assessments based on the use of air dispersion models should be undertaken. They include guidelines for the preparation of meteorological data, emissions data and relevant air quality criteria. The approach taken in this assessment follows as closely as possible the approaches suggested by the guidelines.

2. LOCAL SETTING AND PROJECT DESCRIPTION

The site is located at Eastern Creek in the central western suburbs of Sydney NSW. It comprises four land parcels, identified as Lot 2 on Deposited Plan (DP) 262213, Lot 10 on DP 241859, Lot 1 on DP 400697 and Lot W on DP 419612. For this assessment, a Study Area was set up which includes the project site and surrounding lands. The location of the site and the Study Area is shown in **Figure 1**.

The site was formerly used as a hard rock quarry and quarrying ceased in September 2006. The nearest sensitive receptors are concentrated to the north of the site, in the suburb of Minchinbury, approximately 550 metres (m) from the northern edge of the quarry pit, on the northern side of the M4 Motorway.

The area is predominantly flat to undulating, however, a deep void exists on the project site in the form of the former quarry pit. There are existing 30 m high, steep banked stockpiles of excavated quarry overburden material located to the north and west of the quarry pit. As part of the project, these will be reshaped to form amenity berms up to 10 m high. The base of the quarry is approximately 150 m below the surrounding ground-level. **Figure 2** shows the terrain in the study area, including the quarry pit.

Once operational, the facility will accept inert and solid wastes from construction and demolition, commercial and industrial waste streams complying with acceptable waste of non-putrescible class 2 facilities, and green waste clean ups. It will have the ability to accept up to 2 million tonnes per annum (Mtpa) of waste. It is estimated that there will be a total of 148,400 vehicle movements at the site per year with vehicle sizes ranging between 1 and 40 tonnes. The waste will either be recovered, sent to landfill or if required sent to an appropriate offsite facility.

An estimated 50 to 80% of total waste accepted onto the site (1 to 1.6 Mtpa, based on maximum capacity intake) will go through the recovery process and be recycled. The

remaining 20 to 50% (0.4 to 1 Mpta, based on maximum capacity intake) will be sent to landfill.

Incoming waste will be classified at the primary weighbridge based on advice from the carrier, inspection of the carrier's documentation and verification of this information by visual inspection using the weighbridge camera. This will be verified by visual inspection by a spotter at the unloading area. Any non-complying materials identified will be sent offsite. Liquid wastes, medical wastes, toxic and hazardous wastes and putrescible materials will not be received at the facility.

Some material brought onto the site will be identified outright as unsuitable for recovery and will be directed to the landfill or to the WTS, from where it will be transported to the landfill or off-site as appropriate. Materials to be sent to landfill will be loaded to on-site dump trucks (two 40 t dump trucks and one 50 t dump truck) and transferred to the landfill facility in the base of the quarry. Segregated loads of recoverable materials will be unloaded directly at the appropriate segregated stockpile. Mixed loads suitable for recovery will be unloaded at the MPC, where sorting will take place within a partially enclosed MPC/WTS building fitted with mist sprays. Segregated recoverable materials will be placed at the appropriate stockpile for either sale or recycling.

To recover resources for recycling, on-site processing of waste will occur by sorting, chipping, shredding, composting, screening, sieving, crushing and/or grinding, and some recycled products will also be blended. The recycled materials (that is, saleable products) will be stored on the site until sold.

Greenwaste material will be shredded and stockpiled in windrows. Up to 20,000 t of greenwaste may be stockpiled on site at any one time. The water collected from a sump at the green/timber waste stockpiles will be re-circulated by pumping from the sump and allowing it to gently seep out of perforated pipes at several locations across the windrow, to aid in the greenwaste composting process, with any excess directed to a leachate treatment plant. After a resting period of eight weeks the product will be tested and available for sale or alternatively be blended, tested and available for sale.

This assessment assumes that the maximum of 2 Mtpa of material will be delivered to the site. It is estimated that 1,250,000 tpa will go either to the MPC or to the appropriate segregated stockpile and of this:

- 250,000 tpa will be sent to landfill;
- 170,000 tpa will be sent off-site (no reprocessing);
- 170,000 tpa will require crushing only;
- 250,000 tpa will require crushing and screening;
- 370,000 tpa will require screening only;
- 30,000 tpa will require shredding only; and
- 10,000 tpa will require shredding and screening;

The remaining 750,000 tpa received will go directly to the WTS for transfer to the landfill. Thus, it is assumed that a total of 1 Mtpa of material will be sent off-site, either with or without on-site processing, and 1 Mtpa of material will be sent to landfill.

The layout of the site is shown in **Figure 3**. When fully operational the facility will include the following:

- raised enclosed MPC/WTS structure;
- wheel washing station;
- inwards/ outwards weighbridge for vehicles entering the facility and one way dump truck weighbridge facility for loads entering the land filling area;
- administration building which will include employee amenities, administration offices, training rooms, first aid facilities, logistics central control and communications centre;
- workshop building and plant storage bays, for maintenance and service activities for site trucks, plant and equipment;
- bunded above ground double skin diesel fuel tanks;
- light and heavy vehicle parking areas;
- internal roads;
- hardstand processing and stockpile areas;
- paved sales areas;
- leachate drainage works including sump and leachate wells;
- non-leachate site drainage/ stormwater system, including naturalized channels, pipework, culverts, sumps, tanks and detention ponds;
- water treatment facilities;
- telemetry controlled water spray and sprinkler system, with provision for manual override, installed at stockpile areas and earthern berms;
- noise, dust, windspeed and water quality monitoring systems;
- lighting;
- security fencing and gates for the resource recovery facility (RRF) and landfill; and
- earthern amenity berms to a height of ten metres to the west, north and south of the RRF, to be constructed from overburden stockpiles on site and landscaped.

Three screens will operate to sort and separate products. One mobile and one fixed crusher will also be used on-site to process screened materials, mainly oversized material that will be recycled. Other equipment will include excavators, front-end loaders (FELs), forklifts, a bulldozer, water cart, two compactors for the landfill and haul trucks.

All roads leading to and from the facility will be paved. The route down to the base of the landfill, while unpaved, is a hard rock surface and is considered to have a low propensity for dust generation. Water suppression will be used along this road for dust mitigation, as described in **Section 4.5**, and surface sealing by spray binders will be considered if necessary.

Natural wind breaks and physical barriers will be used to aid with reducing dust emissions off-site. Sprinkler systems will also be installed for stockpile areas and vehicles. Further details of proposed mitigation measures are provided in **Section 4.5**.

Operations at the facility will generally be conducted seven days per week between the hours of 6 am and 10 pm. Landfill activities will not occur after 6 pm.

The proponent will draw on experience from operation of a similar facility at Alexandria. Some experience from the operations at Alexandria, together with an air quality assessment for nearby activities (**Heggies, 2006**), have assisted with the development of this assessment.

3. EXISTING ENVIRONMENT

This section describes the dispersion meteorology, local climatic conditions and existing dust levels in the area.

3.1 Dispersion Meteorology

The dispersion models used for this assessment, AUSPLUME and CALPUFF, require information about the dispersion characteristics of the area. In particular, data are required on wind speed, wind direction, atmospheric stability class[1] and mixing height[2]. Meteorological data from St Marys and Horsley Park have been reviewed for this study.

DECC have listed requirements for meteorological data that are used for air dispersion modelling in their *Approved Methods* (**DEC, 2005a**). The requirements are as follows:

- Data must span at least one year;
- Data must be 90% complete; and
- Data must be representative of the area in which emissions are modelled.

The DECC operate a weather station at St Marys, approximately 5 km to the west of the project site, which measures (among other parameters) wind speed, wind direction and temperature. Data for 2004 are available and have been processed into a form suitable for use in the dispersion models. There were 8,784 hours available which represents 100% of the year. While wind patterns may vary from year to year the 2004 data will contain most meteorological conditions that occur in the area.

At Horsley Park, the Bureau of Meteorology operate an automatic weather station at the equestrian centre. This site is approximately 5 km to the south of the proposed site. Measurements include temperature, wind speed, wind direction and sigma-theta (a measure of the fluctuation of the horizontal wind direction). Holmes Air Sciences had data available for 2005 from this site. There were 8,424 hours recovered which represents 96% of the year.

Figures 4 and **5** show annual and seasonal wind-roses, prepared from the St Marys and Horsley Park wind data respectively.

It can be seen that, annually at the St Marys site, the most common winds are from the south-southwest and south (refer **Figure 4**). These winds are evident in all seasons, to various degrees. In summer, winds from the east-southeast are also common. In 2004 the percentage of calm conditions (when winds are less than or equal to 0.5 m/s) was 19.3% and the average wind speed was 1.8 m/s.

[1] In dispersion modelling, stability class is used to categorise the rate at which a plume will disperse. In the Pasquill-Gifford stability class assignment scheme, as used in this study, there are six stability classes A through to F. Class A relates to unstable conditions such as might be found on a sunny day with light winds. In such conditions plumes will spread rapidly. Class F relates to stable conditions, such as occur when the sky is clear, the winds are light and an inversion is present. Plume spreading is slow in these circumstances. The intermediate classes B, C, D and E relate to intermediate dispersion conditions.

[2] The term mixing height refers to the height of the turbulent layer of air near the earth's surface into which ground-level emissions will be rapidly mixed. A plume emitted above the mixed-layer will remain isolated from the ground until such time as the mixed-layer reaches the height of the plume. The height of the mixed-layer is controlled mainly by convection (resulting from solar heating of the ground) and by mechanically generated turbulence as the wind blows over the rough ground.

At the Horsley Park site, winds in 2005 (**Figure 5**) were predominantly from the southwest, although winds from the north were also common. Some similarities between this site and the St Marys site are evident but the percentage of calm conditions was only 6% at Horsley Park, which was lower than at St Marys (19%). Average wind speed at Horsley Park in 2005 was 3.2 m/s.

To use the wind data to assess dispersion, it is necessary to also have available data on atmospheric stability. For the St Marys site, atmospheric stability was derived from information on cloud cover (Mascot) and wind speed. A stability class was determined for each pair of wind speed and wind direction observations by the method of Turner (**Turner, 1970**). Stability class for Horsley Park was calculated for each hour of the meteorological data using sigma-theta (a measure of the fluctuation of the horizontal wind direction) according to the method recommended by the US EPA (**US EPA, 1986**). **Table 1** shows the frequency of occurrence of the stability categories expected in the area.

The most common stability class at St Marys was determined to be F class. This is consistent with the low wind speeds measured at this site and would suggest that the dispersion conditions are such that pollutant emissions disperse slowly for a significant proportion of the time. In contrast, D class was determined to occur most often at the Horsley Park site, due to the higher average wind speeds. Under D class conditions pollutant emissions will disperse rapidly.

Table 1 : Frequency of occurrence of stability classes in the study area

Stability Class	St Marys, 2004 data	Horsley Park, 2005 data
A	2.9	12.7
B	20.8	5.5
C	14.8	10.3
D	15.0	43.0
E	6.4	16.6
F	40.1	11.9
Total	100	100

From the review of data from two nearby meteorological stations, there were some similarities in the wind directions although wind speeds exhibited some differences. The St Marys data were selected for the dispersion modelling as the data were 100% complete and, due to the relatively high proportion of poor dispersion conditions, were likely to produce more conservative results. Joint wind speed, wind direction and stability class frequency tables for the St Marys data are provided in **Appendix A**.

3.2 Local Climatic Conditions

The Bureau of Meteorology also collects climatic information from Prospect Dam, to the east of the study area. Meteorological data collected from this station over a period of 114 years are summarised in **Table 2** (**Bureau of Meteorology, 2003**). Temperature and humidity data consist of monthly averages of 9 am and 3 pm readings. Also presented are monthly averages of maximum and minimum temperatures. Rainfall data consist of mean and median monthly rainfall and the average number of raindays per month.

Temperature data show that January is typically the warmest month with a mean daily maximum of 28°C. July is the coldest month with a mean daily minimum temperature of 6.1°C. Rainfall data collected at Prospect Dam show that March is the wettest month with a mean

rainfall of 98 mm over 11 rain days. Annually the area experiences, on average, 879 mm of rain per year.

Table 2 : Climate information for the study area

Element	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean daily maximum temperature - deg C	28.0	27.7	26.1	23.5	20.1	17.2	16.7	18.4	20.9	23.4	25.0	27.2	22.8
Highest daily Max Temp - deg C	44.7	42.5	39.5	37.1	29.4	25.6	26.5	29.4	35.0	39.0	41.2	42.7	44.7
Mean daily minimum temperature - deg C	17.5	17.7	16.1	13.0	10.2	7.5	6.1	6.8	9.3	12.1	14.1	16.4	12.3
Lowest daily Min Temp - deg C	10.0	10.8	7.9	4.5	1.2	0.1	0.0	0.0	2.6	4.5	6.9	7.8	0.0
Mean 9am air temp - deg C	21.0	20.8	19.6	16.7	13.4	10.4	9.3	10.8	14.1	17.0	18.1	20.4	16.0
Mean 9am wet bulb temp - deg C	18.3	18.5	17.3	14.5	11.8	8.8	7.5	8.5	11.0	13.5	15.1	17.0	13.5
Mean 9am dew point - deg C	16.4	16.9	15.4	12.5	10.1	6.7	5.1	5.7	7.6	10.2	12.4	14.5	11.1
Mean 9am relative humidity - %	76.0	80.0	78.0	77.0	81.0	79.0	77.0	72.0	67.0	67.0	71.0	71.0	75.0
Mean 3pm air temp - deg C	26.6	26.3	24.8	22.4	19.2	16.4	15.9	17.4	19.6	21.8	23.4	25.7	21.7
Mean 3pm wet bulb temp - deg C	20.0	20.0	18.8	16.5	14.4	11.9	10.9	11.6	13.1	15.2	16.9	18.6	15.7
Mean 3pm dew point - deg C	15.6	15.8	14.5	11.5	9.9	7.1	5.1	4.9	6.3	9.1	11.6	13.5	10.4
Mean 3pm relative humidity - %	53.0	55.0	55.0	53.0	57.0	56.0	51.0	46.0	45.0	48.0	50.0	50.0	51.0
Mean monthly rainfall – mm	95.9	92.2	98.2	75.9	73.6	75.6	59.3	52.2	48.1	59.2	72.4	76.1	878.5
Median (5th decile) monthly rainfall - mm	72.6	58.9	78.3	55.1	39.7	39.0	34.8	31.1	41.2	43.3	61.6	56.0	851.8
Mean no. of rain days	10.6	10.5	10.8	9.4	9.2	9.4	7.6	8.0	8.6	9.2	9.3	9.8	112.3
Highest monthly rainfall - mm	426.7	519.1	380.7	363.5	556.0	531.3	323.7	458.5	186.3	269.0	391.3	338.1	
Lowest monthly rainfall - mm	3.9	2.8	5.1	2.0	1.8	1.0	0.0	0.0	0.0	0.0	0.8	2.2	
Highest recorded daily rainfall - mm	161.2	164.6	153.9	163.1	314.2	163.4	143.5	321.0	96.5	102.1	126.2	154.9	321.0
Mean no. of clear days	6.6	5.2	6.8	8.9	9.2	10.1	11.5	13.5	11.7	8.5	6.9	7.2	106.2
Mean no. of cloudy days	12.5	11.8	12.0	8.2	9.8	8.5	6.7	6.5	7.3	9.5	11.2	10.8	114.7
Mean daily evaporation - mm	5.5	5.0	4.1	3.1	2.1	1.7	1.9	2.6	3.7	4.5	5.1	6.0	3.8

Climate averages for Station: 067019 PROSPECT DAM. Commenced: 1887; Last record: 2001; Latitude (deg S): -33.8193; Longitude (deg E): 150.9127; State: NSW

Source : Bureau of Meteorology (2003)

3.3 Existing Air Quality

Existing air quality (in terms of dust levels) has been determined from air quality monitoring undertaken in the area. The DECC measures particulate matter (PM_{10}) concentrations at St Marys (5 km to the west of the project site) using a Tapered Element Oscillating Microbalance (TEOM). This is the closest known air quality monitoring station to the project site. In addition, monitoring of dust deposition has been carried out at two locations near to the northern boundary of the site, by Hanson Construction Materials. The monitoring data are discussed below.

Quarterly air quality monitoring reports are prepared by the DECC and the reports for 2004, 2005 and 2006 (**DEC, 2005b, 2006 and 2007**) have been reviewed to obtain information on PM_{10} concentrations in the area. **Table 3** below summarises the TEOM measurements at St Marys. The monitoring data represent the contribution of many sources of particulate matter around the St Marys site, including local sources (for example, traffic and construction activities) as well as widespread events such as bushfires and dust storms. The St Marys

site is in a similar environment to the project site and the data are therefore considered to be relevant for the purposes of this assessment.

Table 3 : Summary of DECC PM_{10} monitoring data for St Marys

Year	Average for year ($\mu g/m^3$)	Maximum 24-hour average in year ($\mu g/m^3$)
2004	17	49
2005	19	55
2006	20	71

The TEOM measurements of PM_{10} presented in **Table 3** show that maximum 24-hour averages can exceed DECC's 24-hour average 50 $\mu g/m^3$ criterion on occasions (refer **Table 5**). The highest measurements were generally recorded in the summer months, when bushfires are commonly a contributing factor. The annual average PM_{10} concentrations have been below the DECC's annual average 30 $\mu g/m^3$ criterion (refer **Table 5**).

Annual average TSP concentrations can be estimated from measured PM_{10} concentrations by assuming that 40% of the TSP was PM_{10}. This relationship was obtained from data collected by co-located TSP and PM_{10} monitors operated for reasonably long periods of time in the Hunter Valley (**NSW Minerals Council, 2000**). Application of this relationship to the existing PM_{10} data (20 $\mu g/m^3$ for annual average PM_{10} in 2006, the year with the highest measurements) indicates that annual average TSP concentrations in the area are of the order of 50 $\mu g/m^3$, which is less than the DECC assessment criterion of 90 $\mu g/m^3$.

As part of a concept plan prepared for Hanson Construction Materials Pty Limited, for a proposed development adjacent to the southeastern boundary of the project site, Heggies Australia prepared an air quality impact assessment (**Heggies, 2006**) which presented dust deposition monitoring results for the area. Dust deposition was measured for Hanson Construction Material at two locations ("Wonderland" and "Freeway") to monitor activities at the quarry (refer to **Figure 1** for approximate locations of dust monitors). The monitoring results for the period between January 2004 and July 2006 are shown below in **Table 4**.

Table 4 : Measured dust deposition levels in the area

Site	Monitoring period	Average insoluble solids (g/m^2/month)
"Wonderland"	January 2004 to July 2006	2.4
"Freeway"	January 2004 to July 2006	0.9
Average	-	**1.6**

Source: Heggies, 2006

Measured dust deposition levels were below the DECC's total deposited dust criterion of 4 g/m^2/month (refer **Table 6**). The average for both sites was 1.6 g/m^2/month and this level has been taken to be representative of the existing deposition levels at the project site. It is noted that the Hanson data were collected when quarrying was occurring on the project site and the quarry activities would have contributed to the measured levels shown in **Table 4**.

In summary, the following background levels have been taken to apply both at the project site and at the nearest sensitive residential receptors:

- Annual average PM_{10} concentrations of 20 $\mu g/m^3$;
- Annual average TSP concentration of 50 $\mu g/m^3$; and
- Annual average dust deposition of 1.6 g/m^2/month.

Existing 24-hour hour average PM_{10} concentrations vary from day to day. Monitoring of PM_{10} concentrations at St Marys showed that 24-hour average concentrations can exceed the 50 $\mu g/m^3$ criterion on occasions (refer **Table 3**). In fact, in many parts of NSW the criterion is exceeded a few times each year, predominantly due to natural events such as bushfires and dust storms. Taking 2004 as an example, the highest 24-hour average PM_{10} concentration recorded at the St Marys site was 49 $\mu g/m^3$, which only permits a 1 $\mu g/m^3$ contribution from a project before the criterion is exceeded. This complicates the assessment process as projects with quite small PM_{10} contributions may still demonstrate exceedances when the background levels are high. In other years, 2005 and 2006 in particular, the highest 24-hour average PM_{10} concentrations exceeded the 50 $\mu g/m^3$ criterion and by taking the approach of adding maximum background levels to project levels would prohibit any project contribution.

For this study, 24-hour average PM_{10} concentrations have been assessed by examining model predictions at the nearest sensitive receptors. An objective was to determine the probability of the project causing exceedences of 50 $\mu g/m^3$ at these locations. This is discussed further in **Section 4.4**.

4. DUST ASSESSMENT

This section provides an assessment of the air quality impacts of the project. In particular, dust impacts are predicted and assessed. The assessment uses a computer-based dispersion model to predict ground-level dust concentrations and deposition levels in the vicinity of the facility. Model predictions have been compared to relevant air quality criteria after taking account of the existing air quality, where relevant.

In summary, **Section 4** provides information on the following:

- Air quality criteria;
- Methods used to estimate dust emissions from the facility;
- Methods for predicting dust impacts; and
- Expected dispersion and dust deposition patterns due to emissions from the facility and a comparison of the predicted dust concentration and deposition levels with DECC assessment criteria.

4.1 Dust Assessment Criteria

When assessing any project with a potential for significant air emissions, it is necessary to compare the impacts of the project with relevant air quality criteria. Air quality criteria are used to assess the potential for ambient air quality to give rise to adverse health or nuisance effects.

Table 5 and **Table 6** summarise the current air quality assessment criteria noted by the DECC (**DEC, 2005a**). Generally, the air quality criteria relate to the total burden of dust in the air and not just the dust from the project being assessed. In other words, some consideration of background levels needs to be made when using these criteria to assess impacts. The estimation of appropriate background levels for this assessment is discussed in **Section 3.3**.

Table 5 : DECC assessment criteria for particulate matter concentrations

Pollutant	Criterion	Averaging Period	Agency
Total suspended particulate matter (TSP)	90 $\mu g/m^3$	Annual mean	National Health & Medical Research Council
Particulate matter < 10 µm (PM_{10})	50 $\mu g/m^3$	24-hour maximum	DECC
	30 $\mu g/m^3$	Annual mean	DECC long-term reporting goal

In addition to health impacts, airborne dust also has the potential to cause nuisance impacts by depositing on surfaces. **Table 6** shows the maximum acceptable increase in dust deposition from the existing deposition levels, as well as the maximum acceptable total deposited dust, that is, background plus project. The criteria for dust deposition levels are set to protect against nuisance impacts (**DEC, 2005a**).

Table 6 : DECC criteria for dust deposition

Pollutant	Averaging period	Maximum increase in deposited dust level	Maximum total deposited dust level
Deposited dust	Annual	2 g/m^2/month	4 g/m^2/month

4.2 Estimated Dust Emissions

Dust emissions will arise from various activities at the site. Total dust emissions from the project have been estimated by analysing the activities proposed to take place at the site during operations.

The proposed activities have been combined with emission factors developed, both locally and by the US EPA, to estimate the amount of dust produced from the operations. The emission factors applied are considered to be the most up to date methods for determining dust generation rates. The fraction of fine, inhalable and coarse particles for each activity has been taken into account for the dispersion modelling.

The operational description provided by the proponent has been used to determine haul road distances and routes, stockpile and pit areas, activity operating hours, truck sizes and other details that are necessary to estimate dust emissions for a typical year of operation.

The most significant dust generating activities from the proposed operations have been identified and the respective dust emission estimates are presented in **Table 7**. It should be noted that a proportion of the materials received, and stockpiled, will have a low propensity for dust generation. These materials include glass, plastic, paper, metals and cardboard. For the purposes of the emission calculations, all materials processed at the site have been considered to have a potential for dust generation. This is a conservative approach.

Details of the calculations of the dust emissions are presented in **Appendix B**. The estimated emissions take account of proposed air pollution controls including active controls such as watering of stockpiles, load-out points and haul routes to minimise dust emissions. Details on the proposed dust mitigation measures are provided in **Section 4.5**.

Table 7 : Estimated dust emissions due to the proposed operations

ACTIVITY	TSP emission rate (kg/y)		
	Year 0	Year 13	Year 20
Vehicles coming to site (paved)	20,776	20,776	20,776
Dumping material at MPC or segregated stockpile	3,757	3,757	3,757
Dumping material at WTS	2,254	2,254	2,254
Loading material by FEL for processing	3,757	3,757	3,757
Loading and sorting material by excavator	12,523	12,523	12,523
Screening material	3,938	3,938	3,938
Crushing material	270	270	270
Loading material to stockpiles	6,262	6,262	6,262
Loading material to trucks	10,019	10,019	10,019
Hauling material to landfill (unpaved, inc return)	92,312	27,694	23,078
Vehicles leaving site (paved)	20,776	20,776	20,776
Dumping material to landfill	10,019	10,019	10,019
Wind erosion from exposed landfill area	7,247	7,247	7,247
Wind erosion from soil stockpiles	412	412	412
Wind erosion from other stockpiles	329	329	329
Total dust (kg)	**194,651**	**130,032**	**125,417**

It can be seen from **Table 7** that the operations are estimated to emit 194,651 kg of dust in the early stages of operation, of which dust from road haulage to landfill is the most significant dust generating activity. In practice, the dust emissions will be controlled through regular cleaning of paved roads, watering of unsealed surfaces and application of binding agents to reduce this source of dust to the minimum practicable (see **Section 4.5** for discussion on dust mitigation measures). The assessment of impacts is therefore conservative.

Lower dust emissions are expected in the mid-term and final stages of landfilling due to the shorter haul distance into the quarry pit. The initial stage (Year 0) represents the worst-case scenario.

4.3 Approach to Dust Assessment

The approach taken for the dust assessment was as follows:

- Estimate annual dust emissions of each activity associated with the operations (refer **Section 4.2**);
- Provide emissions and meteorological information to a computer-based dispersion model to predict dust concentrations in the region and at nearest sensitive receptors; and
- Compare predicted concentrations with relevant air quality criteria.

This section is provided so that technical reviewers can appreciate how the modelling of different particle size categories was carried out.

Off-site dust levels from the project have been predicted using AUSPLUME (Version 6.0). AUSPLUME is an advanced Gaussian dispersion model developed on behalf of the Victorian EPA (**VEPA, 1986**) and is based on the United States Environmental Protection Agency's Industrial Source Complex (ISC) model. It is widely used throughout Australia and is regarded as a "state-of-the-art" model. AUSPLUME is the model required for use by the DECC unless project characteristics dictate otherwise (**DEC, 2005a**).

The modelling has been based on the use of three particle-size categories (0 to 2.5 μm - referred to as $PM_{2.5}$, 2.5 to 10 μm and 10 to 30 μm). Mass emission rates in each of these size ranges have been determined using the factors derived from the **SPCC (1986)** study and TSP emission rates calculated using emission factors derived primarily from **US EPA (1985)** work (see **Appendix B**).

The distribution of particles in each particle size range, as determined from the **SPCC (1986)** study, is as follows:

- $PM_{2.5}$ is 4.7% of the TSP;
- $PM_{2.5-10}$ is 34.4% of TSP; and
- PM_{10-30} is 60.9% of TSP.

Modelling was done using three AUSPLUME source groups with each group corresponding to a particle size category. Each source in the group was assumed to emit at the full TSP emission rate and to deposit from the plume in accordance with the deposition rate appropriate for particles with an aerodynamic diameter equal to the geometric mean of the limits of the particle size range, except for the $PM_{2.5}$ group, which was assumed to have a particle size of 1 μm. The predicted concentrations in the three plot output files for each group were then combined according to the weightings above (see bullet points preceding this paragraph) to determine the concentration of PM_{10} and TSP.

The AUSPLUME model also has the capacity to take into account dust emissions that vary in time, or with meteorological conditions. This has proved particularly useful for simulating emissions for operations where wind speed is an important factor in determining the rate at which dust is generated.

For the current study, the operations were represented by a series of volume sources located according to the positions of the dust sources as they would be for the scenario being modelled. **Figure 6** shows the location of the modelled dust sources. Three scenarios were modelled, representative of Years 0, 13 and 20 of operations respectively; that is, the initial, mid-term and final stages of landfilling. This was to represent the potential range of impacts as landfilling operations progressed closer to the surface.

Estimates of emissions for each source were developed on an hourly time step taking into account the activities that would take place at that location. Thus, for each source, for each hour, an emission rate was determined which depended upon the level of activity and the wind speed. It is important to do this in the AUSPLUME model to ensure that long-term average emission rates are not combined with worst-case dispersion conditions which are associated with light winds. Light winds at a project site such as this would correspond with periods of low dust generation (because wind erosion and other wind dependent emissions rates will be low) and also correspond with periods of poor dispersion. If these measures are not taken then the model has the potential to significantly overstate impacts.

Dust concentrations and deposition rates from the project have been predicted over the area shown in **Figure 1**. Terrain has been considered in the modelling.

Pit retention was considered an important factor to include in the dispersion modelling given the large height difference between the local ground level and the floor of the quarry pit. For the purposes of the dispersion modelling the calculation determines the fraction of dust emitted in the pit which will escape the pit. The relationship used is dependent on the

gravitational settling velocity of the particles and wind speed and is given by **Equation 1** below (**US EPA, 1995**).

$$\varepsilon = \frac{1}{\left(1 + \frac{v_g}{(\alpha U_r)}\right)}$$ **Equation 1**

where:
ε = escape fraction for the particle size category
V_g = gravitational settling velocity (m/s)
U_r = approach wind speed at 10 m (m/s)
α = proportionality constant in the relationship between flux from the pit and the product of U_r and concentration in the pit (0.029)

To model the effect of pit retention, the emissions from sources within the quarry pit have therefore been reduced to account for the fact that much of the coarser dust would remain trapped in the pit.

As an example of modelling emissions with pit retention, particles in the $PM_{2.5}$ (FP) category are taken to have a gravitational settling velocity of 0.0000914 m/s. For a 1 m/s approach wind speed, the fraction of particles that escape the pit is estimated by Equation 1 to be 0.997 – that is, almost all of the particles in this size range escape the pit. Under the same wind conditions the escaped fraction for the PM_{10-30} (RE) particles, with an assumed gravitational settling velocity of 0.106328 m/s, would be 0.21 – that is, only 21% of these particles escape the pit.

The modelling has been performed using the meteorological data discussed in **Section 3.1** and the dust emission estimates from **Section 4.2**. It has been assumed that each activity will occur for the hours given in the project description (refer **Section 2**), except for wind erosion sources which have been modelled for 24-hours per day. Model predictions have been made at 125 discrete receptors (including nearest residences) located in the study area shown in **Figure 1**. The location of these receptors has been chosen to provide finer resolution closer to the dust sources and nearby receptors. The AUSPLUME model input files can be provided in electronic form on request.

Dust impacts and model predictions using the AUSPLUME model are presented as contour plots in **Figure 7** and are discussed in **Section 4.4**.

4.4 Assessment of Dust Impacts

Dust concentrations from proposed operations have been presented as isopleth diagrams in **Figure 7** showing the following:

1. Predicted maximum 24-hour average PM_{10} concentration;
2. Predicted annual average PM_{10} concentration;
3. Predicted annual average TSP concentration; and
4. Predicted maximum 1-day average dust deposition.

The contour plots in **Figure 7** are associated with Year 0 (initial stages) of landfilling operations, which is representative of the worst case impact since the haulage distance to

landfill over unsealed surfaces would be at a maximum. This haul distance reduces over time.

In examining the maximum 24-hour average contour plot it should be noted that this does not represent the dispersion pattern for any particular day, but shows the highest predicted 24-hour average concentrations that occurred at each location for the worst day in the year. The maxima are used to show concentrations which can possibly be reached under the modelled conditions. It should also be noted that the contour plots show predicted concentrations due only to modelled dust sources for the facility.

Table 8 summarises the dispersion model predictions for two nearby receptor locations. The receptor locations are shown in **Figure 6**. Results show the project only contribution as well as the cumulative impacts of emissions from this project and existing sources in the area.

Table 8 : Dust model predictions at nearby sensitive receptors

Receptor ID	Due to project only			Existing levels (2006, refer Section 3.3)	Total (maximum year from project + existing)	Criteria
	Year 0	Year 13	Year 20			
Maximum 24-hour average PM_{10} ($\mu g/m^3$)						
R1	39	28	27	71	110	50
R2	18	9	9	71	89	50
Annual average PM_{10} ($\mu g/m^3$)						
R1	5.6	4.5	4.4	20	25.6	30
R2	1.3	0.9	0.9	20	21.3	30
Annual average TSP ($\mu g/m^3$)						
R1	7.0	5.6	5.5	50	57	90
R2	1.4	1.0	1.0	50	51.4	90
Annual average dust deposition (g/m^2/month)						
R1	0.3	0.3	0.3	1.6	1.9	4
R2	0.1	0.1	0.1	1.6	1.7	4

Table 8 shows that the model results for annual average PM_{10}, TSP and dust deposition at these receptors, including the cumulative results, are within relevant DECC criteria. However, the approach of adding maximum measured to maximum predicted 24-hour average PM_{10} concentrations will rarely show compliance with the 50 $\mu g/m^3$ criterion. This is because the maximum measured value of 71 $\mu g/m^3$ does not permit any project contribution before 50 $\mu g/m^3$ is exceeded (note that the maximum PM_{10} for the same year as the meteorological data file, 2004, was 49 which only permits 1 or 2 $\mu g/m^3$ from the project before an exceedance is predicted). The high estimated dust emissions in Year 0 produce higher model predictions than for subsequent years.

The potential 24-hour average PM_{10} impacts have been investigated further by examining the predicted frequency of PM_{10} concentrations, due to the project in Year 0, occurring at the two nearby receptors. **Figure 8** shows a time series of model predictions at the nearest receptors while **Figure 9** presents the same data in histogram form. If it were assumed that the existing annual average PM_{10} concentration (say, 20 $\mu g/m^3$) occurred every day of the year then the assessment would be very much simplified as a maximum project contribution of around 30 $\mu g/m^3$ or more would be the point at which air quality impacts would be observed - assuming 50 $\mu g/m^3$ is the level at which impacts occur. However, existing PM_{10}

concentrations will vary from day to day so **Table 9** has been constructed to show the approximate number of days when the cumulative PM_{10} concentration will exceed 50 $\mu g/m^3$ for various background levels.

Table 9 : Predicted number of days when PM_{10} concentration exceeds 50 $\mu g/m^3$

Assumed background PM_{10} level ($\mu g/m^3$)	Permitted contribution from project before exceedance is predicted ($\mu g/m^3$)	Approximate number of exceedances of 50 $\mu g/m^3$ per year	
		R1	R2
20	30	4	0
30	20	9	0
40	10	68	2

From the information in **Table 9** it can be seen that, as the existing background levels increase, the potential for cumulative impacts (above 50 $\mu g/m^3$) also increases. When the background concentration is at the average level of 20 $\mu g/m^3$, then there would be 4 days in the year when the project would cause an exceedance of 50 $\mu g/m^3$ at the nearest receptor. The probability of the project causing an exceedance of 50 $\mu g/m^3$ increases, with increasing background levels.

While annual average dust concentrations and deposition levels are predicted to comply with ambient air quality criteria, this assessment has highlighted a potential for the project to cause exceedances of the 24-hour average PM_{10} criterion, even in background concentrations are at average levels. The project will therefore need to be subject to air quality management procedures to ensure that the possibility of adverse short-term air quality impacts is minimised. Dust mitigation measures are discussed in **Section 4.5** below.

Potential cumulative air quality impacts of the project with the adjacent Hanson activities have been considered by examining dispersion model results presented in the air quality impact assessment for the Hanson site (**Heggies, 2006**). This study showed that the predicted maximum 24-hour average PM_{10} concentration from the Hanson facility was 2.1 $\mu g/m^3$ at the nearest assessed residential receptor (R1). This is a small increment which would not affect the conclusions of this study and so no further assessment has been undertaken.

It is understood that a future subdivision is proposed for areas to the west of the project site however plans have not been approved. Based on the results of the dispersion modelling some areas of the development land may experience dust impacts of similar magnitude to those predicted for receptor 1 discussed above if not properly managed. Air quality monitoring would assist in the determination of dust levels due to project operations.

4.5 Dust Mitigation Measures

This section describes the management actions that will be put in place to minimise dust emissions from site activities. The proposed dust mitigation measures will include the following:

- Spray mists and sprinkler systems for crushing, grinding and chipping operations:
- Spray mists on all material stockpiles;
- Construction of perimeter berms around the main area of operations to provide a barrier for dust emissions;

- Spray mists and sprinkler systems on the perimeter berms;
- Wetting of vehicles with potentially dusty loads, prior to unloading;
- Cleaning spills of potentially dust materials immediately;
- Wheel wash for all vehicles travelling off-site;
- Water carts operated as required; and
- Use of onboard reservoirs on site dump trucks to allow wetting whilst in motion.
- Sealing of operational surfaces at the RRF

The calculations of dust emissions have considered each of the mitigation measures above and, where appropriate, dust emissions have been reduced according to NPI control factor estimates (see Table 3 of **NPI, 2001**). The assumed reductions in emissions are provided in **Appendix B**.

In practice, the dust emissions are likely to be controlled beyond the level assumed in the modelling, however given that the air dispersion modelling has highlighted the potential for short-term air quality impacts to occur, the operations will need to adopt best practice mitigation measures.

4.5.1 Air Quality Management Plan

An Air Quality Management Plan (AQMP) is proposed to ensure that dust emissions are minimised to the most practical. An AQMP will be developed and included in the LEMP and EWMP to be developed for the Project, with a focus on activities which generate the most significant emissions – in this instance those associated with haulage movements and transfer and loading activities.

Further detail on a number of management measures proposed for the facility are outlined below.

Watering Of Haul Roads

Dust emissions will be controlled through regular cleaning of paved roads, watering of unsealed surfaces and application of binding agents to reduce this source of dust to the minimum practicable.

Lower dust emissions are expected in the mid-term and final stages of landfilling due to the shorter haul distance into the quarry pit. The initial stage (Year 0) represents the worst-case scenario.

A 'low level' of watering, between 1-2litres/minute, will be applied to unsealed roads. Onboard reservoirs will be used on site dump trucks to allow wetting whilst in motion. In addition wetting of potentially dusty loads will be undertaken prior to unloading and all vehicles travelling off-site will be required to pass through a wheel wash.

Dust Suppression

Water sprays will be used to minimise particulate emissions to the atmosphere from crushing, grinding and chipping operations. Dust suppression will be employed through spray mists on all material stockpiles.

Perimeter Berms

Perimeter berms approximately 10 metres in height will be constructed, in order to provide a barrier for dust emissions. These berms will be vegetated, which when mature will serve as

further mitigation of off-site emissions from dust. Spray mists and sprinkler systems will be installed on the perimeter berms.

4.5.2 Monitoring

In addition to the measures listed above, a real-time dust monitoring and reactive control system will help to identify activities that may lead to off-site air quality impacts. The dust monitoring can be used to assess compliance with the DECC's ambient air quality criteria and access to the data in real-time will enable site operators to modify activities, as required, to minimise dust emissions and off-site impacts.

A minimum of one real time monitor (eg DustTrak, TEOM, E-Bam, E-Sampler) should be used to identify real-time impacts and delineate short term concentrations. The application of real-time air monitoring equipment will provide important information on short-term air quality not obtainable from high volume air sampling or deposition jars.

The data from such a system would enable identification of potential "trouble spots" during routine operations and provide the evidence to enable appropriate repairs or engineering solutions to be developed. The data from such a system would also enable records of operational dust levels to be maintained and provide opportunity to implement mitigation measures (*eg* increased watering of haul roads) based upon monitoring peaks.

The monitoring location should be determined through an assessment of potential suitable locations on site. The dispersion modelling, and meteorological data used indicates key impacts and receptors to the north or north-west of the facility and this would be the preference for a monitoring location.

4.6 Construction Impacts

Dust emissions from construction works have the potential to cause nuisance impacts if not properly managed. In practice, it is not possible to realistically quantify impacts using dispersion modelling. To do so would require knowledge of weather conditions for the few weeks that work will be taking place in each location on the site.

Air quality impacts during construction would largely result from dust generated during earthworks and other engineering activities associated with the plant construction. These activities will generally be conducted behind earthen berms. The total amount of dust generated would depend on the silt and moisture content of the soil, the types of operations being carried out, exposed area, frequency of water spraying and speed of machinery. The detailed approach to construction will depend on decisions that will be made by the successful contractor and changes to the construction methods and sequences are expected to take place during the construction phase.

As construction is likely to continue for approximately six months, it is important that exposed areas be stabilised as quickly as possible and that appropriate dust suppression methods be used to keep dust impacts to a minimum. It is desirable that monitoring be carried out during the construction phase of the project to assess compliance with DECC criteria. Monitoring may include dust deposition gauges, at the closest residences or other sensitive receptors, to assess compliance.

Proper dust management will require the use of water carts, the defining of trafficked areas, the imposition of site vehicle speed limits and constraints on work under extreme unfavourable weather conditions, such as dry wind conditions.

5. ODOUR ASSESSMENT

This section provides an assessment of the odour impacts of the project. The assessment uses a computer-based dispersion model to predict odour levels from the project, in the local area.

In summary, **Section 5** provides information on the following:

- Odour assessment criteria;
- Estimated odour emissions from the facility;
- Methods for predicting impacts from the estimated odour emissions; and
- Expected patterns of off-site odour levels due to emissions from the site operations and a comparison between the model predictions and DECC assessment criteria.

5.1 Odour Assessment Criteria

This section evaluates odour in terms of measurement and air quality criteria that relate to odour. There is still considerable debate in the scientific community about appropriate odour criteria as determined by dispersion modelling.

5.1.1 Measurement of Odour

Odour is measured using panels of people who are presented with samples of odorous gas diluted with decreasing quantities of clean odour-free air. The panellists then note when the smell becomes detectable. Odour in the air is then quantified in terms of odour units which is the number of dilutions required to bring the odour to a level at which 50% of the panellists can just detect the odour. This process is known as olfactometry.

Olfactometry can involve a "forced-choice" end point or a "free choice" endpoint. The "forced-choice" method is where panellists identify from multiple sniffing ports, the one port where odour is detected, regardless of whether they are sure they can detect odour. The "free choice" endpoint is a "yes/no" decision where panellists are required to say whether or not they can detect odour from one sniffing port. Forced-choice olfactometry generally detects lower odour levels than free choice olfactometry.

In both the "forced-choice" and "free choice" cases, odorous air is presented to the panellists in increasing concentrations. For the forced-choice method, where there are multiple ports for each panellist, the concentration is increased until all panellists consistently distinguish the port with the sample from the blanks. For a yes/no olfactometer (which has only one sniffing port) one method used is to increase the concentration of odour in the sample until all panellists respond. The sample is then shut off and once all panellists cease to respond, the sample is introduced again at random dilutions and the panellists are asked whether they can detect the odour.

An Australian Standard (AS/NZS 4323.3.2001) for olfactometry has been developed which is consistent with the European Standard, CEN. This enables results between laboratories to be more uniform.

An odour unit is a difficult unit to define precisely. Historically it has been the level at which 50% of the population can just detect that there is an odour present. The standard (AS/NZS 4323.3.2001) defines 1 odour unit (ou) as that concentration of odorant(s) at standard conditions that elicits a physiological response from a panel (detection threshold) equivalent to that elicited by one Reference Odour Mass (ROM) evaporated into 1 cubic metre of neutral gas at standard conditions.

Some of the terms in this definition require further explanation as follows:

- Standard conditions for olfactometry are a temperature of 0°C (273K) and normal atmospheric pressure (101.3 kPa) on a wet basis.
- Neutral gas is air or nitrogen that is treated in such a way that it is as odourless as possible.
- One ROM evaporated into one cubic metre of neutral gas at standard conditions is the mass of a substance that will elicit the D_{50} physiological response assessed by a panel in conformity with the standard and has by definition a concentration of 1 ou.
- The D_{50} physiological response is the dose at which 50% of a population can detect a sensory stimulus.
- The detection threshold is the highest dilution factor at which the sample has a probability of 0.5 of eliciting with certainty the correct perception that an odour is present. This dilution factor will be too high for the sample to be recognised.
- It is common to use n-butanol as a reference gas and for this compound one ROM is 132 μg which, when evaporated into 1 cubic metre of neutral gas at standard conditions, produces a concentration of 40 ppb. Panellists are usually screened for sensitivity to n-butanol and the panel threshold reported as part of the odour measurement procedure. There is a requirement that a panellist's sensitivity to the reference material falls between 0.5 and two times the accepted reference value which for butanol is 20–80 ppb.

The purpose of these very precise definitions is to improve the repeatability and accuracy of odour measurements.

As with all sensory methods of identification there is variability between individuals. Consequently the results of odour measurements depend on the way in which the panel is selected and the way in which the panel responses are interpreted. The process by which these imprecise measurements are translated into regulatory criteria is still being refined. However, the DECC has recently published a Technical Framework for the assessment of odour from stationary sources, which includes recommendations for odour criteria (**DECC, 2006**). These are explained below and have been used for this assessment.

5.1.2 Odour Criteria

The determination of air quality criteria for odour and their use in the assessment of odour impact is recognised as a difficult topic in air pollution science. The topic has received considerable attention in recent years and the procedures for assessing odour impacts using dispersion models have been refined considerably.

The DECC has in recent times attempted to refine odour criteria and the way in which they should be applied with dispersion models to assess the likelihood of nuisance impact arising from the emission of odour.

There are two factors that need to be considered:

1. what "level of exposure" to odour is considered acceptable to meet current community standards in NSW; and
2. how can dispersion models be used to determine if a source of odour meets the criteria which are based on this acceptable level of exposure.

The term "level of exposure" has been used to reflect the fact that odour impacts are determined by several factors. The most important factors (the so-called **FIDOL** factors) are:

- the **F**requency of the exposure;
- the **I**ntensity of the odour;
- the **D**uration of the odour episodes;
- the **O**ffensiveness of the odour, and
- the **L**ocation of the source.

In determining the offensiveness of an odour it needs to be recognised that for most odours the context in which an odour is perceived is also relevant. Some odours, for example the smell of sewage, hydrogen sulfide, butyric acid, landfill gas etc., are likely to be judged offensive regardless of the context in which they occur. Other odours such as the smell of jet fuel may be acceptable at an airport, but not in a house, and diesel exhaust may be acceptable near a busy road, but not in a restaurant.

In summary, whether or not an individual considers an odour to be a nuisance will depend on the FIDOL factors outlined above and although it is possible to derive formulae for assessing odour annoyance in a community, the response of any individual to an odour is still unpredictable. Odour criteria need to take account of these factors.

The DECC Technical Framework includes some recommendations for odour criteria. The criteria have been refined by DECC to take account of population density in a particular area. **Table 10** lists the odour certainty thresholds, to be exceeded not more than 1% of the time, for different population densities.

Table 10 : DECC odour assessment criteria

Population of affected community	Odour performance criteria (nose response odour certainty units at the 99th percentile)
Rural single residence (≤2)	7
~10	6
~30	5
~125	4
~500	3
Urban (>2000) and/or schools and hospitals	2

The difference between odour criteria is based on considerations of risk of odour impact rather than differences in odour acceptability between urban and rural areas. For a given odour level there will be a wide range of responses in the population exposed to the odour. In a densely populated area there will therefore be a greater risk that some individuals within the community will find the odour unacceptable than in a sparsely populated area.

The criteria assume that 7 odour units at the 99th percentile would be acceptable to the average person, but as the number of exposed people increases there is a chance that sensitive individuals would be exposed. The criterion of 2 odour units at the 99th percentile is considered to be acceptable for the whole population.

It is common practice to use dispersion models to determine compliance with odour criteria. This introduces a complication because Gaussian dispersion models are only able to directly

predict concentrations over an averaging period of 3-minutes or greater. The human nose, however, responds to odours over periods of the order of a second or so. During a 3-minute period, odour levels can fluctuate significantly above and below the mean depending on the nature of the source.

To determine more rigorously the ratio between the one-second peak concentrations and three-minute and longer period average concentrations (referred to as the peak-to-mean ratio) that might be predicted by a Gaussian dispersion model, the DECC commissioned a study by Katestone Scientific Pty Ltd (see **Katestone 1995** and **1998**). This study recommended peak-to-mean ratios for a range of odour source types. The ratio is also dependent on atmospheric stability and the distance from the source. A summary table of these ratios is presented in **Appendix C**.

The DECC Technical Framework (**DECC, 2006**) takes account of this peaking factor and the criteria shown in **Table 10** are based on nose-response time.

5.2 Estimated Odour Emissions

Potential odour sources from the project are the active tipping and capped areas of the landfill, the leachate dam/trench and windrows associated with composting of greenwaste on-site. In dispersion modelling terms, these represent "area" sources.

Odour emissions from area sources are probably the most difficult to measure for a variety of reasons. Firstly the source is often heterogeneous. For example in the case of landfill sites, there will be different odour emission rates from different sections of the landfill. Secondly, unlike stack emissions, area emission rates are dependent upon atmospheric conditions including wind speed, degree of turbulence, temperature, etc. This clearly adds another level of complexity to odour assessments.

The landfill will be categorised as a Class 2 landfill, with no putrescible waste to be landfilled. However, a small volume of biodegradable materials may be landfilled and could produce odours over time. One of the objectives of the project however is to maximise recycling at the RRF and to minimise biodegradable material to landfill. To estimated odour emissions from the landfill, previous studies of emissions from Class 2 landfills were used. These studies were undertaken in the 1990s, during which time Class 2 landfills accepted a wider range of materials, including a higher volume of organic and biodegradable material than is proposed for this project. Odour emissions would therefore have been higher than those that will occur for the current project. Nevertheless, the odour emission data from these landfills (referred to as "standard" Class 2 odour emissions), is assumed to have relevance to this assessment, provided a suitable odour reduction factor is applied.

There are limited odour emissions data available for Class 2 landfills. Measurements made for a non-putrescible landfill site after six months of operations (**CEE, 1994**) have indicated levels of approximately 0.5 $ou.m^3/m^2/min$ (certainty units). Due to decomposition of biodegradable material over time, odours from the landfill area will reach their maximum after a number of years of operation (perhaps 2 years), when it is estimated that emissions may increase by a factor of about 14 (**CEE, 1994**) from levels six months into operations. Therefore, to model for a worst-case scenario it is necessary to take into account the potential increase in odour over time to approximately 7 $ou.m^3/m^2/min$ (or 0.117 $ou.m^3/m^2/s$). These worst-case emissions however, will not occur over the whole landfill area. As the landfill progresses, emissions from the previously capped cells will rise to a peak and then fall again.

This variation in emission rates from a given landfill area over time may occur in a similar fashion to that suggested by the **Maunsell (1994)** model in **Figure 10**. Assuming that the peak for the proposed landfill operation will be approximately 0.117 ou.$m^3/m^2/s$, the profile of this landfill gas model was applied to the current study to estimate the emissions for the time period specified in **Figure 10** (30 years). To account for variability in emissions across the landfill area, the average emission rate was then calculated and taken to apply for the whole landfill area. This value (0.051 ou.$m^3/m^2/s$) was taken to be representative of "standard" Class 2 odour emissions. As discussed above, it was then necessary to apply a proportionate reduction factor, to more accurately estimate emissions from proposed landfill operations, which will accept a low proportion of organic and biodegradable material

At the waste management and Class 2 landfill facility operated by the proponent at Alexandria, the total amount of organic or biodegradable material received in 2006 was 5,282 tonnes. In the past at a standard Class 2 landfill operation, all of this would have been landfilled. However, under the modern operating conditions most of these materials were recovered or recycled and, of the 5,282 tonnes of organic and potentially biodegradable materials, only 32 tonnes actually went to landfill. Thus, less than 1% was landfilled [32 / 5282 = 0.6%]. Odour emissions from capped areas have therefore been taken to be 1% of the standard historical Class 2 odour emissions.

In addition to odours from capped areas, there may be small quantities of odour emitted from the active tipping face. Odour measurements from the covered active tipping face at the proponent's Alexandria facility have been collected by **The Odour Unit (2006)** and are considered to be representative of emissions from this project, given that the two facilities will accept similar materials. Odour emissions from two different surfaces were measured; shipping container alternate daily cover and virgin excavated natural material (VENM) cover. The higher of these measurement data have been used for the modelling which is the more conservative approach.

Odour emissions from the greenwaste windrows were taken to be equivalent to measurements on greenwaste at Australian Native Landscapes operations at Eastern Creek (**Holmes Air Sciences, 2003**). It has been assumed that the total area of the greenwaste windrows occupies no more than 5,000 m^2. Odour emissions from the leachate dam/trench were taken from measurements made at the Eastern Creek landfill (**Holmes Air Sciences, 2003**) and assume aerobic conditions.

Table 11 provides the quantitative information on each odour source used in the dispersion modelling. Odour emissions in the dispersion model have been multiplied by the recommended peak-to-mean ratios for different source types (see **Appendix C**) to predict odour levels for nose response times. Peak-to-mean factors for the near-field have been applied for the purposes of this assessment. For area sources, these factors have numerical values of 2.5 for unstable and neutral atmospheric conditions and 2.3 for stable conditions in the near field.

Table 11 : Odour sources and emissions used in the dispersion modelling

Source	Area (m^2)	SOER ($ou.m^3/m^2/s$)	SOER with peak-to-mean ($ou.m^3/m^2/s$)		TOER with peak-to-mean ($ou.m^3/s$)	
			Neutral (2.5)	Stable (2.3)	Neutral (2.5)	Stable (2.3)
Capped areas	220,000	0.00051*	0.0013	0.0012	280	258
Covered tip face	450	3.83	9.58	8.81	4309	3964
Greenwaste windrows	5,000	0.105	0.263	0.242	1313	1208
Leachate pond/trench	30	0.069	0.173	0.159	5	5

** 1% of estimated average odour emissions from standard Class 2 landfills*
SOER = Specific Odour Emission Rate. TOER = Total Odour Emission Rate.

The odour emissions shown in **Table 11** have been taken to represent the "upper limit" of emissions from the project, given the tight controls on materials that will be accepted for landfill, the low proportion of biodegradable materials and the assumed maximum extents of odour emitting surfaces. For example, the capped area is assumed to be 22 hectares, which is the maximum landfill area and will only be reached after 20 years.

Also, landfill gas monitoring at the Alexandria site (**EMR, 2005 and 2006**) has found that there have been negligible methane emissions detected from the landfill cap.

In addition, the proponent has proposed the use of a product referred to as "BioMagic". BioMagic is a solution which acts as an oxidising agent to speed up the bacteria consumption of waste in order to reduce or eliminate odours. This product is proposed for use on any identified odour source at the site including the greenwaste stockpiles, composting products, the active tipping face and uncovered tipping areas. The product has the potential to control odour emissions from many of the sources listed in **Table 11**, although no emission reduction has been assumed for the dispersion modelling.

5.3 Approach to Odour Assessment

The approach taken for the odour assessment was to use estimated odour emissions (refer **Table 11**), meteorological information and a dispersion model to predict off-site odour levels from the facility. Model predictions were then compared with the DECC's odour assessment criteria.

The dispersion model used was CALPUFF (Version 6.113). CALPUFF is an advanced computer-based dispersion model that simulates the dispersion of emissions by representing emissions as a series of puffs emitted sequentially. Provided the rate at which the puffs are emitted is sufficiently rapid, the puffs will overlap and the serial release will represent a continuous release. The advantage of the puff modelling approach over the steady state Gaussian models such as ISCST3 and AUSPLUME, which have also been widely used in source dispersion assessments in the past, is that the progress and dispersion of each individual puff can be treated separately and can be made to account for local wind conditions and the way in which wind conditions at a particular place vary with time. This is particularly important for areas with complex terrain that would influence wind patterns, such as the quarry void at the project site.

The CALPUFF model makes use of wind fields generated by the CALMET model. CALMET generates a three-dimensional wind field on an hourly basis by taking observations of winds at selected locations and interpolating these to produce information on wind speed and direction at a grid of regularly spaced points covering the area of interest. Modifications that

are imposed on this interpolated wind field (by topography and differential heating and differential surface roughness) are then applied to the winds at each grid point to develop a final wind field.

A wind field has been generated for each hour of the 2004 calendar year using meteorological data collected by DECC at St Marys. The CALMET model has essentially used the data from the St Marys site to determine wind patterns over the entire modelling domain (that is, for the area shown in **Figure 1**), given information on the local landuse and terrain features. In addition, the wind data from St Marys have been used as input to the CSIRO's prognostic model (The Air Pollution Model, TAPM) in order to generate upper air information on higher altitude winds and temperature profiles as required by the CALMET model. TAPM is a prognostic model which has the ability to generate meteorological data for any location in Australia (from 1997 onwards) based on synoptic information determined from the six hourly Limited Area Prediction System (LAPS) (**Puri *et al.*, 1997**). The model is discussed further in the accompanying user manual (see **Hurley, 2002**).

A summary of the data and parameters used as part of the meteorological component of this study are shown in **Table 12**.

Table 12 : Summary of meteorological parameters used for this study

TAPM (v 2.0)	
Number of grids (spacing)	4 (30 km, 10 km, 3 km, 1 km)
Number of grids point	25 x 25 x 25
Year of analysis	Jan 2004 to Dec 2004
Centre of analysis	33°49' S, 150°48.5' E
Data assimilation	St Marys
CALMET (v 5.5)	
Meteorological grid domain	5 km x 5 km
Meteorological grid resolution	0.1 km
Number of grid cells	50 x 50 x 9
Surface meteorological stations	St Marys for wind velocity and temperature. Cloud cover from Sydney Airport (BoM). Ceiling height, pressure and relative humidity by TAPM.
Upper air meteorological station	Data extracted from TAPM simulation for proposed site
Simulation length	8784 hours (Jan 2004 to Dec 2004)
Mode	Diagnostic wind module

The odour modelling has been performed using the CALMET meteorological information as described above with the odour emission information from **Section 5.2**. The way in which the model has been used in this study has been to predict the 1-hour average odour levels (expressed in odour units) at 125 receptors around the site. The receptor locations are the same as those used for the dust modelling and have been chosen to provide greater resolution near the modelled emission sources.

Plots of the odour levels at the 99th percentile have been compiled (refer **Figure 11**), showing the extent to which odours are predicted to occur for 99% of the time. This allows for direct comparison with the DECC's odour assessment criteria.

5.4 Assessment of Odour Impacts

Odour modelling results are shown in **Figure 11**. The contours extend further to the north and south, consistent with the predominant wind patterns in the area (refer **Figure 4**). It can be seen that the most stringent DECC odour criteria, 2 odour units, does not extend into any residential areas, suggesting that adverse odour impacts from the project would not occur.

Table 13 shows the model results for two nearby sensitive receptor locations. These receptor locations are shown in **Figure 6**.

Table 13 : Odour model predictions at two nearby sensitive receptors

Receptor ID	Predicted 99th percentile nose-response odour levels (odour units)	Criteria
R1	1.1	2
R2	0.3	2

As the model results for the nearby sensitive receptors are below the DECC's most stringent odour criteria of 2 odour units, the predicted odour impacts of the proposed activities have been taken to be acceptable.

Some caution should however be given to the model results as a reduction to odour emissions has been assumed on the basis that limited odour generating material will be landfilled. Should the quantity of biodegradable material accepted at the landfill be higher than anticipated, the potential for adverse odour impacts will also increase.

It is worth noting that the experience and measurements associated with the Alexandria facility suggest that there will be limited odour generating material going to landfill. In addition, recent changes to licensing under the Protection of the Environment Operations Act encourage the recycling of all materials where possible.

5.5 Odour Mitigation Measures

It is anticipated that landfill gas monitoring will be a standard licence condition and this will be conducted periodically to identify whether the activities generate significant odour. Gas monitoring will be undertaken following *Environment Guidelines: Solid Waste Landfills.* (**DECC, 1996**). Monitoring is proposed to be conducted monthly for initial operations and, if no adverse impacts are observed, will be reduced to quarterly after six months of operations and to annually after 18 months of operation. Monitoring of landfill gas (methane and hydrogen sulfide) will be undertaken using a suitable landfill gas monitor.

Landfill gas extraction will be provided for by the site operation in the event that gas or odour emissions are detected.

As discussed in **Section 5.2**, a product known as BioMagic will be tested on key odour sources to minimise emissions. It would be useful if the effectiveness of this product can be demonstrated, for example through odour sampling.

6. CONCLUSIONS

This report has assessed the dust and odour impacts associated with the proposed materials processing centre, waste transfer station and non-putrescible Class 2 inert and solid waste landfill facility at Eastern Creek. Dispersion modelling has been used to predict off-site dust and odour levels due to the proposed activities.

The dust modelling results showed that annual average PM_{10}, TSP and deposition levels at nearest sensitive receptors would be below the DECC's assessment criteria, even when considering existing levels. The dust modelling is conservative and impacts are likely to be lower than predicted. The dispersion modelling has highlighted a potential for exceedances of the DECC's 24-hour average PM_{10} criterion at nearest receptors, due to project activities. Best practice dust mitigation measures as well as continuous dust monitoring with real-time strategies should be considered once the facility is operational to minimise the potential for adverse impacts and to ensure that air quality criteria are not exceeded at nearest receptors.

Odour levels at nearest receptors were predicted to be below the most stringent assessment criterion noted by the DECC. The results therefore suggested that there would be no adverse odour impacts associated with the project. Modelling assumed that some reduction to "standard" odour emissions from Class 2 landfills was appropriate and landfill gas monitoring would be important to show that the odour emissions are as low as anticipated.

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APPENDIX A
JOINT WIND SPEED, WIND DIRECTION AND STABILITY CLASS FREQUENCY TABLES

STATISTICS FOR FILE: C:\Jobs\LtHorse\metdata\StMarys\stm2004.aus
MONTHS: All
HOURS : All
OPTION: Frequency

PASQUILL STABILITY CLASS 'A'

Wind Speed Class (m/s)

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.001025	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001025
NE	0.001480	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001480
ENE	0.000455	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000455
E	0.000455	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000455
ESE	0.000228	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000228
SE	0.000455	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000455
SSE	0.000569	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000569
S	0.001138	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001138
SSW	0.000569	0.000228	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000797
SW	0.000569	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000569
WSW	0.000455	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000455
W	0.000683	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000683
WNW	0.000683	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000683
NW	0.000911	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000911
NNW	0.001708	0.000114	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001821
N	0.000797	0.000114	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000911
CALM									0.016166
TOTAL	0.012181	0.000455	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.028802

MEAN WIND SPEED (m/s) = 0.59
NUMBER OF OBSERVATIONS = 253

PASQUILL STABILITY CLASS 'B'

Wind Speed Class (m/s)

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.005920	0.005237	0.000114	0.000000	0.000000	0.000000	0.000000	0.000000	0.011270
NE	0.004440	0.001935	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.006375
ENE	0.003985	0.000797	0.000114	0.000000	0.000000	0.000000	0.000000	0.000000	0.004895
E	0.003643	0.002391	0.000228	0.000000	0.000000	0.000000	0.000000	0.000000	0.006261
ESE	0.003301	0.004212	0.001594	0.000000	0.000000	0.000000	0.000000	0.000000	0.009107
SE	0.004098	0.004440	0.001708	0.000000	0.000000	0.000000	0.000000	0.000000	0.010246
SSE	0.003985	0.005123	0.001252	0.000000	0.000000	0.000000	0.000000	0.000000	0.010360
S	0.012523	0.006944	0.001594	0.000114	0.000000	0.000000	0.000000	0.000000	0.021175
SSW	0.008766	0.004895	0.001480	0.000114	0.000000	0.000000	0.000000	0.000000	0.015255
SW	0.004098	0.002732	0.001708	0.000000	0.000000	0.000000	0.000000	0.000000	0.008538
WSW	0.002163	0.002391	0.001252	0.000000	0.000000	0.000000	0.000000	0.000000	0.005806
W	0.001480	0.001480	0.000797	0.000000	0.000000	0.000000	0.000000	0.000000	0.003757
WNW	0.002277	0.000797	0.000683	0.000114	0.000000	0.000000	0.000000	0.000000	0.003871
NW	0.005464	0.001594	0.000683	0.000000	0.000000	0.000000	0.000000	0.000000	0.007741
NNW	0.017077	0.013661	0.000683	0.000000	0.000000	0.000000	0.000000	0.000000	0.031421
N	0.014117	0.017304	0.001480	0.000000	0.000000	0.000000	0.000000	0.000000	0.032901
CALM									0.019012
TOTAL	0.097336	0.075934	0.015369	0.000342	0.000000	0.000000	0.000000	0.000000	0.207992

MEAN WIND SPEED (m/s) = 1.57
NUMBER OF OBSERVATIONS = 1827

PASQUILL STABILITY CLASS 'C'

Wind Speed Class (m/s)

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.001252	0.002277	0.000114	0.000000	0.000000	0.000000	0.000000	0.000000	0.003643
NE	0.001594	0.001025	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002618
ENE	0.001252	0.001366	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002618
E	0.001594	0.002049	0.001480	0.000114	0.000000	0.000000	0.000000	0.000000	0.005237
ESE	0.001366	0.002505	0.004895	0.001138	0.000000	0.000000	0.000000	0.000000	0.009904
SE	0.001366	0.001935	0.002960	0.001594	0.000000	0.000000	0.000000	0.000000	0.007855
SSE	0.003074	0.002618	0.003188	0.000911	0.000000	0.000000	0.000000	0.000000	0.009791
S	0.008197	0.005009	0.002732	0.001594	0.000000	0.000000	0.000000	0.000000	0.017532
SSW	0.005351	0.003415	0.003757	0.001708	0.000000	0.000000	0.000000	0.000000	0.014230
SW	0.002277	0.001935	0.002163	0.001708	0.000000	0.000000	0.000000	0.000000	0.008083
WSW	0.000683	0.001935	0.002505	0.000911	0.000000	0.000000	0.000000	0.000000	0.006034
W	0.000683	0.001252	0.003301	0.001025	0.000000	0.000000	0.000000	0.000000	0.006261
WNW	0.000342	0.000569	0.002618	0.002505	0.000000	0.000000	0.000000	0.000000	0.006034
NW	0.001594	0.000797	0.001821	0.000683	0.000000	0.000000	0.000000	0.000000	0.004895
NNW	0.002277	0.004554	0.001025	0.000455	0.000000	0.000000	0.000000	0.000000	0.008311
N	0.004212	0.006034	0.000342	0.000228	0.000000	0.000000	0.000000	0.000000	0.010815
CALM									0.024362
TOTAL	0.037113	0.039276	0.032901	0.014572	0.000000	0.000000	0.000000	0.000000	0.148224

MEAN WIND SPEED (m/s) = 2.27
NUMBER OF OBSERVATIONS = 1302

PASQUILL STABILITY CLASS 'D'

Wind Speed Class (m/s)

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.000114	0.001252	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001366
NE	0.000342	0.002391	0.000228	0.000000	0.000000	0.000000	0.000000	0.000000	0.002960
ENE	0.000342	0.003074	0.000683	0.000000	0.000000	0.000000	0.000000	0.000000	0.004098
E	0.000342	0.004440	0.003757	0.000228	0.000000	0.000000	0.000000	0.000000	0.008766
ESE	0.000228	0.004554	0.014913	0.007400	0.000911	0.000114	0.000000	0.000000	0.028119
SE	0.000342	0.002277	0.007855	0.005351	0.000911	0.000114	0.000000	0.000000	0.016849
SSE	0.000569	0.002505	0.003871	0.000683	0.000114	0.000000	0.000000	0.000000	0.007741
S	0.003188	0.001708	0.002277	0.001366	0.000569	0.000000	0.000000	0.000000	0.009107
SSW	0.001821	0.002960	0.003643	0.003415	0.002163	0.001138	0.000342	0.000000	0.015483
SW	0.001366	0.001594	0.002618	0.002505	0.000342	0.000000	0.000000	0.000000	0.008424
WSW	0.000228	0.001138	0.002618	0.001935	0.001025	0.000114	0.000000	0.000000	0.007058
W	0.000114	0.001480	0.002505	0.001025	0.000911	0.000114	0.000000	0.000000	0.006148
WNW	0.000228	0.001366	0.003415	0.002618	0.002391	0.000228	0.000000	0.000000	0.010246
NW	0.000342	0.000569	0.002846	0.002163	0.000569	0.000455	0.000000	0.000000	0.006944
NNW	0.001025	0.001480	0.001935	0.001138	0.000228	0.000000	0.000000	0.000000	0.005806
N	0.001252	0.002732	0.001025	0.000683	0.000342	0.000000	0.000000	0.000000	0.006034
CALM									0.004781
TOTAL	0.011840	0.035519	0.054189	0.030510	0.010474	0.002277	0.000342	0.000000	0.149932

MEAN WIND SPEED (m/s) = 3.70
NUMBER OF OBSERVATIONS = 1317

PASQUILL STABILITY CLASS 'E'

Wind Speed Class (m/s)

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.000000	0.000569	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000569
NE	0.000000	0.001138	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001138
ENE	0.000000	0.000911	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000911
E	0.000000	0.003301	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.003301
ESE	0.000000	0.005123	0.000797	0.000000	0.000000	0.000000	0.000000	0.000000	0.005920
SE	0.000000	0.006148	0.000683	0.000000	0.000000	0.000000	0.000000	0.000000	0.006831
SSE	0.000000	0.004668	0.000683	0.000000	0.000000	0.000000	0.000000	0.000000	0.005351
S	0.000000	0.006148	0.000342	0.000000	0.000000	0.000000	0.000000	0.000000	0.006489
SSW	0.000000	0.007400	0.001252	0.000000	0.000000	0.000000	0.000000	0.000000	0.008652
SW	0.000000	0.003529	0.000569	0.000000	0.000000	0.000000	0.000000	0.000000	0.004098
WSW	0.000000	0.002846	0.000569	0.000000	0.000000	0.000000	0.000000	0.000000	0.003415
W	0.000000	0.002163	0.000683	0.000000	0.000000	0.000000	0.000000	0.000000	0.002846
WNW	0.000000	0.003529	0.000455	0.000000	0.000000	0.000000	0.000000	0.000000	0.003985
NW	0.000000	0.001821	0.000342	0.000114	0.000000	0.000000	0.000000	0.000000	0.002277
NNW	0.000000	0.003074	0.000455	0.000000	0.000000	0.000000	0.000000	0.000000	0.003529
N	0.000000	0.004895	0.000228	0.000000	0.000000	0.000000	0.000000	0.000000	0.005123
CALM									0.000000
TOTAL	0.000000	0.057263	0.007058	0.000114	0.000000	0.000000	0.000000	0.000000	0.064435

MEAN WIND SPEED (m/s) = 2.46
NUMBER OF OBSERVATIONS = 566

PASQUILL STABILITY CLASS 'F'

Wind Speed Class (m/s)

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.006148	0.000797	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.006944
NE	0.007400	0.000911	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.008311
ENE	0.003415	0.000683	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.004098
E	0.004212	0.001252	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.005464
ESE	0.003188	0.002163	0.000228	0.000000	0.000000	0.000000	0.000000	0.000000	0.005578
SE	0.004098	0.002505	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.006603
SSE	0.015369	0.002277	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.017646
S	0.056011	0.007172	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.063183
SSW	0.056466	0.009563	0.000228	0.000000	0.000000	0.000000	0.000000	0.000000	0.066257
SW	0.027095	0.002960	0.000455	0.000000	0.000000	0.000000	0.000000	0.000000	0.030510
WSW	0.008880	0.001480	0.000114	0.000000	0.000000	0.000000	0.000000	0.000000	0.010474
W	0.004668	0.001708	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.006375
WNW	0.003757	0.001366	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.005123
NW	0.003188	0.001708	0.000342	0.000000	0.000000	0.000000	0.000000	0.000000	0.005237
NNW	0.006148	0.002277	0.000228	0.000000	0.000000	0.000000	0.000000	0.000000	0.008652
N	0.018101	0.003074	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.021175
CALM									0.128985
TOTAL	0.228142	0.041894	0.001594	0.000000	0.000000	0.000000	0.000000	0.000000	0.400615

MEAN WIND SPEED (m/s) = 0.90
NUMBER OF OBSERVATIONS = 3519

ALL PASQUILL STABILITY CLASSES

Wind Speed Class (m/s)

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.014458	0.010132	0.000228	0.000000	0.000000	0.000000	0.000000	0.000000	0.024818
NE	0.015255	0.007400	0.000228	0.000000	0.000000	0.000000	0.000000	0.000000	0.022883
ENE	0.009449	0.006831	0.000797	0.000000	0.000000	0.000000	0.000000	0.000000	0.017077
E	0.010246	0.013434	0.005464	0.000342	0.000000	0.000000	0.000000	0.000000	0.029485
ESE	0.008311	0.018556	0.022427	0.008538	0.000911	0.000114	0.000000	0.000000	0.058857
SE	0.010360	0.017304	0.013206	0.006944	0.000911	0.000114	0.000000	0.000000	0.048839
SSE	0.023566	0.017190	0.008994	0.001594	0.000114	0.000000	0.000000	0.000000	0.051457
S	0.081056	0.026981	0.006944	0.003074	0.000569	0.000000	0.000000	0.000000	0.118625
SSW	0.072974	0.028461	0.010360	0.005237	0.002163	0.001138	0.000342	0.000000	0.120674
SW	0.035405	0.012750	0.007514	0.004212	0.000342	0.000000	0.000000	0.000000	0.060223
WSW	0.012409	0.009791	0.007058	0.002846	0.001025	0.000114	0.000000	0.000000	0.033242
W	0.007628	0.008083	0.007286	0.002049	0.000911	0.000114	0.000000	0.000000	0.026070
WNW	0.007286	0.007628	0.007172	0.005237	0.002391	0.000228	0.000000	0.000000	0.029941
NW	0.011498	0.006489	0.006034	0.002960	0.000569	0.000455	0.000000	0.000000	0.028005
NNW	0.028233	0.025159	0.004326	0.001594	0.000228	0.000000	0.000000	0.000000	0.059540
N	0.038479	0.034153	0.003074	0.000911	0.000342	0.000000	0.000000	0.000000	0.076958
CALM									0.193306
TOTAL	0.386612	0.250342	0.111111	0.045537	0.010474	0.002277	0.000342	0.000000	1.000000

MEAN WIND SPEED (m/s) = 1.76
NUMBER OF OBSERVATIONS = 8784

FREQUENCY OF OCCURENCE OF STABILITY CLASSES

A : 2.9%
B : 20.8%
C : 14.8%
D : 15.0%
E : 6.4%
F : 40.1%

STABILITY CLASS BY HOUR OF DAY

Hour	A	B	C	D	E	F
01	0000	0000	0000	0021	0022	0323
02	0000	0000	0000	0020	0023	0323
03	0000	0000	0000	0015	0019	0332
04	0000	0000	0000	0017	0021	0328
05	0000	0000	0029	0022	0018	0297
06	0000	0022	0145	0032	0009	0158
07	0000	0115	0180	0041	0001	0029
08	0026	0192	0120	0028	0000	0000
09	0042	0196	0085	0043	0000	0000
10	0037	0244	0055	0030	0000	0000
11	0048	0255	0049	0014	0000	0000
12	0046	0259	0048	0013	0000	0000
13	0031	0242	0071	0022	0000	0000
14	0020	0168	0142	0036	0000	0000
15	0002	0092	0151	0121	0000	0000
16	0001	0041	0122	0202	0000	0000
17	0000	0001	0068	0271	0010	0016
18	0000	0000	0027	0188	0072	0079
19	0000	0000	0010	0062	0115	0179
20	0000	0000	0000	0032	0094	0240
21	0000	0000	0000	0028	0057	0281
22	0000	0000	0000	0015	0043	0308
23	0000	0000	0000	0024	0038	0304
24	0000	0000	0000	0020	0024	0322

STABILITY CLASS BY MIXING HEIGHT

Mixing height	A	B	C	D	E	F
<=500 m	0027	0369	0495	0190	0566	3519
<=1000 m	0152	0859	0348	0190	0000	0000
<=1500 m	0074	0599	0459	0866	0000	0000
<=2000 m	0000	0000	0000	0058	0000	0000
<=3000 m	0000	0000	0000	0013	0000	0000
>3000 m	0000	0000	0000	0000	0000	0000

MIXING HEIGHT BY HOUR OF DAY

Hour	0000 to 0100	0100 to 0200	0200 to 0400	0400 to 0800	0800 to 1600	1600 to 3200	Greater than 3200
01	0318	0019	0013	0000	0013	0003	0000
02	0314	0032	0007	0001	0011	0001	0000
03	0322	0025	0010	0000	0007	0002	0000
04	0319	0028	0009	0001	0005	0004	0000
05	0322	0031	0004	0000	0005	0004	0000
06	0209	0092	0059	0001	0002	0003	0000
07	0121	0061	0119	0064	0001	0000	0000
08	0000	0070	0123	0173	0000	0000	0000
09	0000	0000	0100	0193	0073	0000	0000
10	0000	0000	0000	0232	0134	0000	0000
11	0000	0000	0000	0146	0220	0000	0000
12	0000	0000	0000	0092	0274	0000	0000
13	0000	0000	0000	0000	0366	0000	0000
14	0000	0000	0000	0000	0366	0000	0000
15	0000	0000	0000	0000	0366	0000	0000
16	0000	0000	0000	0000	0366	0000	0000
17	0016	0004	0006	0000	0339	0001	0000
18	0072	0061	0019	0001	0208	0005	0000
19	0169	0090	0036	0002	0061	0008	0000
20	0230	0072	0034	0006	0022	0002	0000
21	0271	0048	0022	0006	0016	0003	0000
22	0301	0037	0018	0000	0006	0004	0000
23	0297	0036	0018	0003	0009	0003	0000
24	0309	0027	0017	0001	0009	0003	0000

APPENDIX B
ESTIMATED DUST EMISSIONS

ESTIMATED DUST EMISSIONS (Year 0 – worst case)

ACTIVITY	TSP emission/year	Intensity	units	Emission factor	units	Variable 1	units	Variable 2	units	Variable 3	units
Vehicles COMING TO site (paved)	20776	148400	trips/year			0.7	km/one way trip	0.2	kg/VKT		
Dumping material to MPC or segregated stockpile	3757	1250000	t/y	0.01002	kg/t	1.215	average (ws/2.2)^1.3	0.5	moisture content - %	70	% dust control
Dumping material to WTS	2254	750000	t/y	0.01002	kg/t	1.215	average (ws/2.2)^1.3	0.5	moisture content - %	70	% dust control
Loading material by FEL for processing	3757	1250000	t/y	0.01002	kg/t	1.215	average (ws/2.2)^1.3	0.5	moisture content - %	70	% dust control
Loading and sorting material by excavator	12523	1250000	t/y	0.01002	kg/t	1.215	average (ws/2.2)^1.3	0.5	moisture content - %		
Screening material	3938	630000	t/y	0.01250	kg/t	50	% dust control by water sprays				
Crushing material	270	200000	t/y	0.00270	kg/t	50	% dust control by water sprays				
Loading material to stockpiles	6262	1250000	t/y	0.01002	kg/t	1.215	average (ws/2.2)^1.3	0.5	moisture content - %	50	% dust control
Loading material to trucks	10019	2000000	t/y	0.01002	kg/t	1.215	average (ws/2.2)^1.3	0.5	moisture content - %	50	% dust control
Hauling material to landfill (unpaved, inc return)	92312	23078	trips/year			4	km/return trip	1.0	kg/VKT		
Vehicles LEAVING site (paved)	20776	148400	trips/year			0.7	km/one way trip	0.2	kg/VKT		
Dumping material to landfill	10019	1000000	t/y	0.01002	kg/t	1.215	average (ws/2.2)^1.3	0.5	moisture content - %		
Wind erosion from exposed landfill area	7247	22	ha	329.4	kg/ha/y	112	Av no. of raindays	4	silt content - %	2.4818	% of winds above 5.4 m/s
Wind erosion from soil stockpiles	412*	1	ha	823.5	kg/ha/y	112	Av no. of raindays	10	silt content - %	2.4818	% of winds above 5.4 m/s
Wind erosion from other stockpiles	329*	2	ha	329.4	kg/ha/y	112	Av no. of raindays	4	silt content - %	2.4818	% of winds above 5.4 m/s

* *includes 50% reduction by water sprays*

The dust emission inventories have been prepared using the operational description of the proposed activities provided by the proponent. Estimated emissions are presented for all significant dust generating activities associated with the operations. The relevant emission factors used for the study are described below.

Hauling material / product over road surfaces
After the application of water the emission factor used for trucks hauling material on unsealed surfaces was 1 kg per vehicle kilometre travelled (kg/VKT). For sealed surfaces, 0.2 kg/VKT has been used.

Loading / dumping /transferring material
Each tonne of material loaded will generate a quantity of TSP that will depend on the wind speed and the moisture content. Equation 1 shows the relationship between these variables.

Equation 1

$$E_{TSP} = k \times 0.0016 \times \left(\frac{\left(\frac{U}{2.2}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}} \right) \qquad kg/t$$

where,
E_{TSP} *= TSP emissions*
$k = 0.74$
U *= wind speed(m/s)*
M *= moisture content (%)*
[where $0.25 \leq M \leq 4.8$*]*

Wind erosion
The emission factor for wind erosion is given in Equation 2 below.

Equation 2

$$E_{TSP} = 1.9 \times \left(\frac{s}{1.5}\right) \times \left(\frac{365 - p}{235}\right) \times \left(\frac{f}{15}\right) \qquad \text{kg/ha/day}$$

where,
s = silt content (%)
p = number of raindays per year, and
f = percentage of the time that wind speed is above 5.4 m/s

A summary of dust emission estimates for each activity, activity type, location of emission sources and activity hours is provided below. The location of the sources can be obtained from **Figure 6**. AUSPLUME model input files can be provided on request.

```
 ------------------------------      19-Dec-2007 10:55
  DUST EMISSION CALCULATIONS V2
 ------------------------------

 Output emissions file  : C:\Jobs\LHBC_ERM\ausplume\emiss.src
 Meteorological file    : C:\Jobs\LHBC_ERM\metdata\StMarys\stm2004.aus
 Number of dust sources : 18
 Number of activities   : 15
 No-blast conditions    : None
 Wind sensitive factor  : 0.829 (1.092 adjusted for activity hours)
 Wind erosion factor    : 20.269

  -----ACTIVITY SUMMARY-----
 ACTIVITY NAME : Vehicles COMING TO site (paved)
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 20776 kg/y
 FROM SOURCES  : 10
1 2 3 4 5 6 7 8 9 10
 HOURS OF DAY  :
0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0

 ACTIVITY NAME : Dumping material to MPC or segregated stockpile
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 3757 kg/y
 FROM SOURCES  : 1
6
 HOURS OF DAY  :
0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0

 ACTIVITY NAME : Dumping material to WTF
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 2254 kg/y
 FROM SOURCES  : 4
7 8 9 10
 HOURS OF DAY  :
0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0

 ACTIVITY NAME : Loading material by FEL for processing
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 3757 kg/y
 FROM SOURCES  : 1
6
 HOURS OF DAY  :
0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0

 ACTIVITY NAME : Loading and sorting material by excavator
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 12523 kg/y
 FROM SOURCES  : 3
6 7 8
 HOURS OF DAY  :
0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0

 ACTIVITY NAME : Screening material
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 3938 kg/y
 FROM SOURCES  : 4
7 8 9 10
 HOURS OF DAY  :
0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0

 ACTIVITY NAME : Crushing material
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 270 kg/y
 FROM SOURCES  : 4
7 8 9 10
 HOURS OF DAY  :
0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0

 ACTIVITY NAME : Loading material to stockpiles
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 6262 kg/y
 FROM SOURCES  : 4
7 8 9 10
 HOURS OF DAY  :
0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0

 ACTIVITY NAME : Loading material to trucks
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 10019 kg/y
 FROM SOURCES  : 5
6 7 8 9 10
 HOURS OF DAY  :
0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0
```

```
 ACTIVITY NAME : Hauling material to landfill (unpaved, inc return)
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 92312 kg/y
 FROM SOURCES  : 13
6 7 8 9 10 11 12 13 14 15 16 17 18
 HOURS OF DAY  :
0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0

 ACTIVITY NAME : Vehicles LEAVING site (paved)
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 20776 kg/y
 FROM SOURCES  : 10
1 2 3 4 5 6 7 8 9 10
 HOURS OF DAY  :
0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0

 ACTIVITY NAME : Dumping material to landfill
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 10019 kg/y
 FROM SOURCES  : 4
12 13 17 18
 HOURS OF DAY  :
0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0

 ACTIVITY NAME : Wind erosion from exposed landfill area
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 7247 kg/y
 FROM SOURCES  : 10
4 5 6 12 13 14 15 16 17 18
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Wind erosion from soil stockpiles
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 412 kg/y
 FROM SOURCES  : 4
7 8 9 10
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Wind erosion from other stockpiles
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 329 kg/y
 FROM SOURCES  : 4
7 8 9 10
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 Pit retention sources: 7
12 13 14 15 16 17 18
```

APPENDIX C
PEAK-TO-MEAN RATIOS

Table C1 : Recommended factors for estimating peak concentrations for different source types, distances and stabilities

Source type	Stability	Near field				Far field			p
		i_{max}	x_{max}	P/M 60	P/M 3	i	P/M 60	P/M 3	
Area	Neutral, Convective	0.5	500 – 1000	2.5	1.9	0.4	2.3	1.7	0.15
	Stable	0.5	300 – 800	2.3	1.7	0.3	1.9	1.4	0.10
Line	Neutral, Convective	1.0	350	6	2.8	0.75	6	2.8	0.25
	Stable	1.0	250	6	2.8	0.65	6	2.8	0.25
Surface point	Neutral	2.5	200	25	10	1.2	5 - 7	3	0.2
	Stable	2.5	200	25	10	1.2	5 - 7	3	0.2
	Convective	2	1000	12	7	0.6	3 - 4	2.5	0.15
Tall point	Neutral, Stable	4.5	5 h	35	8	1.0	6	1.3	0.5
	Convective	2.3	2.5 h	17	4	0.5	3	1.1	0.5
Wake affected point	Neutral, Convective	0.4	-	2.3	1.4	-	2.3	1.4	0.1
Volume	Neutral, Convective	0.4	-	2.3	1.4	-	2.3	1.4	0.1

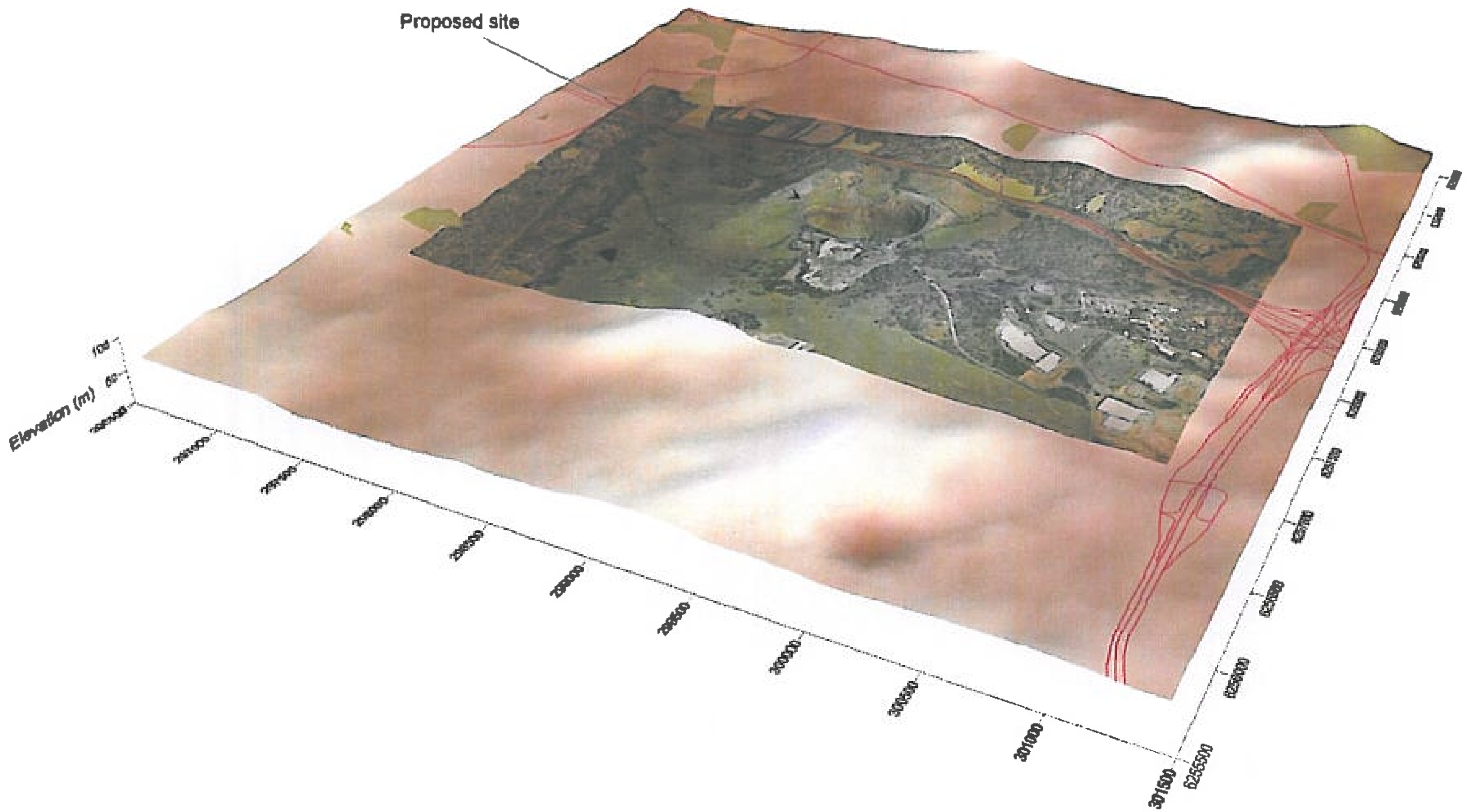
i_{max} is maximum centreline intensity of concentration
x_{max} is the approximation location of i_{max} in metres
P/M 60 is the peak-to-mean ratio for long averaging times (typically 1 hour), at a probability of 10^{-3}
P/M 3 is the best estimates of the peak-to-mean ratio for 3 minute averages, at probability 10^{-3}
p is the averaging time power law exponent
h is stack height

Source: **Katestone Scientific (1998)**

FIGURES

Location of study area

FIGURE 1



Pseudo three-dimensional representation of the local terrain

FIGURE 2

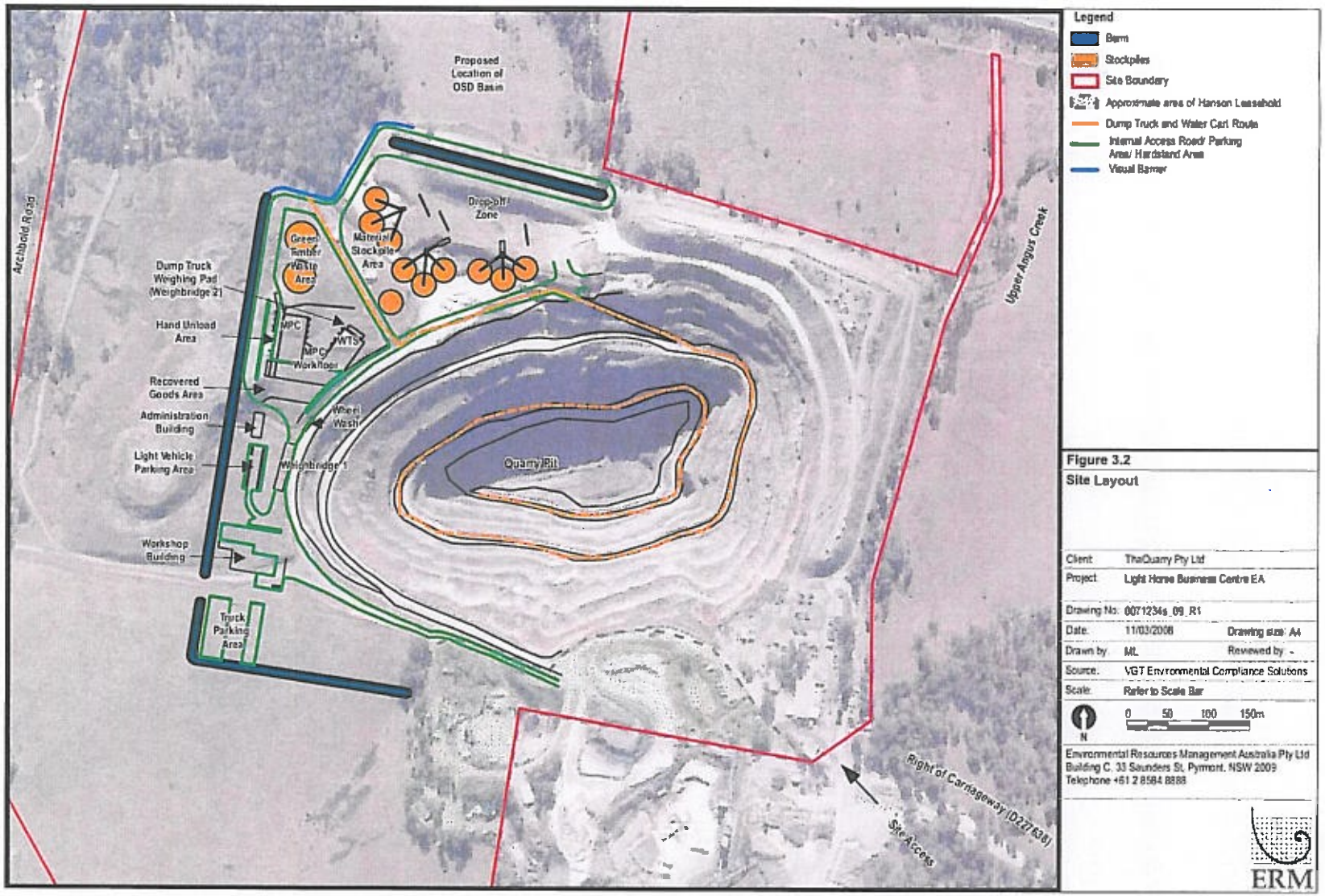
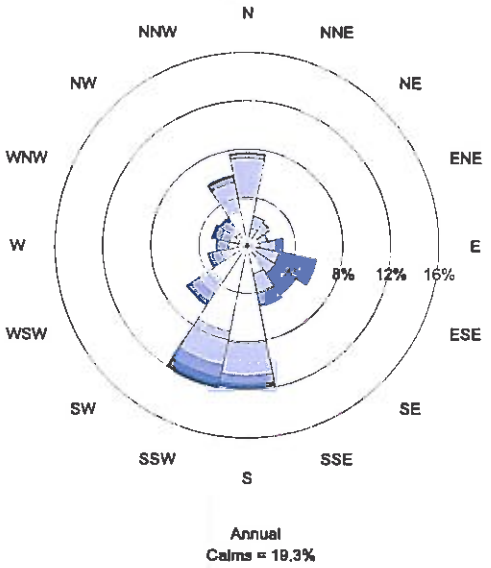


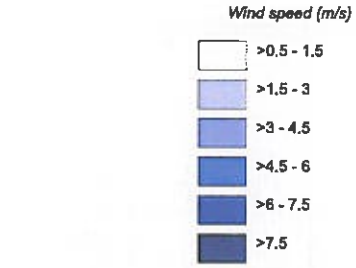
FIGURE 3

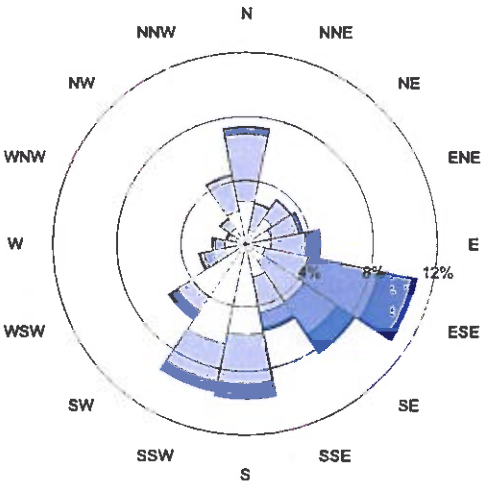
Site layout

Annual and seasonal windroses for St Marys (2004)

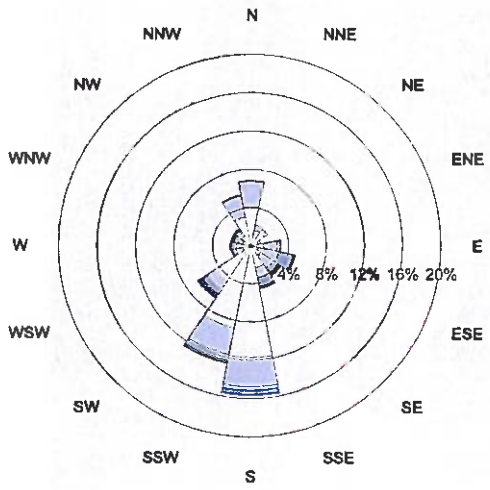


Annual
Calms = 19.3%

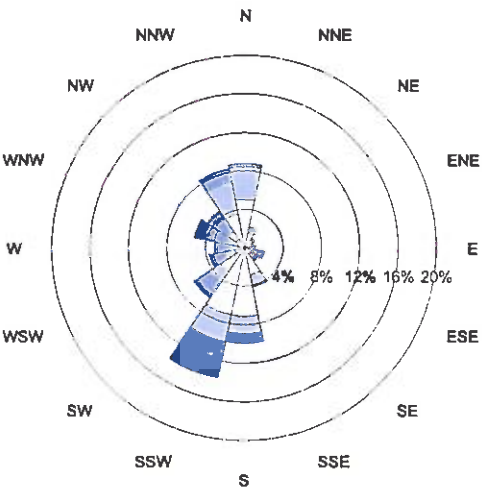




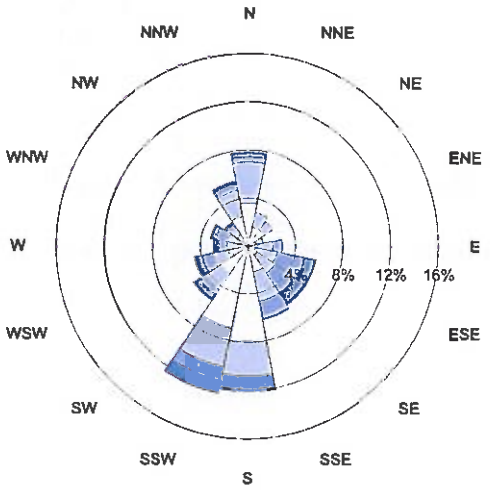
Summer
Calms = 15.8%



Autumn
Calms = 22.4%



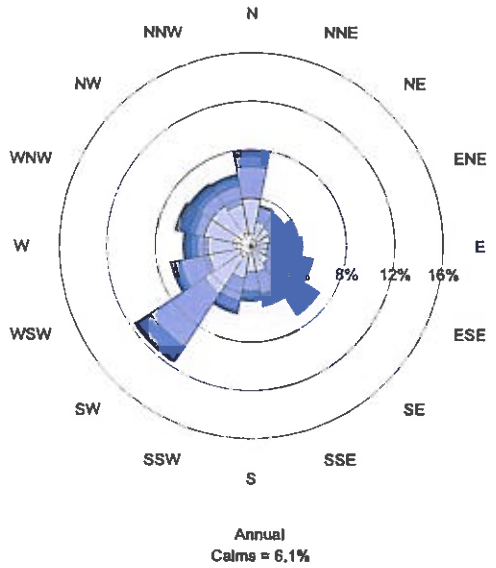
Winter
Calms = 23.1%



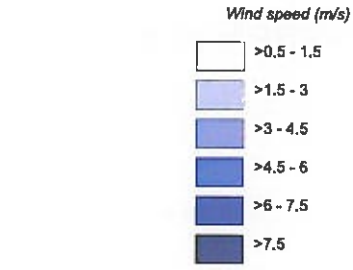
Spring
Calms = 16.0%

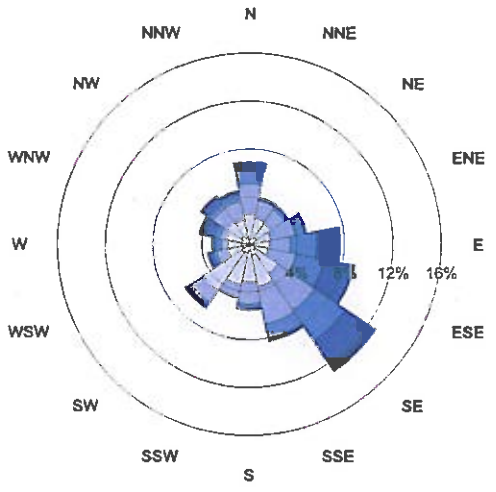
FIGURE 4

Annual and seasonal windroses for Horsley Park (2005)

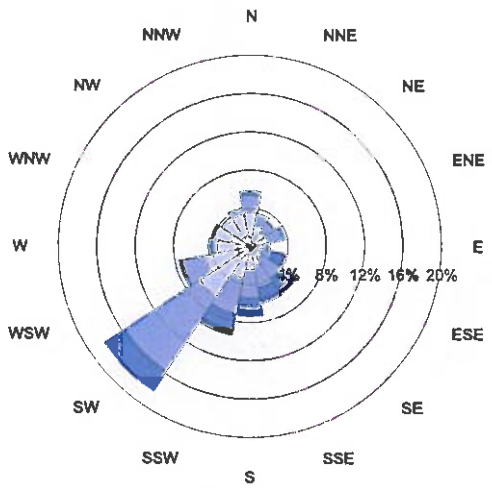


Annual
Calms = 6.1%

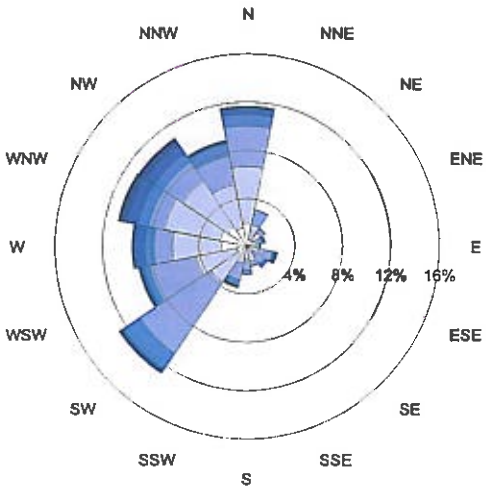




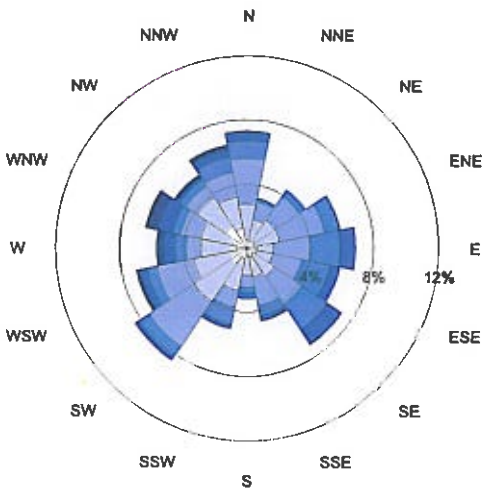
Summer
Calms = 5.4%



Autumn
Calms = 6.4%



Winter
Calms = 6.2%

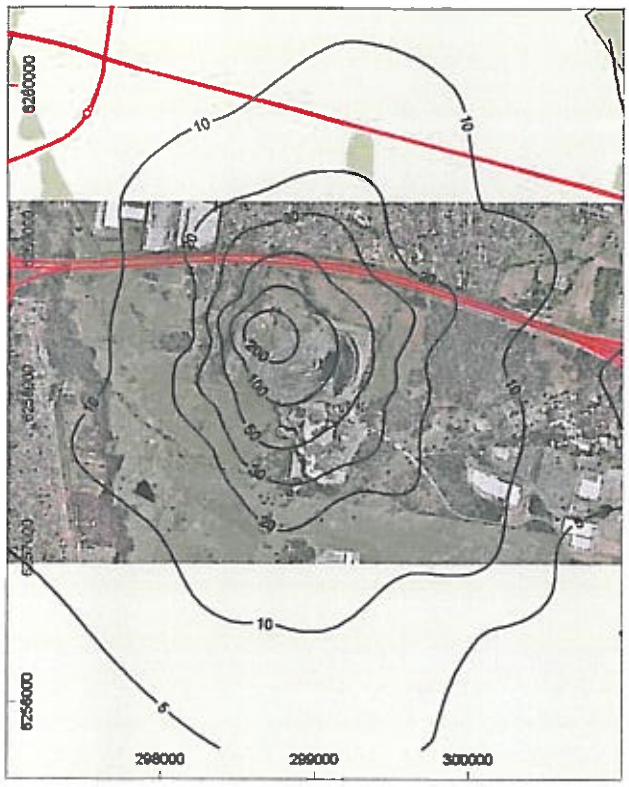


Spring
Calms = 6.4%

FIGURE 5

MGA Zone 56 (GDA 94)

Location of modelled dust sources and receptors



Maximum 24-hour average PM_{10} - $\mu g/m^3$

Annual average PM_{10} - $\mu g/m^3$

Annual average TSP - $\mu g/m^3$

Annual average dust deposition - $g/m^2/month$

Predicted dust concentration and deposition levels due to proposed operations

FIGURE 7

Time series of predicted 24-hour average PM_{10} concentrations at nearest receptors

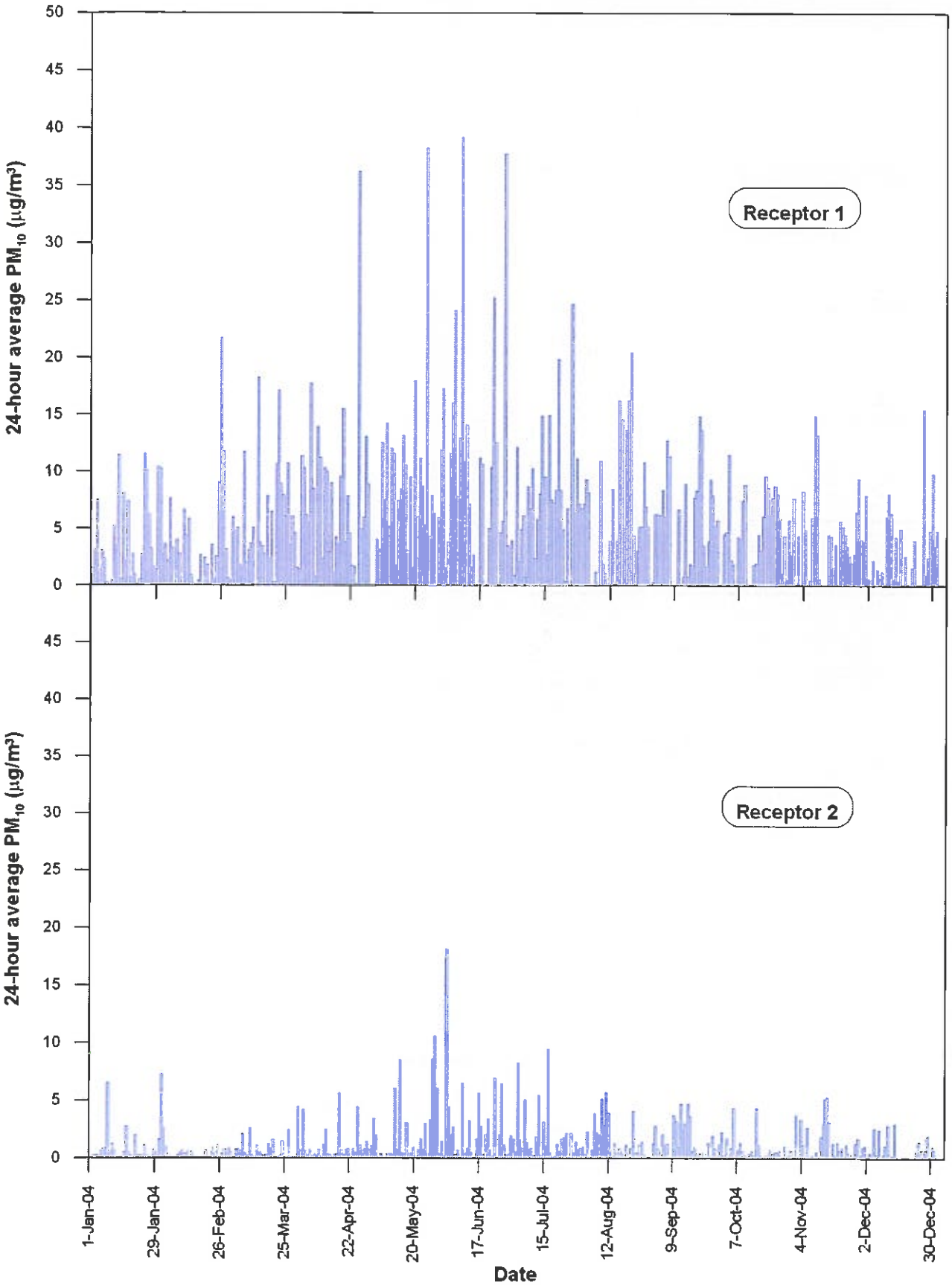


FIGURE 8

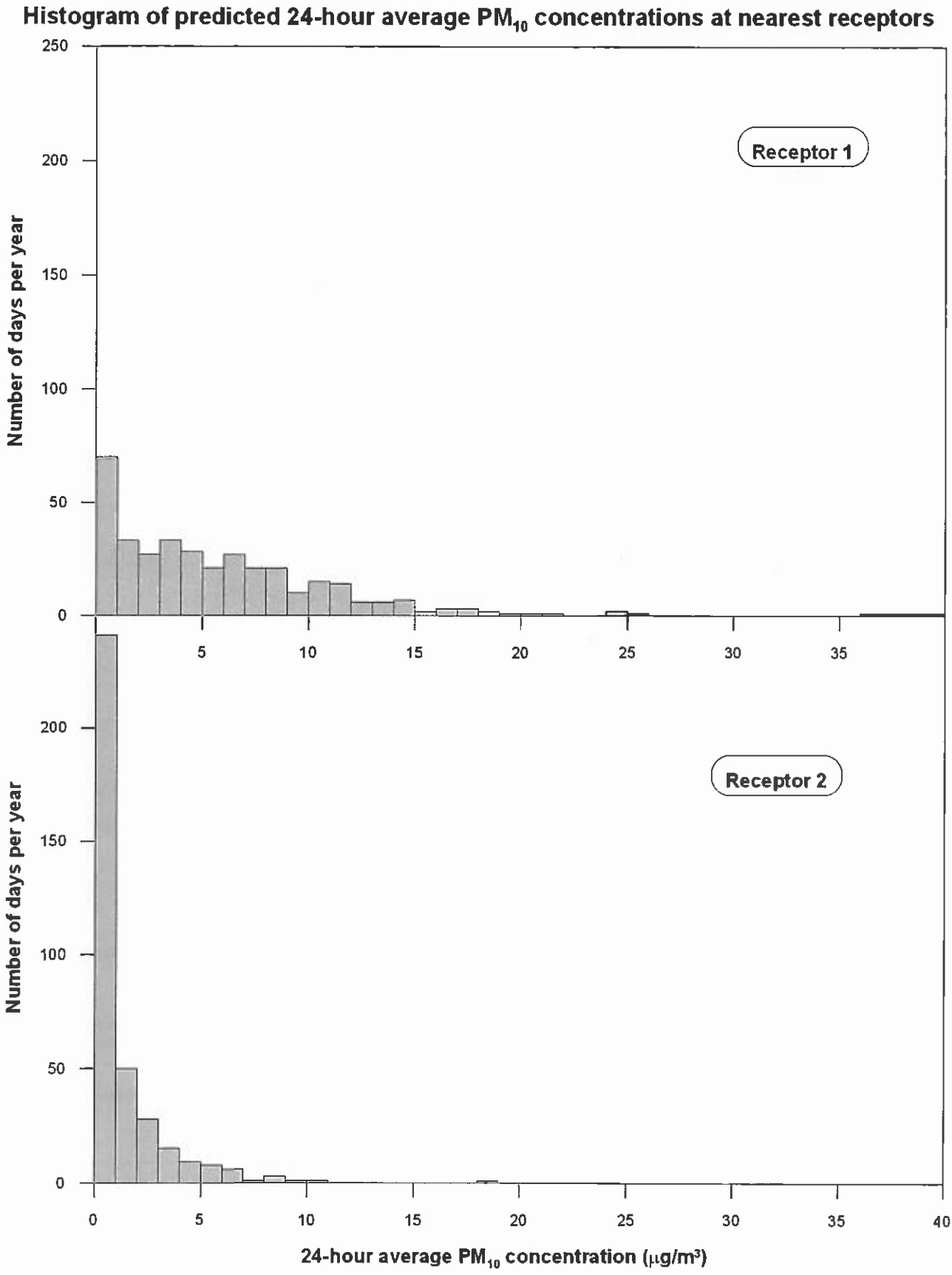

Histogram of predicted 24-hour average PM10 concentrations at nearest receptors
Receptor 1
Receptor 2
Number of days per year
Number of days per year
0
50
100
150
200
250
0
5
10
15
20
25
30
35
40
24-hour average PM10 concentration (µg/m³)

FIGURE 9

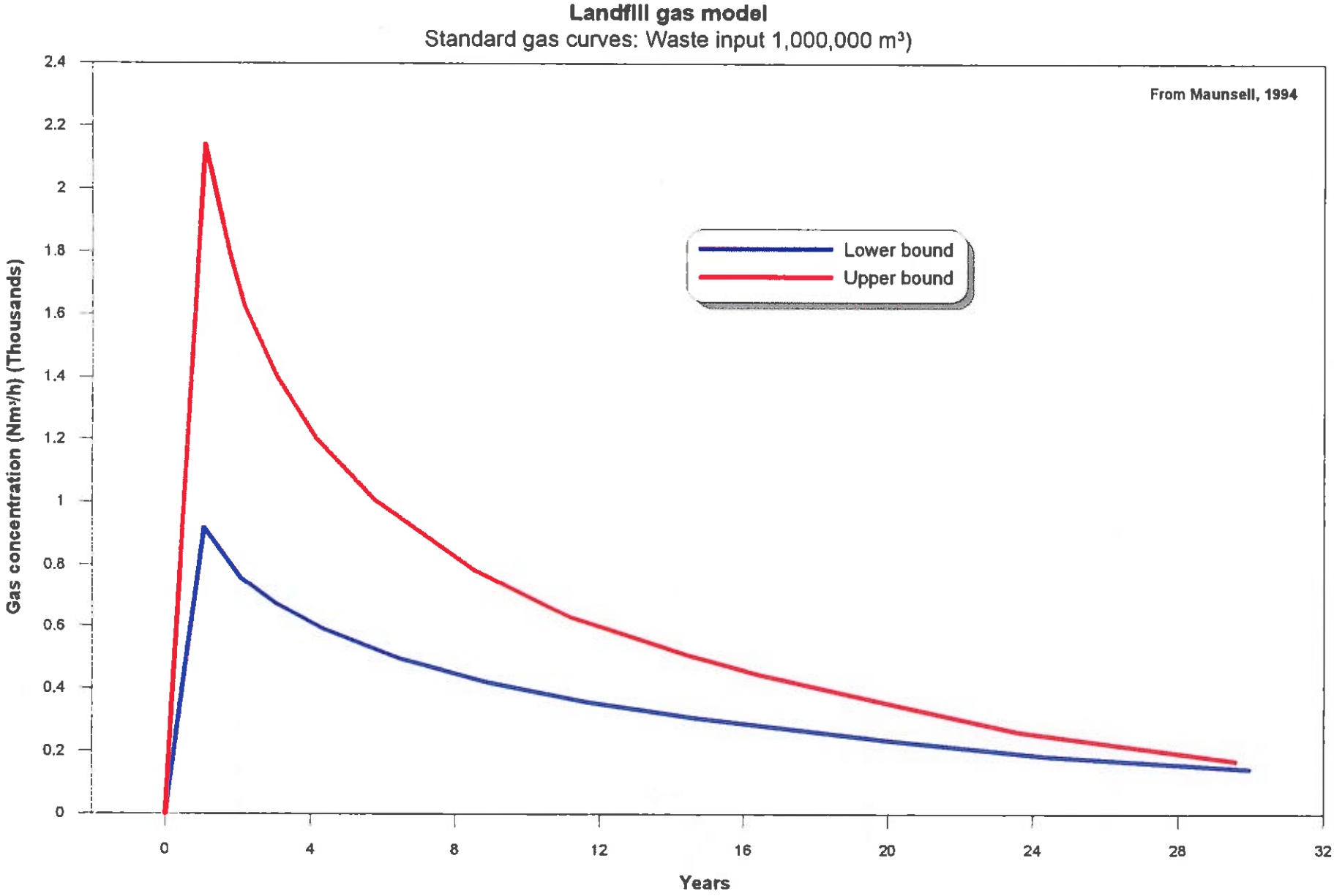
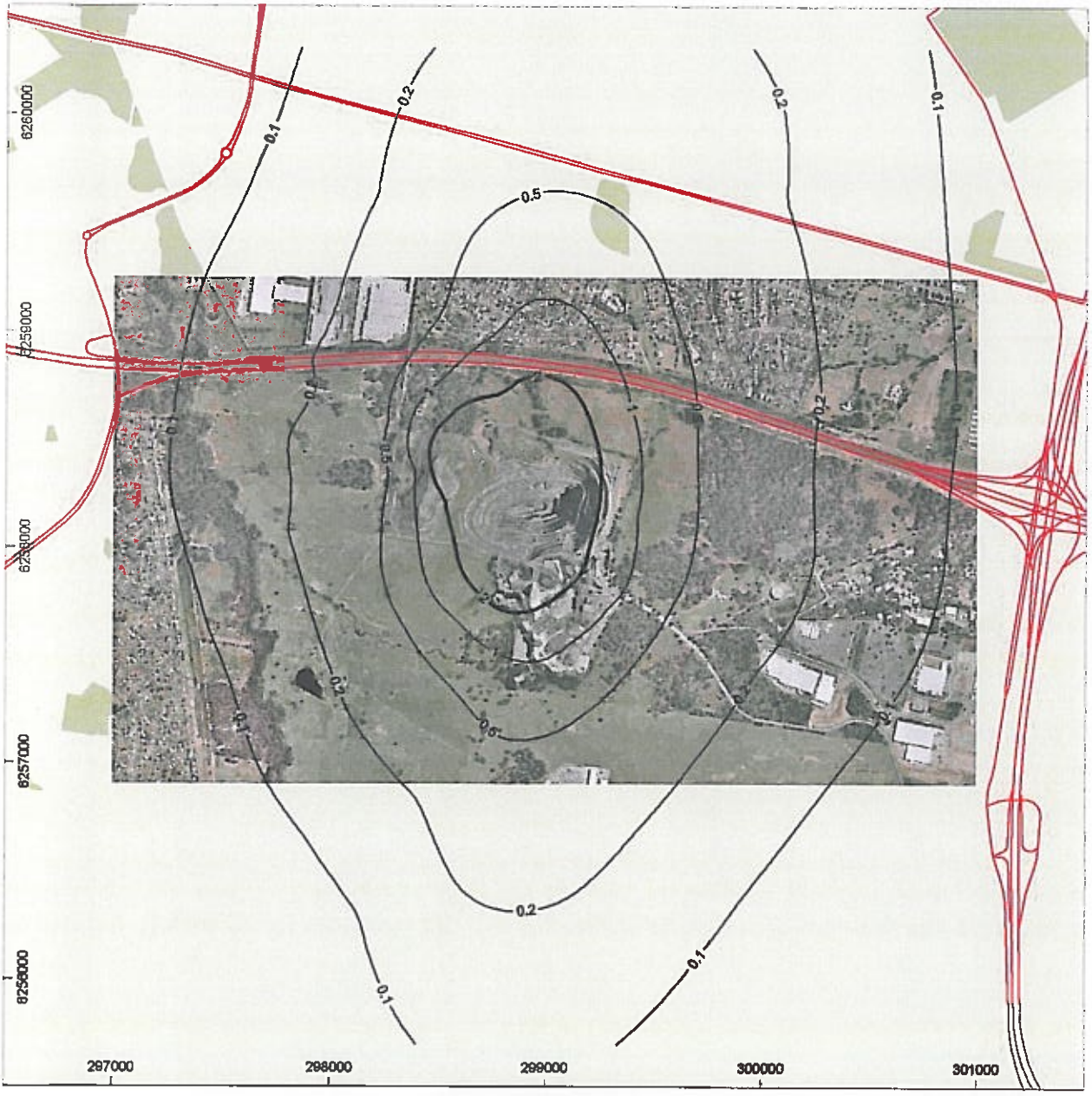

Landfill gas model
Standard gas curves: Waste input 1,000,000 m³)
From Maunsell, 1994
Lower bound
Upper bound
Gas concentration (Nm³/h) (Thousands)
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
4
8
12
16
20
24
28
32
Years

FIGURE 10



MGA Zone 56 (GDA 94)

Predicted 99th percentile nose-response odour levels (odour units)

Assumptions:
Total capped area size = 22 ha
1% of solid waste Class 2 average odour emissions
Cover active tipping face at 450 m^2
Greenwaste composting area at 5,000 m^2

FIGURE 11