Annual Environmental Management Report & Annual Review

Name of Mine	Rocglen Coal Mine		
Titles/Mining Leases	ML 1620, ML 1662		
MOP Commencement Date	01-10-2011	**MOP Completion Date**	30-10-2015
AEMR Commencement Date	01-08-2014	**AEMR Completion Date**	31-07-2015
Name of Leaseholder	Whitehaven Coal Mining Pty Ltd		
Reporting Officer:	Jill Johnson		
Title:	Group Manager - Environment		
Signature:	_____		
Date:	_____		

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1 INTRODUCTION

1.1 Consents, Leases and Licences

This is the seventh Annual Environmental Management Report (AEMR) produced for the Rocglen Coal Mine (RCM), and it has been prepared in accordance with Conditions 4 and 5 of Mining Lease (ML 1620) (Mining Act 1992), Condition 4 of Mining Lease (ML 1662) and Clause (c) of Environmental Monitoring and Reporting in the Statement of Commitments within PA 10_0015 MOD 1. The AEMR generally follows the format identified in the Department of Primary Industries Mineral Resources (DPI-MR) document entitled *"Guidelines to the Mining, Rehabilitation and Environmental Management Process"* Version 3, dated January 2006. It also addresses Condition 3 (Schedule 5) of PA 10_0015 MOD 1 which requires provision of an Annual Review and is herein referred to as an AEMR/Annual Review.

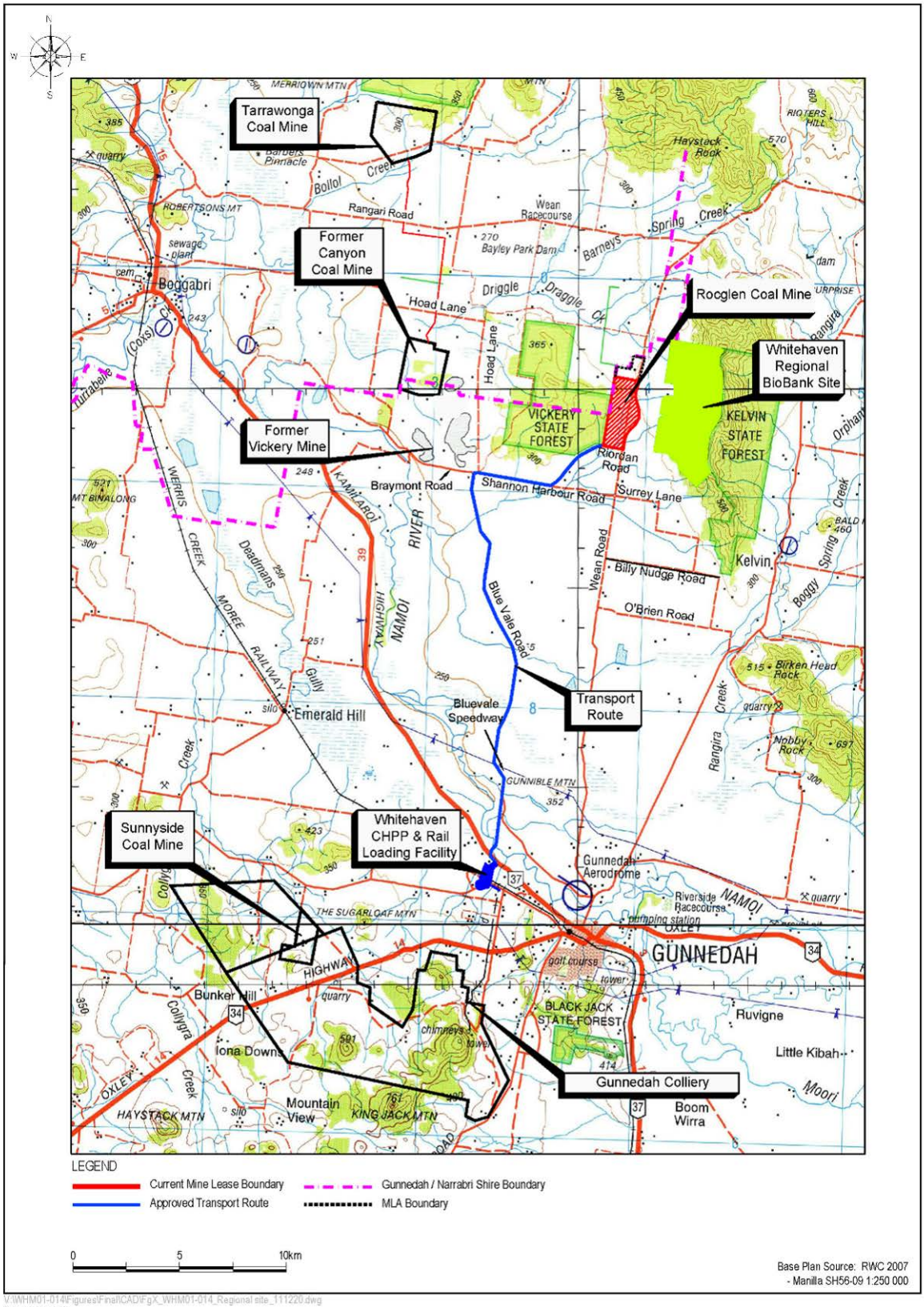
The RCM is located approximately 28km north of Gunnedah (Figure 1). The RCM is owned by Whitehaven Coal Limited (WCL) and operated by Whitehaven Coal Mining Pty Ltd (WCMPL). WCMPL is a wholly owned subsidiary of WCL, a publicly listed company which has several coal mining interests in the Gunnedah Basin NSW.

The RCM was initially approved on the 15th April 2008 under PA 06_0198 with a minor modification (PA 06_0198 MOD 1) granted in May 2010 to address highwall stability issues. Whitehaven submitted a Project Application, and accompanying Environmental Assessment, under Part 3A of the *Environmental Planning and Assessment Act 1979* in March 2010. PA 10_0015 was issued on the 27th September 2011 and allows for additional extraction of up to 5 million tonnes of coal at a maximum recovery rate of 1.5 million tonnes per annum (i.e. increased projected life of the operation for coal extraction by up to four years).

PA 10_0015 was modified (PA 10_0015 MOD 1) on the 10th November 2014, to condition cumulative coal haulage from the Tarrawonga/Vickery/Rocglen mines.

The external boundary of ML 1620 and ML 1662 corresponds to the area referred to in PA 10_0015 MOD 1 and covers an area of approximately 460 hectares. Though primarily covering the period from 1st August 2014 to 31st July 2015 (the reporting period), where relevant the AEMR/Annual Review provides information on historical aspects of the operations, longer term trends in environmental monitoring results, and provides relevant information on activities to be undertaken during the ensuing period (i.e. from 1st August 2015 to 31st July 2016).

Table 1 identifies the leases, licences and approvals in place for the RCM at the end of the reporting period, the issuing / responsible authority, dates of issue, duration (where limited) and relevant comments. The list is presented chronologically according to the date of issue.



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Environmental, Land and Project Management Consultants

Figure 1 - Location Plan

Table 1 - Tenements, Licences and Approvals

Issuing / Responsible Authority	Type of Lease, Licence, Approval	Date of Issue	Expiry	Comments
Department of Mineral Resources*[1]	Exploration Licence (EL 5831)	6th April 2001 (Renewed 15th August 2003, 11th November 2008, and 12th May 2014)	5th April 2018	Approval for exploration
Minister for Planning	Project Approval (PA) 06_0198	15th April 2008	10th June 2020	Original approval for the mine
Department of Environment and Climate Change*[2]	Environment Protection Licence No. 12870	31st July 2008	Nil Anniversary date: 31st July	Approval granted for Mining for Coal and Coal Works to 2 Mtpa.
Department of Primary Industries*[1]	ML 1620	10th June 2008	9th June 2029	Approval of open cut
Department of Water and Energy (DWE)*[3]	Water Licence 90BL254856 90BL256103 90BL254857 90BL256108 90BL254858 90BL254859 90BL256106 90BL256105 90BL256104 90BL256102 90BL111536 90BL110883 90BL104367 90BL004169 90BL102845 90BL013922 90BL107181 90BL102847 90BL256140 90BL256141	Various	Nil	Used for groundwater monitoring purposes
	90BL254684	12th May 2009	11th May 2014	700ML aquifer interference Licence has been converted to 90WA832698/90AL832697.
	90BL254758 90BL255249	18th Jan 2010 18th Jan 2010	17th Jan 2015 17th Jan 2015	120ML mining
Minister for Planning	Project Approval (PA) 06_0198 MOD 1	27th May 2010	10th June 2020	Notice of Modification for highwall stability works
Minister of Planning and Infrastructure (DoPI)*[4]	Project Approval (PA 10_0015) Extension	27th September 2011	31st December 2022	Extension Approval

Issuing / Responsible Authority	Type of Lease, Licence, Approval	Date of Issue	Expiry	Comments
Department of Trade and Investment, Regional Infrastructure and Services, Division of Resources and Energy (DTIRIS) *1	Mining Operations Plan (MOP)	1st October 2011	30th September 2013	Mining Operations Plan for Extension Approval
Department of Sustainability, Environment, Water, Population and Communities*5	Environmental Protection and Biodiversity Conservation Act (EPBC 2010/5502) Approval	21st December 2011	16th November 2025	Approval for subsequent disturbance of threatened and migratory species due to extension approval
Minister for Resources and Energy	ML 1662	9th January 2012	9th January 2033	Mining Lease for extension approval
NSW Trade and Investment – Division of Resources and Energy	Mining Operations Plan (MOP)	21st October 2013	30th October 2015	Minor amendment to MOP was made to facilitate access to coal outside of the current MOP limit but within the open cut pit limit until a new MOP is developed.
Department of Planning and Environment (DP&E)	Project Approval PA 10_0015 MOD 1 (Appendix 1)	10th November 2014	31st December 2022	Cumulative Coal Road Transport
NSW EPA	EPL 12870 (Appendix 2)	14th July 2014	N/A Anniversary date: 31st July	Variation to condition noise, blast fume and pollution incident response management plan

*1 Now, NSW Department of Industry, Skills and Regional Development
*2 Now, Environment Protection Authority (EPA)
*3 Now, NSW Department of Primary Industries - Water
*4 Now, Department of Planning and Environment (DPE)
*5 Now, Department of the Environment

1.2 Mine Contacts

The current Manager Mining Engineering and Group Manager - Environment contact details are as follows:

- Blair Meyers, Manager Mining Engineering. Retains statutory responsibility for mining activities at the site. Contact: (02) 6740 7000.
- Mrs Jill Johnson, Group Manager – Environment. Oversees overall environmental and rehabilitation performance across the site. Contact: (02) 6741 9321.

1.3 Actions Required at Previous AEMR Review

The annual environmental meeting for the 2013/2014 AEMR/Annual Review for RCM was undertaken by the DRE on 15th April 2015. The actions arising from the 2013/14 AEMR and annual inspection, and where these actions are addressed in this document are provided in Table 2.

Table 2 - Actions Required

Action Required	2014/15 AEMR Reference
DRE	
Provide DRE with copy of the emplacement of carbonaceous material procedure.	Provided May 2015
Include statements regarding 'other infrastructure', 'rehabilitation trials and research' and 'further development of the rehabilitation plan'.	Section 5
Review options for growth media augmentation.	5.2.5
Review tree establishment program. Investigate soil amelioration options and consider conducting amelioration trials (as appropriate).	5.2.5
DP&E	
Consider providing information pertaining to the deposition of subsoil/topsoil on the exposed carbonaceous material located on the Western Emplacement Area	Required cover will be placed upon final rehabilitation of the Western Emplacement Area

Consider, as and where required, a dedicated section outlining any incidents that were required to be notified in accordance with Schedule 5, Condition 6 of the Project Approval, actions taken as a result of the incident, and any associated agency consultation.	3.21
Consider including a section outlining any consultation undertaken in relation to the finalisation of the Water Management Plan as required by Schedule 3, Condition 21	2.8.1
Consider including detail in relation to any closure planning activities undertaken in the reporting period	5.2.2

2 OPERATIONS DURING THE REPORTING PERIOD

2.1 Exploration

During the reporting period there were 6 exploration boreholes drilled in ML 1620.

2.2 Land Preparation

Land preparation activities undertaken at the mine during the reporting period were conducted in accordance with commitments identified in the current MOP. Stripping of topsoil (33,306 m^3) and subsoil (4,260 m^3) was undertaken from an area of approximately 5.2 hectares.

Table 3, the "Production and Waste Summary", shows that at the end of the reporting period, 66,445 m^3 topsoil and subsoil had been replaced for rehabilitation purposes.

Table 3 - Production and Waste Summary

	Cumulative Production			
	Start of Reporting Period (up to 31/7/14)	**During Reporting Period (1/8/14 to 31/7/15)**	**Cumulative Total at End of Reporting Period**	**Cumulative Total at End of next Reporting Period (estimated)**
Soil Stripped (m^3)	446,105	37,566	483,671	486,604
Soil Used/Spread (m^3)	227,980	84,064	312,044	318,944
Waste Rock (m^3)	48,546,816	5,648,356	54,195,172	59,367,334
ROM Coal (t)*	6,100,846	1,170,755	7,271,601	8,422,721
Processing Waste (t)**	1,359,954	386,988	1,746,942	2,035,916
Product (t)	5,099,383	834,814	5,934,197	6,816,697

* ROM Coal is total production at the mine site. The difference between ROM Coal and final product is related to changes in stockpile volumes both at the mine and the CHPP during the reporting period.

** Rocglen waste produced at Whitehaven CHPP.

2.3 Construction

There were no construction activities onsite during the reporting period.

2.4 Mining

All mining during the reporting period was undertaken by open cut methods using the techniques identified in the MOP.

During the reporting period, a total of 5,648,356 Bank Cubic Meters (BCM) (or 7,342,863 m^3, assuming a swell factor of 1.3) friable and competent overburden was removed to produce

1,170,755 tonnes of ROM coal at an average overburden:coal stripping ratio of 5.7:1 (See Table 3).

Plans 3 and 4 present the status of mine and infrastructure development as of 31st July 2015. The plans also identify the limit of mining at the commencement of the reporting period.

During the reporting period the pit advanced approximately 180m in a south-east direction, and 180m in a south-west direction.

All mining constraints during the reporting period were as identified in previous AEMRs/Annual Reviews.

Table 4 presents a list of mining equipment in use at the mine at the end of the reporting period, together with its principal function(s).

Table 4 - Mining Equipment

Item (or equivalent)	No. on site	Function
Excavator (Hitachi EX1900)	1	Overburden and coal loading
Excavator (Hitachi EX 3600-6)	1	Overburden excavation and loading
Excavator (CAT 330B)	1 (p/t)	Drainage, windrows etc
Rear Dump Truck (CAT 785C)	5	Overburden/coal haulage
Rear Dump Truck (CAT 777)	3	Overburden/coal haulage
Wheel Loader (CAT IT38)	1 (p/t)	Lifting, stemming etc
Dozer (CAT D10T)	2	Clearing; pit activities; dump maintenance
Dozer (CAT D11R)	2	Overburden/rip/push
Grader (CAT 16M)	1	Road maintenance
Grader (CAT 14H)	1	Road maintenance
Scraper (CAT 637)	2	Campaign topsoil/subsoil removal and replacement
Drill Rig Terex SKF50	1	Campaign blast hole drilling
Water Cart 34,000L	1	Dust suppression
Water Cart 30,000L	1	Dust suppression
Water Cart 13,000L	1	Dust suppression
Water Cart 10,000L	1	Dust suppression
Crushing Plant	1	Coal size reduction
Wheel Loader (CAT 988H)	2	Feeding/processing plant/product truck loading
Lighting Plant*	10	Light for evening, night operations
Fuel/Service Truck	1	Equipment refuelling/servicing
Forklift/Tyre Handler	1	Equipment Handling
125 kVA diesel generator	1	Electricity generation for site services
820 kVA diesel generator	1	Coal processing
Pump	6	Pit Pumping/Filling water cart

* Not necessarily all in operation at the same time

Rocglen hours of operation during the reporting period were within Project Approval limits. Currently the mine has two production shifts on weekdays which are day shift (7:00am to 3:00pm) and afternoon shift (3:00pm to 11:00pm). A Saturday shift is not currently rostered for Rocglen.

2.5 Processing

2.5.1 Outline of Processing Activities

With the exception of coal crushing to <200 mm, no coal processing was undertaken within the MOP/PA area. During the reporting period, all Rocglen coal was transported to the Whitehaven CHPP. Figure 2 presents a schematic of coal movements and washery inputs, outputs and yields for the reporting period. The differences in CHPP inputs and outputs in Figure 2 (i.e. outputs do not exactly match coal sales) are a result of existing stockpile volumes at the start and end of the reporting period.

2.5.2 Changes or Additions to the Process or Facilities

The only change during the reporting period was the commencement of receipt of reject for co-disposal in the backfilled void.

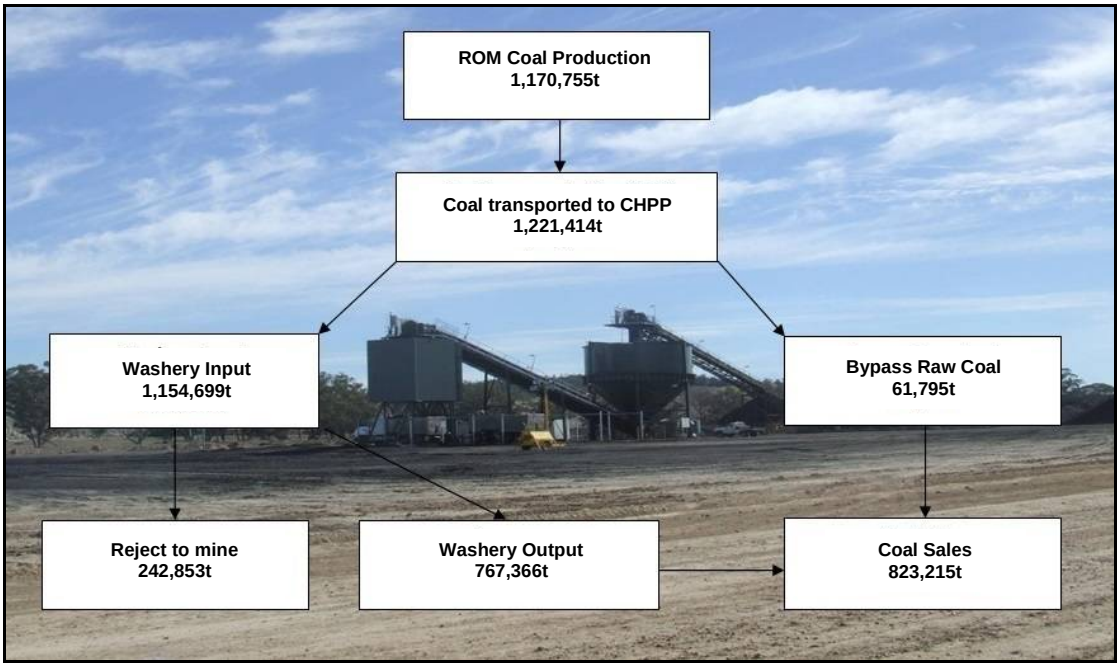

Figure 2 - Coal Movement and Production Summary

2.6 Waste Management

2.6.1 Introduction

Wastes produced at the mine or Whitehaven CHPP during the reporting period remain unchanged from those identified in the last reporting period and are comprised of:

- General domestic-type wastes from on-site buildings and routine maintenance consumables;
- Oils and other hydrocarbons;
- Sewage;
- Overburden and interburden;
- Mine equipment tyres; and
- Coarse and fine coal rejects from any coal preparation undertaken.

The following sub-sections identify the management procedures adopted for each of these wastes throughout the reporting period.

2.6.2 Domestic Type Wastes

All general wastes were collected on-site and placed into large storage receptacles. A local industrial waste collector collects this waste.

The mine maintains a recycling program for office and general recyclables (paper, cardboard, bottles, cans etc.) at the site office and crib room.

2.6.3 Oil Containment and Disposal

Waste oils from maintenance activities were pumped from equipment to bulk storage tanks bunded in accordance with EPA requirements. When breakdown maintenance was undertaken away from the workshop, oil was pumped from the equipment to a tank on the service truck from which it was subsequently transferred to the bulk storage tank.

Waste oil and filters stored at the maintenance workshop were collected and disposed of by a licensed contractor.

Runoff from the concrete vehicle and equipment wash pad was directed to an oil separator and containment system for subsequent pump out and disposal.

2.6.4 Sewage Treatment and Disposal

Effluent from the sewage and ablutions facilities at the mine was managed through the Gunnedah Council-approved septic system, with pump outs undertaken by a licensed waste disposal contractor on an as-needs-basis.

2.6.5 Mine Equipment Tyres

Used mine equipment tyres are retained on site until disposal within the open cut void, generally 20m below natural ground level. Survey records, number of tyres emplaced, and date of emplacement are maintained for all tyres.

2.6.6 Overburden and Interburden

Overburden materials at the mine comprise weathered conglomerates with some fracturing. The overburden is cast into the mined-out areas by blasting or removed from above the coal seam by a combination of dozer pushing and excavator loading and hauling using dump trucks. Interburden removal to enable lower coal ply excavation is undertaken by excavator and dump truck.

2.6.7 Processing Plant Residues

The coarse and fine rejects produced from washing RCM coal comprise a mixture of coal and non-coal materials, e.g. sedimentary rocks such as shale, mudstone or claystone, and sand, silts and clays which either occur naturally within the coal seam or represent overburden or interburden materials which dilute the coal during its extraction.

2.7 Ore and Product Stockpiles

All ROM coal produced at the mine is delivered to high ash or low ash ROM stockpiles. Average stockpile volume during the reporting period was 95,416.25t.

2.8 Water Management

2.8.1 Activities

RCM is located within the catchment of the Namoi River. Locally, and within proximity of the mine site, Driggle Draggle Creek to the north and the unnamed drainage channel to the south of the mine site provide flows to the Namoi River during runoff events.

The management of water at the mine during the reporting period was undertaken in accordance with requirements of the MOP and Water Management Plan (WMP) including the following processes and objectives:

- Containment of runoff from open cut areas by directing this water into in-pit sumps;
- Pumping excess water from the in-pit sumps into the Void Water Dam;
- Directing sediment-laden runoff from disturbance areas and rehabilitated areas into designated sediment control dams;

- Installing temporary erosion and sediment control devices or structures as required to minimise the discharge of sediment laden water from newly disturbed areas;
- Diverting clean water runoff unaffected by the operations away from disturbed areas and off-site, where possible;
- Maintaining sediment control structures to ensure that the designed capacities are maintained for optimum settling of sediments;
- Implementing an effective revegetation and maintenance program for the site;
- Effective treatment of dirty water for controlled discharge from site; and
- Draw down of dirty water dams to prevent discharge from site.

The WMP was reviewed to align with the 2015 draft MOP during the reporting period and will be submitted to DP&E during the 2015/2016 reporting period.

2.8.2 Water Sources, Demand and Use

Within the Project Approval area and immediate vicinity of the mine, surface water resources are limited to a number of ephemeral drainage lines which flow for a short period after substantial rainfall. Water storage dams and a series of interlinked sediment basins are shown on Plans 3 and 4.

Water is required on the mine site primarily for dust suppression purposes, with minor quantities required for potable, toilet and ablutions purposes. Where practicable, water collected on-site is retained or reused, with water for dust suppression sourced from a combination of on-site water harvesting, inflows from the exposed coal seam, overburden and interburden, and groundwater extraction. Water for potable, toilet and ablutions purposes is trucked to the site from Gunnedah.

During the reporting period, a total of 189ML was used for mine site and processing facility dust suppression purposes, the majority of which was sourced within the Project Approval Area. The approximate volumes obtained from the various sources are as follows:

- 137 ML of void water (pumped to the void water dam); and
- 52 ML from both clean and dirty water surface storages.

No water was pumped from the production bore to the bore pump dam during the reporting period, as a sufficient amount of water was available within the pit and surface water storages during period.

The total water use of approximately 189 ML is higher than the annual water use predicted in the Extension Environmental Assessment, which indicated a water requirement of approximately 90 ML per year for dust suppression and processing requirements. This higher than predicted volume can be attributed to increased need for dust suppression during the severely dry summer period, concentrated efforts to reduce the volume of water stored in surface water storages, increasing storage capacity in preparation for wet weather. These water sources were targeted and used for dust suppression on active and inactive mining areas in order to minimise dust generation and evaporate excess water. This facilitates mine

sequence progression within the pit and reduces the likelihood of wet weather discharge events occurring. The water used in the reporting period is lower than the water use of 253ML during the previous reporting period.

2.8.3 Stored Water

Table 5 presents an estimate of the volume of stored water at the beginning and end of the reporting period.

Table 5 - Stored Water

	Volumes Held (m^3)		Storage Capacity at the end of the Reporting Period (m^3)
	Start of Reporting Period	**At end of Reporting Period**	
Clean Water (in Storage Dams)	3,708	4,429	15,279
Dirty Water (in Sediment Basins)	19,392	20, 107	77,885
Pit Water*	144,500	207,004	100,996

* Within mine void and Void Water Dam

2.8.4 Groundwater Management

Inflows into the open cut result from a combination of:

- Direct rainfall runoff and infiltration through the emplaced overburden which flows down-dip to the open cut sump(s); and
- Inflows from the exposed coal seam and fractured rock.

Any water produced in pit was stored in the pit or pumped to the void water dam and subsequently prioritised for dust suppression purposes to maintain capacity in the dam.

Contamination of groundwater is controlled by the management of chemical, oil and grease spills and storage, with:

- Vehicle maintenance carried out in designated areas;
- Any spills being cleaned up; and
- Fuels, oil and greases being stored within a bunded area, constructed in accordance with AS 1940-2004 and/or EPA requirements.

Groundwater from surrounding bores, as well as the mine production bore, is monitored on a regular basis to detect and assess any changes in groundwater quality or level that may be attributable to the mine (see Section 3.4.2).

2.9 Hazardous Material Management

No explosive materials are retained at the site. LDE has a storage facility located adjacent to the Tarrawonga site, which removes the requirement for on-site storage. Mixing of nitropril with distillate to produce an explosive is undertaken on the day of each blast using a purpose built explosives mixer and in a quantity adequate only for that particular blast.

Safety Data Sheets (SDS) are retained on-site for all hazardous materials, independent of the quantity. Additionally, all contractors are required to supply Safety Data Sheets for any hazardous goods they may bring onto the site.

2.10 Other Infrastructure Management

Management of infrastructure (e.g. buildings, roads, generators and pumps) and other facilities not specified elsewhere within this AEMR/Annual Review, is undertaken on an as-needs basis or in accordance with statutory requirements in order to maintain them in an operationally efficient, safe, neat and tidy condition, and one which does not result in the direct or indirect generation of unacceptable environmental impacts.

3 ENVIRONMENTAL MANAGEMENT AND PERFORMANCE

The following sub-sections document the implementation and effectiveness of the various control strategies for environmental risks adopted at the mine, together with monitoring data for the reporting period. Life of mine monitoring data is included in the relevant appendices, where relevant, to allow for discussion on longer-term trends. Monitoring locations are shown on Figure 3.

A risk identification matrix and the relevant environmental management procedures are identified in the RCM Mining Operations Plan (MOP) 2011.

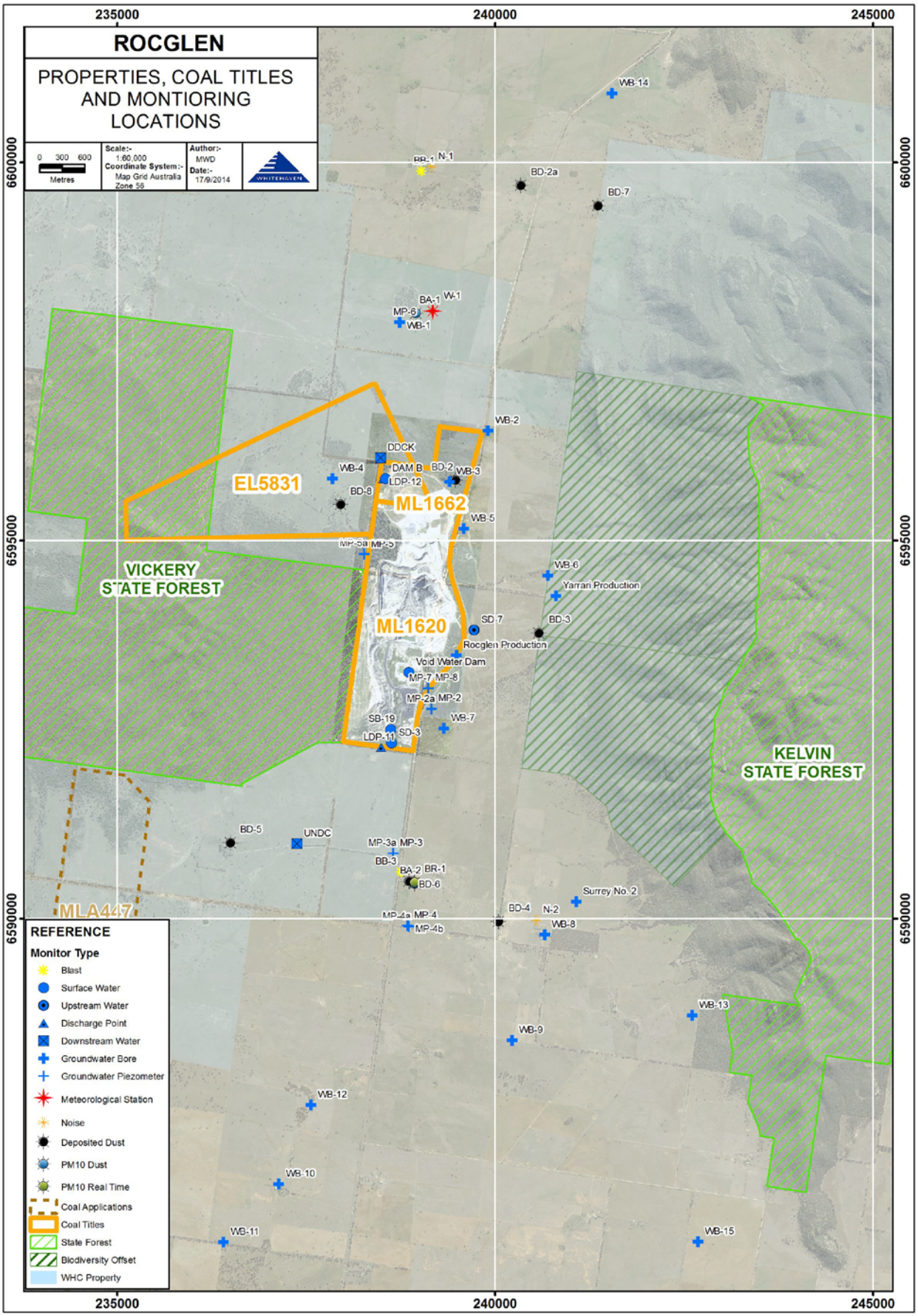

Figure 3 – Monitoring Locations

3.1 Air Pollution

3.1.1 Management

The air quality criteria applicable to the RCM are specified in PA 10_0015 MOD 1 Schedule 3, and are summarised below.

- Maximum annual increase in deposited dust level – 2g/m^2/month.
- Maximum total annual dust deposition (all sources) – 4g/m^2/month.
- Total annual average TSP (all sources) concentration – 90 μg/m^3. Although no specific TSP monitoring occurs, Whitehaven has received approval from DPE to determine TSP air quality monitoring values by multiplying measured PM_{10} values by a factor of 2.
- Annual average PM_{10} level – 30 μg/m^3.
- 24 hour average PM_{10} level – 50 μg/m^3.

Routine air quality monitoring at the RCM is required for deposited dust and PM_{10} particulates. Compliance monitoring of deposited dust is undertaken on a monthly basis whilst PM_{10} levels are monitored every 6 days. A real time dust monitor is utilised for the management of dust on a real time basis as outlined in Section 3.1.2.

In order to satisfy the criteria identified above, Whitehaven employs a range of air pollution control measures including:

Land Preparation

- Cleared trees and branches are retained. No burning of vegetation occurs on-site.
- Where practicable, soil stripping is undertaken when there is sufficient soil moisture to prevent significant dust lift-off and at a time that avoids periods of high winds.
- Land disturbance, including groundcover removal, is limited in advance of mining activities consistent with operational requirements. Under normal circumstances, a maximum of 100 metres is prepared in advance of mining.
- Groundcover is removed with the topsoil, as opposed to prior to topsoil removal.
- Soil stockpiles stored for greater than 3 months are seeded and fertilised as soon as possible.

Drilling and Blasting

- The drill rig utilises water injection and is fitted with dust aprons which are lowered during drilling.
- Coarse aggregates are used for blast hole stemming at all times.
- Where practicable, blasting is restricted during unfavourable weather conditions.

Overburden Removal and Placement

- Where practicable, ripping of softer overburden material is avoided during periods of high wind.
- Dumping at higher elevations is minimised during high winds where practicable, with preference given to lower dumps or in pit locations.

Coal Mining and Preparation

- When necessary, low moisture coal is sprayed with water prior to excavation.
- Water is applied to the coal at the feed hopper, crusher and at all conveyor transfer and discharge points.
- When necessary the cessation of coal processing activities occurs during periods of concurrent high winds and temperatures.
- Water carts apply water sprays around the ROM pad.

Transport

- Internal roads are watered, with emphasis on those subject to frequent trafficking.
- The speed of all on-site vehicles and equipment is restricted to 60km/hr.
- All operators on site have the responsibility of reviewing the dust generation from their activities, and contact the water cart direct, or their supervisor for action on dust control.
- All trucks hauling product coal and coal rejects between Rocglen and the Whitehaven CHPP are fitted with roll-over tarpaulins.

Rehabilitation

- Rocglen has a progressive approach to the rehabilitation of disturbed areas within the mine site to ensure that, where practicable, completed mining and overburden emplacement areas are quickly shaped, top-soiled and vegetated.

3.1.2 Performance

Deposited Dust

Table 6 shows a summary of the deposited dust monitoring data presented in Appendix 3. A graphical representation of the total insoluble solids and ash content data for each of the sites monitored during the reporting period is also included in Appendix 3. Figure 3 identifies the locations of the various deposited dust gauges monitored during the reporting period.

A review of Table 6 and Appendix 3 shows that, as with the previous reporting period, the mean annual total insoluble solids (deposited dust) criterion of 4g/m^2/month was satisfied at all monitoring locations over the last 12 months.

AS/NZS Audit

An internal audit of the Rocglen deposited dust gauges was carried out during February 2015 to determine the compliance of each dust monitor with the specifications listed in AS/NZS

3580.10.1:2003. A number of areas of improvement in monitoring equipment were identified by the audit.

In response to the audit findings ALS ACIRL (dust monitor service provider) were engaged to install stoppers in all gauges and where required stands were relocated by Whitehaven personnel from under tree driplines.

Table 6 - Deposited Dust Monitoring data

Site	Property Name	Annual Average Total Insoluble Solids*[1] (g/m^2/month)	Annual Average Ash*[1] (g/m^2/month)	Predicted Year 5 Rocglen plus 1.2 g/m^2/month Background
BD-2a	Penryn	3.2	2.3	Not predicted
BD-3	Belah	1.6	1.0	1.4
BD-4	Surrey*[2]	1.3	0.8	1.3
BD-5	Stratford	1.3	0.9	1.2
BD-6	Roseberry*[2]	1.2	0.5	1.3
BD-7	Roseglass*[2]	1.1	0.6	1.2
BD-8	Yarrawonga	0.9	0.7	1.9

*[1] At end of reporting period

*[2] Licensed under EPL 12870

PM_{10} High Volume Air Sampling

Whitehaven has two High Volume Air Samplers (PM_{10}) located on neighbouring properties. One is located at the project related property "Costa Vale", to the north of the mine site. The other PM_{10} monitoring location is licensed (EPL ID – 10), and is located on the privately owned "Roseberry" property to the south-east of the mine site. Each sampler runs for 24 hours every 6 days, with filter papers sent to an accredited laboratory for analysis.

The annual average limit was below criteria at both monitoring locations throughout the reporting period ("Costa Vale" – 12.4 $\mu g/m^3$, "Roseberry" – 10.5 $\mu g/m^3$), as displayed in Figure 4 and Figure 5 . The long term PM_{10} levels and averages are provided in Figure 4 and Figure 5. Both figures indicate a steady annual average PM_{10} level during the reporting period. The full PM_{10} data set is provided in Appendix 3.

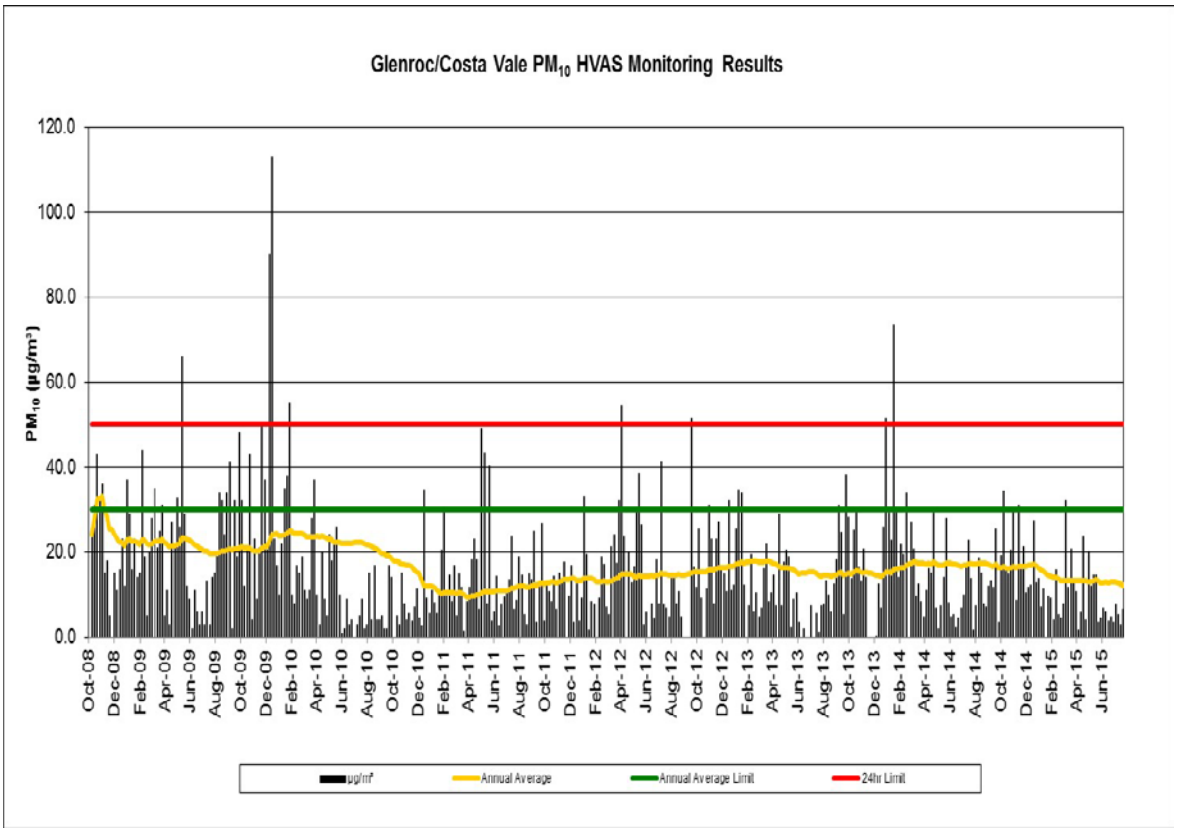

Figure 4 - Costa Vale High Volume PM_{10} Monitoring Results

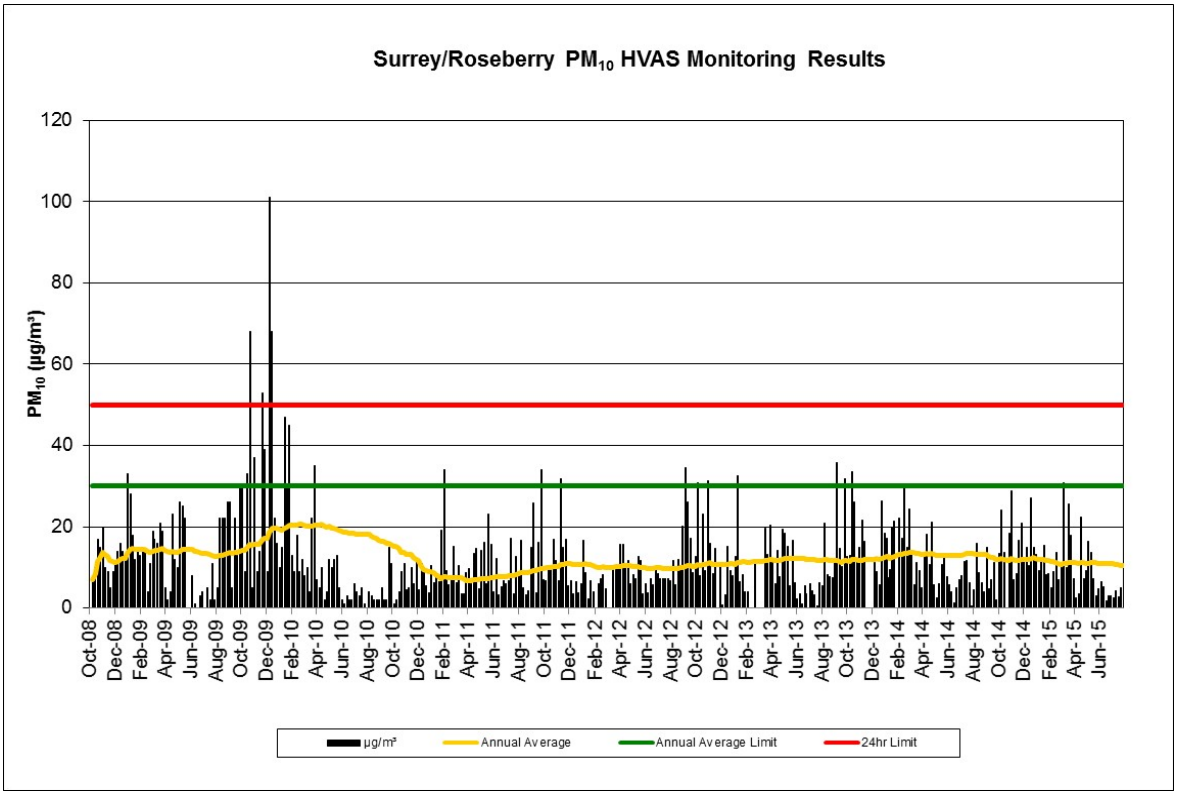

Figure 5 - Roseberry High Volume PM_{10} Monitoring Results

Continuous Real Time PM_{10}

In accordance with Condition 3(16) of PA 10_0015 MOD 1, a continuous real time dust monitor, or Tapered Element Oscillating Microbalance (TEOM) monitor (PM_{10}), operated at the "Roseberry" property during the period. Data is generated every 15 minutes and correlated against current weather conditions, with alarms notifying site personnel of elevated PM_{10} results when wind conditions and direction is indicative of mining influence on the monitor. The monitor is also an invaluable management tool for assessing dust levels on a real time basis, through its web based platform; where both environmental and operational personnel have access to the system. Average monthly PM_{10} levels recorded at the monitor are shown in Table 7.

Table 7 - Real Time PM_{10} Monitoring Data

Month	Average PM_{10} Per Month ($\mu g/m^3$)	Cumulative Average Over Reporting Period ($\mu g/m^3$)
Aug-14	10.9	10.9
Sep-14	14.9	12.9
Oct-14	19.4	15.1
Nov-14	22.0	16.8
Dec-14	13.1	16.1
Jan-15	10.1	15.1
Feb-15	11.3	14.5
Mar-15	16.9	14.8
Apr-15	9.8	14.3
May-15	11.9	14.0
Jun-15	6.16	13.3
Jul-15	7.0	12.8

Table 7 shows that the highest readings were received during November 2014, as a result of prolonged hot and dry conditions. Two exceedances of the 24hr PM_{10} limit occurred during the period, the first on the 15th November 2014, with an average of 79.6 $\mu g/m^3$. Consistently elevated wind speeds, combined with hot and dry conditions resulted in elevated levels throughout the region during November. The second exceedance occurred in May 2015, with a PM_{10} reading of 60.1 $\mu g/m^3$, which was determined to be non-mine related as high PM_{10} results were recorded across the region as a result of severe dust storms in southern NSW.

3.1.3 Comparison with EA Predictions

The Air Quality Impact Assessment (AQIA) for the Extension EA was undertaken by PAE Holmes Pty Ltd to determine predicted air quality impacts associated with the extended mining operation. The predicted levels and comparisons with actual monitoring data are included below for both dust deposition and PM_{10}.

Dust Deposition

The AQIA predicted that the annual average dust deposition levels at all receptors surrounding the extended mine would be well below the relevant criteria of 4g/m^2/month for cumulative dust deposition when using a background dust deposition level of 1.2g/m^2/month.

During the reporting period, all monitoring points were below the predicted annual average deposited dust levels during year 5 of operation (refer Table 6), and all monitoring points were below the annual average limit of 4g/m^2/month. The year five predictions are being used as a comparison as this more closely reflects actual operations comparative to the next modelled prediction from the AQIA which was Year 10.

PM_{10}

The AQIA provided the following predictions for cumulative PM_{10} levels from the extended Rocglen Mine:

- Annual average PM_{10} limit, including a background level of 21 µg/m^3:
  - "Costa Vale" - 24 µg/m^3
  - "Roseberry" - 23 µg/m^3
- 24 hour average limit (Year 5), including a background level of 22 µg/m^3:
  - "Costa Vale" - 37 µg/m^3
  - "Roseberry" - 48 µg/m^3

The annual average compliance limit is 30 µg/m^3 and the 24 hour compliance limit is 50 µg/m^3.

Both monitoring locations did not exceed the predicted annual average or the annual average compliance limit. The annual averages were 12.4 µg/m^3 at "Costa Vale" and 10.5 µg/m^3 at "Roseberry".

3.2 Erosion and Sedimentation

3.2.1 Management

Methods for the management of erosion and sediment control at the mine are presented in the MOP, Rehabilitation Management Plan and Water Management Plan.

Control of erosion and sediment generation is achieved through a range of controls identified in Section 2.8, and additional measures which assist in the control of erosion and sedimentation at RCM which include:

- Installation of water management structures prior to any ground disturbance taking place;
- Minimal land disturbance by clearing the smallest practical area of land ahead of disturbance activities;

- Disturbance areas that are not actively utilised i.e. soil stockpiles or rehabilitation areas, are revegetated as soon as practical following completion of works in that area;
- Where practical, disturbance areas are shaped such as to provide a free draining surface to direct dirty water runoff into the relevant sediment dams;
- Where localised flooding or ponding occurs, access is restricted until such time as the ground is no longer waterlogged in order to reduce the potential for additional sediment mobilisation; and
- Where necessary, temporary erosion and sediment control measures are utilised to prevent and/or reduce the potential for adverse erosion developing. These include sediment fences, check dams, surface protection and revegetation methods such as mulching.

3.2.2 Performance

The effectiveness of the procedures for erosion and sedimentation management are assessed visually as part of routine mine operations and supervision including monthly inspections undertaken by the site Environmental Officer, with any ameliorative works initiated as and when required. The turf installed along the main western drainage line, which drains the western emplacement area, and the turf drop structure, which drains part of the western emplacement's plateau, have performed well over the reporting period. Some minor tunnelling has occurred in the contour at the base of the turf drop structure due to the dispersive nature of soil present on the western rehabilitation slopes. Aside from this minor tunnelling, there remains no evidence of erosion in the areas that have been turfed, proving its ongoing success since its installation in October 2012.

Generally other control structures, such as the small catch basins along the western rehabilitation drainage line and mounding on the rehabilitation slopes, worked well in slowing the velocity of water and limiting erosion. Sediment basins at the north and south of the site performed well in capturing dirty water.

3.2.3 Comparison with EA Predictions

The soil assessment undertaken for the extension EA identified that the Brown Alluvial soil at RCM has high potential for erosion when removed and placed for rehabilitation due to high sodicity levels at depth. This soil makes up 47% of the soils on site. The other two soils identified on site, Brown Duplex Fine Sandy Loam and Self Mulching Black Earths, require typical erosion control measures. All subsoils within the area were identified to have high potential for erosion due to sodicity levels. To address the potential for erosion on rehabilitation slopes, contour furrows/mounds and contour banks at intervals down the slope were installed progressively as recommended. Organic matter in chicken manure has been added to Brown Alluvial Soils during rehabilitation to promote soil structure and

reduce the potential for rill erosion. Engineered drains using seeding for ground-cover vegetation were used within waterways as recommended in the assessment.

The Extension EA recommended erosion and sedimentation is monitored monthly or following rainfall events greater than 25mm in a 24 hour period. This has been carried out by the site's Environmental Officer during the reporting period, particularly during the summer months where frequent storm events took place.

The Extension EA identified that all sediment basins would be cleaned of accumulated sediment once their capacity has been reduced by 25%. Ongoing inspection of available dam capacity will be undertaken.

3.3 Surface Water Pollution

3.3.1 Management

The prevention of surface water pollution is achieved through the management of surface water as presented in Section 2.8.1.

3.3.2 Performance

Wet Weather Discharge

During the reporting period, two wet weather discharges and a number of controlled discharges occurred from the site. The storage structures onsite have been built to the 90%ile 5 day event design criteria, with the design specification incorporated in the existing EPL 12870. Nevertheless, sampling has been undertaken during each discharge event to monitor the water quality parameters. Licensed Discharge Point 11 (LDP-11) is located on the site's southern boundary immediately downstream of SD3 and Licensed Discharge Point 12 (LDP-12) at the northern boundary immediately downstream of Dam B.

Water analysis results from each discharge, as well as any ambient monitoring upstream and downstream of the site, are included in Appendix 4 and a discussion of the results is provided below.

27th August 2014 - Ambient Monitoring

Ambient monitoring occurred upstream of the mine site at SD7, and downstream of the site at Driggle Draggle Creek (DDCK) and the Unnamed Drainage Channel (UNDC) on the 27th August 2014, in accordance with EPL 12870. There was no flow or discharge at LDP 11, or LDP 12. The upstream analysis identified Total Suspended Solids (TSS) levels of 25 mg/L, pH of 7.26, and Oil and Grease of <5. The downstream analysis of DDCK and UNDC returned results of 25 and 16 mg/L of TSS, pH of 7.26 and 7.3, and Oil and Grease of <5 mg/L and <5 mg/L respectively.

7th April 2015 - Wet Weather Discharge

Discharge occurred on the 7th April 2015, from SD3, via LDP 11. Sample analysis identified elevated TSS levels of 222mg/L, pH of 7.22, and Oil and Grease of <5 mg/L. The Rocglen weather station recorded 67mm (refer 3.19.2) of rainfall in the five days prior to the discharge. Consequently the elevated TSS results are not considered a non-compliance as the rainfall exceeded the 5 day 90%ile rainfall amount.

21st April 2015 - Wet Weather Discharge

Discharge occurred on the 21st April 2015, via LDP 12. Sample analysis identified elevated TSS levels of 353mg/L, pH of 8.12, and Oil and Grease of <5 mg/L. The Rocglen weather station recorded 52.2mm (refer 3.19.2) of rainfall in the five days prior to the discharge. Consequently the elevated TSS results are not considered a non-compliance as the rainfall exceeded the 5 day 90%ile rainfall amount.

5th May 2015 - Controlled Discharge

A controlled discharge occurred on the 5th May 2015 via LDP 11, to increase storage capacity within discharge dam SD3. Following flocculation treatment a sample was taken which returned compliant results of 30 mg/L TSS, pH of 8.05, and Oil and Grease <5 mg/L. The dam was discharged to empty.

8th May 2015 - Controlled Discharge

A controlled discharge occurred on the 5th May 2015 via LDP 12, to increase storage capacity within discharge Dam A1. Following flocculation treatment a sample was taken which returned compliant results of 28 mg/L TSS, pH of 8.30, and Oil and Grease <5 mg/L. The dam was discharged to empty.

19th May 2015 - Controlled Discharge

A controlled discharge occurred on the 19th May 2015 via LDP 12, to increase storage capacity within discharge Dam B1. Following flocculation treatment a sample was taken which returned compliant results of 11 mg/L TSS, pH of 8.26, and Oil and Grease <5 mg/L. The dam was discharged to empty.

1st June 2015 - Ambient Monitoring

Ambient monitoring occurred downstream of the mine site at DDCK and UNDC on the 1st of June 2015 in accordance with EPL 12870. There was no discharge or flow at either LDP 11 or LDP 12. Analysis of the samples returned results of 75 and 11mg/L TSS, pH of 7.2 and 6.9, and Oil and Grease of <5 mg/L and <5 mg/L respectively.

17th June 2015 – Ambient Monitoring

Ambient monitoring occurred downstream of the mine site at DDCK and UNDC on the 17th of June 2015 in accordance with EPL 12870. There was no discharge or flow at either LDP 11 or LDP 12. Analysis of the samples returned results of 17 and 74mg/L TSS, pH of 6.95 and 7.18, and Oil and Grease of <5 mg/L and <5 mg/L respectively.

8th July 2015 - Controlled discharge

A controlled discharge occurred on the 8th July 2015 via LDP 11, to increase storage capacity within discharge Dam SD3. Following flocculation treatment a sample was taken which returned compliant results of <5 mg/L TSS, pH of 8.13, and Oil and Grease <5 mg/L. The dam was discharged to empty.

No non-compliant discharges have taken place during the period as a result of a significant focus on water management at RCM.

In addition to monitoring any water discharge events, RCM undertakes quarterly sampling of surface waters. The results of analysis are presented in Appendix 4. Whilst there are no criteria or concentration limits specified for the quarterly surface water samples, the results do provide an indication as to the quality of waters on-site. In general, the water quality in each dam remained consistent throughout the reporting period, with the exception of elevated results of Electrical conductivity (EC), Total Organic Carbon (TOC), and TSS for SB 19 in November 2014.

The Void Water Dam has consistently shown poorer water quality in terms of EC, averaging 2,087µS/cm over the reporting period. Void water stored in the Void Water Dam is prioritised as a water source for dust suppression to prevent any contamination of other surface water. SD7, upstream of the site, generally displayed a slightly alkaline pH, ranging from 7.7 to 9.4, with EC levels averaging 221µS/cm. Fluctuations in total suspended solids in sediment basins have been recorded and are common due to the ongoing treat-and-release programs. Oil and grease levels in all LDP storages have been below 5 mg/L throughout the reporting period, indicating no hydrocarbon contamination.

3.3.3 Comparison with EA Predictions

The surface water assessment carried out by GSS Environmental for the Extension EA predicted that there would be minimal impact on flow regimes downstream of the Project Site due to the RCM. Soil and water assessments for the site suggested that Total Suspended Solids (TSS) is likely to be the key water quality parameter requiring management during the life of the Project to ensure the water quality in downstream watercourses is not impacted. During the period TSS has not been as problematic in surface water at Rocglen, compared to previous years due to a high focus on water management. A number of surface water management recommendations were made in the surface water assessment for the Extension Project including the installation of sediment basins, targeting final discharge dams for water use and using flocculants to settle suspended solids. These measures have been implemented throughout the reporting period, and ensured that, as predicted in EA investigations, downstream water courses were minimally impacted by TSS.

EA investigations by GSS Environmental predicted 2 days (during a median year of 575.7mm rainfall) of discharge during the first year of operation on the assumption that controlled discharge of water is undertaken. Rocglen recorded 356.8mmof rain for the period; which is much lower than the long term average of 622.4 mm, and recorded two discharges during the period, which is generally consistent with what was predicted.

It was also recommended that salinity and alkalinity be closely monitored in the runoff from overburden emplacements and subsoil stockpiles to ensure that there are no adverse effects on downstream waterways. During the reporting period these parameters were monitored, showing typically alkaline pH and fluctuating Electrical Conductivity levels in all surface water storages.

3.4 Groundwater Pollution

3.4.1 Management

With the exception of fuels and oils, no materials occur, or are retained on the mine sites which are likely to be a source of groundwater pollution.

The methods for management of potential pollutants are summarised in Section 2.8.4. Ongoing monitoring to assess trends in groundwater chemistry will enable assessment of potential contaminants to groundwater, with particular emphasis on heavy metals, and major cations and anions. Groundwater monitoring requirements are identified in Table 8.

3.4.2 Performance

Throughout the life of the mine to date, the mine's performance with respect to groundwater management, the prevention of pollution and the assessment of impacts on groundwater availability to other surrounding users, has been assessed through groundwater level and chemistry monitoring undertaken at a series of piezometers and bores within ML 1620 and ML 1662 and extending to adjacent properties. The details of these piezometers and bores monitored throughout the reporting period are listed in Table 8.

Table 8 - Groundwater Monitoring

Site (See Figure 3)	Registered Bore No. / Licence No	Property / Location	Logger Installed	Frequency		Purpose
				SWL*2, EC*3 and pH	Representative Metals and Ions*4	
MP-2	GW968534 90BL254856	Mine site		Quarterly	Six monthly	To determine existing status and any impacts
MP-2a	90BL256103	Mine site	Yes	Quarterly	Six monthly	To determine existing status and any impacts
MP-3	GW968535 90BL254857	"Stratford"		Quarterly	Six monthly	To determine existing status and any impacts
MP-3a	90BL256108	"Stratford"	Yes	Quarterly	Six monthly	To determine existing status and any impacts
MP-4*1	GW968536 90BL254858	Surrey Lane		Quarterly	Six monthly	To determine existing status and any impacts
MP-4a*1	90BL256140	Surrey Lane	Yes	Quarterly	Six monthly	To determine existing status and any impacts
MP-4b*1	90BL256141	Surrey Lane		Quarterly	Six monthly	To determine existing status and any impacts
MP-5	GW968537 90BL254859	"Yarrawonga"		Quarterly	Six monthly	To determine existing status and any impacts
MP-5a	90BL256106	"Yarrawonga"	Yes	Quarterly	Six monthly	To determine existing

Site (See Figure 3)	Registered Bore No. / Licence No	Property / Location	Logger Installed	Frequency		Purpose
				SWL*2, EC*3 and pH	Representative Metals and Ions*4	
						status and any impacts
MP-6	90BL256105	"Costa Vale"	Yes	Quarterly	Six Monthly	To determine existing status and any impacts
MP-7	90BL256104	Mine site		Quarterly	Six Monthly	To determine existing status and any impacts
MP-8	90BL256102	Mine site		Quarterly	Six Monthly	To determine existing status and any impacts
WB-1*1	GW000743	"Costa Vale"		Quarterly	Six monthly	To determine existing status and any impacts
WB-2*1	GW050395 90BL111536	"Roseberry"		Quarterly	Six monthly	To determine existing status and any impacts
WB-3	GW050166 90BL110883	"Glenroc"		Quarterly	Six monthly	To determine existing status and any impacts
WB-4	GW045621 90BL104367	"Yarrawonga"		Quarterly	Six monthly	To determine existing status and any impacts
WB-5*1	GW011066 90BL004169	"Roseberry"		Quarterly	Six monthly	To determine existing status and any impacts
WB-6	GW044068 90BL102845	"Yarrari"		Quarterly	Six monthly	To determine existing status and any impacts
WB-7*1	GW022319 90BL013922	"Roseberry"		Quarterly	Six monthly	To determine existing status and any impacts
WB-8*1	GW052958 90BL107181	"Surrey"		Quarterly	Six monthly	To determine existing status and any impacts
WB-9*1	N/A	"Carlton"		Quarterly	Six monthly	To determine existing status and any impacts
WB-10*1	N/A	"Brolga"		Quarterly	Six monthly	To determine existing status and any impacts
WB-11*1	N/A	"Brolga"		Quarterly	Six monthly	To determine existing status and any impacts
WB-12*1	N/A	"Brolga"		Quarterly	Six monthly	To determine existing status and any impacts
WB-13*1	N/A	"Carlton"		Quarterly	Six monthly	To determine existing status and any impacts
WB-14*1	N/A	"Barock"		Quarterly	Six monthly	To determine existing status and any impacts
WB-15*1	N/A	"Kahana"		Quarterly	Six monthly	To determine existing status and any impacts
Yarrari	N/A	"Yarrari"		Quarterly	Six monthly	To determine existing status and any impacts
Surrey No.2*1	N/A	"Surrey"		Quarterly	Six monthly	To determine existing status and any impacts

*1 Non-Company owned bore *2 SWL – Standing Water Level *3 EC = Electrical Conductivity

*4 As specified in SWMP

Appendix 5 presents the results of the groundwater monitoring undertaken since the commencement of the mine. Monitoring sites are shown on Figure 3.

A review of the groundwater monitoring results shows the following trends:

Groundwater levels

Groundwater levels have remained relatively consistent at all monitoring locations during the reporting period (including consistent fluctuations associated with non-mining influences at some locations) with the exception of MP-5a, as discussed below:

- **MP-5a** is a relatively new piezometer installed directly adjacent to MP-5. Since monitoring commenced in March 2013, it showed a reasonably consistent SWL until September 2013, where the SWL dropped 4.4m to 71.25m. The SWL dropped a further 5.3m in November 2013, where it remained consistent at around 76.6m. In more recent times the bore has remained relatively consistent, dropping 1.62m since the beginning of 2014. There remains insufficient data at this point to verify any ongoing trend, however being in relatively close proximity to the open cut pit (within 1km), drawdown is not unexpected.

The pressure transducers/loggers installed in monitoring bores on site in accordance with the EA show consistent groundwater levels at MP-3a, MP-4b, while showing a slight increase in the groundwater level at MP-2A and slight decrease in groundwater level at MP-5A. MP-6a graphic reflects interference to logger from cattle. These results are generally consistent with the results of quarterly monitoring undertaken in the reporting period for these monitoring bores. A summary of the pressure transducer monitoring data is provided in Figure 6.

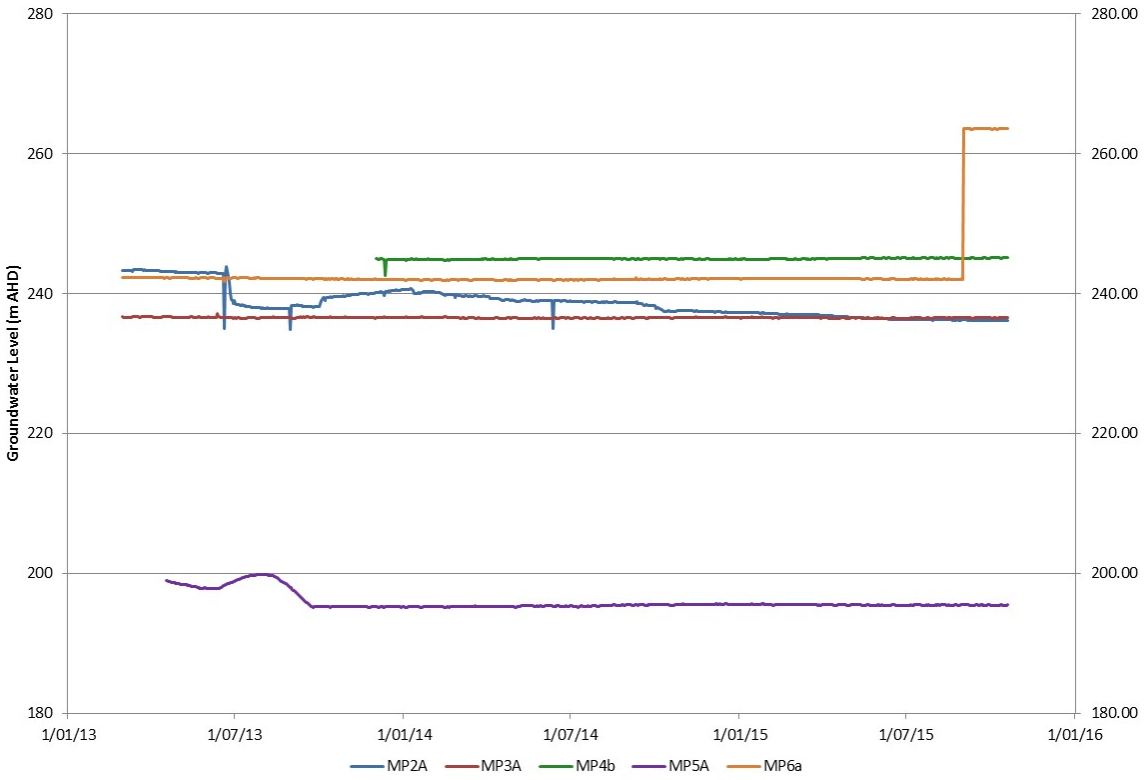

Figure 6 - Pressure Transducer Groundwater Levels

Groundwater quality

- The water in most bores generally has a neutral pH.
- The water in all bores can be described as fresh to brackish.
- Water quality has been compared to the Australian (ANZECC) guidelines for drinking water (cattle). The quality of groundwater at each monitoring location remained relatively consistent throughout the reporting period, with the exceptions of MP4-a, MP-5a, MP-7, WB5, WB-9, WB10, WB-11, WB12 and WB15, as discussed below.
- **MP4-a** recorded an increase in sulphate from <1 to 45mg/L. Any trend in sulphate will be determined by subsequent monitoring. Manganese dropped from 4.21 to 0.79mg/L. The ionic balance also dropped from its highest reading received last reporting period, 11.6 mg/L, down to 0.6 mq/L.
- Only mud was recovered at **MP-5a**.
- **MP-7** recorded a decrease in Fe from 5.59mg/L last reporting period, down to 1.45mg/L this period.
- **WB5** showed a decrease in total alkalinity from 630mg/L down to 261mg/L.
- **WB-9** recorded a slight increase in $S0_4$ and Mg concentrations during the reporting period.
- **WB10** recorded an increase in total alkalinity from 578mg/L last period, to 734mg/L, along with slight increase of Cl, Ca, Mg, and Na, but all results were well below the ANZECC guidelines. There was also a decrease in Fe from 26.7mg/L down to 9.44mg/L.
- **WB-11** recorded an increase in Na, K, and Fe during the reporting period. Although results were elevated when compared to previous monitoring, results were comparable to concentrations typically recorded at other monitoring locations.
- **WB12** recorded an increase in SO_4 and Na, and a decrease in Ammonia as Nitrogen to its lowest recording yet of 3.94mg/L.
- **WB15** recorded a decrease in SO_4 and Ca, and an increase in Cl, Mg, and Na, but all results were well below the ANZECC guidelines.

Previous monitoring has shown that after unusually elevated results, analyte concentrations usually return to more typical levels and it is expected that this trend will continue.

3.4.3 Comparison with EA Predictions

The hydrogeological assessment undertaken by Douglas Partners for the Extension EA concluded that drawdown on the surrounding groundwater system as a result of the expanded mining operation would be limited during the operation of the mine. This is due to faulting in the vicinity of the mine and generally low permeability of the Maules Creek

Formation strata, with hydraulic connectivity within the alluvium at the north and south of the site considered to be limited. As found during the reporting period, standing water levels generally have not lowered at the monitoring and groundwater bores surrounding the mine, with the exception of MP-5a. Douglas Partners predicted that at the end of the northern phase of mining during the extension of the pit, MP-5 / MP-5a could be drawn down by up to 13.4m. Results indicate that the actual drop of approximately 15.22m in SWL is slightly higher than this prediction. Other fluctuations in standing levels were recorded and are likely to be associated with stock and domestic watering purposes.

3.5 Contaminated Polluted Land

Investigations during the Extension EA revealed that no environmentally harmful products had been used within the Project area nor had there been any disposal of potential environmental contaminants. This situation has remained unchanged throughout the life of the mine to-date and consequently there is no reason to expect that contaminated lands would be present within the current Project Approval area.

3.6 Threatened Flora

3.6.1 Management

Whitehaven has prepared a Rehabilitation Management Plan (RMP) in accordance with Schedule 3, Condition 36 of PA 10_0015 MOD 1 which was approved by the Division of Resources and Energy in April 2012. The plan includes requirements for flora monitoring on rehabilitated areas. Rehabilitation monitoring was undertaken at RCM during November 2014 and April 2015 (refer Appendix 6), in accordance with the Rehabilitation Management Plan.

To address and offset vegetation impacts of the RCM, a Biodiversity Offset Strategy was prepared as part of the Rocglen Extension Project. The area of offset required was calculated using the NSW BioBanking Assessment Methodology, which calculates the number of "credits" required at the impact site based on the area and condition of each vegetation type impacted and the number of credits generated at a BioBank Site based on the improvement in biodiversity values via conservation management. On the 28th June 2012, the Whitehaven Regional BioBank site was formally established under BioBank Agreement 43. This BioBank site, which includes the "Yarrari" and "Belah" properties, now accounts for the RCM offset requirements. The BioBank credits required to be retired for these approvals occurred on the 17th April 2013, and the area is now subject to active management in accordance with the Management Plan for the Regional BioBank site.

A BioBank Management Plan has been prepared for the site, with active management required to commence on release of the first years management costs from the BioBank Trust Fund. Funds were released from the 1st August 2013. Management actions undertaken during the reporting period are discussed in Section 3.6.2.

3.6.2 BioBank Management Actions

Management actions to be undertaken at the BioBank site and the management actions that occurred in the reporting period are summarised in Table 9.

Table 9 - Biobank Management Actions

Management Action	Action Progress	Comments
Management of grazing for conservation	Grazing excluded from all areas of BioBank during Year 3	Grazing excluded across the biobank with good groundcover % retained across the site as a consequence.
Weed control	Weed spraying (including African Boxthorn, Noogoora Burr, Horehound and Bathurst Burr) as required, weather/season dependent. Prickly Pear control using Cochineal Beetle on an ongoing basis. Spraying of 52 hectares of Lovegrass in front paddocks undertaken via contractor in September 2014.	BioBank site generally retains minor areas of weeds, with active management ongoing.
Management of fire for conservation	Ecological burns not required during early years of active management.	Ecological burns not required under management plan at this stage.
Management of human disturbance	The biobank site has generally been off-limits to the public, with only the property manager permitted on site.	No additional human disturbance has been undertaken on the site other than through general site management activities such as fence line repairs, track maintenance, and feral animal control.
Retention of native vegetation	Minor vegetation removal in the construction of the new 'Surrey' boundary fence line. There have been no requirements to burn native vegetation under the fire management plan.	No activities have been undertaken on site that have resulted in vegetation removal other than for the replacement of the boundary fence.
Planting or seeding	Opportunistic planting of 9 plots was undertaken, with approximately 1180 trees being planted during this reporting period.	Favourable conditions allowed for planting during the reporting period.
Retention of dead timber	The biobank site has generally been off-limits to the public, with only the property manager permitted on site. No dead timber has been removed and/or used for fencing purposes.	Dead timber is retained on site in accordance with the management plan.
Erosion control	No active erosion identified during the reporting period.	There have been no areas of active erosion identified as a cause of concern during this reporting period.
Retention of rocks	The BioBank site has generally been off-limits to the public, with only the property manager permitted on site. No rocks have been removed during the reporting period.	Rocks retained on site in accordance with the management plan.
Control of feral and over abundant native herbivores	The resident property manager has undertaken feral animal control throughout the reporting period, removing 1,173 goats and approximately 70 rabbits from the	Feral animal control has been ongoing by the resident property manager.

Management Action	Action Progress	Comments
	property since 2008.	
Vertebrate pest management	The resident property manager has undertaken vertebrate pest management, removing 309 pigs and 36 foxes from the property since 2008. This was undertaken by opportunistic shooting and/or trapping. Baiting for rabbits and foxes occurred during the reporting period.	Vertebrate pest control has been ongoing by the resident property manager.
Nutrient control	No fertilisers or pesticides were applied to the BioBank sites during the reporting period. Herbicides were used only for control of weeds.	Pesticides and herbicides may be applied to the biobank in accordance with the management plan requirements.
Control of exotic fish species	Not Applicable	Not Applicable
Maintenance or reintroduction of natural flow regimes	All nominated dams on the bio bank site were filled and seeded in September 2014.	Works were undertaken on site using a bull dozer, and then hand seeded with Jap Millet.

3.6.3 Comparison with EA Predictions

The following recommendations were followed during the reporting period as directed by RPS (2010):

- Clearing of the minimal amount of land required for mine development;
- Areas of clearing minimised, with trees retained as much as possible;
- Weeds and invasive grasses controlled on an ongoing basis;
- Dust generation minimised at all times;
- Stockpiles of materials retained in cleared areas;
- Installation of erosion and sedimentation measures; and
- Maintenance of vehicles and machinery.

Perennial introduced grasses are used on rehabilitated areas, but excluded from native vegetation areas to minimise competition for moisture.

3.7 Threatened Fauna

3.7.1 Management

Whitehaven engaged RPS Harper Somers O'Sullivan to undertake a Flora and Fauna Assessment to support the application for the Extension Approval. Further to Countrywide Ecological Service investigations in 2007 RPS recorded a total of 100 fauna species, including one additional threatened species, the Speckled Warbler *(Pyrrholaemus sagittatus),* present within the project area.

As discussed in Section 3.6, Whitehaven developed a Rehabilitation Management Plan (RMP) in accordance with Schedule 3, Condition 36 of PA 10_0015 MOD 1. The RMP includes detail on monitoring, and where fauna monitoring will be undertaken biennially. Fauna monitoring plots were established during spring 2009 in areas adjacent to the site, with two control pasture monitoring plots established during the reporting period.

3.7.2 Performance

No threatened fauna or active nests were identified during the reporting period. It is anticipated that annual fauna monitoring will continue in the next reporting period.

It has been found that due to Rocglen's proximity to Vickery State Forest, much of the fauna species richness can still be expected to continue to exist on the mine site throughout the life of the mine. It has also been noted that the abundance of water located at the Rocglen site has attracted many animals to congregate on the rehabilitation and in the woodlands around the mine.

3.7.3 Comparison with EA Predictions

EA predictions by GSS Environmental in 2010 found that Rocglen Coal Mine would be unlikely to significantly affect any threatened, migratory or protected fauna species occurring within the subject site, due to the large amount of similar vegetation occurring on "Yarrawonga" and in Vickery State Forest. Findings of annual rehabilitation monitoring are noted in Appendix 6.

3.7.4 Management

Weed management within the ML's involves general observations during monthly inspections to determine levels of weed infestation. Weed control is undertaken by Whitehaven's environmental personnel. All persons involved with weed control hold ChemCert Australia accreditation. Whitehaven also works with the Gunnedah Shire Council Noxious Weed Inspector to identify target control areas surrounding the site and implement actions in accordance with relevant legislation and the local Noxious Weed Management Plan.

3.7.5 Performance

RCM has not experienced any major weed issues during the reporting period. Weed management comprised of campaign spot spraying of African Boxthorn *(Lycium ferocissimum)*, and spot spraying for Mother of Millions (*Bryophyllum delagoense*). African Boxthorn was present and targeted at the north of the site amongst scattered woodland areas during the cooler months of the reporting period. Spot spraying was also undertaken

for all weeds in the areas surrounding the crib hut, workshop, and helicopter pad on three occasions during the reporting period.

3.8 Blasting

3.8.1 Management

Blasting criteria for the mine are nominated in Project Approval PA 10_0015 MOD 1, and Condition L4 of Environment Protection Licence 12870, and specify that:

- Blasting must only be carried out between 9.00 am and 5.00 pm, Monday to Saturday, with a maximum of 1 blast per day, unless an additional blast is required due to a misfire.
- The overpressure level from blasting operations must not:
  (a) exceed 115dB (Lin Peak) for more than 5% of the total number of blasts over each reporting period; and
  (b) exceed 120dB (Lin Peak) at any time.

  at any residence on privately-owned land.
- Ground vibration peak particle velocity from the blasting operations must not:
  (a) exceed 5mm/s for more than 5% of the total number of blasts during each reporting period; and
  (b) exceed 10mm/s at any time,

  at any residence on privately-owned land.

Flyrock, air vibration, ground vibration and dust from blasting are controlled using a combination of design and operational methods which are detailed in the MOP and the Blast Management Plan. Road closures during blasting occurred for all blasts within 500 metres of Wean Road.

3.8.2 Performance

During the reporting period there were a total of 30 blasts onsite. Blasts were monitored using a combination of two permanent blast monitors, located at licensed points “Roseberry” and “Retreat”, and one portable blast monitor. The portable monitor was located at the unlicensed point “Kahana” for 7 months, in response to landholder concern, until the 21st of May 2015 when it was relocated to the “Roseberry” property. This relocation was in response to concerns from the blast engineer regarding unexpectedly high results from the “Roseberry” monitor.

The maximum recorded ground vibration during the reporting period was 1.15 mm/s recorded at “Roseberry” on the 29th August 2014. The maximum recorded peak

overpressure level during the reporting period was 116.1 dBL recorded at "Roseberry" on the 5th September 2014. None of the blast results exceeded the 100 percentile limits listed above, however 2 blasts during the period exceeded the 115dB limit, with results of 116.1 dB on the 5th September 2014 and 115.7 on the 18th September 2014. Both of these results were recorded at "Roseberry", and make up 6.7% of all blasts undertaken for the period. All blast monitoring results for the reporting period, including the time of initiation have been included in Appendix 7.

3.8.3 Comparison with EA Predictions

Spectrum Acoustics carried out a blasting and vibration assessment for the Extension EA and concluded that, based on historical measurement results for the Rocglen Mine, there are no anticipated exceedances of blasting criteria at any privately owned residence as a result of operations under the Extension Project. In accordance with this prediction, no exceedance of either overpressure or ground vibration 100 percentile limits was recorded during the reporting period. However as noted in Section 3.9.2, >5% of all blasts undertaken recorded >115 dBL overpressure. Spectrum Acoustics recommended that blast monitoring should continue to be conducted at the nearest privately owned residences to the north and south of the mine and this has been carried out during the reporting period.

3.9 Operational Noise

3.9.1 Management

The operational noise criteria specified in PA 10_0015 MOD 1 and EPL 12870 are as follows:

Noise Criteria dB(A)

Location	***Day***	***Evening***	***Night***	
	$L_{Aeq\ (15\ min)}$	$L_{Aeq\ (15\ min)}$	$L_{Aeq\ (15\ min)}$	$L_{A1\ (1\ min)}$
All privately-owned land	*35*	*35*	*35*	*45*

The cumulative road noise criteria specified in PA 10_0015 MOD 1 (Rocglen) and PA 11_0047 MOD1 (Tarrawonga) is:

Road Traffic Noise Criteria dB(A)

Location	***Day*** $L_{Aeq\ (15\ hour)}$	***Evening*** $L_{Aeq\ (15\ hour)}$	***Night*** $L_{Aeq\ (9\ hour)}$
All privately-owned residences	*60*	*60*	*55*

Control of noise generation and propagation at the mine is by a combination of general source and propagation path methods including:

- Installation and maintenance of appropriate mufflers on plant and equipment;
- Where operationally feasible, scheduling activities to minimise operation of equipment in exposed locations when winds are blowing towards residences and elevated locations when temperature inversions are present;
- Equipment removal or replacement;
- Changing operational procedures;
- Restricting hours of operations;
- Enclosure of fixed items of plant, e.g. generators;
- Bunding close to noise sources to create obstructions to the propagation path;
- On-going site road maintenance using the mine-based grader; and
- Regular equipment maintenance.

In accordance with the Condition 3 (c) of Schedule 3 of PA 10_0015 MOD 1 RCM is required to regularly assess real-time noise levels and meteorological forecasting data to ensure compliance with the operational noise criteria. RCM utilises a mobile real time noise monitor which is used to actively monitor noise at surrounding properties which are likely to receive the greatest impact from operations. The unit monitors operational noise levels in comparison with compliance levels and when noise levels approach criteria an alarm system is triggered to operations personnel. Operations and environmental personnel are able to log on to a web based platform where real time noise and weather data is viewable. The web based platform may also be used to live stream from the monitor to identify specific sources of noise which will be used to confirm if the source is mining related.

A range of controls are used in to mitigate noise on a real time basis, including:

- Relocation of dump position to reduce noise impacts;
- Changes in operator behaviour (speed of trucks, haul road used, speed of dozers);
- Use of predictive forecasts to determine suitable dumping locations (i.e. upper dumps during the day, and in-pit dumping at night where possible); and
- Stand down items of equipment to achieve noise compliance.

Relevant personnel comprising of the Environmental Officer, Open Cut Examiner and Operations Manager have been trained in the operation of the real time system, including alarms, live streaming of audio and reactive management to noise impacts.

3.9.2 Performance

RCM's approved Noise Management Plan details the requirements for attended and real time operational monitoring. Cumulative road haulage noise monitoring from RCM and Tarrawonga haulage is detailed in the Road Traffic Noise Management Plan. The noise monitoring sites are identified on Figure 3.

Attended noise monitoring was undertaken on a quarterly basis during the reporting period (September 2014, December 2014, March 2015 and June 2015).

Cumulative road noise monitoring occurred in December 2014 and June 2015, as required under the Road Traffic Noise Management Plan.

No exceedances of either operational or road transport noise criteria were noted during the reporting period. Monitoring results are provided in Appendix 8.

REAL TIME NOISE MONITORING

In accordance with Project Approval requirements, Whitehaven has utilised a real time noise monitor to manage noise impacts at various locations, in particular the property "Penryn" during the reporting period. This property was determined to have potential impact from operations, along with the landholders expressing concern regarding noise from the operation. During the reporting period, in-pit dumping below natural surface level has been a successful operational adjustment in reducing noise impacts from operations during night periods.

3.9.3 Comparisons with EA Predictions

The noise impact assessment carried out by Spectrum Acoustics for the Extension EA recommended that noise monitoring be relocated to the "Retreat" property, to the north of the previous location "Costa Vale", with agreement by the landholder and in accordance with the extension approval. This was completed, with all monitoring events carried out at "Retreat" and recording all compliant results as predicted.

Attended noise monitoring continued as recommended at the "Surrey" property during this reporting period. All results were within the noise compliance criteria specified above. Modelling has previously identified the "Surrey" property as being close to the noise criteria of 35dB.

Spectrum Acoustics predicted that road traffic noise levels would remain compliant with the traffic noise criterion. Traffic noise monitoring has continued to be conducted at the "Brooklyn" and "Weroona" residences on Blue Vale Road, where noise levels from coal haulage were within compliance levels during all monitoring events.

3.10 Visual, Stray Light

3.10.1 Management

The mine is generally well positioned with respect to visual aspects, with views of the mining operations and/or areas of mine-related disturbance initially limited to those from the project related residences "Costa Vale" located adjacent to the northern boundary of the mine site, "Stratford" to the south of the mine site, "Yarrari" and "Belah" to the east and Vickery State Forest to the west.

As mining has progressed, the western emplacement has developed to maximum height which has resulted in the site being visible from locations further to the south and east. Low rainfall has made the establishment and maintenance of vegetation on the western emplacement to reduce its visual impact challenging. Rehabilitation on the northern emplacement has continued during the reporting period, and it is anticipated that the rehabilitation of this area will be completed within the first half of the next reporting period. Management / minimisation of local and more distant visual impacts are achieved by:

- Undertaking activities in accordance with the various management plans applicable to the mine, all of which incorporate safeguards which indirectly reduce visual impact;
- Minimising the extent of land disturbance / clearing in advance of mining;
- Progressive rehabilitation of disturbed areas;
- Sympathetic positioning and direction of lights, when possible, to avoid impacting on local residences;
- Communication between environmental and operation staff regarding surrounding residences that may receive lighting impact; and
- In the event of a complaint in relation to lights, immediate action is taken at site to mitigate the impact.

3.10.2 Performance

Whitehaven did not receive any complaints during the reporting period in regards to lighting impacts at properties. The reduction in complaints compared to previous reporting periods can be attributed to operations generally occurring lower in the pit and therefore a reduced need for lighting plants at elevation, and on the continuous management of potential lighting impacts. In the event of a light related complaint, operations will be notified of the complaint and lights will be adjusted to reduce impact.

During the reporting period the northern emplacement was targeted for shaping and rehabilitation, with rehabilitation of this area being largely completed early in the next reporting period. This will reduce the exposure and visibility of the area to properties north of the mine.

3.10.3 Comparison with EA Predictions

GSS Environmental (GSSE) undertook a visual amenity assessment considering the post-mining outlooks from five residences (both privately owned and project-related) in close proximity to the mine. The purpose was to assess the visual amenity of the local setting, particularly of privately owned residences, with the addition of the key elements associated with the Rocglen Extension Project and residual impacts following implementation of mitigation measures and site rehabilitation. GSSE predicted the impact of the Rocglen

Extension on the visual amenity of the local area to be low and acceptable. GSSE identified sympathetic positioning of lights and progressive rehabilitation to be the main initiatives to reduce visual impact. As mentioned in Section 3.10.2, the matter of sympathetic lighting placement is continuously considered by operations personnel. Progressive rehabilitation has occurred on the western and northern emplacements as described in Section 5.

3.11 Aboriginal Heritage

3.11.1 Management

In 2010, RPS archaeologists conducted an assessment and field survey of the potential impact of the Rocglen Extension on Aboriginal heritage. The archaeological field survey, which covered the area proposed to be disturbed by the expansion of the Northern Emplacement Area, was undertaken with members of four local Aboriginal Stakeholder groups. In summary, three stone artefact sites were located comprising of one isolated find (IF1) and two artefacts scatters (AS1 and AS2). Descriptions and their current status and previously identified sites are shown in Table 10.

Table 10 - Identified Aboriginal Artefacts and Scarred Trees

Initial Environmental Assessment PA 06_0198			
Site Name	**Site Type**	**Site Description/Comments**	**Current Status**
B1	Isolated Artefact	8 negative flake scars partly exposed in a dust/sand erosion feature along a fence line, 10m from the central drainage line.	Artefacts salvaged due to being within area of disturbance, held at the Cumbo Gunerrah keeping place.
B2	Artefact Scatter	8 small trimming flakes were scattered on and around a large ant mound on the crest of a contour bank. Perhaps the remains of a knapping or a tool manufacturing site.	Artefacts salvaged due to being within area of disturbance, held at the Cumbo Gunerrah keeping place.
B3	Extended Artefact Scatter	Artefact scatter extending approximately 800m along the western bank of the central drainage line containing >40 artefacts.	Artefacts salvaged due to being within area of disturbance, held at the Cumbo Gunerrah keeping place.
Btree 1	Scarred Tree	The scar is 160cm long, 40cm wide and 295cm from the ground on a large box gum located on the eastern side of the Wean Road Easement.	Scar tree fenced with signage, undisturbed within current project area.
Btree 2	Scarred Tree	The scar is 57cm long, 15cm wide and 146cm from the ground on a large box gum located on the eastern side of the Wean Road Easement	Scar tree fenced with signage, undisturbed within current project area.
Stratford ST1	Scarred Tree	The scar is 223cm long, 70cm wide and 18cm from the ground on a large box gum located in a closed road on the “Stratford” property	Scar tree undisturbed on neighbouring Whitehaven Property.
Stratford ST2	Scarred Tree	The scar is 140cm long, 42cm wide and 14cm from the ground on a large box gum located north-south oriented closed road easement on the “Stratford” property	Scar tree undisturbed on neighbouring Whitehaven Property.
Extension Environmental Assessment PA 10_0015			
AS1	Artefact Scatter	Artefact scatter containing flake pieces comprising mudstone, chert and grey silcrete located in an area of exposed soil.	Artefacts salvaged 17th May 2012 and transferred to Cumbo Gunerrah keeping place.

Initial Environmental Assessment PA 06_0198			
Site Name	**Site Type**	**Site Description/Comments**	**Current Status**
AS2	Artefact Scatter	Artefact scatter containing flaked pieces of greenstone and chert located in an area of exposed soil.	Artefacts salvaged 17th May 2012 and transferred to Cumbo Gunerrah keeping place.
IF1	Isolated Find	An isolated chalcedony flake with a banded quartz vein located within an area of eucalypt trees.	Could not be located during salvage 17th May 2012, hence left in-situ.

3.11.2 Performance

RCM, either directly or through the soil stripping contractor, regularly consults with representatives of the local Aboriginal community. In accordance with the agreement with the representative Aboriginal group, being the Min Min Aboriginal Corporation, notification of planned topsoil stripping is provided by the soil stripping contractor or site Environmental Officer directly to the nominated Aboriginal site monitors approximately 2 to 3 days in advance of planned activities. On 23rd September 2013, correspondence was received from Gunida Gunyah Aboriginal Corporation stating that they no longer wished to be involved with any surveying or mining activities. They will continue to be consulted with on aspects such as changes to the management plan.

Given that pre-stripping (separate stripping of topsoil, subsoil and friable overburden) is undertaken well in advance of mining and the soil stripping contractor is also engaged in other activities on the mine site, the flexibility exists to delay topsoil stripping activities should the situation ever arise in the future where monitors are temporarily unavailable.

During the reporting period, no cultural material of significance was identified during soil stripping activity. To date, the measures in place to protect Aboriginal Cultural Heritage are considered satisfactory, with all measures identified in the EA and consent criteria in place.

3.11.3 Comparison with EA Predictions

Management measures for Aboriginal heritage items are detailed by RPS in the Extension EA. All measures recommended by RPS have been implemented at Rocglen and were implemented during the reporting period when required. These include consultation with community groups, the salvage and transfer of artefacts to the local keeping place, the protection of scarred trees on Wean Road and the invitation of representative monitors for all soil stripping campaigns.

3.12 Natural Heritage

No features of European heritage were discovered within the Project Approval Area and hence, no specific management procedures are required.

3.13 Spontaneous Combustion

3.13.1 Management

RCM coal has a low percentage of inorganic sulphur and hence a low potential for exothermic oxidation reactions. The short residence time of ROM coal stockpiles at the mine also minimises the potential for spontaneous combustion incidents.

In the event of spontaneous combustion, Whitehaven personnel are present within the area of the ROM coal stockpiles during work hours and are trained to watch for indications of spontaneous combustion. Any incident would be followed by excavation to identify the source and extinguishment through water saturation with the sites water cart or fire tender.

3.13.2 Performance

There were no incidents of spontaneous combustion during the reporting period.

3.14 Bushfire

3.14.1 Management

The mine maintains firebreaks around both its landholding and the mine area and maintains firefighting equipment as well as earthmoving equipment, a water truck and fire tender which would be used in the control of fires. Rocglen personnel also liaise with the local (Nandewar) Rural Fire Service and the Regional Fire Control, as required.

3.14.2 Performance

Whilst no incidents of fire occurred on the mine site during the reporting period, there was one small, isolated bushfire located on the BioBank offset property. This fire was observed by RCM mine personnel, and was extinguished utilising a mine owned water cart.

3.15 Mine Subsidence

As RCM is an open cut operation, mine subsidence is not relevant to the site.

3.16 Hydrocarbon Contamination

3.16.1 Management

It is Whitehaven's objective that:

- All bulk hydrocarbons, i.e. fuel, oils and grease (both new and waste) retained at the RCM be contained within bunded areas within the contained water management system as described in Section 3.3.1;
- All fixed or portable equipment incorporate self-contained bunding;
- Hydrocarbon-contaminated materials be disposed of appropriately; and
- Minor spillages, if occurring, are cleaned up and the contaminated soil either bio-remediated or transferred off-site to an appropriately licensed waste disposal area.

Major spillages, if occurring, would be treated in accordance with the three-phase system identified in the site's Pollution Incident Response Management Plan.

3.16.2 Performance

Whitehaven's procedures for hydrocarbon management have been effective throughout the reporting period with:

- No groundwater contamination evident or reported by landowners; and
- No requirement for off-site disposal of contaminated materials.
- No reportable incidents of hydrocarbon spills or contamination.

One non-reportable incident occurred onsite in June 2015, in which the oil water separator was found to be malfunctioning during the Environmental Monthly Inspection. As a result of the malfunction, oil and grease from the workshop were found in the oil-water separator discharge pond. The water in the pond was tested, and returned readings of 384 mg/L of suspended solids, 91 mg/L of organic carbon, 448 mg/L of oil and grease, and a pH of 7.30. A clean up was undertaken by RCM personnel utilising floating oil booms and oil absorbent pads.

The booms and absorbent pads were collected in waste bags to be disposed of in the workshop waste collection. The water within the pond was then pumped back through the oil water separator, and the contaminated soil from the pond was collected and placed in the bioremediation cells onsite.

It was determined that the original malfunction of the oil water separator was caused by the high levels of rainfall inundating the separator. The oil water separator has been included in more regular mechanical inspection schedules.

3.17 Methane Drainage/Ventilation

Data relating to this section is reported separately through National Pollutant Inventory reporting and National Greenhouse and Energy Reporting processes.

3.18 Public Safety

3.18.1 Management

The mine is located wholly on Whitehaven owned land in a rural area, with a private access road entering the site on the south-western boundary and the Wean Road positioned adjacent to the eastern side of the mine boundary. The site is fenced with lockable access gates and visible signs installed.

Visitors to the mine are required to report to the mine office and unauthorised personnel are not permitted to move around the mine area unaccompanied. Procedures are in place with respect to blasting to ensure the area around each blast site (exclusion zone) is clear of personnel and that all surrounding residents are advised in advance of proposed blasts.

3.18.2 Performance

There were no issues recorded during the reporting period.

3.19 Meteorological Monitoring

3.19.1 Management

The meteorological station for the RCM is located at the "Costa Vale" property, north of the site. The weather station is accessible via an online web platform in association with the real time noise and dust monitors, and is serviced by Novecom Pty Ltd. The station has been in operation since April 2012 recording 15 minute wind speed, wind direction, temperatures, humidity and rainfall.

3.19.2 Performance

In April 2015, following concern by RCM personnel about rainfall recording results, additional maintenance was carried out on the weather station rain gauge. A software error was discovered to be affecting the gauge results, which was resulting in the gauge reporting only half of the rainfall being collected. The software error was removed, and an updated data set provided by Novecom detailing the actual rain records collected from 1st January 2015. Daily meteorological data is presented in Appendix 9, as received from Novecom.

Rainfall

Rainfall data from the previous 12 months is presented in Table 11 and Figure 7. Full station data is presented in Appendix 9.

Table 11 - Rainfall Data (1 Aug 2014 - 31 July 2015)[*1]

Month	Monthly Rainfall Reporting Period	Long Term Average Rainfall*[2]	Rain days Reporting Period	Long Term Average Rain days*[2]
August 2014	41.9	41.3	7	4.8
September 2014	6.4	40.3	1	4.5
October 2014	13.3	55.5	1	5.4
November 2014	8.3	62.6	2	5.7
December 2014	48.3	70.1	11	6.0
January 2015	46.7	71.3	6	5.5
February 2015	9.7	67.3	3	5.1
March 2015	12.9	47.7	4	3.9
April 2015	59.7	37.5	5	3.4
May 2015	45.0	42.5	6	4.1
June 2015	46.8	43.6	3	
July 2015	17.8	42.7	4	
TOTAL	**356.8**	**622.4**	**53**	

*1 Data received in the table has not been corrected to account for the aforementioned software error, as there is no way to determine when the bug began operating.

*2 Gunnedah Pool (Station 055 023) averages from 1876-2012.

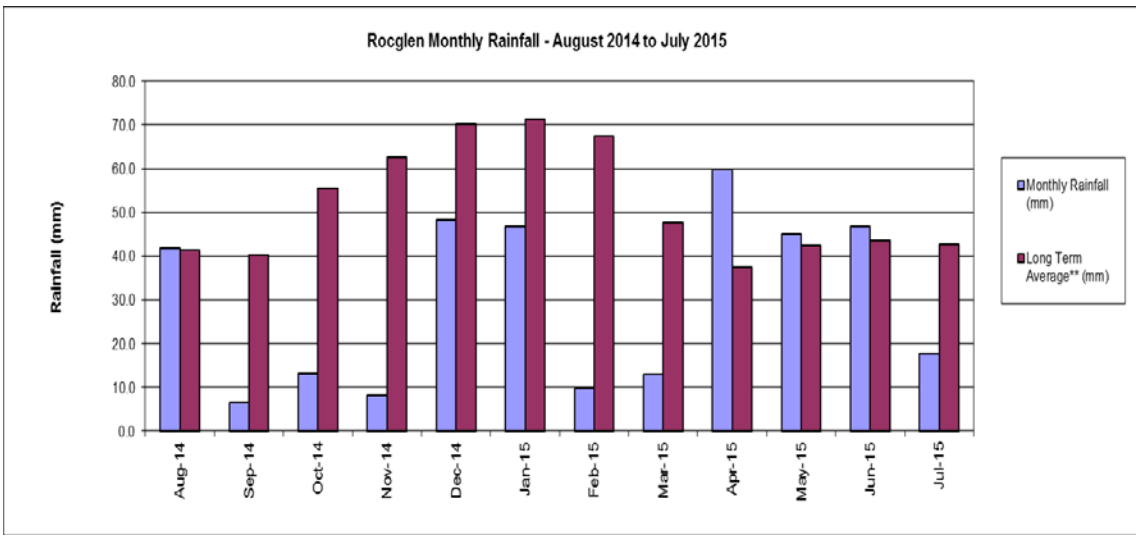

Figure 7 - Rainfall Data

A review of Table 11 and Figure 7 shows that the total rainfall at the mine during the reporting period was 356.8 mm. This is considered a very dry year when compared to the long term average of 622.4mm at Gunnedah. Figure 7 depicts higher than average rainfall events in August 2014, and April, May, and June 2015, although April 2015 was the only month to exceed the average by more than 5 mm.

Temperature

Maximum and minimum temperatures for the reporting period are presented in Table 12 together with long-term monthly averages for Gunnedah Pool (Bureau of Meteorology Station 055023).

Table 12 - Monthly Temperatures

Month	Monthly Temperature			
	Reporting Period (°C)		Station 055023 (Gunnedah Pool)* (°C)	
	Min	Max	Av. Min	Av. Max
August 2014	-4.2	21.5	4.2	18.9
September 2014	-2.0	31.8	7.0	22.8
October 2014	4.0	30.4	10.7	26.7
November 2014	10.5	42.3	14.2	30.3
December 2014	12.6	38.5	16.8	32.9
January 2015	10.8	37.7	18.4	34.0
February 2015	11.2	37.0	18.1	32.9
March 2015	7.0	39.7	15.8	30.7
April 2015	6.3	30.1	11.4	26.4
May 2015	-2.4	26.3	7.1	21.3
June 2015	-1.6	21.8	4.3	17.6
July 2015	-3.7	19.5	3.0	16.9

* Gunnedah Pool (Station 055 023) averages from 1876-2011

Wind Speed and Direction

Fifteen minute average wind speed and direction data is collected from the Rocglen meteorological station, as it, together with operational records and environmental monitoring results, can be used to assess the environmental effects or consequences of specific activities undertaken at the mine or in surrounding areas. Recorded wind data for the reporting period is presented in Appendix 9, and shows the following:

- The predominant wind direction for the period were southerly winds, followed by easterlies. The distinct trend of southerlies is a result of the local topography, with the mine located in a depression bordered by the Kelvin Range to the east and the Vickery State Forest to the west.
- Throughout the year wind speeds predominately fell within the 1.5-3m/s range. The majority of the wind speeds above 6m/s came from an easterly direction.

Inversions

The meteorological station at “Costa Vale” is fitted with temperature sensors at 2m and 10m intervals to assist in the determination of inversion conditions. Both attended and real time noise results obtained over the reporting period were assessed to determine if inversions contributed to any elevation in noise levels, particularly during winter months where inversions occur regularly.

3.20 Other Issues and Risks

3.20.1 Feral Animal Control

During the reporting period, feral animals have not been a major issue within the Rocglen site. However, feral animal management actions on the adjacent BioBank site have resulted in the removal of approximately 59 goats, 69 pigs, 3 foxes and 3 rabbits in the reporting period.

3.21 Incidents

A single incident being exceedance of 5% of blasts above 115 dBL occurred during the reporting period. Reporting of the incident was undertaken to the DP&E, DRE and EPA post the reporting period. It is thought that the exceedance was the result of prevailing meteorological conditions at the time of two blasts undertaken in September 2014.

4 COMMUNITY RELATIONS

4.1 Environmental Complaints

Whitehaven maintains a designated complaints line. In the event of a complaint, details pertaining to the complainant, complaint and action taken are recorded on a "Complaints Form".

During the reporting period one complaint was received in relation to operations at the mine. The nature of the complaint, details and response are presented in Table 13. Table 14 compares the number and nature of complaints registered during the previous and current reporting periods. Any complaints that are made are reported to the Community Consultative Committee (CCC), updated on Whitehaven's website and documented in the AEMR/Annual Review.

Table 13 - Complaints Summary

Method	Date/ Time	Nature of Complaint	Investigation	Action Taken / Follow-up
Phone call to Site Office	29/08/2014 12:00pm	Complainant rang the site office concerned about the noise of the blast and fume from the blast. Complainant stated that this was the first blast they had heard from Rocglen in some time and it was very loud, caused birds to lift.	The Rocglen Environmental Officer contacted the complainant at approximately 12:20pm on 29/08/14 to notify the complainant that their message had been received and to discuss the complaint. The complainant notified the EO that they had called as the blast was very loud and that was unusual as they usually do not hear Rocglen blasts. They were also concerned that fume from the blast may impact them, however the complainant confirmed that no fume was visible and that there was little dust visible from the blast, although there was a faint gunpowder smell. The EO informed the complainant that the blast monitors showed the blast was well within the overpressure limit of 115dB, and that the blast may have sounded louder than usual as the wind was blowing in the general direction of the complainant's property and the blast was relatively high in the pit.	No follow up required.

Table 14 - Complaints Comparison

AEMR period	Issue														Total
	Driver behaviour	Dust/Noise/ speed/ Rubbish from Wean Rd	Lack of consultation	Blasting	Noise/Light/ Rubbish	Mine Noise/ Dust	Noise	Lights/ Noise	Lights	Fencing/ Noise	Livestock	Dust	Ground water	Noise/Dust /Lights	
2008-09	1	1	1	4											7
2009-10					2										2
2010-11		2			1	5									8
2011-12				1	1	1	1	1	2	1					8
2012-13				2				2			2	1	1	1	9
2013-14				3											3
2014-15				1											1

4.2 Community Liaison

In accordance with Condition 5 of Schedule 5 of PA 10_0015 MOD 1, a Community Consultative Committee (CCC) continues to be operated. The committee comprises representatives of Gunnedah Shire Council, RCM and the community and is chaired by Mr John Sturgess.

Since its inception, the CCC has met on a regular basis, meeting 4 times per year. During the reporting period meetings were held on 13th August 2014, 12th November 2014, and the 11th March 2015. Given the limited number of issues discussed at each CCC meeting it was proposed at the March 2015 meeting that future meetings be held on a 6 monthly basis, with March and September nominated as the suitable meeting months moving forward. This proposal was accepted by the CCC members. RCM representatives and Whitehaven's Community Relations personnel continue to maintain regular personal contact with the neighbours in the vicinity of the mine. These contacts not only provide a means of information dissemination, but also enable Whitehaven to ascertain and address any potential issues which may arise from time to time.

Community organisations and other local business and institutions regularly identify an interest with activities occurring at the mine site. In this regard, and to maintain links with those business and community members, information is provided as required, and on occasion, guided tours of mine have been undertaken.

5 REHABILITATION

5.1 Buildings

No rehabilitation of buildings occurred during the reporting period.

5.2 Rehabilitation of Disturbed Land

5.2.1 Objectives

It is Whitehaven Coal's objective that areas disturbed by mining activities at RCM are progressively rehabilitated in order to minimise the areas of exposure and hence reduce the potential of air quality impacts, erosion and sedimentation, and visibility of mining operations from surrounding residences and publicly available vantage points.

Short term rehabilitation objectives include:

- Minimise clearing/vegetation disturbance consistent with operational requirements;
- Schedule operations including overburden/interburden emplacement and shaping and revegetation to minimise visual exposure;
- Rehabilitate areas of disturbance no longer required for mining-related operations;
- Apply appropriate soil material (topsoil/subsoil) to the final landform based on material availability and post-mining land use;
- Stabilise all earthworks, drainage lines and disturbed areas in order to minimise erosion and sedimentation; and
- Control vermin, feral animals and noxious weeds.

The overall long-term mine rehabilitation objective is to provide a low maintenance, geotechnically stable and safe landform that blends in with the surrounding topography and provides a mixture of rehabilitated bushland and grazing areas that are generally consistent to pre-mining conditions.

Long term rehabilitation objectives include:

- Re-establish land to either pasture or bushland over the areas disturbed by the mine;
- Increase the area of land allocated to bushland/woodland through the revegetation of those areas disturbed by the mine and the long-term conservation of remnant and degraded native vegetation and/or habitat corridors on the mine site;
- Provide habitat for fauna and corridors for fauna movement within the final landform; and
- Monitor rehabilitation success in terms of physical and biological parameters.

5.2.2 Variations in Activities against MOP

The total area rehabilitated is generally consistent with the progressive annual rehabilitation proposed in the MOP, as a total of 65.3ha has been completed to date, which aligns with that proposed to occur within MOP Year 5 (2015).

RCM has been liaising with DRE regarding the refinement of the final landform in preparation of the 2015 draft MOP, and subsequent Closure MOP required by mid 2016.

5.2.3 Post Rehabilitation Land Use

Two post rehabilitation land uses are to be developed at RCM, Pasture and Bushland. The western slope and plateau / ridge of both the northern and western emplacement areas will be planted with locally occurring tree and shrub species with the objective of re-establishing bushland areas, while the slopes of the final void, the northern and eastern slopes of the northern emplacement area, and the eastern slopes of the western emplacement areas will be seeded in accordance with the objective of returning the area to pasture.

Pockets of bushland will be planted in the pasture areas to provide wildlife refuges and create a more aesthetically appealing landscape, while a wildlife corridor will be established north of the final void, linking the Vickery State Forest to the west with the BioBank Site and the Kelvin Ranges to the east. Further bushland will be established along the southern and western boundaries, and along the eastern boundary north to the end of the Wean Road realignment.

At the end of the previous reporting period, the majority of the western face of the western emplacement and the lower western slope of the northern emplacement had been planted with tube stock tree and shrub species. Some areas are established however the majority of these areas were severely affected by the lack of rainfall over the reporting period and as such will require infill planting. The northern slope of the northern emplacement area was also seeded in the previous reporting period, with moderate establishment of cover due to reduced rainfall over the reporting period. Earth works, seeding, and planting of this northern rehab are scheduled to occur early in the next reporting period.

5.2.4 Landform Details

The major features of the proposed final landform include the final void, a northern elevated landform formed from the northern emplacement, and an elevated ridgeline extending southwards from the adjacent Vickery State Forest along the western boundary of the project site formed from the western emplacement area. The slopes of the elevated ridgeline and the northern, western and parts of the eastern sloped of the final void will generally be between 10 and 18 degrees, however the highwall on the south eastern margin of the final void will be battered back to approximately 45 degrees.

Erosion controls are built into the rehabilitation slopes before and during the seeding process. Contour banks are constructed to capture and transport runoff from rehabilitation

slopes to water conveyance / drainage structures such as the rock lined drain on the western slope of the northern emplacement, reducing the potential for erosion on the rehabilitation slopes. During the seeding process, the area is also mounded to increase the retention rate of water on the rehabilitation slopes, and reduce the volume and velocity of runoff, which also reduces the potential for erosion. Runoff which reports to the water management structures located on the rehabilitation slopes is directed into the existing water management system on site, eventually reporting to the northern or southern discharge dams.

5.2.5 Cover Material

Soil material used on the Northern Emplacement area during the reporting period was replaced utilising a contracted scraper fleet, and was generally sourced from stockpiles on site with some soil directly emplaced on the eastern slope. Where resources allow, topsoil and subsoil will each be spread to a nominal depth of between 100 and 150 millimetres, giving a combined depth of soil material on the rehabilitated landform between 200 and 300 millimetres.

A site soil balance was requested by DRE following the 2012/2013 AEMR review and as such, was developed from survey data acquired and updated at the end of the current reporting period (Table 15). As described in the EA and MOP, subsoil may be excluded or reduced in areas to monitor establishment of woodland in reduced soil profiles and subject to the availability of subsoil. This is likely to occur in areas of woodland as the volume of subsoil currently available for rehabilitation is not sufficient to cover all future rehabilitation.

A topsoil assessment was undertaken during the period to determine requirements for soil ameliorants. Multiple samples were collected from the Northern Emplacement and submitted to East West Enviro Agriculture Pty Ltd for analysis and recommendations. In summary, East West advised that:-

- soils would be of acceptable nutrient status to support pasture growth assuming that other factors, such as moisture, are not limiting growth,
- low levels of phosphorus could be addressed with an application of fertiliser but may not be necessary if native trees are being planted,
- slightly elevated levels of sodium (sodicity) need to be considered when selecting seed blends for planting, especially in the areas RNRE1 & RNRE2. An application of gypsum may be warranted in these areas.

Where thought appropriate, the recommendations have been incorporated into the sites rehabilitation scope of works that will be reported on in the 2015/16 AEMR.

Table 15 - Site Soil Balance

	Subsoil (m^3)	Topsoil (m^3)
Volume respread at end of reporting period	121,230*	205,294
Volume stockpiled at end of reporting period	622,362	286,633
Volume stripped at end of reporting period	4,260	33,300
Minimum volume required over mine life	226,110	226,110

* Estimate based upon area respread with subsoil and topsoil

5.2.6 Vegetation Species

Rehabilitation was undertaken in accordance with the Rehabilitation Management Plan and the Extension Environmental Assessment. Vegetation species used in rehabilitation on site, the land use area they are planted and the habit of the species is described in Table 16 below. Some pasture species have been added to the seed mix used on site following the advice of an agronomist, based upon climate and soil characteristics. Seed collection programmes have been undertaken through Fields Native Nursery who supplied Whitehaven with significant quantities of understorey and overstorey species.

Table 16 - Rehabilitation Revegetation Species

Species	Post Mining Land Use Area	Habit/Life form
Acacia deanei	Woodland	Tree
Acacia decora	Woodland	Shrub
Acacia hakeoides	Woodland	Shrub
Acacia implexa	Woodland	Tree
Acacia salicinia	Woodland	Tree
Acacia spectabilis	Woodland	Shrub
Biserrula pelecinus	Pasture	Forb
Bothriochloa Insculpta	Pasture	Graminoid
Brachychiton populneus	Woodland	Tree
Capparis mitchellii	Woodland	Tree
Chrysopogon filipes	Woodland	Graminoid
Digitaria erianthus	Pasture	Graminoid
Dodonaea sinuolata	Woodland	Shrub
Dodonea viscosa	Woodland	Shrub
Eremophila longifolia	Woodland	Shrub

Eucalyptus albens	Woodland	Tree
Eucalyptus beyeriana	Woodland	Tree
Eucalyptus chloroclada	Woodland	Tree
Eucalyptus crebra	Woodland	Tree
Eucalyptus melliodora	Woodland	Tree
Eucalyptus pilligaensis	Woodland	Tree
Eucalyptus populneus	Woodland	Tree
Eucalyptus sideroxylon	Woodland	Tree
Hardenbergia violacea	Woodland	Vine
Jasminum suavissimum	Woodland	Vine
Megathyrsus maximus	Pasture	Graminoid
Notelaea microcarpa	Woodland	Shrub
Pittosporum angustifolium	Woodland	Shrub
Swainsona galegifolia	Woodland	Shrub
Trifolium hirtum	Pasture	Forb
Trifolium vesiculosum	Pasture	Forb
Urochloa mosambicensis	Pasture	Graminoid

5.2.7 Progression to Maturity

The rehabilitation on the western emplacement consists of small areas of established and maturing woodland vegetation, however much of the area is subject to ongoing re-planting due to a combination of poor rainfall, native herbivore grazing and poor soil quality. The planting of woodland areas which occurred in October 2013 resulted in a success rate of only 5% following severe browsing by native herbivores in conjunction with a lack of sufficient follow up rainfall over the spring and summer period. Pasture areas of the western emplacement area will continue to be managed, with reseeding to occur in areas of poor establishment.

The rehabilitation areas on the northern emplacement were planted with tubestock during October 2013, which experienced a 5% success rate due to a combination of factors including insufficient follow up rainfall, grazing by native herbivores and high temperatures. Infill planting occurred in July 2014 prior to forecast rainfall.

As most areas of current rehabilitation are relatively newly planted, the risks remain significant, however these areas can be managed to encourage a higher survival rate in future plantings. Risks associated with weather, particularly rainfall, are considered most likely to have an impact on tree survival in newly planted areas, however other factors such as grazing pressure, high temperatures, competition from weeds, and disease may also

impact on vegetation establishment. Many of these risks can be managed, while risks associated with competition from weeds is managed by ongoing weed control, and the impact of adverse weather can be minimised by timely planting and follow up watering if required.

5.2.8 Present and Future Habitat

Winter and spring monitoring programmes will be undertaken on site in accordance with the Rehabilitation Management Plan. Part of this monitoring provides an annual snapshot of the habitats available in these areas and habitat utilisation by fauna. This is then compared to baseline data collected from adjacent unaffected land surrounding the mine to determine its success and progression in regards to habitat value for native and threatened species. In past monitoring programmes several threatened fauna species have been identified and recorded adjacent to the ML.

5.2.9 Weeds and Other Unwanted Vegetation

Monthly inspections of rehabilitation areas as well as general observations day to day are undertaken in order to identify the presence of noxious weeds or other unwanted vegetation in rehabilitation areas. Weed infestations are managed with a combination of chemical, physical or biological controls when discovered, if possible. There were no significant noxious weed populations at RCM at the end of the reporting period, aside from an African Boxthorn infestation in remnant vegetation north of the northern emplacement. Noxious weeds are managed as required by legislation.

5.2.10 Erosion Control

Monthly inspections of rehabilitation and water management areas, as well as general observations day to day are undertaken in order to identify evidence/the presence of erosion. Erosion is managed on site by various measures and methods including the construction of contour banks on rehabilitation slopes to direct water to conveyance structures capable of resisting erosion, the installation of mounding in between contours on rehabilitation sloped, to reduce the velocity and volume of runoff water, the seeding of rehabilitation areas as soon as practicably possible following soil replacement, and avoiding the use of highly sodic subsoils on rehabilitation areas.

During the reporting period, minor erosion occurred primarily within drainage structures (contour drains, waterways and spillways). These erosion areas were controlled with the use of mulch hay bales. There were also several instances of tunnel erosion occurring under contour banks on the western slope of the western rehabilitation area. These instances of tunnel erosion are attributed to sodic subsoil. At this time remediation works are scheduled to align with additional rehabilitation works required on the eastern side of the emplacement.

Sediment basins and storage dams are sampled quarterly, with dams located immediately upstream licenced discharge points also sampled in the event of discharge. These results are utilised to monitor pollution levels and ensure discharge water are within compliance criteria as set out in the EPL.

5.2.11 Fencing

No exclusion fencing is in place around rehabilitated areas. Fencing is restricted to the property boundary.

5.2.12 Rehabilitation Summary

Table 17 and Table 18 present a Rehabilitation Summary and listing of maintenance activities as required in the DRE Guidelines.

The shaping and soil replacement of the northern rehabilitation was undertaken during the reporting period, and 51.6ha will be further rehabilitated, with the inclusion of contour banks, conveyance channels, and a drop structure, early in the next reporting period. Once shaped the area will be seeded and planted, with approximately half of the area to return to bushland, while the rest will return to pasture.

Table 17 - Rehabilitation Summary

		Area Affected (hectares)		
		This Report Period (as of 31.07.15)	**Last Report Period (as of 31.07.14)**	**Cumulative Next Report Period (estimated)**
A:	**MINE LEASE AREA**			
A1	**Mine Lease(s)**	458.3		
B:	**DISTURBED AREAS**			
B1	**Infrastructure area** (other disturbed areas to be rehabilitated at closure including facilities, roads)	25.7	22.5	25.7
B2:	**Active Mining Area** (excluding items B3 - B5 below)	43.6	56.6	23.9
B3	**Waste emplacements**, (active/unshaped/in or out-of-pit)	107.2	111.1	133.2
B4	**Tailings emplacements,** (active/unshaped/uncapped)	N/A	N/A	N/A
B5	**Shaped waste emplacement** (awaits final vegetation)	51.6	36.0	2.3
ALL DISTURBED AREAS		228.1	226.1	184.9
C	**REHABILITATION PROGRESS**			
C1	**Total Rehabilitated area*** (except for maintenance)	65.3	65.3	114.6
D:	**REHABILITATION ON SLOPES**			
D1	**10 to 18 degrees**	60.3	60.3	93.8
D2	**Greater than 18 degrees**	0	0	0
E:	**SURFACE OF REHABILITATED LAND**			
E1	**Pasture and grasses**	65.3	65.3	116.9
E2	**Native forest/ecosystems***	0	0	0
E3	**Plantations and crops**	0	0	0
E4	**Other** (include non vegetative outcomes)	N/A	N/A	N/A

* Areas with established tube stock are considered to be “native forest/ecosystem”. “Pasture and Grasses” also includes areas with recently planted tube stock that are not yet established. C1 – Total Rehabilitated Area includes all rehabilitation regardless of progress.

Table 18 - Maintenance Activities on Rehabilitated Land

NATURE OF TREATMENT	Area Treated (ha)		
	Report period	**Next period**	**Comment/control strategies/ treatment detail**
Additional erosion control works (drains re-contouring, rock protection**)**	0	2	Installation of water conveyance structure on northern emplacement to occur 2015/16 period.
Re-covering (detail - further topsoil, subsoil sealing etc)	Nil	Nil	Will only take place in the event of major soil loss.
Soil treatment (detail - fertilizer, lime, gypsum etc)	Nil	1	Gypsum to be spread on areas of the Northern Emplacement Area susceptible to tunnel erosion ie contour drains.
Treatment/Management (detail - grazing, cropping, slashing etc)	Nil	Nil	None to occur.
Re-seeding/Replanting (detail - species density, season etc)	0	4	Reseeding planned for areas of poor establishment on southern slope of western emplacement area were not undertaken. Infill planting will occur depending on rainfall outlook.
Adversely Affected by Weeds (detail - type and treatment)	4.5	4	General spot spraying of Boxthorn at the north of the site.
Feral animal control (detail - additional fencing, trapping, baiting etc)	See section 3.20.1	See section 3.20.1	Trapping to occur off site at surrounding properties.

5.3 Other Infrastructure

Status of other infrastructure remained unchanged during the reporting period.

5.4 Rehabilitation Trials and Research

Comprehensive rehabilitation monitoring has been undertaken by EcoLogical Pty Ltd during the reporting period, refer Appendix 6.

Rehabilitation/revegetation monitoring by Whitehaven personnel has been confined to inspections of water management structures, soil stockpiles and seeded/planted areas for evidence of instability, erosion, or poor vegetation establishment. Results over the reporting period were good in terms of the minimal erosion experienced during heavy rainfall events, however as previously noted there were several instances of tunnel erosion causing contour bank failure on the western slope of the western emplacement.

Tubestock previously planted on the northern and western emplacement areas performed poorly, with only limited establishment due to a lack of sufficient rainfall and high temperatures. Areas of poor vegetation establishment remain on the southern slopes of the

western emplacement area. Monitoring of vegetation establishment by site personnel is ongoing. Weather conditions are summarised in Appendix 9 and Section 3.19.

The turf lined water conveyance channel at the toe of the western face of the western emplacement area has shown minimal erosion and has remained established despite drought-like conditions.

No specific rehabilitation trials or research programmes are proposed for the Rocglen site in the next reporting period however there need will be considered in the development of the Closure MOP for the site required by mid 2016.

6 ACTIVITIES PROPOSED IN THE NEXT AEMR PERIOD

Activities proposed for the 2015 / 2016 reporting period include:

- The continuation of rehabilitation on the northern emplacement, including the establishment of bushland and pasture areas;
- The commencement of rehabilitation works on the wildlife corridor linking Vickery State Forest and the Biobank Site;
- Continued community liaison, support and involvement / education in the mine's activities;
- Continued implementation of management objectives for the Whitehaven Regional Biodiversity Offset Area, as identified in the offset area management plan;
- Continuation of the effective water management practices currently used on site, for the prevention of non-compliant discharges from the site; and
- The continuation of feral animal control programs in conjunction with adjoining landholders and leaseholders.

Appendix 1

PA 10_0015 MOD 1

Appendix 2

ENVIRONMENT PROTECTION LICENCE 12870

Appendix 3

DUST MONITORING DATA

Appendix 4

SURFACE WATER AND WET WEATHER DISCHARGE MONITORING DATA

Appendix 5

GROUNDWATER MONITORING DATA

Appendix 6

2014/15 REHABILITATION REPORT

Appendix 7

BLAST MONITORING RESULTS

Appendix 8

NOISE MONITORING RESULTS

Appendix 9

METEOROLOGICAL DATA

Notice of Modification

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

As delegate of the Minister for Planning, I approve the modification of the project approval referred to in Schedule 1, as set out in Schedule 2.

Carolyn McNally
Secretary

Sydney 10.11.14 2014

SCHEDULE 1

The project approval (MP 10_0015) granted by the Minister for Planning and Infrastructure for the Rocglen Extension Project on 27 September 2011.

SCHEDULE 2

1. Delete the word "Infrastructure" in the footnotes and replace with "Environment".

2. Delete all references to "Director-General" and replace with "Secretary".

3. In the Table of Contents:
   a) insert the word "Project" between the words "Surrender of Existing" and "Approval";
   b) delete the words "Staged Submission of any Strategy, Plan or Program" and replace with "Updating & Staging Strategies, Plans or Programs";
   c) insert the heading "Protection of Public Infrastructure" beneath the heading "Staged Submission of any Strategy, Plan or Program";
   d) insert the heading "Bushfire Management" below the heading "Waste";
   e) delete the heading for Appendix 7 and replace with "APPENDIX 7: STATEMENT OF COMMITMENTS"; and
   f) update the page numbers for each heading in the Table of Contents.

4. In the Definitions list, delete the definitions for "Director-General" and "RTA", and update/insert the following definitions:

Approved haulage route	The route used to transport coal from the Project and the Tarrawonga and Vickery coal mines to the Whitehaven CHPP, including the use of sections of the public road network, as shown in Figure 3 of Appendix 2
CHPP	Coal Handling and Preparation Plant
Cumulative haulage	The total amount of ROM coal transported from the Project and the Tarrawonga and Vickery coal mines
Department	Department of Planning and Environment
EA	Environmental assessment titled: • *Whitehaven Coal Limited Rocglen Coal Mine Extension Project Environmental Assessment*, dated February 2011, and associated response to submissions titled *Whitehaven Coal Limited Rocglen Coal Mine Extension Project - Response to Submissions,* dated June 2011; and • *Whitehaven ROM Coal Haulage modification*, dated February 2014, and associated response to submissions titled *Whitehaven ROM Coal Haulage Modification – Response to Submissions,* dated April 2014.
EPA	Environmental Protection Authority

Kamilaroi Highway overpass	A section of private haul road to be developed over the Kamilaroi Highway, providing access from Blue Vale Road directly to the Whitehaven CHPP access road, and to be constructed as part of the Vickery Coal Project (SSD 5000)
Minister	Minister for Planning, or delegate
OEH	NSW Office of Environment and Heritage
RMS	Roads and Maritime Services
Secretary	Secretary of the Department, or nominee
Tarrawonga coal mine	The Tarrawonga Extension Project (MP 11_0047)
Vickery coal mine	The Vickery Coal Project (SSD 5000)

5. In condition 5 of schedule 2, delete the words "the Executive Director, Mineral Resources in".

6. Insert the following after condition 6 of schedule 2:

"**Coal Transport**

6A. For the period up until the commissioning of the Kamilaroi Highway overpass, the Proponent:
   (a) may not transport more than 1.5 million tonnes of ROM coal from the site in any calendar year;
   (b) shall transport all coal from the site to the Whitehaven CHPP via the approved haulage route; and
   (c) shall, together with the owners of the Tarrawonga and Vickery coal mines, ensure that the cumulative haulage of coal along the approved haulage route does not exceed 3.5 million tonnes.

6B. For the period following the commissioning of the Kamilaroi Highway overpass, the Proponent:
   (a) may not transport more than 1.5 million tonnes of ROM coal from the site in any calendar year;
   (b) shall transport all coal from the site to the Whitehaven CHPP via the approved haulage route and the Kamilaroi Highway overpass; and
   (c) shall, together with the owners of the Tarrawonga and Vickery coal mines, ensure that the cumulative haulage of coal along the approved haulage route does not exceed 4.5 million tonnes."

7. Delete the heading "Staged Submission of any Strategy, Plan or Program" and condition 12 of schedule 2, and replace with the following:

"UPDATING & STAGING STRATEGIES, PLANS OR PROGRAMS

12. With the approval of the Secretary, the Proponent may submit any strategies, plans or programs required by this approval on a progressive basis.

    To ensure the strategies, plans or programs under the conditions of this approval are updated on a regular basis, the Proponent may at any time submit revised strategies, plans or programs to the Secretary for approval.

    With the agreement of the Secretary, the Proponent may prepare any revised strategy, plan or program without undertaking consultation with all parties under the applicable condition of this approval.

    Notes:
    - *While any strategy, plan or program may be submitted on a progressive basis, the Proponent must ensure that the existing operations on site are covered by suitable strategies, plans or programs at all times.*
    - *If the submission of any strategy, plan or program is to be staged, then the relevant strategy, plan or program must clearly describe the specific stage to which the strategy, plan or program applies, the relationship of this stage to any future stages, and the trigger for updating the strategy, plan or program."*

8. Insert the following after condition 13 of schedule 2:

"PROTECTION OF PUBLIC INFRASTRUCTURE

14. Unless the Proponent and the applicable authority agree otherwise, the Proponent shall:
   (a) repair, or pay the full costs associated with repairing, any public infrastructure that is damaged by the project; and
   (b) relocate, or pay the full costs associated with relocating, any public infrastructure that needs to be relocated as a result of the project.

    Note: This condition does not apply to any damage to roads caused as a result of general road usage."

9. Delete the condition 2 of schedule 3, and replace with the following:

"2. The Proponent, together with the owners of the Tarrawonga and Vickery coal mines, shall ensure that the noise generated on public roads by the project and the other mines, does not exceed the criteria in Table 2 at any existing residence on privately-owned land.

Table 2: Road traffic noise criteria dB(A)

Land	Day and Evening LAeq (15 hour)	Night LAeq (9 hour)
All privately-owned residences	60	55

However, these criteria do not apply if the Proponent has a written agreement with the relevant landowner to exceed the criteria, and the Proponent has advised the Department in writing of the terms of this agreement.

Note: Traffic noise generated by the project is to be measured in accordance with the relevant procedures in the NSW Road Noise Policy."

10. In condition 4(a) of schedule 3, delete the word "OEH" and replace with "the EPA".

11. Delete condition 4(c) of schedule 3 and replace with the following:
"(c) describe the measures that would be implemented to ensure the noise impacts generated by project-related traffic on the Kamilaroi Highway overpass are minimised as far as practicable; and"

12. In condition 12(a) of schedule 3, delete the word "OEH" and replace with "the EPA".

13. In the notes to condition 15 of schedule 3, delete the word "OEH" and replace with "the EPA".

14. In condition 16(a) of schedule 3, delete the words "the off-site".

15. In condition 17(a) of schedule 3, delete the word "OEH" and replace with "the EPA".

16. In condition 18(b) of schedule 3, delete the word "OEH" and replace with "the EPA".

17. In condition 22 of schedule 3, delete the word "OEH" and replace with "the EPA".

18. In condition 26 of schedule 3, insert ", as may be modified from time to time through the agreement of both parties. If there is a dispute in relation to this agreement, then either party may refer the matter to the Secretary for resolution" after the word "Council".

19. Insert the following after condition 26 of schedule 3:

"Traffic Management Plan

27. The Proponent shall prepare and implement a traffic management plan for the Project, to the satisfaction of the Secretary. This plan must:
    (a) be prepared in consultation with RMS, Gunnedah Shire Council, Narrabri Shire Council, and the owners of the Tarrawonga and Vickery coal mines;
    (b) be submitted to the Secretary for approval, by 30 June 2015;
    (c) include:
        - a protocol for operating haul trucks during school bus hours;
        - consideration of measures to minimise dust from unsealed roads that may be used for access to the mine site;
        - arrangements to comply with cumulative coal haulage limits from the Project and the Tarrawonga and Vickery coal mines; and
        - a monitoring program to audit vehicle movements, including the origin and destination of employees, against predictions in the EA."

20. In condition 28 of schedule 3, delete the word "Figure 1" and replace with "Figure 3".

21. Insert the following after condition 29 of schedule 3:

"29A. For all coal transported by road under this approval, the Proponent shall ensure that:
    (a) trucks travelling to and from the site do not exceed 40 kilometres per hour in the vicinity of the school bus when it is operating near school bus stops along the approved haulage route, unless an alternative protocol is agreed by the Secretary; and
    (b) spillage from coal haulage vehicles is minimised and promptly managed."

22. In condition 34 of schedule 3, delete the words "the Executive Director, Mineral Resources in".

23. In condition 36 of schedule 3, delete the words "the Executive Director, Mineral Resources in".

APPENDICES

24. In Appendix 2, insert the following after "Figure 2":

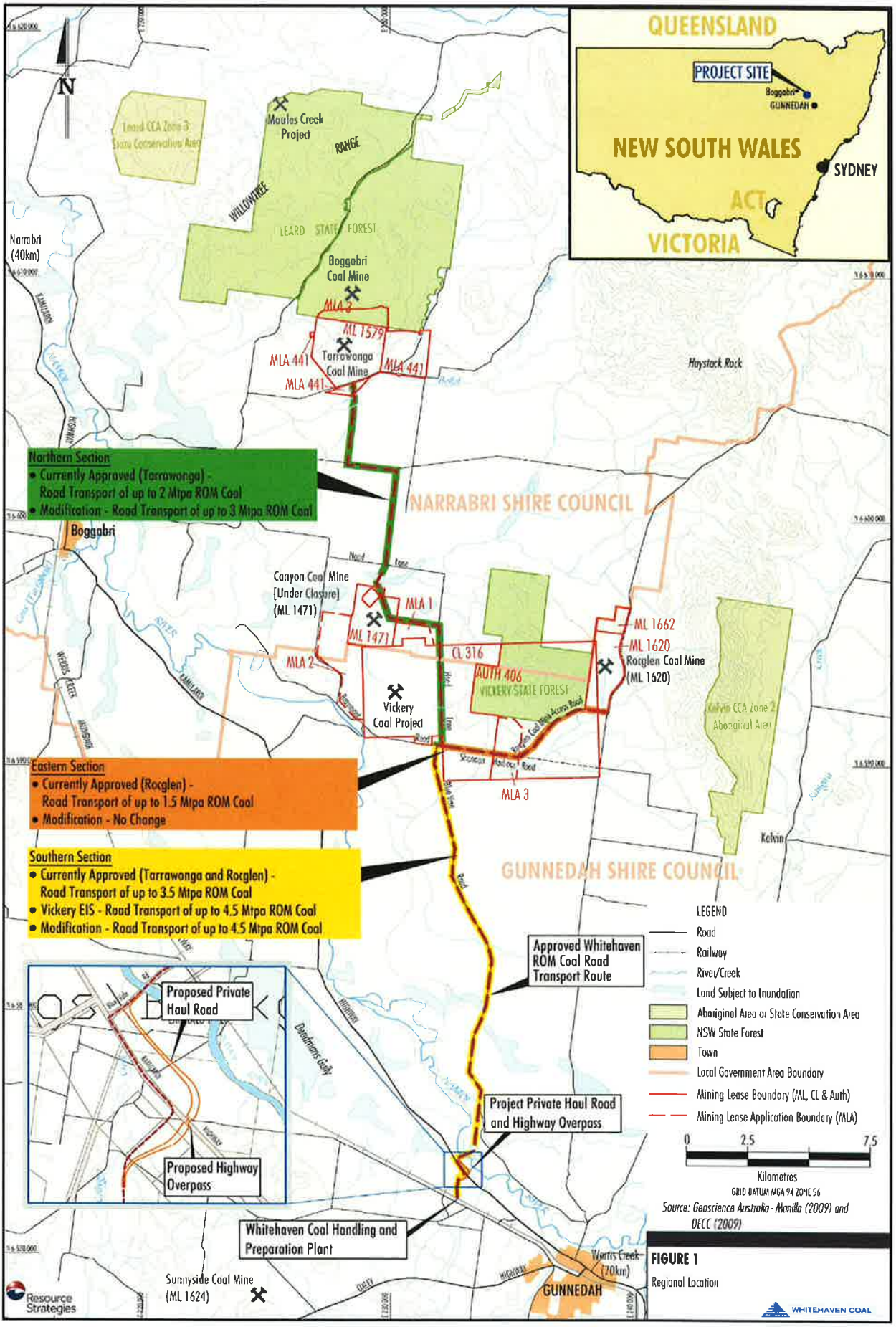

Figure 3: *Approved Road Haulage Route*

Project Approval

Section 75J of the *Environmental Planning & Assessment Act 1979*

As delegate of the Minister for Planning and Infrastructure, I approve the project application referred to in schedule 1, subject to the conditions in schedules 2 to 5.

These conditions are required to:

- prevent, minimise, and/or offset adverse environmental impacts;
- set standards and performance measures for acceptable environmental performance;
- require regular monitoring and reporting; and
- provide for the ongoing environmental management of the project.

Richard Pearson
Deputy Director-General
Development Assessment and Systems Performance

Sydney 27th September 2011

SCHEDULE 1

Application Number:	10_0015
Proponent:	Whitehaven Coal Mining Limited
Approval Authority:	Minister for Planning and Infrastructure
Land:	See Appendix 1
Project:	Rocglen Extension Project

TABLE OF CONTENTS

DEFINITIONS

Annual review	The review required by condition 3 of schedule 5
BCA	Building Code of Australia
BOS	Biodiversity offset strategy
CCC	Community Consultative Committee
Conditions of this approval	Conditions contained in schedules 2 to 5 inclusive
Council	Gunnedah Shire Council
Day	The period from 7am to 6pm on Monday to Saturday, and 8am to 6pm on Sundays and Public Holidays
Department	Department of Planning and Infrastructure
Director-General	Director-General of the Department, or delegate
DRE	Division of Resources and Energy (within the Department of Trade and Investment, Regional Infrastructure and Services)
EA	Environmental assessment titled *Whitehaven Coal Limited Rocglen Coal Mine Extension Project Environmental Assessment*, dated February 2011, and associated response to submissions titled *Whitehaven Coal Limited Rocglen Coal Mine Extension Project - Response to Submissions,* dated June 2011
EEC	Endangered Ecological Community as defined under the *Threatened Species Conservation Act 1995*
EP&A Act	*Environmental Planning and Assessment Act 1979*
EP&A Regulation	*Environmental Planning and Assessment Regulation 2000*
EPL	Environment Protection Licence issued under *POEO Act*
Evening	The period from 6pm to 10pm
Feasible	Feasible relates to engineering considerations and what is practical to build or carry out
Incident	A set of circumstances that causes or threatens to cause material harm to the environment, and/or breaches or exceeds the limits or performance measures/criteria in this approval
Land	In general, the definition of land is consistent with the definition in the EP&A Act. However, in relation to the noise and air quality conditions in Schedules 3 and 4, it means the whole of a lot, or contiguous lots owned by the same landowner, in a current plan registered at the Land Titles Office at the date of this approval
Material harm to the environment	Actual or potential harm to the health or safety of human beings or to ecosystems that is not trivial
Mining operations	Includes the removal of overburden and the extraction, processing, handling, storage and transportation of coal
Minister	Minister for Planning and Infrastructure, or delegate
Minor	Small in quantity, size and degree
Mitigation	Activities associated with reducing the impacts of the project
Negligible	Small and unimportant, such as to be not worth considering
Night	The period from 10pm to 7am on Monday to Saturday, and 10pm to 8am on Sundays and Public Holidays
NOW	NSW Office of Water (within the Department of Primary Industries)
OEH	Office of Environment and Heritage (within the Department of Premier and Cabinet)
Offset strategy	The biodiversity conservation and enhancement program described in the EA, and depicted generally in Appendix 4
POEO Act	*Protection of the Environment Operations Act 1997*
Privately-owned land	Land that is not owned by a public agency or a mining company (or its subsidiary)
Project	The development described in the EA
Proponent	Whitehaven Coal Mining Limited, or its successors
Reasonable	Reasonable relates to the application of judgement in arriving at a decision, taking into account: mitigation benefits, cost of mitigation versus benefits provided, community views and the nature and extent of potential improvements
Rehabilitation	The treatment or management of land disturbed by the project for the purpose of establishing a safe, stable and non-polluting environment, and includes remediation
ROM	Run-of-mine
RTA	Roads and Traffic Authority
Site	The land listed in Appendix 1
Statement of commitments	The Proponent's commitments in Appendix 7
Whitehaven Regional Biobank Site	The Proponent's offset site off Wean Road, Gunnedah on Lot 36 DP 754950, Lot 1 DP 247949, Lot A DP 405391 and Lot 2 DP 728391 and located as shown in Figure 1 of Appendix 2 and Figure 1 of Appendix 4

SCHEDULE 2
ADMINISTRATIVE CONDITIONS

OBLIGATION TO MINIMISE HARM TO THE ENVIRONMENT

1. The Proponent shall implement all reasonable and feasible measures to prevent and/or minimise any material harm to the environment that may result from the construction, operation or rehabilitation of the project.

TERMS OF APPROVAL

2. The Proponent shall carry out the project in accordance with the:
   (a) EA;
   (b) statement of commitments; and
   (c) conditions of this approval.

   Notes:
   - *The general layout of the project is shown in Appendix 2; and*
   - *The statement of commitments is reproduced in Appendix 7.*

3. If there is any inconsistency between the above documents, the most recent document shall prevail to the extent of the inconsistency. However, the conditions of this approval shall prevail to the extent of any inconsistency.

4. The Proponent shall comply with any reasonable requirement/s of the Director-General arising from the Department's assessment of:
   (a) any reports, strategies, plans, programs, reviews, audits or correspondence that are submitted in accordance with this approval; and
   (b) the implementation of any actions or measures contained in these documents.

LIMITS ON APPROVAL

Mining Operations

5. The Proponent may carry out mining operations on the site until the end of December 2022.

   Note: Under this approval, the Proponent is required to rehabilitate the site and carry out additional undertakings to the satisfaction of both the Director-General and the Executive Director, Mineral Resources in DRE. Consequently, this approval will continue to apply in all other respects - other than the right to conduct mining operations - until the rehabilitation of the site and these additional undertakings have been carried out satisfactorily.

Coal Extraction

6. The Proponent shall not extract more than 1.5 million tonnes of ROM coal from the site in a calendar year.

SURRENDER OF EXISTING PROJECT APPROVAL

7. By the end of September 2012, or as otherwise agreed by the Director-General, the Proponent shall surrender the existing project approval for the Rocglen Coal Mine (06_0198) in accordance with section 75YA of the EP&A Act.

8. Prior to the surrender of project approval 06_0198, the conditions of this approval shall prevail to the extent of any inconsistency between the two approvals.

STRUCTURAL ADEQUACY

9. The Proponent shall ensure that all new buildings and structures, and any alterations or additions to existing buildings and structures, are constructed in accordance with the relevant requirements of the BCA.

   Notes:
   - *Under Part 4A of the EP&A Act, the Proponent is required to obtain construction and occupation certificates (where necessary) for the proposed building works; and*
   - *Part 8 of the EP&A Regulation sets out the requirements for the certification of the project.*

DEMOLITION

10. The Proponent shall ensure that all demolition work on site is carried out in accordance with *Australian Standard AS 2601-2001: The Demolition of Structures,* or its latest version.

OPERATION OF PLANT AND EQUIPMENT

11. The Proponent shall ensure that all the plant and equipment used on site, or to transport coal from the site, is:
    (a) maintained in a proper and efficient condition; and
    (b) operated in a proper and efficient manner.

STAGED SUBMISSION OF ANY STRATEGY, PLAN OR PROGRAM

12. With the approval of the Director-General, the Proponent may submit any strategy, plan or program required by this approval on a progressive basis.

    Note: While any strategy, plan or program may be submitted on a progressive basis, the Proponent will need to ensure that the existing operations at the site are covered by suitable strategies, plans or programs at all times. In addition, if any strategy, plan or program is prepared for only part of a project, then it must clearly describe which part of the project it applies to, and give an indication when the strategy, plan or program will need to be updated to include the other parts of the project.

13. The Proponent shall continue to implement the existing strategies, plans or programs that apply to any development on site under project approval 06_0198 until they are replaced by an equivalent strategy, plan or program approved under this approval.

SCHEDULE 3
ENVIRONMENTAL PERFORMANCE CONDITIONS

NOISE

Noise Criteria

1. The Proponent shall ensure that the noise generated by the project does not exceed the criteria in Table 1 at any residence on privately-owned land or on more than 25 percent of any privately-owned land.

Table 1: Noise criteria dB(A)

Location	***Day***	***Evening***	***Night***	
	$L_{Aeq\ (15\ min)}$	$L_{Aeq\ (15\ min)}$	$L_{Aeq\ (15\ min)}$	$L_{A1\ (1\ min)}$
All privately-owned land	35	35	35	45

Note: Noise generated by the project is to be measured in accordance with the relevant procedures and exemptions (including certain meteorological conditions) of the NSW Industrial Noise Policy.

However, these criteria do not apply if the Proponent has a written agreement with the relevant landowner to exceed the criteria, and the Proponent has advised the Department in writing of the terms of this agreement.

Road Traffic Noise Criteria

2. The Proponent shall ensure that the road traffic noise generated by the project and the Tarrawonga coal mine does not exceed the criteria in Table 2.

Table 2: Road traffic noise impact criteria dB(A) $L_{Aeq\ (1\ hour)}$

Location	***Day***	***Evening***	***Night***
Any residence on privately-owned land	55	55	50

Note: Road traffic noise is to be measured in accordance with the relevant procedures and exemptions (including certain meteorological conditions) of the NSW Road Traffic Noise Policy.

Operating Conditions

3. The Proponent shall:
   (a) implement best practice noise management to minimise the operational, low frequency, and road traffic noise generated by the project;
   (b) minimise the noise impacts of the project during temperature inversions; and
   (c) regularly assess the real-time noise monitoring and meteorological forecasting data and relocate, modify, and/or stop operations on site to ensure compliance with the relevant conditions of this approval,

   to the satisfaction of the Director-General.

Noise Management Plan

4. The Proponent shall prepare and implement a Noise Management Plan for the project to the satisfaction of the Director-General. This plan must:
   (a) be prepared in consultation with OEH, and submitted to the Director-General for approval by the end of December 2011;
   (b) describe the noise mitigation measures that would be implemented to ensure compliance with the relevant conditions of this approval;
   (c) include a Road Traffic Noise Management Plan that has been prepared in consultation with the operators of the Tarrawonga coal mine; and
   (d) include a noise monitoring program that:
      - uses a combination of real-time and supplementary attended monitoring to evaluate the performance of the project; and
      - includes a protocol for determining exceedances of the relevant conditions of this approval.

BLASTING

Blasting Criteria

5. The Proponent shall ensure that the blasting on site does not cause exceedances of the criteria in Table 3.

Table 3: Blasting criteria

Location	*Airblast overpressure (dB(Lin Peak))*	*Ground vibration (mm/s)*	*Allowable exceedance*
Residence on privately-owned land	115	5	5% of the total number of blasts over a period of 12 months
	120	10	0%

However, these criteria do not apply if the Proponent has a written agreement with the relevant landowner to exceed the criteria, and the Proponent has advised the Department in writing of the terms of this agreement.

Blasting Hours

6. The Proponent shall only carry out blasting on site between 9am and 5pm Monday to Saturday inclusive. No blasting is allowed on Sundays, public holidays, or at any other time without the written approval of the Director-General.

Blasting Frequency

7. The Proponent shall not carry out more than one blast a day on site, unless an additional blast is required following a blast misfire.

Note: A blast may involve a number of explosions within a short period, typically less than two minutes.

Property Inspections

8. If the Proponent receives a written request from the owner of any privately-owned land within 2 kilometres of the approved open cut mining pit on site, or other landowner nominated by the Director-General, for a property inspection to establish the baseline condition of any buildings and/or structures on their land, or to have a previous property inspection report updated, then within 2 months of receiving this request the Proponent shall:
   (a) commission a suitably qualified, experienced and independent person, whose appointment has been approved by the Director-General, to:
      - establish the baseline condition of the buildings and/or structures on the land or update the previous property inspection report; and
      - identify any measures that should be implemented to minimise the potential blasting impacts of the project on these buildings and/or structures; and
   (b) give the landowner a copy of the new or updated property inspection report.

Property Investigations

9. If the owner of any privately-owned land claims that the buildings and/or structures on their land have been damaged as a result of blasting on site, then within 2 months of receiving this claim the Proponent shall:
   (a) commission a suitably qualified, experienced and independent person, whose appointment has been approved by the Director-General, to investigate the claim; and
   (b) give the landowner a copy of the property investigation report.

If this independent property investigation confirms the landowner's claim, and both parties agree with these findings, then the Proponent shall repair the damages to the satisfaction of the Director-General.

If the Proponent or landowner disagrees with the findings of the independent property investigation, then either party may refer the matter to the Director-General for resolution.

Operating Conditions

10. The Proponent shall
   (a) implement best blasting management practice on site to:
      - protect the safety of people and livestock in the surrounding area;
      - protect public or private property in the surrounding area; and
      - minimise the dust and fume emissions of the blasting; and

(b) operate a suitable system to enable the public to get up-to-date information on the proposed blasting schedule on site,

to the satisfaction of the Director-General.

11. The Proponent shall not carry out any blasting on site that is within 500 metres of:
    (a) a public road without the approval of Council; and
    (b) any land outside the site that is not owned by the Proponent, unless:
        - the Proponent has a written agreement with the relevant landowner to allow blasting to be carried out closer to the land, and the Proponent has advised the Director-General in writing of the terms of this agreement; or
        - the Proponent has:
            - demonstrated to the satisfaction of the Director-General that the blasting can be carried out closer to the land, without compromising the safety of people or livestock, or damaging the buildings and/or structures on the land; and
            - updated the Blast Management Plan to include the specific measures that would be implemented while blasting is being carried out within 500 metres of the land.

Blast Management Plan

12. The Proponent shall prepare and implement a Blast Management Plan for the project to the satisfaction of the Director-General. This plan must:
    (a) be prepared in consultation with OEH, and submitted to the Director-General for approval by the end of December 2011;
    (b) describe the measures that would be implemented to ensure compliance with the relevant conditions of this approval; and
    (c) include a blast monitoring program to evaluate the performance of the project.

AIR QUALITY & GREENHOUSE GAS

Odour

13. The Proponent shall ensure that no offensive odours, as defined under the POEO Act, are emitted from the site.

Greenhouse Gas Emissions

14. The Proponent shall implement all reasonable and feasible measures to minimise the release of greenhouse gas emissions from the site.

Air Quality Criteria

15. The Proponent shall ensure that all reasonable and feasible avoidance and mitigation measures are employed so that the particulate emissions generated by the project do not exceed the criteria listed in Tables 4, 5 and 6 at any residence on privately-owned land or on more than 25 percent of any privately-owned land.

Table 4: Long-term criteria for particulate matter

Pollutant	***Averaging period***	***[d]Criterion***
Total suspended particulate (TSP) matter	Annual	[a]90 µg/m^3
Particulate matter < 10 µm (PM_{10})	Annual	[a]30 µg/m^3

Table 5: Short-term criterion for particulate matter

Pollutant	***Averaging period***	***[d] Criterion***
Particulate matter < 10 µm (PM_{10})	24 hour	[a] 50 µg/m^3

Table 6: Long-term criteria for deposited dust

Pollutant	***Averaging period***	***Maximum increase in deposited dust level***	***Maximum total[1] deposited dust level***
[c]Deposited dust	Annual	[b]2 g/m^2/month	[a]4 g/m^2/month

Notes:

- *[a] Total impact (i.e. incremental increase in concentrations due to the project plus background concentrations due to other sources);*
- *[b] Incremental impact (i.e. incremental increase in concentrations due to the project on its own);*

- [c] *Deposited dust is to be assessed as insoluble solids as defined by Standards Australia, AS/NZS 3580.10.1:2003: Methods for Sampling and Analysis of Ambient Air - Determination of Particulate Matter - Deposited Matter - Gravimetric Method*; *and*
- [d] *Excludes extraordinary events such as bushfires, prescribed burning, dust storms, sea fog, fire incidents, illegal activities or any other activity agreed to by the Director-General in consultation with OEH.*

Operating Conditions

16. The Proponent shall:
    (a) implement best practice air quality management on site, including all reasonable and feasible measures to minimise the off-site odour, fume and dust emissions generated by the project, including those generated by any spontaneous combustion on site,
    (b) minimise any visible air pollution generated by the project;
    (c) minimise the surface disturbance on site; and
    (d) regularly assess the real-time air quality monitoring and meteorological forecasting data, and relocate, modify and/or stop operations on site to ensure compliance with the relevant conditions of this approval,

    to the satisfaction of the Director-General.

Air Quality & Greenhouse Gas Management Plan

17. The Proponent shall prepare and implement an Air Quality & Greenhouse Gas Management Plan for the project to the satisfaction of the Director-General. This plan must:
    (a) be prepared in consultation with OEH, and submitted to the Director-General for approval by the end of December 2011;
    (b) describe the measures that would be implemented to ensure compliance with the relevant conditions of this approval, including a real-time air quality management system that employs reactive and proactive mitigation measures; and
    (c) include an air quality monitoring program that:
        - uses a combination of real-time monitors, high volume samplers and dust deposition gauges to evaluate the performance of the project; and
        - includes a protocol for determining exceedances of the relevant conditions of this approval.

METEOROLOGICAL MONITORING

18. During the life of the project, the Proponent shall ensure that there is a meteorological station operating in the vicinity of the site that:
    (a) complies with the requirements in the *Approved Methods for Sampling of Air Pollutants in New South Wales* guideline; and
    (b) is capable of continuous real-time measurement of temperature lapse rate in accordance with the *NSW Industrial Noise Policy*, or as otherwise agreed by OEH.

AUGER MINING

19. The Proponent shall ensure that the auger mining carried out on site:
    (a) is restricted to the areas approved for auger mining;
    (b) is designed to remain safe and stable in the long term; and
    (c) does not result in vertical subsidence of greater than 20 mm.

SOIL & WATER

Under the Water Act 1912 and/or the Water Management Act 2000, the Proponent is required to obtain water licences for the project.

Water Supply

20. The Proponent shall ensure that it has sufficient water for all stages of the project, and if necessary, adjust the scale of mining operations on site to match its available water supply to the satisfaction of the Director-General.

Surface Water Discharges

21. The Proponent shall ensure that all surface water discharges from the site comply with the discharge limits (both volume and quality) set for the project in any EPL.

Water Management Plan

22. The Proponent shall prepare and implement a Water Management Plan for the project to the satisfaction of the Director-General. This plan must be prepared in consultation with OEH, NOW and DRE by suitably qualified and experienced persons whose appointment has been approved by the Director-General, and

submitted to the Director-General for approval by the end of February 2012. In addition to the standard requirements for management plans (see condition 2 of schedule 5), this plan must include:

(a) a Site Water Balance that:
- includes details of:
  - sources and security of water supply;
  - water use on site;
  - water management on site;
  - any off-site water transfers;
- describes what measures would be implemented to minimise water use on site; and
- is to be updated each year during the annual review;

(b) a Surface Water Management Plan, that includes:
- a detailed description of the water management system on site, including the:
  - clean water diversion systems;
  - erosion and sediment controls; and
  - water storages;
- detailed plans, including design objectives and performance criteria, for:
  - design and management of the final void;
  - reinstatement of drainage lines on the rehabilitated areas of the site; and
  - control of any potential water pollution from the rehabilitated areas of the site;
- performance criteria for the following, including trigger levels for investigating any potentially adverse impacts:
  - the water management system;
  - surface water quality in Driggle Draggle Creek or the unnamed creek to the south of the site;
  - the health of any riparian vegetation in Driggle Draggle Creek or the unnamed creek to the south of the site;
- a program to monitor:
  - the effectiveness of the water management system;
  - surface water flows and quality in Driggle Draggle Creek and the unnamed creek to the south of the site;
  - the health of any riparian vegetation in Driggle Draggle Creek or the unnamed creek to the south of the site; and
- a plan to respond to any exceedances of the performance criteria, and mitigate and/or offset any adverse surface water impacts of the project;

(c) a Groundwater Management Plan, which includes:
- performance criteria, including trigger levels for investigating any potentially adverse groundwater impacts;
- a program to monitor:
  - groundwater inflows to the mining operations;
  - the impacts of the project on any alluvial aquifers;
  - the seepage/leachate from water storages, backfilled voids, and the final void on site;
- a program to validate the groundwater model for the project, and calibrate it to site specific conditions; and
- a plan to respond to any exceedances of the performance criteria, and mitigate and/or offset any adverse groundwater impacts.

BIODIVERSITY

Biodiversity Offset

23. By the end of June 2012, unless the Director-General agrees otherwise, the Proponent shall enter into a Biobanking agreement with the Minister for Environment and Heritage, in accordance with Part 7A of the *Threatened Species Conservation Act 1995*, to implement the Biodiversity Offset Strategy described in the EA (for the Whitehaven Regional Biobank Site), and summarised in Table 7;

Table 7: Biodiversity Offset Strategy to be implemented at the Whitehaven Regional Biobank Site

Total Vegetation Clearing	***Minimum Offset to be provided***
Total of 95.44 ha of vegetation to be cleared	• Retirement of 4,859 Ecosystem Credits (including 478 Ecosystem Credits for the clearing of 47.9 ha of the BOS area approved under 06_0198); • Conservation of the residual BOS area approved under 06_0198 (60 ha), at the existing location within the Whitehaven Regional Biobank Site; • Conservation of 0.62 ha of White box Grassy Woodland; • Conservation of 231.42 ha of suitable foraging habitat for the Regent Honeyeater and Swift Parrot; and • Restoration of 118.33 ha of derived grassland to woodland.

Note: The Whitehaven Regional Biobank Site is shown in Figure 1 in Appendix 4.

HERITAGE

Heritage Management Plan

24. The Proponent shall prepare and implement a Heritage Management Plan for the project to the satisfaction of the Director-General. This plan must:
    (a) be prepared in consultation with OEH and Aboriginal stakeholders;
    (b) be submitted to the Director-General for approval by the end of December 2011;
    (c) describe the measures that would be implemented:
        - record and salvage the Aboriginal sites within the project disturbance area, including RPS Rocglen IF1, RPS Rocglen AS1 and RPS Rocglen AS2 at locations as shown in Appendix 6 and any potential archaeological deposits;
        - store the Aboriginal objects salvaged, both during construction and in the long term;
        - protect, monitor and/or manage the Aboriginal sites on site that are outside the project disturbance area on site, including measures to protect scarred trees (NPWS # 20-4-0194 and # 20-4-0195 at locations as shown in Appendix 6);
        - manage the discovery of any human remains or previously unidentified Aboriginal objects;
        - enable Aboriginal stakeholders to get reasonable access to the site during the project;
        - ensure Aboriginal stakeholders are consulted about the conservation and management of Aboriginal cultural heritage on site; and
        - ensure workers on site receive suitable heritage inductions, and that suitable records are kept of these inductions.

TRANSPORT

Road Works

25. By the end of December 2012, unless the Director-General agrees otherwise, the proponent shall upgrade and tar seal Wean Road to the satisfaction of Council from the northern end of the existing tar seal to the point of the Gunnedah/Narrabri Shire Council boundary, in general accordance with Council's Rural Local Roads Standard.

Road Maintenance

26. During the project, the Proponent shall contribute towards the maintenance of the public roads used by the project, in accordance with the existing road maintenance agreement between the Proponent and Council.

Operating Conditions

28. The Proponent shall transport all coal from the site to the Whitehaven Siding coal handling and preparation plant by road, using only the designated transport route shown in Figure 1 of Appendix 2.

29. The Proponent shall only dispatch coal from the site by road between the hours of:
    (a) 7 am to 9.15 pm, Monday to Friday;
    (b) 7 am to 5.15 pm Saturday; and
    (c) at no time on Sundays and public holidays.

Monitoring of Coal Transport

30. The Proponent shall:
    (a) keep accurate records of the amount of coal transported (on a monthly basis) from the site, as well as the number of coal truck movements generated by the project; and
    (b) make these records publicly available on its website at the end of each calendar year.

VISUAL

Visual Amenity and Lighting

31. The Proponent shall:
    (a) implement all reasonable and feasible measures to minimise the visual and off-site lighting impacts of the project;
    (b) establish and maintain an effective vegetative screen along the boundary of the site that adjoins public roads;
    (c) ensure that no outdoor lights shine above the horizontal; and
    (d) ensure that all external lighting associated with the project complies with *Australian Standard AS4282 (INT) 1995 - Control of Obtrusive Effects of Outdoor Lighting*, or its latest version.

WASTE

32. The Proponent shall:
    (a) minimise the waste generated by the project; and
    (b) ensure that the waste generated by the project is appropriately stored, handled and disposed of in a lawful manner.

BUSHFIRE MANAGEMENT

33. The Proponent shall:
    (a) ensure that the project is suitably equipped to respond to any fires on site; and
    (b) assist the Rural Fire Service and emergency services as much as possible if there is a fire in the surrounding area.

REHABILITATION

Rehabilitation Objectives

34. The Proponent shall rehabilitate the site to the satisfaction of the Executive Director, Mineral Resources in DRE. This rehabilitation must be generally consistent with the proposed rehabilitation strategy described in the EA (and depicted conceptually in Figure 1 in Appendix 5), and comply with the objectives in Table 8.

Table 8: Rehabilitation Objectives

Feature	***Objective***
Mine site (as a whole)	Safe, stable and non-polluting
Final void	• Minimise the size and depth of the final void as far as is reasonable and feasible; and • The final void is to be safe, stable and non-polluting
Surface infrastructure	To be decommissioned and removed, unless the Director-General agrees otherwise
Other land affected by the project	Restore ecosystem function, including maintaining or establishing self-sustaining eco-systems comprised of: • local native plant species; • at least 206 hectares of woodland (see Figure 1 in Appendix 5); and • a landform consistent with the surrounding environment
Community	Minimise the adverse socio-economic effects associated with mine closure

Progressive Rehabilitation

35. The Proponent shall carry out the rehabilitation of the site progressively, that is, as soon as reasonably practicable following disturbance.

Rehabilitation Management Plan

36. The Proponent shall prepare and implement a Rehabilitation Management Plan to the satisfaction of the Executive Director, Mineral Resources in DRE. This plan must:
    (a) be prepared in consultation with the Department, NOW, OEH, Council and the CCC;
    (b) be submitted to the Executive Director, Mineral Resources in DRE by the end of February 2012;
    (c) be prepared in accordance with any relevant DRE guideline;
    (d) describe the measures that would be implemented to ensure compliance with the relevant conditions of this approval;
    (e) address all aspects of rehabilitation including mine closure, final landform, and final land use; and
    (f) build to the maximum extent practicable on the other management plans required under this approval.

SCHEDULE 4
ADDITIONAL PROCEDURES

NOTIFICATION OF LANDOWNERS

1. By the end of December 2011, the Proponent shall notify in writing the owners of "Brolga", "Surrey" and any privately-owned land within 2 kilometres of the proposed footprint of the open-cut pit that they are entitled to ask for an inspection to establish the baseline condition of any buildings or structures on their land, or to have a previous property inspection report updated.

2. As soon as practicable after obtaining monitoring results showing:
   (a) an exceedance of the relevant criteria in Schedule 3, the Proponent shall notify the affected landowner and/or tenants in writing of the exceedance, and provide regular monitoring results to each of these parties until the project is complying with the relevant criteria again; and
   (b) an exceedance of the relevant air quality criteria in Schedule 3, the Proponent shall send a copy of the NSW Health fact sheet entitled *"Mine Dust and You"* (as may be updated from time to time) to the affected landowners and/or existing tenants of the land (including tenants of any mine-owned land).

INDEPENDENT REVIEW

3. If an owner of privately-owned land considers the project to be exceeding the relevant criteria in Schedule 3, then they may ask the Director-General in writing for an independent review of the impacts of the project on their land.

   If the Director-General is satisfied that an independent review is warranted, then within 2 months of the Director-General's decision the Proponent shall:
   (a) commission a suitably qualified, experienced and independent person, whose appointment has been approved by the Director-General, to:
      - consult with the landowner to determine his/her concerns;
      - conduct monitoring to determine whether the project is complying with the relevant criteria in Schedule 3; and
      - if the project is not complying with these criteria then identify the measures that could be implemented to ensure compliance with the relevant criteria; and
   (b) give the Director-General and landowner a copy of the independent review.

4. If the independent review determines that the project is complying with the relevant criteria in Schedule 3, then the Proponent may discontinue the independent review with the approval of the Director-General.

   If the independent review determines that the project is not complying with the relevant impact assessment criteria in Schedule 3, then the Proponent shall:
   (a) implement all reasonable and feasible mitigation measures, in consultation with the landowner and appointed independent person, and conduct further monitoring until the project complies with the relevant criteria; or
   (b) secure a written agreement with the landowner to allow exceedances of the relevant criteria,

   to the satisfaction of the Director-General.

SCHEDULE 5
ENVIRONMENTAL MANAGEMENT, REPORTING AND AUDITING

ENVIRONMENTAL MANAGEMENT

Environmental Management Strategy

1. The Proponent shall prepare and implement an Environmental Management Strategy for the project to the satisfaction of the Director-General. This strategy must:
   (a) be submitted to the Director-General for approval by the end of December 2011;
   (b) provide the strategic framework for environmental management of the project;
   (c) identify the statutory approvals that apply to the project;
   (d) describe the role, responsibility, authority and accountability of all key personnel involved in the environmental management of the project;
   (e) describe the procedures that would be implemented to:
      - keep the local community and relevant agencies informed about the operation and environmental performance of the project;
      - receive, handle, respond to, and record complaints;
      - resolve any disputes that may arise during the course of the project;
      - respond to any non-compliance;
      - respond to emergencies; and
   (f) include:
      - copies of any strategies, plans and programs approved under the conditions of this approval; and
      - a clear plan depicting all the monitoring required to be carried out under the conditions of this approval.

Management Plan Requirements

2. The Proponent shall ensure that the management plans required under this approval are prepared in accordance with any relevant guidelines, and include:
   (a) detailed baseline data;
   (b) a description of:
      - the relevant statutory requirements (including any relevant approval, licence or lease conditions);
      - any relevant limits or performance measures/criteria;
      - the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the project or any management measures;
   (c) a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;
   (d) a program to monitor and report on the:
      - impacts and environmental performance of the project;
      - effectiveness of any management measures (see (c) above);
   (e) a contingency plan to manage any unpredicted impacts and their consequences;
   (f) a program to investigate and implement ways to improve the environmental performance of the project over time;
   (g) a protocol for managing and reporting any:
      - incidents;
      - complaints;
      - non-compliances with statutory requirements; and
      - exceedances of the impact assessment criteria and/or performance criteria; and
   (h) a protocol for periodic review of the plan.

   Note: The Director-General may waive any of these requirements if they are unnecessary or unwarranted for particular management plans.

Annual Review

3. By the end of each December, the Proponent shall review the environmental performance of the project to the satisfaction of the Director-General. This review must:
   (a) describe the development (including any rehabilitation) that was carried out in the past year, and the development that is proposed to be carried out over the next year;
   (b) include a comprehensive review of the monitoring results and complaints records of the project over the past year, which includes a comparison of these results against the
      - relevant statutory requirements, limits or performance measures/criteria;
      - monitoring results of previous years; and
      - relevant predictions in the EA;
   (c) identify any non-compliance over the past year, and describe what actions were (or are being) taken to ensure compliance;
   (d) identify any trends in the monitoring data over the life of the project;

(e) identify any discrepancies between the predicted and actual impacts of the project, and analyse the potential cause of any significant discrepancies; and
(f) describe what measures will be implemented over the next year to improve the environmental performance of the project.

Revision of Strategies, Plans and Programs

4. Within 3 months of:
(a) the submission of an annual review under condition 3 above;
(b) the submission of an incident report under condition 6 below;
(c) the submission of an audit report under condition 8 below; and
(d) any modification to the conditions of this approval (unless the conditions require otherwise),
the Proponent shall review, and if necessary revise, the strategies, plans, and programs required under this approval to the satisfaction of the Director-General.

Note: This is to ensure the strategies, plans and programs are updated on a regular basis, and incorporate any recommended measures to improve the environmental performance of the project.

Community Consultative Committee

5. The Proponent shall operate a Community Consultative Committee (CCC) for the project in general accordance with the *Guidelines for Establishing and Operating Community Consultative Committees for Mining Projects* (Department of Planning, 2007, or its latest version), and to the satisfaction of the Director-General.

Notes:
- *The CCC is an advisory committee. The Department and other relevant agencies are responsible for ensuring that the Proponent complies with this approval; and*
- *In accordance with the guideline, the Committee should be comprised of an independent chair and appropriate representation from the Proponent, Council and the local community.*

REPORTING

Incident Reporting

6. As soon as is practicable after the Proponent becomes aware of any incident associated with the project, the Proponent shall notify the Director-General and any other relevant agencies of the incident. Within 7 days of the date of the incident, the Proponent shall provide the Director-General and any relevant agencies with a detailed report on the incident.

Regular Reporting

7. The Proponent shall provide regular reporting on the environmental performance of the project on its website, in accordance with the reporting arrangements in any plans or programs approved under the conditions of this approval.

INDEPENDENT ENVIRONMENTAL AUDIT

8. By the end of March 2013, and every 3 years thereafter, unless the Director-General directs otherwise, the Proponent shall commission and pay the full cost of an Independent Environmental Audit of the project. This audit must:
(a) be conducted by a suitably qualified, experienced and independent team of experts whose appointment has been endorsed by the Director-General;
(b) include consultation with the relevant agencies;
(c) assess the environmental performance of the project and assess whether it is complying with the requirements in this approval and any relevant EPL or Mining Lease (including any assessment, plan or program required under these approvals);
(d) review the adequacy of strategies, plans or programs required under the abovementioned approvals; and
(e) recommend appropriate measures or actions to improve the environmental performance of the project, and/or any assessment, plan or program required under the abovementioned approvals.

Note: This audit team must be led by a suitably qualified auditor and include experts in any field specified by the Director-General.

9. Within six weeks of the completion of this audit, or as otherwise agreed by the Director-General, the Proponent shall submit a copy of the audit report to the Director-General, together with its response to any recommendations contained in the audit report.

ACCESS TO INFORMATION

10. The Proponent shall:

(a) make copies of the following publicly available on its website:

- the documents referred to in Condition 2 of Schedule 2;
- all current statutory approvals for the project;
- all approved strategies, plans and programs required under the conditions of this approval;
- a comprehensive summary of the monitoring results of the project, which have been reported in accordance with the conditions of this approval, or any approved plans and programs;
- a complaints register, updated on a monthly basis;
- minutes of CCC meetings;
- the annual reviews of the project;
- any independent environmental audit of the project, and the Proponent's response to the recommendations in any audit;
- any other matter required by the Director-General; and

(b) keep this information up-to-date,

to the satisfaction of the Director-General.

APPENDIX 1
SCHEDULE OF LAND

Area	***Land Title Reference***
Mine Site Area including the proposed Wean Road diversion	*Lots 1 and 4 DP 1120601* *Lot 1 DP 787417*
Coal Haulage Route	*Lots 23 and 28 DP 754929* *Council roads and road reserve, including:* • *Shannon Harbour road (SR 93);* • *Hoad Lane (SR 95);* • *Blue Vale Road (SR 7); and* • *Kamilaroi Highway (SH 29).*
Wean Road	*Wean Road (SR 6)*

APPENDIX 2
PROJECT LAYOUT PLANS

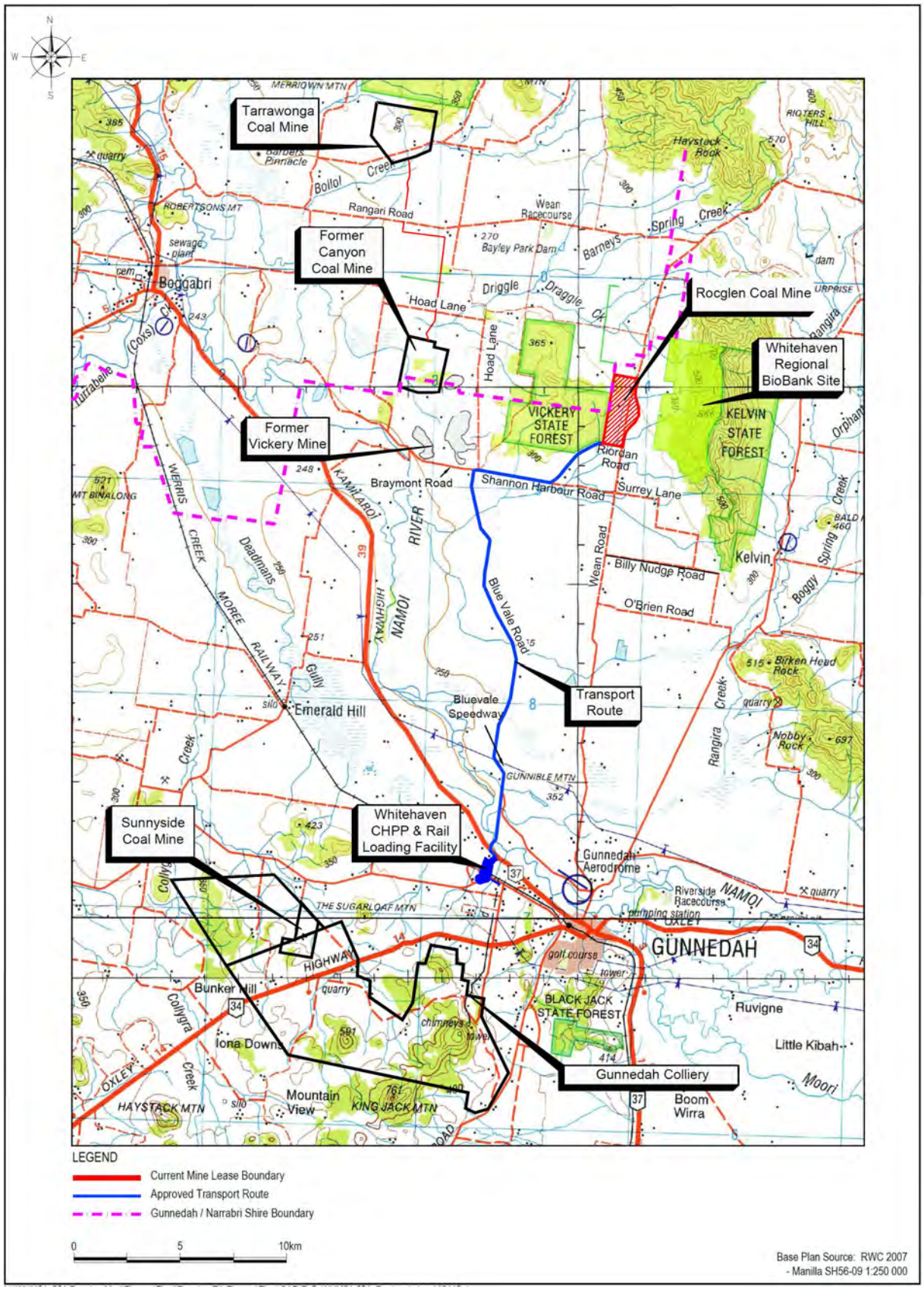

Figure 1: *Regional setting of Rocglen Extension and Whitehaven Regional Biobank Site*

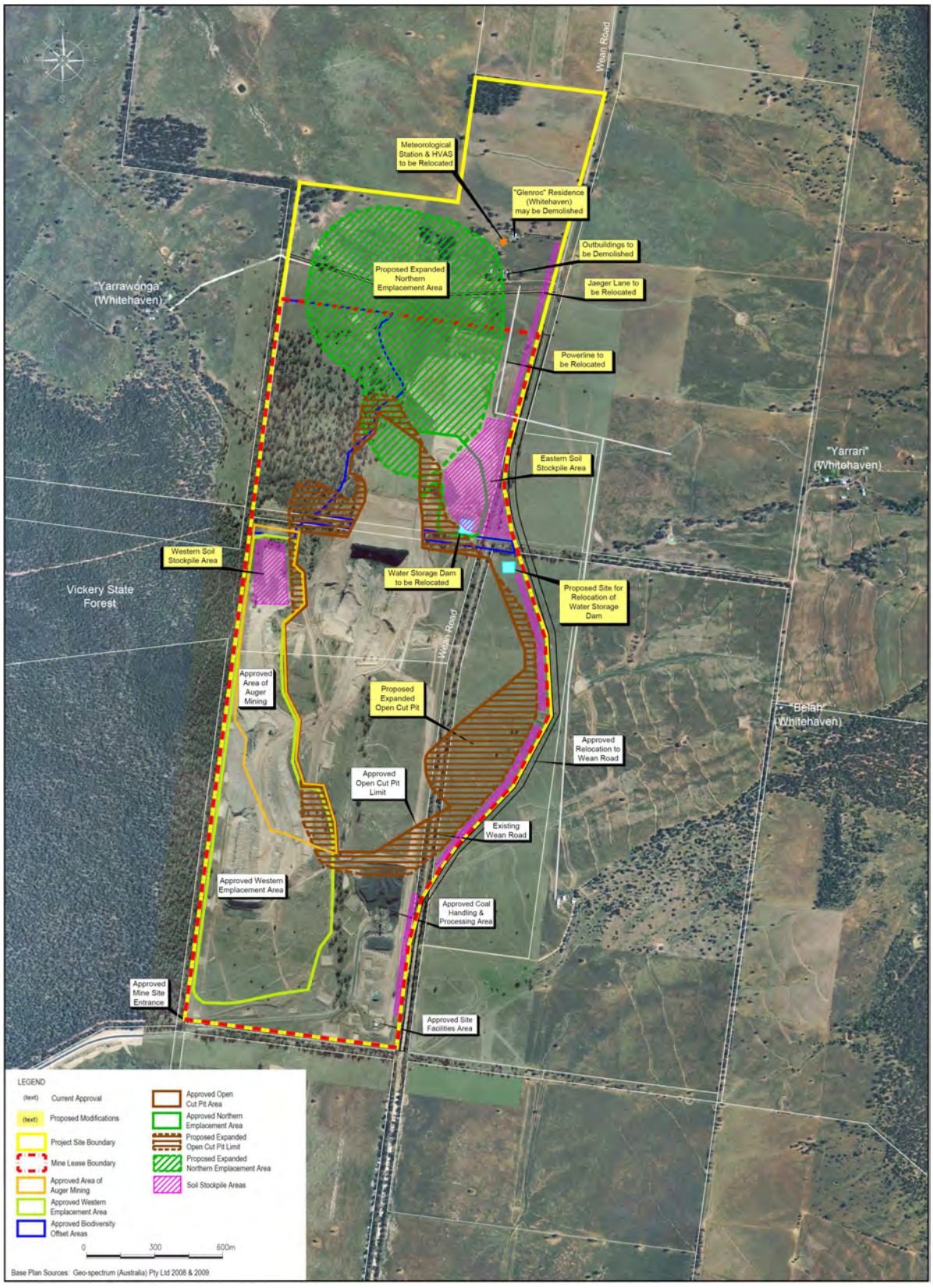

Figure 2: *Rocglen Extension Project Layout*

APPENDIX 3
LAND OWNERSHIP PLAN

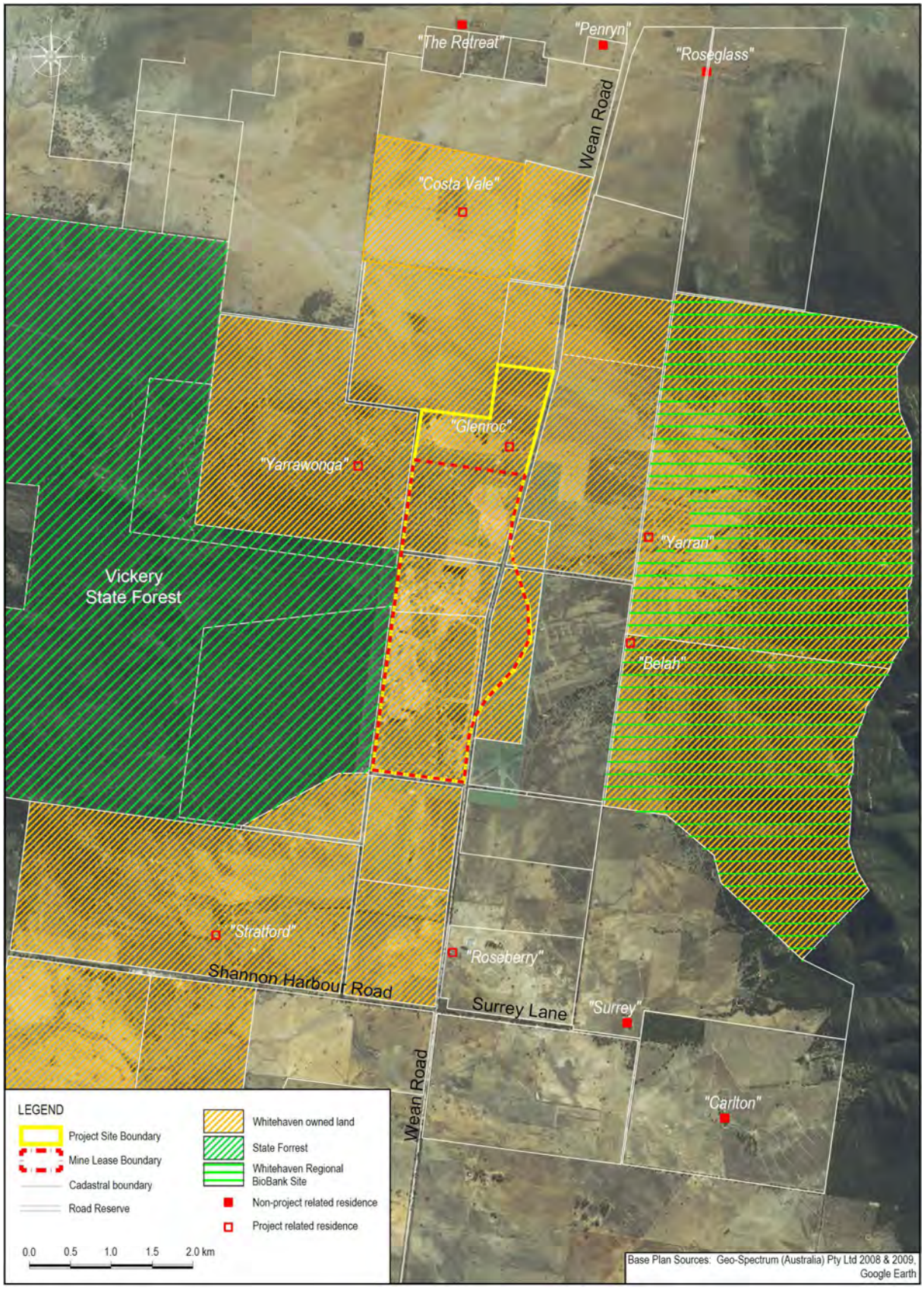

Figure 1: *Land ownership and neighbouring residences*

APPENDIX 4
WHITEHAVEN REGIONAL BIOBANK SITE

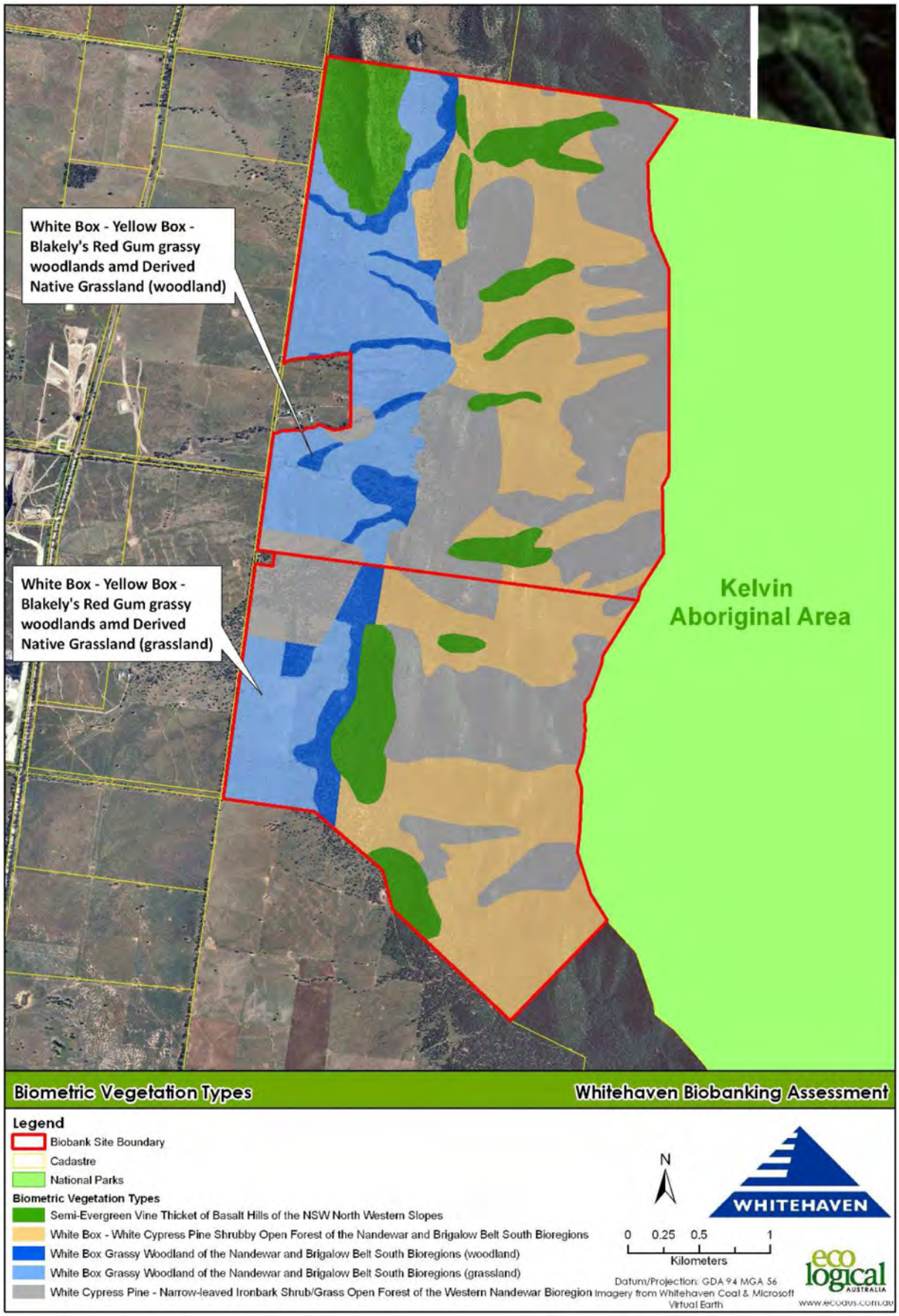

Figure 2: *Whitehaven Regional Biobank Site (showing locations of EPBC Act listed ecological communities to be utilised as offsets for the Rocglen Extension Project)*

APPENDIX 5
CONCEPTUAL REHABILITATION PLAN

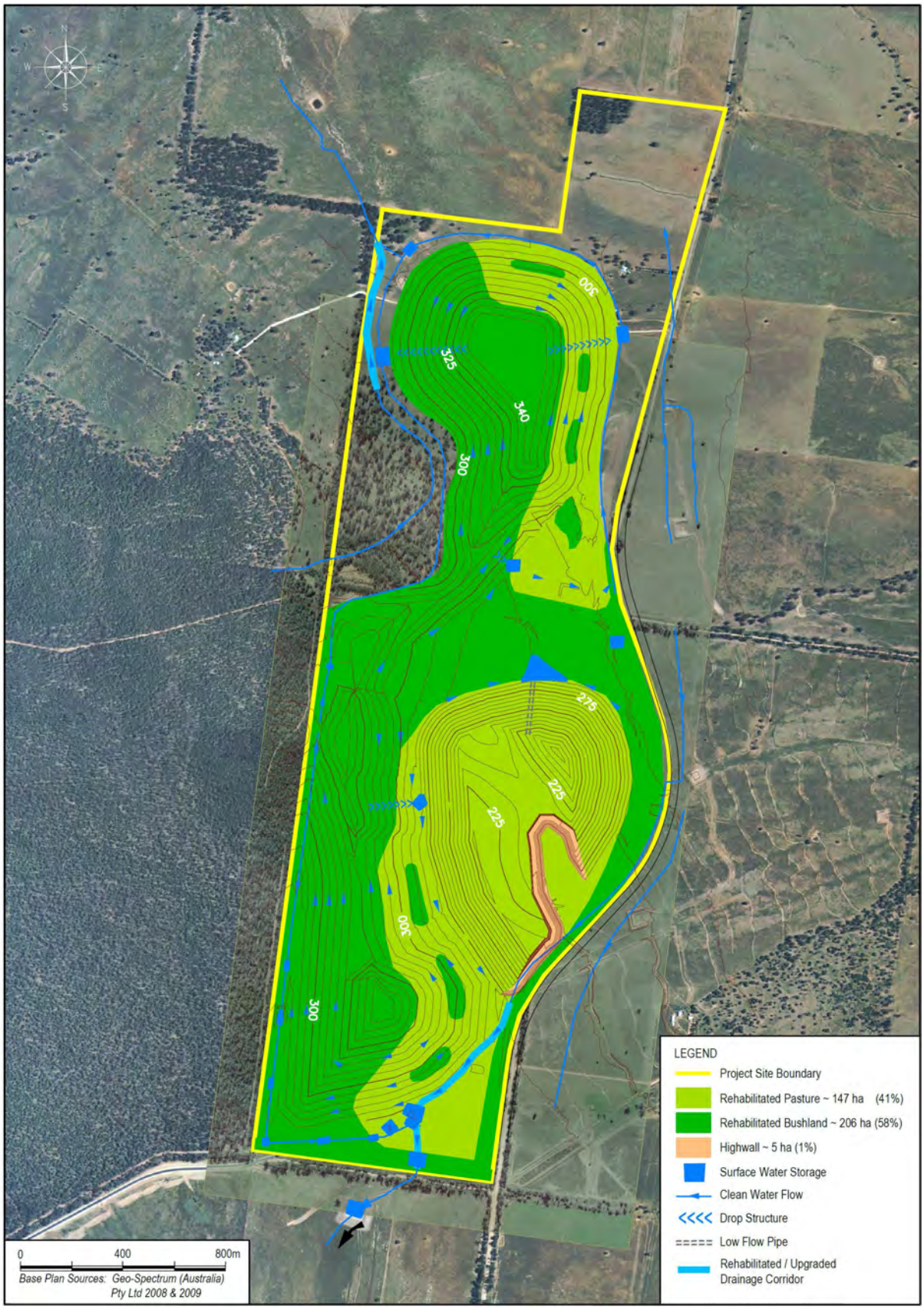

Figure 1: *Conceptual Rehabilitation Plan (note that configuration of the final void must be consistent with the Rehabilitation Management Plan)*

APPENDIX 6
ABORIGINAL HERITAGE SITES

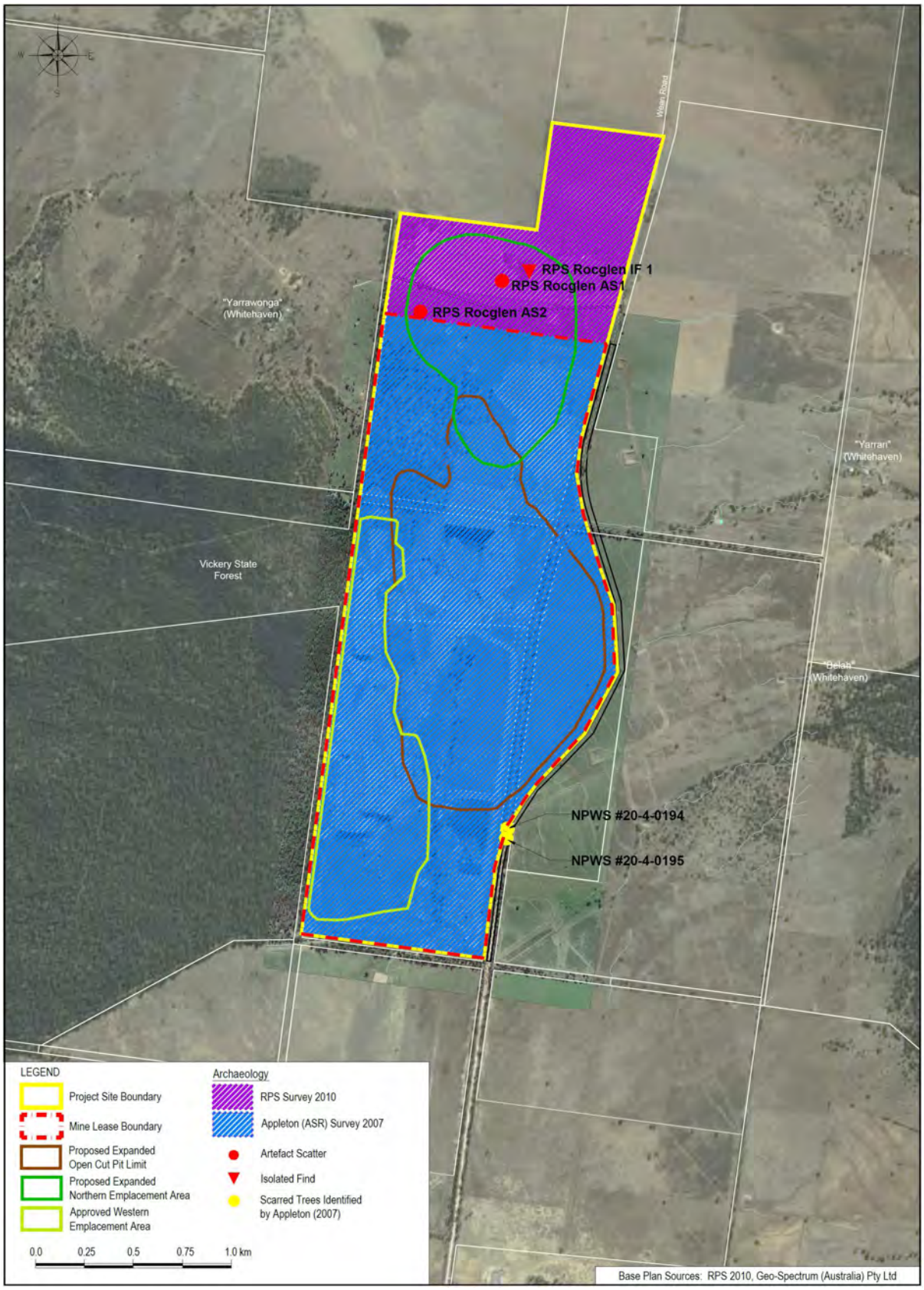

Figure 1: *Aboriginal heritage sites*

APPENDIX 7
STATEMENT OF COMMITMENTS

Compliance with the EA

(a) Whitehaven will carry out the development for the Project generally in accordance with the Project Application and this EA report.

General Operation

Production Limit

(a) Whitehaven will not extract more than 1.5 Mtpa of ROM coal from the Project Site

Hours of Operation

(b) Mining operations may be undertaken 24 hours a day, Monday to Saturday, with the exception of public holidays.

(c) Coal transport will be undertaken between 7am and 9:15pm Monday to Friday, and between 7am and 5:15pm on Saturdays.

Refinement of Mine Plan

(d) Any refinements to the concept mine plan outlined in this EA report will be detailed and assessed as part of the MOP process managed by the I&I NSW.

Consultation

(e) Routine consultation will be undertaken with residents surrounding the Project Site and along the coal transport route, as well as with the CCC, to ensure any concerns relating to mine operations are identified and appropriately addressed.

Environmental Monitoring and Reporting

Revision of Environmental Management Plans and Monitoring Programs

(a) Within 12 months of approval, Whitehaven will review, update and integrate relevant aspects of the environmental management of the Project in the existing set of environmental management plans for the Rocglen Coal Mine. This will be undertaken in consultation with the relevant government agencies.

(b) Within 12 months of approval, Whitehaven will review, update and integrate relevant aspects of the environmental monitoring of the Project in the existing set of environmental monitoring programs for the Rocglen Coal Mine. This will be undertaken in consultation with the relevant government agencies.

Annual Environmental Management Plan

(c) Whitehaven will prepare an AEMR for the Project for submission to the Director-General and relevant government agencies.

Soil Stripping, Stockpiling and Re-Spreading

(a) Soil materials within the Project Site will be stripped, handled and stockpiled in a manner that minimises the potential for soil loss and structural deterioration.

(b) Topsoil stockpiles will be established to a maximum height of 3 metres.

(c) Soil material will be maintained in a slightly moist condition during stripping, and will not be stripped in either an excessively dry or wet condition.

(d) If mining sequencing, equipment scheduling and weather conditions permit, stripped material will be placed directly onto reshaped emplacement areas and spread immediately to avoid the requirement for stockpiling.

(e) The surface of soil stockpiles will be left coarsely textured in order to promote infiltration and minimise erosion until vegetation is established, as well as to prevent anaerobic zones forming.

(f) Where long-term stockpiling is planned (that is, greater than 3 months) the stockpiles will be seeded and fertilised as soon as possible. An annual cover crop that produces sterile florets or seeds will be sown.

(g) Prior to re-spreading stockpiled material onto completed mining or overburden emplacement areas, an assessment of weed infestation on stockpiles will be undertaken to determine if individual stockpiles require herbicide application and/or 'scalping' of weed species prior to spreading.

(h) A soil inventory will be maintained to ensure adequate material is available for planned rehabilitation activities.

(i) Where natural protection from surface runoff flows is not available or achievable, protective earthworks, such as contour banks, and/or straw bale protection will be installed. Silt fencing (or similar) will be installed immediately downslope of any stockpile area potentially susceptible to erosion and maintained until the stockpile is considered stable with an effective vegetation cover.

(j) Whitehaven will adopt the general practice, where appropriate subsoil is available and targeting areas being rehabilitated to pasture, of including an intermediate layer of subsoil between the overburden material and the topdressing to improve the water holding capacity of the rehabilitated landform and reinstate a more natural soil profile. For areas being rehabilitated to bushland, Whitehaven may preferentially reduce the subsoil replacement depth and/or exclude subsoil replacement in selected areas to establish trial areas to monitor bushland development in different soil profiles.

(k) Where resources allow, topsoil and subsoil will each be spread to a nominal depth of between 100 to 150 mm, giving a combined depth of soil material on the rehabilitated landform of between 200 and 300 mm.

(l) The subsoil layer will be spread on an even but roughened surface that has been ripped along the line of the contour to break any compacted and/or smooth surfaces. Ripping will also assist the keying of subsoil into the overburden, which will, in turn, assist in the prevention of land slip and can help vegetation penetrate deep into the soil profile, encourage ingress of water and minimise erosion.

(m) Stripped soil material will be spread, treated with fertiliser and seeded in one consecutive operation in order to reduce the potential for soil loss to wind and water erosion.

Geotechnical Stability – Open Cut Pit and Highwall

(a) Progressive stability reviews and monitoring of geological conditions will be undertaken once the pit moves within 250 metres of the realigned Wean Road to ensure geotechnical stability and safe conditions. If any unfavourable conditions are observed or detected, a detailed assessment will be undertaken by a suitably qualified geotechnical engineer before mining is allowed to continue towards Wean Road.

(b) When the Belmont Fault (or fault zone) is more than 150 metres from Wean Road, operations will mine through the Belmont Fault. The uppermost alluvial material and weathered rock on the eastern side of the fault will have individual face angles no steeper than 45 degrees.

(c) Benching will be adopted at a maximum interval of 25 metres in alluvial, weathered rock and brecciated rock.

(d) In fresh strata face angles will designed at 75 degrees to pit bottom. If in following the upturned Belmont Seam down to pit bottom the floor rock is strong and competent, then the face will be developed on the dip slope without the need for benches in rock beneath the Belmont Seam.

(e) When the top of the stable highwall reaches 50 metres from Wean Road (i.e. when the eastern limit of the Belmont Fault zone reaches 150 metres from Wean Road), the eastern end wall will be turned at right angles to the west. Once the turned highwall encounters sound rock, as it continues to the west, it can be turned again to develop parallel to the Belmont Fault until it reaches the planned pit limit.

(f) The turned highwall in the fault zone will be notched to achieve a stable face. This notch will not approach Wean Road any closer than 150 metres without geotechnical advice.

(g) A block of unmined ground will be left to contain the Belmont Fault zone and prevent it causing collapse back towards Wean Road. The size of this block of unmined ground will be determined by geotechnical investigation by the time a change in highwall direction is required.

(h) If the highwall is free of faulting mining will resume southeast towards the currently planned pit limit. Such mining will cease when the pit crest reaches 50 metres from Wean Road. If additional faulting is detected in this advancing face then the relevance of such structure on highwall stability will be investigated before continuation of highwall development.

Rehabilitation and Mine Closure

Progressive Rehabilitation

(a) Whitehaven will adopt a progressive approach to the rehabilitation of disturbed areas within the Project Site to ensure that, where practicable, completed mining and overburden emplacement areas are quickly shaped, topdressed and vegetated to provide a stable landform. Early reshaping and revegetation of the external batter slopes of the emplacement areas is particularly important and will be targeted as a priority.

(b) Disturbed areas will generally undergo rehabilitation within one year of overburden emplacement and reshaping.

Overburden Placement and Shaping

(c) Placement and shaping of overburden will be undertaken to achieve stable slopes.

(d) Placement and shaping of overburden will be undertaken in a manner which, wherever practicable, ensures that any friable or weathered materials are placed below the subsoil and topsoil layers in order to provide a cover of more competent material and avoid the exposure of large rocks on the final surface.

(e) Any coarse coal rejects placed in the mine void will be covered with at least 3 metres of overburden material.

Subsoil and Topsoil Replacement

(f) Refer to commitments listed above in **Section 8.4**.

Drainage and Surface Water Structure Installation

(g) Surface water management structures will be progressively installed on the rehabilitated landform. The heights (effective depths) and cross-sectional areas of the individual banks will be determined on the basis of individual sub-catchment areas, but will typically be less than 0.7 metres and 3 square metres (m^2), respectively. Rock-lined drains will be used, where required, to convey water safely from the rehabilitated landform into the surface water management system that takes water from the site.

Revegetation

(h) The topdressed surfaces of those areas designated to be restored to rehabilitated pasture will be sown with a mixture of pasture species appropriate for the season. The seed mixture will include fast growing, short-lived species and perennial grasses and legumes.

(i) The topdressed surfaces of those areas designated to be restored as rehabilitated bushland will be initially stabilised with a non-persistent cover crop followed by planting of a selection of locally occurring tree and shrub species that will encourage the re-establishment of the pre-mining vegetation communities and, in the medium to longer term, create habitat and corridors for native fauna.

(j) All areas identified for bushland and pasture re-establishment will be fenced and have stock excluded until it can be demonstrated that the vegetation is stable and self-sustaining, and that grazing will not impact upon its establishment.

Rehabilitation Monitoring and Maintenance

(k) Areas being rehabilitated will be regularly inspected and assessed against the long and short-term rehabilitation objectives. During regular inspections, aspects of rehabilitation to be monitored will include:

- Evidence of any erosion or sedimentation from areas with establishing vegetation cover;
- Success of initial grass cover establishment;
- Success of tree and shrub plantings;
- Adequacy of drainage controls;
- Presence/absence of weeds; and

- General stability of the rehabilitation site.

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

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

(n) Monitoring will be conducted periodically by independent, suitably skilled and qualified persons at locations that are representative of the range of conditions on the rehabilitating areas. Annual reviews will be conducted of monitoring data to assess trends and monitoring program effectiveness.

Conceptual Post-Mining Land Use

(o) The disturbed area within the Project Site will be restored to either rehabilitated bushland or rehabilitated pasture, with approximately 5 hectares (1 percent) remaining as a stabilised highwall of the final void.

(p) Along the eastern boundary of the Project Site, adjacent to the realigned Wean Road, a strip of rehabilitated bushland will be established to screen the view of the final void and generally improve the visual amenity from Wean Road, as well as provide vegetation connectivity north-south on the eastern side of the void.

(q) In addition to the large area to be rehabilitated to bushland, strategically placed tree lots will be established within rehabilitated pasture areas to break-up the landform and act as wildlife refuges and linkages.

(r) Tree trunks and branches less than 300 mm diameter and other smaller vegetative debris removed during clearing activities will be spread over those areas to be restored as rehabilitated bushland where practical.

Final Void Management

(s) The final void will be designed and managed as a stable landform. Appropriate long-term land use options for the void will be considered and adequately assessed in consultation with relevant stakeholders as the mine approaches closure.

Final Void Stability – Low Walls

(t) The low walls will be battered back from the angle of repose to ensure the long term geotechnical stability of the face, with the determination of geotechnical stability and recommendations as to the final slope undertaken by a qualified geotechnical engineer on the basis of an assessment of the overburden material, the likely degree of settlement, and the degree of weathering expected in the long term. It is expected that the low wall sides of the final void will be battered back to a maximum of 18 degrees with a goal of 10 degrees being optimal.

(u) Surface water drainage on and over the low wall will be minimised through the construction of drainage control structures, the construction of Dam F, and the aim of diverting as much of the catchment as possible away from the final void and back into the surface water system.

(v) Erosion of the low wall will be controlled by limiting the length of slope through the use of contour and graded drains, minimising the slope, and by the establishment of suitable vegetation.

Final Void Stability – Highwall

(w) To ensure the safety of the final void, the surrounding final slopes will be left in a condition where the risk of slope failure is minimised. The highwall of the final void will be left at 45 degrees to ensure long term geotechnical stability. This will be assessed by a suitably qualified geotechnical engineer.

(x) Whitehaven will undertake progressive stability reviews and monitoring of the highwall once it moves to within 250 metres of the Wean Road deviation to ensure safe working conditions. If any failures are observed, or additional faulting is detected, then a detailed assessment will be undertaken by a suitably qualified geotechnical engineer before mining is allowed to continue towards Wean Road.

(y) Whitehaven will adopt the geotechnical stability commitments listed above in **Section 8.5** as the open cut pit progresses and the final landform is being formed.

Biodiversity Offset Strategy

(a) The revised *Biodiversity Offset Strategy* described in **Section 5.8**, which has been prepared on the basis of the BioBanking Methodology to 'inform' the 'improve or maintain' assessment, will be implemented. This *Strategy*, in summary, comprises the retirement of 4,859 credits (for the impact to 95.44ha as a consequence of the project) from the Whitehaven Regional BioBank Site, which is in the final stages of registration by the DECCW as a BioBank Site under Part 7A of the TSC Act.

(b) The Whitehaven Regional BioBank Site will be actively managed via a BioBanking Management Plan with in-perpetuity management funding, and will have the highest level of conservation status outside of National Parks via a BioBanking Agreement registered on the land title in-perpetuity.

Air Quality

Vegetation Clearing and Soil Stripping

(c) Cleared trees and branches will be retained for use in stabilising slopes identified for restoration of rehabilitated woodland. No burning of vegetation is permitted or occurs on-site.

(d) Where practicable, soil stripping will be undertaken when there is sufficient soil moisture to prevent lift-off dust and at times that avoid periods of high winds. Where this is not possible, dust suppression by water application will be undertaken to increase soil moisture.

(e) Land disturbance, including groundcover removal, will be limited in advance of mining activities consistent with operational requirements. Under normal circumstances, a maximum of 100 metres will be prepared in advance of mining.

(f) Groundcover will be removed with the topsoil, as opposed to prior to topsoil removal.

(g) Where long-term stockpiling of soil materials is planned (typically greater than 3 months) the stockpiles will be seeded and fertilised as soon as possible.

Drilling and Blasting Activities

(h) Water injection will be used on the drilling rig.

(i) Coarse aggregates will be used for blasthole stemming at all times.

(j) Where practicable, blasting will be restricted during unfavourable weather conditions.

(k) When necessary, dust aprons will be lowered during on-site drilling.

Overburden Ripping and Placement

(l) Where practicable, ripping of softer overburden material will be avoided during periods of high winds.

Coal Mining

(m) When necessary, low moisture coal will be sprayed with water prior to excavation.

Crushing and Screening

(n) Notwithstanding the generally moist nature of the ROM coal pad, when necessary, water will be applied to the coal at the feed hopper, crusher and at all conveyor transfer and discharge points.

(o) When necessary, some flexibility does exist to enable cessation of coal processing activities during periods of concurrent high winds and temperatures that have the potential to cause coal dust dispersal independent of water applications.

Internal Transport

(p) As required, internal roads will be watered, with emphasis on those subject to frequent trafficking.

(q) The speed of all on-site vehicles and equipment will be restricted.

(r) All internal roads will be clearly defined to control their locations.

(s) As roads within the Project Site become obsolete, they will be promptly ripped and revegetated.

External Transport

(t) All trucks hauling product coal and coal rejects between Rocglen and the Whitehaven CHPP will be required to be fitted with roll-over tarpaulins.

(u) All trucks transporting coal will be well maintained to ensure optimal operation, which will minimise the potential for noise emissions.

Rehabilitation

(v) As per the commitments listed in **Section 8.6**, Whitehaven will adopt a progressive approach to the rehabilitation of disturbed areas within the Project Site to ensure that, where practicable, completed mining and overburden emplacement areas are quickly shaped, topdressed and vegetated to provide a stable landform.

Monitoring

(w) The existing *Air Quality Monitoring Program* (Whitehaven 2009a) will be reviewed and, as necessary, updated to integrate relevant aspects of the Project.

(x) A real-time PM_{10} monitor will be installed and operated. As recommended by PAEHolmes (2011), it is proposed to locate this monitor at the "Roseberry" residence, co-located within one of the existing HVAS.

(y) The existing weather station and HVAS within the "Glenroc" property will be relocated. As recommended by PAEHolmes (2011), it is proposed to move these items to "Costa Vale", which is along the axis of prevailing winds.

Noise

Project Design

(a) The external batter slopes of the expanded Northern Emplacement Area will be re-shaped and revegetated in Years 1 and 2 of the Project to, amongst other things, minimise the projection of noise from overburden transportation and emplacement activities towards privately owned residences located to the north and north-east later in the mine life.

General Operation

(b) Contractors, including all personnel and sub-contractors, will be advised of noise compliance limits prior to their work commencing. Contractors will be expected to take practical measures to limit noise generation during their activities where possible.

(c) Prior to being brought on-site, all earthmoving equipment will be tested to ensure sound power levels are consistent with the previous assessments undertaken by Spectrum Acoustics.

(d) Site personnel will be required to pay due attention to site weather conditions and modify or stand down from operational activities if directed by mine management.

(e) Where possible, equipment with lower sound power levels will be used in preference to more noisy equipment.

(f) All equipment used on-site will be regularly serviced to ensure the sound power levels remain at or below the levels used in the modelling undertaken by Spectrum Acoustics.

(g) Mid-high frequency broadband reverse beepers are fitted to on-site mobile mining equipment.

(h) The on-site road network will be maintained to limit vehicle body noise.

External Transport

(i) All transport activities, including the haul route used between Rocglen and the Whitehaven CHPP and the hours of coal haulage, will continue to be undertaken strictly in accordance with that approved under PA 06_0198.

(j) The haul route between Rocglen and the Whitehaven CHPP is fully sealed and will continue to be maintained under an existing contribution plan with Council.

(k) Drivers will be instructed to operate in accordance with an existing Transport Policy and Code of Conduct, which identify aspects such as travelling speeds, general behaviour, avoidance of exhaust brakes, load coverage, complaints and disciplinary procedures. The Policy and Code apply to all employee and contractor-owned vehicles.

(l) The trucks will be speed limited to 93 km per hour to, amongst other things, minimise engine noise.

(m) All trucks transporting coal will be well maintained to ensure optimal operation, which will minimise the potential for noise emissions.

Monitoring

(n) As per the commitments listed in **Section 8.3**, the existing *Noise Monitoring Program* (Whitehaven 2008d) will be reviewed and, as necessary, updated to integrate relevant aspects of the Project. Specifically, "Retreat" or "Penryn" will be included as a noise monitoring location in the revised Program in place of "Costa Vale" (which is now owned by Whitehaven).

(o) Traffic noise monitoring will continue to be conducted at the "Brooklyn" and "Werona" residences on Blue Vale Road in accordance with the existing *Road Noise Management Plan* (Spectrum Acoustics 2008).

Blasting and Vibration

Blast Design

(a) Blast design and implementation will be undertaken by a suitably qualified blasting engineer and/or experienced and appropriately certified shot-firer.

(b) Burden distances and stemming lengths will be designed to ensure that explosion gases are almost completely without energy by the time they emerge into the atmosphere.

(c) Blast design will ensure charges consistently detonate in carefully designed sequences.

(d) Meteorological conditions will be analysed prior to blasting to avoid times when the potential for impact is heightened, and also endeavours will be made to blast at around midday over the winter period to avoid temperature inversions.

Air Vibrations (Noise and Airblasts)

(e) Noise and airblast generation will be controlled to ensure that all, or the majority of, explosion energy is consumed in fragmenting and displacing the overburden by the time the gases vent (via the broken burden rock and/or ejected stemming material) into the atmosphere. This will be achieved via:

- Ensuring blasthole spacing is implemented in accordance with blast design;
- Careful selection and implementation of burden distance and stemming length;
- Using appropriate materials (for example, 20 mm aggregates) for stemming;
- Ensuring that charges detonate in the correct sequence and with inter-row delays that provide good progressive release of burden;
- Limited the maximum weight of explosive detonated in a given delay period (the maximum instantaneous charge (MIC)) to conservative and proven levels; and
- Refining these controls on the basis of the blast monitoring program.

Ground Vibrations

(f) Blast design will ensure the minimum practicable weight of explosive detonates at an instant (minimising the MIC) by using the maximum number of delay periods in each blast.

(g) Blast design will ensure that most of the energy liberated by the charge(s) on a given delay number is consumed in providing good fragmentation, adequate displacement and/or a loose, highly diggable muckpile.

Dust and Other Post-Blast Emissions

(h) Stemming columns will be designed to ensure ejection velocities are low.

(i) Appropriate aggregates for blasthole stemming and nonel delay-type or electronic detonators will be used to initiate charges.

Road Closures

(j) For all blasts within 500 metres of Wean Road, the road will be closed with blast notice boards updated at least 24 hours prior to each blast. Road closures typically occur for a period of up to 10 minutes.

(k) Whitehaven will inspect the road following the blast and any rock fragments removed from the road surface prior to re-opening.

(l) Whitehaven will monitor the distance flyrock travels (if any) beyond the designed blast envelope and identify if further safeguards are required.

Consultation

(m) The proposed blasting schedule will be provided to all residents within a 3 km radius of the blast providing advance notice of the date and time of each proposed blast. A verbal confirmation on the day of the blast will also be undertaken.

(n) Whitehaven will erect a blast notice board near the mine entrance on Wean Road notifying passing motorists when the next blast is scheduled.

Monitoring

(o) As per the commitments listed in **Section 8.3**, the existing *Blasting Monitoring Program* (Whitehaven 2008a) will be reviewed and, as necessary, updated to integrate relevant aspects of the Project. Specifically, "Retreat", as the nearest privately-owned residence to the north of the Project Site, will be included as a blast monitoring location in the revised Program in place of "Costa Vale" (which is now owned by Whitehaven).

Surface Water

General

(a) All hydrocarbon products will be securely stored.

(b) All of the mining fleet will be refuelled within designated areas of the Project Site.

(c) With the exception of some maintenance activities on mobile equipment, all maintenance works requiring the use of oils, greases and lubricants would be undertaken within designated areas of the Project Site.

(d) All water from wash-down areas and workshops would be directed to oil/water separators and containment systems.

(e) All storage tanks will be either self-bunded tanks or bunded with an impermeable surface with a capacity to contain a minimum of 110% of the largest storage tank capacity.

(f) Chemical flocculation to help increase the settling times of the sediment (TSS) in the water column will also be employed as required.

(g) As required, appropriate drainage structures and erosion and sediment controls will be installed and maintained.

(h) All efforts will be undertaken to ensure that any water discharged from the Project Site via the LDPs meets the quality limits imposed by the DECCW on the site's EPL.

(i) Key changes, as detailed in **Appendix M**, to be integrated into the existing surface water management system are:

- Additional water management controls to deal with water from the increased disturbance footprint in the northern area of the site;
- Additional water management controls to address TSS issues during wet weather discharge;
- Relocation of the Mine Water Dam; and
- More effective diversion of clean water from off-site catchments to the east.

(j) Dirty water generated from disturbed areas to be captured and diverted using contour banks and drop structures in a manner that minimises the potential for concentrated overland flow and subsequent erosion. This water will be channelled through a series of sediment basins to reduce sediment loads prior to discharge.

(k) Water generated within the open cut pit, primarily as a result of rainfall/runoff and some groundwater seepage, to be managed within the open cut via in-pit sumps. This water will be directed to and contained within these in-pit sumps until it is necessary to pump the water to the new Mine Water Dam, which will be constructed as a 'turkeys nest' to receive mine water only.

(l) Clean water diversions will be constructed wherever possible upstream of disturbance areas to minimise the amount of dirty water to be contained and treated within the dirty water management system.

(m) Progressive rehabilitation of all re-shaped surfaces to assist in reducing the level of TSS (and possible high pH and salinity) in runoff from disturbed areas. This will also reduce the dependence on sediment controls and generally assist in improving water quality.

(n) Water collected in the open cut extraction pit and/or dirty water dams will be used, as much as possible, for dust suppression purposes. This is the preferential use of water on-site to minimise the chance of pollution to downstream waterways.

(o) Sediment control structures will be maintained to ensure the design capacities are preserved for optimum settling rates. This will be most critical for those 'end-of-line' sediment basins that discharge from the Project Site.

(p) Implementation of an effective revegetation, maintenance and monitoring program.

Site Water Management Plan

(q) Within 12 months of Project Approval, a new *Site Water Management Plan* will be prepared in accordance with regulatory requirements and the *Blue Book (Volume 1 and Volume 2E).*

Site Water Balance and Discharge

(r) Whitehaven will consider and, where appropriate, adopt the following to improve site water balance and minimise uncontrolled overflow discharge:

- The proposed dams will be built to at least the specified sizes, and made larger where practical to provide additional storage in order to further reduce the chance of uncontrolled overflow discharge. Increasing the total storage will provide opportunity to retain and treat water prior to controlled discharge;
- Water will be promptly transferred amongst sediment basins to ensure the maximum available on-site storage capacity of rainfall events is maintained; and
- That controlled discharge of treated (settled and/or flocculated) water will be undertaken to draw down the water storage within all the dirty water dams on-site, which will provide the capacity to contain the majority rainfall events and reduce uncontrolled overflow discharge.

Drainage Lines

(s) Sections of drainage lines that are or will be impacted upon by the mining operation will be rehabilitated post-mining generally in accordance with Section 5.3.3 of the *Blue Book (Volume 1)* and the *Guidelines for Controlled Activities – In-Stream Works* (DWE 2008, as cited in GSSE 2010c) for watercourse rehabilitation and riparian zone rehabilitation.

Licensed Discharge Points

(t) While LDP 11 will continue to be used at the southern end of the Project Site, LDP 12 will be superseded and relocated in consultation with the OEH.

Monitoring

(u) As per the commitments listed in **Section 8.3**, the existing surface water monitoring program will be reviewed and, as necessary, updated to integrate relevant aspects of the Project. **Table 47** presents a summary of the proposed surface water monitoring.

Groundwater Monitoring

(a) All hydrocarbon products will be securely stored.

(b) All of the mining fleet will be refuelled within designated areas of the Project Site

(c) With the exception of some maintenance activities on mobile equipment, all maintenance works requiring the use of oils, greases and lubricants would be undertaken within designated areas of the Project Site.

(d) All water from wash-down areas and workshops would be directed to oil/water separators and containment systems.

(e) All storage tanks will be either self-bunded tanks or bunded with an impermeable surface with a capacity to contain a minimum of 110% of the largest storage tank capacity.

(f) As per the commitments listed in **Section 8.3**, the existing groundwater monitoring program will be reviewed, updated and implemented to integrate relevant aspects of the Project.

(g) Bores will be cleaned out (air-lift developed) and depth checked with a weighted tape. Bores will then be geophysically wireline logged (SP/SPR and Gamma) to confirm slotted intervals and the nature of the strata over slotted intervals.

(h) All monitoring bores will be surveyed for location and level (both ground level and the level of the RP from which groundwater levels are measured).

(i) Monitoring of groundwater levels will initially be undertaken on a monthly basis for the first year of the Project, after which the interval may potentially be relaxed subject to review of the results. In the longer term a monitoring interval of three months is anticipated. Samples will be analysed for all major ions, including carbonate.

(j) Pressure transducers/dataloggers will be installed in monitoring bores MP-01 to MP-05 for the continual recording of groundwater levels. These instruments will be downloaded every 2 months. MP-04 and MP-05 will be deepened to at least 10 metres below the water table.

(k) In order to address the concerns of the NOW in regard to the potential for impact on alluvial aquifers of the Namoi River and associated tributaries, the following program of investigations will be undertaken:

- Bores MP-04 and WB-01 are nominally located within the alluvium south and north of the mine, respectively. Once this is confirmed through the above commitments, a second bore will be drilled adjacent to each of them, to a depth at which the base of the alluvium is intersected. This adjacent bore will be completed as a monitoring bore in the Maules Creek Formation and have a pressure transducer/datalogger installed for continuous water level monitoring. Such actions will need to be agreed to by the relevant landowners; and
- There is some uncertainty regarding the nature of the interface between the southern alluvium and the weathered conglomerate profile of the Maules Creek Formation at the southern end of the proposed pit. On this basis, a pair of piezometers will be installed immediately to the south of the proposed pit, one in the Belmont Seam and one in the alluvium/weathered conglomerate. Also, hydraulic testing will be undertaken on the bore in the alluvium/weathered conglomerate to allow refinement of the groundwater model in this regard.

Flora and Fauna

(a) All efforts will be made by Whitehaven to avoid disturbance of the vegetation communities within the Project Site and to maintain and enhance as much of the existing remnant vegetation on-site, in addition to the proposed biodiversity offset areas (see **Section 5.8**), as possible.

(b) A high level of hygiene will be adopted in respect to vehicle and machinery to help prevent soil-borne disease transmission and weed seed dispersal.

(c) Strict erosion and sediment control measures will be installed, monitored and maintained to prevent the erosion and sedimentation impact on adjacent areas.

(d) Dust control measures will be implemented to protect adjacent retained vegetation communities.

(e) The minimal practicable amount of clearing will be undertaken as a general objective, particularly within those areas that currently contain identified threatened species or ecological communities.

(f) Where possible disturbance areas will be marked to protect adjoining vegetation prior to disturbance activities in order to reduce potential damage from uncontrolled or accidental access.

(g) Stockpiling of materials will occur within already disturbed areas.

(h) Weed management, monitoring and control practices will be implemented to minimise the spread of exotic species into natural areas within the site.

(i) A tree felling protocol will be developed, by a suitably qualified and licensed ecologist with previous experience supervising the felling of trees, in order to minimise harm to fauna species during clearing activities.

(j) Where possible, tree felling will be supervised by the ecologist that developed the tree felling protocol or by another suitably qualified and licensed ecologist.

(k) Where trees are to be removed an assessment of the surrounding level of tree hollow provision will be undertaken by a suitably qualified ecologist in order to determine the need for local supplementing of tree hollows (using salvaged tree hollows or nest boxes).

(l) Mature and hollow-bearing trees will be retained wherever feasible within the site.

(m) Vegetation to be removed will be clearly marked in the field using temporary fencing (flagging tape or similar) so that the boundaries are clearly established and to minimise the potential for equipment to accidently enter areas to be retained.

(n) Where possible, the timing of clearing activities will be undertaken at such times to avoid removal of hollow-bearing trees during breeding season of threatened species.

(o) Regular monitoring of the vegetation within the Project Site and offset areas will be undertaken in order to enable effective management with regards to rehabilitation (planting), regeneration, watering, fencing and weed control.

Aboriginal Heritage

(a) As per the commitments listed in **Section 8.3**, the existing ACHMP (Whitehaven 2008c) will be reviewed and, as necessary, updated to integrate relevant aspects of the Project.

(b) All efforts will be made by Whitehaven to minimise disturbance within the Project Site.

(c) Liaisons will continue to be undertaken with the registered Aboriginal stakeholders and other interested parties until all issues in relation to the management of Aboriginal cultural heritage have been resolved.

(d) If impact to the Aboriginal sites identified with the Project Site (RPS Rocglen IF1, RPS Rocglen AS1 and RPS Rocglen AS2) is unavoidable, a surface salvage will be undertaken in accordance with Section 3 of the ACHMP (Whitehaven 2008c). Artefacts salvaged will be transferred to relevant Aboriginal groups under a Care and Control Permit under Section 85A of the NP&W Act.

(e) Protective measures designed to prevent damage to the scarred trees (NPWS # 20-4-0194 and NPWS #20-4-0195) will be enacted upon as per recommendations in Appleton (2007) and the ACHMP (Whitehaven 2008c).

(f) In areas where surface excavation might occur in the future within 25 metres of the east-west oriented drainage line, Whitehaven will follow protocols in Section 4.1(iii) of the ACHMP (Whitehaven 2008c).

(g) In general during the course of the Project, if it is suspected Aboriginal cultural heritage material has been encountered, work will cease immediately in that locale. The OEH, along with the RCLALC, BBGTP, GGAC and MMAC, will be notified. Works will only recommence when an appropriate and approved management strategy has been agreed to by all of the relevant stakeholders.

(h) In the event that skeletal remains are uncovered during operations, work will stop in the vicinity immediately and the NSW Coroner's Office and NSW Police contacted. If skeletal remains are deemed to be of Aboriginal origin, a representative of the local Aboriginal Community and the OEH will be consulted.

European Heritage

(a) If significant European cultural heritage material is uncovered during site works, work will cease in that area immediately. An archaeologist will be contacted to assess the significance of the remains and works will only recommence when an appropriate and approved management strategy is instigated.

Visual Amenity

(a) All efforts will be made by Whitehaven to minimise the visual impact of the mine during and post-operation.

(b) As per the commitments listed above in **Section 8.6**, Whitehaven will adopt a progressive approach to the rehabilitation of disturbed areas within the Project Site to ensure that, where practicable, completed mining and overburden emplacement areas are quickly shaped, topdressed and vegetated. Early reshaping and revegetation of the external batter slopes of the emplacement areas will be targeted as a priority.

(c) In addition to retaining areas of existing remnant vegetation, it is proposed to restore approximately 206 hectares (58 percent) of the disturbed area within the Project Site as rehabilitated bushland. This large area, which includes the western slopes of the Northern and Western Emplacement Areas, will blend in well with the retained remnant vegetation areas within the Project Site and within the adjacent Vickery State Forest and "Yarrawonga" property.

(d) Strategically placed bushland tree lots will be integrated into the post-mining landform to break-up the landform and provide visual texture. This will be complimented by the establishment of pasture grass areas that will provide short-term visual impact mitigation prior to the trees becoming established.

(e) An earthen bund of appropriate height will be established between the realigned Wean Road and the active pit area. This bund will be vegetated immediately following construction. The bund will provide an effective visual screen of the site from Wean Road. In addition to the bund, a strip of bushland will be established to screen the view of the final void and generally improve the visual amenity from Wean Road.

(f) The requirements of the Australian Standard *AS 4282 1997 – Control of Obtrusive Effects of Outdoor Lighting* will be taken into consideration when placing lights required when working outside of daylight hours. In particular, lighting plant will be positioned and directed away from surrounding residences and aimed downwards to avoid light spill onto adjoining lands and public roads.

Greenhouse Gas Emissions

(a) The *Greenhouse and Energy Efficiency Plan* prepared by Denis Cooke & Associates in June 2009 in accordance with PA 06_0198 will continue to be implemented at Rocglen in order to promote continuous change and sustainable improvement in energy management and efficiency.

Traffic and Transport

(a) Coal transportation will be undertaken via the approval haulage route between Rocglen and the Whitehaven CHPP.

(b) Coal transport will be undertaken between the approved times of 7am and 9:15pm Monday to Friday, and between 7am and 5:15pm on Saturdays.

(c) On school days, Whitehaven will maintain the communication system between the truck drivers and the local school bus driver. The system has been negotiated between Whitehaven and the local bus drivers and involves two-way radio communication to ensure that trucks do not exceed 40 km per hour when travelling in the vicinity of the school bus.

(d) All trucks transporting coal from the mine and backloading reject from the Whitehaven CHPP will be covered with fitted roll-over tarpaulins.

(e) All trucks transporting coal will be well maintained to ensure optimal operation.

(f) Drivers will be instructed to operate in accordance with a Transport Policy and Code of Conduct, which identify aspects such as travelling speeds, general behaviour, avoidance of exhaust brakes, load coverage, complaints and disciplinary procedures. The Policy and Code apply to all employee and contractor-owned vehicles.

(g) The on-going use of the road network will be covered under the arrangements of the existing road maintenance agreement with Gunnedah Shire Council to ensure the subject roads continue to be adequately maintained.

Waste Management

(a) All production wastes and non-production wastes will be managed in accordance with current approved waste management strategies (see **Section 4.12**).

(b) Whitehaven will approach waste generation and management according to the following principles – (a) waste avoidance; (b) waste re-use; (c) waste recycling; and (d) waste removal and disposal.

Bushfire Hazard

(a) Vegetation will be cleared away from around blast sites for a distance of greater than 20 metres.

(b) All coal will be removed from open cut around blast sites.

(c) Blast design and implementation will be undertaken by a suitably qualified blasting engineer and/or experienced and appropriately certified shot-firer.

(d) An inspection of blast sites will be undertaken prior to blast.

(e) Water truck/cart will be available to douse any fire ignited or smouldering vegetation.

(f) Refuelling will be undertaken within designated fuel bays or within cleared area of the Project Site and vehicles will be turned off while refuelling.

(g) No smoking policy will be enforced in designated areas of the Project Site.

(h) Fire extinguishers will be maintained within site vehicles.

(i) Coal stockpiles will be are regularly inspected and, as required, watered.

(j) The height and volume of coal stockpiles will be controlled to limit the duration coal is retained in stockpiles.

(k) Whitehaven will regularly liaise with the NSW Forests and NSW Rural Fire Service in relation to the bushfire hazard presented by the Vickery State Forest and to a lesser extent the nearby CCC Zone 2 Kelvin.

Socio-Economic

(a) Whitehaven will continue to engage the community in consultation for the purposes of providing information relating to the Project and company operations in general. It is anticipated that consultation will include:

- Circulation of information and newsletters, as required, relating to mining activities (for example, blasting schedule); and
- Continuation of the Rocglen CCC established under PA 06_0198 for the existing Rocglen operation.

(b) Whitehaven will respond to any community complaints within 24 hours of receipt. All complaints will be investigated and the results of the investigation reported to the complainant in a timely manner.

Environment Protection Licence

Licence - 12870

Licence Details	
Number:	12870
Anniversary Date:	31-July

Licensee

WHITEHAVEN COAL MINING LIMITED

PO BOX 600

GUNNEDAH NSW 2380

Premises

ROCGLEN COAL MINE

WEAN ROAD

GUNNEDAH NSW 2380

Scheduled Activity

Coal Works

Mining for Coal

Fee Based Activity	Scale
Coal works	0-2000000 T handled
Mining for coal	> 500000-2000000 T produced

Region

North - Armidale

Ground Floor, NSW Govt Offices, 85 Faulkner Street
ARMIDALE NSW 2350

Phone: (02) 6773 7000

Fax: (02) 6772 2336

PO Box 494 ARMIDALE

NSW 2350

Environment Protection Licence

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Information about this licence

Dictionary

A definition of terms used in the licence can be found in the dictionary at the end of this licence.

Responsibilities of licensee

Separate to the requirements of this licence, general obligations of licensees are set out in the Protection of the Environment Operations Act 1997 ("the Act") and the Regulations made under the Act. These include obligations to:

- ensure persons associated with you comply with this licence, as set out in section 64 of the Act;
- control the pollution of waters and the pollution of air (see for example sections 120 - 132 of the Act);
- report incidents causing or threatening material environmental harm to the environment, as set out in Part 5.7 of the Act.

Variation of licence conditions

The licence holder can apply to vary the conditions of this licence. An application form for this purpose is available from the EPA.

The EPA may also vary the conditions of the licence at any time by written notice without an application being made.

Where a licence has been granted in relation to development which was assessed under the Environmental Planning and Assessment Act 1979 in accordance with the procedures applying to integrated development, the EPA may not impose conditions which are inconsistent with the development consent conditions until the licence is first reviewed under Part 3.6 of the Act.

Duration of licence

This licence will remain in force until the licence is surrendered by the licence holder or until it is suspended or revoked by the EPA or the Minister. A licence may only be surrendered with the written approval of the EPA.

Licence review

The Act requires that the EPA review your licence at least every 5 years after the issue of the licence, as set out in Part 3.6 and Schedule 5 of the Act. You will receive advance notice of the licence review.

Fees and annual return to be sent to the EPA

For each licence fee period you must pay:

- an administrative fee; and
- a load-based fee (if applicable).

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The EPA publication “A Guide to Licensing” contains information about how to calculate your licence fees. The licence requires that an Annual Return, comprising a Statement of Compliance and a summary of any monitoring required by the licence (including the recording of complaints), be submitted to the EPA. The Annual Return must be submitted within 60 days after the end of each reporting period. See condition R1 regarding the Annual Return reporting requirements.

Usually the licence fee period is the same as the reporting period.

Transfer of licence

The licence holder can apply to transfer the licence to another person. An application form for this purpose is available from the EPA.

Public register and access to monitoring data

Part 9.5 of the Act requires the EPA to keep a public register of details and decisions of the EPA in relation to, for example:

- licence applications;
- licence conditions and variations;
- statements of compliance;
- load based licensing information; and
- load reduction agreements.

Under s320 of the Act application can be made to the EPA for access to monitoring data which has been submitted to the EPA by licensees.

This licence is issued to:

WHITEHAVEN COAL MINING LIMITED
PO BOX 600
GUNNEDAH NSW 2380

subject to the conditions which follow.

Environment Protection Licence

Licence - 12870

1 Administrative Conditions

A1 What the licence authorises and regulates

A1.1 This licence authorises the carrying out of the scheduled activities listed below at the premises specified in A2. The activities are listed according to their scheduled activity classification, fee-based activity classification and the scale of the operation.

Unless otherwise further restricted by a condition of this licence, the scale at which the activity is carried out must not exceed the maximum scale specified in this condition.

Scheduled Activity	Fee Based Activity	Scale
Coal Works	Coal works	0 - 2000000 T handled
Mining for Coal	Mining for coal	> 500000 - 2000000 T produced

A2 Premises or plant to which this licence applies

A2.1 The licence applies to the following premises:

Premises Details
ROCGLEN COAL MINE
WEAN ROAD
GUNNEDAH
NSW 2380
THE LAND APPROVED UNDER PROJECT APPROVAL 10_0015- INDICATED IN APPENDIX 1- SCHEDULE OF LAND OF PROJECT APPROVAL 10_0015, DATED 27 SEPTEMBER 2011 (DOC13/87411).

A3 Information supplied to the EPA

A3.1 Works and activities must be carried out in accordance with the proposal contained in the licence application, except as expressly provided by a condition of this licence.

In this condition the reference to "the licence application" includes a reference to:
a) the applications for any licences (including former pollution control approvals) which this licence replaces under the Protection of the Environment Operations (Savings and Transitional) Regulation 1998; and
b) the licence information form provided by the licensee to the EPA to assist the EPA in connection with the issuing of this licence.

Environment Protection Licence

Licence - 12870

2 Discharges to Air and Water and Applications to Land

P1 Location of monitoring/discharge points and areas

P1.1 The following points referred to in the table below are identified in this licence for the purposes of monitoring and/or the setting of limits for the emission of pollutants to the air from the point.

Air

EPA identification no.	Type of Monitoring Point	Type of Discharge Point	Location Description
4	Ambient Air Monitoring		Location labelled BD4 (Surrey) identified on Figure 3 Proposed Air Quality Monitoring Network provided with licence variation application and letter from Whitehaven Coal Mining Pty. Ltd. dated 27 February 2009.
6	Ambient Air Monitoring		Location labelled BD6 (Roseberry) identified on Figure 3 Proposed Air Quality Monitoring Network provided with licence variation application and letter from Whitehaven Coal Mining Pty. Ltd. dated 27 February 2009.
7	Ambient Air Monitoring		Location labelled BD7 (Roseglass) identified on Figure 3 Proposed Air Quality Monitoring Network provided with licence variation application and letter from Whitehaven Coal Mining Pty. Ltd. dated 27 February 2009.
10	Ambient Air Monitoring		PM10 location labelled "Roseberry" identified on Figure 3 Proposed Air Quality Monitoring Network provided with licence variation application and letter from Whitehaven Coal Mining Pty. Ltd. dated 27 February 2009.
17	Ambient Air Monitoring		Real time air quality monitor located on "Roseberry" as referred to in map titled "Figure 2: Air Quality Monitoring Locations" received by the EPA on 15 June 2012 (DOC12/25238).

P1.2 The following utilisation areas referred to in the table below are identified in this licence for the purposes of the monitoring and/or the setting of limits for any application of solids or liquids to the utilisation area.

P1.3 The following points referred to in the table are identified in this licence for the purposes of the monitoring and/or the setting of limits for discharges of pollutants to water from the point.

Water and land

EPA Identification no.	Type of Monitoring Point	Type of Discharge Point	Location Description

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11	Wet weather discharge Discharge water quality monitoring	Wet weather discharge Discharge water quality monitoring	Discharge location marked as LDP11 in "Figure 5: Rocglen Coal Mine Water Management Plan. Surface and Groundwater Monitoring Locations" received by the EPA on 15 June 2012 (DOC12/25238).
12	Wet weather discharge Discharge water quality monitoring	Wet weather discharge Discharge water quality monitoring	Discharge location marked as LDP12 in "Figure 5: Rocglen Coal Mine Water Management Plan. Surface and Groundwater Monitoring Locations" received by the EPA on 15 June 2012 (DOC12/25238).
13	Ambient water quality monitoring		Monitoring location on northern side of mining lease marked as Driggle Draggle Creek Monitoring Location in "Figure 5: Rocglen Coal Mine Water Management Plan. Surface and Groundwater Monitoring Locations" received by EPA on 15 June 2012 (DOC12/25238).
14	Ambient water quality monitoring		Monitoring location on southern side of mining lease marked as Unnamed Drainage Channel Monitoring Point in "Figure 5: Rocglen Coal Mine Water Management Plan. Surface and Groundwater Monitoring Locations" received by EPA on 15 June 2012 (DOC12/25238).
15	Ambient water quality monitoring		Monitoring location on easthern side of mining lease marked as SD7 in "Figure 5: Rocglen Coal Mine Water Management Plan. Surface and Groundwater Monitoring Locations" received by EPA on 15 June 2012 (DOC12/25238).
16	Surface water quality monitoring		Monitoring location marked as Existing Mine Water Dam in "Figure 5: Rocglen Coal Mine Water Management Plan. Surface and Groundwater Monitoring Locations" received by EPA on 15 June 2012 (DOC12/25238).

P1.4 The following point(s) in the table are identified in this licence for the purpose of the monitoring of weather parameters at the point.

EPA Identification No.	Type of Monitoring Point	Description of Location

W1	Weather Analysis	Weather station located on "Costa Vale" identified as Met Station in "Figure 2: Air Quality Monitoring Locations" received by the EPA on 15 June 2012 (DOC12/25238).

3 Limit Conditions

L1 Pollution of waters

L1.1 Except as may be expressly provided in any other condition of this licence, the licensee must comply with section 120 of the Protection of the Environment Operations Act 1997.

L2 Concentration limits

L2.1 For each monitoring/discharge point or utilisation area specified in the table\s below (by a point number), the concentration of a pollutant discharged at that point, or applied to that area, must not exceed the concentration limits specified for that pollutant in the table.

L2.2 Where a pH quality limit is specified in the table, the specified percentage of samples must be within the specified ranges.

L2.3 To avoid any doubt, this condition does not authorise the pollution of waters by any pollutant other than those specified in the table\s.

L2.4 Water and/or Land Concentration Limits

POINT 11,12

Pollutant	Units of Measure	50 percentile concentration limit	90 percentile concentration limit	3DGM concentration limit	100 percentile concentration limit
Oil and Grease	milligrams per litre				10
pH	pH				6.5-8.5
Total suspended solids	milligrams per litre				50

L2.5 The Total Suspended Solids concentration limits specified for Points 11 and 12 may be exceeded for water discharged provided that:

(a) the discharge occurs solely as a result of rainfall measured at the premises that exceeds 38.4 millimetres over any consecutive 5 day period immediately prior to the discharge occurring; and

(b) all practical measures have been implemented to dewater all sediment dams within 5 days of rainfall such that they have sufficient capacity to store run off from a 38.4 millimetre, 5 day rainfall event.

Note: 38.4 mm equates to the 5 day 90%ile rainfall depth for Gunnedah sourced from Table 6.3a Managing Urban Stormwater: Soils and Construction Volume 1: 4th edition, March 2004.

L3 Waste

L3.1 Reject material from the Whitehaven CHPP can be disposed of at the premises in accordance with the Project Approval 10_0015.

L4 Noise limits

L4.1 Noise generated at the premises must not exceed the noise limits in the table below.

Locality and Location	Day- LAeq (15 minute)	Evening- LAeq (15 minute)	Night- LAeq (15 minute)	Night- LA1 (1 minute)
All surrounding residences	35	35	35	45

L4.2 The noise limits identified in the above table do not apply at privately owned residences that are:
a) identified as residences subject to acquisition or noise mitigation on request within the Project Approval; or
b) subject to a private agreement, relating to the noise levels, between the licensee and the land owner.

L4.3 For the purpose of the table above:

a) Day is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays;
b) Evening is defined as the period from 6pm to 10pm;
c) Night is defined as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sundays and Public Holidays.

L4.4 **Determining Compliance**

To determine compliance:
a) with the Leq(15 minute) noise limits in the Noise Limits table, the noise measurement equipment must be located:
i) approximately on the property boundary, where any dwelling is situated 30 metres or less from the property boundary closest to the premises; or
ii) within 30 metres of a dwelling façade, but not closer than 3m, where any dwelling on the property is situated more than 30 metres from the property boundary closest to the premises; or, where applicable
iii) within approximately 50 metres of the boundary of a National Park or a Nature Reserve.
b) with the LA1(1 minute) noise limits in the Noise Limits table, the noise measurement equipment must be located within 1 metre of a dwelling façade.
c) with the noise limits in the Noise Limits table, the noise measurement equipment must be located:

i) at the most affected point at a location where there is no dwelling at the location; or
ii) at the most affected point within an area at a location prescribed by part (a) or part (b) of this condition.

L4.5 The noise limits set out in the Noise Limits table apply under all meteorological conditions except for the following:
a) Wind speeds greater than 3 metres/second at 10 metres above ground level; or
b) Stability category F temperature inversion conditions and wind speeds greater than 2 metres/second at 10 metres above ground level; or
c) Stability category G temperature inversion conditions.

For the purposes of this condition:
a) Data recorded by the meteorological station identified as EPA Identification Point(s) W1 must be used to determine meteorological conditions; and
b) Temperature inversion conditions (stability category) are to be determined by the sigma-theta method referred to in Part E4 of Appendix E to the NSW Industrial Noise Policy.

L4.6 For the purposes of determining the noise generated at the premises the modification factors in Section 4 of the NSW Industrial Noise Policy must be applied, as appropriate, to the noise levels measured by the noise monitoring equipment.

L4.7 The noise limits set by this licence do not apply where a current legally binding agreement exists between the licensee and the occupant of a residential property that:

a) agrees to an alternative noise limit for that property; or
b)provides an alternative means of compensation to address noise impacts from the premises.

A copy of any agreement must be provided to the EPA before the licensee can take advantage of the agreement.

L5 Blasting

L5.1 The airblast overpressure level from blasting operations at the premises must not exceed 115dB (Lin Peak) at any noise sensitive locations for more than five per cent of the total number of blasts over each reporting period. Error margins associated with any monitoring equipment used to measure this are not to be taken into account in determining whether or not the limit has been exceeded.

L5.2 The airblast overpressure level from blasting operations at the premises must not exceed 120dB (Lin Peak) at any time at any noise sensitive locations. Error margins associated with any monitoring equipment used to measure this are not to be taken into account in determining whether or not the limit has been exceeded.

L5.3 Ground vibration peak particle velocity from the blasting operations at the premises must not exceed 5mm/sec at any noise sensitive locations for more than five per cent of the total number of blasts over each reporting period. Error margins associated with any monitoring equipment used to measure this are not to be taken into account in determining whether or not the limit has been exceeded.

L5.4 Ground vibration peak particle velocity from the blasting operations at the premises must not exceed 10mm/sec at any time at any noise sensitive locations. Error margins associated with any monitoring equipment used to measure this are not to be taken into account in determining whether or not the limit

has been exceeded.

4 Operating Conditions

O1 Activities must be carried out in a competent manner

O1.1 Licensed activities must be carried out in a competent manner.
This includes:
a) the processing, handling, movement and storage of materials and substances used to carry out the activity; and
b) the treatment, storage, processing, reprocessing, transport and disposal of waste generated by the activity.

O2 Maintenance of plant and equipment

O2.1 All plant and equipment installed at the premises or used in connection with the licensed activity:
a) must be maintained in a proper and efficient condition; and
b) must be operated in a proper and efficient manner.

O3 Dust

O3.1 All operations and activities occurring at the premises must be carried out in a manner that will minimise the emission of dust from the premises.

O3.2 Trucks transporting coal from the premises must be covered immediately after loading to prevent wind blown emissions and spillage. The covering must be maintained until immediately before unloading the trucks.

O4 Other operating conditions

Blast Fume

O4.1 Offensive blast fume must not be emitted from the premises.

Definition: *Offensive blast fume* means post-blast gases (whether visible or invisible, odorous or odourless) from the detonation of explosives at the premises that by reason of their nature, duration, character or quality, or the time at which they are emitted, or any other circumstances:
(i) are harmful to (or is likely to be harmful to) a person that is outside the premises from which it is emitted, or
(ii) interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted.

Pollution Incident Response Management Plan

O4.2 The licensee must maintain, and implement as necessary, a current Pollution Incident Response Management Plan (PIRMP) for the premises. The PIRMP must document systems and procedures to deal with all types of incidents (e.g. spills, explosions, fire) that may occur at the premises or that may be associated with activities that occur at the premises and which are likely to cause harm to the environment.

O4.3 The licensee must keep the PIRMP on the premises at all times.

5 Monitoring and Recording Conditions

M1 Monitoring records

M1.1 The results of any monitoring required to be conducted by this licence or a load calculation protocol must be recorded and retained as set out in this condition.

M1.2 All records required to be kept by this licence must be:
a) in a legible form, or in a form that can readily be reduced to a legible form;
b) kept for at least 4 years after the monitoring or event to which they relate took place; and
c) produced in a legible form to any authorised officer of the EPA who asks to see them.

M1.3 The following records must be kept in respect of any samples required to be collected for the purposes of this licence:
a) the date(s) on which the sample was taken;
b) the time(s) at which the sample was collected;
c) the point at which the sample was taken; and
d) the name of the person who collected the sample.

M2 Requirement to monitor concentration of pollutants discharged

M2.1 For each monitoring/discharge point or utilisation area specified below (by a point number), the licensee must monitor (by sampling and obtaining results by analysis) the concentration of each pollutant specified in Column 1. The licensee must use the sampling method, units of measure, and sample at the frequency, specified opposite in the other columns:

M2.2 Air Monitoring Requirements

POINT 4,6,7

Pollutant	Units of measure	Frequency	Sampling Method
Particulates - Deposited Matter	grams per square metre per month	Continuous	AM-19

POINT 10

Pollutant	Units of measure	Frequency	Sampling Method

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PM10	micrograms per cubic metre	Every 6 days	AM-18

POINT 17

Pollutant	Units of measure	Frequency	Sampling Method
PM10	micrograms per cubic metre	Continuous	AM-22

M2.3 Water and/ or Land Monitoring Requirements

POINT 11,12

Pollutant	Units of measure	Frequency	Sampling Method
Conductivity	microsiemens per centimetre	Special Frequency 1	In situ
Oil and Grease	milligrams per litre	Special Frequency 1	Grab sample
pH	pH	Special Frequency 1	In situ
Total organic carbon	milligrams per litre	Special Frequency 1	Grab sample
Total suspended solids	milligrams per litre	Special Frequency 1	Grab sample

POINT 13,14,15

Pollutant	Units of measure	Frequency	Sampling Method
Conductivity	microsiemens per centimetre	Special Frequency 2	In situ
Oil and Grease	milligrams per litre	Special Frequency 2	Grab sample
pH	pH	Special Frequency 2	In situ
Total organic carbon	milligrams per litre	Special Frequency 2	Grab sample
Total suspended solids	milligrams per litre	Special Frequency 2	Grab sample

POINT 16

Pollutant	Units of measure	Frequency	Sampling Method
Aluminium	milligrams per litre	Yearly	Grab sample
Arsenic	milligrams per litre	Yearly	Grab sample
Bicarbonate	milligrams per litre	Yearly	Grab sample
Chloride	milligrams per litre	Yearly	Grab sample
Conductivity	microsiemens per centimetre	Quarterly	In situ
Iron	milligrams per litre	Yearly	Grab sample
Manganese	milligrams per litre	Yearly	Grab sample
Oil and Grease	milligrams per litre	Quarterly	Grab sample
pH	pH	Quarterly	In situ

Sodium	milligrams per litre	Yearly	Grab sample
Total organic carbon	milligrams per litre	Quarterly	Grab sample
Total suspended solids	milligrams per litre	Quarterly	Grab sample

M2.4 For the purposes of the table(s) above Special Frequency 1 means the collection of samples as soon as practicable after each discharge commences and in any case not more than 12 hours after each discharge commences.

M2.5 For the purposes of the table(s) above Special Frequency 2 means the collection of samples quarterly (in the event of a flow during the quarter) at a time when there is flow and as soon as practicable after each wet weather discharge from points 11 and 12 commences and in any case not more than 12 hours after each discharge commences.

Note: Groundwater monitoring points have not been formally included in the licence. However, the licensee is required to undertake groundwater monitoring in accordance with a Department of Planning approved Water Management Plan required under Schedule 3, condition 2 Project Approval 06-0198 dated 15 April 2008. The licensee has submitted the document “Site Water Management Plan for the Rocglen Coal Mine, Whitehaven Coal Mining Pty Ltd, 2008.” This document has been approved by Planning following consultation by the licensee with the EPA. The results of this monitoring are required to be reported in the Annual Environmental Management Report (AEMR).

M3 Testing methods - concentration limits

M3.1 Monitoring for the concentration of a pollutant emitted to the air required to be conducted by this licence must be done in accordance with:
a) any methodology which is required by or under the Act to be used for the testing of the concentration of the pollutant; or
b) if no such requirement is imposed by or under the Act, any methodology which a condition of this licence requires to be used for that testing; or
c) if no such requirement is imposed by or under the Act or by a condition of this licence, any methodology approved in writing by the EPA for the purposes of that testing prior to the testing taking place.

Note: The *Protection of the Environment Operations (Clean Air) Regulation 2010* requires testing for certain purposes to be conducted in accordance with test methods contained in the publication "Approved Methods for the Sampling and Analysis of Air Pollutants in NSW".

M3.2 Subject to any express provision to the contrary in this licence, monitoring for the concentration of a pollutant discharged to waters or applied to a utilisation area must be done in accordance with the Approved Methods Publication unless another method has been approved by the EPA in writing before any tests are conducted.

M4 Weather monitoring

M4.1 For each monitoring point specified in the table below, the licensee must monitor (by sampling and obtaining results by analysis) the parameters specified in Column 1. The licensee must use the sampling

method, units of measure, averaging period and sample at the frequency, specified opposite in the other columns.

POINT W1

Parameter	Units of Measure	Frequency	Averaging Period	Sampling Method
Rainfall	mm/h	Continuous	1 hour	AM-4
Wind speed @10 metres	m/s	Continuous	15 minute	AM-2 & AM-4
Wind direction @10 metres	°	Continuous	15 minute	AM-2 & AM-4
Temperature @2 metres	°C	Continuous	15 minute	AM-4
Temperature @10 metres	°C	Continuous	15 minute	AM-4
Sigma theta @10 metres	°	Continuous	15 minute	AM-2 & AM-4
Solar radiation	W/m2	Continuous	15 minute	AM-4
Additional Requirements: - Siting	-	-	-	AM-1 & AM-4
Additional Requirements: - Measurement	-	-	-	AM-2 & AM-4

M4.2 The meteorological weather station must be maintained so as to be capable of continuously monitoring the parameters specified in this section.

M5 Recording of pollution complaints

M5.1 The licensee must keep a legible record of all complaints made to the licensee or any employee or agent of the licensee in relation to pollution arising from any activity to which this licence applies.

M5.2 The record must include details of the following:
a) the date and time of the complaint;
b) the method by which the complaint was made;
c) any personal details of the complainant which were provided by the complainant or, if no such details were provided, a note to that effect;
d) the nature of the complaint;
e) the action taken by the licensee in relation to the complaint, including any follow-up contact with the complainant; and
f) if no action was taken by the licensee, the reasons why no action was taken.

M5.3 The record of a complaint must be kept for at least 4 years after the complaint was made.

M5.4 The record must be produced to any authorised officer of the EPA who asks to see them.

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M6 Telephone complaints line

M6.1 The licensee must operate during its operating hours a telephone complaints line for the purpose of receiving any complaints from members of the public in relation to activities conducted at the premises or by the vehicle or mobile plant, unless otherwise specified in the licence.

M6.2 The licensee must notify the public of the complaints line telephone number and the fact that it is a complaints line so that the impacted community knows how to make a complaint.

M6.3 The preceding two conditions do not apply until 3 months after: the date of the issue of this licence.

M7 Blasting

M7.1 To determine compliance with condition(s) L4.1, L4.2, L4.3 and L4.4:

a) Airblast overpressure and ground vibration levels experienced at the following noise sensitive locations must be measured and recorded for all blasts carried out in or on the premises and electronically recorded at points BB1 and BB3.

b) Instrumentation used to measure the airblast overpressure and ground vibration levels must meet the requirements of Australian Standard AS 2187.2-2006.

Note: A breach of the licence will still occur where airblast overpressure or ground vibration levels from the blasting operations at the premises exceeds the limit specified in the conditions of this licence at any “noise sensitive locations” other than the locations identified in the above condition.

M7.2 For the purpose of condition M7.1, the blasting monitoring locations are described as:

EPA Identification No.	Description of Location
BB1	Property 'Retreat' residence
BB3	Property 'Roseberry' residence

M7.3 For the purpose of condition M8.1, the noise monitoring locations are described as:

EPA Identification No.	Description of Location
N1	Property 'Retreat' residence
N2	Property 'Surrey' residence
N3	Portable monitor

M7.4 Note: N3 is a portable monitor enabling the monitor to be relocated to areas of potential greatest impact. The licensee is responsible to ensure that it is located at the most suitable location.

M7.5 The location, frequency of monitoring and the parameters to be monitored may be varied by the EPA

once the variability of the noise impact is established.

M8 Other monitoring and recording conditions

M8.1 NOISE MONITORING

For each monitoring point specified below, the Licensee must monitor the noise or vibration parameter specified in Column 1. The Licensee must use the sampling method, units of measure, and sample at the frequency, specified opposite in the other columns.

POINTS: N1, N2

Parameter	Units of Measure	Frequency	Sampling Method
Ambient Noise	LAeq (15 minute) LAmax LA1 (1 minute) LA10 LA90 LAmin	Frequency of monitoring as detailed in the document "Noise Monitoring Program for the Rocglen Mine, Whitehaven Coal Mining Pty. Ltd., 24/4/2008"	Type 1 Noise Meter – unattended and attended monitoring as detailed in the document "Noise Monitoring Program for the Rocglen Mine, Whitehaven Coal Mining Pty. Ltd., 24/4/2008"

M8.2 To assess compliance with the noise limits presented in the Noise Limits table, attended noise monitoring must be undertaken in accordance with the condition titled Determining Compliance, outlined above, and:
a) at each one of the locations listed in the Noise Limits table;
b) occur quarterly in a reporting period;
c) occur during each day, evening and night period as defined in the NSW Industrial Noise Policy for a minimum of:
i) 1.5 hours during the day;
ii) 30 minutes during the evening; and
iii) 1 hour during the night.
d) occur for three consecutive operating days.

6 Reporting Conditions

R1 Annual return documents

R1.1 The licensee must complete and supply to the EPA an Annual Return in the approved form comprising:
a) a Statement of Compliance; and
b) a Monitoring and Complaints Summary.
At the end of each reporting period, the EPA will provide to the licensee a copy of the form that must be completed and returned to the EPA.

R1.2 An Annual Return must be prepared in respect of each reporting period, except as provided below.

Note: The term "reporting period" is defined in the dictionary at the end of this licence. Do not complete the Annual Return until after the end of the reporting period.

R1.3 Where this licence is transferred from the licensee to a new licensee:
a) the transferring licensee must prepare an Annual Return for the period commencing on the first day of the reporting period and ending on the date the application for the transfer of the licence to the new licensee is granted; and
b) the new licensee must prepare an Annual Return for the period commencing on the date the application for the transfer of the licence is granted and ending on the last day of the reporting period.

Note: An application to transfer a licence must be made in the approved form for this purpose.

R1.4 Where this licence is surrendered by the licensee or revoked by the EPA or Minister, the licensee must prepare an Annual Return in respect of the period commencing on the first day of the reporting period and ending on:
a) in relation to the surrender of a licence - the date when notice in writing of approval of the surrender is given; or
b) in relation to the revocation of the licence - the date from which notice revoking the licence operates.

R1.5 The Annual Return for the reporting period must be supplied to the EPA by registered post not later than 60 days after the end of each reporting period or in the case of a transferring licence not later than 60 days after the date the transfer was granted (the 'due date').

R1.6 The licensee must retain a copy of the Annual Return supplied to the EPA for a period of at least 4 years after the Annual Return was due to be supplied to the EPA.

R1.7 Within the Annual Return, the Statement of Compliance must be certified and the Monitoring and Complaints Summary must be signed by:
a) the licence holder; or
b) by a person approved in writing by the EPA to sign on behalf of the licence holder.

R2 Notification of environmental harm

Note: The licensee or its employees must notify all relevant authorities of incidents causing or threatening material harm to the environment immediately after the person becomes aware of the incident in accordance with the requirements of Part 5.7 of the Act.

R2.1 Notifications must be made by telephoning the Environment Line service on 131 555.

R2.2 The licensee must provide written details of the notification to the EPA within 7 days of the date on which the incident occurred.

R3 Written report

R3.1 Where an authorised officer of the EPA suspects on reasonable grounds that:
a) where this licence applies to premises, an event has occurred at the premises; or
b) where this licence applies to vehicles or mobile plant, an event has occurred in connection with the carrying out of the activities authorised by this licence,
and the event has caused, is causing or is likely to cause material harm to the environment (whether the

harm occurs on or off premises to which the licence applies), the authorised officer may request a written report of the event.

R3.2 The licensee must make all reasonable inquiries in relation to the event and supply the report to the EPA within such time as may be specified in the request.

R3.3 The request may require a report which includes any or all of the following information:
a) the cause, time and duration of the event;
b) the type, volume and concentration of every pollutant discharged as a result of the event;
c) the name, address and business hours telephone number of employees or agents of the licensee, or a specified class of them, who witnessed the event;
d) the name, address and business hours telephone number of every other person (of whom the licensee is aware) who witnessed the event, unless the licensee has been unable to obtain that information after making reasonable effort;
e) action taken by the licensee in relation to the event, including any follow-up contact with any complainants;
f) details of any measure taken or proposed to be taken to prevent or mitigate against a recurrence of such an event; and
g) any other relevant matters.

R3.4 The EPA may make a written request for further details in relation to any of the above matters if it is not satisfied with the report provided by the licensee. The licensee must provide such further details to the EPA within the time specified in the request.

R4 Other reporting conditions

R4.1 The licensee must report any exceedence of the licence blasting limits to the regional office of the EPA as soon as practicable after the exceedence becomes known to the licensee or to one of the licensee's employees or agents.

R4.2 A noise compliance assessment report must be submitted to the EPA within thirty (30) days of the completion of the quarterly noise monitoring. The assessment must be prepared by a suitably qualified and experienced acoustical consultant and include:
a) an assessment of compliance with noise limits detailed in the limit conditions of this licence; and
b) an outline of any management actions taken within the monitoring period to address any exceedences of the limits detailed in the limit conditions of this licence.

7 General Conditions

G1 Copy of licence kept at the premises or plant

G1.1 A copy of this licence must be kept at the premises to which the licence applies.

G1.2 The licence must be produced to any authorised officer of the EPA who asks to see it.

G1.3 The licence must be available for inspection by any employee or agent of the licensee working at the premises.

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8 Pollution Studies and Reduction Programs

U1 Coal Mine Wind Erosion of Exposed Land Assessment

U1.1 The licensee must undertake the following steps:

1. Calculate the wind erosion exposed surface area (in hectares) within the premises as of 31 October 2015.
2. Determine the wind erosion exposed surface area (in hectares) predicted as at 31 October 2015 within the licensee's Environmental Assessment for the premises.
3. Compare the areas calculated in steps 1 and 2.
4. Submit a written report to the EPA at armidale@epa.nsw.gov.au containing the analysis required in steps 1 to 3, by 31 December 2015.

The report submitted to the EPA must be accompanied by spatial data to confirm the wind erosion exposed surface area calculations. The following data is required:

- Shapefiles showing the premises boundary.
- Shapefiles showing the wind erosion exposed area within the premises as of 31 October 2015
- Shapefiles showing areas classified as stabilised surface as of 31 October 2015
- Details of any studies undertaken to verify that the areas of stabilised surface meet the definition.

Note: *Definitions:*
Environmental Assessment means any environmental assessment document prepared in order to gain approval or consent under the Environmental Planning and Assessment Act (1979) under which the licensee currently operates at the premises. If the predictions made in this document do not correspond to the current year of mine operation, the licensee should extrapolate between predictions.

Stabilised Surface means any previously disturbed surface area which shows visual or other evidence of surface crusting and is resistant to wind-driven fugitive dust and is demonstrated to be stabilised. Stabilisation can be determined in accordance with one or more of the applicable test methods contained in the Rule 403 Implementation Handbook located at: www.capcoa.org/Docs/SCAQMD%20r403%20handbook.doc.

Wind Erosion Exposed Surface Area means the portion of the premises surface which has been physically moved, uncovered, destabilised or otherwise modified from its natural state, thereby increasing the potential for fugitive particulate matter emissions, but excluding areas which have been:

- *paved or covered by a permanent building or structure;*
- *maintained with a vegetative ground cover of at least 50% of ground cover for particular areas. Vegetative ground cover can be determined in accordance with the standardised procedure for revegetation assessment contained in Atyeo C. & Thackway R. (2009) located at: http://data.daff.gov.au/data/warehouse/pe_brs90000004196/revegetationManual200906_20100410_ap14.pdf or*
- *classified as a stabilised surface.*

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Dictionary

General Dictionary

3DGM [in relation to a concentration limit]	Means the three day geometric mean, which is calculated by multiplying the results of the analysis of three samples collected on consecutive days and then taking the cubed root of that amount. Where one or more of the samples is zero or below the detection limit for the analysis, then 1 or the detection limit respectively should be used in place of those samples
Act	Means the Protection of the Environment Operations Act 1997
activity	Means a scheduled or non-scheduled activity within the meaning of the Protection of the Environment Operations Act 1997
actual load	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009
AM	Together with a number, means an ambient air monitoring method of that number prescribed by the *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales*.
AMG	Australian Map Grid
anniversary date	The anniversary date is the anniversary each year of the date of issue of the licence. In the case of a licence continued in force by the Protection of the Environment Operations Act 1997, the date of issue of the licence is the first anniversary of the date of issue or last renewal of the licence following the commencement of the Act.
annual return	Is defined in R1.1
Approved Methods Publication	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009
assessable pollutants	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009
BOD	Means biochemical oxygen demand
CEM	Together with a number, means a continuous emission monitoring method of that number prescribed by the *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales*.
COD	Means chemical oxygen demand
composite sample	Unless otherwise specifically approved in writing by the EPA, a sample consisting of 24 individual samples collected at hourly intervals and each having an equivalent volume.
cond.	Means conductivity
environment	Has the same meaning as in the Protection of the Environment Operations Act 1997
environment protection legislation	Has the same meaning as in the Protection of the Environment Administration Act 1991
EPA	Means Environment Protection Authority of New South Wales.
fee-based activity classification	Means the numbered short descriptions in Schedule 1 of the Protection of the Environment Operations (General) Regulation 2009.
general solid waste (non-putrescible)	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997

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flow weighted composite sample	Means a sample whose composites are sized in proportion to the flow at each composites time of collection.
general solid waste (putrescible)	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environmen t Operations Act 1997
grab sample	Means a single sample taken at a point at a single time
hazardous waste	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
licensee	Means the licence holder describe d at the front of this licence
load calculation protocol	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009
local authority	Has the same meaning as in the Protection of the Environment Operations Act 1997
material harm	Has the same meaning as in section 147 Protection of the Environment Operations Act 1997
MBAS	Means methylene blue active substances
Minister	Means the Minister administering the Protection of the Environment Operations Act 1997
mobile plant	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
motor vehicle	Has the same meaning as in the Protection of the Environment Operations Act 1997
O&G	Means oil and grease
percentile [in relation to a concentration limit of a sample]	Means that percentage [eg.50%] of the number of samples taken that must meet the concentration limit specified in the licence for that pollutant over a specified period of time. In this licence, the specified period of time is the Reporting Period unless otherwise stated in this licence.
plant	Includes all plant within the meaning of the Protection of the Environment Operations Act 1997 as well as motor vehicles.
pollution of waters [or water pollution]	Has the same meaning as in the Protection of the Environment Operations Act 1997
premises	Means the premises described in condition A2.1
public authority	Has the same meaning as in the Protection of the Environment Operations Act 1997
regional office	Means the relevant EPA office referred to in the Contacting the EPA document accompanying this licence
reporting period	For the purposes of this licence, the reporting period means the period of 12 months after the issue of the licence, and each subsequent period of 12 mo nths. In the case of a licence continued in force by the Protection of the Environment Operations Act 1997, the date of issue of the licence is the first anniversary of the date of issue or last renewal of the licence following the commencement of the Act.
restricted solid waste	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
scheduled activity	Means an activity listed in Schedule 1 of the Protection of the Environment Operations Act 1997
special waste	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
TM	Together with a number, means a test method of that number prescribed by the *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales*.

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TSP	Means total suspended particles
TSS	Means total suspended solids
Type 1 substance	Means the elements antimony, arsenic, cadmium, lead or mercury or any compound containing one or more of those elements
Type 2 substance	Means the elements beryllium, chromium, cobalt, manganese, nickel, selenium, tin or vanadium or any compound containing one or more of those elements
utilisation area	Means any area shown as a utilisation area on a map submitted with the application for this licence
waste	Has the same meaning as in the Protection of the Environment Operations Act 1997
waste type	Means liquid, restricted solid waste, general solid waste (putrescible), general solid waste (non-putrescible), special waste or hazardous waste

Mr Robert O'Hern

Environment Protection Authority

(By Delegation)

Date of this edition: 31-July-2008

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End Notes

1	Licence varied by notice 1096864, issued on 19-May-2009, which came into effect on 19-May-2009.
2	Licence varied by notice 1103283, issued on 18-Aug-2009, which came into effect on 18-Aug-2009.
3	Licence varied by notice 1126963, issued on 13-Jul-2011, which came into effect on 13-Jul-2011.
4	Licence varied by notice 1503204 issued on 20-Dec-2011
5	Licence varied by notice 1503676 issued on 21-Jun-2012
6	Licence varied by notice 1509252 issued on 15-Oct-2012
7	Licence varied by notice 1510430 issued on 21-Mar-2013
8	Licence varied by notice 1516120 issued on 06-Sep-2013
9	Licence varied by notice 1518355 issued on 05-Feb-2014
10	Licence varied by notice 1522247 issued on 19-Nov-2014
11	Licence varied by notice 1529402 issued on 14-Jul-2015

GLENROC/COSTA VALE PM10 HIGH VOLUME AIR SAMPLER

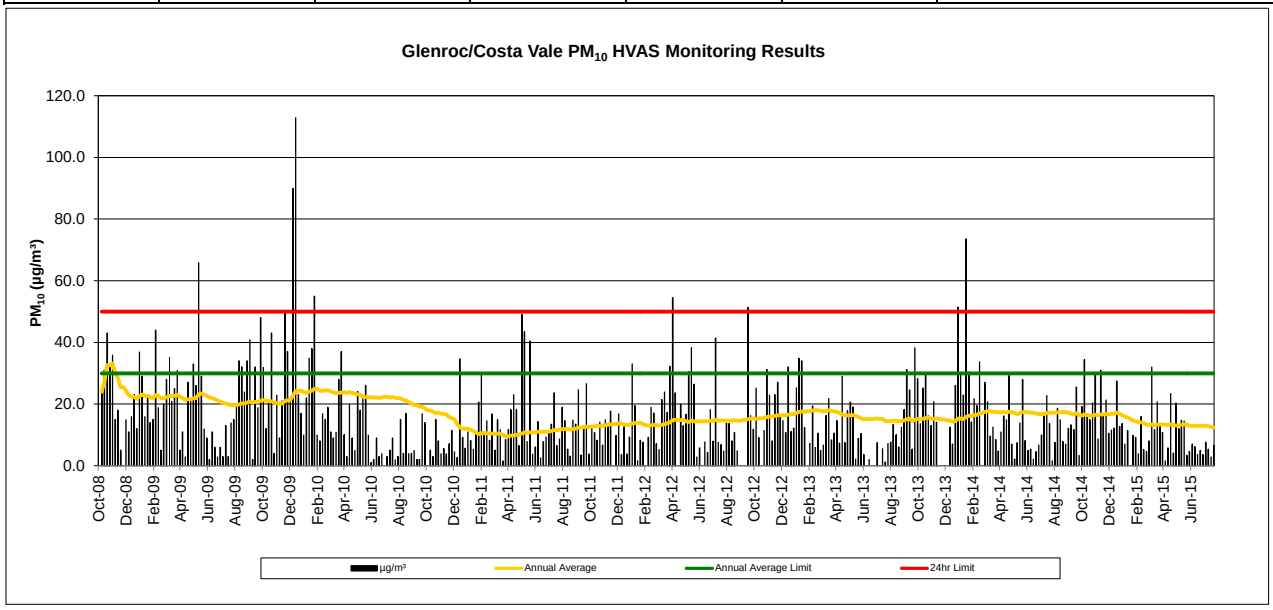
Date	mg/paper	µg/m³	Annual Average	Annual Average Limit	24hr Limit	Comments
8/10/2008	38.5	24.0	24.0	30	50	
14/10/2008	49.3	31.0	27.5	30	50	
20/10/2008	67.2	43.0	32.7	30	50	
26/10/2008	48.7	32.0	32.5	30	50	
1/11/2008	55.0	36.0	33.2	30	50	
7/11/2008	22.2	15.0	30.2	30	50	
13/11/2008	26.6	18.0	28.4	30	50	
19/11/2008	7.7	5.0	25.5	30	50	
25/11/2008			25.5	30	50	Unit malfunction
1/12/2008	23.2	15.0	24.3	30	50	
7/12/2008	16.8	11.0	23.0	30	50	
13/12/2008	24.4	16.0	22.4	30	50	
19/12/2008	26.8	23.0	22.4	30	50	
25/12/2008	22.8	12.0	21.6	30	50	
31/12/2008	56.7	37.0	22.7	30	50	
6/01/2009	44.4	29.0	23.1	30	50	
12/01/2009	25.4	16.0	22.7	30	50	
18/01/2009	36.5	23.0	22.7	30	50	
24/01/2009	20.5	14.0	22.2	30	50	
30/01/2009	23.8	15.0	21.8	30	50	
5/02/2009	66.8	44.0	23.0	30	50	
11/02/2009	30.3	19.0	22.8	30	50	
17/02/2009	7.7	5.0	22.0	30	50	
23/02/2009	30.4	20.0	21.9	30	50	
1/03/2009	43.0	28.0	22.1	30	50	
7/03/2009	54.4	35.0	22.6	30	50	
13/03/2009	33.7	21.0	22.6	30	50	
19/03/2009	39.8	25.0	22.7	30	50	
25/03/2009	48.2	31.0	23.0	30	50	
31/03/2009	8.4	5.0	22.3	30	50	
6/04/2009	18.2	11.0	22.0	30	50	
12/04/2009	5.2	3.0	21.4	30	50	
18/04/2009	43.8	27.0	21.5	30	50	
24/04/2009	35.1	22.0	21.5	30	50	
30/04/2009	52.9	33.0	21.9	30	50	
6/05/2009	41.7	26.0	22.0	30	50	
12/05/2009	105.8	66.0	23.2	30	50	
18/05/2009	45.8	29.0	23.4	30	50	
24/05/2009	18.9	12.0	23.1	30	50	
30/05/2009	14.0	9.0	22.7	30	50	
5/06/2009	3.3	2.0	22.2	30	50	
11/06/2009	18.2	11.0	21.9	30	50	
17/06/2009	10.3	6.0	21.5	30	50	
23/06/2009	6.4	3.0	21.1	30	50	
29/06/2009	4.8	6.0	20.8	30	50	
5/07/2009	4.6	3.0	20.4	30	50	
11/07/2009	21.9	13.0	20.2	30	50	
17/07/2009	4.1	3.0	19.9	30	50	
23/07/2009	22.7	14.0	19.7	30	50	
29/07/2009	24.0	15.0	19.6	30	50	
4/08/2009	31.9	20.0	19.6	30	50	
10/08/2009	54.3	34.0	19.9	30	50	
16/08/2009	51.4	32.0	20.2	30	50	
22/08/2009	38.1	24.0	20.2	30	50	
28/08/2009	55.0	34.0	20.5	30	50	
3/09/2009	66.5	41.0	20.9	30	50	
9/09/2009	2.6	2.0	20.5	30	50	
15/09/2009	50.5	32.0	20.7	30	50	
21/09/2009	29.7	19.0	20.7	30	50	
27/09/2009	76.9	48.0	21.2	30	50	
3/10/2009	50.4	32.0	21.3	30	50	
9/10/2009	19.5	12.0	21.1	30	50	
15/10/2009	32.9	21.0	21.0	30	50	
21/10/2009	67.3	43.0	21.0	30	50	
27/10/2009	6.6	4.0	20.5	30	50	
2/11/2009	36.2	23.0	20.3	30	50	
8/11/2009	14.7	9.0	20.2	30	50	
14/11/2009	32.9	21.0	20.2	30	50	
20/11/2009	75.9	50.0	21.0	30	50	
26/11/2009	55.7	37.0	21.2	30	50	
2/12/2009	33.0	21.0	21.3	30	50	
8/12/2009	133.4	90.0	22.6	30	50	
14/12/2009	174.9	113.0	24.2	30	50	
20/12/2009	36.3	23.0	24.2	30	50	
26/12/2009	25.9	17.0	24.3	30	50	
1/01/2010	16.1	10.0	23.9	30	50	
7/01/2010	33.7	22.0	23.8	30	50	
13/01/2010	52.6	35.0	24.1	30	50	
19/01/2010	58.8	38.0	24.3	30	50	
25/01/2010	84.0	55.0	25.0	30	50	
31/01/2010	15.7	10.0	24.9	30	50	
6/02/2010	12.4	8.0	24.3	30	50	
12/02/2010	25.1	17.0	24.3	30	50	
18/02/2010	23.4	15.0	24.4	30	50	
24/02/2010	12.1	19.0	24.4	30	50	
2/03/2010	17.9	11.0	24.1	30	50	
8/03/2010	13.5	9.0	23.7	30	50	
14/03/2010	16.7	11.0	23.6	30	50	

Date	mg/paper	µg/m³	Annual Average	Annual Average Limit	24hr Limit	Comments
20/03/2010	43.5	28.0	23.6	30	50	
26/03/2010	57.9	37.0	23.7	30	50	
1/04/2010	15.2	10.0	23.8	30	50	
7/04/2010	5.4	3.0	23.7	30	50	
13/04/2010	32.3	20.0	23.9	30	50	
19/04/2010	14.2	9.0	23.6	30	50	
25/04/2010	7.5	5.0	23.4	30	50	
1/05/2010	38.5	24.0	23.2	30	50	
7/05/2010	28.3	18.0	23.1	30	50	
13/05/2010	34.4	22.0	22.4	30	50	
19/05/2010	42.3	26.0	22.3	30	50	
25/05/2010	16.3	10.0	22.3	30	50	
31/05/2010	2.0	1.0	22.1	30	50	
6/06/2010	2.6	2.0	22.1	30	50	
12/06/2010	14.7	9.0	22.1	30	50	
18/06/2010	4.1	3.0	22.1	30	50	
24/06/2010	6.8	4.0	22.1	30	50	
30/06/2010			22.4	30	50	
6/07/2010	5.5	3.0	22.4	30	50	
12/07/2010	8.0	5.0	22.2	30	50	
18/07/2010	14.4	9.0	22.3	30	50	
24/07/2010	3.3	2.0	22.1	30	50	
30/07/2010	5.3	3.0	21.9	30	50	
5/08/2010	24.8	15.0	21.8	30	50	
11/08/2010	6.4	4.0	21.3	30	50	
17/08/2010	27.3	17.0	21.1	30	50	
23/08/2010	6.7	4.0	20.8	30	50	
29/08/2010	6.1	4.0	20.3	30	50	
4/09/2010	8.1	5.0	19.7	30	50	
10/09/2010	3.5	2.0	19.7	30	50	
16/09/2010	2.8	2.0	19.2	30	50	
22/09/2010	26.5	17.0	19.1	30	50	
28/09/2010	21.9	14.0	18.6	30	50	
4/10/2010	0.2	0.0	18.0	30	50	
10/10/2010	7.6	5.0	17.9	30	50	
16/10/2010	5.0	3.0	17.6	30	50	
22/10/2010	22.9	15.0	17.1	30	50	
28/10/2010	12.9	8.0	17.2	30	50	
3/11/2010	6.6	4.0	16.9	30	50	
9/11/2010	9.2	5.6	16.8	30	50	
15/11/2010	6.2	3.8	16.5	30	50	
21/11/2010	11.6	7.1	15.8	30	50	
27/11/2010	18.7	11.5	15.4	30	50	
3/12/2010	7.8	4.6	15.1	30	50	
9/12/2010	4.5	2.7	13.7	30	50	
15/12/2010	58.1	34.6	12.4	30	50	
21/12/2010	15.4	9.2	12.1	30	50	
27/12/2010	9.6	5.7	11.9	30	50	
2/01/2011	18.6	11.1	12.0	30	50	
8/01/2011	13.7	8.2	11.7	30	50	
14/01/2011	9.2	5.5	11.2	30	50	
20/01/2011	17.3	10.3	10.8	30	50	
26/01/2011	34.6	20.6	10.2	30	50	
1/02/2011	50.1	29.8	10.5	30	50	
7/02/2011	15.4	11.0	10.6	30	50	
13/02/2011	24.7	14.7	10.6	30	50	
19/02/2011	14.0	8.3	10.4	30	50	
25/02/2011	28.2	16.8	10.4	30	50	
3/03/2011	8.4	5.0	10.3	30	50	
9/03/2011	25.0	14.9	10.4	30	50	
15/03/2011	19.8	11.8	10.4	30	50	
21/03/2011	2.5	1.5	10.0	30	50	
27/03/2011	14.3	8.5	9.5	30	50	
2/04/2011	19.6	11.7	9.5	30	50	
8/04/2011	29.9	18.1	9.8	30	50	
14/04/2011	39.0	23.2	9.8	30	50	
20/04/2011	30.5	18.1	10.0	30	50	
26/04/2011	10.9	6.5	10.0	30	50	
2/05/2011	82.5	49.1	10.4	30	50	
8/05/2011	73.1	43.5	10.9	30	50	
14/05/2011	13.3	7.9	10.6	30	50	
20/05/2011	67.9	40.4	10.9	30	50	
26/05/2011	6.6	3.9	10.8	30	50	
1/06/2011	10.3	6.1	10.8	30	50	
7/06/2011	24.1	14.3	11.0	30	50	
13/06/2011	4.6	2.7	10.9	30	50	
19/06/2011	12.9	7.7	11.0	30	50	
25/06/2011	15.8	9.4	11.1	30	50	
1/07/2011	18.6	11.1	11.1	30	50	
7/07/2011	22.7	13.5	11.3	30	50	
13/07/2011	39.7	23.6	11.6	30	50	
19/07/2011	10.9	6.5	11.5	30	50	
25/07/2011	14.7	8.8	11.7	30	50	
31/07/2011	31.8	18.9	11.9	30	50	
6/08/2011	24.5	14.6	11.9	30	50	
12/08/2011	9.1	5.4	11.9	30	50	
18/08/2011	5.2	3.1	11.7	30	50	
24/08/2011	25.1	14.9	11.9	30	50	
30/08/2011	22.7	13.5	12.0	30	50	
5/09/2011	41.6	24.8	12.4	30	50	

Date	mg/paper	µg/m³	Annual Average	Annual Average Limit	24hr Limit	Comments
11/09/2011	5.9	3.5	12.4	30	50	
17/09/2011	21.5	12.8	12.6	30	50	
23/09/2011	44.9	26.7	12.7	30	50	
29/09/2011	6.4	3.8	12.6	30	50	
5/10/2011	20.9	12.4	12.8	30	50	
11/10/2011	18.0	10.7	12.9	30	50	
17/10/2011	13.9	8.3	12.9	30	50	
23/10/2011	24.0	14.3	12.9	30	50	
29/10/2011	11.3	6.7	12.9	30	50	
4/11/2011	25.1	15.0	13.1	30	50	
10/11/2011	23.2	13.8	13.2	30	50	
16/11/2011	29.7	17.7	13.4	30	50	
22/11/2011	<0.1	<0.1	13.6	30	50	
28/11/2011	16.5	9.8	13.5	30	50	
4/12/2011	28.5	17.0	13.7	30	50	
10/12/2011	6.1	3.6	13.7	30	50	
16/12/2011	21.2	12.6	13.4	30	50	
22/12/2011	6.4	3.8	13.3	30	50	
28/12/2011	15.7	9.3	13.4	30	50	
3/01/2012	55.7	33.2	13.7	30	50	
9/01/2012	32.7	19.5	13.9	30	50	
15/01/2012	2.9	1.7	13.8	30	50	
21/01/2012	13.9	8.3	13.8	30	50	
27/01/2012	12.8	7.6	13.6	30	50	
2/02/2012	19.7	0.0	13.1	30	50	Unit malfunction
8/02/2012	15.5	9.2	13.1	30	50	
14/02/2012	32.0	19.1	13.1	30	50	
20/02/2012	28.7	17.1	13.3	30	50	
26/02/2012	12.0	7.1	13.1	30	50	
3/03/2012	9.1	5.4	13.1	30	50	
9/03/2012	36.0	21.4	13.2	30	50	
15/03/2012	40.3	24.0	13.4	30	50	
21/03/2012	29.1	17.3	13.7	30	50	
27/03/2012	54.0	32.2	14.1	30	50	
2/04/2012	91.5	54.5	14.8	30	50	
8/04/2012	39.6	23.6	14.9	30	50	
16/04/2012			14.8	30	50	Unit malfunction
20/04/2012	33.6	20.0	14.8	30	50	
26/04/2012	21.6	12.9	14.9	30	50	
2/05/2012	28.1	16.7	14.4	30	50	
8/05/2012	51.2	30.5	14.1	30	50	
14/05/2012	64.7	38.5	14.7	30	50	
20/05/2012	44.3	26.4	14.4	30	50	
26/05/2012	5.1	3.0	14.4	30	50	
1/06/2012	16.3	5.8	14.4	30	50	Unit moved to Costa Vale
7/06/2012			14.4	30	50	Unit malfunction
13/06/2012	13.1	7.8	14.5	30	50	
19/06/2012	7.3	4.3	14.4	30	50	
25/06/2012	30.7	18.3	14.6	30	50	
1/07/2012	13.2	7.9	14.5	30	50	
7/07/2012	69.4	41.4	15.0	30	50	
13/07/2012	12.9	7.7	14.7	30	50	
19/07/2012	11.5	6.8	14.7	30	50	
25/07/2012	8.1	4.8	14.7	30	50	
31/07/2012	23.1	13.8	14.6	30	50	
6/08/2012	23.0	13.7	14.6	30	50	
12/08/2012	13.4	8.0	14.6	30	50	
18/08/2012	18.2	10.8	14.7	30	50	
24/08/2012	8.2	4.9	14.6	30	50	
30/08/2012			14.6	30	50	No Power
17/09/2012	43.2	51.3	15.1	30	50	
23/09/2012	27.4	16.4	15.3	30	50	
29/09/2012	19.7	11.8	15.3	30	50	
5/10/2012	42.5	25.3	15.2	30	50	
11/10/2012	11.6	9.1	15.3	30	50	
17/10/2012			15.4	30	50	No power
23/10/2012	19.5	11.6	15.4	30	50	
29/10/2012	52.4	31.2	15.8	30	50	
4/11/2012	38.6	23.0	16.0	30	50	
10/11/2012	13.4	8.0	16.0	30	50	
16/11/2012	38.6	23.0	16.1	30	50	
22/11/2012	45.5	27.1	16.4	30	50	
28/11/2012	27.1	16.1	16.3	30	50	
4/12/2012	24.9	14.8	16.3	30	50	
10/12/2012	17.9	10.7	16.3	30	50	
16/12/2012	53.7	32.0	16.6	30	50	
22/12/2012	18.7	11.1	16.7	30	50	
28/12/2012	20.4	12.2	16.7	30	50	
3/01/2013	44.8	25.4	17.1	30	50	
9/01/2013	64.3	34.8	17.5	30	50	
15/01/2013	24.3	34.0	17.6	30	50	
21/01/2013	20.8	12.4	17.4	30	50	
27/01/2013			17.7	30	50	Paper water damaged - unable to be analysed
2/02/2013	12.4	7.4	17.7	30	50	
8/02/2013	32.5	19.4	17.9	30	50	
14/02/2013	10.3	6.1	18.0	30	50	
20/02/2013	14.9	10.5	18.0	30	50	
26/02/2013	8.3	4.9	17.8	30	50	
4/03/2013	11.5	6.8	17.6	30	50	
10/03/2013	27.2	16.2	17.8	30	50	

Date	mg/paper	µg/m³	Annual Average	Annual Average Limit	24hr Limit	Comments
16/03/2013	36.9	22.0	18.1	30	50	
22/03/2013	14.2	8.4	17.8	30	50	
28/03/2013	17.6	10.5	17.6	30	50	
3/04/2013	24.6	14.6	17.5	30	50	
9/04/2013	12.2	7.3	17.1	30	50	
15/04/2013	48.9	29.1	16.6	30	50	
21/04/2013	12.5	7.4	16.4	30	50	
27/04/2013	29.8	17.8	16.4	30	50	
3/05/2013	34.5	20.6	16.4	30	50	
9/05/2013	32.1	19.1	16.5	30	50	
15/05/2013	3.7	2.2	16.2	30	50	
21/05/2013	14.9	8.9	15.9	30	50	
27/05/2013	17.4	10.4	15.4	30	50	
2/06/2013	6.0	3.6	15.0	30	50	
8/06/2013	<0.1	<0.1	15.2	30	50	
14/06/2013	3.5	2.1	15.1	30	50	
20/06/2013	0.5	<0.1	15.1	30	50	
26/06/2013	<0.1	<0.1	15.3	30	50	
2/07/2013	12.5	7.4	15.3	30	50	
8/07/2013	0.3	<0.1	15.3	30	50	No Power
14/07/2013	9.6	5.7	15.2	30	50	
20/07/2013	2.1	1.2	14.5	30	50	
26/07/2013	12.2	7.3	14.5	30	50	
1/08/2013	12.7	7.6	14.5	30	50	
7/08/2013	22.3	13.3	14.6	30	50	
13/08/2013	16.8	10.0	14.6	30	50	
19/08/2013	10.3	6.1	14.4	30	50	
25/08/2013	21.1	12.6	14.5	30	50	
31/08/2013	30.6	18.2	14.6	30	50	
6/09/2013	52.2	31.1	15.1	30	50	
12/09/2013	41.4	24.6	15.3	30	50	
18/09/2013	9.1	5.4	14.5	30	50	
24/09/2013	64.4	38.4	14.9	30	50	
30/09/2013	47.4	28.2	15.2	30	50	
6/10/2013	23.2	13.8	15.0	30	50	
12/10/2013	42.4	25.2	15.3	30	50	
18/10/2013	50.0	29.8	15.5	30	50	
24/10/2013	27.5	16.4	15.6	30	50	
30/10/2013	21.8	13.0	15.3	30	50	
5/11/2013	35.1	20.9	15.2	30	50	
11/11/2013	23.6	14.1	15.3	30	50	
17/11/2013			15.2	30	50	No run - power off
23/11/2013			15.0	30	50	No run - power off
29/11/2013			15.0	30	50	No run - power off
5/12/2013	0.6	0.1	14.7	30	50	
11/12/2013	21.0	12.5	14.7	30	50	
17/12/2013	11.8	7.0	14.2	30	50	
23/12/2013	43.7	26.0	14.5	30	50	
29/12/2013	86.2	51.4	15.3	30	50	
4/01/2014	49.3	29.4	15.3	30	50	
10/01/2014	38.5	22.9	15.1	30	50	
16/01/2014	124.0	73.6	15.9	30	50	
22/01/2014	51.1	30.4	16.2	30	50	
28/01/2014	14.2	14.2	16.2	30	50	
3/02/2014	36.8	21.9	16.4	30	50	
9/02/2014	32.8	19.5	16.4	30	50	
15/02/2014	56.8	33.8	17.0	30	50	
21/02/2014			17.1	30	50	No run - power off
27/02/2014	45.4	27.0	17.5	30	50	
5/03/2014	35.1	20.9	17.8	30	50	
11/03/2014	16.2	9.6	17.6	30	50	
17/03/2014	21.1	12.6	17.5	30	50	
23/03/2014	12.3	8.5	17.5	30	50	
29/03/2014	7.9	4.7	17.3	30	50	
4/04/2014	18.6	11.1	17.3	30	50	
10/04/2014	27.1	16.1	17.4	30	50	
16/04/2014	25.1	15.0	17.2	30	50	
22/04/2014	49.0	29.2	17.6	30	50	
28/04/2014	11.8	7.0	17.4	30	50	
4/05/2014	3.6	2.1	17.0	30	50	
10/05/2014	12.4	7.4	16.8	30	50	
16/05/2014	23.6	14.0	17.0	30	50	
22/05/2014	47.0	28.0	17.4	30	50	
28/05/2014	13.8	8.2	17.4	30	50	
3/06/2014	8.2	4.9	17.4	30	50	
9/06/2014	9.1	5.4	17.2	30	50	
15/06/2014	3.7	2.2	17.2	30	50	
21/06/2014	7.5	4.5	16.9	30	50	
27/06/2014	11.4	6.8	16.8	30	50	
3/07/2014	16.7	9.9	16.8	30	50	
9/07/2014	29.1	17.3	16.8	30	50	
15/07/2014	38.4	22.9	17.1	30	50	
21/07/2014	23.0	13.7	17.3	30	50	
27/07/2014	2.9	1.7	17.2	30	50	
2/08/2014	12.6	7.5	17.2	30	50	
8/08/2014	32.2	18.6	17.3	30	50	
14/08/2014	25.1	15.0	17.4	30	50	
20/08/2014	13.1	7.8	17.4	30	50	
26/08/2014	11.9	7.1	17.3	30	50	
1/09/2014	20.3	12.1	17.2	30	50	

Date	mg/paper	µg/m³	Annual Average	Annual Average Limit	24hr Limit	Comments
7/09/2014	22.1	13.2	16.9	30	50	
13/09/2014	19.6	11.7	16.7	30	50	
19/09/2014	42.8	25.5	17.0	30	50	
25/09/2014	5.9	3.5	16.4	30	50	
1/10/2014	32.2	19.2	16.3	30	50	
7/10/2014	57.7	34.4	16.6	30	50	
13/10/2014	26.8	16.0	16.5	30	50	
19/10/2014	25.0	14.9	16.2	30	50	
25/10/2014	34.3	20.5	16.3	30	50	
31/10/2014	49.9	29.7	16.6	30	50	
6/11/2014	14.8	8.8	16.4	30	50	
12/11/2014	52.0	31.0	16.7	30	50	
18/11/2014	27.6	16.4	16.7	30	50	
24/11/2014	36.0	21.4	16.7	30	50	
30/11/2014	17.6	10.5	16.6	30	50	
6/12/2014	19.7	11.7	16.8	30	50	
12/12/2014	20.4	12.2	16.8	30	50	
18/12/2014	46.1	27.5	17.2	30	50	
24/12/2014	21.3	12.7	16.9	30	50	
30/12/2014	23.0	13.7	16.3	30	50	
5/01/2015	12.0	7.1	15.9	30	50	
11/01/2015	19.2	11.4	15.8	30	50	
23/01/2015	16.5	9.8	14.7	30	50	
29/01/2015	15.5	9.2	14.3	30	50	
4/02/2015	6.7	4.0	14.2	30	50	
10/02/2015	26.7	15.9	14.1	30	50	
16/02/2015	8.7	5.2	13.8	30	50	
22/02/2015	7.7	4.6	13.3	30	50	
28/02/2015	13.5	8.0	13.3	30	50	
6/03/2015	53.9	32.1	13.3	30	50	
12/03/2015	19.7	11.7	13.2	30	50	
18/03/2015	35.0	20.8	13.4	30	50	
24/03/2015	17.0	13.0	13.4	30	50	
30/03/2015	18.0	10.7	13.4	30	50	
5/04/2015	2.8	1.7	13.4	30	50	
11/04/2015	9.8	5.8	13.3	30	50	
17/04/2015	39.5	23.5	13.4	30	50	
23/04/2015	6.9	4.1	13.2	30	50	
29/04/2015	34.1	20.3	13.1	30	50	
5/05/2015	20.2	12.0	13.2	30	50	
11/05/2015	24.7	14.7	13.4	30	50	
17/05/2015	24.5	14.6	13.5	30	50	
23/05/2015	5.8	3.4	13.3	30	50	
29/05/2015	7.7	4.6	12.9	30	50	
4/06/2015	11.8	7.0	12.9	30	50	
10/06/2015	10.5	6.2	12.9	30	50	
16/06/2015	6.3	3.8	12.9	30	50	
22/06/2015	8.3	4.9	12.9	30	50	
28/06/2015	6.1	3.6	12.9	30	50	
4/07/2015	12.7	7.6	12.9	30	50	
10/07/2015	9.0	5.4	12.9	30	50	
16/07/2015	5.0	3.0	12.6	30	50	
22/07/2015	11.0	6.6	12.4	30	50	



SURREY/ROSEBERRY PM10 HIGH VOLUME AIR SAMPLER

Date	mg/paper	µg/m³	Annual Average	Annual Average Limit	24hr Limit	Comments
8/10/2008	11.6	7	7.0	30	50	
14/10/2008	15.9	10	8.5	30	50	
20/10/2008	26.6	17	11.3	30	50	
26/10/2008	23.7	15	12.3	30	50	
1/11/2008	31.4	20	13.8	30	50	
7/11/2008	14.8	10	13.2	30	50	
13/11/2008	13.7	9	12.6	30	50	
19/11/2008	7	5	11.6	30	50	
25/11/2008	14.1	9	11.3	30	50	
1/12/2008	17.5	11	11.3	30	50	
7/12/2008	21.1	14	11.5	30	50	
13/12/2008	23.6	16	11.9	30	50	
19/12/2008	22.2	14	12.1	30	50	
25/12/2008	19	12	12.1	30	50	
31/12/2008	51.2	33	13.5	30	50	
6/01/2009	42.6	28	14.4	30	50	
12/01/2009	28.6	18	14.6	30	50	
18/01/2009	19.5	12	14.4	30	50	
24/01/2009	22.3	15	14.5	30	50	
30/01/2009	20.1	13	14.4	30	50	
5/02/2009	21.8	14	14.4	30	50	
11/02/2009	12.9	14	14.4	30	50	
17/02/2009	6	4	13.9	30	50	
23/02/2009	16.6	11	13.8	30	50	
1/03/2009	29.4	19	14.0	30	50	
7/03/2009	26.3	17	14.1	30	50	
13/03/2009	25.4	16	14.2	30	50	
19/03/2009	32.2	21	14.4	30	50	
25/03/2009	29	19	14.6	30	50	
31/03/2009	8.7	5	14.3	30	50	
6/04/2009	3	2	13.9	30	50	
12/04/2009	3.8	4	13.6	30	50	
18/04/2009	37	23	13.8	30	50	
24/04/2009	18.9	12	13.8	30	50	
30/04/2009	16.4	10	13.7	30	50	
6/05/2009	40.8	26	14.0	30	50	
12/05/2009	40.2	25	14.3	30	50	
18/05/2009	36	22	14.5	30	50	
24/05/2009			14.5	30	50	PM10 switched off by resident
30/05/2009			14.5	30	50	PM10 switched off by resident
5/06/2009	4	8	14.4	30	50	
11/06/2009	1.8	1	14.0	30	50	
17/06/2009			14.0	30	50	PM10 switched off by resident
23/06/2009	2.6	3	13.8	30	50	
29/06/2009	6.5	4	13.5	30	50	
5/07/2009	0.5	<1	13.5	30	50	
11/07/2009	7.8	5	13.3	30	50	
17/07/2009	3.6	2	13.1	30	50	
23/07/2009	17.8	11	13.0	30	50	
29/07/2009	3.6	2	12.8	30	50	
4/08/2009	11.1	5	12.6	30	50	
10/08/2009	35.4	22	12.8	30	50	
16/08/2009	35.2	22	13.0	30	50	
22/08/2009	34.1	22	13.2	30	50	
28/08/2009	41.9	26	13.4	30	50	
3/09/2009	42.8	26	13.7	30	50	
9/09/2009	7.7	5	13.5	30	50	
15/09/2009	35	22	13.7	30	50	
21/09/2009	19.7	13	13.7	30	50	
27/09/2009	46.9	30	13.9	30	50	
3/10/2009	46.9	30	14.2	30	50	
9/10/2009	15.1	9	14.3	30	50	
15/10/2009	51.1	33	14.7	30	50	
21/10/2009	107.5	68	15.6	30	50	
27/10/2009	7.9	5	15.4	30	50	
2/11/2009	58.4	37	15.7	30	50	
8/11/2009	14.7	9	15.7	30	50	
14/11/2009	21.4	14	15.8	30	50	

Date	mg/paper	µg/m³	Annual Average	Annual Average Limit	24hr Limit	Comments
20/11/2009	79.8	53	16.6	30	50	
26/11/2009	58.5	39	17.1	30	50	
2/12/2009	14.8	9	17.1	30	50	
8/12/2009	150.6	101	18.6	30	50	
14/12/2009	104.5	68	19.5	30	50	
20/12/2009	34	22	19.7	30	50	
26/12/2009	25	16	19.7	30	50	
1/01/2010	14.8	10	19.3	30	50	
7/01/2010	22.7	15	19.1	30	50	
13/01/2010	70.2	47	19.6	30	50	
19/01/2010	47.3	30	19.9	30	50	
25/01/2010	68.1	45	20.5	30	50	
31/01/2010	20.3	13	20.5	30	50	
6/02/2010	14.4	9	20.4	30	50	
12/02/2010	27	18	20.4	30	50	
18/02/2010	14	9	20.5	30	50	
24/02/2010	18.3	12	20.5	30	50	
2/03/2010	13.2	8	20.4	30	50	
8/03/2010	15.9	10	20.2	30	50	
14/03/2010	6.5	4	20.0	30	50	
20/03/2010	34.4	22	20.0	30	50	
26/03/2010	54.5	35	20.3	30	50	
1/04/2010	10.1	7	20.4	30	50	
7/04/2010	8.2	5	20.4	30	50	
13/04/2010	16.4	10	20.5	30	50	
19/04/2010	3.9	2	20.1	30	50	
25/04/2010	6.9	4	20.0	30	50	
1/05/2010	19.1	12	20.0	30	50	
7/05/2010	16.3	10	19.8	30	50	
13/05/2010	18.7	12	19.5	30	50	
19/05/2010	20.5	13	19.4	30	50	
25/05/2010	7.9	5	19.1	30	50	
31/05/2010	2.5	2	18.8	30	50	
6/06/2010	1.5	1	18.7	30	50	
12/06/2010	4.6	3	18.7	30	50	
18/06/2010	2.8	2	18.5	30	50	
24/06/2010	3.2	2	18.5	30	50	
30/06/2010	10	6	18.5	30	50	
6/07/2010	5.8	4	18.2	30	50	
12/07/2010	4.6	3	18.2	30	50	
18/07/2010	8	5	18.3	30	50	
24/07/2010	2	1	18.1	30	50	
30/07/2010	0.6	0	18.1	30	50	
5/08/2010	7	4	18.0	30	50	
11/08/2010	4.2	3	17.7	30	50	
17/08/2010	3.7	2	17.4	30	50	
23/08/2010	2.8	2	17.1	30	50	
29/08/2010	3.6	2	16.7	30	50	
4/09/2010	8	5	16.3	30	50	
10/09/2010	3.4	2	16.3	30	50	
16/09/2010	2.6	2	16.0	30	50	
22/09/2010	23.7	15	16.0	30	50	
28/09/2010	17.7	11	15.7	30	50	
4/10/2010	0.9	1	15.2	30	50	
10/10/2010	3.8	2	15.1	30	50	
16/10/2010	6.7	4	14.6	30	50	
22/10/2010	13.9	9	13.7	30	50	
28/10/2010	16.7	11	13.8	30	50	
3/11/2010	7.1	4.4	13.2	30	50	
9/11/2010	8.2	5	13.2	30	50	
15/11/2010	16.2	9.9	13.1	30	50	
21/11/2010	9.7	5.9	12.3	30	50	
27/11/2010	19.7	12.1	11.9	30	50	
3/12/2010	7.8	4.6	11.8	30	50	
9/12/2010	18.5	11	10.3	30	50	
15/12/2010	16.8	10	9.4	30	50	
21/12/2010	8.4	5.6	9.1	30	50	
27/12/2010	6.2	3.7	8.9	30	50	
2/01/2011	17.5	10.4	8.9	30	50	
8/01/2011	10.5	6.2	8.8	30	50	

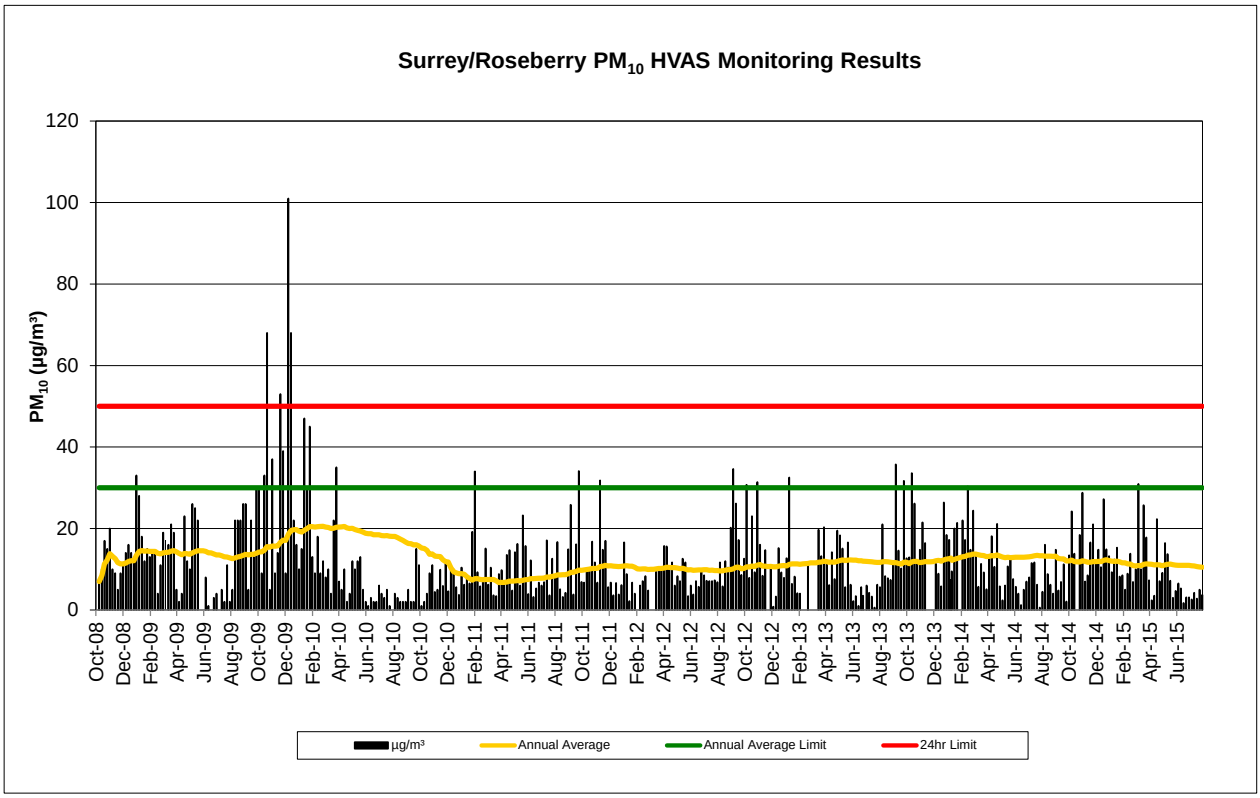
Date	mg/paper	µg/m³	Annual Average	Annual Average Limit	24hr Limit	Comments
14/01/2011	13.9	8.2	8.1	30	50	
20/01/2011	10.9	6.5	7.7	30	50	
26/01/2011	32.3	19.2	7.3	30	50	
1/02/2011	57.2	34	7.7	30	50	
7/02/2011	15.7	9.3	7.7	30	50	
13/02/2011	9.8	5.8	7.5	30	50	
19/02/2011	12.5	7.4	7.4	30	50	
25/02/2011	25.4	15.1	7.5	30	50	
3/03/2011	10.5	6.2	7.5	30	50	
9/03/2011	17.4	10.4	7.5	30	50	
15/03/2011	6	3.6	7.5	30	50	
21/03/2011	5.7	3.4	7.2	30	50	
27/03/2011	14.7	8.8	6.7	30	50	
2/04/2011	16.4	9.8	6.8	30	50	
8/04/2011	10.3	6.1	6.8	30	50	
14/04/2011	22.7	13.5	6.9	30	50	
20/04/2011	24.7	14.7	7.1	30	50	
26/04/2011	8.1	4.8	7.1	30	50	
2/05/2011	23.8	14.2	7.1	30	50	
8/05/2011	27.3	16.2	7.2	30	50	
14/05/2011	10	6	7.1	30	50	
20/05/2011	39	23.2	7.3	30	50	
26/05/2011	26.4	15.7	7.5	30	50	
1/06/2011	6.6	3.9	7.5	30	50	
7/06/2011	20.5	12.2	7.7	30	50	
13/06/2011	5.3	3.2	7.7	30	50	
19/06/2011	8.9	5.3	7.7	30	50	
25/06/2011	11.3	6.7	7.8	30	50	
1/07/2011	10	6	7.8	30	50	
7/07/2011	11.4	6.8	7.9	30	50	
13/07/2011	28.7	17.1	8.1	30	50	
19/07/2011	6	3.6	8.1	30	50	
25/07/2011	21.2	12.6	8.3	30	50	
31/07/2011	13.3	7.9	8.4	30	50	
6/08/2011	28	16.7	8.6	30	50	
12/08/2011	8.5	5.1	8.6	30	50	
18/08/2011	5.3	3.2	8.6	30	50	
24/08/2011	7.1	4.2	8.7	30	50	
30/08/2011	25	14.9	8.9	30	50	
5/09/2011	43.4	25.8	9.2	30	50	
11/09/2011	6.3	3.8	9.3	30	50	
17/09/2011	27	16.1	9.5	30	50	
23/09/2011	57.2	34.1	9.8	30	50	
29/09/2011	11.6	6.9	9.7	30	50	
5/10/2011	11.3	6.7	9.8	30	50	
11/10/2011	16	9.5	10.0	30	50	
17/10/2011	17.3	10.3	10.1	30	50	
23/10/2011	28.2	16.8	10.2	30	50	
29/10/2011	19.6	11.7	10.2	30	50	
4/11/2011	11.3	6.7	10.2	30	50	
10/11/2011	39.5	31.8	10.7	30	50	
16/11/2011	24.9	14.8	10.8	30	50	
22/11/2011	28.5	17	10.9	30	50	
28/11/2011	9.4	5.6	10.8	30	50	
4/12/2011	11.3	6.7	10.9	30	50	
10/12/2011	6	3.6	10.7	30	50	
16/12/2011	11.1	6.6	10.7	30	50	
22/12/2011	6.3	3.8	10.7	30	50	
28/12/2011	10.3	6.1	10.7	30	50	
3/01/2012	27.8	16.6	10.8	30	50	
9/01/2012	14.7	8.8	10.8	30	50	
15/01/2012	3.7	2.2	10.7	30	50	
21/01/2012	11.2	6.7	10.7	30	50	
27/01/2012	6.8	4	10.5	30	50	
2/02/2012	1.6		10.1	30	50	Regional flooding unit malfunction
8/02/2012	10.1	6	10.1	30	50	
14/02/2012	11.9	7.1	10.1	30	50	
20/02/2012	13.9	8.3	10.1	30	50	
26/02/2012	8.1	4.8	9.9	30	50	
3/03/2012	10.9		10.0	30	50	Power loss

Date	mg/paper	µg/m³	Annual Average	Annual Average Limit	24hr Limit	Comments
9/03/2012			10.0	30	50	Unit malfunction
15/03/2012	15.8	9.4	10.1	30	50	
21/03/2012	16.9	10.1	10.2	30	50	
27/03/2012	17.5	10.4	10.2	30	50	
2/04/2012	26.3	15.7	10.3	30	50	
8/04/2012	26.3	15.6	10.5	30	50	
14/04/2012	18.1	10.8	10.4	30	50	
20/04/2012	19.7	11.7	10.4	30	50	
26/04/2012	10.1	6	10.4	30	50	
2/05/2012	14	8.3	10.3	30	50	
8/05/2012	12	7.1	10.1	30	50	
14/05/2012	21.2	12.6	10.3	30	50	
20/05/2012	19.7	11.7	10.1	30	50	
26/05/2012	5.8	3.4	9.8	30	50	
1/06/2012	10.1	6	9.9	30	50	
7/06/2012	6.4	3.8	9.7	30	50	
13/06/2012	11.9	7.1	9.8	30	50	
19/06/2012	9.6	5.7	9.8	30	50	
25/06/2012	16	9.5	9.9	30	50	
1/07/2012	14.3	8.5	9.9	30	50	
7/07/2012	12.1	7.2	9.9	30	50	
13/07/2012	11.9	7.1	9.7	30	50	
19/07/2012	12	7.1	9.8	30	50	
25/07/2012	12.3	7.3	9.7	30	50	
31/07/2012	11.4	6.8	9.7	30	50	
6/08/2012	19.6	11.7	9.6	30	50	
12/08/2012	9.7	5.8	9.6	30	50	
18/08/2012	20.1	12	9.8	30	50	
24/08/2012	17.4	10.4	9.9	30	50	
30/08/2012	33.9	20.2	10.0	30	50	
5/09/2012	57.7	34.6	10.1	30	50	
11/09/2012	43.6	26.1	10.5	30	50	
17/09/2012	28.7	17.2	10.5	30	50	
23/09/2012	14.4	8.6	10.1	30	50	
29/09/2012	21.2	12.6	10.2	30	50	
5/10/2012	51.5	30.7	10.6	30	50	
11/10/2012	13.3	7.9	10.6	30	50	
17/10/2012	38.6	23	10.8	30	50	
23/10/2012	15.6	9.3	10.7	30	50	
29/10/2012	52.8	31.4	11.0	30	50	
4/11/2012	26.8	16	11.2	30	50	
10/11/2012	14.1	8.4	10.8	30	50	
16/11/2012	24.7	14.7	10.7	30	50	
22/11/2012			10.6	30	50	No run - unplugged
28/11/2012	12.3	10.3	10.7	30	50	
4/12/2012	1	0.8	10.6	30	50	Short run time (1062)
10/12/2012	5.6	3.3	10.6	30	50	
16/12/2012	25.6	15.2	10.8	30	50	
22/12/2012	15.5	9.2	10.9	30	50	
28/12/2012	13.2	7.9	10.9	30	50	
3/01/2013	21.4	12.7	10.8	30	50	
9/01/2013	54.6	32.5	11.2	30	50	
15/01/2013	10.8	6.4	11.3	30	50	
21/01/2013	13.8	8.2	11.3	30	50	
27/01/2013	5.6	4.1	11.3	30	50	
2/02/2013	6.8	4	11.2	30	50	
8/02/2013	0.1	<0.1	11.3	30	50	Short run time
14/02/2013	<0.1	<0.1	11.4	30	50	Short run time
20/02/2013	10.9	11.3	11.4	30	50	Short run time
26/02/2013	<0.1	<0.1	11.6	30	50	Short run time
4/03/2013	1.1	<0.1	11.6	30	50	
10/03/2013	2.8	<0.1	11.6	30	50	
16/03/2013	33.1	19.7	11.7	30	50	
22/03/2013	22.2	13.2	11.8	30	50	
28/03/2013	34.1	20.3	12.0	30	50	
3/04/2013	18.8	11.2	11.9	30	50	
9/04/2013	10.3	6.1	11.7	30	50	
15/04/2013	23.9	14.2	11.8	30	50	
21/04/2013	12.7	7.6	11.7	30	50	
27/04/2013	32.8	19.5	12.0	30	50	

Date	mg/paper	µg/m³	Annual Average	Annual Average Limit	24hr Limit	Comments
3/05/2013	30.8	18.3	12.1	30	50	
9/05/2013	25.3	15.1	12.3	30	50	
15/05/2013	9.4	5.6	12.2	30	50	
21/05/2013	27.8	16.6	12.2	30	50	
27/05/2013	10.4	6.2	12.3	30	50	
2/06/2013	3.7	2.2	12.2	30	50	
8/06/2013	5.7	3.4	12.2	30	50	
14/06/2013	1.7	1	12.1	30	50	
20/06/2013	9.5	5.6	12.1	30	50	
24/06/2013	5.9	3.5	12.0	30	50	
2/07/2013	10.1	6	12.0	30	50	
8/07/2013	7.1	4.2	11.9	30	50	
14/07/2013	4.6	3.3	11.8	30	50	
20/07/2013	1.1	0.6	11.7	30	50	
26/07/2013	10.5	6.2	11.7	30	50	
1/08/2013	9.4	5.6	11.7	30	50	
7/08/2013	35.2	21	11.8	30	50	
13/08/2013	13.9	8.3	11.9	30	50	
19/08/2013	13.1	7.8	11.8	30	50	
25/08/2013	12.5	7.4	11.8	30	50	
31/08/2013	20	11.9	11.6	30	50	
6/09/2013	59.9	35.7	11.6	30	50	
12/09/2013	24.5	14.6	11.4	30	50	
18/09/2013	17.2	10.2	11.3	30	50	
24/09/2013	53.3	31.7	11.7	30	50	
30/09/2013	21.4	12.7	11.7	30	50	
6/10/2013	21.7	12.9	11.4	30	50	
12/10/2013	56.4	33.6	11.8	30	50	
18/10/2013	43.8	26.1	11.9	30	50	
24/10/2013	18.8	11.2	11.9	30	50	
30/10/2013	24.8	14.8	11.6	30	50	
5/11/2013	36.1	21.5	11.7	30	50	
11/11/2013	27.5	16.4	11.9	30	50	
17/11/2013			11.8	30	50	Short run time
23/11/2013			11.8	30	50	No run - power off
29/11/2013			11.9	30	50	No run - power off
5/12/2013	18.5	11.3	12.1	30	50	
11/12/2013	14.5	8.9	12.2	30	50	
17/12/2013	9.4	5.8	12.0	30	50	
23/12/2013	38.9	26.4	12.3	30	50	
29/12/2013	30	18.4	12.5	30	50	
4/01/2014	28.1	17.2	12.6	30	50	
10/01/2014	15.5	9.5	12.2	30	50	
16/01/2014	32.7	20	12.4	30	50	
22/01/2014	34.8	21.4	12.7	30	50	
8/01/2014	12	7.4	12.7	30	50	
3/02/2014	35.9	22	13.1	30	50	
9/02/2014	28.1	17.2	13.1	30	50	
15/02/2014	49.4	30.3	13.5	30	50	
21/02/2014	24.1	14.8	13.5	30	50	
27/02/2014	39.8	24.4	13.7	30	50	
5/03/2014	22.3	13.7	13.7	30	50	
11/03/2014	9.3	5.7	13.6	30	50	
17/03/2014	18.5	11.3	13.4	30	50	
23/03/2014	15	9.2	13.4	30	50	
29/03/2014	8.3	5.1	13.1	30	50	
4/04/2014	21.8	13.4	13.1	30	50	
10/04/2014	29.5	18.1	13.3	30	50	
16/04/2014	17.3	10.6	13.3	30	50	
22/04/2014	34.4	21.1	13.5	30	50	
28/04/2014	9.5	5.8	13.3	30	50	
4/05/2014	3.9	2.4	13.0	30	50	
10/05/2014	9.8	6	12.8	30	50	
16/05/2014	17.5	10.7	12.9	30	50	
22/05/2014	21.1	12.9	12.9	30	50	
28/05/2014	12.4	7.6	12.9	30	50	
3/06/2014	9.3	5.7	13.0	30	50	
9/06/2014	6.6	4	13.0	30	50	
15/06/2014	2	1.2	13.0	30	50	
21/06/2014	8.1	5	13.0	30	50	

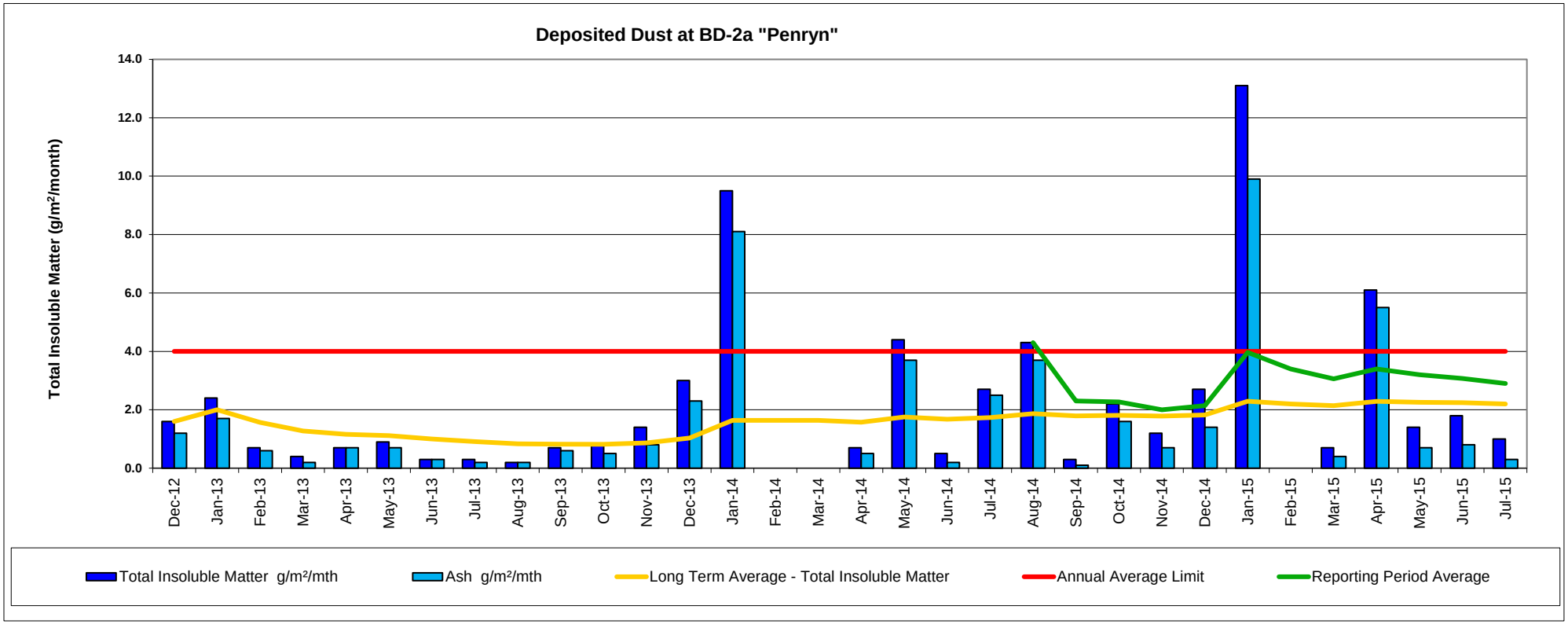
Date	mg/paper	µg/m³	Annual Average	Annual Average Limit	24hr Limit	Comments
27/06/2014	11.4	7	13.0	30	50	
3/07/2014	13	8	13.1	30	50	
9/07/2014	18.7	11.5	13.2	30	50	
15/07/2014	19.1	11.7	13.3	30	50	
21/07/2014	10.2	6.2	13.4	30	50	
27/07/2014	1	0.6	13.3	30	50	
2/08/2014	7.3	4.5	13.3	30	50	
8/08/2014	26.1	16	13.2	30	50	
14/08/2014	14.3	8.8	13.2	30	50	
20/08/2014	10.2	6.2	13.2	30	50	
26/08/2014	6.5	4	13.1	30	50	
1/09/2014	24.1	14.8	13.2	30	50	
7/09/2014	7.9	4.8	12.7	30	50	
13/09/2014	11.3	6.9	12.5	30	50	
19/09/2014	18.2	11.2	12.5	30	50	
25/09/2014	3.5	2.1	12.0	30	50	
1/10/2014	21.8	13.4	12.0	30	50	
7/10/2014	39.4	24.2	12.2	30	50	
13/10/2014	22.6	13.8	11.9	30	50	
25/10/2014	30	18.4	11.8	30	50	
31/10/2014	47	28.8	12.1	30	50	
6/11/2014	10.1	7	11.9	30	50	
12/11/2014	13.9	8.5	11.7	30	50	
18/11/2014	27.1	16.6	11.7	30	50	
24/11/2014	34.3	21	11.9	30	50	
30/11/2014	18.6	11.4	11.9	30	50	
6/12/2014	24.2	14.8	11.9	30	50	
12/12/2014	17.2	10.5	11.9	30	50	
18/12/2014	44.4	27.2	12.2	30	50	
24/12/2014	24.3	14.9	12.3	30	50	
30/12/2014	21.6	13.2	12.1	30	50	
5/01/2015	15.2	9.3	12.0	30	50	
11/01/2015	20.3	12.4	11.9	30	50	
17/01/2015	25	15.3	12.0	30	50	
23/01/2015	13.3	8.2	11.8	30	50	
29/01/2015	13.9	8.5	11.6	30	50	
4/02/2015	8.2	5	11.6	30	50	
10/02/2015	14.5	8.9	11.3	30	50	
16/02/2015	22.5	13.8	11.3	30	50	
22/02/2015	11.2	6.9	10.9	30	50	
28/02/2015	16.3	10	10.8	30	50	
6/03/2015	50.4	30.9	10.9	30	50	
12/03/2015	16.4	10	10.9	30	50	
18/03/2015	41.9	25.7	11.2	30	50	
24/03/2015	29.1	17.8	11.3	30	50	
30/03/2015	11.9	7.3	11.3	30	50	
5/04/2015	4	2.4	11.2	30	50	
11/04/2015	5.7	3.5	11.1	30	50	
17/04/2015	36.4	22.3	11.1	30	50	
23/04/2015	11.6	7.1	11.1	30	50	
29/04/2015	14.9	9.1	10.9	30	50	
5/05/2015	26.8	16.4	11.1	30	50	
11/05/2015	22.4	13.7	11.2	30	50	
17/05/2015	11.7	7.2	11.3	30	50	
23/05/2015	4.9	3	11.1	30	50	
29/05/2015	7.6	4.7	11.0	30	50	
4/06/2015	9.4	6.5	11.0	30	50	
10/06/2015	8.7	5.3	11.0	30	50	
16/06/2015	2.8	1.7	10.9	30	50	
22/06/2015	5.1	3.1	11.0	30	50	
28/06/2015	5	3.1	10.9	30	50	
4/07/2015	4.2	2.6	10.9	30	50	

Date	mg/paper	µg/m³	Annual Average	Annual Average Limit	24hr Limit	Comments
10/07/2015	6.9	4.2	10.8	30	50	
16/07/2015	4.5	2.8	10.7	30	50	
22/07/2015	8.2	5	10.5	30	50	
28/07/2015	6.1	3.7	10.5	30	50	



Deposited Dust BD-2a "Penryn"

Sample Number	Sample Location	Sample Date	Sample Month	Sampler	Time	Volume Collected ml	Total Insoluble Matter g/m²/mth	Reporting Period Average - Total Insoluble Matter	Long Term Average - Total Insoluble Matter	Annual Average Limit	Ash g/m²/mth	Comment
EN1204844-008	BD-2a	19-Dec-12	Dec-12	ALS	1145	50	1.6		1.6	4.0	1.2	Insects
EN1300224-008	BD-2a	17-Jan-13	Jan-13	ALS	1140	300	2.4		2.0	4.0	1.7	Insects, plant material
EN1300660-008	BD-2a	18-Feb-13	Feb-13	ALS	1110	1800	0.7		1.6	4.0	0.6	Insects, plant material
EN1301078-008	BD-2a	18-Mar-13	Mar-13	ALS	1230	700	0.4		1.3	4.0	0.2	Insects, plant material
EN1301447-001	BD-2a	17-Apr-13	Apr-13	ALS	1235	200	0.7		1.2	4.0	0.7	
EN1301833-008	BD-2a	18-May-13	May-13	ALS	1200	150	0.9		1.1	4.0	0.7	Insects, plant material
EN1302215-008	BD-2a	17-Jun-13	Jun-13	ALS	1245	1000	0.3		1.0	4.0	0.3	Insects, plant material
EN1302629-008	BD-2a	16-Jul-13	Jul-13	ALS	1235	300	0.3		0.9	4.0	0.2	Insects
EN1303028-004	BD-2a	15-Aug-13	Aug-13	ALS	1040	300	0.2		0.8	4.0	0.2	Insects, plant material
EN1303431-004	BD-2a	16-Sep-13	Sep-13	ALS	1250	100	0.7		0.8	4.0	0.6	Insects, plant material
EN1303808-004	BD-2a	15-Oct-13	Oct-13	ALS	1225	300	0.8		0.8	4.0	0.5	Insects, plant material
WN1304189-001	BD-2a	14-Nov-13	Nov-13	ALS	1205	350	1.4		0.9	4.0	0.8	Insects, plant material
EN1304649-001	BD-2a	16-Dec-13	Dec-13	ALS	1100	600	3.0		1.0	4.0	2.3	Insects, plant material
2600185401-001	BD-2a	14-Jan-14	Jan-14	ALS	1230	110	9.5		1.6	4.0	8.1	Insects, plant material
2600186701-001	BD-2a	13-Feb-14	Feb-14	ALS	1245	0			1.6	4.0		Bottle broken - no sample
2600188201-001	BD-2a	14-Mar-14	Mar-14	ALS	1230	800	<0.1		1.6	4.0	<0.1	Insects
2600189701-001	BD-2a	15-Apr-14	Apr-14	ALS	1220	1250	0.7		1.6	4.0	0.5	Plant material, broken funnel, recent heavy rain
2600191001-001	BD-2a	15-May-14	May-14	ALS	1215	250	4.4		1.8	4.0	3.7	Plant material-broken funnel in bottle
2600192301-001	BD-2a	16-Jun-14	Jun-14	ALS	1140	1200	0.5		1.7	4.0	0.2	Insects
2600193601-001	BD-2a	15-Jul-14	Jul-14	ALS	1200	200	2.7		1.7	4.0	2.5	Insects
2600195001-001	BD-2a	15-Aug-14	Aug-14	ALS	1230	400	4.3	4.3	1.9	4.0	3.7	Insects, plant material, broken funnel in bottle
2600196401-001	BD-2a	16-Sep-14	Sep-14	ALS	1230	1200	0.3	2.3	1.8	4.0	0.1	
2600197801-001	BD2-A	17-Oct-14	Oct-14	ALS	12:50	750	2.2	2.3	1.8	4.0	1.6	Insects, Plant material
2600199201-001	BD2-A	18-Nov-14	Nov-14	ALS	11:15	400	1.2	2.0	1.8	4.0	0.7	Insects, Plant material
2600200901-001	BD2-A	18-Dec-14	Dec-14	ALS	12:05	1000	2.7	2.1	1.8	4.0	1.4	Bird Droppings, Plant material
2600202401-001	BD2-A	19-Jan-15	Jan-15	ALS	12:15	400	13.1	4.0	2.3	4.0	9.9	Plant material
2600204001-001	BD2-A	18-Feb-15	Feb-15	ALS	11:25	500	0	3.4	2.2	4.0	0	Values of 68 and 57(ash) excluded from average
2600205501-001	BD2-A	19-Mar-15	Mar-15	ALS	11:00	240	0.7	3.1	2.1	4.0	0.4	Insects
2600207001-001	BD2-A	17-Apr-15	Apr-15	ALS	11:30	1500	6.1	3.4	2.3	4.0	5.5	Insects
2600208501-001	BD2-A	19-May-15	May-15	ALS	12:35	1000	1.4	3.2	2.3	4.0	0.7	Insects, Plant material
2600209901-001	BD2-A	22-Jun-15	Jun-15	ALS	12:15	1500	1.8	3.1	2.2	4.0	0.8	Insects,
2600211301-001	BD2-A	20-Jul-15	Jul-15	ALS	11:30	250	1	2.9	2.2	4.0	0.3	Insects, Plant material


Deposited Dust at BD-2a "Penryn"
Total Insoluble Matter (g/m²/month)
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
Dec-12
Jan-13
Feb-13
Mar-13
Apr-13
May-13
Jun-13
Jul-13
Aug-13
Sep-13
Oct-13
Nov-13
Dec-13
Jan-14
Feb-14
Mar-14
Apr-14
May-14
Jun-14
Jul-14
Aug-14
Sep-14
Oct-14
Nov-14
Dec-14
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Total Insoluble Matter g/m²/mth
Ash g/m²/mth
Long Term Average - Total Insoluble Matter
Annual Average Limit
Reporting Period Average

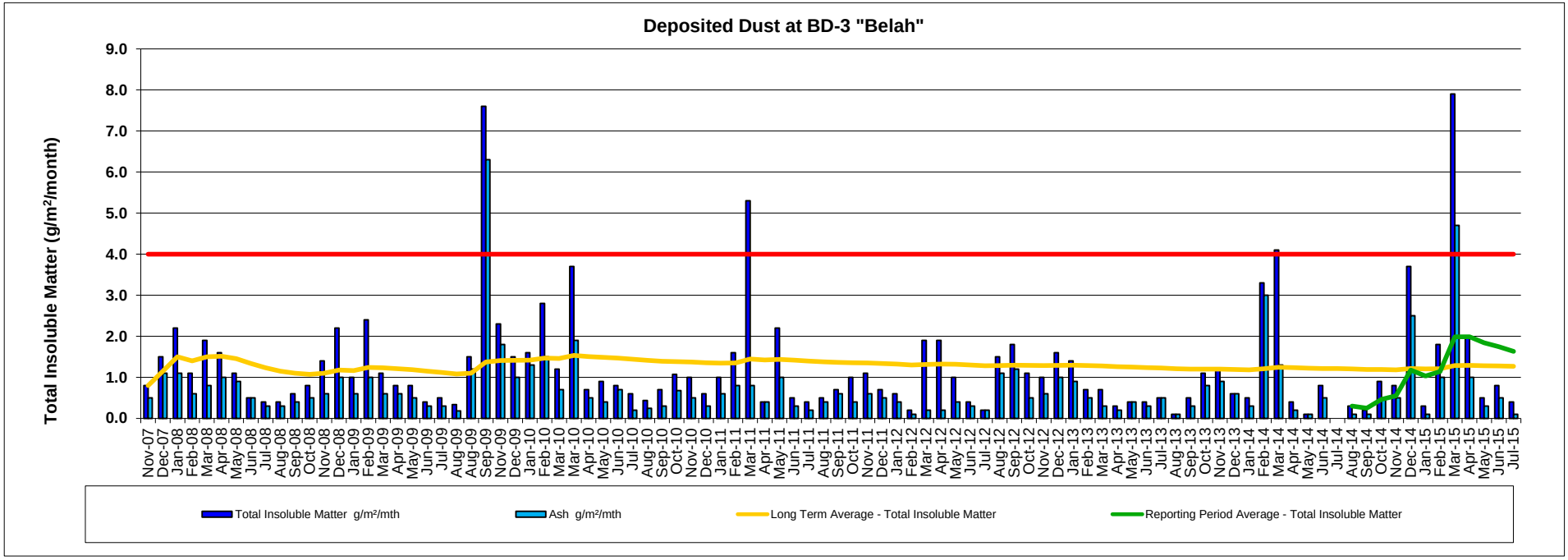
Deposited Dust BD-3 "Belah"

Sample Number	Sample Location	Sample Date	Sample Month	Sampler	Time	Volume Collected ml	Total Insoluble Matter g/m²/mth	Reporting Period Average - Total Insoluble Matter	Long Term Average - Total Insoluble Matter	Annual Average Limit	Ash g/m²/mth	Comment
28550.03	BD-3	05-Nov-07	Oct-07	Client	1315	630	0.8		0.8	4.0	0.5	
28662.03	BD-3	05-Dec-07	Nov-07	Client	1315	1515	1.5		1.2	4.0	1.1	
28923.03	BD-3	03-Jan-08	Dec-07	Client	1035	1345	2.2		1.5	4.0	1.1	
29224.03	BD-3	05-Feb-08	Jan-08	Client	1330	1335	1.1		1.4	4.0	0.6	
29525.03	BD-3	05-Mar-08	Feb-08	Client	1205	1170	1.9		1.5	4.0	0.8	
29773.03	BD-3	04-Apr-08	Mar-08	Client	0940	90	1.6		1.5	4.0	1.0	
30055.03	BD-3	05-May-08	Apr-08	Client	1205	230	1.1		1.5	4.0	0.9	
30386.03	BD-3	04-Jun-08	May-08	Client	1020	865	0.5		1.3	4.0	0.5	
30660.03	BD-3	09-Jul-08	Jun-08	Client	1330	445	0.4		1.2	4.0	0.3	
30902.03	BD-3	05-Aug-08	Jul-08	Client	0850	395	0.4		1.2	4.0	0.3	
31210.03	BD-3	01-Sep-08	Aug-08	Client	1640	740	0.6		1.1	4.0	0.4	
31527.03	BD-3	02-Oct-08	Sep-08	Client	1545	1085	0.8		1.1	4.0	0.5	
31775.03	BD-3	05-Nov-08	Oct-08	Client	1750	1685	1.4		1.1	4.0	0.6	
32023.03	BD-3	04-Dec-08	Nov-08	Client	0730	1005	2.2		1.2	4.0	1.0	
32518.03	BD-3	05-Jan-09	Dec-08	Client	1558	1130	1.0		1.2	4.0	0.6	
32246.03	BD-3	02-Feb-09	Jan-09	Client	1650	230	2.4		1.2	4.0	1.0	
32863.03	BD-3	02-Mar-09	Feb-09	Client	1535	1300	1.1		1.2	4.0	0.6	
2600 1004 -00	BD-3	01-Apr-09	Mar-09	ALS Acirl		<50	0.8		1.2	4.0	0.6	
2600 1019 -00	BD-3	01-May-09	Apr-09	ALS Acirl		400	0.8		1.2	4.0	0.5	
2600 1034 -01	BD-3	04-Jun-09	May-09	ALS Acirl		600	0.4		1.2	4.0	0.3	
2600 1042 - 01	BD-3	06-Jul-09	Jun-09	ALS Acirl		500	0.5		1.1	4.0	0.3	
2601 1054 - 01	BD-3	03-Aug-09	Jul-09	ALS Acirl	1500	350	0.3		1.1	4.0	0.2	
2600 1064 - 00	BD-3	31-Aug-09	Aug-09	ALS Acirl	1450	50	1.5		1.1	4.0	1.2	
2600 1098 - 01	BD-3	29-Sep-09	Sep-09	ALS Acirl	1355	600	7.6		1.4	4.0	6.3	
2600 1128 - 00	BD-3	03-Nov-09	Oct-09	ALS Acirl	1405	600	2.3		1.4	4.0	1.8	
2601 1204 - 00	BD-3	04-Dec-09	Nov-09	ALS Acirl	1150	dry	1.5		1.4	4.0	1.0	
2600 1222 - 00	BD-3	04-Jan-10	Dec-09	ALS Acirl	1625	2500	1.6		1.4	4.0	1.3	
2600 1234 - 00	BD-3	01-Feb-10	Jan-10	ALS Acirl	1450	200	2.8		1.5	4.0	1.5	
2600 1247 - 00	BD-3	02-Mar-10	Feb-10	ALS Acirl	1345	2000	1.2		1.5	4.0	0.7	
2600 1260 - 00	BD-3	30-Mar-10	Mar-10	ALS Acirl	1230	200	3.7		1.5	4.0	1.9	
2600 1268 - 00	BD-3	27-Apr-10	Apr-10	ALS Acirl	1320	400	0.7		1.5	4.0	0.5	
2600 1277 - 00	BD-3	25-May-10	May-10	ALS Acirl	1420	10	0.9		1.5	4.0	0.4	
2600 1288 - 776	BD-3	24-Jun-10	Jun-10	ALS Acirl	0930	900	0.8		1.5	4.0	0.7	
2600 1288 - 827	BD-3	22-Jul-10	Jul-10	ALS Acirl	0940	600	0.6		1.4	4.0	0.2	
2600-1309-913	BD-3	20-Aug-10	Aug-10	ALS Acirl	1325	2000	0.4		1.4	4.0	0.2	Insects
6800-4319-07	BD-3	21-Sep-10	Sep-10	ALS Acirl	1115	800	0.7		1.4	4.0	0.3	insects
2600-1340-09	BD-3	21-Oct-10	Oct-10	ALS Acirl	1110	2500	1.1		1.4	4.0	0.7	No observations recorded
EN1002887-002	BD-3	22-Nov-10	Nov-10	ALS Acirl	1430	2200	1.0		1.4	4.0	0.5	Insects/Plant Material
EN1003102-002	BD-3	22-Dec-10	Dec-10	ALS Acirl	1340	1400	0.6		1.4	4.0	0.3	Insects/Plant Material
EN1100201-002	BD-3	21-Jan-11	Jan-11	ALS Acirl	1340	200	1.0		1.3	4.0	0.6	Insects/Plant Material
EN1100445-002	BD-3	22-Feb-11	Feb-11	ALS Acirl	1210	200	1.6		1.4	4.0	0.8	Insects/Plant Material/Spiders
EN1100694-002	BD-3	24-Mar-11	Mar-11	ALS Acirl	1110	400	5.3		1.4	4.0	0.8	Spiders/Insects/Bird Droppings/Plant
EN1100921-002	BD-3	20-Apr-11	Apr-11	ALS Acirl	1145	250	0.4		1.4	4.0	0.4	Plant Material
EN1101201-002	BD-3	20-May-11	May-11	ALS Acirl	1150	Nil	2.2		1.4	4.0	1.0	Insects
EN1101447-002	BD-3	20-Jun-11	Jun-11	ALS Acirl	1215	1600	0.5		1.4	4.0	0.3	Insects/Plant Material

WHITEHAVEN COAL MINING PTY LTD
Deposited Dust Data - BD-3

Sample Number	Sample Location	Sample Date	Sample Month	Sampler	Time	Volume Collected ml	Total Insoluble Matter g/m²/mth	Reporting Period Average - Total Insoluble Matter	Long Term Average - Total Insoluble Matter	Annual Average Limit	Ash g/m²/mth	Comment
EN1101811-002	BD-3	19-Jul-11	Jul-11	ALS Acirl	1235	50	0.4		1.4	4.0	0.2	Clear
EN1102303-002	BD-3	17-Aug-11	Aug-11	ALS	1215	80	0.5		1.4	4.0	0.4	Bird droppings, plant material
EN1102774-002	BD-3	16-Sep-11	Sep-11	ALS	1245	700	0.7		1.4	4.0	0.6	Insects, Plant material
EN1103123-002	BD-3	17-Oct-11	Oct-11	ALS	1250	1700	1.0		1.4	4.0	0.4	
EN1103468-002	BD-3	15-Nov-11	Nov-11	ALS	1245	400	1.1		1.4	4.0	0.6	Insects, Plant material
EN1104230-002	BD-3	15-Dec-11	Dec-11	ALS	1220	2500	0.7		1.3	4.0	0.5	Insects, Plant material
EN1200243-002	BD-3	13-Jan-12	Jan-12	ALS	1245	600	0.6		1.3	4.0	0.4	Insects, Plant material
EN1200609-002	BD-3	13-Feb-12	Feb-12	ALS	1400	2500	0.2		1.3	4.0	0.1	Insects, Plant material
EN1201022-002	BD-3	15-Mar-12	Mar-12	ALS	1200	500	1.9		1.3	4.0	0.2	Insects, Plant material
EN1201452-002	BD-3	16-Apr-12	Apr-12	ALS	1215	100	1.9		1.3	4.0	0.2	Insects, Plant material
EN1201861-002	BD-3	17-May-12	May-12	ALS	1245	200	1.0		1.3	4.0	0.4	Insects, Plant material
EN1202262-002	BD-3	18-Jun-12	Jun-12	ALS	1300	1500	0.4		1.3	4.0	0.3	Plant material
EN1202678-002	BD-3	18-Jul-12	Jul-12	ALS	1330	1600	0.2		1.3	4.0	0.2	Insects
EN1203134-002	BD-3	17-Aug-12	Aug-12	ALS	1230	50	1.5		1.3	4.0	1.1	Insects, Plant material
EN1203584-002	BD-3	18-Sep-12	Sep-12	ALS	1305	100	1.8		1.3	4.0	1.2	Insects, Bird droppings
EN1203990-002	BD-3	18-Oct-12	Oct-12	ALS	1340	300	1.1		1.3	4.0	0.5	Insects
EN1204414-002	BD-3	19-Nov-12	Nov-12	ALS	1235	50	1.0		1.3	4.0	0.6	Insects, Plant material
EN1204844-002	BD-3	19-Dec-12	Dec-12	ALS	1325	50	1.6		1.3	4.0	1.0	Insects, bird droppings
EN1300224-002	BD-3	17-Jan-13	Jan-13	ALS	1310	150	1.4		1.3	4.0	0.9	Insects, plant material
EN1300660-002	BD-3	18-Feb-13	Feb-13	ALS	1145	1900	0.7		1.3	4.0	0.5	Insects, plant material
EN1301078-002	BD-3	18-Mar-13	Mar-13	ALS	1320	700	0.7		1.3	4.0	0.3	Insects, plant material
EN1301447-002	BD-3	17-Apr-13	Apr-13	ALS	1245	200	0.3		1.3	4.0	0.2	Insects, plant material
EN1301833-002	BD-3	16-May-13	May-13	ALS	1230	150	0.4		1.2	4.0	0.4	Insects, plant material
EN1302215-002	BD-3	17-Jun-13	Jun-13	ALS	1325	1100	0.4		1.2	4.0	0.3	Insects, plant material
EN1302629-002	BD-3	16-Jul-13	Jul-13	ALS	1310	400	0.5		1.2	4.0	0.5	Insects
EN1303028-002	BD-3	15-Aug-13	Aug-13	ALS	1000	300	0.1		1.2	4.0	0.1	Insects, plant material
EN1303431-002	BD-3	16-Sep-13	Sep-13	ALS	1305	150	0.5		1.2	4.0	0.3	Insects, plant material
EN1303808-002	BD-3	15-Oct-13	Oct-13	ALS	1245	300	1.1		1.2	4.0	0.8	Insects, plant material
WN1304189-002	BD-3	14-Nov-13	Nov-13	ALS	1235	300	1.2		1.2	4.0	0.9	Insects, plant material
EN1304649-002	BD-3	16-Dec-13	Dec-13	ALS	1115	450	0.6		1.2	4.0	0.6	Insects, plant material
2600185401-002	BD-3	14-Jan-14	Jan-14	ALS	1250	100	0.5		1.2	4.0	0.3	Insects, plant material
2600186701-002	BD-3	13-Feb-14	Feb-14	ALS	1255	200	3.3		1.2	4.0	3.0	Plant material
2600188201-002	BD-3	14-Mar-14	Mar-14	ALS	1245	550	4.1		1.2	4.0	1.3	Spider in bottle, insects
2600189701-002	BD-3	15-Apr-14	Apr-14	ALS	1235	1100	0.4		1.2	4.0	0.2	Plant material, broken funnel, recent heavy rain
2600191001-002	BD-3	15-May-14	May-14	ALS	1230	250	0.1		1.2	4.0	0.1	Plant material
2600192301-002	BD-3	16-Jun-14	Jun-14	ALS	1155	1000	0.8		1.2	4.0	0.5	Insects
2600193601-002	BD-3	15-Jul-14	Jul-14	ALS	1240	250	<0.1		1.2	4.0	<0.1	Insects, Plant material
2600195001-002	BD3	15-Aug-14	Aug-14	ALS	12:30	300	0.3	0.3	1.2	4.0	0.1	Insects, Plant material
2600196401-002	BD-3	16-Sep-14	Sep-14	ALS	1300	1250	0.2	0.3	1.2	4.0	0.1	
2600197801-002	BD3	17-Oct-14	Oct-14	ALS	13:25	700	0.9	0.5	1.2	4.0	0.5	Insects, Plant material
2600199201-002	BD3	18-Nov-14	Nov-14	ALS	11:20	500	0.8	0.6	1.2	4.0	0.5	Insects
2600200901-002	BD3	18-Dec-14	Dec-14	ALS	12:40	1000	3.7	1.2	1.2	4.0	2.5	Insects-glass
2600202401-002	BD3	19-Jan-15	Jan-15	ALS	12:30	2750	0.3	1.0	1.2	4.0	0.1	Insects
2600204001-002	BD3	18-Feb-15	Feb-15	ALS	11:40	1250	1.8	1.1	1.2	4.0	1	Insects, Plant material
2600205501-002	BD3	19-Mar-15	Mar-15	ALS	10:35	450	7.9	2.0	1.3	4.0	4.7	Insects, Plant material-funnel broken in bottle

Sample Number	Sample Location	Sample Date	Sample Month	Sampler	Time	Volume Collected ml	Total Insoluble Matter g/m²/mth	Reporting Period Average - Total Insoluble Matter	Long Term Average - Total Insoluble Matter	Annual Average Limit	Ash g/m²/mth	Comment
2600207001-002	BD3	17-Apr-15	Apr-15	ALS	11:45	1500	2	2.0	1.3	4.0	1	Insects
2600208501-002	BD3	19-May-15	May-15	ALS	13:15	1000	0.5	1.8	1.3	4.0	0.3	Insects, Plant material
2600209901-002	BD3	22-Jun-15	Jun-15	ALS	12:30	1500	0.8	1.7	1.3	4.0	0.5	Plant material
2600211301-002	BD3	20-Jul-15	Jul-15	ALS	11:45	250	0.4	1.6	1.3	4.0	0.1	Insects, Plant material



Deposited Dust BD-4 "Surrey"

Sample Number	Sample Location	Sample Date	Sample Month	Sampler	Time	Volume Collected ml	Total Insoluble Matter g/m²/mth	Reporting Period Average - Total Insoluble Matter	Long Term Average - Total Insoluble Matter	Annual Average Limit	Ash g/m²/mth	Comment
28550.04	BD-4	05-Nov-07	Oct-07	Client	1245	610	1.6		1.6	4.0	0.4	
28662.04	BD-4	05-Dec-07	Nov-07	Client	1400	1530	1.3		1.5	4.0	0.9	
28923.04	BD-4	03-Jan-08	Dec-07	Client	1000	1465	1.1		1.3	4.0	0.4	
29224.04	BD-4	05-Feb-08	Jan-08	Client	1415	1365	3.3		1.8	4.0	0.9	
29525.04	BD-4	05-Mar-08	Feb-08	Client	1135	1115	1.3		1.7	4.0	0.5	
29773.04	BD-4	04-Apr-08	Mar-08	Client	0845	100	2.1		1.8	4.0	1.1	
30055.04	BD-4	05-May-08	Apr-08	Client	1300	210	0.9		1.7	4.0	0.7	
30386.04	BD-4	04-Jun-08	May-08	Client	1140	965	0.5		1.5	4.0	0.5	
30660.04	BD-4	09-Jul-08	Jun-08	Client	1300	505	0.4		1.4	4.0	0.3	
30902.04	BD-4	05-Aug-08	Jul-08	Client	0840	280	0.2		1.3	4.0	0.2	
31210.04	BD-4	01-Sep-08	Aug-08	Client	1730	715	0.4		1.2	4.0	0.2	
31527.04	BD-4	02-Oct-08	Sep-08	Client	1500	1215	1.2		1.2	4.0	0.7	
31775.04	BD-4	05-Nov-08	Oct-08	Client	1735	1760	1.0		1.2	4.0	0.6	
32023.04	BD-4	04-Dec-08	Nov-08	Client	0845	1150	1.7		1.2	4.0	0.7	
32518.04	BD-4	05-Jan-09	Dec-08	Client	1642	1100	0.8		1.2	4.0	0.5	
32246.04	BD-4	02-Feb-09	Jan-09	Client	1504	215	1.1		1.2	4.0	0.7	
32863.04	BD-4	02-Mar-09	Feb-09	Client	1628	1620	0.6		1.1	4.0	0.3	
2600 1004 -00	BD-4	01-Apr-09	Mar-09	ALS Acirl		<50	1.8		1.2	4.0	1.2	
2600 1019 -00	BD-4	01-May-09	Apr-09	ALS Acirl		300	1.3		1.2	4.0	0.6	
2600 1034 -01	BD-4	04-Jun-09	May-09	ALS Acirl		600	0.5		1.2	4.0	0.4	
2600 1042 - 01	BD-4	06-Jul-09	Jun-09	ALS Acirl		450	0.3		1.1	4.0	0.2	
2602 1054 - 01	BD-4	03-Aug-09	Jul-09	ALS Acirl	1530	350	0.4		1.1	4.0	0.2	
2600 1064 - 00	BD-4	31-Aug-09	Aug-09	ALS Acirl	1512	20	1.1		1.1	4.0	0.8	
2600 1098 - 01	BD-4	29-Sep-09	Sep-09	ALS Acirl	1425	800	10.6		1.5	4.0	8.7	
2600 1128 - 00	BD-4	03-Nov-09	Oct-09	ALS Acirl	1433	700	1.2		1.5	4.0	0.7	
2601 1204 - 00	BD-4	04-Dec-09	Nov-09	ALS Acirl	1230	dry	2.0		1.5	4.0	1.2	
2600 1222 - 00	BD-4	04-Jan-10	Dec-09	ALS Acirl	1640	2500	0.6		1.5	4.0	1.2	
2600 1234 - 00	BD-4	01-Feb-10	Jan-10	ALS Acirl	1525	50	1.4		1.5	4.0	0.6	
2600 1247 - 00	BD-4	02-Mar-10	Feb-10	ALS Acirl	1410	2300	0.8		1.4	4.0	0.5	
2600 1260 - 00	BD-4	30-Mar-10	Mar-10	ALS Acirl	1340	200	0.9		1.4	4.0	0.6	
2600 1268 - 00	BD-4	27-Apr-10	Apr-10	ALS Acirl	1400	350	0.9		1.4	4.0	0.5	
2600 1277 - 00	BD-4	25-May-10	May-10	ALS Acirl	1505	10	0.4		1.4	4.0	0.3	
2600 1288 - 776	BD-4	24-Jun-10	Jun-10	ALS Acirl	0915	900	0.9		1.4	4.0	0.7	
2600 1288 - 827	BD-4	22-Jul-10	Jul-10	ALS Acirl	0835	600	0.4		1.3	4.0	0.2	
2600-1309-913	BD-4	20-Aug-10	Aug-10	ALS Acirl	1425	2000	0.4		1.3	4.0	0.2	Insects, Plant Material
6800-4319-07	BD-4	21-Sep-10	Sep-10	ALS Acirl	1025	800	1.1		1.3	4.0	0.6	Insects
2600-1340-09	BD-4	21-Oct-10	Oct-10	ALS Acirl	1230	2500	0.8		1.3	4.0	0.6	No observations recorded
EN1002887-003	BD-4	22-Nov-10	Nov-10	ALS Acirl	1535	2400	1.4		1.3	4.0	1.2	Insects/Plant Material
EN1003102-003	BD-4	22-Dec-10	Dec-10	ALS Acirl	1440	1300	0.5		1.3	4.0	0.2	Insects/Bird Droppings/Plant
EN1100201-003	BD-4	21-Jan-11	Jan-11	ALS Acirl	1405	300	2.2		1.3	4.0	1.6	Insects/Plant Material
EN1100445-003	BD-4	22-Feb-11	Feb-11	ALS Acirl	1300	200	2.6		1.3	4.0	0.8	Insects/Plant Mat/Bird Droppings
EN1100694-003	BD-4	24-Mar-11	Mar-11	ALS Acirl	1150	400	1.2		1.3	4.0	0.8	Insects/Plant Material
EN1100921-003	BD-4	20-Apr-11	Apr-11	ALS Acirl	1230	250	0.4		1.3	4.0	0.4	flying ants/Insects
EN1101201-003	BD-4	20-May-11	May-11	ALS Acirl	1210	Nil	0.3		1.3	4.0	0.2	Insects/Plant Material

WHITEHAVEN COAL MINING PTY LTD

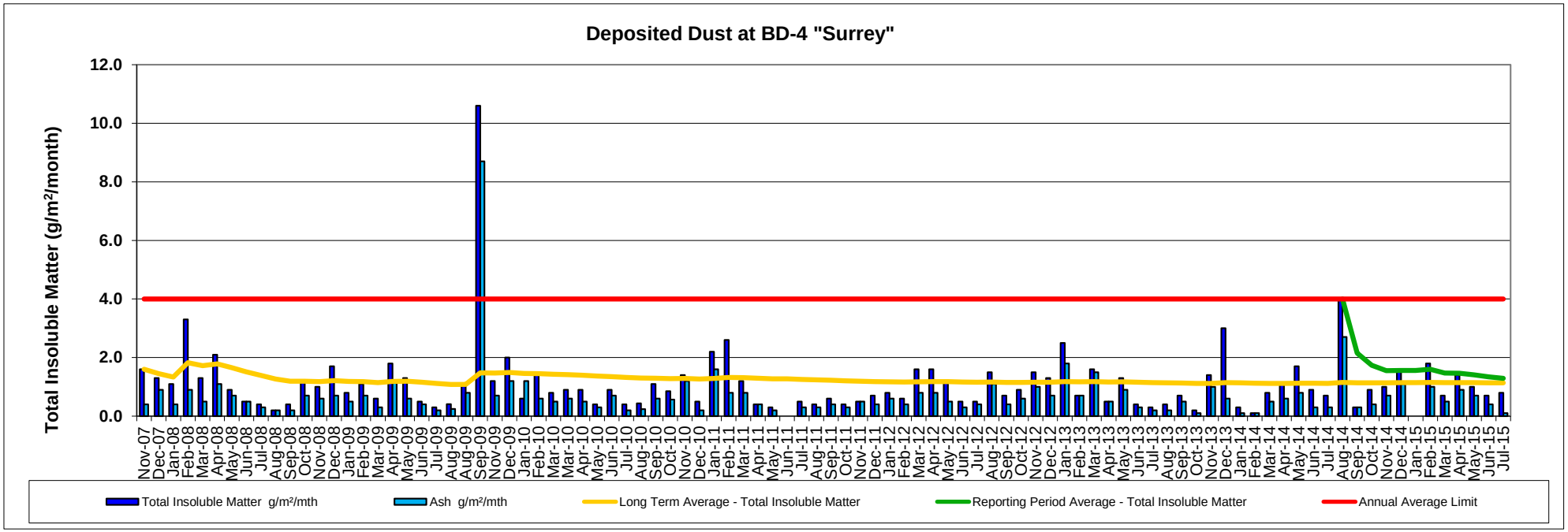
Deposited Dust Data - BD-4

Sample Number	Sample Location	Sample Date	Sample Month	Sampler	Time	Volume Collected ml	Total Insoluble Matter g/m²/mth	Reporting Period Average - Total Insoluble Matter	Long Term Average - Total Insoluble Matter	Annual Average Limit	Ash g/m²/mth	Comment
	BD-4	20-Jun-11	Jun-11	ALS Acirl	1300				1.3	4.0		Dry/Funnel Broken/Bottle Broken
EN1101811-003	BD-4	19-Jul-11	Jul-11	ALS Acirl	1310	50	0.5		1.3	4.0	0.3	Clear
EN1102303-003	BD-4	17-Aug-11	Aug-11	ALS	1310	80	0.4		1.2	4.0	0.3	Insects
EN1102774-003	BD-4	16-Sep-11	Sep-11	ALS	1330	900	0.6		1.2	4.0	0.4	Insects, Plant material
EN1103123-003	BD-4	17-Oct-11	Oct-11	ALS	1340	1700	0.4		1.2	4.0	0.3	Insects, Bird Droppings
EN1103468-003	BD-4	15-Nov-11	Nov-11	ALS	1330	300	0.5		1.2	4.0	0.5	Insects, Plant material
EN1104230-003	BD-4	15-Dec-11	Dec-11	ALS	1225	2500	0.7		1.2	4.0	0.4	Insects, Plant material
EN1200243-003	BD-4	13-Jan-12	Jan-12	ALS	1340	300	0.8		1.2	4.0	0.6	Insects, Plant material
EN1200609-003	BD-4	13-Feb-12	Feb-12	ALS	1445	2500	0.6		1.2	4.0	0.4	Insects, Plant material
EN1201022-003	BD-4	15-Mar-12	Mar-12	ALS	1230	500	1.6		1.2	4.0	0.8	Insects, Plant material
EN1201452-003	BD-4	16-Apr-12	Apr-12	ALS	1300	200	1.6		1.2	4.0	0.8	Insects, Plant material
EN1201861-003	BD-4	17-May-12	May-12	ALS	1415	200	1.2		1.2	4.0	0.5	Insects, Bird Droppings
EN1202262-003	BD-4	18-Jun-12	Jun-12	ALS	1415	1200	0.5		1.2	4.0	0.3	Insects
EN1202678-003	BD-4	18-Jul-12	Jul-12	ALS	1455	1600	0.5		1.2	4.0	0.4	Insects
EN1203134-003	BD-4	17-Aug-12	Aug-12	ALS	1355	100	1.5		1.2	4.0	1.1	Insects, Plant material
EN1203584-003	BD-4	18-Sep-12	Sep-12	ALS	1440	100	0.7		1.2	4.0	0.4	Insects
EN1203990-003	BD-4	18-Oct-12	Oct-12	ALS	1500	300	0.9		1.1	4.0	0.6	Insects, Bird droppings
EN1204414-003	BD-4	19-Nov-12	Nov-12	ALS	1350	50	1.5		1.2	4.0	1.0	Insects, Bird droppings
EN1204844-003	BD-4	19-Dec-12	Dec-12	ALS	1410	50	1.3		1.2	4.0	0.7	Insects
EN1300224-003	BD-4	17-Jan-13	Jan-13	ALS	1340	250	2.5		1.2	4.0	1.8	Insects, Bird droppings
EN1300660-003	BD-4	18-Feb-13	Feb-13	ALS	1320	1800	0.7		1.2	4.0	0.7	Insects, plant material
EN1301078-003	BD-4	18-Mar-13	Mar-13	ALS	1410	800	1.6		1.2	4.0	1.5	Insects, plant material
EN1301447-003	BD-4	17-Apr-13	Apr-13	ALS	1345	200	0.5		1.2	4.0	0.5	Insects, plant material
EN1301833-003	BD-4	16-May-13	May-13	ALS	1330	150	1.3		1.2	4.0	0.9	Insects, plant material-dead spider in bottle
EN1302215-003	BD-4	17-Jun-13	Jun-13	ALS	1415	900	0.4		1.2	4.0	0.3	Insects
EN1302629-003	BD-4	16-Jul-13	Jul-13	ALS	1430	400	0.3		1.1	4.0	0.2	Insects
EN1303028-007	BD-4	15-Aug-13	Aug-13	ALS	830	300	0.4		1.1	4.0	0.2	Insects, plant material
EN1303431-007	BD-4	16-Sep-13	Sep-13	ALS	1405	100	0.7		1.1	4.0	0.5	Insects, plant material
EN1303808-007	BD-4	15-Oct-13	Oct-13	ALS	0:00	300	0.2		1.1	4.0	0.1	Insects, plant material
WN1304189-003	BD-4	14-Nov-13	Nov-13	ALS	0:00	300	1.4		1.1	4.0	1.0	Insects, plant material
EN1304649-003	BD-4	16-Dec-13	Dec-13	ALS	0:00	650	3.0		1.1	4.0	0.6	Insects, plant material
2600185401-003	BD-4	14-Jan-14	Jan-14	ALS	0:00	100	0.3		1.1	4.0	0.1	Insects, plant material
2600186701-003	BD-4	13-Feb-14	Feb-14	ALS	0:00	100	0.1		1.1	4.0	0.1	
2600188201-003	BD-4	14-Mar-14	Mar-14	ALS	0:00	480	0.8		1.1	4.0	0.5	Insects
2600189701-003	BD-4	15-Apr-14	Apr-14	ALS	0:00	2000	1.1		1.1	4.0	0.6	Insects, plant material, recent heavy rain
2600191001-003	BD-4	15-May-14	May-14	ALS	0:00	500	1.7		1.1	4.0	0.8	Plant material
2600192301-003	BD-4	16-Jun-14	Jun-14	ALS	0:00	1000	0.9		1.1	4.0	0.3	Plant material
2600193601-003	BD-4	15-Jul-14	Jul-14	ALS	0:00	300	0.7		1.1	4.0	0.3	Plant material
2600195001-003	BD4	15-Aug-14	Aug-14	ALS	13:40	450	4	4.0	1.2	4.0	2.7	Insects, Plant material
2600196401-003	BD-4	16-Sep-14	Sep-14	ALS	12:30	1200	0.3	2.2	1.1	4.0	0.3	Insects, plant material
2600197801-003	BD4	17-Oct-14	Oct-14	ALS	13:50	700	0.9	1.7	1.1	4.0	0.4	Insects, plant material
2600199201-003	BD4	18-Nov-14	Nov-14	ALS	12:40	500	1	1.6	1.1	4.0	0.7	Insects
2600200901-003	BD4	18-Dec-14	Dec-14	ALS	13:30	1000	1.6	1.6	1.1	4.0	1.1	Insects, Plant material
2600202401-003	BD4	19-Jan-15	Jan-15	ALS	13:35	2000	<0.1	1.6	1.1	4.0	<0.1	Insects
2600204001-003	BD4	18-Feb-15	Feb-15	ALS	12:45	550	1.8	1.6	1.1	4.0	1	Insects, Plant material
2600205501-003	BD4	19-Mar-15	Mar-15	ALS	9:30	500	0.7	1.5	1.1	4.0	0.5	Insects-funnel broken-funnel replaced

WHITEHAVEN COAL MINING PTY LTD

Deposited Dust Data - BD-4

Sample Number	Sample Location	Sample Date	Sample Month	Sampler	Time	Volume Collected ml	Total Insoluble Matter g/m²/mth	Reporting Period Average - Total Insoluble Matter	Long Term Average - Total Insoluble Matter	Annual Average Limit	Ash g/m²/mth	Comment
2600207001-003	BD4	17-Apr-15	Apr-15	ALS	12:55	1750	1.4	1.5	1.1	4.0	0.9	Insects
2600208501-003	BD4	19-May-15	May-15	ALS	13:55		1	1.4	1.1	4.0	0.7	
2600209901-003	BD4	22-Jun-15	Jun-15	ALS	13:05	1750	0.7	1.3	1.1	4.0	0.4	Insects, Plant material
2600211301-003	BD4	20-Jul-15	Jul-15	ALS	12:45	250	0.8	1.3	1.1	4.0	0.1	Insects



Deposited Dust BD-5 "Stratford"

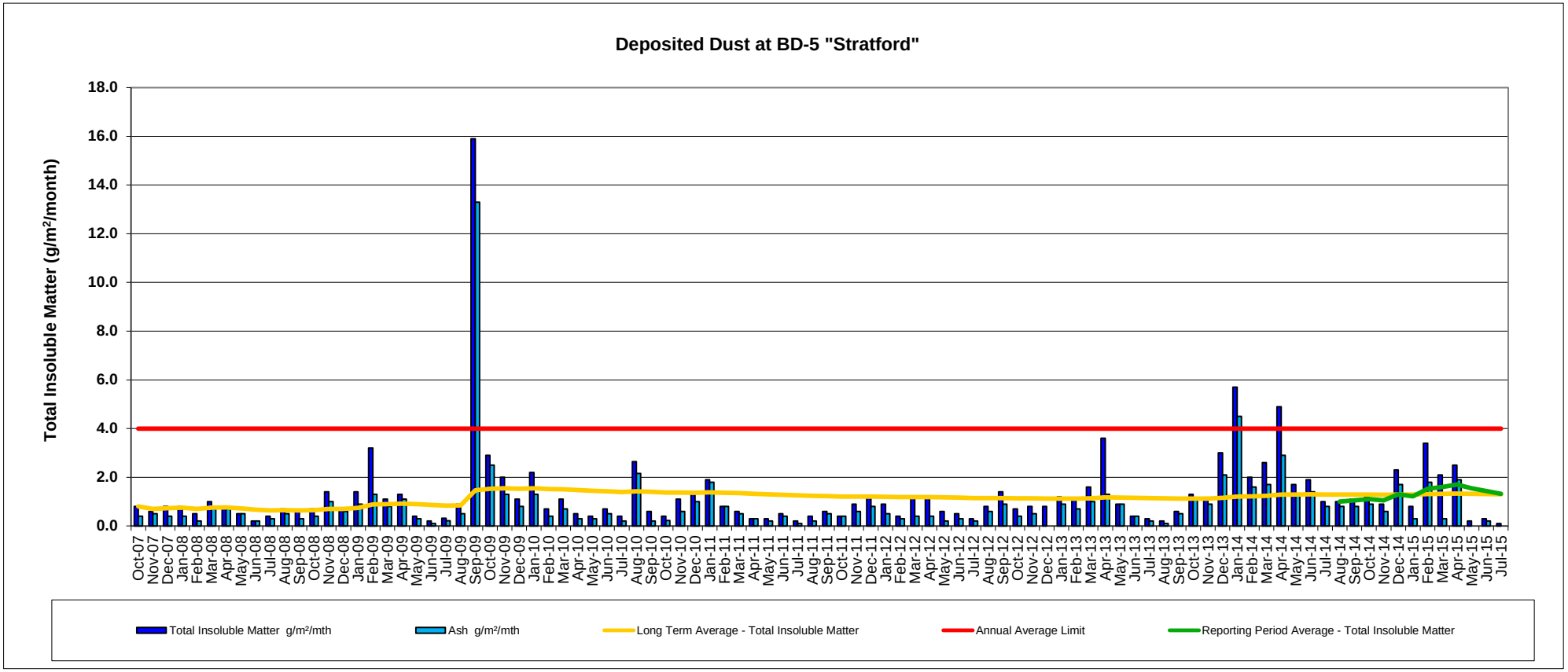
Sample Number	Sample Location	Sample Date	Sample Month	Sampler	Time	Volume Collected ml	Total Insoluble Matter g/m²/mth	Reporting Period Average - Total Insoluble Matter	Long Term Average - Total Insoluble Matter	Annual Average Limit	Ash g/m²/mth	Comment
28550.05	BD-5	05-Nov-07	Oct-07	Client	1300	695	0.8		0.8	4.0	0.4	
28662.05	BD-5	05-Dec-07	Nov-07	Client	1350	1165	0.6		0.7	4.0	0.5	
28923.05	BD-5	03-Jan-08	Dec-07	Client	1020	1500	0.8		0.7	4.0	0.4	
29224.05	BD-5	05-Feb-08	Jan-08	Client	1350	1220	0.8		0.8	4.0	0.4	
29525.05	BD-5	05-Mar-08	Feb-08	Client	1150	1050	0.5		0.7	4.0	0.2	
29773.05	BD-5	04-Apr-08	Mar-08	Client	0905	50	1.0		0.8	4.0	0.7	
30055.05	BD-5	05-May-08	Apr-08	Client	1230	175	0.8		0.8	4.0	0.7	
30386.05	BD-5	04-Jun-08	May-08	Client	1110	835	0.5		0.7	4.0	0.5	
30660.05	BD-5	09-Jul-08	Jun-08	Client	1315	555	0.2		0.7	4.0	0.2	
30902.05	BD-5	05-Aug-08	Jul-08	Client	0820	280	0.4		0.6	4.0	0.3	
31210.05	BD-5	02-Sep-08	Aug-08	Client	1100	640	0.7		0.6	4.0	0.5	
31527.05	BD-5	02-Oct-08	Sep-08	Client	1430	995	0.6		0.6	4.0	0.3	
31775.05	BD-5	05-Nov-08	Oct-08	Client	1700	1500	0.7		0.6	4.0	0.4	
32023.05	BD-5	04-Dec-08	Nov-08	Client	0805	1175	1.4		0.7	4.0	1.0	
32518.05	BD-5	05-Jan-09	Dec-08	Client	1614	1180	0.7		0.7	4.0	0.6	
32246.05	BD-5	02-Feb-09	Jan-09	Client	1442	235	1.4		0.7	4.0	0.9	
32863.05	BD-5	02-Mar-09	Feb-09	Client	1551	1520	3.2		0.9	4.0	1.3	
2600 1004 -00	BD-5	01-Apr-09	Mar-09	ALS Acirl		50	1.1		0.9	4.0	0.8	
2600 1019 -00	BD-5	01-May-09	Apr-09	ALS Acirl		400	1.3		0.9	4.0	1.1	
2600 1034 -01	BD-5	04-Jun-09	May-09	ALS Acirl		500	0.4		0.9	4.0	0.3	
2600 1042 - 01	BD-5	06-Jul-09	Jun-09	ALS Acirl		550	0.2		0.9	4.0	0.1	
2603 1054 - 01	BD-5	03-Aug-09	Jul-09	ALS Acirl	1355	450	0.3		0.8	4.0	0.2	
2600 1064 - 00	BD-5	31-Aug-09	Aug-09	ALS Acirl	1524	20	0.9		0.8	4.0	0.5	
2600 1098 - 01	BD-5	29-Sep-09	Sep-09	ALS Acirl	1450	700	15.9		1.5	4.0	13.3	
2600 1128 - 00	BD-5	03-Nov-09	Oct-09	ALS Acirl	1445	600	2.9		1.5	4.0	2.5	
2601 1204 - 00	BD-5	04-Dec-09	Nov-09	ALS Acirl	1205	10	2.0		1.5	4.0	1.3	
2600 1222 - 00	BD-5	04-Jan-10	Dec-09	ALS Acirl	1645	2500	1.1		1.5	4.0	0.8	
2600 1234 - 00	BD-5	01-Feb-10	Jan-10	ALS Acirl	1500	300	2.2		1.6	4.0	1.3	
2600 1247 - 00	BD-5	02-Mar-10	Feb-10	ALS Acirl	1430	2200	0.7		1.5	4.0	0.4	
2600 1260 - 00	BD-5	30-Mar-10	Mar-10	ALS Acirl	1300	400	1.1		1.5	4.0	0.7	
2600 1268 - 00	BD-5	27-Apr-10	Apr-10	ALS Acirl	1335	400	0.5		1.5	4.0	0.3	
2600 1277 - 00	BD-5	25-May-10	May-10	ALS Acirl	1345	10	0.4		1.4	4.0	0.3	
2600 1288 - 776	BD-5	24-Jun-10	Jun-10	ALS Acirl	1136	800	0.7		1.4	4.0	0.5	
2600 1288 - 827	BD-5	22-Jul-10	Jul-10	ALS Acirl	0855	600	0.4		1.4	4.0	0.2	
2600-1309-913	BD-5	20-Aug-10	Aug-10	ALS Acirl	1245	2000	2.6		1.4	4.0	2.2	Insects, Plant Material
6800-4319-07	BD-5	21-Sep-10	Sep-10	ALS Acirl	1205	900	0.6		1.4	4.0	0.2	insects
2600-1340-09	BD-5	21-Oct-10	Oct-10	ALS Acirl	1050	2500	0.4		1.4	4.0	0.2	No observations recorded
EN1002887-004	BD-5	22-Nov-10	Nov-10	ALS Acirl	1445	2400	1.1		1.4	4.0	0.6	Insects/Plant Material
EN1003102-004	BD-5	22-Dec-10	Dec-10	ALS Acirl	1355	1800	1.3		1.4	4.0	1.0	Insects
EN1100201-004	BD-5	21-Jan-11	Jan-11	ALS Acirl	1245	400	1.9		1.4	4.0	1.8	Glass in Gauge/Insects/Plant
EN1100445-004	BD-5	22-Feb-11	Feb-11	ALS Acirl	1230	200	0.8		1.4	4.0	0.8	No field observations
EN1100694-004	BD-5	24-Mar-11	Mar-11	ALS Acirl	1125	500	0.6		1.3	4.0	0.5	Insects/Plant Material
EN1100921-004	BD-5	20-Apr-11	Apr-11	ALS Acirl	1200	300	0.3		1.3	4.0	0.3	Insects
EN1101201-004	BD-5	20-May-11	May-11	ALS Acirl	1240	Nil	0.3		1.3	4.0	0.2	Plant Material
EN1101447-003	BD-5	20-Jun-11	Jun-11	ALS Acirl	1315	1500	0.5		1.3	4.0	0.4	Plant Material
EN1101811-004	BD-5	19-Jul-11	Jul-11	ALS Acirl	1244	100	0.2		1.3	4.0	0.1	Clear
EN1102303-004	BD-5	17-Aug-11	Aug-11	ALS Acirl	1330	100	0.4		1.2	4.0	0.2	Insects

WHITEHAVEN COAL MINING PTY LTD
Deposited Dust Data - BD-5

Sample Number	Sample Location	Sample Date	Sample Month	Sampler	Time	Volume Collected ml	Total Insoluble Matter g/m²/mth	Reporting Period Average - Total Insoluble Matter	Long Term Average - Total Insoluble Matter	Annual Average Limit	Ash g/m²/mth	Comment
EN1102774-004	BD-5	16-Sep-11	Sep-11	ALS Acirl	1300	900	0.6		1.2	4.0	0.5	Insects
EN1103123-004	BD-5	17-Oct-11	Oct-11	ALS Acirl	1310	1700	0.4		1.2	4.0	0.4	Insects
EN1103468-004	BD-5	15-Nov-11	Nov-11	ALS Acirl	1300	400	0.9		1.2	4.0	0.6	Insects, Plant material
EN1104230-004	BD-5	15-Dec-11	Dec-11	ALS Acirl	1250	2500	1.2		1.2	4.0	0.8	Insects, Plant material
EN1200243-004	BD-5	13-Jan-12	Jan-12	ALS Acirl	1350	300	0.9		1.2	4.0	0.5	Insects, Plant material
EN1200609-004	BD-5	13-Feb-12	Feb-12	ALS Acirl	1430	2500	0.4		1.2	4.0	0.3	Insects, Plant material
EN1201022-004	BD-5	15-Mar-12	Mar-12	ALS Acirl	1300	500	1.2		1.2	4.0	0.4	Insects, Plant material
EN1201452-004	BD-5	16-Apr-12	Apr-12	ALS Acirl	1315	200	1.2		1.2	4.0	0.4	Insects, Plant material
EN1201861-004	BD-5	17-May-12	May-12	ALS Acirl	1325	200	0.6		1.2	4.0	0.2	Insects
EN1202262-004	BD-5	18-Jun-12	Jun-12	ALS Acirl	1315	1300	0.5		1.2	4.0	0.3	Insects, Plant material
EN1202678-004	BD-5	18-Jul-12	Jul-12	ALS Acirl	1420	1600	0.3		1.1	4.0	0.2	Surround still very wet
EN1203134-004	BD-5	17-Aug-12	Aug-12	ALS	1320	100	0.8		1.1	4.0	0.6	Insects, Bird droppings, Plant material
EN1203584-004	BD-5	18-Sep-12	Sep-12	ALS	1350	100	1.4		1.1	4.0	0.9	Insects, Plant material
EN1203990-004	BD-5	18-Oct-12	Oct-12	ALS	1410	300	0.7		1.1	4.0	0.4	Insects, Plant material
EN1204414-004	BD-5	19-Nov-12	Nov-12	ALS	1310	100	0.8		1.1	4.0	0.5	Insects, Plant material
EN1204844-004	BD-5	19-Dec-12	Dec-12	ALS	1240	50	0.8		1.1	4.0	-	Insects
EN1300224-004	BD-5	17-Jan-13	Jan-13	ALS	1230	300	1.2		1.1	4.0	0.9	Insects
EN1300660-004	BD-5	18-Feb-13	Feb-13	ALS	1240	2000	1.1		1.1	4.0	0.7	Insects, plant material
EN1301078-004	BD-5	18-Mar-13	Mar-13	ALS	1350	800	1.6		1.1	4.0	1.0	Insects, plant material
EN1301447-004	BD-5	17-Apr-13	Apr-13	ALS	1315	200	3.6		1.2	4.0	1.3	Insects, plant material
EN1301833-004	BD-5	16-May-13	May-13	ALS	1245	200	0.9		1.2	4.0	0.9	Insects, plant material
EN1302215-004	BD-5	17-Jun-13	Jun-13	ALS	1350	1100	0.4		1.2	4.0	0.4	Insects
EN1302629-004	BD-5	16-Jul-13	Jul-13	ALS	1400	400	0.3		1.1	4.0	0.2	Insects
EN1303028-005	BD5	15-Aug-13	Aug-13	ALS	920	300	0.2		1.1	4.0	0.1	Insects, plant material
EN1303431-005	BD5	16-Sep-13	Sep-13	ALS	1320	100	0.6		1.1	4.0	0.5	Insects, plant material
EN1303808-005	BD5	15-Oct-13	Oct-13	ALS	1315	300	1.3		1.1	4.0	1.1	Insects, plant material
WN1304189-004	BD5	14-Nov-13	Nov-13	ALS	1315	350	1.1		1.1	4.0	0.9	Insects, plant material
EN1304649-004	BD5	16-Dec-13	Dec-13	ALS	1200	600	3.0		1.2	4.0	2.1	Insects, plant material
2600185401-004	BD5	14-Jan-14	Jan-14	ALS	1330	100	5.7		1.2	4.0	4.5	Insects, plant material
2600186701-004	BD5	13-Feb-14	Feb-14	ALS	1310	100	2.0		1.2	4.0	1.6	Insects, plant material
2600188201-004	BD5	14-Mar-14	Mar-14	ALS	1330	950	2.6		1.2	4.0	1.7	Insects, plant material
2600189701-004	BD5	15-Apr-14	Apr-14	ALS	1305	2200	4.9		1.3	4.0	2.9	Insects, plant material, recent heavy rain
2600191001-004	BD5	15-May-14	May-14	ALS	1320	500	1.7		1.3	4.0	1.3	Insects
2600192301-004	BD5	16-Jun-14	Jun-14	ALS	1245	1250	1.9		1.3	4.0	1.4	Plant material
2600193601-004	BD5	15-Jul-14	Jul-14	ALS	1300	500	1.0		1.3	4.0	0.8	Insects, Plant material
2600195001-004	BD5	15-Aug-14	Aug-14	ALS	13:10	300	1	1.0	1.3	4.0	0.8	Insects, Plant material
2600196401-004	BD5	16-Sep-14	Sep-14	ALS	13:45	1200	1.1	1.1	1.3	4.0	0.8	Insects
2600197801-004	BD5	17-Oct-14	Oct-14	ALS	13:40	700	1.2	1.1	1.3	4.0	0.9	Insects
2600199201-004	BD5	18-Nov-14	Nov-14	ALS	12:00	400	0.9	1.1	1.3	4.0	0.6	Insects, Plant material
2600200901-004	BD5	18-Dec-14	Dec-14	ALS	13:00	1100	2.3	1.3	1.3	4.0	1.7	Insects, Plant material
2600202401-004	BD5	19-Jan-15	Jan-15	ALS	13:05	1800	0.8	1.2	1.3	4.0	0.3	Insects
2600204001-004	BD5	18-Feb-15	Feb-15	ALS	12:35	750	3.4	1.5	1.3	4.0	1.8	Insects
2600205501-004	BD5	19-Mar-15	Mar-15	ALS	10:00	500	2.1	1.6	1.3	4.0	0.3	Insects, Plant material
2600207001-004	BD5	17-Apr-15	Apr-15	ALS	12:25	1800	2.5	1.7	1.3	4.0	1.9	Insects

WHITEHAVEN COAL MINING PTY LTD
Deposited Dust Data - BD-5

Sample Number	Sample Location	Sample Date	Sample Month	Sampler	Time	Volume Collected ml	Total Insoluble Matter g/m²/mth	Reporting Period Average - Total Insoluble Matter	Long Term Average - Total Insoluble Matter	Annual Average Limit	Ash g/m²/mth	Comment
2600208501-004	BD5	19-May-15	May-15	ALS	13:30	1000	0.2	1.6	1.3	4.0	<0.1	Insects, Plant material
2600209901-004	BD5	22-Jun-15	Jun-15	ALS	13:20	2000	0.3	1.4	1.3	4.0	0.2	
2600211301-004	BD5	20-Jul-15	Jul-15	ALS	12:15	250	0.1	1.3	1.3	4.0	<0.1	Insects



Deposited Dust BD-6 "Roseberry"

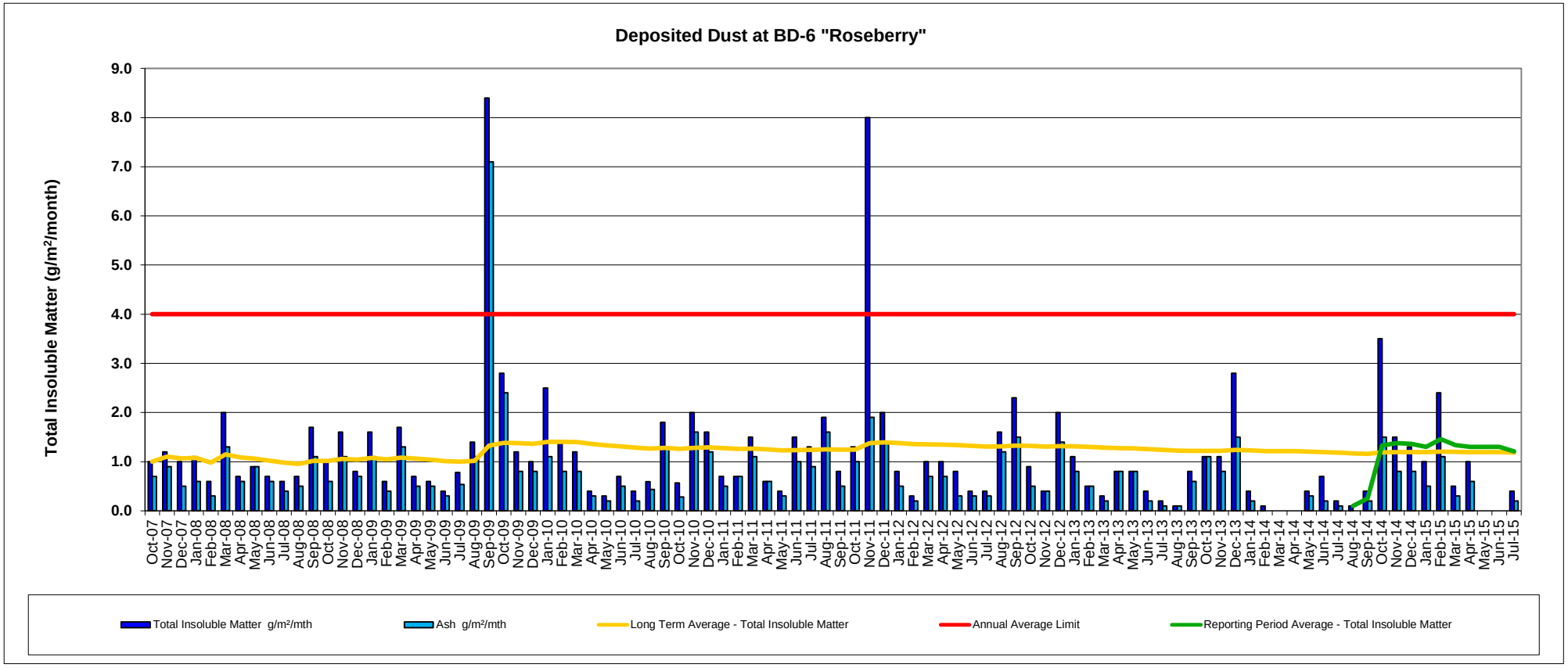
Sample Number	Sample Location	Sample Date	Sample Month	Sampler	Time	Volume Collected ml	Total Insoluble Matter g/m²/mth	Reporting Period Average - Total Insoluble Matter	Long Term Average - Total Insoluble Matter	Annual Average Limit	Ash g/m²/mth	Comment
28550.06	BD-6	05-Nov-07	Oct-07	Client	1250	610	1.0		1.0	4.0	0.7	
28662.06	BD-6	05-Dec-07	Nov-07	Client	1330	1690	1.2		1.1	4.0	0.9	
28923.06	BD-6	03-Jan-08	Dec-07	Client	1010	1235	1.0		1.1	4.0	0.5	
29224.06	BD-6	05-Feb-08	Jan-08	Client	1400	1065	1.1		1.1	4.0	0.6	
29525.06	BD-6	05-Mar-08	Feb-08	Client	1145	1090	0.6		1.0	4.0	0.3	
29773.06	BD-6	04-Apr-08	Mar-08	Client	0855	130	2.0		1.2	4.0	1.3	
30055.06	BD-6	05-May-08	Apr-08	Client	1240	215	0.7		1.1	4.0	0.6	
30386.06	BD-6	04-Jun-08	May-08	Client	1125	860	0.9		1.1	4.0	0.9	
30660.06	BD-6	09-Jul-08	Jun-08	Client	1305	565	0.7		1.0	4.0	0.6	
30902.06	BD-6	05-Aug-08	Jul-08	Client	0830	310	0.6		1.0	4.0	0.4	
31210.06	BD-6	01-Sep-08	Aug-08	Client	1700	665	0.7		1.0	4.0	0.5	
31527.06	BD-6	02-Oct-08	Sep-08	Client	1515	1245	1.7		1.0	4.0	1.1	
31775.06	BD-6	05-Nov-08	Oct-08	Client	1710	1595	1.0		1.0	4.0	0.6	
32023.06	BD-6	04-Dec-08	Nov-08	Client	0825	1275	1.6		1.1	4.0	1.1	
32518.06	BD-6	05-Jan-09	Dec-08	Client	1630	1230	0.8		1.0	4.0	0.7	
32246.06	BD-6	02-Feb-09	Jan-09	Client	1520	110	1.6		1.1	4.0	1.1	
32863.06	BD-6	02-Mar-09	Feb-09	Client	1605	1450	0.6		1.0	4.0	0.4	
2600 1004 -00	BD-6	01-Apr-09	Mar-09	ALS Acirl		<50	1.7		1.1	4.0	1.3	
2600 1019 -00	BD-6	01-May-09	Apr-09	ALS Acirl		300	0.7		1.1	4.0	0.5	
2600 1034 -01	BD-6	04-Jun-09	May-09	ALS Acirl		600	0.6		1.0	4.0	0.5	
2600 1042 - 01	BD-6	06-Jul-09	Jun-09	ALS Acirl		650	0.4		1.0	4.0	0.3	
2604 1054 - 01	BD-6	03-Aug-09	Jul-09	ALS Acirl	1510	350	0.8		1.0	4.0	0.5	
2600 1064 - 00	BD-6	31-Aug-09	Aug-09	ALS Acirl	1500	20	1.4		1.0	4.0	1.1	
2600 1098 - 01	BD-6	29-Sep-09	Sep-09	ALS Acirl	1405	300	8.4		1.3	4.0	7.1	
2600 1128 - 00	BD-6	03-Nov-09	Oct-09	ALS Acirl	1415	700	2.8		1.4	4.0	2.4	
2601 1204 - 00	BD-6	04-Dec-09	Nov-09	ALS Acirl	1215	dry	1.2		1.4	4.0	0.8	
2600 1222 - 00	BD-6	04-Jan-10	Dec-09	ALS Acirl	1635	2500	1.0		1.4	4.0	0.8	
2600 1234 - 00	BD-6	01-Feb-10	Jan-10	ALS Acirl	1517	100	2.5		1.4	4.0	1.1	
2600 1247 - 00	BD-6	02-Mar-10	Feb-10	ALS Acirl	1400	2300	1.4		1.4	4.0	0.8	
2600 1260 - 00	BD-6	30-Mar-10	Mar-10	ALS Acirl	1330	200	1.2		1.4	4.0	0.8	
2600 1268 - 00	BD-6	27-Apr-10	Apr-10	ALS Acirl	1345	400	0.4		1.4	4.0	0.3	
2600 1277 - 00	BD-6	25-May-10	May-10	ALS Acirl	1450	10	0.3		1.3	4.0	0.2	
2600 1288 - 776	BD-6	24-Jun-10	Jun-10	ALS Acirl	0920	800	0.7		1.3	4.0	0.5	
2600 1288 - 827	BD-6	22-Jul-10	Jul-10	ALS Acirl	0845	500	0.4		1.3	4.0	0.2	
2600-1309-913	BD-6	20-Aug-10	Aug-10	ALS Acirl	1410	2000	0.6		1.3	4.0	0.4	Insects, Plant Material
6800-4319-07	BD-6	21-Sep-10	Sep-10	ALS Acirl	1040	900	1.8		1.3	4.0	1.3	insects, plant material
2600-1340-09	BD-6	21-Oct-10	Oct-10	ALS Acirl	1225	2500	0.6		1.3	4.0	0.3	No observations recorded
EN1002887-005	BD-6	22-Nov-10	Nov-10	ALS Acirl	1520	2200	2.0		1.3	4.0	1.6	Insects
EN1003102-005	BD-6	22-Dec-10	Dec-10	ALS Acirl	1415	2000	1.6		1.3	4.0	1.2	Insects/Plant Material
EN1100201-005	BD-6	21-Jan-11	Jan-11	ALS Acirl	1355	500	0.7		1.3	4.0	0.5	Insects/Plant Material
EN1100445-005	BD-6	22-Feb-11	Feb-11	ALS Acirl	1250	300	0.7		1.3	4.0	0.7	Insects/Plant Material
EN1100694-005	BD-6	24-Mar-11	Mar-11	ALS Acirl	1140	400	1.5		1.3	4.0	1.1	Insects/Plant Material
EN1100921-005	BD-6	20-Apr-11	Apr-11	ALS Acirl	1215	250	0.6		1.2	4.0	0.6	Plant Material
EN1101201-005	BD-6	20-May-11	May-11	ALS Acirl	1200	Nil	0.4		1.2	4.0	0.3	Insects
EN1101447-004	BD-6	20-Jun-11	Jun-11	ALS Acirl	1240	1500	1.5		1.2	4.0	1.0	Bird Droppings/Plant Material

WHITEHAVEN COAL MINING PTY LTD

Deposited Dust Data - BD-6

Sample Number	Sample Location	Sample Date	Sample Month	Sampler	Time	Volume Collected ml	Total Insoluble Matter g/m²/mth	Reporting Period Average - Total Insoluble Matter	Long Term Average - Total Insoluble Matter	Annual Average Limit	Ash g/m²/mth	Comment
EN1101811-005	BD-6	19-Jul-11	Jul-11	ALS Acirl	1300	100	1.3		1.2	4.0	0.9	Green
EN1102303-005	BD-6	17-Aug-11	Aug-11	ALS Acirl	1250	80	1.9		1.3	4.0	1.6	Broken funnel - glass in bottle
EN1102774-005	BD-6	16-Sep-11	Sep-11	ALS Acirl	1315	700	0.8		1.2	4.0	0.5	Insects
EN1103123-005	BD-6	17-Oct-11	Oct-11	ALS Acirl	1330	1500	1.3		1.2	4.0	1.0	Insects, Plant material
EN1103468-005	BD-6	15-Nov-11	Nov-11	ALS Acirl	1315	200	8.0		1.4	4.0	1.9	Insects, Bird Droppings, Plant Material
EN1104230-005	BD-6	15-Dec-11	Dec-11	ALS Acirl	1230	2500	2.0		1.4	4.0	1.4	Insects, Plant material
EN1200243-005	BD-6	13-Jan-12	Jan-12	ALS Acirl	1330	300	0.8		1.4	4.0	0.5	Insects, Plant material
EN1200609-005	BD-6	13-Feb-12	Feb-12	ALS Acirl	1440	2500	0.3		1.4	4.0	0.2	Insects, Plant material
EN1201022-005	BD-6	15-Mar-12	Mar-12	ALS Acirl	1215	500	1.0		1.4	4.0	0.7	Insects, Plant material, funnel broken in bottle
EN1201452-005	BD-6	16-Apr-12	Apr-12	ALS Acirl	1300	<100ml	1.0		1.3	4.0	0.7	Insects, Plant material, dead frog in bottle
EN1201861-005	BD-6	17-May-12	May-12	ALS Acirl	1350	200	0.8		1.3	4.0	0.3	Insects, Plant material
EN1202262-005	BD-6	18-Jun-12	Jun-12	ALS Acirl	1350	600	0.4		1.3	4.0	0.3	Plant material
EN1202678-005	BD-6	18-Jul-12	Jul-12	ALS Acirl	1440	1600	0.4		1.3	4.0	0.3	Surround still very wet
EN1203134-005	BD-6	17-Aug-12	Aug-12	ALS	1345	100	1.6		1.3	4.0	1.2	Insects, Bird droppings, Plant material
EN1203584-005	BD-6	18-Sep-12	Sep-12	ALS	1410	100	2.3		1.3	4.0	1.5	Bird droppings, Plant material
EN1203990-005	BD-6	18-Oct-12	Oct-12	ALS	1445	200	0.9		1.3	4.0	0.5	Insects, Plant material
EN1204414-005	BD-6	19-Nov-12	Nov-12	ALS	1330	50	0.4		1.3	4.0	0.4	Insects, Bird droppings
EN1204844-005	BD-6	19-Dec-12	Dec-12	ALS	1340	50	2.0		1.3	4.0	1.4	Insects
EN1300224-005	BD-6	17-Jan-13	Jan-13	ALS	1330	150	1.1		1.3	4.0	0.8	Insects, plant material
EN1300660-005	BD-6	18-Feb-13	Feb-13	ALS	1310	2000	0.5		1.3	4.0	0.5	Insects, plant material
EN1301078-005	BD-6	18-Mar-13	Mar-13	ALS	1430	800	0.3		1.3	4.0	0.2	Insects, plant material
EN1301447-005	BD-6	17-Apr-13	Apr-13	ALS	1330	200	0.8		1.3	4.0	0.8	Insects, plant material
EN1301833-005	BD-6	16-May-13	May-13	ALS	1315	200	0.8		1.3	4.0	0.8	Insects, plant material
EN1302215-005	BD-6	17-Jun-13	Jun-13	ALS	1400	1000	0.4		1.3	4.0	0.2	Insects
EN1302629-005	BD-6	16-Jul-13	Jul-13	ALS	1420	500	0.2		1.2	4.0	0.1	Insects
EN1303028-003	BD-6	15-Aug-13	Aug-13	ALS	900	300	0.1		1.2	4.0	0.1	Insects, plant material
EN1303431-003	BD-6	16-Sep-13	Sep-13	ALS	1350	100	0.8		1.2	4.0	0.6	Insects, plant material
EN1303808-003	BD-6	15-Oct-13	Oct-13	ALS	1350	350	1.1		1.2	4.0	1.1	Insects, plant material
WN1304189-005	BD-6	14-Nov-13	Nov-13	ALS	1330	350	1.1		1.2	4.0	0.8	Insects, plant material
EN1304649-005	BD-6	16-Dec-13	Dec-13	ALS	1130	700	2.8		1.2	4.0	1.5	Insects, plant material
2600185401-005	BD-6	14-Jan-14	Jan-14	ALS	1345	100	0.4		1.2	4.0	0.2	Insects, plant material
2600186701-005	BD-6	13-Feb-14	Feb-14	ALS	1340	100	0.1		1.2	4.0	<0.1	Plant material
2600188201-005	BD-6	14-Mar-14	Mar-14	ALS	1345	600	<1		1.2	4.0	<0.1	
2600189701-005	BD-6	15-Apr-14	Apr-14	ALS	1320	750	<1		1.2	4.0	<0.1	Plant material, broken funnel, recent heavy rain
2600191001-005	BD-6	15-May-14	May-14	ALS	1335	300	0.4		1.2	4.0	0.3	
2600192301-005	BD-6	16-Jun-14	Jun-14	ALS	1300	750	0.7		1.2	4.0	0.2	Insects, Plant material
2600193601-005	BD-6	15-Jul-14	Jul-14	ALS	1315	500	0.2		1.2	4.0	0.1	Plant material
2600195001-005	BD6	15-Aug-14	Aug-14	ALS	13:25	300	0.1	0.1	1.2	4.0	<0.1	Plant material
2600196401-005	BD-6	16-Sep-14	Sep-14	ALS	14:05	1250	0.4	0.3	1.2	4.0	0.2	Insects, Plant material
2600197801-005	BD6	17-Oct-14	Oct-14	ALS	12:20	700	3.5	1.3	1.2	4.0	1.5	Insects, Plant material
2600199201-005	BD6	18-Nov-14	Nov-14	ALS	13:15	250	1.5	1.4	1.2	4.0	0.8	Insects
2600200901-005	BD6	18-Dec-14	Dec-14	ALS	13:20	1000	1.3	1.4	1.2	4.0	0.8	
2600202401-005	BD6	19-Jan-15	Jan-15	ALS	12:20	1700	1	1.3	1.2	4.0	0.5	Insects
2600204001-005	BD6	18-Feb-15	Feb-15	ALS	9:45	600	2.4	1.5	1.2	4.0	1.1	Insects
2600205501-005	BD6	19-Mar-15	Mar-15	ALS	12:40	250	0.5	1.3	1.2	4.0	0.3	Insects
2600207001-005	BD6	17-Apr-15	Apr-15	ALS	13:45	1750	1	1.3	1.2	4.0	0.6	Insects

Sample Number	Sample Location	Sample Date	Sample Month	Sampler	Time	Volume Collected ml	Total Insoluble Matter g/m²/mth	Reporting Period Average - Total Insoluble Matter	Long Term Average - Total Insoluble Matter	Annual Average Limit	Ash g/m²/mth	Comment
2600208501-005	BD6	19-May-15	May-15	ALS	13:45	950	<0.1	1.3	1.2	4.0	<0.1	Insects,
2600209901-005	BD6	22-Jun-15	Jun-15	ALS	12:30	1750	<0.1	1.3	1.2	4.0	<0.1	Insects, Plant material
2600211301-005	BD6	20-Jul-15	Jul-15	ALS		250	0.4	1.2	1.2	4.0	0.2	Insects, Plant material



Deposited Dust BD-7 "Roseglass"

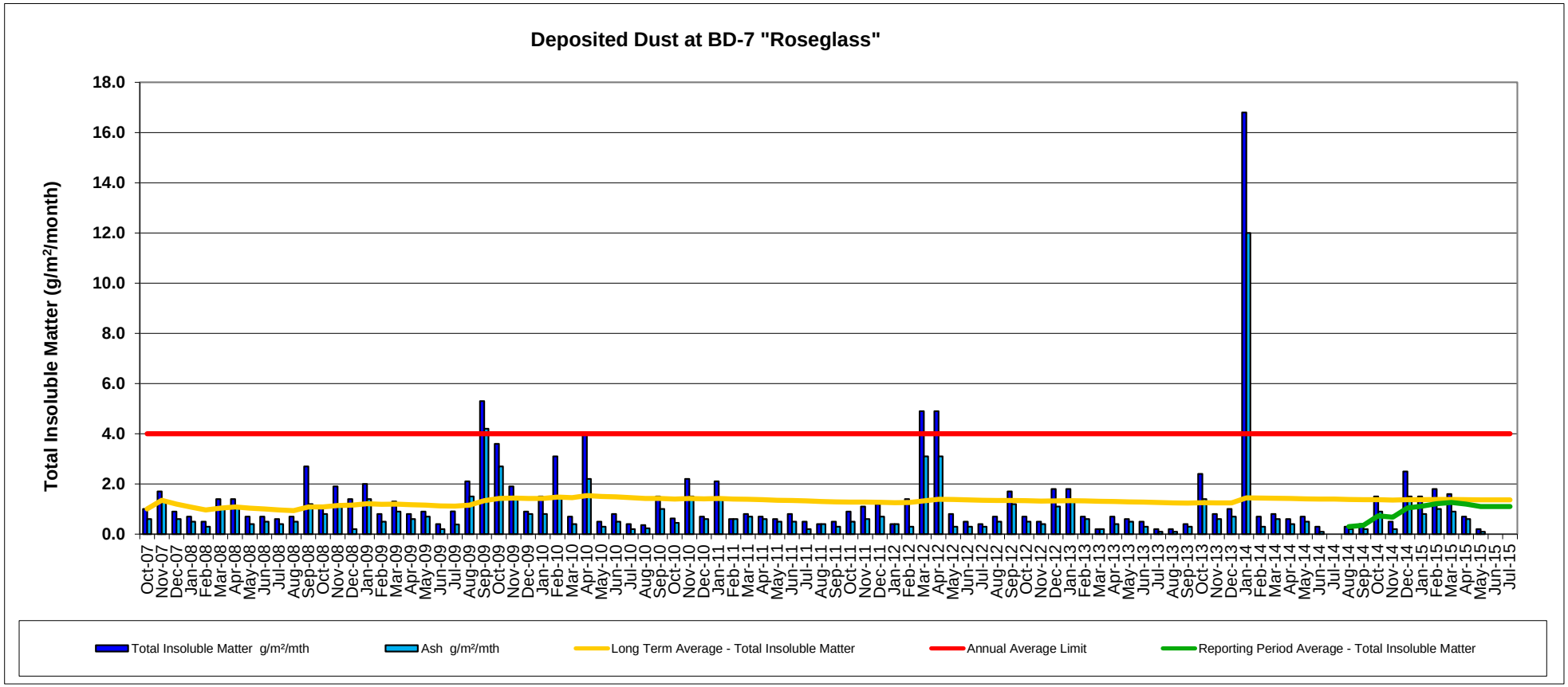
Sample Number	Sample Location	Sample Date	Sample Month	Sampler	Time	Volume Collected ml	Total Insoluble Matter g/m²/mth	Reporting Period Average - Total Insoluble Matter	Long Term Average - Total Insoluble Matter	Annual Average Limit	Ash g/m²/mth	Comment
28550.07	BD-7	05-Nov-07	Oct-07	Client	1355	600	1.0		1.0	4.0	0.6	
28662.07	BD-7	05-Dec-07	Nov-07	Client	1240	1270	1.7		1.4	4.0	1.3	
28923.07	BD-7	03-Jan-08	Dec-07	Client	1110	1315	0.9		1.2	4.0	0.6	
29224.07	BD-7	05-Feb-08	Jan-08	Client	1300	1370	0.7		1.1	4.0	0.5	
29525.07	BD-7	05-Mar-08	Feb-08	Client	1305	1630	0.5		1.0	4.0	0.3	
29773.07	BD-7	04-Apr-08	Mar-08	Client	1010	50	1.4		1.0	4.0	1.0	
30055.07	BD-7	05-May-08	Apr-08	Client	1130	180	1.4		1.1	4.0	1.1	
30386.07	BD-7	04-Jun-08	May-08	Client	0945	770	0.7		1.0	4.0	0.4	
30660.07	BD-7	09-Jul-08	Jun-08	Client	1440	370	0.7		1.0	4.0	0.5	
30902.07	BD-7	05-Aug-08	Jul-08	Client	0925	350	0.6		1.0	4.0	0.4	
31210.07	BD-7	01-Sep-08	Aug-08	Client	1515	710	0.7		0.9	4.0	0.5	
31527.07	BD-7	02-Oct-08	Sep-08	Client	1330	1180	2.7		1.1	4.0	1.2	
31775.07	BD-7	05-Nov-08	Oct-08	Client	1541	1640	1.1		1.1	4.0	0.8	
32023.07	BD-7	04-Dec-08	Nov-08	Client	1000	990	1.9		1.1	4.0	1.1	
32518.07	BD-7	05-Jan-09	Dec-08	Client	1514	1200	1.4		1.2	4.0	0.2	
32246.07	BD-7	02-Feb-09	Jan-09	Client	1624	145	2.0		1.2	4.0	1.4	
32863.07	BD-7	02-Mar-09	Feb-09	Client	1442	1490	0.8		1.2	4.0	0.5	
2600 1004 -00	BD-7	01-Apr-09	Mar-09	ALS Acirl		<50	1.3		1.2	4.0	0.9	
2600 1019 -00	BD-7	01-May-09	Apr-09	ALS Acirl		500	0.8		1.2	4.0	0.6	
2600 1034 -01	BD-7	04-Jun-09	May-09	ALS Acirl		550	0.9		1.2	4.0	0.7	
2600 1042 - 01	BD-7	06-Jul-09	Jun-09	ALS Acirl		400	0.4		1.1	4.0	0.2	
2605 1054 - 01	BD-7	03-Aug-09	Jul-09	ALS Acirl	1410	350	0.9		1.1	4.0	0.4	
2600 1064 - 00	BD-7	31-Aug-09	Aug-09	ALS Acirl	1420	50	2.1		1.2	4.0	1.5	
2600 1098 - 01	BD-7	29-Sep-09	Sep-09	ALS Acirl	1308	800	5.3		1.3	4.0	4.2	
2600 1128 - 00	BD-7	03-Nov-09	Oct-09	ALS Acirl	1330	700	3.6		1.4	4.0	2.7	
2601 1204 - 00	BD-7	04-Dec-09	Nov-09	ALS Acirl	1110	25	1.9		1.4	4.0	1.4	
2600 1222 - 00	BD-7	04-Jan-10	Dec-09	ALS Acirl	1600	2500	0.9		1.4	4.0	0.8	
2600 1234 - 00	BD-7	01-Feb-10	Jan-10	ALS Acirl	1420	1600	1.5		1.4	4.0	0.8	
2600 1247 - 00	BD-7	02-Mar-10	Feb-10	ALS Acirl	1315	2300	3.1		1.5	4.0	1.5	
2600 1260 - 00	BD-7	30-Mar-10	Mar-10	ALS Acirl	1140	300	0.7		1.5	4.0	0.4	
2600 1268 - 00	BD-7	27-Apr-10	Apr-10	ALS Acirl	1240	350	4.0		1.5	4.0	2.2	
2600 1277 - 00	BD-7	25-May-10	May-10	ALS Acirl	1350	10	0.5		1.5	4.0	0.3	
2600 1288 - 776	BD-7	24-Jun-10	Jun-10	ALS Acirl	1000	800	0.8		1.5	4.0	0.5	
2600 1288 - 827	BD-7	22-Jul-10	Jul-10	ALS Acirl	0955	600	0.4		1.5	4.0	0.2	
2600-1309-913	BD-7	20-Aug-10	Aug-10	ALS Acirl	1303	2000	0.4		1.4	4.0	0.2	Insects, Plant Material
6800-4319-07	BD-7	21-Sep-10	Sep-10	ALS Acirl	1220	900	1.5		1.4	4.0	1.0	Insects
2600-1340-09	BD-7	21-Oct-10	Oct-10	ALS Acirl	1200	2500	0.6		1.4	4.0	0.5	No observations recorded on Acirl Analysis Sheet
EN1002887-006	BD-7	22-Nov-10	Nov-10	ALS Acirl	1320	2200	2.2		1.4	4.0	1.5	Insects/Plant Material
EN1003102-006	BD-7	22-Dec-10	Dec-10	ALS Acirl	1245	2000	0.7		1.4	4.0	0.6	Insects/Plant Material
EN1100201-006	BD-7	21-Jan-11	Jan-11	ALS Acirl	1305	300	2.1		1.4	4.0	1.4	Insects/Plant Material
EN1100445-006	BD-7	22-Feb-11	Feb-11	ALS Acirl	1140	400	0.6		1.4	4.0	0.6	Insects/Plant Material
EN1100694-006	BD-7	24-Mar-11	Mar-11	ALS Acirl	1035	500	0.8		1.4	4.0	0.7	Insects/Plant Material
EN1100921-006	BD-7	20-Apr-11	Apr-11	ALS Acirl	1100	300	0.7		1.4	4.0	0.6	Insects
EN1101201-006	BD-7	20-May-11	May-11	ALS Acirl	1130	Nil	0.6		1.4	4.0	0.5	Insects

WHITEHAVEN COAL MINING PTY LTD

Deposited Dust Data - BD-7

Sample Number	Sample Location	Sample Date	Sample Month	Sampler	Time	Volume Collected ml	Total Insoluble Matter g/m²/mth	Reporting Period Average - Total Insoluble Matter	Long Term Average - Total Insoluble Matter	Annual Average Limit	Ash g/m²/mth	Comment
EN1101447-005	BD-7	20-Jun-11	Jun-11	ALS Acirl	1120	1300	0.8		1.3	4.0	0.5	Insects/Plant Material
EN1101811-006	BD-7	19-Jul-11	Jul-11	ALS Acirl	1200	100	0.5		1.3	4.0	0.2	Clear
EN1102303-006	BD-7	17-Aug-11	Aug-11	ALS Acirl	1110	80	0.4		1.3	4.0	0.4	Plant material
EN1102774-006	BD-7	16-Sep-11	Sep-11	ALS Acirl	1200	800	0.5		1.3	4.0	0.3	Insects, Plant material
EN1103123-006	BD-7	17-Oct-11	Oct-11	ALS Acirl	1150	1700	0.9		1.3	4.0	0.5	Insects
EN1103468-006	BD-7	15-Nov-11	Nov-11	ALS Acirl	1200	900	1.1		1.3	4.0	0.6	Insects, Plant material
EN1104230-006	BD-7	15-Dec-11	Dec-11	ALS Acirl	1150	2500	1.2		1.3	4.0	0.7	Insects, Plant material
EN1200243-006	BD-7	13-Jan-12	Jan-12	ALS Acirl	1210	600	0.4		1.3	4.0	0.4	Insects, Plant material
EN1200609-006	BD-7	13-Feb-12	Feb-12	ALS Acirl	1340	2500	1.4		1.3	4.0	0.3	Insects, Plant material
EN1201022-006	BD-7	15-Mar-12	Mar-12	ALS Acirl	1120	500	4.9		1.3	4.0	3.1	Insects, Plant material, dead frog in bottlel
EN1201452-006	BD-7	16-Apr-12	Apr-12	ALS Acirl	1130	200	4.9		1.4	4.0	3.1	Insects, Bird droppings, plant material
EN1201861-006	BD-7	17-May-12	May-12	ALS Acirl	1200	300	0.8		1.4	4.0	0.3	Insects
EN1202262-006	BD-7	18-Jun-12	Jun-12	ALS Acirl	1230	900	0.5		1.4	4.0	0.3	Plant material
EN1202678-006	BD-7	18-Jul-12	Jul-12	ALS Acirl	1240	140	0.4		1.3	4.0	0.3	Surround still very wet
EN1203134-006	BD-7	17-Aug-12	Aug-12	ALS	1200	50	0.7		1.3	4.0	0.5	Plant material
EN1203584-006	BD-7	18-Sep-12	Sep-12	ALS	1200	100	1.7		1.3	4.0	1.2	Insects
EN1203990-006	BD-7	18-Oct-12	Oct-12	ALS	1300	250	0.7		1.3	4.0	0.5	Insects
EN1204414-006	BD-7	19-Nov-12	Nov-12	ALS	1135	50	0.5		1.3	4.0	0.4	Insects
EN1204844-006	BD-7	19-Dec-12	Dec-12	ALS	1130	50	1.8		1.3	4.0	1.1	Insects
EN1300224-006	BD-7	17-Jan-13	Jan-13	ALS	1130	300	1.8		1.3	4.0	1.3	Insects, plant material
EN1300660-006	BD-7	18-Feb-13	Feb-13	ALS	1100	1800	0.7		1.3	4.0	0.6	Insects, plant material
EN1301078-006	BD-7	18-Mar-13	Mar-13	ALS	1220	700	0.2		1.3	4.0	0.2	Insects, plant material
EN1301447-006	BD-7	17-Apr-13	Apr-13	ALS	1215	200	0.7		1.3	4.0	0.4	Insects, plant material
EN1301833-006	BD-7	16-May-13	May-13	ALS	1145	150	0.6		1.3	4.0	0.5	Insects, plant material
EN1302215-006	BD-7	17-Jun-13	Jun-13	ALS	1230	1000	0.5		1.3	4.0	0.3	Insects, plant material
EN1302629-006	BD-7	16-Jul-13	Jul-13	ALS	1220	400	0.2		1.3	4.0	0.1	Plant material
EN1303028-001	BD-7	15-Aug-13	Aug-13	ALS	1055	300	0.2		1.2	4.0	0.1	Insects, plant material
EN1303431-001	BD-7	16-Sep-13	Sep-13	ALS	1240	100	0.4		1.2	4.0	0.3	Insects, plant material
EN1303808-001	BD-7	15-Oct-13	Oct-13	ALS	1215	300	2.4		1.3	4.0	1.4	Insects, plant material
WN1304189-006	BD-7	14-Nov-13	Nov-13	ALS	1220	350	0.8		1.2	4.0	0.6	Insects, plant material
EN1304649-006	BD-7	16-Dec-13	Dec-13	ALS	1245	600	1.0		1.2	4.0	0.7	Insects, plant material
2600185401-006	BD-7	14-Jan-14	Jan-14	ALS	1215	100	16.8		1.4	4.0	12.0	Insects, plant material
2600186701-006	BD-7	13-Feb-14	Feb-14	ALS	1235	100	0.7		1.4	4.0	0.3	Insects, plant material
2600188201-006	BD-7	14-Mar-14	Mar-14	ALS	1215	680	0.8		1.4	4.0	0.6	Insects
2600189701-006	BD-7	15-Apr-14	Apr-14	ALS	1205	2800	0.6		1.4	4.0	0.4	Insects, recent heavy rain
2600191001-006	BD-7	15-May-14	May-14	ALS	1205	250	0.7		1.4	4.0	0.5	Insects
2600192301-006	BD-7	16-Jun-14	Jun-14	ALS	1125	1100	0.3		1.4	4.0	0.1	Insects
2600193601-006	BD-7	15-Jul-14	Jul-14	ALS	1150	150	<0.1		1.4	4.0	<0.1	Insects
2600195001-006	BD7	15-Aug-14	Aug-14	ALS	12:15	250	0.3	0.3	1.4	4.0	0.2	Insects,
2600196401-006	BD7	16-Sep-14	Sep-14	ALS	12:45	1000	0.4	0.4	1.4	4.0	0.2	Insects, plant material
2600197801-006	BD7	17-Oct-14	Oct-14	ALS	12:40	500	1.5	0.7	1.4	4.0	0.9	Insects
2600199201-006	BD7	18-Nov-14	Nov-14	ALS	11:05	250	0.5	0.7	1.4	4.0	0.2	Insects, plant material
2600200901-006	BD7	18-Dec-14	Dec-14	ALS	11:50	1250	2.5	1.0	1.4	4.0	1.5	Insects, Plant material
2600202401-006	BD7	19-Jan-15	Jan-15	ALS	12:05	900	1.5	1.1	1.4	4.0	0.8	Insects, Plant material
2600204001-006	BD7	18-Feb-15	Feb-15	ALS	11:10	1100	1.8	1.2	1.4	4.0	1	Insects

Sample Number	Sample Location	Sample Date	Sample Month	Sampler	Time	Volume Collected ml	Total Insoluble Matter g/m²/mth	Reporting Period Average - Total Insoluble Matter	Long Term Average - Total Insoluble Matter	Annual Average Limit	Ash g/m²/mth	Comment
2600205501-006	BD7	19-Mar-15	Mar-15	ALS	11:15	230	1.6	1.3	1.4	4.0	0.9	Insects
2600207001-006	BD7	17-Apr-15	Apr-15	ALS	11:20	1250	0.7	1.2	1.4	4.0	0.6	Insects
2600208501-006	BD7	19-May-15	May-15	ALS	12:20	850	0.2	1.1	1.4	4.0	0.1	Insects
2600209901-006	BD7	22-Jun-15	Jun-15	ALS	12:00	1500	<0.1	1.1	1.4	4.0	<0.1	Insects
2600211301-006	BD7	20-Jul-15	Jul-15	ALS	11:20	250	<0.1	1.1	1.4	4.0	<0.1	Insects

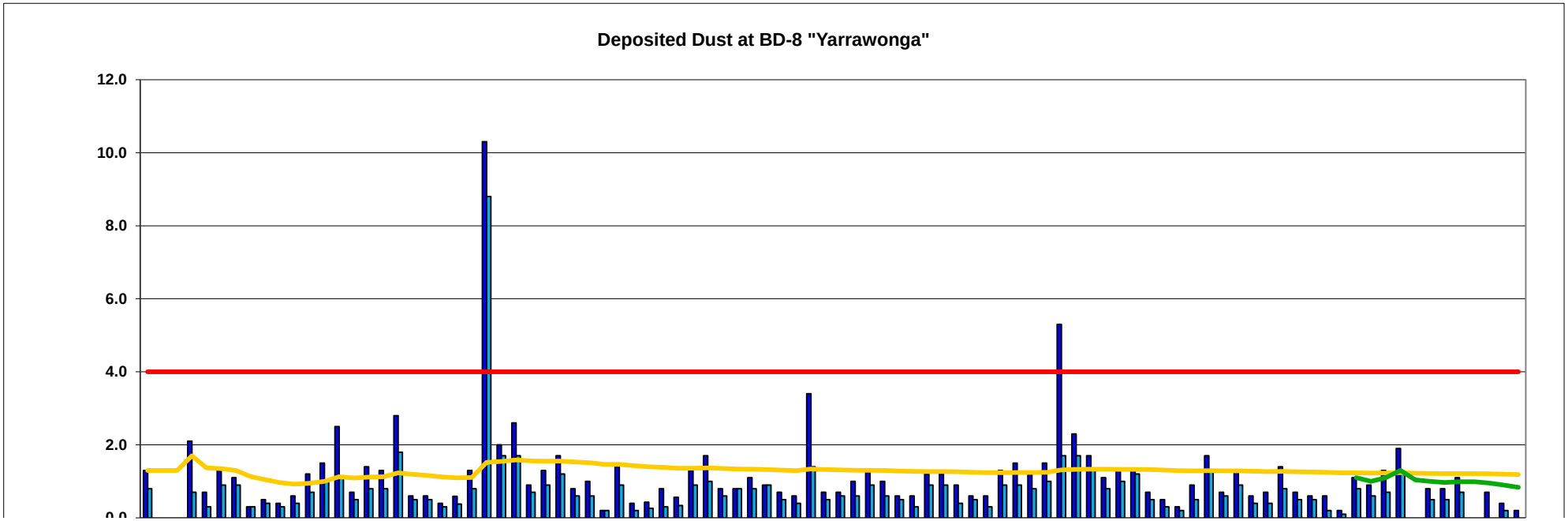


Deposited Dust BD-8 "Yarrawonga"

Sample Number	Sample Location	Sample Date	Sample Month	Sampler	Time	Volume Collected ml	Total Insoluble Matter g/m²/mth	Reporting Period Average - Total Insoluble Matter	Long Term Average - Total Insoluble Matter	Annual Average Limit	Ash g/m²/mth	Comment
28550.08	BD-8	05-Nov-07	Oct-07	Client	1130	630	1.3		1.3	4.0	0.8	
28662.08	BD-8	05-Dec-07	Nov-07	Client	1320				1.3	4.0		No access
28923.08	BD-8	03-Jan-08	Dec-07	Client	1045				1.3	4.0		No access
29224.08	BD-8	05-Feb-08	Jan-08	Client	1340	>2500	2.1		1.7	4.0	0.7	Exposure period 85 days
29525.08	BD-8	06-Mar-08	Feb-08	Client	1030	1595	0.7		1.4	4.0	0.3	
29773.08	BD-8	04-Apr-08	Mar-08	Client	0925	75	1.3		1.4	4.0	0.9	
30055.08	BD-8	05-May-08	Apr-08	Client	1215	380	1.1		1.3	4.0	0.9	
30386.08	BD-8	04-Jun-08	May-08	Client	1045	795	0.3		1.1	4.0	0.3	
30660.08	BD-8	09-Jul-08	Jun-08	Client	1405	470	0.5		1.0	4.0	0.4	
30902.08	BD-8	05-Aug-08	Jul-08	Client	0900	445	0.4		1.0	4.0	0.3	
31210.08	BD-8	01-Sep-08	Aug-08	Client	1615	800	0.6		0.9	4.0	0.4	
31527.08	BD-8	02-Oct-08	Sep-08	Client	1410	1360	1.2		1.0	4.0	0.7	
31775.08	BD-8	05-Nov-08	Oct-08	Client	1627	1980	1.5		1.0	4.0	1.0	
32023.08	BD-8	04-Dec-08	Nov-08	Client	0920	1185	2.5		1.1	4.0	1.1	
32518.08	BD-8	05-Jan-09	Dec-08	Client	1537	1460	0.7		1.1	4.0	0.5	
32246.08	BD-8	02-Feb-09	Jan-09	Client	1535	500	1.4		1.1	4.0	0.8	
32863.08	BD-8	02-Mar-09	Feb-09	Client	1517	1575	1.3		1.1	4.0	0.8	
2600 1004 -00	BD-8	01-Apr-09	Mar-09	ALS Acirl		<50	2.8		1.2	4.0	1.8	
2600 1019 -00	BD-8	01-May-09	Apr-09	ALS Acirl		400	0.6		1.2	4.0	0.5	
2600 1034 -01	BD-8	04-Jun-09	May-09	ALS Acirl		500	0.6		1.2	4.0	0.5	
2600 1042 - 01	BD-8	06-Jul-09	Jun-09	ALS Acirl		600	0.4		1.1	4.0	0.3	
2606 1054 - 01	BD-8	03-Aug-09	Jul-09	ALS Acirl	1440	450	0.6		1.1	4.0	0.4	
2600 1064 - 00	BD-8	31-Aug-09	Aug-09	ALS Acirl	1440	50	1.3		1.1	4.0	0.8	
2600 1098 - 01	BD-8	29-Sep-09	Sep-09	ALS Acirl	1340	800	10.3		1.5	4.0	8.8	
2600 1128 - 00	BD-8	03-Nov-09	Oct-09	ALS Acirl	1355	500	2.0		1.5	4.0	1.7	
2601 1204 - 00	BD-8	04-Dec-09	Nov-09		1145	50	2.6		1.6	4.0	1.7	
2600 1222 - 00	BD-8	04-Jan-10	Dec-09	ALS Acirl	1620	2500	0.9		1.6	4.0	0.7	
2600 1234 - 00	BD-8	01-Feb-10	Jan-10	ALS Acirl	1440	1000	1.3		1.5	4.0	0.9	
2600 1247 - 00	BD-8	02-Mar-10	Feb-10	ALS Acirl	1330	2200	1.7		1.6	4.0	1.2	
2600 1260 - 00	BD-8	30-Mar-10	Mar-10	ALS Acirl	1215	250	0.8		1.5	4.0	0.6	
2600 1268 - 00	BD-8	27-Apr-10	Apr-10	ALS Acirl	1310	350	1.0		1.5	4.0	0.6	
2600 1277 - 00	BD-8	25-May-10	May-10	ALS Acirl	1415	10	0.2		1.5	4.0	0.2	
2600 1288 - 776	BD-8	24-Jun-10	Jun-10	ALS Acirl	0940	900	1.4		1.5	4.0	0.9	
2600 1288 - 827	BD-8	22-Jul-10	Jul-10	ALS Acirl	0910	600	0.4		1.4	4.0	0.2	
2600-1309-913	BD-8	20-Aug-10	Aug-10	ALS Acirl	1345	2000	0.4		1.4	4.0	0.3	Plant Material
6800-4319-07	BD-8	21-Sep-10	Sep-10	ALS Acirl	1130	900	0.8		1.4	4.0	0.3	insects,plant material

Sample Number	Sample Location	Sample Date	Sample Month	Sampler	Time	Volume Collected ml	Total Insoluble Matter g/m²/mth	Reporting Period Average - Total Insoluble Matter	Long Term Average - Total Insoluble Matter	Annual Average Limit	Ash g/m²/mth	Comment
2600-1340-09	BD-8	21-Oct-10	Oct-10	ALS Acirl	1115	2500	0.6		1.4	4.0	0.3	No observations recorded on Acirl Analysis Sheet
EN1002887-007	BD-8	22-Nov-10	Nov-10	ALS Acirl	1410	2200	1.3		1.4	4.0	0.9	Insects/Plant Material
EN1003102-007	BD-8	22-Dec-10	Dec-10	ALS Acirl	1320	1600	1.7		1.4	4.0	1.0	Insects/Plant Material
EN1100201-007	BD-8	21-Jan-11	Jan-11	ALS Acirl	1330	300	0.8		1.4	4.0	0.6	Insects/Plant Material
EN1100445-007	BD-8	22-Feb-11	Feb-11	ALS Acirl	1200	300	0.8		1.3	4.0	0.8	Insects/Plant Material
EN1100694-007	BD-8	24-Mar-11	Mar-11	ALS Acirl	1055	600	1.1		1.3	4.0	0.8	Insects/Plant Material
EN1100921-007	BD-8	20-Apr-11	Apr-11	ALS Acirl	1130	250	0.9		1.3	4.0	0.9	Plant Material
EN1101201-007	BD-8	20-May-11	May-11	ALS Acirl	1230	Nil	0.7		1.3	4.0	0.5	No field observations
EN1101447-006	BD-8	20-Jun-11	Jun-11	ALS Acirl	1200	1600	0.6		1.3	4.0	0.4	Insects
EN1101811-007	BD-8	19-Jul-11	Jul-11	ALS Acirl	1225	100	3.4		1.3	4.0	1.4	Clear
EN1102303-007	BD-8	17-Aug-11	Aug-11	ALS Acirl	1155	110	0.7		1.3	4.0	0.5	No field observations
EN1102774-007	BD-8	16-Sep-11	Sep-11	ALS Acirl	1230	800	0.7		1.3	4.0	0.6	Insects
EN1103123-007	BD-8	17-Oct-11	Oct-11	ALS Acirl	1230	1700	1.0		1.3	4.0	0.6	Insects, Bird Droppings
EN1103468-007	BD-8	15-Nov-11	Nov-11	ALS Acirl	1000	500	1.3		1.3	4.0	0.9	Insects, Plant material
EN1104230-007	BD-8	15-Dec-11	Dec-11	ALS Acirl	1210	2500	1.0		1.3	4.0	0.6	Insects, Plant material
EN1200243-007	BD-8	13-Jan-12	Jan-12	ALS Acirl	1300	600	0.6		1.3	4.0	0.5	Insects, Plant material
EN1200609-007	BD-8	13-Feb-12	Feb-12	ALS Acirl	1420	2500	0.6		1.3	4.0	0.3	Insects, Plant material
EN1201022-007	BD-8	15-Mar-12	Mar-12	ALS Acirl	1240	500	1.2		1.3	4.0	0.9	Insects, Plant material
EN1201452-007	BD-8	16-Apr-12	Apr-12	ALS Acirl	1230	200	1.2		1.3	4.0	0.9	Insects, Plant material
EN1201861-007	BD-8	17-May-12	May-12	ALS Acirl	1310	250	0.9		1.3	4.0	0.4	No field observations
EN1202262-007	BD-8	18-Jun-12	Jun-12	ALS Acirl	1330	1300	0.6		1.2	4.0	0.5	Insects, Plant material
EN1202678-007	BD-8	18-Jul-12	Jul-12	ALS Acirl	1350	1600	0.6		1.2	4.0	0.3	Surround still very wet
EN1203134-007	BD-8	17-Aug-12	Aug-12	ALS	1300	100	1.3		1.2	4.0	0.9	Insects, Plant material
EN1203584-007	BD-8	18-Sep-12	Sep-12	ALS	1330	100	1.5		1.2	4.0	0.9	Insects, Bird droppings, Plant material
EN1203990-007	BD-8	18-Oct-12	Oct-12	ALS	1400	300	1.2		1.2	4.0	0.8	Insects
EN1204414-007	BD-8	19-Nov-13	Nov-12	ALS	1255	100	1.5		1.2	4.0	1.0	Insects, Plant material
EN1204844-007	BD-8	19-Dec-13	Dec-12	ALS	1215	50	5.3		1.3	4.0	1.7	Plant material, lizard in bottle
EN1300224-007	BD-8	17-Jan-13	Jan-13	ALS	1210	300	2.3		1.3	4.0	1.7	Insects
EN1300660-007	BD-8	18-Feb-13	Feb-13	ALS	1215	2000	1.7		1.3	4.0	1.3	Insects, plant material
EN1301078-008	BD-8	18-Mar-13	Mar-13	ALS	1310	700	1.1		1.3	4.0	0.8	Insects, plant material
EN1301447-007	BD-8	17-Apr-13	Apr-13	ALS	1300	200	1.3		1.3	4.0	1.0	Insects, plant material
EN1301833-007	BD-8	16-May-13	May-13	ALS	1300	150	1.3		1.3	4.0	1.2	Insects, plant material
EN1302215-007	BD-8	17-Jun-13	Jun-13	ALS	1340	1000	0.7		1.3	4.0	0.5	Insects, plant material
EN1302629-007	BD-8	16-Jul-13	Jul-13	ALS	1340	400	0.5		1.3	4.0	0.3	Insects, plant material
EN1303028-006	BD-8	15-Aug-13	Aug-13	ALS	940	300	0.3		1.3	4.0	0.2	Insects, plant material
EN1303431-006	BD-8	16-Sep-13	Sep-13	ALS	1335	100	0.9		1.3	4.0	0.5	Insects, plant material
EN1303808-006	BD-8	15-Oct-13	Oct-13	ALS	1330	300	1.7		1.3	4.0	1.3	Insects, plant material
WN1304189-007	BD-8	14-Nov-13	Nov-13	ALS	1255	350	0.7		1.3	4.0	0.6	Insects, plant material
EN1304649-007	BD-8	16-Dec-13	Dec-13	ALS	1230	450	1.3		1.3	4.0	0.9	Insects, plant material

Sample Number	Sample Location	Sample Date	Sample Month	Sampler	Time	Volume Collected ml	Total Insoluble Matter g/m²/mth	Reporting Period Average - Total Insoluble Matter	Long Term Average - Total Insoluble Matter	Annual Average Limit	Ash g/m²/mth	Comment
2600185401-007	BD-8	14-Jan-14	Jan-14	ALS	1310	100	0.6		1.3	4.0	0.4	Insects, plant material
2600186701-007	BD-8	13-Feb-14	Feb-14	ALS	1325	100	0.7		1.3	4.0	0.4	Plant material
2600188201-007	BD-8	14-Mar-14	Mar-14	ALS	1310	770	1.4		1.3	4.0	0.8	Insects, plant material
2600189701-007	BD-8	15-Apr-14	Apr-14	ALS	1250	2200	0.7		1.3	4.0	0.5	Insects, recent heavy rain
2600191001-007	BD-8	15-May-14	May-14	ALS	1230	500	0.6		1.3	4.0	0.5	
2600192301-007	BD-8	16-Jun-14	Jun-14	ALS	1230	750	0.6		1.2	4.0	0.2	Insects
2600193601-007	BD-8	15-Jul-14	Jul-14	ALS	1220	250	0.2		1.2	4.0	0.1	Insects
2600195001-007	BD8	15-Aug-14	Aug-14	ALS	12:50	250	1.1	1.1	1.2	4.0	0.8	Insects, Plant material
2600196401-007	BD8	16-Sep-14	Sep-14	ALS	13:30	1000	0.9	1.0	1.2	4.0	0.6	Insects, plant material
2600197801-007	BD8	17-Oct-14	Oct-14	ALS	13:10	500	1.3	1.1	1.2	4.0	0.7	Insects, plant material
2600199201-007	BD8	18-Nov-14	Nov-14	ALS	11:40	200	1.9	1.3	1.2	4.0	1.2	Plant material
2600200901-007	BD8	18-Dec-14	Dec-14	ALS	12:25	1100	0	1.0	1.2	4.0	0	Plant material, Large amount of red sandy material. Not believed to be related to Rocglen Coal Mine. Value of 115 not included in annual average.
2600202401-007	BD8	19-Jan-15	Jan-15	ALS	12:45	1500	0.8	1.0	1.2	4.0	0.5	Plant material
2600204001-007	BD8	18-Feb-15	Feb-15	ALS	12:00	1000	0.8	1.0	1.2	4.0	0.5	Plant material
2600205501-007	BD8	19-Mar-15	Mar-15	ALS	10:20	280	1.1	1.0	1.2	4.0	0.7	Insects
2600207001-007	BD8	17-Apr-15	Apr-15	ALS	12:00			1.0	1.2	4.0		Broken Bottle
2600208501-007	BD8	19-May-15	May-15	ALS	13:00	1000	0.7	1.0	1.2	4.0	<0.1	Insects, Plant material
2600209901-007	BD8	22-Jun-15	Jun-15	ALS	12:20	2000	0.4	0.9	1.2	4.0	0.2	Insects,
2600211301-007	BD8	20-Jul-15	Jul-15	ALS	11:55	250	0.2	0.8	1.2	4.0	<0.1	Insects, Plant material



Surface Water Monitoring Data

Sample No.	Date	Time	Sample Location	pH	Electrical Conductivity (µS/cm)	Total Suspended Solids (mg/L)	Total Organic Carbon (TOC)	Grease & Oil (mg/L)	Comments
31492.01	23 September 2008	1310	UNDC	7.7	150	510		<2	
32279.01 32279.02	17 December 2008 17 December 2008	1029 1100	SB8 UNDC	7.8 6.6	295 145	1080 21		<2 <2	
ES0909245-001 ES0909245-002 ES0909245-003	24 June 2009 24 June 2009 24 June 2009		Dam Void 1 SB3 SD3	9.3 8.36 8.56	1540 502 354	216 110 1340	20 10 35	<10 <10 <10	Limit of Reporting was raised for Oil and Grease due to insufficient samples Limit of Reporting was raised for Oil and Grease due to insufficient samples Limit of Reporting was raised for Oil and Grease due to insufficient samples
ES0912984-001 ES0912984-002 ES0912984-003	27 August 2009 27 August 2009 27 August 2009	1335 1240 1255	Dam Void 1 SB3 SD3	8.85 8.86 8.34	2260 504 587	60 66 71	3 10 8	<10 <10 <10	Limit of Reporting (LOR) was raised for Oil and Grease due to insufficient samples Limit of Reporting (LOR) was raised for Oil and Grease due to insufficient samples Limit of Reporting (LOR) was raised for Oil and Grease due to insufficient samples
ES0918304-001	30 November 2009	1130	SB3	7.78	620	128	3	<10	Limit of Reporting (LOR) was raised for Oil and Grease due to insufficient samples
ES0919288-001 ES0919290-001 ES0919290-002 ES0919290-003	16 December 2009 16 December 2009 16 December 2009 16 December 2009	1415 1205 1225 1255	Dam Void 1 SB7 SB5 SB14	9.15 9.38 8.9 8.76	4210 600 1440 577	14 18 50 50	4 8 7 7	<10 <10 <10 <10	Limit of Reporting (LOR) was raised for Oil and Grease due to insufficient samples Limit of Reporting (LOR) was raised for Oil and Grease due to insufficient samples Limit of Reporting (LOR) was raised for Oil and Grease due to insufficient samples Limit of Reporting (LOR) was raised for Oil and Grease due to insufficient samples
ES0919733-001	29 December 2009	1530	SB19	6.85	110	444	5		
ES1003579-001 ES1003579-002 ES1003579-003	25 February 2010 25 February 2010 25 February 2010	1535 1550 1515	SB3 SD3 Dam Void 1	8.34 8.44 8.99	423 374 1390	56 37 106	15 <5 5	<5 <5 <5	Limit of Reporting (LOR) was raised for TOC due to matrix interference
ES1005718-001	25 March 2010	1550	SD3	8.71	445	58		<5	
ES1008743-001	7 May 2010	0830	SD3	8.26	434	13		<5	
ES1008996-001 ES1008996-002 ES1008996-003	12 May 2010 12 May 2010 12 May 2010	1400 1408 1315	SB3 SD3 Dam Void 1	8.2 8.42 8.9	565 422 2470	64 19 20	7 14 3	<5 56 <5	
ES1009880-001	24 May 2010	1320	SD3	8.57	412	92	4	6	
ES1014922-001	26 July 2010	0840	SB8	8.34	458	17	5	<5	

Sample No.	Date	Time	Sample Location	pH	Electrical Conductivity (µS/cm)	Total Suspended Solids (mg/L)	Total Organic Carbon (TOC)	Grease & Oil (mg/L)	Comments
ES1015928-001	9 August 2010	1015	SB19	7.47	464	238	13	<5	
ES1015928-002	9 August 2010	0955	SD3	7.62	458	239	12	<5	
ES1015928-003	9 August 2010	1055	Dam Void 1	8.56	2330	8	2	<5	
ES1015928-004	9 August 2010	1035	SD7	7.85	92	8	9	<5	
ES1022524-001	8 November 2010	0920	SB19	8.39	636	41	5	<5	
ES1022524-002	8 November 2010	0905	SD3	8.42	472	107	7	<5	
ES1022524-003	8 November 2010	0950	Dam Void 1	9.12	2330	16	2	<5	
ES1022524-004	8 November 2010	1010	SD7	9.56	77	52	11	<5	
ES1104559-001	2 March 2011	0920	SD3	8.43	605	210	22	<5	
ES1104559-002	2 March 2011	0940	SB19	8.45	573	70	9	<5	
ES1104559-003	2 March 2011	1020	SB18	8.4	724	43	8	<5	
ES1104559-004	2 March 2011	1000	SD7	9.17	1080	236	37	<5	
ES1110300-001	17 May 2011	1030	SB19	8.75	880	76	15	<5	
ES1110300-002	17 May 2011	1020	SD3	8.31	709	214	15	<5	
ES1110300-003	17 May 2011	1040	SB18	9.12	1610	3090	17	<5	
ES1110300-004	17 May 2011	0925	SD7	7.45	159	78	23	<5	
ES1110300-005	17 May 2011	1100	Dam Void 1	8.51	3320	25	2	<5	
ES1116911-001	4 August 2011	1015	SD3	8.49	563	124	11	<5	
ES1116911-002	4 August 2011	1200	SB19	8.38	657	116	8	<5	
ES1116911-003	4 August 2011	1120	SB18	8.07	655	428	16	<5	
ES1116911-004	4 August 2011	1225	SD7	7.4	213	290	66	<5	
ES1116911-005	4 August 2011	1135	VOID	8.16	2920	78	1	<5	
ES1121353-001	29 September 2011	0730	DDCK	7.13	43	83	9	<5	DDCK flowing but no discharge
ES1121353-002	29 September 2011	1130	UNDC	7.15	41	152	10	<5	UNDC flowing but no discharge
ES1116911-001	10 November 2011	0910	SD3	8.4	511	56	4	<5	
ES1116911-002	10 November 2011	0845	SB19	8.33	466	18	4	<5	
ES1116911-004	10 November 2011	0940	SD7	7.61	173	83	15	<5	
ES1116911-005	10 November 2011	1040	VOID	8.42	2530	8	<1	<5	
ES1124937-001	14 November 2011	0730	DDCK	7.34	102	186	24	<5	DDCK flowing but no discharge
ES1124937-002	14 November 2011	0800	SD7	7.67	176	88	15	<5	Upstream sample but no discharge
ES1127736-001	28 November 2011	1530	SD7	7.01	154	60	11	<5	Background quality testing
ES1200148-001	4 January 2012	1010	Bore Dam	8.87	1320	6	3	<5	Background quality testing

Sample No.	Date	Time	Sample Location	pH	Electrical Conductivity (µS/cm)	Total Suspended Solids (mg/L)	Total Organic Carbon (TOC)	Grease & Oil (mg/L)	Comments
ES1201040-001	16 January 2012	1530	Void	8.5	1890	6	3	<5	Background quality testing
ES1205567-001	7 March 2012	1040	SD3	8.09	389	78	3	<5	
ES1205567-002	7 March 2012	1100	SB19	8.29	397	141	3	<5	
ES1205567-004	7 March 2012	1015	VOID	8.47	972	34	2	<5	
ES1205567-005	7 March 2012	0900	SD7	7.49	165	16	14	<5	
ES1211330-001	7 May 2012	1040	SD3	8.55	692	30	5	<5	
ES1211330-002	7 May 2012	1100	SB19	8.49	490	14	2	<5	
ES1211330-003	7 May 2012	1130	SD7	7.61	192	34	14	<5	
ES1211330-004	7 May 2012	1015	VOID	8.49	1150	6	<1	<5	
ES1219036-001	1 August 2012	1030	SD3	8.11	383	28	6	<5	
ES1219036-002	1 August 2012	1050	SB19	8.21	398	24	5	<5	
ES1219036-003	1 August 2012	1000	SD7	7.68	155	23	17	<5	
ES1219036-004	1 August 2012	1130	VOID	8.5	1220	12	2	<5	
ES1228239-001	28 November 2012	1040	SD3	8.84	1110	100	8	<5	
ES1228239-002	28 November 2012	0950	DAM B	8.83	484	944	5	<5	
ES1228239-003	28 November 2012	1020	SD7	8.99	199	98	20	<5	
ES1228239-004	28 November 2012	0930	VOID	8.94	1950	12	2	<5	
ES1304443-001	26 February 2013	1130	SD3	8.01	373	82	4	<5	
ES1304443-002	26 February 2013	1150	SB19	8.19	488	104	5	<5	
ES1304443-003	26 February 2013	1210	SD7	7.68	203	14	15	<5	
ES1304443-004	26 February 2013	1110	VOID	8.98	1680	12	2	<5	
ES1304443-005	26 February 2013	1050	DAM B	8.44	317	636	2	<5	
ES1311061-001	14 May 2013	1040	SD3	8.41	647	50	11	<5	
ES1311061-002	14 May 2013	1020	SB19	8.48	573	139	8	<5	
ES1311061-003	14 May 2013	0920	SD7	7.86	233	29	21	<5	
ES1311061-004	14 May 2013	1000	VOID	9.13	1850	16	3	<5	
ES1317663-001	8 August 2013	1220	SD3	8.16	519	71	12	<5	
ES1317663-002	8 August 2013	1235	SB19	8.26	436	74	10	<5	
ES1317663-003	8 August 2013	1200	SD7	8.77	138	14	17	<5	
ES1317663-004	8 August 2013	1245	VOID	8.79	1250	23	4	<5	
ES1324284-001	8 November 2013	1115	SB19	8.96	1300	146	21	<5	
ES1324284-002	8 November 2013	1010	DAMB	8.34	487	26	6	<5	
ES1324284-003	8 November 2013	930	SD7	7.82	199	18	19	<5	
ES1324284-004	8 November 2013	1045	VOID	9.13	2160	14	9	<5	

Sample No.	Date	Time	Sample Location	pH	Electrical Conductivity (µS/cm)	Total Suspended Solids (mg/L)	Total Organic Carbon (TOC)	Grease & Oil (mg/L)	Comments
ES1402414-001	5 February 2014	0850	VOID	8.94	2450	13	3	<5	
ES1402414-002	5 February 2014	0935	SD3	9.14	1900	76	24	<5	
ES1402414-003	5 February 2014	0915	SB19	9.21	4100	196	75	<5	
ES1402414-004	5 February 2014	1020	DAMB	8.96	752	112	6	<5	
ES1402414-005	5 February 2014	1050	SD7	7.34	222	52	19	<5	
ES1409918-001	5 May 2014	1000	SD3	8.59	818	32	4	<5	
ES1409918-002	5 May 2014	1020	SB19	8.31	431	19	3	<5	
ES1409918-003	5 May 2014	1100	DAM B	8.45	360	224	<1	<5	
ES1409918-004	5 May 2014	1140	SD7	8.14	200	20	12	<5	
ES1409918-005	5 May 2014	940	VOID	9.06	2300	12	2	<5	
ES1417355-001	6 August 2014	930	SD3	8.78	889	8	6	<5	
ES1417355-002	6 August 2014	910	SB19	8.48	525	61	10	<5	
ES1417355-003	6 August 2014	1000	DAM B	8.38	387	98	6	<5	
ES1417355-004	6 August 2014	1040	SD7	8.44	196	10	15	<5	
ES1417355-005	6 August 2014	845	VOID	8.81	1880	<5	3	<5	
ES1424984-001	12 November 2014	950	SD3	9.53	996	94	46	<5	
ES1424984-002	12 November 2014	920	SB19	9.58	1930	1510	249	<5	
ES1424984-003	12 November 2014	1015	DAM B	8.64	490	28	5	<5	
ES1424984-004	12 November 2014	1100	SD7	8.42	244	16	20	<5	
ES1424984-005	12 November 2014	900	VOID	9	2260	16	3	<5	
ES1503432-001	11 February 2015	920	SD3	9.12	695	31	18	<5	
ES1503432-002	11 February 2015	935	SB19	9.43	1930	228	75	<5	
ES1503432-003	11 February 2015	1030	DAM B	8.61	367	85	5	<5	
ES1503432-004	11 February 2015	955	SD7	8.14	301	26	20	<5	
ES1503432-005	11 February 2015	900	VOID	9.15	2260	46	4	<5	
ES1521696-001	11 May 2015	1045	SB19	7.96	444	60	6	<5	
ES1521696-002	11 May 2015	920	DAM B	8	319	96	4	<5	
ES1521696-003	11 May 2015	1005	SD7	7.52	146	18	9	<5	
ES1521696-004	11 May 2015	940	VOID	9.16	1950	33	6	<5	

Wet Weather Discharge Monitoring Data

Sample No.	Sample Location	Date	Time	pH	Electrical Conductivity (µS/cm)	Total Suspended Solids (mg/L)	Total Organic Carbon (TOC)	Grease & Oil (mg/L)	Comments
ES0919733-002	SD3	29 December 2009	1530	7.51	180	552	4		
ES0919733-003	UNDC	29 December 2009	1545	6.87	94	236	7		
ES1000144-001	SD3	4 January 2010	1200	7.74	325	1490	2	<5	
ES1000144-002	UNDC	4 January 2010	1245	7.37	467	34	17	6	
ES1000715-001	DD CK	15 January 2010	1130	6.86	338	258	3	<5	
ES1000715-002	SB 18	15 January 2010	1150	7.51	356	1490	3	<5	
ES1002195-001	SD3	8 February 2010	0925	7.87	323	157	6	6	
ES1002884-001	SD3	15 February 2010	0900	7.48	329	406	3	<5	
ES1002884-002	UNDC	15 February 2010	0925	7.15	318	186	8	<5	
ES1002884-003	SB 18	15 February 2010	0945	7.37	395	556	5	<5	
ES1002884-004	DDCK	15 February 2010	1010	7.34	359	15	6	<5	
ES1002884-005	SB 20	16 February 2010	0715	7.16	119	46	9	<5	
ES1006098-001	SD3	31 March 2010	0925	8.14	435	108	12	<5	
ES1010661-001	SD3	2 June 2010	1200	8.21	410	260	35	<5	
ES1014922-001	SD 3 Pre discharge (controlled)	26 July 2010	0840	8.34	458	17	5	<5	
ES1015036-001	SD3	28 July 2010	1430	8.23	437	23	4	<10	Controlled discharge via Southern Discharge Point.
ES1015610-001	Downstream Bluevale	3 August 2010	1320	7.43	109	45	17	<5	
ES1016051-001	DDCK	10 August 2010	1340	7.40	151	964	12	<5	
ES1016051-002	SB18	10 August 2010	1405	7.37	261	2320	<5	<5	
ES1016145-001	SD3	11 August 2010	1350	8.04	450	368	6	<5	
ES1016145-002	UNDC	11 August 2010	1420	7.72	333	116	12	<5	
ES1016965-001	SB18	20 August 2010	1500	7.97	422	2300	10	<5	
ES1016965-002	DDCK	20 August 2010	1520	7.96	344	912	20	<5	
ES1016965-003	SD3	20 August 2010	1540	8.04	508	172	10	<5	
ES1016965-004	UNDC	20 August 2010	1555	7.90	390	152	25	<5	
ES1018433-001	SD3	10 September 2010	1215	8.18	583	50	6	<5	
ES1018433-002	SB18	10 September 2010	1230	7.94	500	1220	<5	<5	
ES1018433-003	DDCK	10 September 2010	1245	7.74	359	680	<5	<5	
ES1018433-004	UNDC	10 September 2010	1300	8.34	477	229	5	<5	

Sample No.	Sample Location	Date	Time	pH	Electrical Conductivity (µS/cm)	Total Suspended Solids (mg/L)	Total Organic Carbon (TOC)	Grease & Oil (mg/L)	Comments
ES1020462-001 ES1021130-001	SD 3 Pre discharge (controlled) SD 3 Re-sample (oil and grease)	12 October 2010 19 October 2010	1645 1500	8.31 8.64	575 556	11 33	5 6	32 <5	Sample taken to determine whether a controlled discharge could occur. Grease and oil high. No discharge occurred. Oil and grease within limit, however no discharge occurred due to a high pH.
ES1021254-001	SB18 (Pre flocculation)	21 October 2010	1315	8.56	554	276	9	<5	
ES1022161-001	SD 3 Pre discharge (controlled)	2 November 2010	1200	8.25	478	33	6	<5	Sample taken to determine whether a controlled discharge could occur. Water was discharged after results were obtained (all results are within limits). Discharge occurred via Southern Discharge Point.
ES1021481-001 ES1021481-002	SB18 DDCK	25 October 2010 25 October 2010	0745 0800	7.60 7.13	477 95	488 234	11 9	<5 <5	
ES1022526-001	SB18 (Pre flocculation)	8 November 2010	1200	8.19	558	1070	<10	<5	Discharge occurred via Southern Discharge Point.
ES1024131-001	SD3 (Pre flocculation)	25 November 2010	1010	7.40	522	52	9	36	High oil and grease. Resample was taken after flocculation and prior to discharge (see below). Oil And Grease for resample remained within limits.
ES1024689-001	SD3 Pre discharge (controlled)	1 December 2010	1300	8.05	507	23	7	<5	Sample taken to determine whether a controlled discharge could occur. Water was discharged after results were obtained (all results are within limits). Discharge occurred via Southern Discharge Point.
ES1025105-001 ES1025105-002 ES1025105-003	UNDC SB18 DDCK	6 December 2010 6 December 2010 6 December 2010	1300 1320 1335	7.58 8.15 8.37	378 532 452	25 996 462	15 11 8	<5 <5 <5	
ES1121654-001 ES1121654-002	SD3 UNDC	4 October 2011 4 October 2011	0840 1500	7.77 7.27	158 175	62 26	3 17	<5 <5	
ES1123154-001	SD3	21 October 2011	1030	8.13	427	104	<1	<5	Pre Flocculation
ES1123743-001	SD3	31 October 2011	1130	8.06	798	52	7	<5	During flocculation
ES1124306-001	SD3	7 November 2011	1030	8.13	456	31	7	<5	Post flocculation and controlled discharge. Discharge occurred via Southern Discharge Point.
ES1126003-001 ES1126003-002 ES1126003-003 ES1126003-004	SD3 UNDC SD7 DDCK	24 November 2011 24 November 2011 24 November 2011 24 November 2011	1300 1320 1335 1350	7.97 7.44 7.51 7.76	360 266 172 319	408 90 118 448	16 25 21 23	<5 <5 <5 <5	

Sample No.	Sample Location	Date	Time	pH	Electrical Conductivity (µS/cm)	Total Suspended Solids (mg/L)	Total Organic Carbon (TOC)	Grease & Oil (mg/L)	Comments
ES1126317-001	Northern Discharge Point	28 November 2011	0830	7.46	326	56	15	<5	
ES1126317-002	DDCK	28 November 2011	0830	7.60	287	108	16	<5	
ES1127736-001	SD7	28 November 2011	1500	7.01	154	60	11	<5	
ES1200056-001	SD3	29 December 2011	1030	8.01	424	228	5	<5	Sample taken prior to flocculant treatment.
ES1200703-001	SD3	12 January 2012	1330	8.71	451	200	3	<5	Sample taken during flocculation.
ES1202282-001	SD3	31 January 2012	1000	8.39	433	42	4	<5	
ES1202283-001	SD7	31 January 2012	0730	7.76	143	42	9	<5	
ES1202507-001	DDCK	1 February 2012	1445	6.89	23	32	5	<5	
ES1202507-002	SB18	1 February 2012	1455	7.43	114	112	3	<5	
ES1202507-003	UNDC	1 February 2012	1555	7.06	42	40	8	<5	
ES1204082-001	SD7	21 February 2012	0745	7.62	154	<5	14	<5	
ES1204082-002	SD3	21 February 2012	0810	7.97	350	340	17	<5	
ES1204082-003	UNDC	21 February 2012	0845	7.51	254	236	26	<5	
ES121257-001	Northern Discharge Point	18 May 2012	1000	8.03	426	<5	3	<5	Pre controlled discharge sample following flocculation in dam A1.
ES1213744-001	Northern Discharge Point	29 May 2012	0700	8.34	418	<5	3	<5	Sample taken upon release from dam A1
ES1214169-001	SD3	5 June 2012	1500	8.32	359	253	7	<5	Sample taken prior to flocculant treatment
ES1214601-001	SD3	12 June 2012	1030	8.02	381	<5	3	<5	Post flocculation. Discharge occurred via Southern Discharge Point.
ES1216238-001	SD3	28 June 2012	1300	8.29	403	30	4	<5	Pre-controlled discharge sample. Discharge occurred via LDP 11.
ES1216947-001	Floc Dam 1-3 Hrs	4 July 2012	1600	7.92	512	31	3	<5	Flocculant trial
ES1216947-002	Dam 1 Floc-24 Hrs	5 July 2012	1230	8.12	545	26	3	<5	Flocculant trial
ES1216947-003	Dam 1 Floc-48 Hrs	6 July 2012	1300	8.21	546	7	3	<5	Flocculant trial
ES1216947-004	Floc Dam 2-3 Hrs	4 July 2012	1600	8.02	255	36	6	<5	Flocculant trial
ES1216947-005	Dam 2 Floc-24 Hrs	5 July 2012	1215	7.97	361	71	5	<5	Flocculant trial
ES1216947-006	Dam 2 Floc - 48 Hrs	6 July 2012	1300	7.81	359	22	6	<5	Flocculant trial
ES1217578-001	LDP11	13 July 2012	1300	7.89	313	372	11	<5	
ES1217578-002	UNDC	13 July 2012	1600	7.44	86	86	14	<5	
ES1217578-003	SD7	13 July 2012	1430	7.64	148	57	20	<5	Rainfall exceeded 90%ile 5 day storm event
ES1217578-004	LDP12	13 July 2012	1500	7.61	333	274	5	<5	
ES1217578-005	DDCK	13 July 2012	1530	7.30	79	202	22	<5	
ES1218648-001	SB18	30 July 2012	1500	8.09	332	10	2	<5	Controlled discharge
ES1220649-001	Dam A1	23 August 2012	1100	8.69	460	7	2	<5	Contolled discharge - Dam A1 cancelled due to high pH A2 pumped out via LDP-12
ES1220649-002	Dam A2	23 August 2012	1110	8.23	344	7	6	<5	

Sample No.	Sample Location	Date	Time	pH	Electrical Conductivity (µS/cm)	Total Suspended Solids (mg/L)	Total Organic Carbon (TOC)	Grease & Oil (mg/L)	Comments
ES1302200-001 ES1302200-002	UNDC SD7	29 January 2013 29 January 2013	1140 1210	7.13 7.53	104 194	15 24	32 17	<5 <5	No discharge - flows only
ES1302322-001 ES1302322-002 ES1302322-003	LDP11 SD7 UNDC	31 January 2013 31 January 2013 31 January 2013	0700 1400 1430	7.29 7.63 7.13	336 186 301	404 <5 22	11 17 63	<5 <5 <5	Rainfall exceeded 90%ile 5 day storm event (114.8mm)
ES1303726-001	Dam B	18 February 2013	1030	8.34	303	198	<1	<5	No controlled discharge due to high TSS
ES1303941-001	SD3	20th February 2013	1400	7.82	364	19	6	<5	Controlled discharge via LDP 11.
ES1305009-001 ES1305009-002 ES1305009-003	LDP 11 UNDC SD7	2 March 2013 2 March 2013 2 March 2013	0722 0741 0754	8.09 7.25 7.56	380 105 198	374 40 22	5 12 15	<5 <5 <5	Rainfall exceeded 90%ile 5 day storm event (69.8mm)
ES1306605-001	SD3	19 March 2014	1000	8.32	446	12	5	<5	Post flocculation
ES1307071-001	SD3	22 March 2014	1100	8.18	474	<5	5	<5	Controlled discharge via LDP 11.
ES1313686-001 ES1313686-002	DPCK SD7	13 June 2013 13 June 2013	0742 0800	6.97 7.78	96 209	74 54	17 20	<5 <5	No discharge - flows only
ES1314909-001 ES1314909-002 ES1314909-003 ES1314909-004 ES1314909-005	DDCK SD7 UNDC LDP 11 LDP12	28 June 2013 28 June 2013 28 June 2013 28 June 2013 28 June 2013	1030 1110 1230 1330 1315	7.09 7.49 7.18 8.07 8.25	63 122 79 406 316	28 87 70 164 751	12 10 10 5 3	<5 <5 <5 <5 <5	Rainfall exceeded 90%ile 5 day storm event (43mm)
ES1315859-001	SD3	11 July 2013	1045	7.98	390	10	5	<5	Controlled discharge via LDP 11
ES1407147-001 ES1407147-002 ES1407147-003	SD7 DDCK LDP12	28 March 2014 29 March 2014 30 March 2014	1330 1300 0800	7.77 7.01 8.20	180 40 357	41 19 1660	14 7 <1	5 <5 <5	Rainfall exceeded 90%ile 5 day storm event (51.1mm)
ES1407907-001	SD3	4 April 2014	1300	7.72	415	<5	4	<5	Controlled Discharge of approximately 3ML via LDP 11
ES1412332-001	SD3	3 June 2014	1255	8.53	655	58	62	<5	Sample taken prior to flocculant treatment - No Discharge
ES1413443-001	SD3 (LDP11)	18 June 2014	1200	7.89	605	<5	18	<5	Controlled Discharge of approximately 1.5ML via LDP 11.
ES1419359-001 ES1419359-002 ES1419359-003	DDCK SD7 UNDC	27 August 2014 27 August 2014 27 August 2014	1240 1250 1300	7.26 7.79 7.36	63 185 63	25 30 16	16 12 11	<5 <5 <5	No discharge- flows only

Sample No.	Sample Location	Date	Time	pH	Electrical Conductivity (µS/cm)	Total Suspended Solids (mg/L)	Total Organic Carbon (TOC)	Grease & Oil (mg/L)	Comments
ES1507957-001	DDCK	07 April 2015	0748	7.04	57	67	9	<5	Rainfall exceeded 90%ile 5 day strom event (67mm)
ES1507957-002	SD7	07 April 2015	800	7.51	137	184	11	<5	
ES1507957-003	LDP11	07 April 2015	813	7.22	129	222	13	<5	
ES1507957-004	UNDC	07 April 2015	823	7.01	54	141	7	<5	
ES1520297-001	LDP12	21 April 2015	1732	8.12	301	353	5	<5	Rainfall exceeded 90%ile 5 day strom event (52.2mm)
ES1520297-002	UNDC	21 April 2015	1800	7.06	60	49	6	<5	
ES1520297-003	SD7	21 April 2015	1815	7.4	132	74	9	<5	
ES1520297-004	DDCK	21 April 2015	1830	7.14	43	24	7	7	
ES1521697-001	Dam A1	8 May 2015	450	8.3	345	28	3	<5	Controlled discharge via LDP 12
ES1523146-001	UNDC	1 June 2015	742	7.2	230	75	12	<5	No discharge- flows only
ES1523146-002	SD7	1 June 2015	822	7.47	149	10	9	<5	
ES1523146-003	DDC	1 June 2015	840	6.9	121	11	18	<5	
ES1524355-001	DDCK	17 June 2015	800	6.95	69	17	12	<5	No discharge- flows only
ES1524355-002	SD7	17 June 2015	815	7.78	138	6	10	<5	
ES1524355-003	UNDC	17 June 2015	835	7.18	102	74	11	<5	

Denotes samples taken prior to a controlled discharge, prior or during flocculation or post rainfall to determine appropriate flocculation rates. These samples are not associated with wet weather discharge.

Site ID	Date	Time	Depth to Ground - mbgl	Depth to Stand - mbtoc	Field Parameters			pH - Lab	EC - Lab - µs/cm	Total Dissolved Solids	Major Anions						Major Cations				Total Metals																					Mercury - mg/L	Ammonia as Nitrogen (N)	Nitrite as N (mg/L)	Nitrate as N (mg/L)	NOX as N (mg/L)	Total Anions - meq/L	Total Cations - meq/L	Ionic Balance	Comments
					EC - Field - µs/cm	pH - Field	Temp - Field - °C				Hydroxide Alkalinity as CaCO3 - mg/L	Carbonate Alkalinity as CaCO3 - mg/L	Bicarbonate Alkalinity as CaCO3 - mg/L	Alkalinity - mg/L	Sulfate (SO4) - mg/L	Chloride (Cl) - mg/L	Calcium (Ca) - mg/L	Magnesium (Mg) - mg/L	Sodium (Na) - mg/L	Potassium (K) - mg/L	Aluminium (Al) - mg/L	Arsenic (As) - mg/L	Boron (B) - mg/L	Barium (Ba) - mg/L	Beryllium (Be) - mg/L	Cadmium (Cd) - mg/L	Cobalt (Co) - mg/L	Chromium (Cr) - mg/L	Copper (Cu) - mg/L	Manganese (Mn) - mg/L	Nickel (Ni) - mg/L	Lead (Pb) - mg/L	Selenium (Se) - mg/L	Vanadium (V) - mg/L	Zinc (Zn) - mg/L	Iron (Fe) - mg/L										
ANZECC guideline*										4000							1000				5	0.5				0.01	1	1	1		1	0.1							1500	400					
MP-2	03-Sep-08	1650	13.55	14.55																																									
	13-Oct-08	1255	13.00	14.00																																									
	23-Oct-08	0930	13.58	14.58																																									
	29-Oct-08		13.22	14.22	4180	7.35	21				<1	<1	559	559	45	926	174	101	529	5		0.001		0.618	<0.001	0.0001	0.001	0.002	0.003	0.234	0.234	0.011		<0.01	0.042	1.1		0.02				38.2	40.1	2.37	
	23-Jan-09	1741	14.70	15.7																																									
	22-Jun-09	1200	13.80	14.8	5210	7	22.5		4830	3040	<1	<1	538	538	61	1490	254	150	646	7		0.001		0.766	<0.001	<0.0001	0.003	0.01	0.008	0.145	0.011	0.007		0.01	0.095	5.01		<0.01				54.1	53.3	0.74	
	15-Sep-09	1520	13.88	14.88																																									
	30-Nov-09	1030	13.90	14.9	5230	6.91	30.2	6.99	4560		<1	<1	446	446	19.5	1390	247	161	593	7	<0.01	0.002						<0.005	0.019	0.07	0.006	<0.001			0.01	<0.05			<0.01	0.6	0.6	48.4	51.6	3.16	
	25-Feb-10	1320	14.14	15.14																																									
	03-May-10	1130	14.00	15	5240	7.37	22.3		4760	3120	<1	<1	527	527	28.6	1510	237	150	584	6		<0.001		0.737	<0.001	<0.0001	0.002	0.004	0.022	0.148	0.009	0.012		0.01	0.335	4.31		0.01				53.8	49.8	3.88	
	26-Aug-10	1040	13.48	14.48	5060	7.07	Probe Broken																																						
	08-Nov-10	1355	12.04	13.04	3720	6.72	26.9																																						
	07-Mar-11	1320	10.49	11.49	4060	6.98	25.2	7	5070		<1	<1	529	529	22	1390	247	162	611	9	0.71	<0.001						0.001	0.057	0.077	0.004	0.006			0.299	0.52			0.01	0.77	0.78	50.1	52.5	2.3	
	03-May-11	1210	11.10	12.1	4110	6.95	21.7																																						
	30-Aug-11	1130	11.54	12.54	3950	6.9	22.4	7.27	5320	2960	<1	<1	477	477	20	1490	243	152	600	7	7.63	0.006		1.28	<0.001	0.0001	0.005	0.008	0.154	0.436	0.014	0.019		0.02	1.2	9.79		<0.01	<0.01	0.47	0.47	52	50.9	1.03	
	04-Nov-11	1140	11.78	12.78	3820	6.8	23.9																																						
	21-Mar-12	0945	8.17	9.17	4330	7.01	22.3	7.39	5080	3770	<1	<1	500	500	25	1530	272	168	639	9	0.26	0.003		0.867	<0.001	<0.0001	<0.001	0.001	0.037	0.028	0.003	0.003		<0.01	0.13	0.12		0.18	0.03	0.84	0.87	53.7	55.4	1.61	
	23-May-12	1140	8.43	9.43	4170	7.32	15.4																																						
	27-Aug-12	1100	8.71	9.71	4670	7.16	20.7	7.54	4650	3320	<1	<1	548	548	23	1370	256	157	603	8	0.62	0.002		0.86	0.001	0.0005	0.001	0.003	0.036	0.073	0.006	0.012		<0.01	0.178	0.66		0.1	0.03	2.06	2.09	50.1	52.1	2.01	
	26-Nov-12	1045	9.33	10.33	4530	7.07	23.8																																						
	12-Mar-13	1040	10.00	11	4620	7.29	22.7	7.48	5150	3750	<1	<1	498	498	18	1350	256	163	612	8	0.13	0.002		0.819	<0.001	<0.0001	<0.001	0.004	0.044	0.024	0.005	0.002		<0.01	0.17	1.05		0.01	<0.01	1.48	1.48	48.4	53	4.55	
	20-Jun-13	1120	10.36	11.36	4710	7.12	20.5																																						
	28-Aug-13	1200	9.80	10.8	4740	7.2	21.2	7.74	5190	3140	<1	<1	504	504	19	1370	254	169	583	9	0.24	<0.001	0.09	0.8	<0.001	0.0001	<0.001	<0.001	0.006	0.033	0.004	0.005	<0.01	<0.01	0.216	0.37		0.02				49.1	52.2	3.03	
	11-Dec-13	1240	10.84	11.84	4870	7.2	21.8																																						
	26-Feb-14	1310	11.10	12.1	4850	7.4	22.3	8.06	5250	3650	<1	<1	475	475	15	1160	236	151	495	8	0.36	0.002	0.009	0.933	<0.001	0.0001	<0.001	0.006	0.243	0.064	0.006	0.02	<0.01	0.01	0.455	2.63		0.07				42.5	45.9	3.86	
	12-Jun-14	1330	11.40	12.4	4930	7.2	20.9																																						
	10-Sep-14	1050	11.50	12.5	4930	7.2	21.7	7.6	5240	3270	<1	<1	551	551	19	1300	243	157	549	7	0.18	0.001	0.07	0.868	<0.001	<0.0001	<0.001	<0.001	0.024	0.033	0.004	0.002	<0.01	<0.01	0.127	0.29		0.01	<0.01	1.87	1.87	48.1	49.1	1.06	
	28-Nov-14	835	11.68	12.68	4910	7.4	21.5																																						
	03-Mar-15	955	11.8	12.8	4900	7.3	22.2	7.7	5320	3890	<1	<1	537	537	18	1480	255	163	590	7	0.03	<0.001	0.07	0.817	<0.001	<0.0001	<0.001	<0.001	0.015	0.028	0.005	<0.001	<0.01	<0.01	0.144	0.13	<0.0001	0.02	<0.01	2.12	2.12	52.8	52	0.83	
	29-May-15	925	12.02	13.02	5070	7.1	20.6																																						
MP-2A	12-Mar-13	1110	11.30	12.00	1340	5.32	23.9	4.44	1380	2990	<1	<1	<1	<1	20	208	61	29	234	21	0.38	0.011		0.351	<0.001	0.0003	0.016	0.003	0.212	0.401	0.033	0.02		<0.01	2.01	3.69	<0.0001	0.03	0.02	0.22	0.24	6.28	16.2	44	
	15-Apr-13	1000	11.40	12.10																																									
	27-May-13	1415	11.75	12.45																																									
	20-Jun-13	1245	11.80	12.5	4490	6.53	22.4	7.18	5060	3090	<1	<1	466	466	16	1190	226	140	554	8	0.02	0.008		1.15	<0.001	<0.0001	0.015	<0.001	0.001	4.12	0.004	<0.001		<0.01	0.006	6.68	<0.0001	0.78	<0.01	0.01	0.01	43.2	47.1	4.31	
	29-Jul-13	1410	16.74	17.44																																									
	23-Aug-13	1006	16.80	17.5																																									
	28-Aug-13	1130	16.80	17.5	2360	5.3	21.8	5.34	2530	1990	<1	<1	278	278	<1	604	112	66	312	15	0.37	0.002	0.1	0.561	<0.001	0.0003	0.017	0.002	0.116	1.54	0.037	0.008	<0.01	<0.01	0.784	5.2	<0.0001	0.08				22.6	25	5.01	
	30-Sep-13	1610	16.43	17.13																																								
	28-Nov-13	1330	14.52	15.22																																									
	11-Dec-13	1240	14.13	15.03	3140	6.7	22.6																																						
	26-Feb-14	1245	14.80	15.5	3100	6.9	22.2	7.68	3250	1970	<1	<1	489	489	5	668	146	79	323	13	0.8	0.041	0.09	0.833	<0.001	0.0016	0.01	0.046	1.19	2	0.044	0.074	<0.01	0.17	2.23	48.8	<0.0001	0.84				28.7	28.2	0.96	
	14-Mar-14	1530	14.90	15.6																																								
	12-Jun-14	1340	15.61	16.31	3180	7	20.7																																						
	10-Sep-14	1110	15.70	16.4	3210	7	21.7	7.47	3320	1970	<1	<1	543	543	10	761	146	84	373	12	0.06	0.003	0.08	0.67	<0.001	0.0002	0.003	0.003	0.035	1.75	0.02	<0.001	<0.01	<0.01	0.147	0.28		1.08	0.17	0.01	0.18	32.5	30.7	2.84	
	28-Nov-14	850	14.47	15.17	3220	7.3	21.9																																						
	03-Mar-15	1015	14.10	14.8	3280	7.3	21.9	7.7	3550	2150	<1	<1	520	520	18	721	159	83	421	9	0.04	0.002	0.1	0.706	<0.001	0.0002	0.003	0.003	0.048	1.46	0.029	<0.001	<0.01	<0.01	0.158	0.36	<0.0001	<0.01	<0.01	0.7	0.7	31.1	33.3	3.42	
	29-May-15	940	13.61	14.31	3540	7.1	20.6																																						
MP-3	04-Sep-08	1130	11.81	12.75																																									
	13-Oct-08	1000	9.06	10.00																																									
	23-Oct-08	0830	17.36	18.3																																									
	29-Oct-08		#N/A																																										
	23-Jan-09	1800	18.3	19.24																																									
	22-Jun-09	1240	#N/A	Dry																																									
	15-Sep-09	1505	#N/A	Dry																																									
	30-Nov-09	1220	#N/A	Dry																																									
	25-Feb-10	1140	#N/A	Dry																																									
	03-May-10	1050	#N/A	Dry																																									
	26-Aug-10	1000	#N/A	Dry																																									
	08-Nov-10	1400	#N/A	Dry																																									
	07-Mar-11	1150	#N/A	Dry																																									
	03-May-11	1315	#N/A	Dry																																									
	30-Aug-11	1000	#N/A	Dry																																									
	04-Nov-11	1040	#N/A	Dry																																									
	20-Mar-12	0950	#N/A	Dry																																									
	23-May-12	1000	#N/A	Dry																																									
	27-Aug-12	1010	#N/A	Dry																																									
	26-Nov-12	0940	#N/A	Dry																																									
	12-Mar-13	0930	18.26	19.2																																									
	12-Jun-13	1150	18.25	19.19	No Sample																																									
	28-Aug-13	1020	18.13	19.07																																									
	11-Dec-13	1145	18.26	19.2	No sample - mud at bottom																																									
	24-Feb-14	1410	#N/A	Dry																																									
	12-Jun-14	1035	18.27	19.21	No sample-mud at bottom																																									
	27-Nov-14	1050	#N/A	Dry																																									
	28-May-15	1030	#N/A	Dry																																									
MP-3A	12-Mar-13	0950	22.30	22.90	1280	7.48	22.3	7.82	1330	834	<1	<1	478	478	63	124	18	15	312	3	1.14	0.007		0.141	<0.001	<0.0001	0.001	0.004	0.051	0.087	0.005	0.006		0.05	0.24	3.82	<0.0001	0.04	<0.01	0.28	0.28	14.4	15.8	4.66	
	15-Apr-13	0945	22.38	22.98																																									
	27-May-13	1315	22.38	22.98																																									
	12-Jun-13	1220	22.25	22.85	1225	7.79	22.1																																						
	29-Jul-13	1425	22.34	22.94																																									
	23-Aug-13	0953	22.32	22.92																																									
	28-Aug-13	1040	22.30	22.9	1250	7.8	22.6	8.12	1330	796	<1	<1	475	475	48	108	17	15	272	3	2.21	0.005	0.07	0.134	<0.001	<0.0001	0.002	0.003	0.095	0.094	0.004	0.008	<0.01	0.04	0.154	2.11	<0.0001	<0.01				13.5	14	1.6	
	30-Sep-13	1600	22.32	22.92																																									
	28-Nov-13	1345	22.26	22.86																																									
	11-Dec-13	1200	22.27	22.87	1305	7.9	22.1																																						
	26-Feb-14	0950	22.30	22.9	1280	8.1	22.7	8.37	1340	761	<1	15	439	454	44	99	13	12	294	2	0.75	0.004	0.07	0.123	<0.001	<0.0001	<0.001	0.027	0.091	0.077	0.008	0.008	<0.01	0.03	0.078	0.86	<0.0001	<0.01				12.8	14.5	6.17	
	14-Mar-14	1445	22.26	22.86																																									
	17-Jun-14	1050	22.28	22.88	1284	7.8	21.3																																						
	10-Sep-14	1000	22.30	22.9	1290	7.8	22.7	7.98	1330	760	<1	<1	529	529	42	104	12	11	245	1	0.05	0.005	0.05	0.118	<0.001	<0.0001	<0.001	<0.001	0.01	0.089	<0.001	<0.001	<0.01	0.03	0.021	0.07		<0.01	<0.01	0.77	0.77	14.4	12.2	8.3	
	17-Nov-14	1110	22.28	22.88	1295	7.9	23																																						
	03-Mar-15	1340	22.20	22.8	1310	8	23.4	8.13	1440	806	<1	<1	503	503	47	123	20	16	277	2	0.04	0.005	0.06	0.085	<0.001	<0.0001	<0.001	0.001	0.008	0.008	0.002	<0.001	<0.01	0.03	0.05	0.09	<0.0001	0.03	<0.01	0.74	0.74	14.5	14.4	0.34	
	28-May-15	1050	22.27	22.87	1291	7.9	21.3																																						
MPA-a	28-Nov-13	1400	29.12	29.97																																									
	12-Dec-13	1045	29.18	30.03	3210	6.8	28.4																																						
	26-Feb-14	0920	29.35	30.2	3660	7.1	21.9	7.98	3820	2270	<1	<1	1000	1000	1	629	52	26	829	4	4.56	0.013	0.06	1.36	<0.001	<0.0001	0.008	0.014	0.067	4.64	0.016	0.009	<0.01	<0.01	0.22	6.7	<0.0001	0.06				37.7	40.9	3.97	
	14-Mar-14	1430	29.30	30.15																																									
	12-Jun-14	0845	29.33	30.18	3690	7.1	20.5																																						
	10-Sep-14	0900	29.35	30.2	3720	7.2	20.7	7.66	3900	2120	<1	<1	1190	1190	<1	700	44	23	697	3	0.07	0.008	<0.05	1.27	<0.001	<0.0001	<0.001	<0.001	0.001	4.21	0.002	<0.001	<0.01	<0.01	0.015	0.59		0.01	<0.01	<0.01	<0.01	43.5	34.5	11.6	
	27-Nov-14	920	29.3	30.15	3700	7.2	22.1																																						
	04-Mar-15	1200	29.25	30.1	4420	7.3	22.6	7.51	4580		<1	<1	919	919	45	996	41	28	975	4	<0.01	0.006						<0.001	0.003	0.79	0.002	<0.001			0.018	<0.05	<0.0001		<0.01	0.03	0.03	47.4	46.9	0.6	
	28-May-15	940	29.32	30.17	3870	7.2	21.2																																						
MP4-b	28-Nov-13	1405	26.06	26.96																																									
	12-Dec-13	0850	25.87	26.77	2960	7.3	25.1																																						
	26-Feb-14	0850	25.20	26.1	2890	7.5	21.7	8.15	3050	1720	<1	<1	640	640	145	492	8	8	720	2	0.3	0.007	<0.05	0.215	<0.001	<0.0001	<0.001	0.012	0.021	0.874	0.005	0.002	<0.01	<0.01	0.034	0.68	<0.0001	0.22				29.7	32.4	4.37	
	13-Mar-14	1435	25.97	26.87																																									
	12-Jun-14	0900	26.00	26.9	2960	7.3	20.3																																						
	10-Sep-14	0920	26.00	26.9	2950	7.4	20.7	7.96	3020	1680	<1	<1	723	723	126	509	9	9	613	2	0.1	0.005	<0.05	0.155	<0.001	<0.0001	<0.001	<0.001	0.005	0.534	0.002	<0.001	<0.01	<0.01	0.016	0.34		0.04	<0.01	0.02	0.02	31.4	27.9	5.98	
	27-Nov-14	900	25.94	26.84	2960	7.4	21.5																																						
	04-Mar-15	1225	25.9	26.8	2960	7.6	23.3	7.95	3040		<1	<1	698	698	125	532	7	7	687	2	<0.01	0.005						<0.001	0.002	0.055	<0.001	<0.001			0.005	<0.05	<0.0001		<0.01	0.03	0.03	31.6	30.9	1.16	
	28-May-15	1005	25.96	26.86	2980	7.6	21.1																																						
MP-5	04-Sep-08	0940	53.13	54.00																																								
	13-Oct-08	1515	52.9	53.77																																								
	23-Oct-08	0900	52.96	53.83																																								
	29-Oct-08		#N/A																																									
	23-Jan-09	1616	54.39	55.26																																								
	22-Jun-09	1020	#N/A	Dry																																								
	15-Sep-09	1608	#N/A	Dry																																								

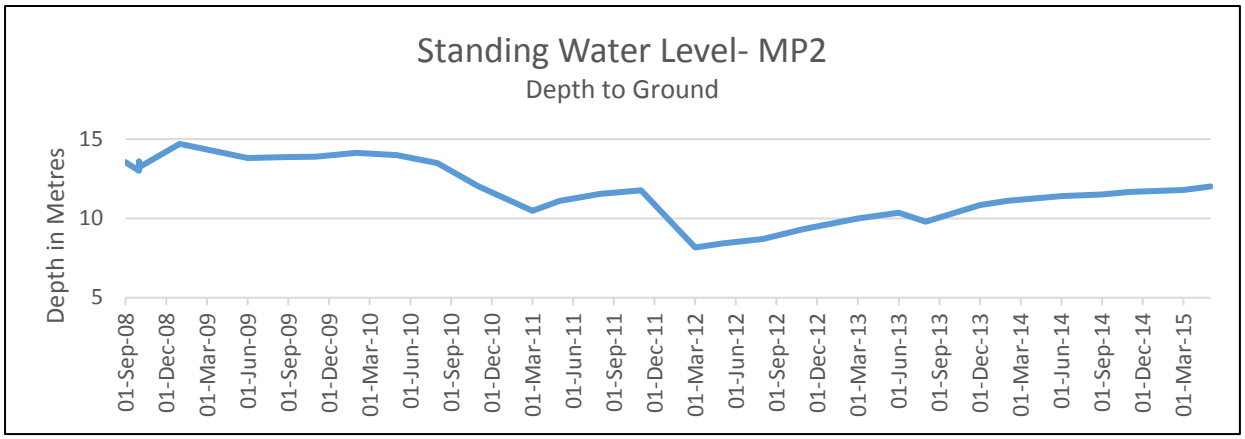
Site ID	Date	Time	Depth to Ground - mbgl	Depth to Stand - mbtoc	Field Parameters			pH - Lab	EC - Lab - µs/cm	Total Dissolved Solids	Major Anions						Major Cations				Total Metals																						Mercury - mg/L	Ammonia as Nitrogen (N)	Nitrite as N (mg/L)	Nitrate as N (mg/L)	NOX as N (mg/L)	Total Anions - meq/L	Total Cations - meq/L	Ionic Balance	Comments
					EC - Field - µs/cm	pH - Field	Temp - Field - °C				Hydroxide Alkalinity as CaCO3 - mg/L	Carbonate Alkalinity as CaCO3 - mg/L	Bicarbonate Alkalinity as CaCO3 - mg/L	Alkalinity - mg/L	Sulfate (SO4) - mg/L	Chloride (Cl) - mg/L	Calcium (Ca) - mg/L	Magnesium (Mg) - mg/L	Sodium (Na) - mg/L	Potassium (K) - mg/L	Aluminium (Al) - mg/L	Arsenic (As) - mg/L	Boron (B) - mg/L	Barium (Ba) - mg/L	Beryllium (Be) - mg/L	Cadmium (Cd) - mg/L	Cobalt (Co) - mg/L	Chromium (Cr) - mg/L	Copper (Cu) - mg/L	Manganese (Mn) - mg/L	Nickel (Ni) - mg/L	Lead (Pb) - mg/L	Selenium (Se) - mg/L	Vanadium (V) - mg/L	Zinc (Zn) - mg/L	Iron (Fe) - mg/L									
ANZECC guideline*										4000							1000				5	0.5				0.01	1	1	1		1	0.1									1500	400					
	30-Nov-09	0915	54.67	55.52																																										
	25-Feb-10	1445	54.73	55.58																																										
	03-May-10	1330	54.6	55.45																																										
	26-Aug-10	1210	54.81	55.66																																										
	08-Nov-10	1140	54.88	55.73																																										
	02-Mar-11	1130	54.85	55.7																																										
	03-May-11	1000	54.8	55.65																																										
	30-Aug-11	1330	54.89	55.74																																										
	04-Nov-11	1300	54.78	55.63																																										
	20-Mar-12	1020	54.85	55.7																																										
	23-May-12	1030	54.41	55.26																																										
	28-Aug-12	1130	55.43	56.28																																										
	26-Nov-12	1125	54.95	55.8																																										
	12-Mar-13	1300	#N/A	Dry																																										
	12-Jun-13	1055	#N/A	Dry																																										
	29-Aug-13	1140	#N/A	Dry																																										
	12-Dec-13	1335	#N/A	Dry																																										
	27-Feb-13	1200	#N/A	Dry																																										
	12-Jun-14	1400	#N/A	Dry																																										
	27-Nov-14	1200	#N/A	Dry																																										
	28-May-15	1200	#N/A	Dry																																										
MP-5A	12-Mar-13	1240	63.00	63.80	2790	7.33	24.7	7.7	3010	1720	<1	<1	828	828	44	493	68	68	575	23	0.1	0.003		0.115	<0.001	0.001	0.001	0.005	0.21	0.204	0.021	0.016		<0.01	4.94	0.51	<0.0001	1.63	<0.01	0.13	0.13	31.4	34.6	4.86	
	15-Apr-13	1400	65.78	66.58																																										
	27-May-13	1250	67.11	67.91																																										
	12-Jun-13	1115	67.03	67.83	2800	7.12	22.4																																						
	29-Jul-13	1500	66.10	66.9																																										
	23-Aug-13	1018	66.20	67																																										
	29-Aug-13	1120	66.90	67.7	2710	7	23.2	7.44	2950	1540	<1	<1	802	802	90	460	69	72	537	21	0.46	0.001	<0.001	<0.05	0.119	<0.0001	0.001	0.002	0.05	0.312	0.006	0.007	<0.01	<0.01	0.128	3.44	<0.0001	0.24				30.9	33.3	3.7	
	30-Sep-13	1630	71.25	72.05																																										
	28-Nov-13	1435	76.55	77.35																																										
	12-Dec-13	1350	76.56	77.36	2770	7	24.8																																						
	27-Feb-14	1130	76.60	77.4	2710	7.2	26.4	7.32	3070	1590	<1	<1	875	875	95	454	68	70	569	16	6.29	0.004	0.001	0.06	0.309	0.0002	0.012	0.02	0.323	0.963	0.034	0.05	<0.01	0.05	0.537	25.4	0.0002	0.39				32.3	34.3	3.04	
	14-Mar-14	1400	76.52	77.32																																									
	17-Jun-14	1410	76.63	77.43	3010	7	22																																					
	10-Sep-14	1415	76.90	77.7	2990	6.9	23.5	7.32	3150	1790	<1	<1	1030	1030	76	492	64	67	454	16	12.8	0.01	0.05	0.367	0.001	0.0002	0.018	0.02	0.086	0.679	0.037	0.024	<0.01	0.05	0.226	18.8		0.26	<0.01	0.01	0.01	36	28.9	11.1	
	27-Nov-14	1220	77.38	78.18	2890	7	23.7																																					
	28-May-15	1225	78.22	79.02	Mud only recovered, no water																																								
MP-6	20-Jun-13	1040	8.11	8.76	3170	6.91	20.8	7.43	3430	1990	<1	<1	1080	1080	13	426	48	34	718	13	0.22	0.005		0.882	<0.001	<0.0001	0.009	<0.001	0.009	1.11	0.025	0.003		<0.01	0.027	10.2	<0.0001	2.51	<0.01	<0.01	<0.01	33.9	36.8	4.05	
	29-Jul-13	1345	8.13	8.78																																									
	22-Aug-13	1559	8.08	8.73																																									
	29-Aug-13	1030	8.14	8.79	2890	7.1	22.4	7.46	3130	1540	<1	<1	1090	1090	2	423	34	28	741	14	0.11	0.006	<0.001	0.09	0.65	<0.0001	0.042	<0.001	0.042	0.665	0.023	0.004	<0.01	<0.01	0.125	8.81	<0.0001	1.66				33.8	36.6	3.99	
	30-Sep-13	1520	8.11	8.76																																									
	28-Nov-13	1245	8.18	8.83																																									
	11-Dec-13	1430	8.17	8.82	2780	7.2	22.4																																						
	24-Feb-14	1245	8.29	8.94	2580	7.4	22.2																																						
	12-Jun-14	1150	8.34	8.99	2360	7.3	21.4																																						
	10-Sep-14	1330	9.33	9.98	2260	7.4	21.2	7.7	2330	1390	<1	<1	998	998	<1	236	10	9	440	6	0.08	0.004	0.09	0.316	<0.001	<0.0001	0.012	<0.001	0.012	0.193	0.008	0.002	<0.01	<0.01	0.033	2.2		1.07	<0.01	0.04	0.04	26.6	20.5	12.9	
	27-Nov-14	1320	8.37	9.02	2160	7.5	22.7																																						
	03-Mar-15	1130	8.43	9.08	2110	7.6	22.3	7.89	2240	1400	<1	<1	907	907	3	191	13	10	538	6	0.3	0.006	0.09	0.335	<0.001	<0.0001	0.002	0.004	0.029	0.166	0.016	0.003	<0.01	<0.01	0.122	4.79	<0.0001	1.16	<0.01	0.03	0.03	23.6	25	2.94	
	28-May-15	1310	8.47	9.12	2100	7.51	21.7																																						
MP-7	13-Mar-13	1030	15.50	16.30	3230	6.8	24.5	6.6	3520	2270	<1	<1	780	780	5	680	140	71	583	8	0.67	0.008		1.06	<0.001	<0.0001	0.008	0.002	0.031	5.4	0.009	0.006		<0.01	0.216	12	<0.0001	0.09	<0.01	0.12	0.12	34.9	38.4	4.79	
	15-Apr-13	1305	15.64	16.44																																									
	27-May-13	1445	15.76	16.56																																										
	02-Jul-13	1120	15.72	16.52	3830	6.81	21.8	7.06	4310	2270	<1	<1	493	493	1	948	151	96	549	4	0.03	0.016		2.57	<0.001	<0.0001	0.015	<0.001	<0.001	5.25	0.007	<0.001		<0.01	<0.005	11.2	<0.0001	0.17	<0.01	0.28	0.28	36.6	39.4	3.68	
	29-Jul-13	1435	15.72	16.52																																									
	23-Aug-13	0936	15.68	16.48																																									
	29-Aug-13	0900	15.70	16.5	3040	6.81	22.3	7.33	3310	1720	<1	<1	586	586	21	700	100	67	540	4	0.05	0.029	<0.001	0.07	1.45	0.0002	<0.001	<0.001	0.148	3.75	0.004	0.003		<0.01	0.49	10.6	<0.0001	0.2				31.9	34.1	3.32	
	30-Sep-13	1644	15.63	16.43																																									
	28-Nov-13	1600	15.60	16.4																																									
	18-Dec-13	1220	15.76	16.56	2970	6.9	23.3																																						
	27-Feb-14	1915	15.70	16.5	2850	6.9	21.9	7.26	3200	1670	<1	<1	595	595	27	669	88	55	569	2	0.43	0.023	<0.001	0.11	1.43	0.0003	0.001	0.027	0.312	2.98	0.013	0.026	<0.01	<0.01	0.404	8.21	<0.0001	0.15				31.3	33.7	3.66	
	19-Jun-14	0935	15.82	16.62	3050	7	20.1																																						
	11-Sep-14	910	15.96	16.6	3040	7	20.7	7.66	3140	1650	<1	<1	547	547	27	627	84	54	466	3	0.11	0.017	0.1	1.42	<0.001	<0.0001	<0.001	<0.001	0.006	2.74	0.002	0.002	<0.01	<0.01	0.03	5.59	<0.0001	0.21	<0.01	0.06	0.06	29.2	29	0.36	
	11-Nov-14	1130	15.97	16.61	3060	7.1	22.3																																						
	03-Mar-15	920	16.06	16.7	3010	7.1	21.8	7.69	3250	1650	<1	<1	614	614	34	619	86	54	508	3	0.02	0.004	0.1	1.03	<0.001	<0.0001	<0.001	<0.001	0.003	1.67	0.001	<0.001	<0.01	<0.01	0.036	1.45	<0.0001	0.14	<0.01	0.02	0.02	30.4	30.9	0.75	
	28-May-15	1115	16.21	16.85	3070	7	21.4																																						
MP-8	13-Mar-13	1030	15.80	16.50	1430	4.73	25.6	4.45	1500	1610	<1	<1	<1	<1	48	250	53	27	263	13	1.76	0.005		0.186	<0.001	0.0004	0.017	0.003	0.112	1.16	0.024	0.03		<0.01	2.37	5.83	<0.0001	0.19	<0.01	0.29	0.29	8.05	16.6	34.8	
	15-Apr-13	1300	15.79	16.49																																									
	27-May-13	1443	15.90	16.6																																									
	02-Jul-13	1240	16.28	16.98	4200	6.7	23.3	7.18	4800	2720	<1	<1	507	507	22	1060	179	110	593	4	1.14	0.01		0.9	<0.001	<0.0001	0.018	0.002	0.005	1.43	0.011	0.002		<0.01	0.035	4.54	<0.0001	0.03	0.01	0.35	0.36	40.5	43.9	4.02	
	29-Jul-13	1440	15.90	16.6																																									
	23-Aug-13	0935	15.84	16.54																																									
	29-Aug-13	0930	15.90	16.6	3180	5.44	22.5	6.28	3440	2220	<1	<1	389	389	1	836	133	88	473	8	0.9	0.008	<0.001	0.07	0.968	0.0001	0.015	0.002	0.091	2.63	0.013	0.008	<0.01	<0.01	0.344	7.06	<0.0001	0.16				31.4	34.7	4.96	
	30-Sep-13	1646	15.81	16.51																																									
	28-Nov-13	1605	15.80	16.5																																									
	18-Dec-13	1200	15.92	16.62	3620	6.4	22.9																																						
	27-Feb-14	0855	16.00	16.7	3540	6.5	22.1	6.72	3920	2280	<1	<1	453	453	<1	968	153	93	590	5	0.26	0.005	<0.001	0.08	0.994	0.0001	0.002	0.018	0.093	2.29	0.014	0.01	<0.01	<0.01	0.397	4.31	<0.0001	0.54				36.9	41.1	5.37	
	19-Jun-14	0920	16.01	16.71	4010	6.9	20.1																																						
	11-Sep-14	0845	7.8	8.45	4170	6.7	20.8	7.47	4420	2620	<1	<1	524	524	2	982	164	102	526	5	0.52	0.002	0.07	0.949	<0.001	<0.0001	0.001	0.003	0.018	1.55	0.008	0.005	<0.01	<0.01	0.106	1.18	<0.0001	0.42	<0.01	0.03	0.03	38.2	39.6	1.76	
	27-Nov-14	1140	16.05	16.7	4130	7	22.9																																						
	03-Mar-15	905	16.15	16.8	4190	6.9	22.4	7.53	4500	2910	<1	<1	578	578	4	1160	183	113	615	5	0.05	0.001	0.08	0.899	<0.001	<0.0001	<0.001	0.001	0.008	1.64	0.006	<0.001	<0.01	<0.01	0.08	0.66	<0.0001	0.41	<0.01	0.04	0.04	44.4	45.3	1.06	
	28-May-15	1135	16.26	16.91	4210	6.9	21.2																																						
WB-1	13-Oct-08	1640	8.95	9.35																																									
	28-Oct-08		8.85	9.25	1996	7.93	22.4			1050	<1	<1	483	483	30	286	9	12	388	4		0.018		0.355	<0.001	0.0001	<0.001	<0.001	0.009	0.045	0.045	0.027		<0.01	1.19	8.7	<0.0001	1.23				17.8	18.4	1.57	
	06-Dec-11	1230	8.64	9.04	1450	8.08	22.3																																						
	21-Mar-12	1030	8.49	8.89	1640	7.98	23.6	8.1	1730	932	<1	<1	508	508	10	286	12	13	420	7	0.1	0.022		0.386	<0.001	0.0001	<0.001	<0.001	0.015	0.039	<0.001	0.006		<0.01	0.468	9.31	<0.0001	2.04	<0.01	0.07	0.07	18.4	20.1	4.34	
	24-May-12	1310	8.52	8.82	1537	8.03	22																																						
	27-Aug-12	1320	7.82	8.22																																									
	26-Nov-12	1200	7.78	8.18																																									
	12-Mar-13	1340	7.85	8.25																																									
	10-Jun-13	900	7.94	8.34		No sample																																							
	29-Aug-13	1100	7.99	8.39																																									
	11-Dec-13	1420	8	8.4	No sample - windmill over bore																																							
	24-Feb-14	1300	8.11	8.51	No sample - windmill over bore																																							
	12-Jun-14	1140	8.15	8.55	No sample- windmill over bore																																							
	27-Nov-14	1330	8.22	8.62	No sample- windmill over bore																																							
	28-May-15	1250	8.31	8.71	No sample- windmill over bore																																							
WB-2	03-Sep-08	1400	16.87	17.25																																								
	13-Oct-08	1630	16.49	16.87																																								
	28-Oct-08		16.60	16.98	3430	7.72	22.7			2310	<1	<1	389	389	6	816	207	120	281	3		<0.001		0.127	<0.001	<0.0001	<0.001	<0.001	0.011	0.01	0.01	<0.001		0.02	0.023	0.15	<0.0001	0.17				31.4	32.5	1.7	
	23-Jan-09	1532	17	17.39																																								
	22-Jun-09	0830	16.65	17.03	3160	7.2	19.6		3050	1750	<1	<1	464	464	27	798	205	103	274	4		0.003		0.128	<0.001	<0.0001	<0.001	0.001	0.132	0.826	0.024	0.012		0.05	1.32	20.1	<0.0001	0.08				32.3	30.7	2.52	
	15-Sep-09	1552	16.45	16.83																																								
	06-Jan-10	0930	16.45	16.83	2070	8.5	24.1	7.51	2010		<1	<1	330	330	13.7	326	126	62	159	7	<0.01	<0.001						<0.001	0.021	0.036	0.009	<0.001			0.334	<0.05	<0.0001		0.02	8.96	8.98	16.7	18.5	5	
	25-Feb-10	1355	16.48	16.86																																								
	03-May-10	1250	16.56	16.94	1821	7.84	23.1		2190	1290	<1	<1	364	364	35.5	505	148	73	194	7		0.001		0.084	<0.001	0.0002	<0.001	<0.001	0.138	0.541	0.01	0.007		0.03	1.03	11.8	<0.0001	2.77				22.3	22	0.47	
	26-Aug-10	1315	19.54	19.92	3000	7.4	Probe Broken																																						
	08-Nov-10	1050	17	17.38	2410	7.3	24.1																																						
	02-Mar-11	1050	16.96	17.34	2450	7.31	27.3	7.53	2750		<1	<1	320	320	28	753	184	109	271	4	<0.01	<0.001						<0.001	0.007	0.004	<0.001	<0.001			0.009	<0.05	<0.0001		0.04	1.74	1.78	28.2	30	3.16	
	03-May-11	925	16.53	16.91	2360	7.55	15																																						
	30-Aug-11	1400	16.36	16.74	2170	8.3	21.8	7.87	2880	1460	<1	<1	290	290	32	778	127	103	269	3	<0.01	<0.001		0.083	<0.001	<0.0001	<0.001	<0.001	0.016	0.002	<0.001	<0.001		0.01	0.025	0.19	<0.0001	<0.01	<0.01	0.5	0.5	28.4	26.6	3.3	
	04-Nov-11	1330	16.44	16.82	2110	8.4	25.4																																						
	20-Mar-12	1330	16.42	16.8	2410	8.46	24.5	8.64	2650	1540	<1	32	114	146	17	804	57	110	335	4	<0.01	0.002		0.023	<0.001	<0.0001	<0.001	<0.001	0.002	0.007	<0.001	<0.001		0.01	0.007	0.08	<0.0001	0.07	<0.01	0.08	0.08	26	26.6	1.18	
	23-May-12	1300	16.14	16.52	2610	8.56	15.7																																						
	27-Aug-12	1250	16.32	16.7	2240	7.57	21.8	7.91	2480	1510	<1	<1	414	414	34	591	167	84	218	5	0.04	<0.001		0.076	<0.001	<0.0001	<0.001	<0.001	0.107	0.103	0.001	0.003		<0.01	0.502	1.03	<0.0001	<0.01	<0.01	4.8	4.8	25.6	24.9	1.56	
	26-Nov-12	1150	16.6	16.98	2560	7.85	24.3																																						
	12-Mar-13	1320	16.02	16.4	2570	7.89	24.8	7.29	2740	1420	<1	<1	230	230	33	692	110	107	282	4	0.01	<0.001		0.092	<0.001	<0.0001	<0.001	<0.001	0.008	0.006	<0.001	<0.001		0.01	0.023	0.15	<0.0001	0.05	<0.01	0.12	0.12	24.8	26.7	3.62	

Site ID	Date	Time	Depth to Ground - mbgl	Depth to Stand - mbtoc	Field Parameters			pH - Lab	EC - Lab - µs/cm	Total Dissolved Solids	Major Anions						Major Cations				Total Metals																				Mercury - mg/L	Ammonia as Nitrogen (N)	Nitrite as N (mg/L)	Nitrate as N (mg/L)	NOX as N (mg/L)	Total Anions - meq/L	Total Cations - meq/L	Ionic Balance	Comments
					EC - Field - µs/cm	pH - Field	Temp - Field - °C				Hydroxide Alkalinity as CaCO3 - mg/L	Carbonate Alkalinity as CaCO3 - mg/L	Bicarbonate Alkalinity as CaCO3 - mg/L	Alkalinity - mg/L	Sulfate (SO4) - mg/L	Chloride (Cl) - mg/L	Calcium (Ca) - mg/L	Magnesium (Mg) - mg/L	Sodium (Na) - mg/L	Potassium (K) - mg/L	Aluminium (Al) - mg/L	Arsenic (As) - mg/L	Boron (B) - mg/L	Barium (Ba) - mg/L	Beryllium (Be) - mg/L	Cadmium (Cd) - mg/L	Cobalt (Co) - mg/L	Chromium (Cr) - mg/L	Copper (Cu) - mg/L	Manganese (Mn) - mg/L	Nickel (Ni) - mg/L	Lead (Pb) - mg/L	Selenium (Se) - mg/L	Vanadium (V) - mg/L	Zinc (Zn) - mg/L	Iron (Fe) - mg/L									
ANZECC guideline*										4000							1000				5	0.5				0.01	1	1	1		1	0.1							1500	400						
	12-Jun-13	1035	17.88	18.26	2620	7.28	20.6																																						
	28-Aug-13	1350	15.92	16.3	2840	7.1	22.9	7.61	3020		<1	<1	440	440	35	694	194	111	261	3	0.07	<0.001	0.08	0.119	<0.001	<0.0001	<0.001	<0.001	0.042	0.02	<0.001	0.002	<0.01	0.02	0.09	0.84	<0.0001	<0.01				29.1	30.2	1.94	
	11-Dec-13	1410	15.73	16.11	No Sample - Tank Empty/Windmill broken + logs stuck in bore.																																									
	26-Feb-14	1410	16.22	16.6	2870	7.9	26	8.15	3070	2320	<1	<1	307	307	26	1980	141	112	236	4	0.01	0.001	0.11	0.118	<0.001	<0.0001	<0.001	<0.001	0.004	0.021	<0.001	<0.001	<0.01	0.01	0.021	0.08	<0.0001	0.3				26.3	26.6	0.65	
	12-Jun-14	1210	15.76	16.14	2700	8.7	14.8																																						
	10-Sep-14	1250	18.82	19.2	2090	7.8	19.3	7.81	3040	2040	<1	<1	470	470	35	708	191	105	235	3	0.02	<0.001	0.08	0.121	<0.001	<0.0001	<0.001	<0.001	0.011	0.004	<0.001	<0.001	<0.01	0.02	0.023	<0.05		0.03	0.02	3.68	3.7	30.1	28.5	2.76	
	28-Nov-15	950	19.75	20.13	2120	8.2	22.2																																						Windmill Running
	03-Mar-15	1200	17.42	17.8	2960	7.7	25.3	7.83	3200	2580	<1	<1	415	415	33	689	187	118	283	3	0.01	<0.001	0.09	0.116	<0.001	<0.0001	<0.001	<0.001	0.005	0.016	<0.001	<0.001	<0.1	0.02	0.033	0.28	<0.0001	0.61	0.03	0.79	0.82	28.4	31.4	5.04	
	29-May-15	1100	15.81	16.19	2470	8.6	16.5																																						Windmill Running
WB-3	03-Sep-08	1430	8.82	9.40																																									
	13-Oct-08	1555	8.87	9.45																																									
	29-Oct-08		8.95	9.53	4480	7.2	21.7				<1	<1	395	395	29	1210	264	196	363	2		0.002		0.012	<0.001	0.0004	0.001	0.05	0.009	0.026	0.026	0.003		0.04	0.026	0.61	<0.0001	0.06				42.7	45.1	2.75	
	23-Jan-09	1545	23.72	24.3																																									
	09-Feb-09	1600	9	9.5																																									
	22-Jun-09	0905	8.99	9.57	4380	7.5	15.9		4080	2690	<1	<1	434	434	22	1270	259	184	407	2		<0.001		0.005	<0.001	<0.0001	<0.001	<0.001	0.028	0.004	0.006	<0.001		0.04	0.131	0.06	<0.0001	0.18				44.8	45.8	1.1	
	15-Sep-09	1549	8.99	9.57																																									
	30-Nov-09	0845	9.03	9.61	2900	7.67	25.6	7.74	3890		<1	<1	324	324	21.2	1220	215	185	360	3	<0.01	0.001						<0.005	0.017	0.003	0.005	<0.001			0.078	<0.05	<0.0001		<0.01	3.78	3.78	41.3	41.7	0.5	
	25-Feb-10	1410	8.92	9.5																																									
	03-May-10	1320	18.53	19.11	4290	7.88	23.5		4000	2680	<1	<1	428	428	29.8	1210	229	168	354	2		0.001		0.006	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		0.04	<0.005	<0.05	<0.0001	<0.01				43.2	40.7	3.06	
	26-Aug-10	1250	8.94	9.52	3260	8.28	Probe Broken																																						
	08-Nov-10	1110	8.98	9.56	2360	8.02	25.8																																						
	02-Mar-11	1150	17.63	18.21	3770	7.44	27.4	7.6	4820		<1	<1	145	145	26	1460	274	157	498	8	<0.01	0.003						<0.001	0.009	0.004	0.002	<0.001			0.015	<0.05	<0.0001		0.09	0.88	0.97	44.7	48.5	4.05	
	03-May-11	945	9.07	9.65	3790	7.7	14.3																																						
	01-Sep-11	1010	9.14	9.72	3830	8.1	16.9	8.32	4860	2480	<1	3	171	174	31	1300	147	191	411	3	<0.01	0.001		0.01	<0.001	<0.0001	<0.001	<0.001	0.006	0.005	<0.001	<0.001		0.02	0.016	<0.05	<0.0001	0.11	<0.01	0.12	0.12	40.8	41	0.27	
	06-Dec-11	1100	9.07	9.65	3650	7.05	22.2																																						
	20-Mar-12	1300	8.71	9.29	3720	6.95	24.3	7.36	4280	2750	<1	<1	398	398	33	1160	256	184	393	2	<0.01	0.001		0.002	<0.001	<0.0001	<0.001	<0.001	0.002	<0.001	<0.001	0.04		<0.001	0.009	<0.05	<0.0001	0.06	<0.01	3.64	3.64	41.4	45.1	4.29	
	23-May-12	1255	8.49	9.07																																									
	27-Aug-12	1350	8.32	8.9																																									
	26-Nov-12	1330	8.2	8.78																																									
	13-Mar-13	1415	7.98	8.56																																									
	20-Jun-13	1100	7.95	8.53	Pump over bore																																								
	30-Aug-13	0815	7.86	8.44																																									
	18-Dec-13	1250	7.87	8.45	Pump off & Covering Bore																																								
	27-Feb-14	1100	7.8	8.38	Pump covering bore																																								
	12-Jun-14	1225	8.05	8.63	Pump over bore																																								
	28-Nov-15	1155	7.74	8.32	Pump over bore																																								
	28-May-15	1340	7.74	8.32	Pump over bore																																								
WB-4	03-Sep-08		casing sealed																																									casing sealed
	13-Oct-08		casing sealed																																									casing sealed
	29-Oct-08		casing sealed																																									casing sealed
	22-Jun-09		casing sealed																																									casing sealed
	15-Sep-09		casing sealed																																									casing sealed
	30-Nov-09		casing sealed																																									casing sealed
	25-Feb-10		casing sealed																																									casing sealed
	26-Aug-10	1230			3650	7.83	Probe Broken																																						Bore covered by pump unable to dip-Sample taken from tank
	08-Nov-10	1205		Tank empty unable to sample																																									Bore covered by pump unable to dip
	02-Mar-11	1200			3320	7.03	29.2	7.16	4010		<1	<1	312	312	26	1200	247	183	363	2	<0.01	0.001						<0.001	0.005	0.002	<0.001	<0.001			0.027	<0.05	<0.0001		<0.01	3.79	3.79	40.6	43.2	3.13	Bore covered by pump unable to dip, Sample taken from tank
	03-May-11	1030			3160	7.1	14.5																																						Bore covered by pump unable to dip,Sample taken from tank
	01-Sep-11	1030			3650	7.15	16.8																																						Bore covered by pump unable to dip, Sample taken from tank
	06-Dec-11	1200			3590	7.36	22.3			2710																																			
	20-Mar-12	1040			3680	7.32	21.7	7.61	4260		<1	<1	378	378	33	1170	244	182	402	2	<0.01	0.002		0.003	<0.001	<0.0001	<0.001	<0.001	0.028	0.002	<0.001	0.001		0.04	0.022	<0.05	<0.0001	0.05	0.02	3.21	3.23	41.2	44.7	4.02	
	24-May-12	1330			3580	7.91	15.3																																						
	28-Aug-12	1200																																											Bore covered by pump unable to dip, Sample taken from tank
	26-Nov-12	1250																																										From tank-no sample -tank empty
	12-Jun-13	1120		Pump over bore																																									
	29-Aug-13	1150		Pump over bore																																									
	12-Dec-13	1400		Pump over bore - Tank Empty																																									
	27-Feb-14	1215		Pump over bore - Tank Empty																																									
	12-Jun-14	1420		Pump over bore-Tank empty																																									
	27-Nov-15	1235		Pump over bore- Tank empty																																									
	28-May-15	1240		Pump over bore- Tank empty																																									
WB-5	03-Sep-08	1540	4.23	4.65																																									
	13-Oct-08	1600	12.92	13.34																																									
	28-Oct-08		12.85	13.27	8400	7.29	22.5			5680	<1	<1	505	505	89	2350	314	288	979	8		<0.001		0.165	<0.001	0.0002	<0.001	<0.001	0.003	0.267	0.267	<0.001		<0.01	0.103	0.47	<0.0001	0.22				78.2	82.1	2.39	
	23-Jan-09	1700	13.1	13.5																																									
	22-Jun-09	1045	#N/A		7930	6.6	21.3		7590	4580	<1	<1	612	612	67	2680	318	270	1080	9		<0.001		0.163	<0.001	<0.0001	<0.001	<0.001	0.002	0.231	0.002	<0.001		<0.01	0.045	2.36	<0.0001	0.02				89.4	85.3	2.36	
	15-Sep-09	1620	#N/A		Bore unable to be dipped			7.26																																				
	30-Nov-09	0930	22.93	23.33	4880	7.06	27.9		7250		<1	<1	494	494	63.8	2330	282	280	965	10	<0.01	<0.001						<0.005	0.002	0.253	0.001	<0.001			0.086	<0.05	<0.0001		<0.01	2.23	2.23	77	79.3	1.45	
	25-Feb-10	1345	13.14	13.54																																									
	03-May-10	1215	12.97	13.37	7500	7.43	23		6720	4570	<1	<1	415	415	91	2360	217	268	1020	9		<0.001		0.124	<0.001	<0.0001	<0.001	<0.001	0.003	0.124	0.001	<0.001		<0.01	0.085	0.21	<0.0001	<0.01				76.8	77.5	0.41	
	26-Aug-10	1125	13.01	13.41	7480	7.47	Probe Broken																																						
	08-Nov-10	1255	14.06	14.46	5810	7.86	25.5	6.67																																					
	02-Mar-11	1315	20.99	21.39	5590	6.45	26.2		7540		<1	<1	216	216	75	2420	301	259	958	10	<0.01	<0.001						<0.005	<0.001	0.243	<0.001	<0.001			0.017	<0.05	<0.0001		0.02	2.13	2.14	74	78.3	2.79	
	03-May-11	1150	12.7	13.1	5760	6.8	16.1	7.85																																					
	30-Aug-11	1240	12.7	13.1	5610	7.8	19.5		7780	4290	<1	<1	328	328	70	2500	191	266	1020	9	0.6	0.001		0.154	<0.001	0.0002	<0.001	<0.001	0.022	0.102	0.006	0.004		<0.01	0.201	1.02	<0.0001	<0.01	<0.01	2.1	2.1	78.5	76	1.63	
	04-Nov-11	1230	12.79	13.19	5550	7.9	26.1	7.86																																					
	20-Mar-12	1026	9.86	10.26	6670	7.82	24.5		7870	4810	<1	<1	258	258	95	2680	176	301	1220	11	<0.01	0.001		0.091	<0.001	<0.0001	<0.001	0.001	0.004	0.044	<0.001	<0.001		0.02	0.022	0.65	<0.0001	<0.10	0.02	1.59	1.61	82.7	86.9	2.45	
	23-May-12	1245	9.06	9.46	6360	8.17	16.8	7.65																																					
	27-Aug-12	1220	12.5	12.9	6930	8.19	18.7		7780	4900	<1	<1	600	600	93	2050	281	256	964	8	0.07	<0.001		0.156	<0.001	<0.0001	<0.001	<0.001	0.006	0.198	0.001	<0.001		<0.01	0.07	0.78	<0.0001	<0.10	0.02	2.85	2.87	71.8	77.2	3.67	
	26-Nov-12	1125	11.42	11.82	6740	7.68	27.1	7.81																																					
	12-Mar-13	1210	11.2	11.6	6890	7.7	24.1		7750	5320	<1	<1	288	288	71	2450	176	289	1060	12	<0.01	<0.001		0.084	<0.001	<0.0001	<0.001	<0.001	<0.001	0.039	<0.001	<0.001		<0.01	0.007	0.41	<0.0001	0.15	0.03	0.34	0.37	76.3	79	1.69	
	12-Jun-13	1010	11.2	10.87	6930	7.86	17.4	8.17																																					
	28-Aug-13	1310	12.1	12.5	6910	8.2	20.5		7630		<1	<1	230	230	57	2500	136	290	964	11	<0.01	<0.001	0.08	0.059	<0.001	<0.0001	<0.001	<0.001	0.002	0.141	<0.001	<0.001	<0.01	<0.01	0.01	0.28	<0.0001	0.09				76.3	72.9	2.31	
	11-Dec-13	1350	12.31	12.71	7130	7.8	24.3	7.86																																					
	26-Feb-14	1340	19	19.4	7200	7.6	26.8		7840	5540	<1	<1	471	471	79	1980	256	254	833	10	<0.01	<0.001	0.09	0.157	<0.001	<0.0001	<0.001	<0.001	0.002	0.174	<0.001	<0.001	<0.01	<0.01	0.014	0.78	<0.0001	0.14				66.9	70.2	2.38	
	12-Jun-14	1240	12.56	12.96	7740	7.9	15	7.71																																					
	10-Sep-14	1220	14.50	14.9	5340	7.6	20.7		7940	5780	<1	<1	630	630	90	2420	286	269	899	10	0.02	<0.001	0.07	0.121	<0.001	<0.0001	<0.001	<0.001	0.004	0.07	<0.001	<0.001	<0.01	<0.01	0.03	0.3		0.35	0.09	0.62	0.71	82.7	75.8	4.39	
	28-Nov-14	930	19.99	20.39	5352	7.9	20.9																																						Pump on
	03-Mar-15	1225	11.5	11.9	7620	7.8	24.7	8.16	8360	6300	<1	<1	261	261	86	2470	171	282	1080	9	<0.01	<0.001	<0.05	0.093	<0.001	<0.0001	<0.001	<0.001	<0.001	0.029	<0.001	<0.001	<0.01	<0.01	0.008	0.1	<0.0001	0.08	0.02	0.25	0.27	76.7	79	1.45	
	29-May-15	1040	11.58	11.98	7390	7.4	17.8																																						
WB-6	03-Sep-08	1626	23.18	23.64																																									
	13-Oct-08	1315	23.05	23.51																																									
	29-Oct-08		#N/A																																										
	23-Jan-09	1720	23.84	24.3																																									
	22-Jun-09	1110	23.74	24.2																																									
	15-Sep-09	1528	23.86	24.32																																									
	30-Nov-09	1000	24.05	24.51																																									
	25-Feb-10	1335	25.08	25.54																																									
	03-May-10	1155	23.74	24.2																																									
	26-Aug-10	1055	23.47	23.96																																									
	08-Nov-10	1310	23.31	23.8																																									
	07-Mar-11	1340	22.74	23.23																																									
	03-May-11	1140	22.53	23.02																																									
	30-Aug-11	1150	22.55	23.04																																									
	04-Nov-11	1155	22.67	23.16																																									
	20-Mar-12	1140	21.72	22.21																																									
	23-May-12	1200	21.06	21.55																																									
	27-Aug-12	1130	20.62	21.11																																									
	26-Nov-12	1100	20.42	20.91																																									
	12-Mar-13	1130	20.43	20.92																																									
	12-Jun-13	0935	20.43	20.95																																									
	28-Aug-13	1230	20.59	21.08																																									
	11-Dec-13	1320	20.66	21.15	No Sample - Windmill over bore																																									
	24-Feb-14	1315	20.86	21.35	No Sample - Windmill over bore																																									
	12-Jun-14	1255	21.08	21.57	Windmill over bore																																									
	28-Nov-14	1215	21.44	21.93	Windmill over bore																																									
	29-May-15	1005	21.88	22.37	Windmill over bore																																									

Site ID	Date	Time	Depth to Ground - mbgl	Depth to Stand - mbtoc	Field Parameters			pH - Lab	EC - Lab - µs/cm	Total Dissolved Solids	Major Anions						Major Cations				Total Metals																							Comments
					EC - Field - µs/cm	pH - Field	Temp - Field - °C				Hydroxide Alkalinity as CaCO3 - mg/L	Carbonate Alkalinity as CaCO3 - mg/L	Bicarbonate Alkalinity as CaCO3 - mg/L	Alkalinity - mg/L	Sulfate (SO4) - mg/L	Chloride (Cl) - mg/L	Calcium (Ca) - mg/L	Magnesium (Mg) - mg/L	Sodium (Na) - mg/L	Potassium (K) - mg/L	Aluminium (Al) - mg/L	Arsenic (As) - mg/L	Boron (B) - mg/L	Barium (Ba) - mg/L	Beryllium (Be) - mg/L	Cadmium (Cd) - mg/L	Cobalt (Co) - mg/L	Chromium (Cr) - mg/L	Copper (Cu) - mg/L	Manganese (Mn) - mg/L	Nickel (Ni) - mg/L	Lead (Pb) - mg/L	Selenium (Se) - mg/L	Vanadium (V) - mg/L	Zinc (Zn) - mg/L	Iron (Fe) - mg/L	Mercury - mg/L	Ammonia as Nitrogen (N)	Nitrite as N (mg/L)	Nitrate as N (mg/L)	NOX as N (mg/L)	Total Anions - meq/L	Total Cations - meq/L	Ionic Balance	
ANZECC guideline*										4000							1000				5	0.5				0.01	1	1	1	1									1500	400					
WB-7	04-Sep-08	0830	41.75	42.00																																							
	13-Oct-08	1240	19.11	19.36																																							
	28-Oct-08		18.90	19.15	2730	7.25	22.1			1540	<1	<1	489	489	25	529	113	63	387	4		0.002		0.609	<0.001	<0.0001	<0.001	<0.001	0.021	0.012	0.012	<0.001		0.02	0.052	0.19	<0.0001	<0.001				25.2	27.8	4.78	
	23-Jan-09	1752	21.18	21.43																																							
	22-Jun-09	1210	#N/A		2690	7.4	18.8		2660	1460	<1	<1	533	533	33	604	117	58	417	4		0.001		0.665	<0.001	<0.0001	<0.001	<0.001	0.02	0.012	<0.001	<0.001		0.02	0.046	0.09	<0.0001	1.4				28.4	28.9	0.92	
	15-Sep-09	1508	#N/A		Bore covered by pump																																							
	30-Nov-09	1200	#N/A		2640	7.39	30.8	7.3	2260		<1	<1	497	497	21.7	571	102	58	367	4	<0.01	0.002						<0.005	0.019	0.006	<0.001	<0.001			0.029	<0.05	<0.001		0.09	5.94	6.03	26.5	25.9	1.06	
	25-Feb-10	1300	#N/A		Sample from tank																																							
	03-May-10	1100	15.00	15.27	2890	7.45	21.4		2470	1320	<1	<1	572	572	28.1	535	122	58	360	3		0.002		0.663	<0.001	<0.0001	<0.001	<0.001	0.038	0.024	0.003	0.006		0.02	5.72	0.45	<0.0001	<0.01				27.1	26.6	0.84	
	26-Aug-10	1020	25.91	26.18	Windmill over bore																																						
	08-Nov-10	1340	31.53	31.8	2240	7.24	31.3																																				
	07-Mar-11	1240	25.13	25.4	2230	7.24	28.5	7.23	2440		<1	<1	573	573	22	535	126	59	378	4	<0.01	0.002						<0.001	0.035	0.008	<0.001	0.001			1.57	<0.05	<0.0001		<0.01	6.45	6.45	27	27.6	1.19	
	03-May-11	1230	14.78	15.05	2130	7.45	18																																				
	30-Aug-11	1035	17.66	17.93	2060	7.9	18.7	7.91	2750	1470	<1	<1	516	516	27	585	122	57	382	4	55.1	0.072		2.72	0.002	0.0002	0.042	0.053	1.46	3.67	0.069	0.442		0.26	16.1	108	<0.0001	0.04	<0.01	6.8	6.8	27.4	27.5	0.21	
	04-Nov-11	1100	29.41	29.68	2080	7.7	23.8																																				
	20-Mar-12	1110	2.96	3.23	3120	7.41	23.7	7.74	3550	2420	<1	<1	482	482	49	845	203	71	475	5	0.07	0.027		1	<0.001	<0.0001	<0.001	0.005	0.35	0.067	<0.001	0.149		0.07	2.48	12.3	<0.0001	0.06	<0.01	40.5	40.5	34.5	36.8	3.19	
	23-May-12	1100	4.60	4.87	3070	8.11	14.9																																				
	27-Aug-12	1030	27.43	27.7	2840	7.4	15.5	7.79	3090	1810	<1	<1	554	554	41	684	165	63	418	3	0.03	0.004		0.694	<0.001	<0.0001	<0.001	<0.001	0.069	0.017	<0.001	0.012		0.03	0.626	1.01	<0.0001	<0.01	<0.01	16.3	16.3	31.2	31.7	0.73	
	26-Nov-12	1015	18.87	19.14	2620	7.18	24.4																																				
	12-Mar-13	1020	9.5	9.77																																							
	12-Jun-13	0915	9.83	10.1		No sample																																					
	28-Aug-13	1100	10.15	10.42																																							
	11-Dec-13	1220	10.36	10.63	No sample - windmill over bore/no pressure off taps at tank																																						
	24-Feb-14	1345	10.68	10.95	No sample - windmill over bore/no pressure off taps at tank																																						
	12-Jun-14	1340	10.87	11.14																																							
	28-Nov-14	820	11.2	11.47	No sample - windmill over bore/no pressure off taps at tank																																						
	29-May-15	1130	11.65	11.92	Windmill running-no pressure at trough/tank empty																																						
WB-8	03-Sep-08	no access	#N/A																																							
	13-Oct-08	no access	#N/A																																							
	29-Oct-08	no access	#N/A																																							
	23-Jan-09	1840	46.4	46.9																																							
	22-Jun-09	1255	32.75	33.17	2240	8.2	18.5		2190	1210	<1	<1	554	554	37	378	49	38	429	7		0.02		0.173	<0.001	0.0004	<0.001	<0.001	0.004	0.016	<0.001	0.003		0.01	0.335	0.36	<0.0001	0.12				22.5	24.4	4.04	
	15-Sep-09	1450	43.38	43.88																																							
	30-Nov-09	1350	#N/A			Dry																																					
	25-Feb-10	1045	49.32	49.82																																							
	03-May-10	1035	32.59	33.09																																							
	26-Aug-10	925	32.23	32.73																																							
	09-Nov-10	1350	32.14	32.64	Unable to sample																																						
	07-Mar-11	1050	#N/A		Unable to sample																																						
	03-May-11		#N/A		Unable to sample																																						
	01-Sep-11	1130	31.77	32.27	Unable to sample																																						
	06-Dec-11	1010	31.58	32.08	Unable to sample																																						
	21-Mar-12	1340	31.43	31.93	Unable to sample																																						
	24-May-12	1240	31.03	31.53	Unable to sample																																						
	28-Aug-12	1030	31.43	31.93																																							
	27-Nov-12	1345	31.31	31.81	Unable to sample																																						
	13-Mar-13	1240	31.19	31.69																																							
	20-Jun-13	1315	30.97	31.47	Pump over bore																																						
	30-Sep-13	0855	31.19	31.69																																							
	12-Dec-13	1235	31.1	31.6	Pump over bore																																						
	27-Feb-14	1235	31.3	31.8	Pump over bore																																						
	12-Jun-14	1015	29.77	30.27	Pump over bore																																						
	27-Nov-14	945	30.68	31.18	Pump over bore																																						
	03-Jun-15	1040	28.8	29.3	Pump over bore																																						
WB-9	3-Sep-08	1740	23.88	24.15																																							
	13-Oct-08	1100	24.09	24.36																																							
	28-Oct-08		24.50	24.77	931	7.53	23.3			417	<1	<1	300	300	17	88	40	32	99	5		0.021		0.459	<0.001	0.0008	<0.001	0.001	0.023	0.157	0.157	0.034		0.02	2.44	37.3	<0.0001	4.54				8.83	9.04	1.12	
	23/Jan/09	1816	24.30	24.57																										0.034	0.002														
	22/Jun/09	1345	23.99	24.26	1080	7.9	20.6		1040	508	<1	<1	403	403	<10	84	21	27	104	8		0.005		0.648	<0.01	0.0017	<0.001	<0.001	0.004			0.005		<0.001	0.792	11.8	<0.0001	1.34				10.4	8.03	13	
	15/Sep/09	1443	23.94	24.25																										0.158	0.002														
	30/Nov/09	1400	24.05	24.36	1261	7.17	25.3	7.14	1020		<1	<1	527	527	64.5	56.1	91	46	115	2	<0.01	<0.001						<0.005	<0.001			<0.001			1.78	0.33	<0.001		<0.01	0.2	0.2	13.4	13.3	0.48	
	25/Feb/10	1120	25.58	25.89	ndmill over bore																																						Windmill over bore
	03/May/10	1010	24.26	24.57	ndmill over bore																																						Bore covered by pump, tank fed by pum empty, could not sample
	26/Aug/10	900	24.59	24.9	1057	7.72	15.5																																				Windmill
	09/Nov/10	1340	24.34	24.65	ndmill over bore																									0.004	<0.001												Windmill over bore
	07/Mar/11	1130	24.68	24.99	1143	7.44	26.7	7.46	1020		<1	<1	525	525	61	58	92	44	122	2	<0.01	0.002						<0.001	0.014			<0.001			0.063	0.66	<0.0001		<0.01	0.3	0.3	13.4	13.6	0.61	
	03/May/11	1345	25.26	25.57	1014	7.6	18.9																							0.005	<0.001												from windmill outlet
	30/Aug/11	930	24.36	24.67	981	7.9	17.4	7.92	1260	712	<1	<1	480	480	67	61	85	44	116	2	<0.01	0.001		0.111	<0.001	<0.0001	<0.001	<0.001	0.005			<0.001		0.01	0.037	0.51	<0.0001	<0.01	<0.01	0.16	0.16	12.7	13	0.97	
	04/Nov/11	1015	24.58	24.89	937	7.7	23.1																							0.044	<0.001												
	20-Mar-12	0930	24.59	24.9	1126	7.58	23.5	7.85	1220	780	<1	<1	517	517	80	67	102	49	141	2	<0.01	0.01		0.523	<0.001	<0.0001	<0.001	0.004	0.067			0.002		0.08	0.597	16.3	<0.0001	0.06	<0.01	0.31	0.31	13.9	15.3	4.85	
	23-May-12	0930	24.21	24.52	902	8.15	17.8																							0.02	<0.001												
	27-Aug-12	0945	23.99	24.3	1010	8.27	15	8.29	1050	666	<1	<1	428	428	73	65	45	44	124	2	0.06	0.003		0.065	<0.001	<0.0001	<0.001	<0.001	0.022			0.002		0.02	0.197	3.46	<0.0001	0.02	<0.01	0.39	0.39	11.9	11.3	2.58	
	26-Nov-12	0910	23.86	24.17	995	8.15	24.3																																				
	12-Mar-13	0910	24.85	25.16																																							
	10-Jun-13	0910	24.06	24.37	ollect sample-tank empty																																						
	28-Aug-13	0910	23.94	24.25																																							
	12-Dec-13	1250	23.78	24.09		No sample - pump over bore/tank empty																								0.169	0.019												
	26-Feb-14	1130	24.69	25	1180	7.5	27.8	8.12	1240	764	<1	<1	447	447	71	85	87	46	114	2	0.78	0.057	0.08	0.562	<0.001	0.0004	0.003	0.057	0.872			0.08	<0.01	0.34	3.35	80.3	<0.0001	0.01				12.8	13.1	1.26	
	12-Jun-14	0915	24.27	24.58	1250	7.7	16																																				
	11-Sep-15	1145	24	24.5	1180	7.5	22.6	7.96	1220	731	<1	<1	455	455	69	71	85	44	114	2	<0.01	0.002	0.07	0.125	<0.001	<0.0001	0.001	0.004	<0.001	0.005	<0.001	<0.001	<0.01	0.02	0.012	0.14	<0.0001	0.03	<0.01	0.27	0.27	12.5	12.9	1.33	
	27-Nov-14	1005	24.3	24.61	1067	8.1	26.1																																				
	04-Mar-15	1315	23.59	23.9	1240	7.3	27.3	7.61	1300		<1	<1	520	520	72	76	87	48	128	2	<0.01	0.002						<0.001	<0.001	0.001	<0.001	<0.001			<0.005	<0.05	<0.0001		<0.01	0.39	0.39	14	13.9	0.45	
	03-Jun-15	1020	23.71	24.02	1120	7.6																																				
WB-10	25-Jul-08	1050	13.75	13.85																																						
	4-Sep-08	0750	13.80	13.90																																						
	13-Oct-08	1200	13.77	13.87																																						
	28/Oct/08		13.9	14	2235	7.45	17.8			1310	<1	<1	632	632	280	141	138	79	248	<1		0.002		0.045	<0.001	<0.0001	<0.001	0.001	0.002	0.02	0.02	0.004		0.01	0.571	6.47	<0.0001	0.04				22.4	24.2	3.72	
	27/Jan/09	1119	14.23	14.27																																						
	22/Jun/09	1530	14.01	14.08	2220	7	21.2		2180	1320	<1	<1	751	751	279	150	139	70	283	1		0.002		0.05	<0.001	<0.0001	<0.001	<0.001	0.004	0.021	0.002	0.003		0.01	0.858	6.91	<0.0001	0.21				25.1	25	0.06	
	11/Sep/09	1432	14.65	14.72																																						
	30/Nov/09	1450	14.62	14.69	2052	7.11	23.8	6.89	1690		<1	<1	717	717	225	117	123	67	259	<1	<0.01	<0.001						<0.005	0.008	0.014	0.001	<0.001			0.195	<0.05	<0.0001		<0.01	0.15	0.15	22.3	23	1.47	
	25/Feb/10	1015	14.23	14.3																																						
	03/May/10	1440	14.47	14.54	2300	7.93	22.5		2010	1260	<1	<1	722	722	360	155	137	70	266	<1		0.005		0.089	<0.001	0.0003	0.001	0.001	0.02	0.069	0.005	0.016		0.03	1.12	18	<0.0001	<0.01				26.3	24.2	4.17	
	24/Sep/10	1020	14.05	14.12	1833	6.7	23.5																																			From bore
	10/Nov/10	1150	14.1	14.17	1905	6.72	24.2																																				
	07/Mar/11	950	14.34	14.41	1910	6.75	24.7	6.91	1850		<1	<1	735	735	251	147	136	73	266	2	0.27	0.004						0.002	0.042	0.136	0.002	0.009			1.11	21.7	<0.0001		<0.01	0.15	0.15	24.1	24.4	0.64	
	03/May/11	1425	14.07	14.14	1685	6.8	21																																				
	01/Sep/11	1240	16.47	16.54	1745	6.95	22.6	7.74	2050	1230	<1	<1	504	504	274	164	126	64	234	<1	0.14	<0.001		0.045	<0.001	<0.0001	<0.001	<0.001	0.006	0.029	0.001	0.002		<0.01	0.203	2.23	<0.0001	0.06	<0.01	0.16	0.16	20.4	21.7	3.15	In small shed
	06/Dec/11	0920	14.12	14.19	1780	6.92	21.1																																				
	21/Mar/12	1220	14.13	14.2	1880	6.94	24.3	7.4	2020	1320	<1	<1	635	635	326	175	140	71	246	1	0.04	<0.001		0.047	<0.001	<0.0001	>0.001	<0.001	0.02	0.026	<0.001	0.002		<0.01	0.259	0.99	<0.0001	0.03	>0.01	0.29	0.29	24.4	23.6	1.8	
	24/May/12	1135	13.95	14.02	1902	6.68	21.7																																				
	04/Sep/12	0925	14.03	14.1	1870	6.92	20.3	7.61	2010	1310	<1	<1	704	704	262	170	137	73	239	1	0.02	<0.001		0.041	<0.001	<0.0001	<0.001	<0.001	0.014	0.019	<0.001	<0.001		<0.01	0.204	1.13	<0.0001	0.09	0.02	0.11	0.13	24.3	23.2	2.22	
	13/Dec/12	925	14.76	14.83	1969	6.94	22.4																																			Brolga house
	13/Mar/13	1030	14.13	14.2	2020	6.97	23.3	7.05	2150	1370	<1	<1	725	725	266	158	131	73	278	1	0.05	<0.001		0.049	<0.001	0.0002	<0.001	<0.001	0.02	0.022	0.001	0.002		<0.01	0.287	4.21	<0.0001	0.01	<0.01	0.11	0.11	24.5	24.7	0.35	
	10/Jul/13	1040	14.08	14.15	1883	6.95	20.1																																				
	30/Aug/13	1030	14.13	14.2	1880	6.9	21.5	7.53	2050	1220	<1	<1	630	630	275	159	143	76	265	1	0.51	0.003	0.09	0.059	<0.001	0.0001	<0.001	<0.001	0.086	0.08	0.002	0.008	<0.01	0.01	0.772	6.57	<0.0001	0.02				22.8	24.9	4.48	
	12/Dec/13	1440	14.3	14.37	1925	7	22																																				
	26-Feb-14	1040	14.33	14.4	2010	7	23.2	7.58	2110	1250	<1	<1	670	670	239	140	132	68	204	<1	0.06	<0.001	0.1	0.064	<0.001	<0.0001	<0.001	0.004	0.017	0.057	<0.001	0.001	<0.01	<0.01	0.106	1.21	<0.0001	<0.01				22.3	21.1	2.91	
	19-Jun-14	1040	14.07	14.14	2010	7.1	20.3																																				
	11-Sep-14	1050	13.93	14	1960	7	20.9	7.6	2020	1170	<1	<1	579	579	301	150	130	70	216	<1	0.11	0.009	0.09	0.086	<0.001	0.0002	<0.001	0.001	0.007	0.064	0.002	0.008	<0.01	0.04	0.259	26.7	<0.0001	0.03	0.02	0.12	0.14	22.1	21.6	0.98	
	28-Nov-14	1050	14.24	14.31	2050	7.1	22.3																																				Brolga- house pump shed
	03-Mar-15	1415	14.56	14.63	2070	7	22.9	7.46	2220	1340	<1	<	734	734	293	155	144	78	270	1	0.18	0.0002	0.08	0.055	<0.001	<0.0001	<0.001	<0.001	0.005	0.055	0.002	0.002	<0.01	<0.01	0.33	9.44	<0.0001	0.66	<0.01	0.02	0.02	25.1	25.4	0.45	
	03-Jun-15	820	14.09	14.16	2210	7	18.9																																				
WB-11	25-Jul-08	1105	18.11	18.28																																						
	4-Sep-08	0740	18.61	18.78																																						
	13-Oct-08	1150	18.13	18.30																																						
	28/Oct/08		18.4	18.57	1086	7.57	19.6			576	<1	<1	323	323	31	133	34	28	149	6		<0.001		0.124	<0.001	<0.0001	<0.001	<0.001	0.004	0.253	0.253	0.004		<0.01	0.048	4.24	<0.0001	0.78				10.9	10.6	1.15	

					Field Parameters						Major Anions						Major Cations				Total Metals																								
Site ID	Date	Time	Depth to Ground - mbgl	Depth to Stand - mbtoc	EC - Field - µs/cm	pH - Field	Temp - Field - °C	pH - Lab	EC - Lab - µs/cm	Total Dissolved Solids	Hydroxide Alkalinity as CaCO3 - mg/L	Carbonate Alkalinity as CaCO3 - mg/L	Bicarbonate Alkalinity as CaCO3 - mg/L	Alkalinity - mg/L	Sulfate (SO4) - mg/L	Chloride (Cl) - mg/L	Calcium (Ca) - mg/L	Magnesium (Mg) - mg/L	Sodium (Na) - mg/L	Potassium (K) - mg/L	Aluminium (Al) - mg/L	Arsenic (As) - mg/L	Boron (B) - mg/L	Barium (Ba) - mg/L	Beryllium (Be) - mg/L	Cadmium (Cd) - mg/L	Cobalt (Co) - mg/L	Chromium (Cr) - mg/L	Copper (Cu) - mg/L	Manganese (Mn) - mg/L	Nickel (Ni) - mg/L	Lead (Pb) - mg/L	Selenium (Se) - mg/L	Vanadium (V) - mg/L	Zinc (Zn) - mg/L	Iron (Fe) - mg/L	Mercury - mg/L	Ammonia as Nitrogen (N)	Nitrite as N (mg/L)	Nitrate as N (mg/L)	NOX as N (mg/L)	Total Anions - meq/L	Total Cations - meq/L	Ionic Balance	Comments
ANZECC guideline*										4000							1000				5	0.5				0.01	1	1	1		1	0.1							1500	400					
	23/Jan/09	1109	18.73	18.91																																									
	22/Jun/09	1505	18.1	18.35	880	8	21.3		917	476	<1	<1	247	247	10	132	360	24	130	2		<0.001		0.1	<0.001	<0.0001	<0.001	<0.001	0.002	0.298	0.002	0.004		<0.01	0.041	5.4	<0.0001	1.79				8.86	9.2	1.86	
	11/Sep/09	1425	18.63	18.88																																									
	30/Nov/09	1425	18.6	18.85	938	7.89	23.1	6.65	929		<1	<1	251	251	2.52	138	29	24	122	2	<0.01	<0.001						<0.001	0.001			<0.001			0.005	<0.05	<0.0001		<0.01	0.08	0.08	8.97	8.79	1.05	
	25/Feb/10	1000	18.47	18.72																																									
	03/May/10	1515	18.24	18.49	1083	8.37	22.5		921	474	<1	<1	246	246	5.84	156	33	24	127	2		<0.001		0.08	<0.001	<0.0001	<0.001	<0.001	0.001	0.379	0.002	0.003		<0.01	0.016	6.02	<0.0001	0.95				9.44	9.19	1.34	
	24/Sep/10	1000	17.66	17.91	865	7.59	24																																						From Bore
	10/Nov/10	1140	17.49	17.74	867	7.49	25.8																																						
	07/Mar/11	930	18.57	18.82	944	7.05	24.5	7.38	845		<1	<1	238	238	<1	181	37	25	132	3	0.13	<0.001						0.001	0.014	0.586	0.001	0.002			0.438	8.99	<0.0001		<0.01	0.02	0.02	9.88	9.71	0.88	
	03/May/11	1400	17.34	17.59	867	7.25	20.3																																						
	01/Sep/11	1220	17.57	17.82	926	7.55	22.7	8.13	1200	528	<1	<1	176	176	<1	229	37	25	132	2	0.1	<0.001		0.078	<0.001	<0.0001	<0.001	<0.001	0.002	0.538	<0.001	<0.001		<0.01	0.009	10.6	<0.0001	0.34	<0.01	0.02	0.02	9.98	9.7	1.43	Near irrigation pump
	06/Dec/11	0900	16.93	17.18	905	7.5	21																																						
	21/Mar/12	1150	16.75	17	910	7.93	23.2	7.97	1020	522	<1	<1	156	156	1	258	31	24	140	4	0.03	<0.001		0.057	<0.001	<0.0001	<0.001	<0.001	0.005	0.397	<0.001	0.001		<0.01	0.016	3.24	<0.0001	0.15	0.23	0.69	0.92	10.4	9.71	3.5	
	24/May/12	1115	16.5	16.75																																									No sample. New pump over bore
	04-Sep-12	9.05	16.17	16.42																																									
	13-Dec-12		#N/A																																										New electric pump over bore-Brolga irrigation pump
	13-Mar-13		#N/A																																										New electric pump over bore-Brolga irrigation pump
	10-Jul-13	1020	15.32	15.57	1241	7.75	19.9																																						
	30-Aug-13	1000	16.67	16.92	1120	7.6	21.8	7.99	1220	719	<1	<1	480	480	80	74	52	41	196	1	0.16	0.001	0.21	0.13	<0.001	<0.0001	<0.001	<0.001	0.035	0.189	0.001	0.007	<0.01	<0.01	0.078	5.59	<0.0001	0.07				13.3	14.5	4.19	
	12-Dec-13	1455	16.7	16.95	1310	7.8	22.4																																						
	26-Feb-14	1020	18.15	18.4	1550	8.2	23.3	8.37	1690	1010	<1	15	446	462	214	130	47	61	202	<1	0.04	0.001	0.14	0.058	<0.001	<0.0001	<0.001	0.004	0.068	0.093	0.001	0.005	<0.01	<0.01	0.06	1.13	<0.0001	0.23				17.4	16.2	3.62	
	19-Jun-14	1020	16.93	17.18	1420	7.7	20.2																																						
	11-Sep-14	1030	16.65	16.9	1210	7.8	20.8	8.16	1250	686	<1	<1	396	396	121	79	36	46	167	<1	0.38	0.002	0.17	0.143	<0.001	<0.0001	<0.001	0.002	0.009	0.229	0.004	0.01	<0.01	<0.01	0.034	6.45	<0.0001	0.05	<0.01	0.08	0.08	12.7	12.8	0.7	
	28-Nov-14	1120	17.43	17.68	1310	8.1	22.8																																						Brolga Irrigation
	03-Mar-15	1400	19.05	19.3	1320	8	24.2	7.96	1440	815	<1	<1	578	578	65	85	44	35	233	1	0.1	0.001	0.41	0.19	<0.001	<0.0001	<0.001	0.003	0.002	0.313	0.002	0.003	<0.01	<0.01	0.055	6.94	<0.0001	0.05	<0.01	0.02	0.02	15.3	15.2	0.25	
	09-Jun-15	1230	17.89	18.14	1567	7.7	22																																						
WB-12	25-Jul-08	1120	12.73	13.03																																									
	04-Sep-08	0800	12.80	13.10																																									
	13-Oct-08	1213	12.83	13.13																																									
	28-Oct-08		12.95	13.25	2152	8.15	19.4			1040	<1	<1	649	649	2	254	34	78	301	3		0.001		0.102	<0.001	0.0001	0.001	0.001	0.005	0.099	0.099	0.003		<0.01	0.314	5.55	<0.0001	6.95				20.2	21.3	2.57	
	27-Jan-09	1129	13.16	13.33																																									
	22-Jun-09	1550	12.99	13.21	2070	8	22.2		1990	1050	<1	<1	725	725	<5	261	31	79	325	2		0.001		0.108	<0.001	<0.0001	0.001	0.004	0.002	0.13	0.007	0.003		<0.01	0.871	8.97	<0.0001	6.82				21.8	22.2	0.81	LOR raised for Turbidimetric Sulfate due to matrix interference
	11-Sep-09	1438	13.05	13.27																																									
	30-Nov-09	1425	12.99	13.21	1537	8.6	22.8	8.34	1640		<1	86	516	602	10.8	149	16	43	284	6	<0.01	<0.001						<0.005	0.009	0.029	0.001	<0.001			0.017	<0.05	<0.0001		0.02	1.37	1.39	16.4	16.8	1.13	
	25-Feb-10	1020	13.19	13.41																																									
	03-May-10	1500	13.15	13.37	1490	8.27	22.5		1390	750	<1	15	567	582	13.6	137	19	43	266	4		0.002		0.069	<0.001	0.0001	<0.001	<0.001	0.004	0.111	0.003	0.003		<0.01	1.27	6.2	<0.0001	3.1				15.8	16.2	1.17	
	24-Sep-10	1035	13.22	13.44	873	8.71	23.7																																						From bore
	10-Nov-10	1210	13.13	13.35	891	7.07	25.9																																						
	07-Mar-11	1010	13.18	13.4	1867	7.37	24	7.38	1780		<1	<1	744	744	2	213	28	68	274	10	0.49	<0.001						<0.001	0.054	0.427	0.007	0.004			0.842	17.4	<0.0001		0.01	0.04	0.05	20.9	19.1	4.48	Plant material in water
	03-May-11	1440	13.15	13.37	1657	7.45	20.8																																						
	01-Sep-11	1310	13.23	13.45	1720	7.65	22.9	8.57	2130	1030	<1	83	591	674	4	260	34	70	277	3	1.03	<0.001		0.106	<0.001	0.0002	<0.001	0.001	0.008	0.226	0.002	0.006		<0.01	0.148	6.08	<0.0001	9.19	0.02	0.14	0.16	20.9	19.6	3.25	Gate No 4
	06-Dec-11	0950	13.13	13.35	1390	7.66	21.1																																						
	21-Mar-12	0945	13.08	13.3	885	7.92	24	7.99	1150	556	<1	<1	489	489	6	71	17	26	190	11	0.14	<0.001		0.044	<0.001	<0.0001	<0.001	0.001	0.016	0.212	0.001	0.001		<0.01	0.064	3.84	<0.0001	21.7	0.02	0.12	0.14	11.9	11.5	1.6	
	24-May-12	1200	13.14	13.36	2150	7.19	21.9																																						
	04-Sep-12	0950	13.08	13.3	2150	7.3	20.7	7.83	2290	1180	<1	<1	926	926	2	235	42	87	318	7	0.34	<0.001		0.14	<0.001	<0.0001	<0.001	<0.001	0.044	0.154	0.002	0.002		<0.01	0.41	20.4	<0.0001	43.2	<0.01	0.01	0.01	25.2	23.3	3.97	
	13-Dec-12	945	13.13	13.35	1907	7.61	22.2																																						Brolga front paddock
	13-Mar-13	1030	12.98	13.2	1800	7.73	23.4	7.72	1940	1000	<1	<1	774	774	7	199	29	64	324	5	0.04	<0.001		0.086	<0.001	0.0002	<0.001	<0.001	0.006	0.076	0.001	<0.001		<0.01	0.121	5.3	<0.0001	15	0.01	0.12	0.13	21.2	20.9	0.73	
	10-Jul-13	1100	13.16	13.38	1692	7.95	20.6																																						
	30-Aug-13	1100	13.08	13.3	1690	8.1	21.7	8.12	1860	922	<1	<1	678	678	5	214	29	71	302	4	0.23	0.001	0.09	0.079	<0.001	<0.0001	<0.001	<0.001	0.025	0.068	0.002	0.003	<0.01	<0.01	0.217	5.09	<0.0001	9.09				19.7	20.5	2.05	
	12-Dec-13	1425	12.98	13.2	1730	7.9	22.7																																						
	26-Feb-14	1100	13.08	13.3	1830	8.2	22.6	8.38	1930	1010	<1	22	612	634	<1	234	33	64	231	2	0.2	0.002	0.09	0.095	<0.001	<0.0001	<0.001	0.011	0.096	0.097	0.004	0.008	<0.01	<0.01	0.217	4.2	<0.0001	8.57				19.3	17.7	4.4	
	19-Jun-14	1100	13.14	13.36	1694	8	20.5																																						
	11-Sep-15	1115	13.08	13.3	1800	7.9	21.7	8.19	1930	976	<1	<1	615	615	2	242	31	72	258	2	0.05	0.002	0.09	0.081	<0.001	<0.0001	<0.001	<0.001	0.005	0.089	0.002	0.002	<0.01	<0.01	0.221	3.97	<0.0001	5.67	0.05	0.63	0.68	19.2	18.8	1.12	
	28-Nov-15	1105	13.06	13.28	1476	8.3	22.6																																						Brolga Front Paddock
	03-Mar-15	1435	13.18	13.4	1630	8.3	23.7	8.23	1800	944	<1	<1	626	626	11	193	29	52	291	3	0.04	0.001	0.08	0.054	<0.001	<0.0001	<0.001	<0.001	0.004	0.069	0.002	<0.001	<0.01	<0.01	0.12	2.36	<0.0001	3.94	0.01	0.05	0.06	18.2	18.5	0.72	
	03-Jun-15	835	13.15	13.37	1628	8.2	20.3																																						
WB-13	13-Mar-13	1030	36.20	36.40	3410	6.91	25.6	7.11	3620	2510	<1	<1	438	438	90	853	263	79	422	4	0.02	<0.001		0.016	<0.001	<0.0001	<0.001	<0.001	0.016	0.003	<0.001	0.001		<0.01	0.038	<0.05	<0.0001	<0.01	<0.01	2.55	2.55	34.7	38.1	4.68	
	10-Jul-13	0950	33.22	33.42	3550	6.77	19.8																																						
	28-Aug-13	0950	38.50	38.70	3730	6.9	21.4	7.5	3730	2400	<1	<1	422	422	100	857	276	86	384	4	0.02	<0.001	0.1	0.016	<0.001	<0.0001	<0.001	<0.001	0.011	< 0.001	<0.001	<0.001	<0.01	<0.01	0.013	<0.001	0.0002	<0.01				34.7	37.7	4.11	
	12-Dec-13	1315	41.82	42.02	3460	7	23.7																																						
	26-Feb-14	1200	42.40	42.6	3460	7	23.5	7.93	3690	2390	<1	<1	405	405	92	773	250	76	324	4	<0.01	<0.001	0.09	0.016	<0.001	<0.0001	<0.001	<0.001	0.02	<0.001	<0.001	0.003	<0.01	<0.01	0.026	<0.05	0.0001	<0.01				31.8	32.9	1.73	
	12-Jun-14	0945	33.93	34.13	3540	7.1	17.1																																						
	11-Sep-14	1215	40.9	41.1	3338	7	22.8	7.63	3570	2200	<1	<1	386	386	97	787	233	72	341	4	0.02	<0.001	0.09	0.017	<0.001	<0.0001	<0.001	0.001	0.009	0.002	<0.001	0.001	<0.01	<0.01	0.012	0.23	0.0007	0.02	<0.01	2.66	2.66	31.9	32.5	0.87	
	27-Nov-14	1030	42.64	42.84	3510	7.1	23.1																																						
	04-Mar-15	1330	44.8	Tap	3500	7	23.9	7.32	3640		<1	<1	451	451	96	913	254	81	383	4	<0.01	<0.001						<0.001	0.001	<0.001	<0.001	<0.001			<0.005	<0.05	<0.0001		<0.01	2.51	2.51	36.8	36.1	0.9	
	03-Jun-15	935	40.03	Tap	3410	7	20.7																																						
WB-14	18-Dec-13	1320	10.16	10.46	1315	7.6	25.7																																						
	27-Feb-14	1015	22.90	23.20	1150	7.8	23	7.83	1300	751	<1	<1	488	488	12	113	37	20	249	<1	<0.01	0.009	0.07	0.401	<0.001	<0.0001	<0.001	<0.001	0.006	<0.001	<0.001	<0.001		0.07	0.012	<0.05	<0.0001	0.02				13.2	14.3	4.09	
	12-Jun-14	1120	18.77	19.07	1260	7.7	21.2																																						
	11-Sep-14	1015	18.6	18.9	1280	7.7	21.5	7.97	1330	754	<1	<1	452	452	12	126	35	18	217	2	0.02	0.011	0.08	0.421	<0.001	0.0002	<0.001	0.001	0.042	0.009	<0.001	0.002	<0.01	0.07	0.033	0.1	<0.0001	0.02	<0.01	1.27	1.27	12.8	12.7	0.5	
	27-Nov-14	1300	13.73	14.03	1288	7.7	23.5																																						
	04-Mar-15	1100	23	23.3	1280	7.8	22.5	7.84	1350		<1	<1	511	511	12	120	33	19	240	2	<0.01	0.011						<0.001	0.004	<0.001	<0.001	<0.001			0.016	<0.05	<0.001		<0.01	1.53	1.53	13.8	13.7	0.56	
	03-Jun-15	1055	22.3	22.45	1260	7.7	20.6																																						
WB-15	11-Jul-14	1525	27.62	27.74																																									
	11-Sep-14	1330	30.39	30.4	1390	6.9	22.1	7.55	1440	790	<1	<1	471	471	92	121	140	46	94	1	0.52	0.002	0.07	0.198	<0.001	0.0002	0.003	0.003	0.301	0.621	0.008	0.072	<0.01	0.01	4080	12	<0.0001	0.55	0.02	0.16	0.18	14.7	14.9	0.5	
	27-Nov-14	1355	27.24	27.25	1403	7	21.9																																						
	04-Mar-15	1400	27.19	27.2	1280	7.4	22.9	8.19	1360		<1	<1	387	387	53	179	59	58	132	2	<0.01	<0.001						<0.001	0.002	0.002	<0.001	<0.001			0.006	<0.05	<0.0001		<0.01	0.84	0.84	13.9	13.5	1.38	
	03-Jun-15	900	27.36	27.37	1380	7.2	19.8																																						
Yarrari	3-Sep-08	1555	55.24	56.06																																									
	13-Oct-08	1310	50.18	51.00																																									
	29-Oct-08		#N/A		4030	7.35	24				<1	<1	372	372	46	987	51	50	558	3		<0.001		0.1	<0.001	0.0002	<0.001	0.001	0.005	0.011	0.011	<0.001		<0.01	0.013	0.11	0.0001	0.1				36.2	39.4	4.12	
	29-Oct-08		#N/A								<1	<1	374	374	46	1040	214	50	563	3		0.003		0.104	<0.001	<0.0001	<0.001	<0.001	0.004	0.011	<0.001	<0.001		<0.01	0.016	0.08	<0.0001	<0.01				37.8	39.3	1.94	
	23-Jan-09	1714	49.90	50.58																																									
	22-Jun-09	1120	#N/A	>50	3580	7.1	21.3														Sample not analysed due to lab administrative error																								
	27-Aug-09	1500	#N/A		3330	7.34	22.1		3070	1980	<1	<1	430	430	42.9	803	167	32	504	3		<0.001		0.061	<0.001	<0.0001	<0.001	<0.001	0.013	0.026	<0.001	<0.001		<0.01	0.041	<0.05	<0.0001	<0.01				32.1	33	1.31	
	30-Nov-09	1005	#N/A		3480	7.25	27.4	7.2	3160		<1	<1	377	377	34.7	882	178	35	508	3	<0.01	<0.001					0.004	<0.005		<0.001	<0.001	<0.001			0.006	<0.05	<0.0001		<0.01	0.51	0.51	33.1	33.9	1.19	
	25-Feb-10	1330	Bore equipped																																										Bore covered by pump unable to dip. Sample taken from tap
	03-May-10	1205	Bore equipped		3520	7.52	22		3310	1900	<1	<1	314	314	52.4	930	175	32	528	3		<0.001		0.063	<0.001	<0.0001	<0.001	<0.001	0.005	0.018	<0.001	<0.001		<0.01	0.007	<0.05	<0.0001	<0.01				33.6	34.4	1.14	Bore covered by pump unable to dip, sampled from pump outlet
	26-Aug-10	1105	Bore equipped		3340	7.42	Probe Broken																																						Bore covered by pump unable to dip. Sample taken from tap
	08-Nov-10	1320	Bore equipped		PUMP SWITCHED OFF																																								Unable to obtain tap sample without pump
	07-Mar-11	1350	Bore equipped		2880	6.97	27.1	7.29	3410		<1	<1	409	409	38	877	180	35	530	4	<0.01	<0.001						<0.001	0.007	0.002	<0.001	0.003			0.039	<0.05	<0.0001		<0.01	0.3	0.3	33.7	35	1.88	Bore covered by pump unable to dip. Sample taken from tap
	03-May-11	1115	Bore equipped		2930	7	20.2																																						Bore covered by pump unable to dip. Sample taken from tap
	30-Aug-11	1200	Bore equipped		2780	7	18.8	7.25	3800	2020	<1	<1	384	384	44	990	190	34	526	3	<0.01	<0.001		0.071	<0.001	<0.0001	<0.001	<0.001	0.007	0.005	<0.001	<0.001		<0.01	0.08	<0.05	<0.0001	<0.01	<0.01	0.23	0.23	36.5	35.2	1.78	Bore covered by pump unable to dip. Sample taken from tap
	04-Nov-11	1200	Bore equipped		2790	7.1	18.8																																						
	20-Mar-12	1200	Bore equipped		3380	6.92	25.2	7.37	3800	2320	<1	<1	405	405	51	1000	213	42	591	4	<0.01	0.001		0.084	<0.001	<0.0001	<0.001	<0.001	0.012	0.002	<0.001	<0.001		<0.01	0.047	<0.05	<0.0001	0.05	<0.01	0.46	0.46	37.4	39.9	3.28	
	23-May-12	1230	Bore equipped		3330	7.51	20.5																																						
	27-Aug-12	1150	Tap in yard		3390	7.11	20.1	7.46	3680	2160	<1	<1	433	433	50	949	194	36	553	3	<0.01	<0.001		0.078	<0.001	<0.0001	<0.001	<0.001	0.003	0.002	<0.001	<0.001		<0.01	0.007	<0.05	<0.0001	<0.01	<0.01	0.39	0.39	36.5	36.8	0.42	
	26-Nov-12	1115	Tap in yard		3360	7.05	25.6																																						
	12-Mar-13	1150	Tap in yard		3420	7.04	25.4	7.6	3700	2330	<1	<1	312	312	42	896	193	40	558	4	<0.01	<0.001		0.071	<0.001	<0.0001	<0.001	<0.001	0.004	<0.001	<0.001	<0.001		<0.01	0.008	<0.05	<0.0001	0.08	<0.01	25.6	25.6	34.2	37.3	4.3	
	12-Jun-13	0950	Pump over bore		3510	7.23	18.1																																						
	28-Aug-13	1245	#N/A		3430	6.9	20.8	7.49	3720	2140	<1	<1	408	408	47	887	207	40	516	4	<0.01	<0.001	<0.001	0.11	0.077	<0.0001	<0.001	<0.001	0.006	<0.001	<0.001	<0.001	<0.01	<0.01	0.007	<0.05	<0.0001	0.02				34.2	36.2	2.87	
	11-Dec-13	1335	Pump over bore		3630	7	24.5																																						
	24-Feb-14	1330	Pump over bore		3490	6.9	25.3																																						
	12-Jun-14	1310	Pump over bore		3590	7	21.7																																						
	10-Sep-14	1150			3620	6.9	19	7.32	3720	2100	<1	<1	443	443	48	891	195	37	482	3	0.01	<0.001	0.09	0.093	<0.001	<0.0001	<0.001	<0.001	0.111	0.02	0.001	0.014	<0.01	<0.01	0.115	<0.05		0.04	<0.01	0.4	0.4	35	33.8	1.69	
	28-Nov-14	1230	Pump over bore		3550	7	28.2																																						
	03-Mar-15	1100	Pump over bore		3520	7.1	25.4	7.48	3820	2310	<1	<1	417	417	50	980	206	41	566	3	0.01	<0.001	0.09	0.08	<0.001	<0.0001	<0.001	<0.001	0.004	0.01	<0.001	<0.001	<0.01	<0.01	0.06	<0.05	<0.0001	0.03	<0.01	0.67	0.67	37	38.4	1.77	
	29-May-15	1020	Pump over bore		3630	6.9	19.4																																						
Surrey No 2	25-Feb-10	1100	38.13	38.44																																									
	26-Aug-10	930	34.66	34.97	3140	7.25	16.8																																						
	09-Nov-10	1400	34.92	35.23	2380	6.92	25.7																																						
	07-Mar-11	1100	35.66	35.97	2710	7.2	24.9	7.15	3180		<1	<1	545	545	43	751	104	92	465	10	0.62	<0.001						<0.001	0.074	0.044	0.001	0.004			0.154	0.82	<0.0001		<0.01	1.54	1.54	33	33.2	0.33	
	03-May-11		#N/A		No Access. Gate Locked.																																								
	01-Sep-11	1110	35.11	35.42	2760	7.15	23.6	7.97	3320	1670	<1	<1	402	402	50	763	100	88	475	8	0.22	<0.001		0.058	<0.001	<0.0001	<0.001	<0.001	0.004	0.012	<0.001	<0.001		0.02	0.022	0.37	<0.0001	0.04	<0.01	1.59	1.59	30.6	33.1	3.92	
	21-Mar-12	1320	34.49	34.80	1520	7.6	24.2	7.88	1630	1000	<1	<1	235	235	62	341	36	26	291	9	5.9	0.004		0.082	<0.001	<0.0001	0.003	0.008	0.033	0.102	0.005	0.004		0.05	0.062	8.88	<0.0001	0.18	<0.01	9.4	9.4	15.6	16.8	3.74	
	24-May-12	1225	34.59	34.90	2790	7.2	21.8																																						
	28-Aug-12	1100	34.29	34.60	3090	7.15	22.1	7.77	3490	1850	<1	<1	558	558	58	829	111	94	495	10	0.09	<0.001		0.086	<0.001	<0.0001	<0.001	<0.001	0.013	0.009	0.001	<0.001		0.02	0.103	0.16	<0.0001	<0.01	<0.01	1.89	1.89	35.7	35.1	0.97	

Site ID	Date	Time	Depth to Ground - mbgl	Depth to Stand - mbtoc	Field Parameters			pH - Lab	EC - Lab - µs/cm	Total Dissolved Solids	Major Anions						Major Cations				Total Metals																				Mercury - mg/L	Ammonia as Nitrogen (N)	Nitrite as N (mg/L)	Nitrate as N (mg/L)	NOX as N (mg/L)	Total Anions - meq/L	Total Cations - meq/L	Ionic Balance	Comments
					EC - Field - µs/cm	pH - Field	Temp - Field - °C				Hydroxide Alkalinity as CaCO3 - mg/L	Carbonate Alkalinity as CaCO3 - mg/L	Bicarbonate Alkalinity as CaCO3 - mg/L	Alkalinity - mg/L	Sulfate (SO4) - mg/L	Chloride (Cl) - mg/L	Calcium (Ca) - mg/L	Magnesium (Mg) - mg/L	Sodium (Na) - mg/L	Potassium (K) - mg/L	Aluminium (Al) - mg/L	Arsenic (As) - mg/L	Boron (B) - mg/L	Barium (Ba) - mg/L	Beryllium (Be) - mg/L	Cadmium (Cd) - mg/L	Cobalt (Co) - mg/L	Chromium (Cr) - mg/L	Copper (Cu) - mg/L	Manganese (Mn) - mg/L	Nickel (Ni) - mg/L	Lead (Pb) - mg/L	Selenium (Se) - mg/L	Vanadium (V) - mg/L	Zinc (Zn) - mg/L	Iron (Fe) - mg/L									
ANZECC guideline*										**4000**							**1000**				**5**	**0.5**				**0.01**	**1**	**1**	**1**		**1**	**0.1**								**1500**	**400**					
	27-Nov-12	1325	34.94	35.25	3100	7.34	22.6																																					
	13-Mar-13	1030	35.69	36.00	3250	7.44	24.5	7.41	3540	1910	<1	<1	544	544	53	779	111	100	525	11	0.13	<0.001		0.084	<0.001	<0.0001	<0.001	<0.001	0.036	0.011	<0.001	0.003		0.02	0.103	0.38	<0.0001	0.02	<0.01	1.81	1.81	34	36.9	4.14	
	20-Jun-13	1315	34.07	34.38	3310	7.35	20.7																																					
	30-Aug-13	0855	33.29	33.60	3110	7.21	21.7	7.72	3360	1800	<1	<1	480	480	56	775	109	97	513	9	3.34	0.003		0.117	<0.001	0.0001	0.002	0.005	0.277	0.09	0.005	0.026		0.04	0.256	6.74	<0.0001	<0.01				32.6	36	4.87	
	12-Dec-13	1220	34.55	34.86	3420	7.3	23.1																																					
	26-Feb-14	1250	33.59	33.90	3060	7.3	23.2	7.47	3430	1820	<1	<1	524	524	56	771	105	92	513	8	12.4	0.003	0.11	0.239	<0.001	0.0002	0.014	0.031	0.791	0.241	0.023	0.059	<0.01	0.12	0.653	29	0.0002	0.01				33.4	35.3	2.82	
	12-Jun-14	1000	32.74	33.05	3310	7.3	21.1																																					
	11-Sep-14	1230	34.29	34.60	3620	7.2	22.3	7.83	3720	1980	<1	<1	462	462	58	792	118	103	450	10	1.07	0.002	0.11	0.136	<0.001	<0.0001	0.002	0.003	0.047	0.059	0.012	0.005	<0.01	0.02	0.126	1.52	<0.0001	0.03	<0.01	2.12	2.12	32.8	34.2	2.1	
	27/Nov/14	925	34.33	34.64	3170	7.4	22.3																																					
	04-Mar-15	1245	34.29	34.6	3210	7.4	23.8	7.51	3410		<1	<1	542	542	56	809	112	100	475	9	<0.01	<0.001						<0.001	0.002	0.01	<0.001	<0.001			0.015	<0.05	<0.0001		<0.01	1.62	1.62	34.8	34.7	0.16	
	03-Jun-15	1030	32.49	32.8	3210	7.4	21.2																																					


Standing Water Level- MP2
Depth to Ground
Depth in Metres
15
10
5
01-Sep-08
01-Dec-08
01-Mar-09
01-Jun-09
01-Sep-09
01-Dec-09
01-Mar-10
01-Jun-10
01-Sep-10
01-Dec-10
01-Mar-11
01-Jun-11
01-Sep-11
01-Dec-11
01-Mar-12
01-Jun-12
01-Sep-12
01-Dec-12
01-Mar-13
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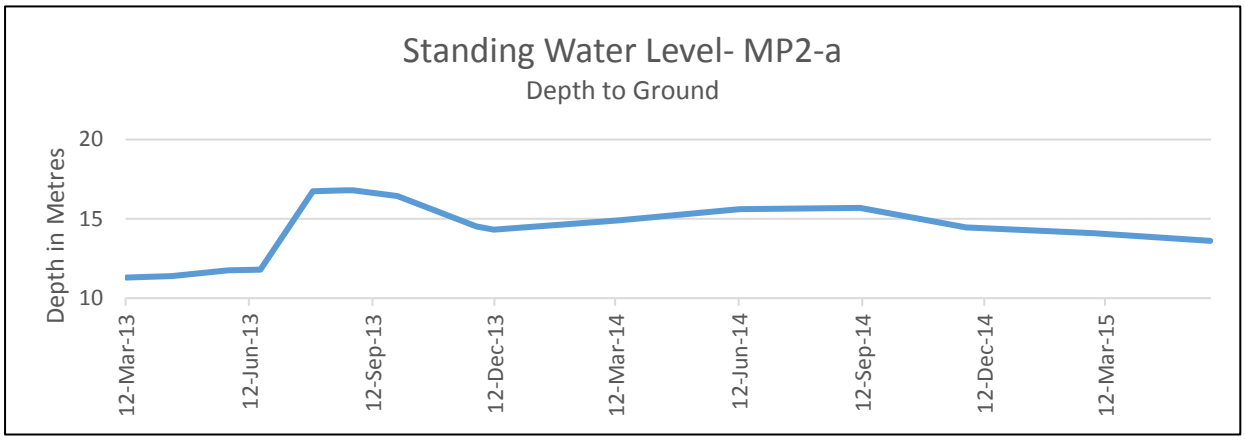
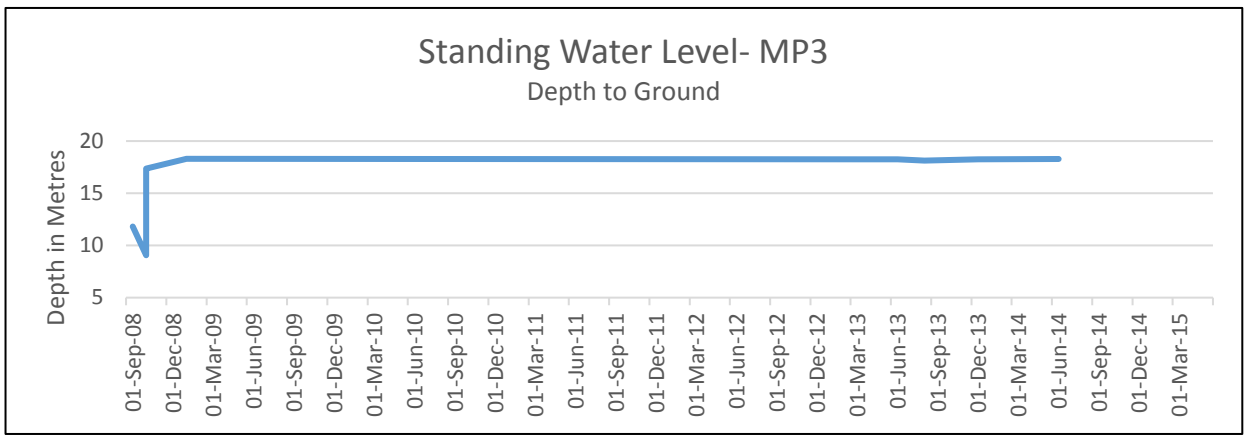
01-Sep-14
01-Dec-14
01-Mar-15


Standing Water Level- MP2-a
Depth to Ground
Depth in Metres
20
15
10
12-Mar-13
12-Jun-13
12-Sep-13
12-Dec-13
12-Mar-14
12-Jun-14
12-Sep-14
12-Dec-14
12-Mar-15


Standing Water Level- MP3
Depth to Ground
Depth in Metres
20
15
10
5
01-Sep-08
01-Dec-08
01-Mar-09
01-Jun-09
01-Sep-09
01-Dec-09
01-Mar-10
01-Jun-10
01-Sep-10
01-Dec-10
01-Mar-11
01-Jun-11
01-Sep-11
01-Dec-11
01-Mar-12
01-Jun-12
01-Sep-12
01-Dec-12
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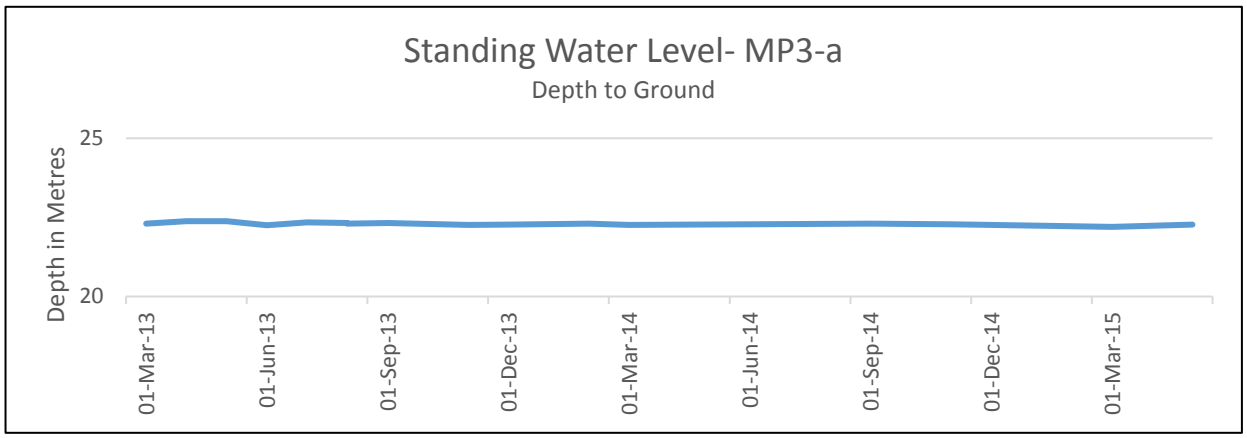
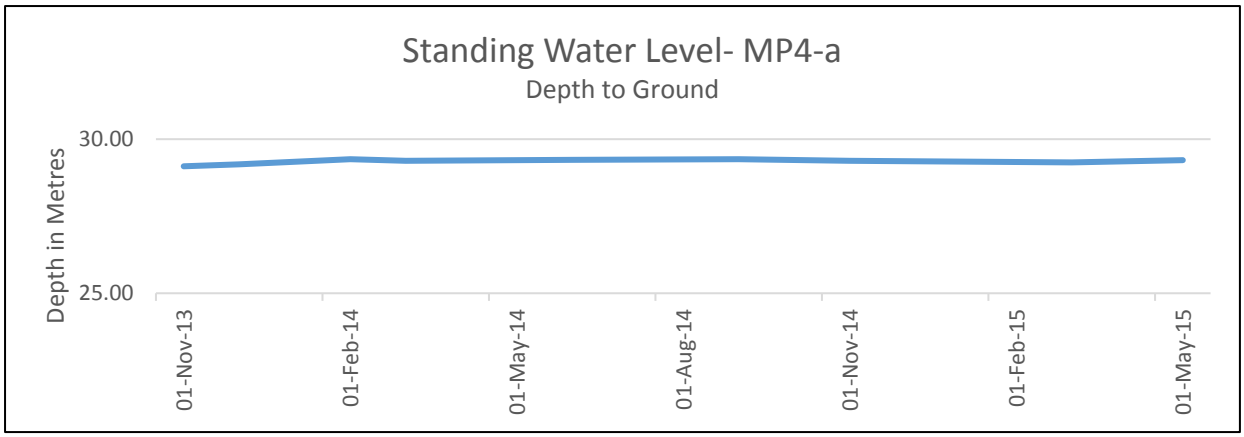
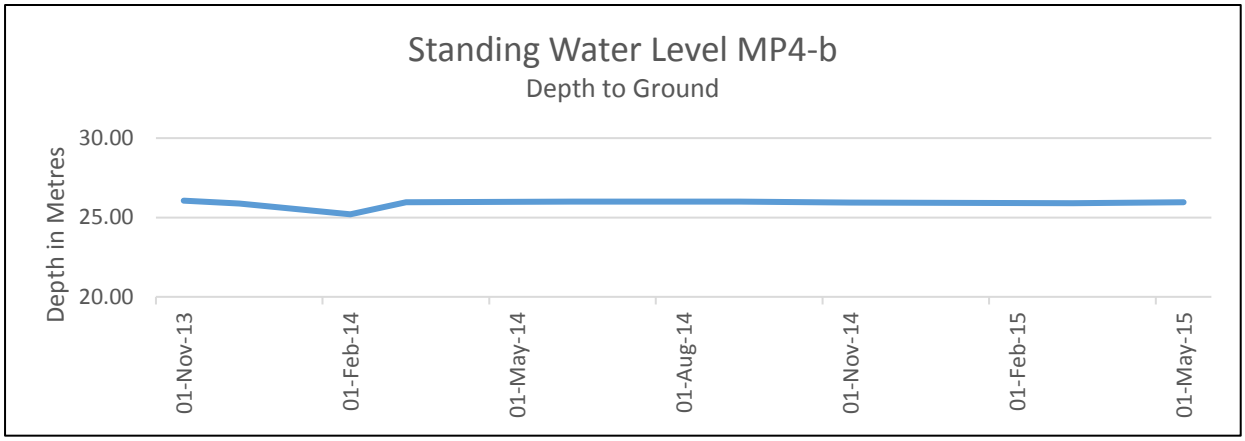
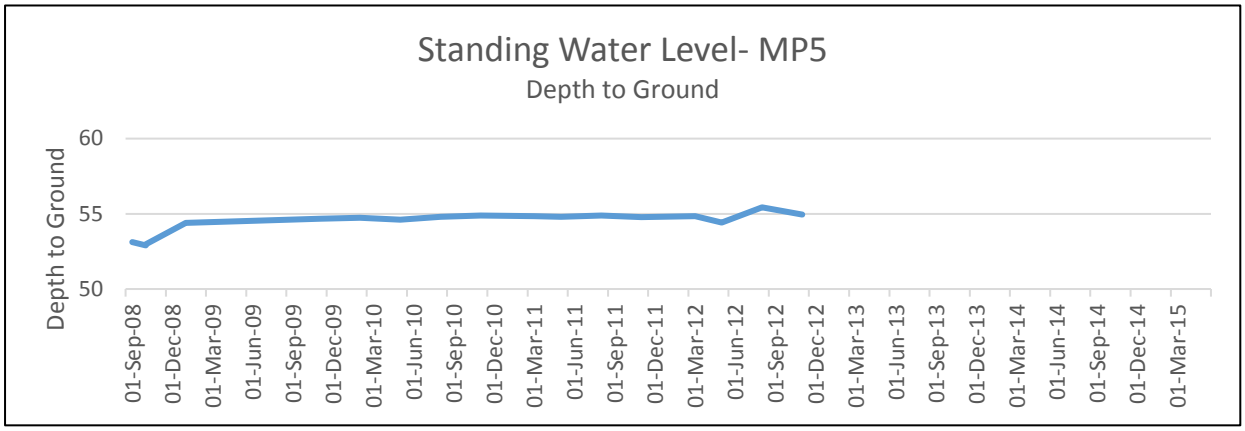
01-Dec-14
01-Mar-15


Standing Water Level- MP3-a
Depth to Ground
Depth in Metres
25
20
01-Mar-13
01-Jun-13
01-Sep-13
01-Dec-13
01-Mar-14
01-Jun-14
01-Sep-14
01-Dec-14
01-Mar-15


Standing Water Level- MP4-a
Depth to Ground
Depth in Metres
30.00
25.00
01-Nov-13
01-Feb-14
01-May-14
01-Aug-14
01-Nov-14
01-Feb-15
01-May-15


Standing Water Level MP4-b
Depth to Ground
Depth in Metres
30.00
25.00
20.00
01-Nov-13
01-Feb-14
01-May-14
01-Aug-14
01-Nov-14
01-Feb-15
01-May-15


Standing Water Level- MP5
Depth to Ground
Depth to Ground
60
55
50
01-Sep-08
01-Dec-08
01-Mar-09
01-Jun-09
01-Sep-09
01-Dec-09
01-Mar-10
01-Jun-10
01-Sep-10
01-Dec-10
01-Mar-11
01-Jun-11
01-Sep-11
01-Dec-11
01-Mar-12
01-Jun-12
01-Sep-12
01-Dec-12
01-Mar-13
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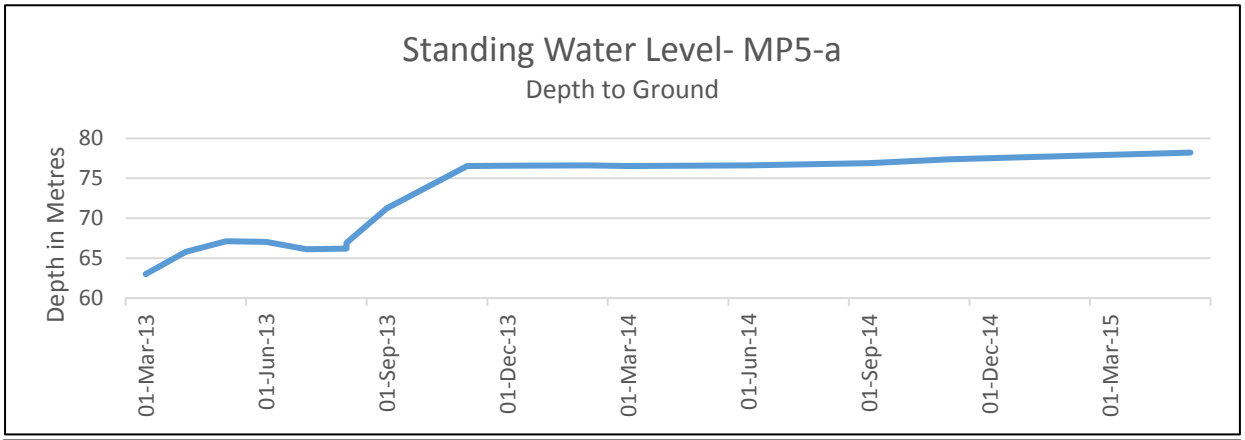
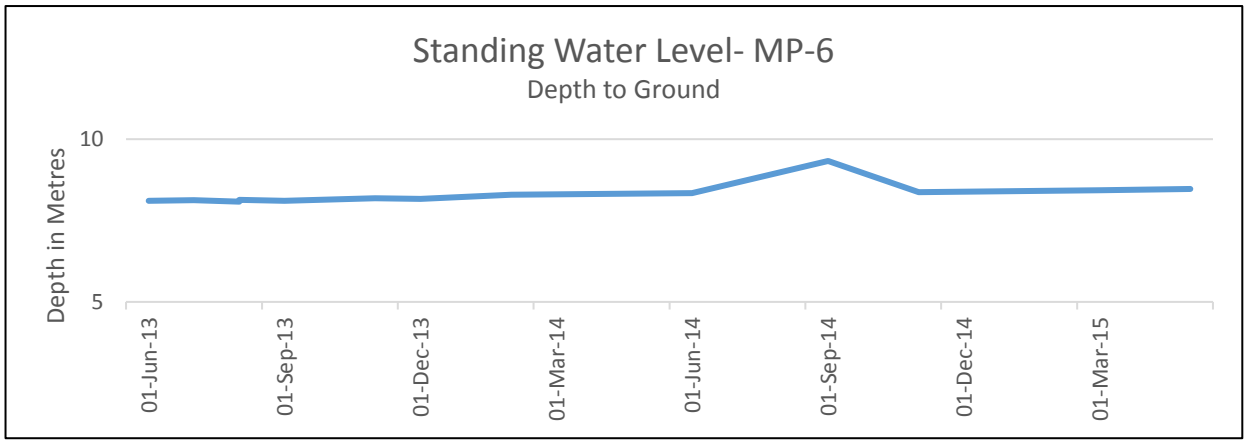
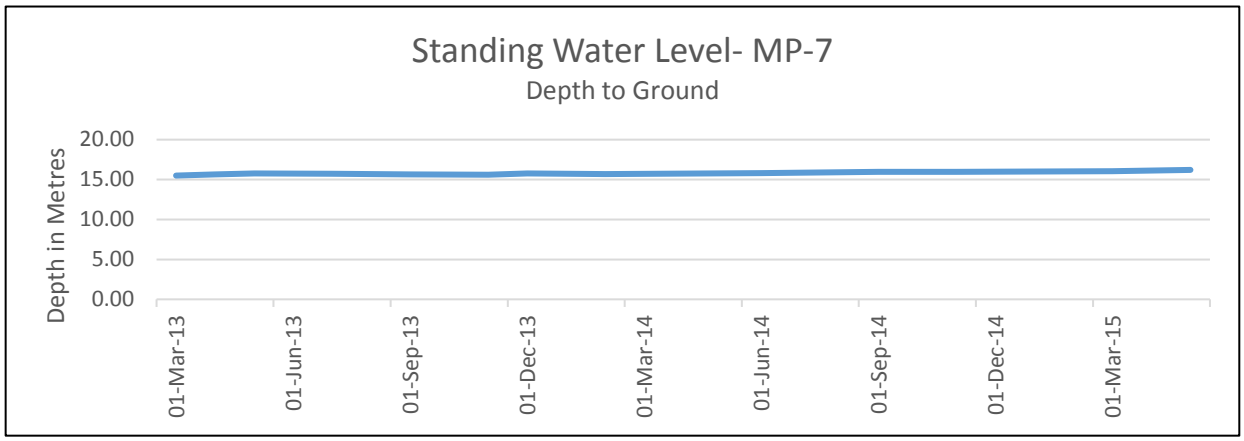
01-Dec-14
01-Mar-15


Standing Water Level- MP5-a
Depth to Ground
Depth in Metres
80
75
70
65
60
01-Mar-13
01-Jun-13
01-Sep-13
01-Dec-13
01-Mar-14
01-Jun-14
01-Sep-14
01-Dec-14
01-Mar-15


Standing Water Level- MP-6
Depth to Ground
Depth in Metres
10
5
01-Jun-13
01-Sep-13
01-Dec-13
01-Mar-14
01-Jun-14
01-Sep-14
01-Dec-14
01-Mar-15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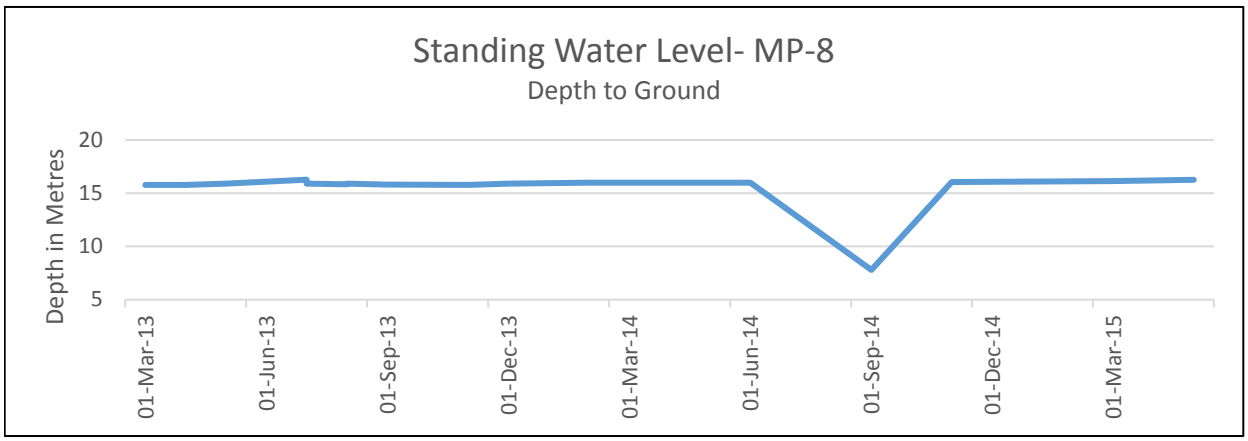
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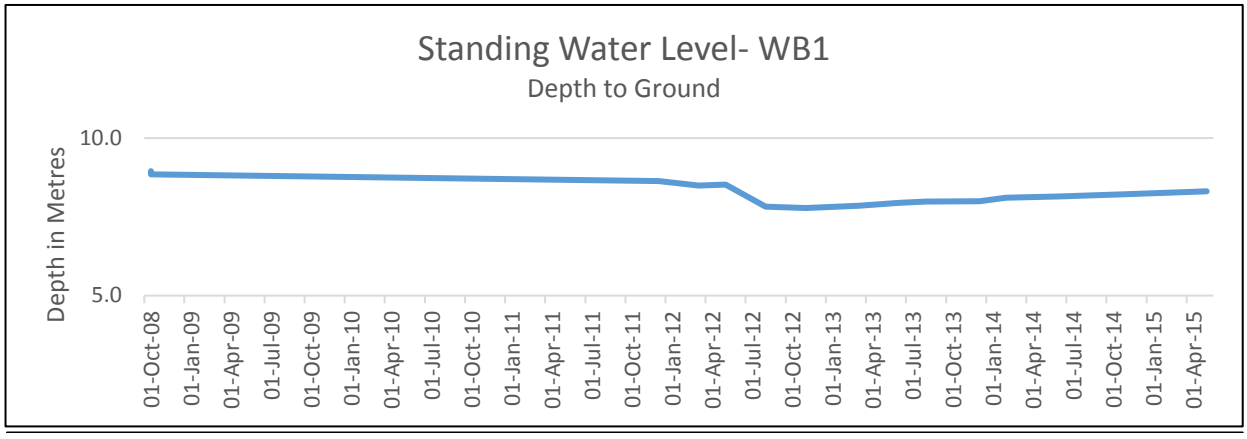
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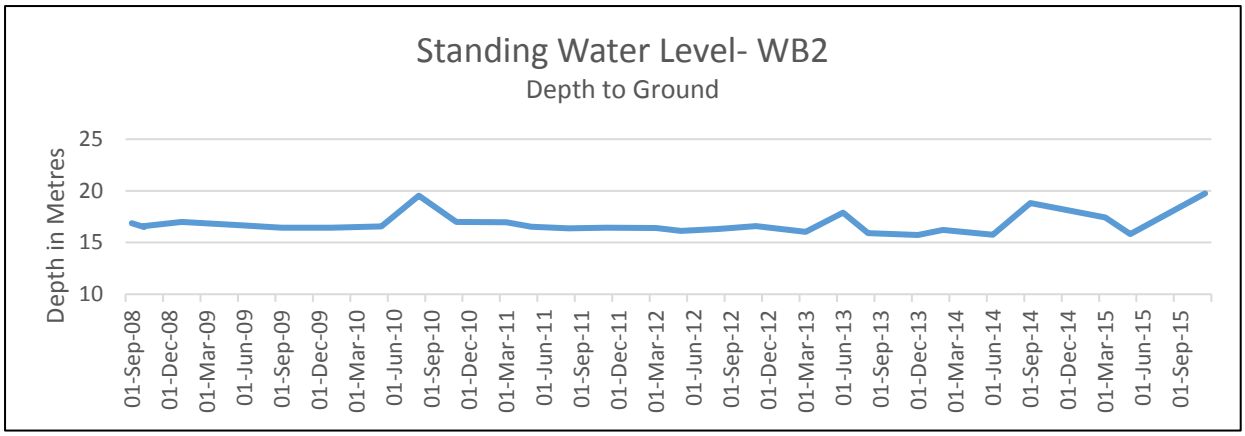
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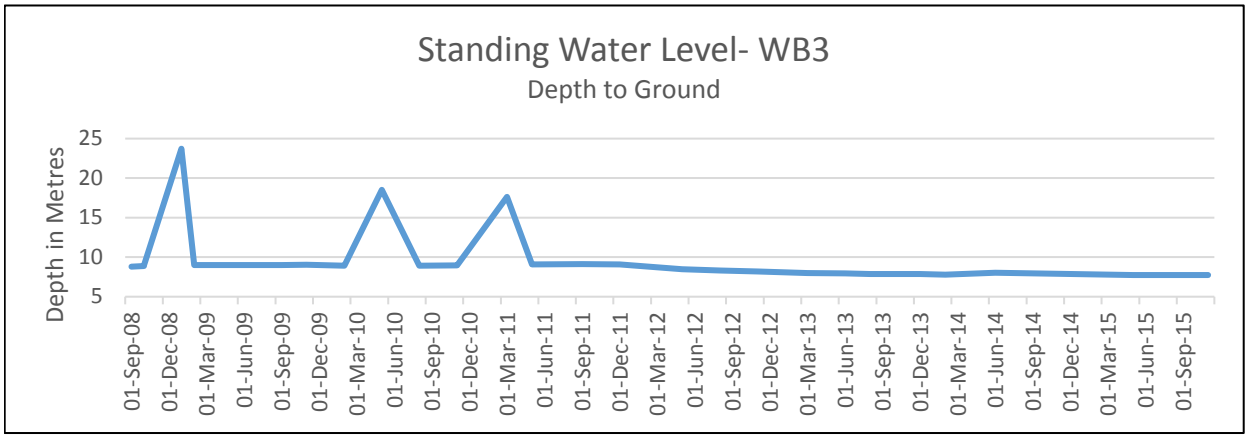
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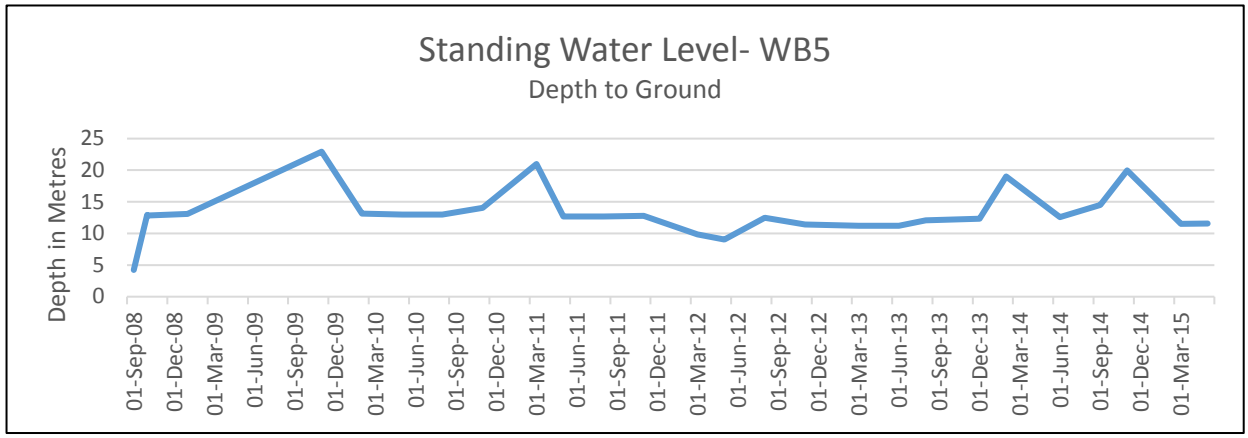
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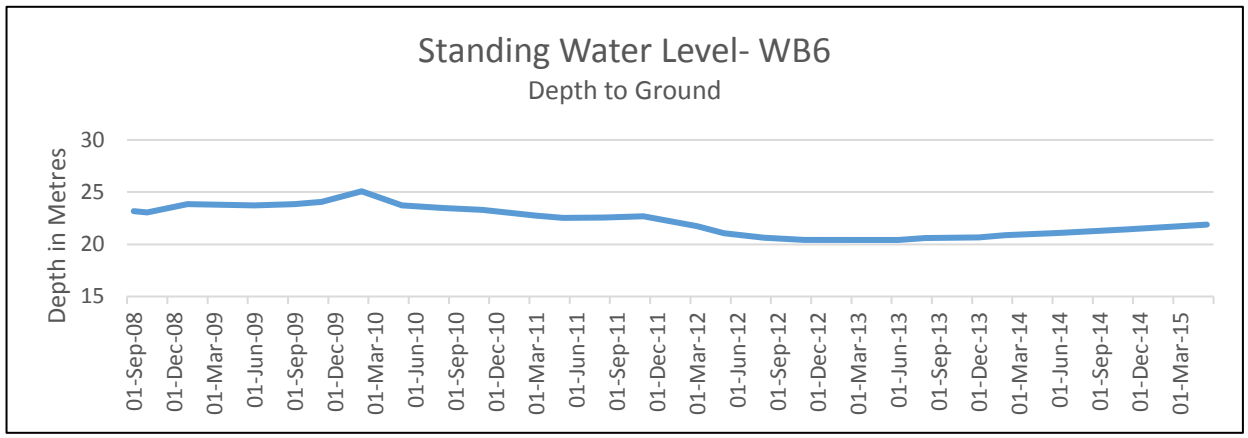
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25
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15
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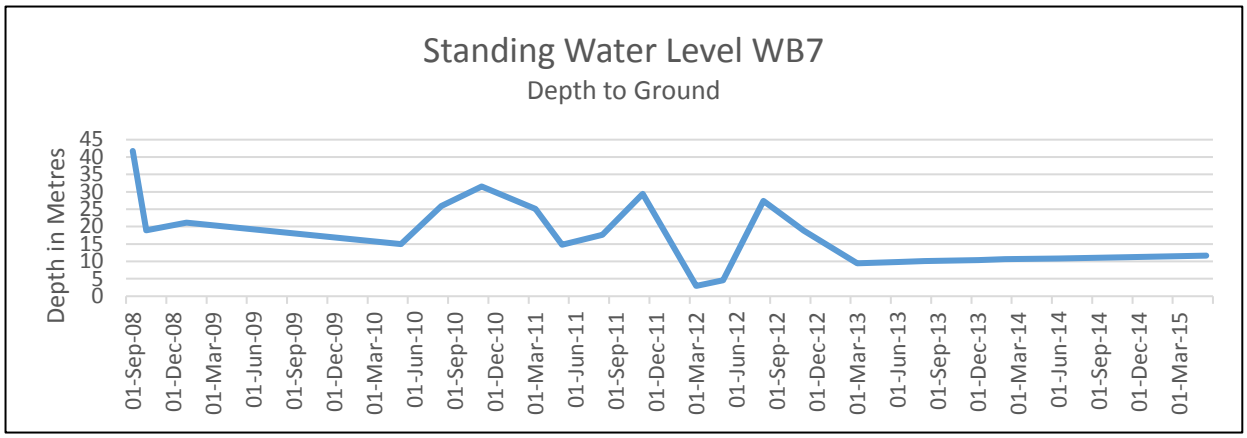
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Depth in Metres
45
40
35
30
25
20
15
10
5
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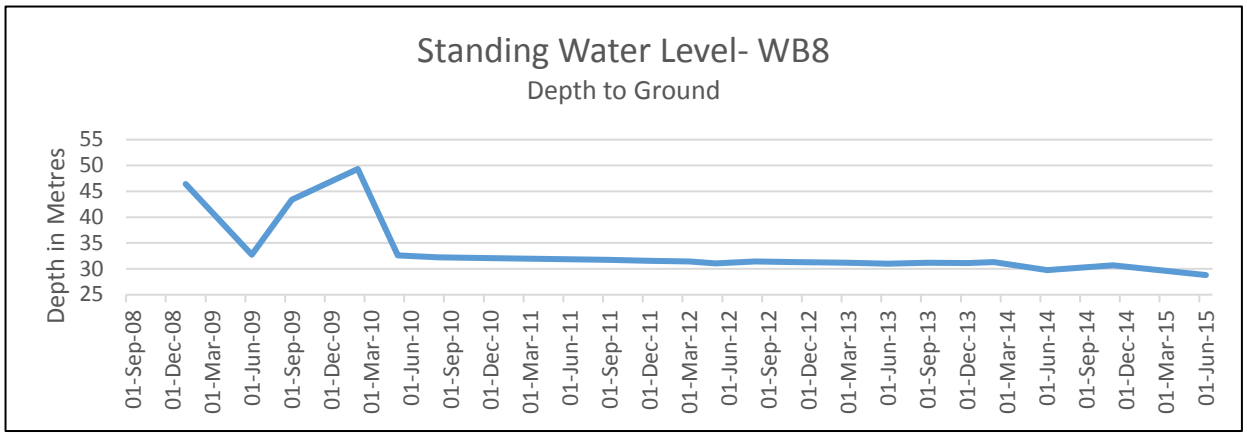
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Depth in Metres
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45
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35
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25
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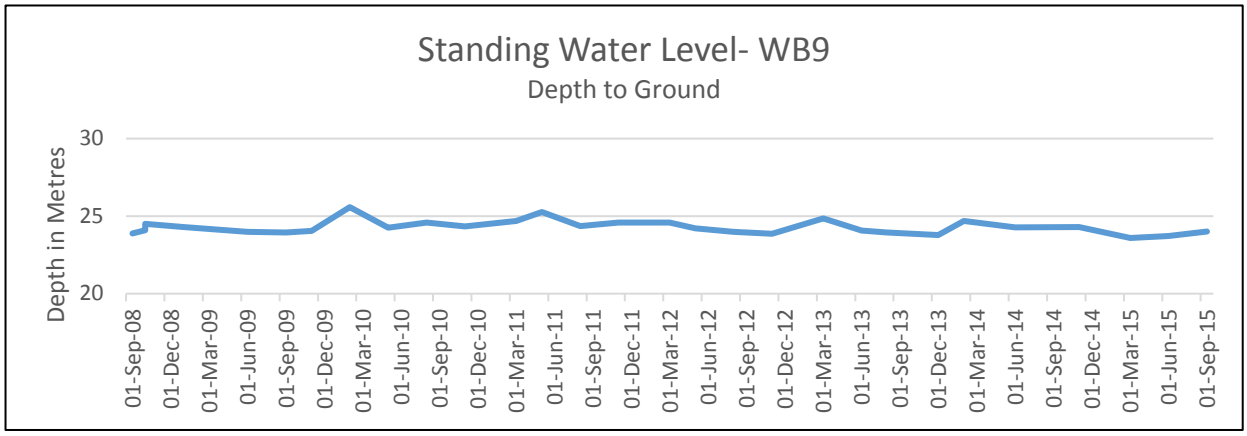
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Depth in Metres
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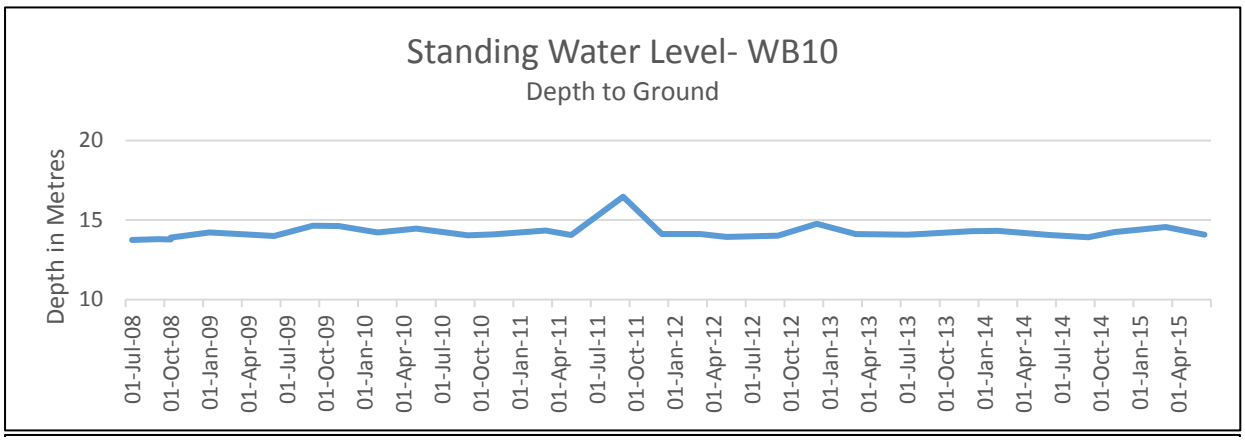
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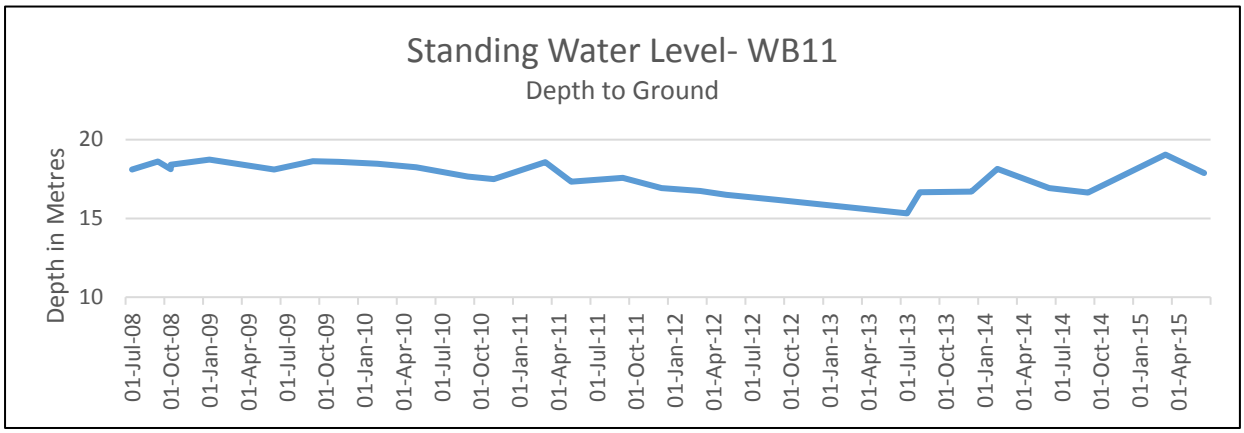
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Depth in Metres
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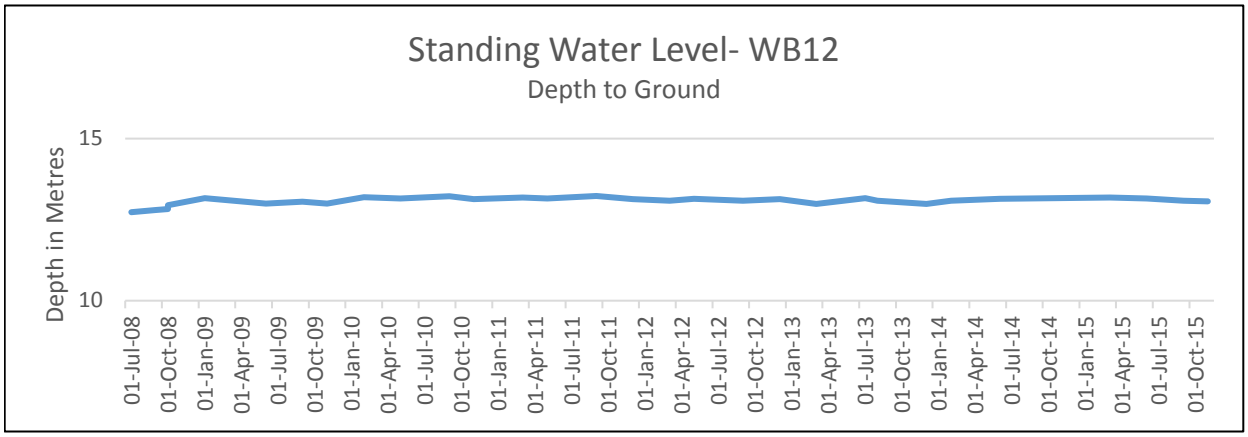
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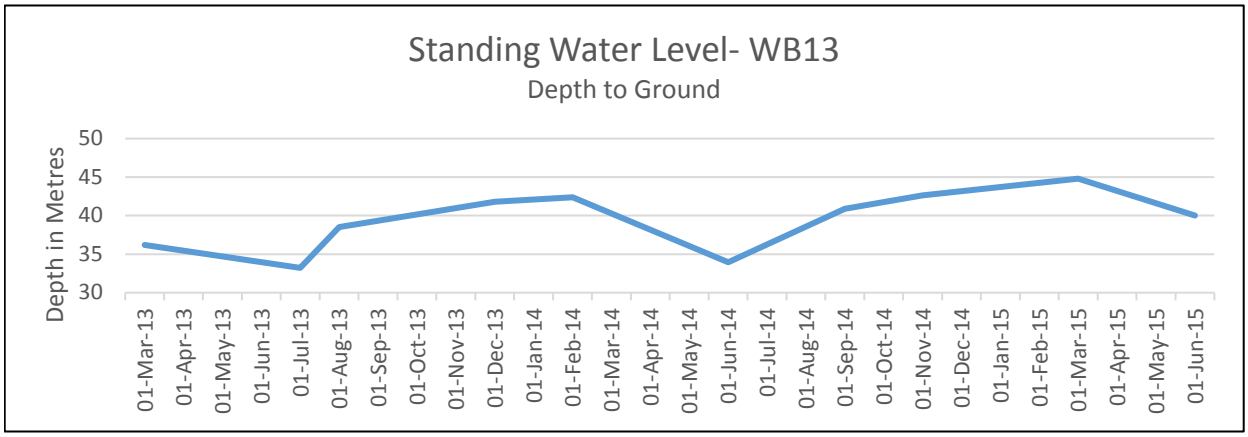
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45
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35
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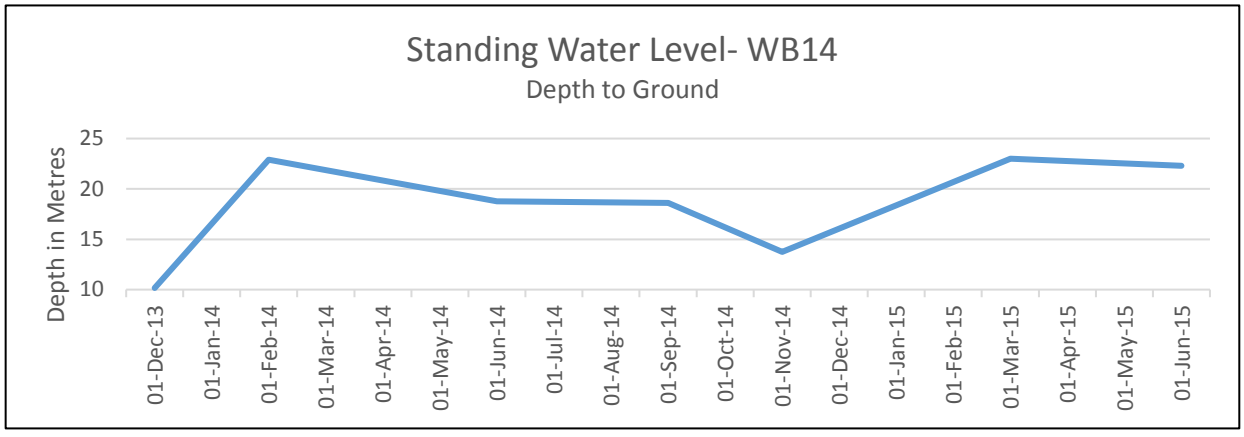
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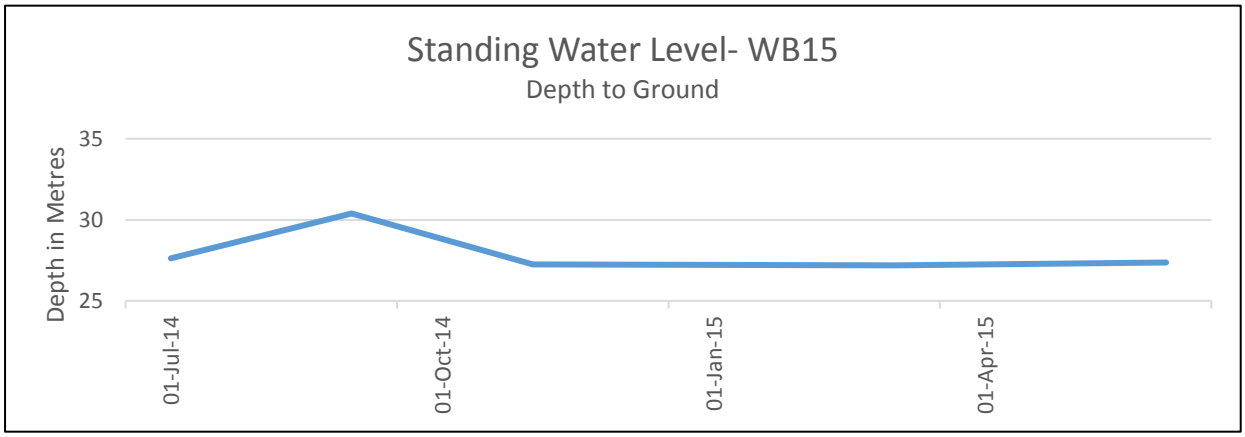
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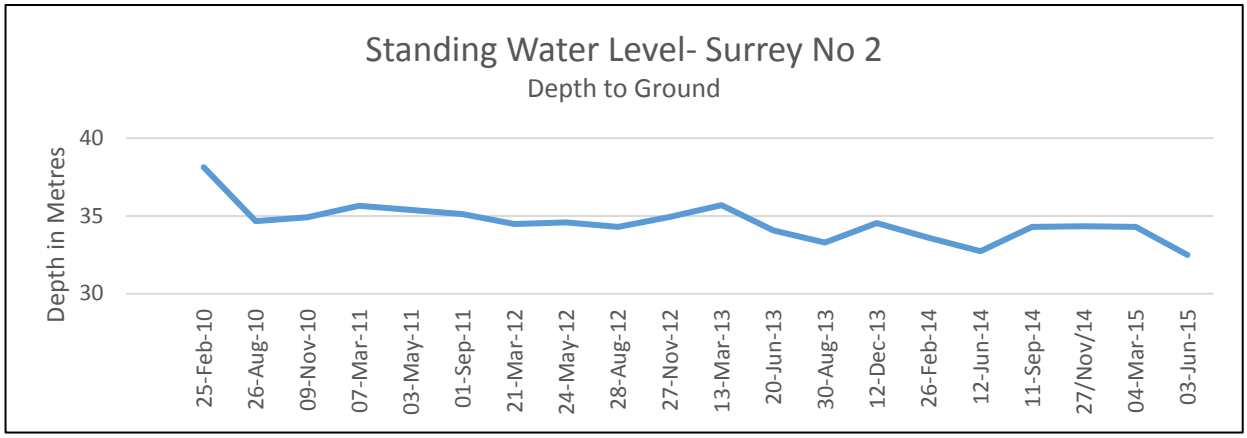
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20-Jun-13
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26-Feb-14
12-Jun-14
11-Sep-14
27/Nov/14
04-Mar-15
03-Jun-15

Rocglen Mine Rehabilitation Monitoring (spring 2014 – autumn 2015)

Prepared for
Whitehaven Coal Mining Limited

5 June 2015

DOCUMENT TRACKING

Item	Detail	
Project Name	Rocglen Mine Rehabilitation Monitoring (spring 2014 – autumn 2015)	
Project Number	14ARMECO-0032	
Project Manager	Nathalie van der Veer 92 Taylor Street, ARMIDALE NSW 2350 02 8081 2684	
Prepared by	Nathalie van der Veer	Linden Burch
Reviewed by	Dr Paul Frazier	
Approved by	Dr Paul Frazier	
Status	FINAL	
Version Number	1	
Last saved on	5 June 2015	
Cover photo	Control woodland (WC02); Rehabilitated woodland (WR01); Rehabilitated pasture (PR01) – Ben Martin.	

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ACKNOWLEDGEMENTS

This document has been prepared by Eco Logical Australia Pty Ltd with support from Whitehaven Coal Mining Limited.

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Abbreviations

ABBREVIATION	DESCRIPTION
AEMR	Annual Environment Management Report
ELA	Eco Logical Australia
RMP	Rehabilitation Management Plan
$EC_{1:5}$	Electrical Conductivity (soil salinity)
EC_e	Electrical Conductivity (actual soil salinity)
ESP	Exchangeable Sodium Percentage
KTP	Key Threatening Processes
OC	Organic Carbon
TN	Total Nitrogen
TSC Act	NSW *Threatened Species Conservation Act 1995*
WHC	Whitehaven Coal

Key outcomes and recommendations

- Due to a prolonged dry period groundcover and growth of planted trees in the rehabilitated areas has been hindered
- Mother of Millions (Class 4 Noxious weed) was identified at WC01 this must be managed in a manner that continuously inhibits the ability of the plant to spread
- Weed control at the woodland rehabilitation area is recommended to prevent Galvanised Burr and Black Roly Poly from dominating the site which may compromise the objectives of woodland rehabilitation juvenile tree survival
- For future monitoring we recommend that the percentage cover (based on Braun Blanquet cover classes) of each species should be measured instead of individual species counts. This would be a more effective method for analysing vegetation cover, as individual herbs may vary in their cover extent.
- We recommend annual satellite image capture and analysis for broad scale monitoring and year-on-year comparison of rehabilitation

1 Introduction

This Rehabilitation Monitoring Report has been prepared by Eco Logical Australia (ELA) for Whitehaven Coal Limited (WHC), in accordance with the Rehabilitation Management Plan (RMP) (GSSE 2013).

1.1 Background

Rocglen Coal Mine (Rocglen) is an open cut mine owned and operated by WHC in the Gunnedah coalfield of NSW. It is located 28 kilometres north of Gunnedah on the Wean road in northwest NSW.

Production at Rocglen commenced in November 2008 and as per revised mine plan is anticipated to be complete in financial year 2016. In accordance with Condition 36 of Schedule 3 of the Rocglen Project Approval (PA 10_0015), which incorporates the initial mine and the Rocglen Extension Project, Whitehaven have developed a RMP. The RMP is intended to provide a framework for mine closure, including progressive rehabilitation strategies and decommissioning works (GSSE 2013). Incorporated into the Plan is the Rehabilitation Monitoring Program which details aspects of rehabilitation requiring monitoring and the associated methods and frequency with which to monitor them.

1.2 Project scope

This document reports on the rehabilitation monitoring undertaken in spring 2014 and Autumn 2015.

Rehabilitation monitoring surveys were undertaken in accordance with the RMP (GSSE 2013) and included:

- Native woodland monitoring
- Native fauna monitoring
- Review of monitoring data to assess trends and monitoring program effectiveness.

In addition to the RMP monitoring recommendations we have also undertaken remote-sensing based landscape assessment.

1.3 Aims & objectives

The aim of this monitoring report is to document the spring 2014 and Autumn 2015 monitoring results and provide an assessment of rehabilitation performance against nearby control landscapes.

Specific monitoring objectives for 2014/2015 included:

- Identify any erosion or sedimentation from areas with establishing vegetation cover
- Monitor success of initial grass cover establishment
- Monitor success of tree and shrub plantings
- Assess adequacy of drainage controls
- Identify presence of weeds
- Assess general stability of rehabilitation site
- Compare rehabilitation monitoring results with the preliminary rehabilitation success criteria outlined in Table 2, Section 2.2 of the Rehabilitation Management Plan (GSSE 2013).

2 Rehabilitation objectives & success criteria

2.1 Rehabilitation objectives

The primary rehabilitation objective is to provide a low maintenance, stable and safe landform that blends in with the surrounding topography and provides a mixture of rehabilitated bushland and grazing comparable to pre-mining conditions (GSSE 2013).

Short term objectives applicable to this report include:

- Rehabilitate areas of disturbance no longer required for mining-related operations
- Apply appropriate soil material (topsoil/subsoil) to the final landform based on material availability and post-mining land use
- Stabilise all earthworks, drainage lines and disturbed areas in order to minimise erosion and sedimentation
- Control vermin, feral animals and noxious weeds.

Long term objectives applicable to this report include:

- Re-establish land to either pasture or bushland over the areas disturbed by the mine
- Increase the area of land allocated to bushland/woodland through the revegetation of those areas disturbed by the mine and the long term conservation of remnant and degraded native vegetation and/or habitat corridors on the mine site
- Provide habitat for fauna and corridors for fauna movement within the final landform
- Monitor rehabilitation success in terms of physical and biological parameters.

2.2 Rehabilitation success criteria

Rehabilitation success criteria are performance objectives or standards against which rehabilitation success in achieving a sustainable system for the proposed post-mine land use is demonstrated.

Table 2-1 summarises the rehabilitation success criteria for each rehabilitation area in the different mine zones. It is intended that each criterion will be further developed based on further research and on-going monitoring. The success criteria will be reviewed every three to five years to ensure that they remain realistic and achievable (GSSE 2013)

Table 2-1: Preliminary rehabilitation success criteria (taken from GSSE 2013)

Rehabilitation Element	Indicator	Criteria
1. Inpit Overburden		
Landform stability	Slope gradient	No less than 75% of the area has overall slopes ≤3H:1V. Where the slopes are steeper, additional water management structures will be utilised (as required).
	Erosion control	Erosion control structures are installed at intervals commensurate with landform slope.
		Average soil loss per annum is <40 tonnes/ha/yr (sheet erosion).
		Dimensions and frequency of occurrence of erosion rills and gullies are generally no greater than that in reference sites that exhibit similar landform characteristics.

Rehabilitation Element	Indicator	Criteria
	Surface Water Drainage	Use of contour banks and diversion drains to direct water into stable areas or sediment control basins.
		All landforms will be free draining except where specific structures (i.e. dams) have been constructed for the storage of water as required for sediment and erosion control or some post mining land use.
Water quality	Water Quality	Ensure receiving waters affected by surface water runoff have contaminant limits within an acceptable range.
Topsoil	Salinity (electrical conductivity)	Soil salinity content is <0.6 dS/m.
	pH	Soil pH is between 5.5 and 8.5.
	Sodium content	Soil Exchange Sodium Percentage (ESP) is <15%.
	Nutrient cycling	Nutrient accumulation and recycling processes are occurring as evidenced by the presence of a litter layer, mycorrhizae and/or other microsymbionts. Adequate macro and micro- nutrients are present.
Vegetation	Land use	Area accomplishes and remains as a healthy stand of shrubs, trees and grass species.
		The site can be managed for its designated land use without any greater management inputs than other land in the area being for a similar purpose.
	Surface cover	Minimum of 70% vegetative cover is present (or 50% if rocks, logs or other features of cover are present). No bare surfaces >20 m^2 in area or >10 m in length down slope.
	Species composition	Subject to proposed land use, comprise a mixture of native trees, shrubs and grasses representative of regionally occurring vegetation where possible.
		Vegetation communities should be developed to attract and support the re-colonisation by native flora and fauna species found in the area.
	Resilience to disturbance	Established species survive and/or regenerate after disturbance. Weeds do not dominate native species after disturbance or after rain. Pests do not occur in substantial numbers or visibly affect the development of native plant species.
	Sustainability	Species are capable of setting viable seed, flowering or otherwise reproducing. Evidence of second generation of shrub and understorey species. Vegetation develops and maintains a litter layer evidenced by a consistent mass and depth of litter over subsequent seasons. More than 75% of shrubs and/or trees are healthy when ranked healthy, sick or dead.
Fauna	Vertebrate species	Representation of a range of species characteristics from each faunal assemblage group (e.g. reptiles, birds, mammals), present in the ecosystem type, based on pre-mine fauna lists and sighted within the three-year period preceding mine closure. The number of vertebrate species does not show a decrease over a number of successive seasons prior to mine closure.

Rehabilitation Element	Indicator	Criteria
	Invertebrate species	Presence of representatives of a broad range of functional indicator groups involved in different ecological processes.
	Habitat structure	Typical food, shelter and water sources required by the majority of vertebrate and invertebrate inhabitants of that ecosystem type are present, including: a variety of food plants; evidence of active use of habitat provided during rehabilitation such as nest boxes, and logs and signs of natural generation of shelter sources including leaf litter.
Visual	Visual Amenity	Long term visual impact should be minimised by creating acceptable landforms, preferably compatible with adjacent landscape
Safety	Physical	Excavations to be rendered safe
		All drill holes, pits, open cuts and other openings to be securely capped, filled or otherwise made safe
		Public and livestock access is to be restricted as appropriate to site conditions
		No rubbish should remain at the surface, or at risk of being exposed through erosion

3 Rehabilitation undertaken to date

During the Annual Environment Management Report (AEMR) period of 2009/2010 vegetation rehabilitation comprised of the establishment of cover crops on soil stockpiles and the amenity bund and the planting of 200 tubestock along the site access road (Whitehaven Coal Mining Pty Ltd 2010).

The first stages of revegetation on the reshaped western emplacement were undertaken during the 2010/2011 AEMR period, this included the planting of 800 trees. Poor soil conditions and lack of rainfall resulted in challenging conditions; however, towards the end of the AEMR period the trees appeared to have established well. Eight-hundred and eighty trees were also planted along Wean Road diversion for screening purposes during this period (Whitehaven Coal Mining Pty Ltd 2011). Soil improvement and sufficient rainfall have allowed for improved vegetation cover and growth, consisting of a mixture of annual and perennial grasses.

Areas of rill erosion were identified on slopes within drainage structures during the 2011/2012 AEMR period; these were controlled with the use of hay bales. Soil remediation work resulted in excellent vegetation cover and growth in the western emplacement area. A total of 7, 270 endemic trees and shrubs were planted in this area and inspections indicated that they were establishing well (Whitehaven Coal Mining Pty Ltd 2012).

Erosion was identified within drainage structures during the 2012/2013 AEMR period; these were controlled with the use of hay bales and were repaired with the use of turf lining and associated earthworks. Existing vegetation rehab showed good cover. Sixteen hectares of the southern section and northern plateau of the western emplacement was shaped, topsoiled and seeded using grasses and legume species. In-fill planting was undertaken on the western emplacement slope with 920 trees and shrubs. Also, understory shrub and small tree seed was incorporated into grass mix which was directly seeded on to freshly topsoiled designated areas (Whitehaven Coal Mining Pty Ltd 2013).

Rehabilitation of the northern emplacement commenced in the 2012/2013 AEMR period. Eleven hectares was shaped, topsoiled and seeded with a mixture of grasses and legumes as recommended by a local agronomist following soil analysis of soil stockpiles on site. A good vegetation cover was established by the end of the reporting period (Whitehaven Coal Pty Ltd 2013).

Mounds were installed on all rehabilitation sites in addition to contour banks to act as small scale water holding structures to reduce water runoff and erosion and allowing pooled water to become available to vegetation (Whitehaven Coal Pty Ltd 2013).

4 Methods

Methods were in accordance with the RMP. Further background information and detail relating to plot design can be found in Appendix A. General observations were made in addition to measurements recorded in the monitoring plots.

4.1 Remote sensing

Four band multi-spectral imagery was captured across the entire target area and control areas on 4 September 2014 using GeoEye-1. This image was then processed into a False Colour Enhanced Image for analysis.

4.2 Erosion

To measure the extent and type of erosion, erosion pins were established at in the woodland rehabilitation plots. Erosion pins were established at strategic points (i.e. slopes and areas of high water energy) along the erosion transect (Appendix A; Appendix I).

4.3 Pasture and woodland monitoring

In accordance with the RMP detailed vegetation and erosion surveys were conducted in spring 2014 (Appendix A). Sample transects were established to assess whether rehabilitation activities are meeting the success criteria. Woodland sites were selected to align with vegetation communities in the adjacent Vickery State Forest and "Yarrawonga", with control sites located on Yarrawonga (Figure 4-4-1). Pasture monitoring sites were located on site and in the adjacent "Yarrawonga" property.

4.4 Fauna monitoring

In accordance with the RMP, fauna surveys were conducted in Spring 2014 and Autumn 2015 (Appendix A). Bird species abundance was recorded using a 15 minute meandering transect. If new species were detected in the last five minutes, the survey was continued for another five and so on to a maximum of one hour total survey. Microbat activity was monitored using Anabat detection devices for two nights at each site. Spotlighting for nocturnal fauna was undertaken for one hour on one night at each site. Fauna monitoring was undertaken in three vegetation communities, establishing a control plot in each, while one site was established in the rehabilitated area along the Western Emplacement Area (Figure 4-4-1).

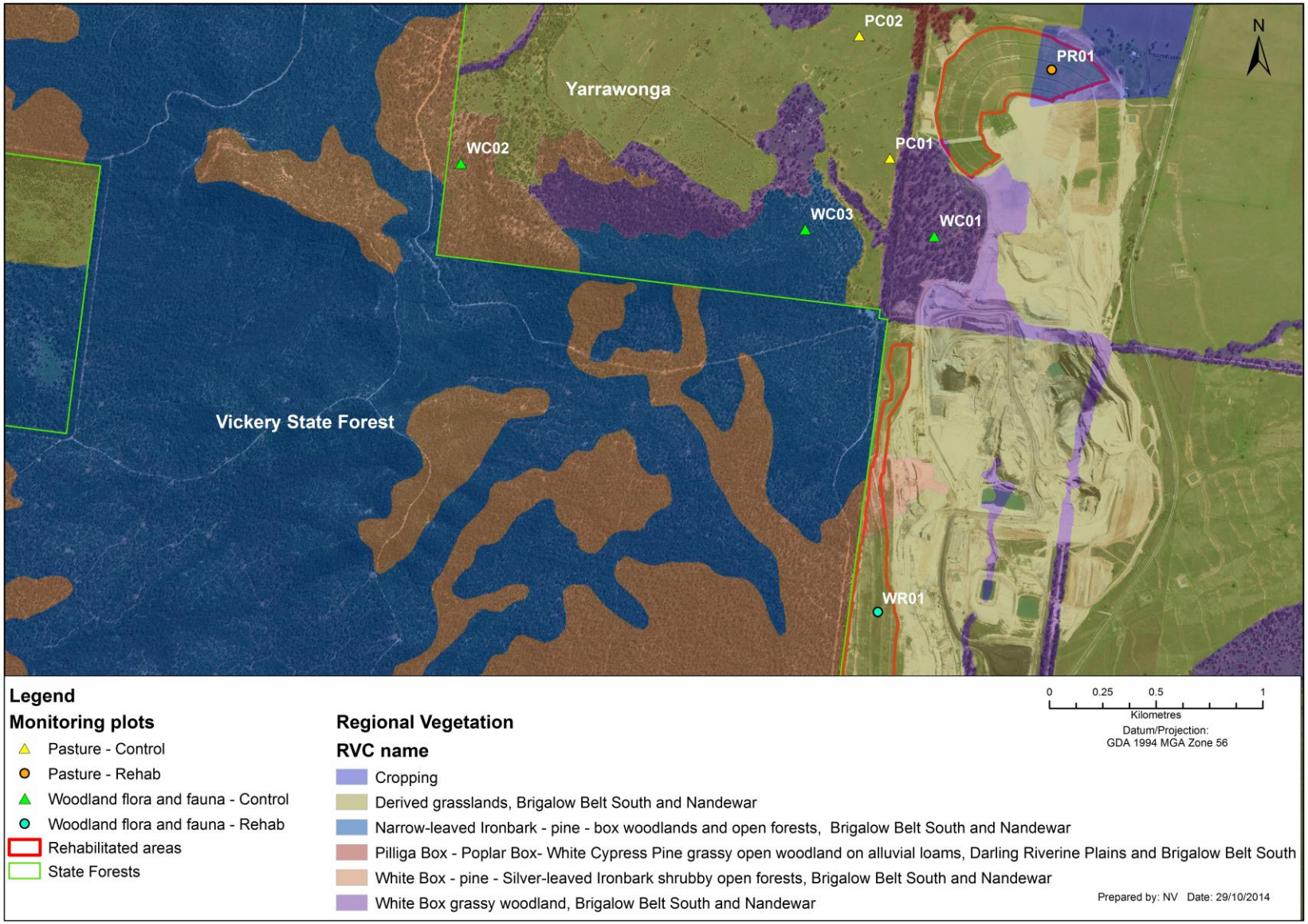

Figure 4-4-1: Flora and fauna monitoring sites (2014)

4.5 Survey dates

Ecologists Ben Martin and Kurtis Lindsay undertook vegetation monitoring (woodland and pasture sites) on 18 and 19 November 2014.

Spring and autumn fauna and habitat monitoring of woodland areas was undertaken by Ecologist Dr Stephen Debus and Linden Burch between 17 – 19 November 2014 and 13 – 15 April 2015.

4.6 Weather

Temperatures in the three months preceding the spring monitoring period were cool to warm and consistent with historical averages (Figure 4-2; Appendix B). The temperature range in November exceeded the historical daily temperature range in November; however, this was influenced by daily temperatures later in the month after the spring survey period. In the three months preceding the autumn monitoring period were warm to hot and were consistent with historical averages (Figure 4-2; Appendix B). Rainfall in the six months leading up to surveying was below average, except in August when recorded rainfall at Rocglen Mine was consistent with the long term average (Figure 4-3; Appendix B). Rainfall remained below the average historical average in the time between the spring and autumn survey periods (Figure 4-3; Appendix B).

Maximum temperatures during the flora and fauna surveys were above the historical average by up to 5ºC, while minimum temperatures were up to 7ºC below the long term average (Figure 4-2; Appendix B).

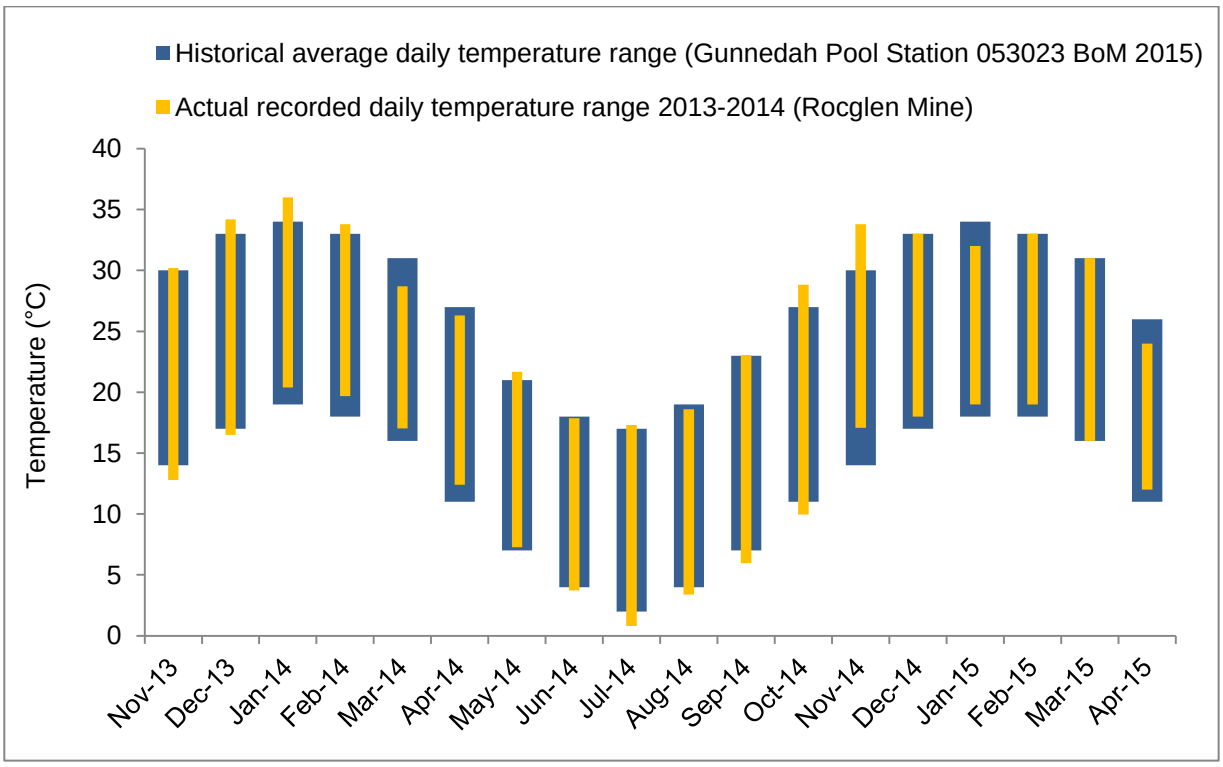

Figure 4-2: Historical average and recorded average daily temperature range

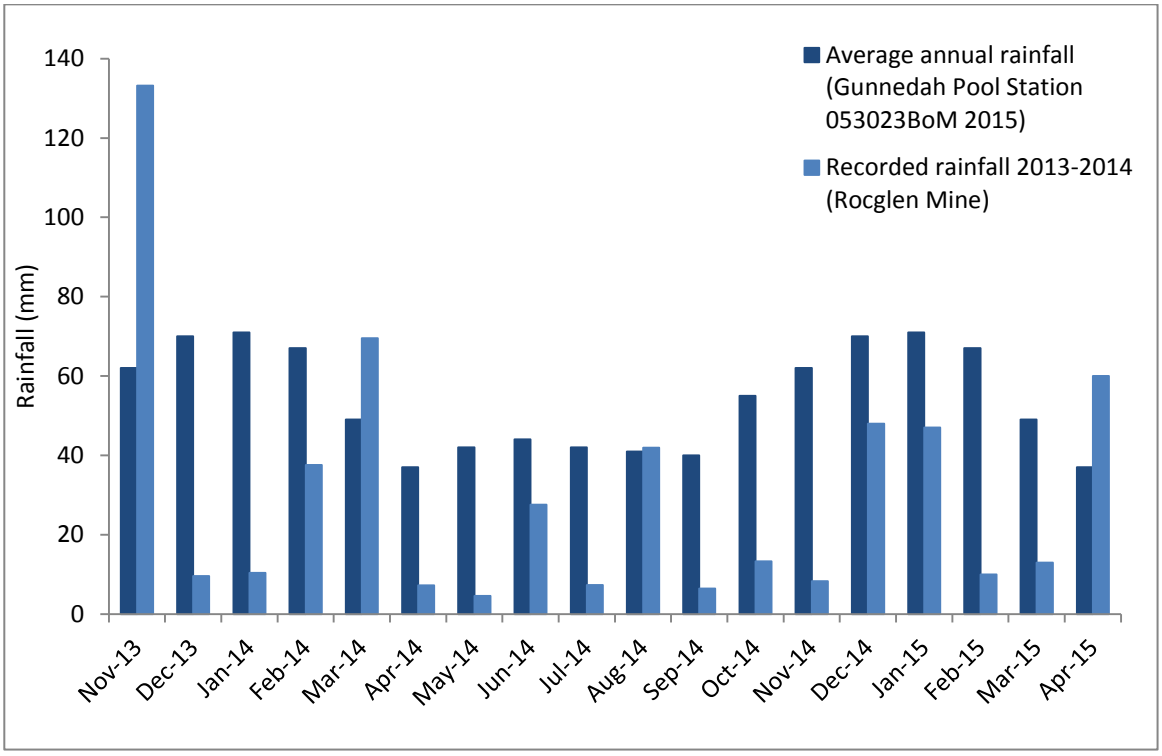

Figure 4-3: Historical average and recorded rainfall

5 Results & discussion

5.1 Remote sensing

The true colour and false colour images indicate the extent and condition of each land cover type in the area. These images show similar vegetation cover across the control and rehabilitation pasture sites. In the woodland areas there is a greater vegetation cover at the control sites, given that tubestock planting in WR01 commenced in 2011.

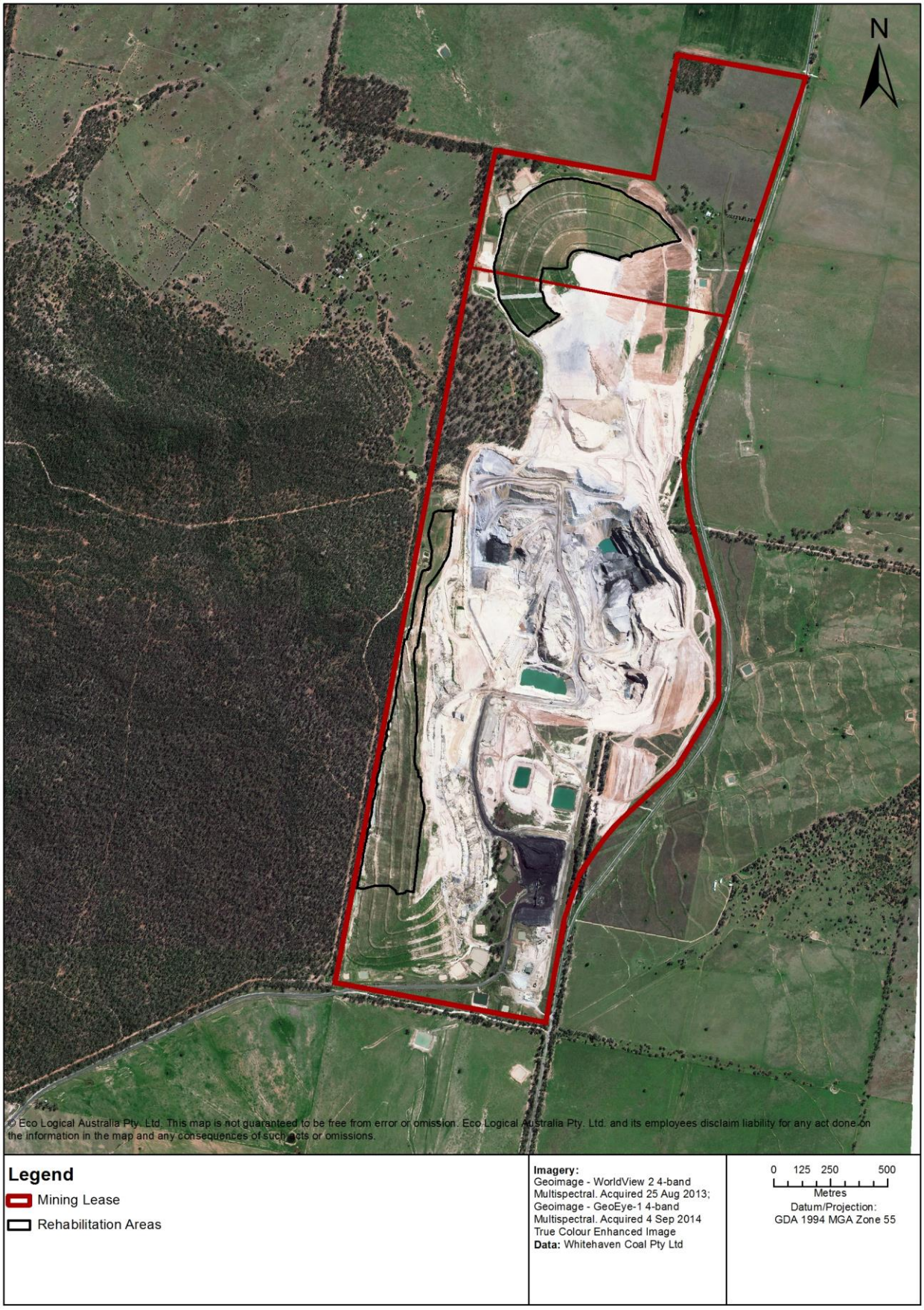

Figure 5-1: Rocglen Mine - True Colour Image

Figure 5-2: Rocglen Mine - False Colour Image

5.2 Pasture monitoring

5.2.1 Groundcover composition

Groundcover composition was recorded for each plot (percentage cover of exotic plants, native plants, bare ground and organic litter). Bare ground dominated at all sites, with mean cover from 48% (PR01) to 87% (PC01) (**Error! Reference source not found.**). A minimum of 70% vegetation cover is rescribed in the RMP; however a minimum 50% cover is allowable if rocks, logs or other features of cover are present. Vegetation cover at PR01 was dominated by weed species which made up 13% of cover compared to 5% native pasture cover meaning it did not meet the minimum success criteria threshold. Suitable cover features were also present at PC02, but vegetative cover was 32%. Vegetative cover was 13% at PC01 and no other cover features were recorded. The vegetative cover at both control sites was less than the success criteria threshold. The rehabilitated site had 10% more exotic species cover compared to the control sites where exotic species cover was 2% and 3%. Litter cover was absent from all plots at PC01, but mean litter cover recorded at PC02 and PR01 was 15% and 33% respectively (**Error! Reference source not found.**).

Table 5-1: Summary of groundcover composition

Cover (%)	PC01			PC02			PR01		
	Minimum recorded	Maximum recorded	Mean	Minimum recorded	Maximum recorded	Mean	Minimum recorded	Maximum recorded	Mean
Weed	1	3	2	0	8	3	4	18	13
Pasture	7	16	11	7	100	29	3	8	5
Bare ground	81	91	87	0	86	53	15	72	48
Litter	0	0	0	0	50	15	10	65	33

*Cells shaded orange indicate exceedance of success criteria

5.2.2 Species diversity

There were no clear trends for pasture species diversity between the control and rehabilitation sites (Figure 5-3). Rehabilitation began on the northern emplacement in the second half of the 2012/2013 AEMR reporting period when a grass and legume mixture was sown. During the 2014 surveys none of the species sown were recorded in the monitoring plots; however an unidentified exotic grass was recorded in four plots which may be a sown pasture species (Appendix E).

5.2.3 Weed species

For the purposes of monitoring the pasture zones a weed species was determined to be an exotic or native species unpalatable to grazing stock or one that threatens agricultural productivity. Weeds were recorded in all plots at each site, except Plot 1 at PC02. Weed species diversity was greater at PR01 than at either controls with 64 individual plants representing six species (Appendix D; Table E-2). The high percentage of weeds is likely to result from the large proportion of bare ground, creating an opportunity for invasion and establishment.

The survey design is to record ‘living plants’ this meant we did not record quantitative data on dead plants. However it was observed that dead exotic weeds in the family Brassicaceae (commonly known as Turnip Weed or Wild Mustard) were present at both the pasture and woodland rehabilitation sites. These short-lived annuals had all seeded, died and dried-out by the time we performed the surveys.

Hence we could not identify any of these plants to the species level or get adequate quadrat cover estimates. The species may have included *Rapistrum rugosum*, *Raphanus raphanistrum, Brassica tournefortii* and *Sisymbrium thellungii.*

These species are known to dominate areas in autumn-winter, and this is occurring at Rocglen. By the time natives are planted or seeds are sown in the rehabilitation areas the Brassicaceae take over and prevent plant establishment through direct competition (i.e. for water and light resources). We advise that aggressive weed control programs are undertaken targeting these species in the rehabilitation areas due for plant establishment, prior to and post planting/seeding. This will improve the chances of favourable species establishing.

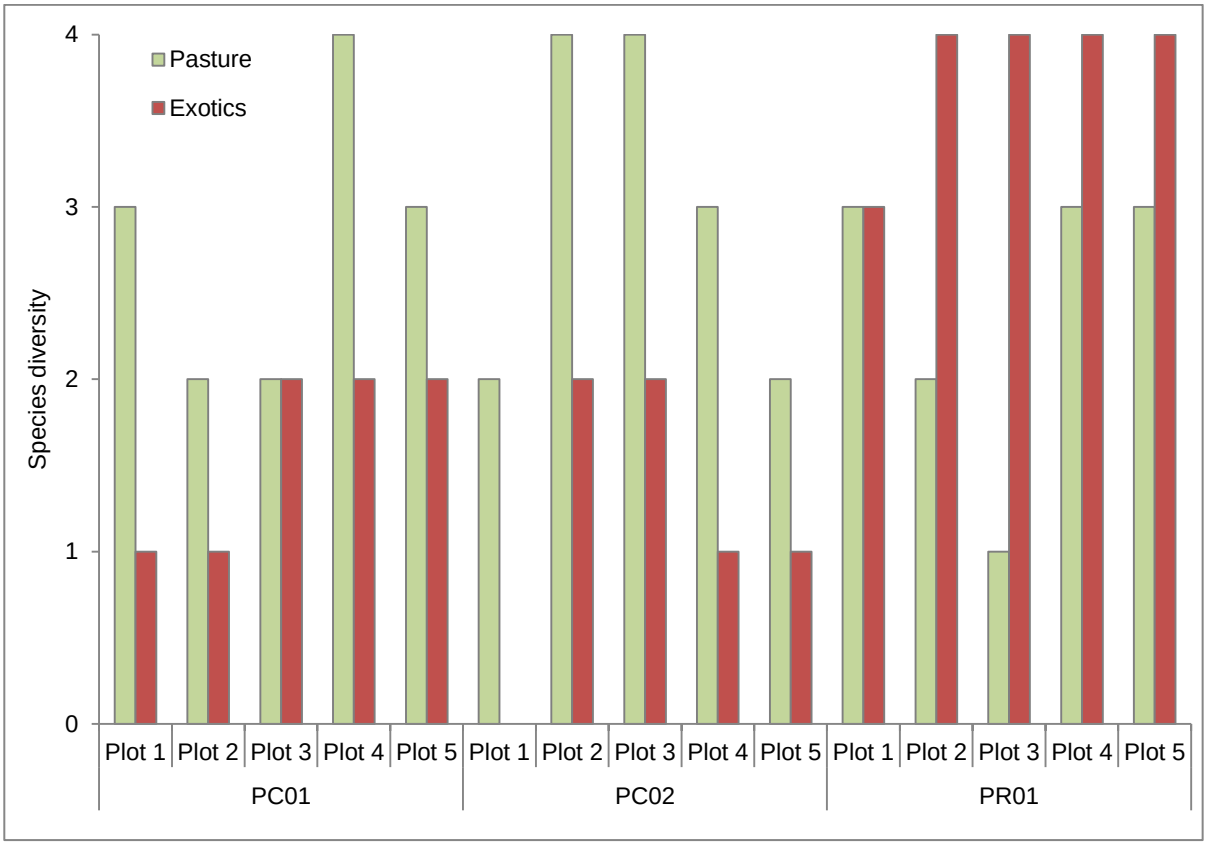

Figure 5-3: Species diversity according to pasture and exotic species

5.2.4 Soil samples

Soil test results for pH and Soil Exchange Sodium Percentage (ESP) did not show any distinct patterns separating the control plots from the rehabilitation plot. Soil pH at all sites was within the ideal pH range for plant growth (5.5 – 8.5) as specified by the success criteria, while ESP was within the success criteria (<15%) with results indicating soil at all sites was non-sodic.

Particle size analysis indicated the control sites have sandy loam soils, while the rehabilitation site is clay. The dispersion index score at PR01 was 2. This indicates few problems for cropping and new or established pasture systems; however, the soil is still prone to compaction (NSW DPI 2014).

The RMP success criteria stated soil salinity content should to be <0.6 dS/m. This measure was interpreted as a conversion of soil salinity ($EC_{1:5}$) to actual soil salinity (EC_e) by using the soil texture results from the particle size analysis. Results ranged from 0.69 dS/m (PC02) to 1.89 dS/m (PR01) and

exceeded the success threshold at all sites; however at a soil salinity of 2 dS/m salts in soil have minimal impact on the yield of most agricultural crops and pastures (NSW DPI 2014).

Nitrogen (N) available for plant growth is difficult to measure in soil because the form and availability of nitrogen in soil can change quickly as it fluctuates with season and rainfall. At the time of sampling and analysis Total Nitrogen (TN) (a measure of the total organic and mineral forms of nitrogen present in the soil) was low for all sites; the highest average TN occurred in PC01 (1383 mg/kg) and the lowest average occurred at PR01 (604 mg/kg). Nitrate N (a mineral form of nitrogen available to plants) ranged from 0.8 mg/kg (PC02) to 12.9 mg/kg (PR01). Whilst it is difficult to determine a preferred level of nitrate, the level of nitrate at PR01 is above the recommended of 10 mg/kg for pastures (Reid & Dirou 2004).

Extractable Phosphorous (Colwell) were consistent across all sites ranging from 6.6 to 7.7 mg/kg. The preferred levels of extractable phosphorous vary from 20 to 100 mg/kg depending on soil texture. Low levels of phosphorous are expected since Australian soils are naturally deficient (Reid & Dirou 2004). Phosphorous requirements will depend on whether improved or native pasture systems are used to meet rehabilitation outcomes. Current phosphorous levels (Colwell level <20 mg/kg) are suitable for a diverse perennial native pasture in temperate Australia (Dorrough et al. 2008). However, higher phosphorous levels will be required for medium production and to benefit target pasture species in an improved pasture (Havilah et al. 2005).

Organic Carbon (OC) levels ranged from 0.79 % (PR01) ton 1.77 % (PC01). Sites PC02 and PR01 both had low (<2% according to Reid & Dirou 2004) levels of OC while at PC01 moderate levels were recorded.

The optimal value for the Ca/Mg ratio is 3:1 (Reid & Dirou 2004); however a well-structured soil will generally have twice the amount of exchangeable calcium to exchangeable magnesium and if the ratio is less than 2:1 then this may indicate reduced soil stability (Baker & Gourley 2011). The Ca/Mg Ratio ranged from 2.22:1 (PC01) to 3.19:1 (PR01). The value recorded at PR01 indicates that the stability of the clay soil at this site is not reduced by the Ca/Mg Ratio; however, the lower value at PC01 indicates a risk to the soil structure breaking down due to dispersion.

5.3 Woodland monitoring

5.3.1 General community description

The vegetation community at WC01 is Inland Grey Box grassy woodland with associated *Callitris* spp. and *Atalaya hemiglauca* (Whitewood) There is also a well-developed shrub layer dominated by *Geijera parviflora* (Wilga) and *Eremophila mitchelli* (False Sandalwood) on sandy clay loam in a valley flat. WC02 is in Narrow-leaved Ironbark shrubby woodland with Wilga and associated *Callitris* spp. on a grassy slope. WC03 is a community of Narrow-leaved Ironbark Shrubby Woodland with associated *Callitris* spp. with a tall shrub layer comprised of Wilga.

5.3.2 Tree health

Trees greater than 1.6 m tall were recorded and tagged. One False Sandalwood tree was recorded at WC01 with a DBH of 10 mm and was in good health. A greater number of large trees occurred at the other control sites. At WC02 there were six large trees, comprising of four species with DHB ranging from 40 mm to 390 mm (Appendix D). Twenty-four trees were recorded at WC03 comprising of three species and DBH ranged from 25 mm to 180 mm (Appendix D). Given that WR01 is a rehabilitation site no large trees were recorded.

5.3.3 Groundcover composition

Groundcover composition was recorded for each plot (percentage cover of exotic plants, native plants, bare ground, rock, cryptogam and organic litter). Native plant cover was variable across all sites and the dominant cover at the control sites was organic matter (Figure 5-4). Exotic plant cover was not recorded at any of the control sites, but accounted for 36% of ground cover at WR01. There was no substantial difference between the bare ground between the control sites and the rehabilitation site. The vegetative groundcover at the control sites was less than the success criteria threshold (50% accounting for presence of other cover features). The vegetative cover at WR01 was greater than 50%, but a large proportion of this was made up of exotic plants (Figure 5-4).

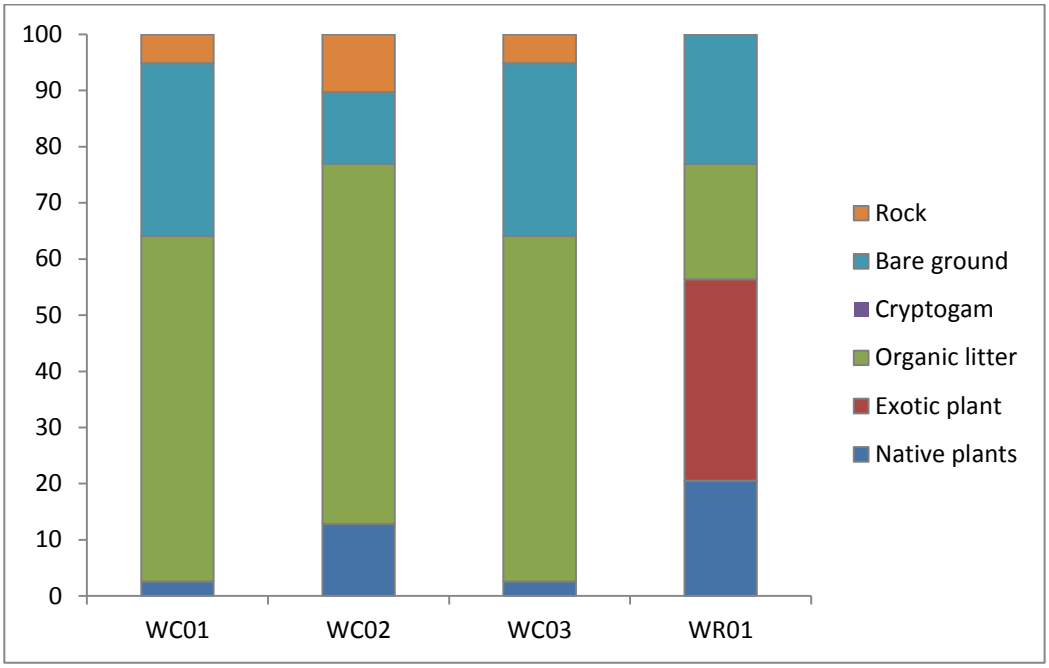

Figure 5-4: Groundcover composition at Woodland monitoring sites

5.3.4 Exotic species

The greater proportion of exotic species recorded at WR01 (57%) consisted of four species across all plots (Figure 5-5). *Sclerolaena birchii* (Galvanised Burr) and *Sclerolaena muricata* var. *villosa* (Black Roly-Poly) were observed in large numbers at WR01. Galvanised Burr and Black Roly-Poly are native species, however they are considered as weeds in pastures because they are generally not eaten by livestock, contaminate wool and compete with plants that provide feed (NSW DPI 2012). Whilst Galvanised Burr is not a declared noxious weed in Gunnedah Shire Council, it has been declared as a Class 4 noxious weed in surrounding LGAs and may become an issue in the future. Advice should be sought from Local Land Services regarding any restriction and requirements for clearing native vegetation before any control actions are undertaken.

No exotic species were recorded for WC01 and WC03, while the exotic species in WC02 accounted for 11% of all species. There were a total of 300 individual weeds recorded across all plots at WC02 composed entirely of *Misopates orontium* (Lesser Snapdragon) (Figure 5-6; Appendix D).

As described in Section 5.2.3 exotic species belonging to the Brassicaceae family could be limiting the establishment of native groundcover species in the rehabilitation areas and therefore require targeted weed control.

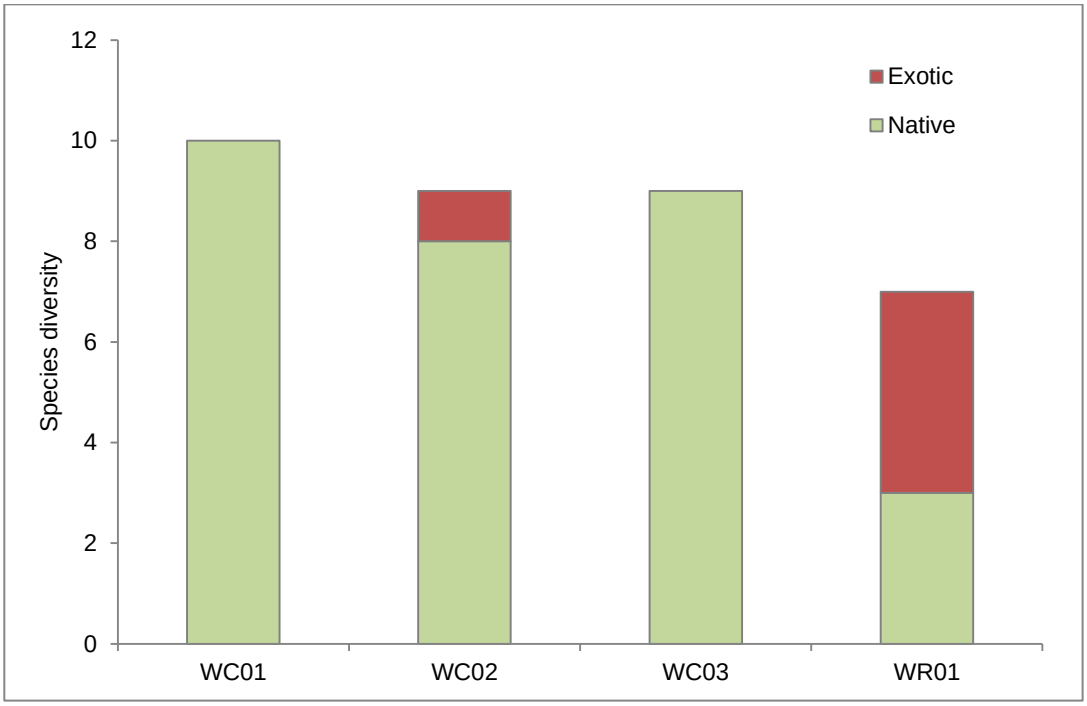

Figure 5-5: Species diversity at Woodland plots

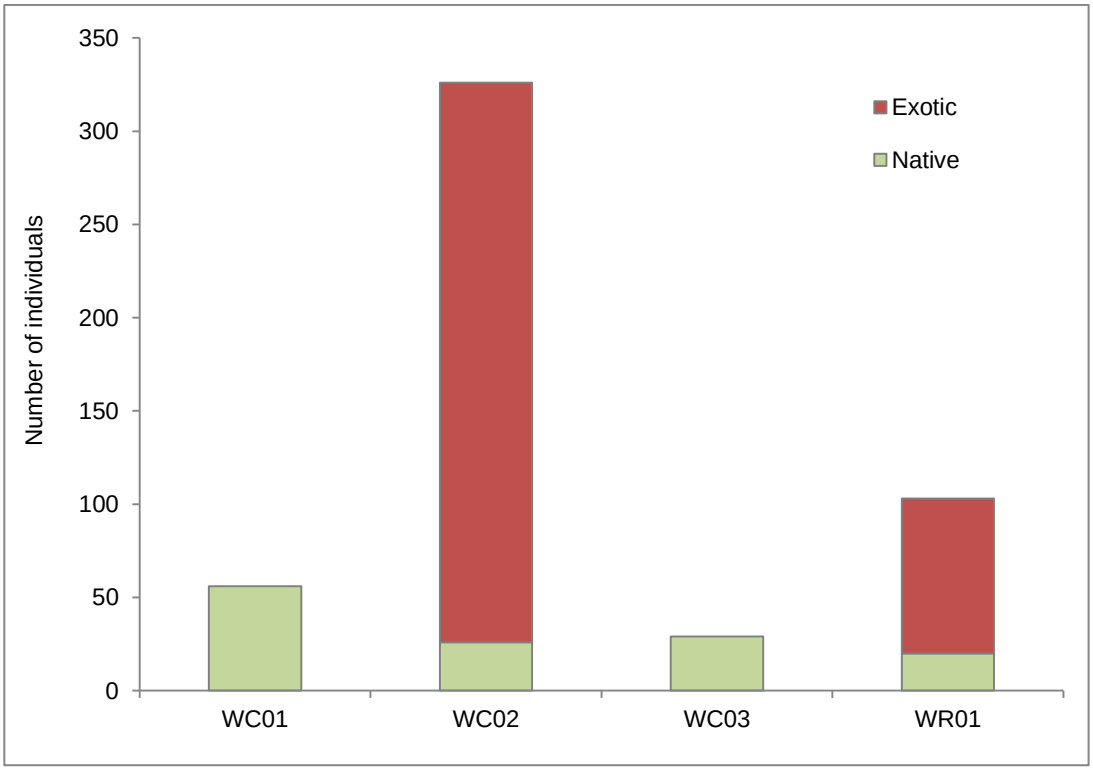

Figure 5-6: Species abundance at Woodland sites

5.3.5 Soil samples

Soils for each site were analysed for chemical and physical attributes. Generally there were not distinct patterns across the sites and between the control and rehabilitation sites. The results of soil sampling are in Appendix H.

Soil pH is within the range specified by the success criteria (5.5 – 8.5), except for WC01 where pH 4.93 making it slightly acidic. ESP at all sites was below the success criteria (<15%) with results ranging from 1.13% (WC02) to 2.55% (WC01).

Particle size analysis indicated control sites had loam (WC01 and WC03) and loamy sand (WC02) whilst WR01 was sandy loam. The dispersion index ranged from 0 (WR01) to 4 (WC01) indicating the soils are structurally stable. The ESP for all sites was less than the success criteria threshold (<15%) and were non-sodic.

Soil salinity content (EC_e) ranged from 0.38 dS/m (WC01) to 7.176 dS/m (WR01). WC01 was the only site within the success criteria threshold. The result for WR01 is very high and is nearly 12 times the maximum threshold value, making it moderately saline and may be limiting to some plant species.

At the time of sampling total nitrogen varied across all sites, ranging from 513 mg/kg (WR01) to 1538 mg/kg (WC03). Nitrate N ranged from 0.7 mg/kg (WC01) to 6.7 mg/kg (WR01).

Extractable phosphorous ranged from 5.8 mg/kg (WC03) to 20.7 mg/kg (WR01) indicating the soil at all sites is deficient of phosphorous. Organic carbon was low (<2.0%) at all sites. with the exception of WC03 (2.98%), The low level recorded at WR01 is expected given the site has only recently been rehabilitated.

5.3.6 Fauna monitoring

Spring 2014

Bird species diversity at the control sites was at least three times greater than at the rehabilitated woodland site, with 9 species recorded at WR01 and 38 species recorded at WC01 (Figure 5-7). Species abundance was also lower in the rehabilitation site compared to the controls (Figure 5-8). No threatened species were identified at the rehabilitation site (Appendix G). The following species listed as vulnerable under the TSC Act were recorded at the control sites:

- Grey-crowned Babbler at WC01, WC02 and opportunistically in Vickery State Forest
- Speckled Warbler at WC02 and WC03
- Brown Treecreeper at WC02 and WC03
- *Glossopsitta pusilla* (Little Lorikeet) at WC02 and WC03

Opportunistic sightings of *Neophema pulchella* (Turquoise Parrot (listed as Vulnerable under the TSC Act 1995) and Brown Treecreeper were recorded in the State Forest (Appendix G).

Tree species are yet to form a canopy layer in the rehabilitated area, and many birds recorded came from and returned to the adjacent State Forest. Lack of shelter coupled with mining activities immediately adjacent to the rehabilitation site, creating noise is likely to deter many species. Noisy Miners are listed as a Key Threatening Process (KTP) under the TSC Act and therefore require control to ensure threatened species and other birds are not excluded from areas of otherwise suitable habitat (NSW Scientific Committee n.d.). Noisy miners were present in large numbers (15 individuals) at WC01; however, given the higher species diversity at this site it appears they have not yet caused a decline in other species.

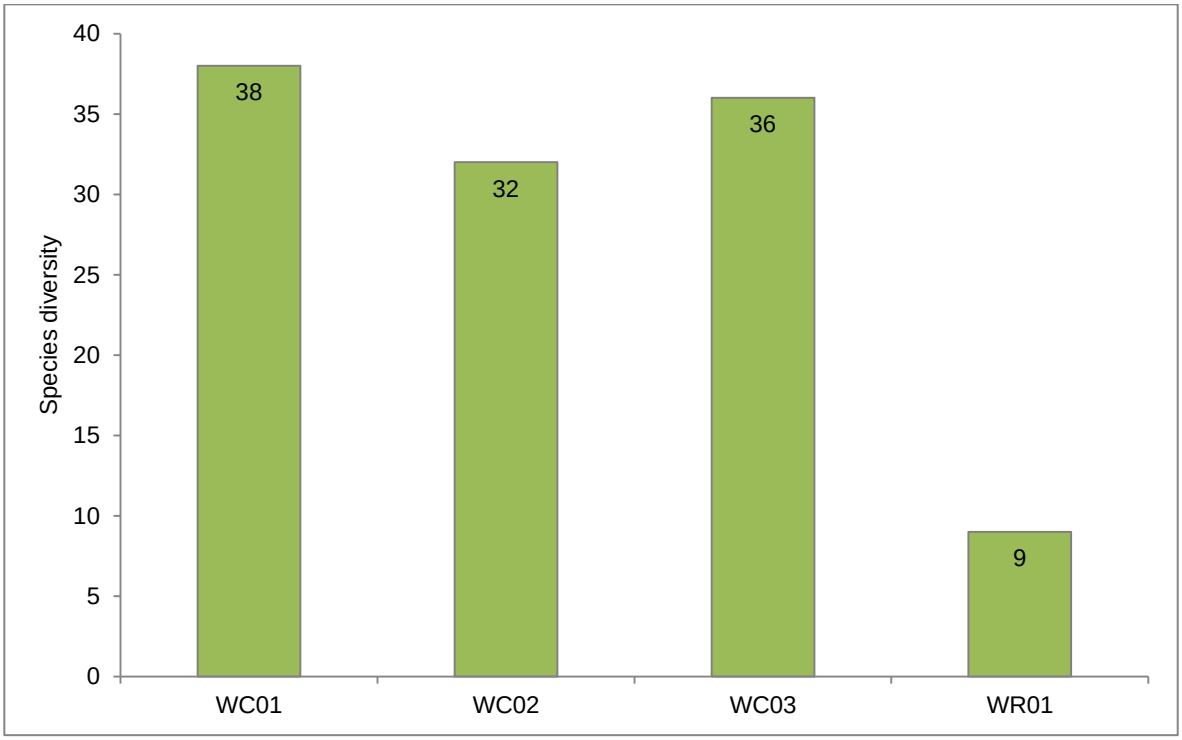

Figure 5-7: Number of bird species recorded within fauna monitoring sites Spring 2014

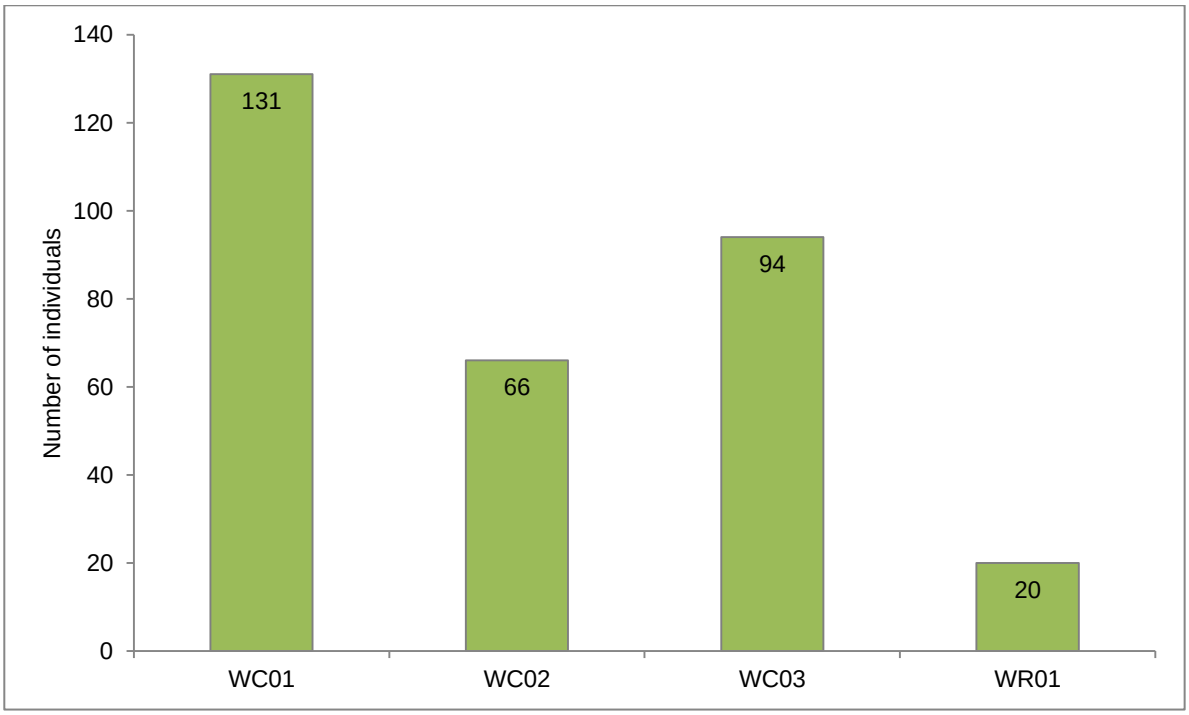

Figure 5-8: Bird species abundance recorded within fauna monitoring sites Spring 2014

Moderate microbat activity levels were recorded at all sites. Sixteen species were identified, including six species listed as vulnerable under the TSC Act. *Saccolaimus flaviventris* (Yellow-bellied Sheathtail Bat) was well represented by number of calls and occurred at all sites except WR01. *Chalinolobus dwyeri* (Large-eared Pied Bat), *Chalinolobus picatus* (Little Pied Bat), *Miniopterus schreibersii*

oceanensis (Eastern Bentwing Bat) and *Vespadelus troughtoni* (Eastern Cave Bat) were represented by only a few calls each. It is also possible that *Nyctophilus corbeni* (South-eastern Long-eared Bat) was present because its calls cannot be separated from other co-occurring Long-eared Bats. Full Anabat analyses are presented in Appendix C.

Other fauna species recorded during the survey include five species of frog, a lizard and nine species of mammal of which four were exotic. Number of species per site ranged from zero to four, while eight species were sighted opportunistically in the State Forest (Appendix G).

Many terrestrial fauna sightings made at WR01 were located around the sediment traps along the western boundary. Like the birds recorded on this site, the mammals recorded came from and returned to the Vickery State Forest.

Autumn 2015

Bird species diversity at the control sites was at least double that recorded at the rehabilitated woodland site, with 12 species recorded at WR01 and 42 species recorded at WC03 (Figure 5-9). Species abundance was also lower in the rehabilitation site compared to the controls, except WC02 which had a similar number to WR01 (Figure 5-10). No threatened species were identified at the rehabilitation site (Appendix G). The following species listed as vulnerable under the TSC Act were recorded at the control sites:

- Grey-crowned Babbler at WC01, WC02 and opportunistically in Vickery State Forest)and
- Speckled Warbler at WC02 and WC03)
- Brown Treecreeper at WC02 and WC03
- *Glossopsitta pusilla* (Little Lorikeet) at WC02 and WC03

Falco subniger (Black Falcon) was sighted near the vicinity of WR01. Opportunistic sightings of Grey-crowned Babbler and Brown Treecreeper were recorded in the State Forest (Appendix G).

Tree species are yet to form a canopy layer in the rehabilitated area, and many birds recorded came from and returned to the adjacent State Forest. Lack of shelter coupled with mining activities immediately adjacent to the rehabilitation site, creating noise is likely to deter many species. However, smaller insect feeders including *Malurus cyaneus* (Superb Fairy-wren) and *Taeniopygia bichenovii* (Double-barred Finch) were utilising the saltbush across the site and the *Acacia salicina* (Native Willow) at the northern end of the site. Similarly, 20 *Petrochelidon nigricans* (Tree Martin) were recorded at WR01 foraging for insects low over the site habitat, but did not land, suggesting the site is supporting a food source.

Noisy miners were present in large numbers (15 individuals) at WC01; however, given the higher species diversity at this site it appears they have not yet caused a decline in other species.

Moderate microbat activity levels were recorded at all sites. At least 15 species were identified, including five species listed as vulnerable under the TSC Act. Eastern Bentwing Bat and Yellow-bellied Sheathtail Bat was well represented by number of calls and occurred at all sites. Little Pied Bat, Eastern Bentwing Bat and Eastern Cave Bat were represented by only a few calls each. It is also possible that South-eastern Long-eared Bat was present because its calls cannot be separated from other co-occurring Long-eared Bats. Full Anabat analyses are presented in Appendix C.

Other fauna species recorded during the survey include two species of frog, a lizard and seven species of mammal of which three were exotic. Number of species per site ranged from zero to five, while five species were sighted opportunistically in the State Forest (Appendix G).

Many terrestrial fauna sightings made at WR01 were located around the sediment traps along the western boundary. Mammals recorded came from and returned to the Vickery State Forest.

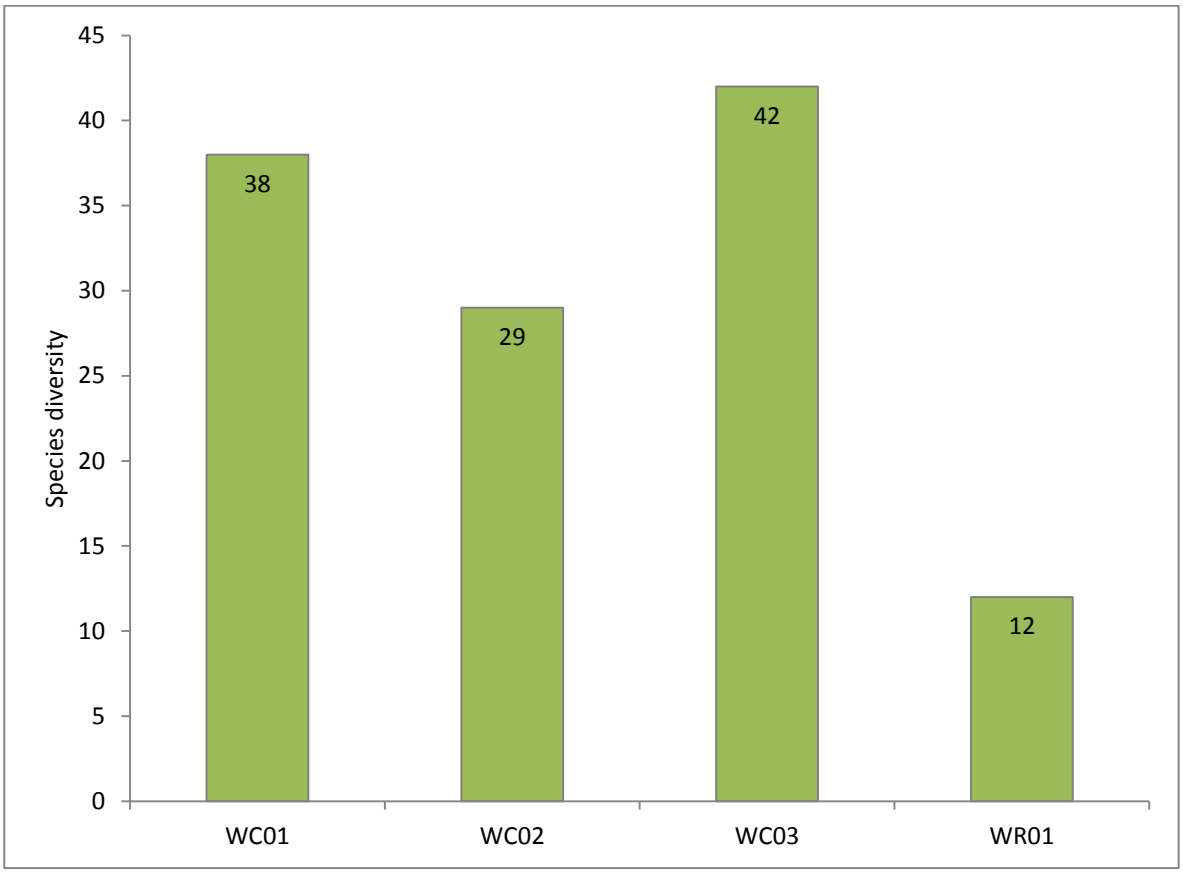

Figure 5-9: Number of bird species recorded within bird monitoring sites Autumn 2015

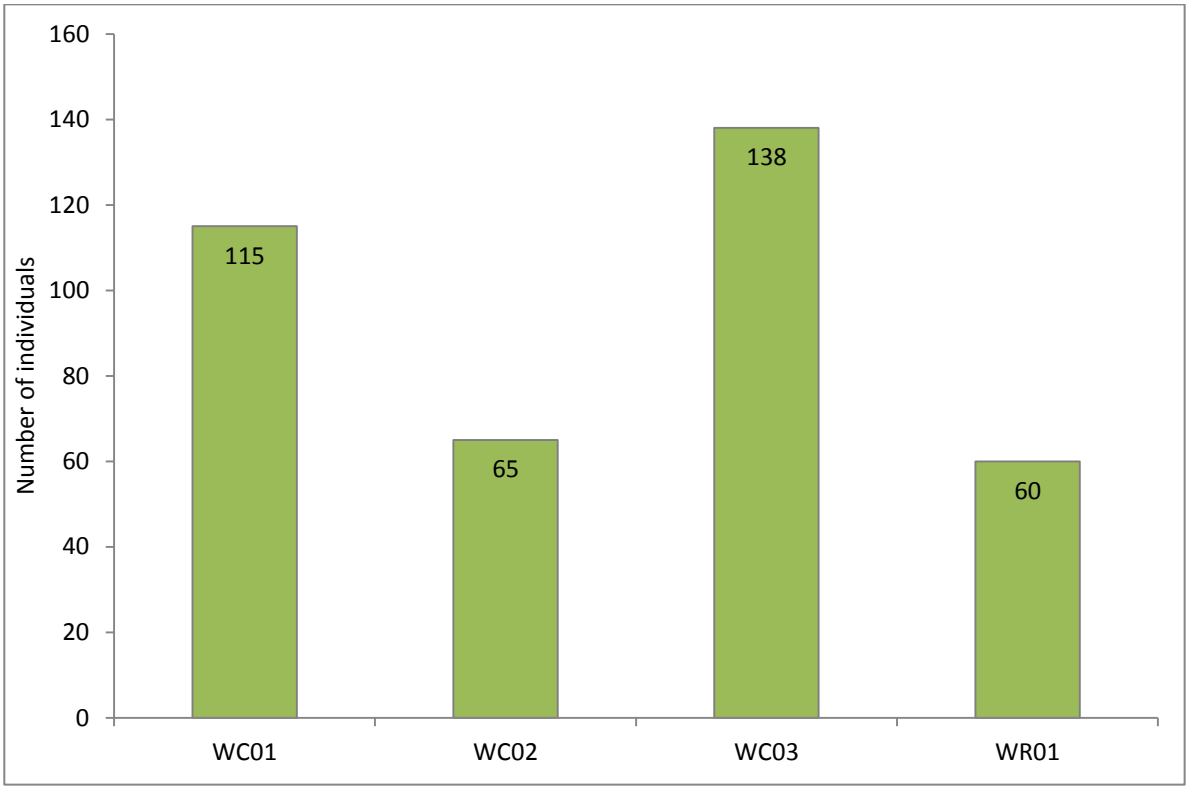

Figure 5-10: Bird species abundance recorded within fauna monitoring sites Autumn 2015

5.4 General observations

5.4.1 Spring 2014

To date approximately 9000 trees and shrubs have been planted on the western emplacement where WR01 is located. At the time of surveying the success rate of these trees and shrubs was very poor. Even though initial inspections in 2012 indicated the trees had established well. Groundcover was sparse across the rehabilitation area, as is reflected in the data collected from the monitoring plots. A prolonged period of below average rainfall has hindered rehabilitation suppressing the success of the rehabilitated areas.

5.4.2 Autumn 2015

Tunnel erosion was observed at several points along the western slope of the woodland rehabilitation site. Extensive rill erosion was also observed across the rehabilitation site.

Datura ferox (Fierce Thornapple) was identified at the woodland rehab site and *Bryophyllum delagoense* (Mother of Millions) was identified in the WC01. As a Class 4 Noxious weed in the Gunnedah Shire Council, the growth of Mother of Millions must be managed in a manner that continuously inhibits the ability of the plant to spread.

6 Recommendations and conclusions

Remote sensing imagery provides baseline data that covers the impact site and surrounding control areas. We recommend annual data capture to enable change detection between successive capture dates and assist with the quantification of rehabilitation success across the site. Data capture prior to spring surveys will enable targeted field investigation of potential problems, such as weed outbreaks or broad reduction in ground cover.

The pasture rehabilitation sites are yet to resemble the control sites and will require weed control to allow for establishment and survival of sown species. Surface cover at all sites was lacking. Soil sampling at the pasture sites indicate there are few physical limitations; however, soil fertility, particularly for phosphorous will may need to be amended and it is recommended a local agronomist is engaged to provide further advice.

Fauna recorded at the rehabilitation site were observed coming from and returning to the Vickery State Forest. As habitat in the rehabilitated sites progresses and becomes more established species are more likely to take up residence. Threatened bird and bat species were recorded at the control sites during both rounds of monitoring. Three threatened bat species were recorded in the woodland rehabilitation site during the autumn monitoring period, an indicator that they may be using this area for foraging.

Mother of Millions was identified at WC01 during the autumn survey. As a Class 4 Noxious weed in the Gunnedah Shire Council, the growth of Mother of Millions must be managed in a manner that continuously inhibits the ability of the plant to spread. Other weeds which require control in the woodland rehabilitation area include Galvanised Burr and Black Roly Poly. Weed control will assist in promoting growth of native groundcover and planted trees. Observations made at the site and species recorded in the rehabilitation plot indicate a low success rate of tree planting made in previous years. This may be attributed to below average rainfall.

Brassicaceae dominate the ground layer at the pasture rehabilitation sites and require management to promote success of native ground layer establishment.

For future monitoring we recommend that the percentage cover (based on Braun Blanquet cover classes) of each species should be measured instead of individual species counts. This would be a more effective method for analysing vegetation cover, as individual herbs may vary in their cover extent.

References

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Appendix A Methods

2.8 Rehabilitation Monitoring and Maintenance

A commitment to effective rehabilitation involves an on-going monitoring and maintenance program throughout and beyond the operation of the mine. Areas being rehabilitated will be regularly inspected and assessed against the long and short-term rehabilitation objectives. Aspects of rehabilitation to be monitored will include:

- Evidence of any erosion or sedimentation from areas with establishing vegetation cover;
- Success of initial grass cover establishment;
- Success of tree and shrub plantings;
- Adequacy of drainage controls;
- Presence/absence of weeds; and
- General stability of the rehabilitation site.

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

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

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

Monitoring should be conducted periodically by independent and suitably skilled persons at locations that are representative of the range of conditions on the rehabilitating areas. Annual reviews should be conducted of monitoring data to assess trends and monitoring program effectiveness. The outcome of these reviews will be reported in the AEMR/Annual Report.

In developing the rehabilitation monitoring program, the following aspects should be taken into consideration:

- Replicated monitoring sites should be established in representative rehabilitation areas of different ages. One monitoring site per 20 to 40 hectares is appropriate for each major age class of the rehabilitation areas.
- Sites should be monitored 12 months after establishment and then every two years.
- A standard monitoring plot design for areas rehabilitated with trees should be used:
  - 2 metre by 2 metre quadrats – these will provide some estimate of statistical variance, so that if required, statistical analyses can be undertaken to objectively compare different rehabilitation treatments and changes over time;
  - a 20 metre by 10 metre plot overlying the 2 metre quadrats and located 5 metres either side of the centerline, for ease of monitoring; and
  - a 50 metre erosion monitoring transect on contour, running through the centre of the plot.

Plate 1 shows the monitoring plot design to be adopted for the monitoring of an area revegetated with trees.

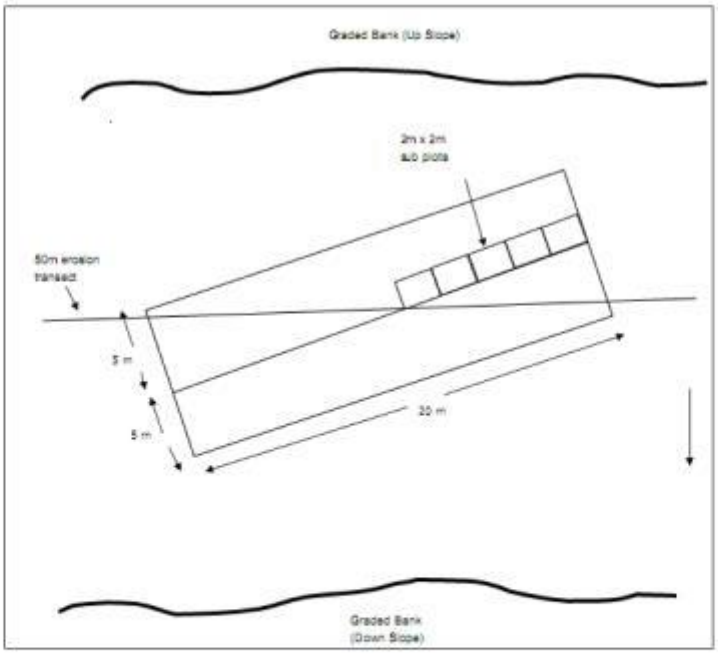

Plate 1 – Typical Monitoring Plot Design (Areas Revegetated to Bushland)

For the areas rehabilitated as pasture, it is proposed that a 100 metre transect be established across a 'typical' section of rehabilitation at the site and monitored for:

- Grass cover in 2 metre by 2 metre (4 square metres) plots every 20 metres;
- Pasture species present;
- Weed species present and percentage area noted;
- Percentage of bare ground; and
- Extent and type of erosion.

Along the 100 metre transect general comments such as rocks present, presence/absence of topsoil and other factors likely to influence rehabilitation development should be noted.

Table 6 presents the monitoring program, including the specific aspects and elements to be monitored and monitoring frequencies for the various aspects.

Table 6 – Rehabilitation Monitoring Program

Aspect of Rehabilitation	Elements to be Monitored	Monitoring Frequency
Ecosystem Establishment		
General Description	• Describe the vegetation in general terms, e.g. mixed eucalypt woodland with grass understorey and scattered shrubs, dense Acacia scrub, etc.	12 months after establishment and then every 2 years
2m x 2m Quadrats	• Count the number of plants of all species, excluding grass • Measure live vegetation cover for understorey and grasses (separately) using a line intercept method • Record details of ground cover (litter, logs, rocks etc.)	12 months after establishment and then every 2 years
20m x 10m Plots	• Count, by species, all trees >1.6m tall. • Tag and measure DBH of trees >1.6m tall, to a maximum of 10 for any one species. • Record canopy cover over the whole 20m centreline when trees are tall enough • Subjectively describe tree health, by species if relevant, noting signs of stress, nutrient deficiencies, disease and severe insect attack. Where health problems are noted, record the percentage of unhealthy trees. • Record any new plant species not present in the smaller plots, including any problem and declared noxious weeds • Take five surface soil samples (e.g. at approx. 5m intervals along the centreline) and bulk these for analyses of: pH, EC, chloride and sulfate; exchangeable Ca/Mg/K/Na; cation exchange capacity; particle size analysis and R1 dispersion index; 15 bar and field capacity moisture content; organic carbon; total and nitrate nitrogen; total and extractable phosphorus; Cu, Mn and Zn.	12 months after establishment and then every 2 years
50m Transect	• Along the 50m erosion monitoring transect, record the location, number and dimension of all gullies >30cm wide and/or 30cm deep. • Erosion pins should be established in plots located in newer rehabilitation to record sheet erosion if present	12 months after establishment and then every 2 years
Rehabilitation in General	• When traversing between monitoring plots, note the presence of species of interest not previously recorded (e.g. key functional or structural species, protected species, noxious weeds), as well as obvious problems including any extensive bare areas (e.g. those greater than 0.1 ha). • Observations such as this can provide useful, broad scale information on rehabilitation success and problems.	12 months after establishment and then every 2 years

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WHC_PLN_ROC_REHABILITATION MANAGEMENT PLAN

Aspect of Rehabilitation	Elements to be Monitored	Monitoring Frequency
Photographic Record	• For each 20m x 10m plot, a photograph should be taken at each end of the plot, along the centreline looking in.	12 months after establishment and then every 2 years
Habitat	• General observations relating to the availability and variety of food sources (e.g. flowering/fruiting trees, presence of invertebrates etc). • Availability and variety of shelter (e.g. depth of leaf litter, presence of logs, hollows etc). • Presence/absence of free water in the rehabilitated areas	12 months after establishment and then every 2 years
Fauna	• General observations of vertebrate species (including species of conservation significance). • Detailed fauna surveys including presence and approximate abundance and distribution of vertebrate species (focussing on species of conservation significance).	After rehabilitation is three years old undertake monitoring biennially in both Autumn and Spring
Weeds and Pests	• Species identity. • Approximate numbers/level of infestation. • Observations of impact on rehabilitation (if any).	Quarterly during the first 2 years and biennially after that. Inspections should be opportunistic after significant rainfall events.
Geotechnical Stability		
	• Assessment of the stability of batters and also looking at surface settlements (sink holes). In particular where these features could impact on the performance of any surface water management system. • Surface integrity of landform cover/capping (measurement of extent of integrity failure). • Presence / absence of landform slumping.	Annually

Appendix B Weather

Table B-1: Weather conditions preceding and during the spring 2014 and autumn 2015 monitoring periods

Month	Rocglen Mine Monthly Mean[#]						Historical Averages[*]			
	Min Temp (°C)	Max Temp (°C)	Rainfall (mm)	Cumulative rainfall	No. of rain days**	Maximum daily rainfall (mm)	Min Temp (°C)	Max Temp (°C)	Rainfall (mm)	No. of rain days**
Nov-13	13	30	133	133	7	59	14	30	62	6
Dec-13	17	34	10	143	3	6	17	33	70	6
Jan-14	20	36	10	153	1	9	19	34	71	6
Feb-14	20	34	38	191	3	20	18	33	67	5
Mar-14	17	29	70	260	6	24	16	31	49	4
Apr-14	12	26	7	267	3	4	11	27	37	3
May-14	7	22	5	272	2	2	7	21	42	4
Jun-14	4	18	28	300	6	11	4	18	44	5
Jul-14	1	17	7	307	3	4	2	17	42	5
Aug-14	3	19	42	349	7	12	4	19	41	5
Sep-14	6	23	6	355	1	6	7	23	40	5
Oct-14	10	29	13	368	1	13	11	27	55	6
Nov-14	17	34	8	377	2	6	14	30	62	6
Dec-14	18	33	48	425	11	15	17	33	70	6
Jan-15	19	32	47	472	9	20	18	34	71	6
Feb-15	19	33	10	482	3	3	18	33	67	5
Mar-15	16	31	13	495	4	8	16	31	49	4
Apr-15	12	24	60	555	5	16	11	26	37	3

[#] Rocglen Mine data

* Gunnedah Pool Post Office Station 053023 BoM 2015

** ≥1mm

Table B-2: Weather conditions during the spring 2014 and autumn 2015 monitoring period (data from Rocglen Mine)s

	Date	Min temp (°C)	Average temp (°C)	Max temp (°C)	Rainfall (mm)	Min Wind Speed (m/s)	Average Wind Speed (m/s)	Max Wind Speed (m/s)
Flora	18/11/2014	10.5	25.1	32.1	0	0	2	6.3
	19/11/2014	15.3	26.1	35.3	0	0	1.6	11
Fauna Spring	17/11/2014	11.1	24.5	32.4	0	0	1	2.2
	18/11/2014	10.5	25.1	32.1	0	0	2	6.3
	19/11/2014	15.3	26.1	35.3	0	0	1.6	11
Fauna Autumn	13/04/2015	12.1	19.3	26.2	0	0	1.8	4.9
	14/04/2015	12.1	19.3	26.3	0	0	1.0	3
	15/04/2015	13.2	20.2	28.2	0	0	1.2	5.5

Appendix C Bat Surveys

RESULTS FROM SPRING 2014 MONITORING

Bat calls were analysed using the program AnalookW (Version 3.8 25 October 2012, written by Chris Corben, www.hoarybat.com). Call identifications were made by Alicia Scanlon from Eco Logical Australia Pty Ltd using regional based guides to the echolocation calls of microbats in New South Wales (Pennay et al. 2004); and south-east Queensland and north-east New South Wales (Reinhold et al. 2001) and the accompanying reference library of over 200 calls from north-eastern NSW. Available: (http://www.forest.nsw.gov.au/research/bats/default.asp). Alicia has over six years of experience in the identification of ultrasonic call recordings.

Bat calls are analysed using species-specific parameters of the call profile such as call shape, characteristic frequency, initial slope and time between calls (Rinehold et al. 2001). To ensure reliable and accurate results the following protocols (adapted from Lloyd et. al. 2006) were followed:

- Search phase calls were used in the analysis, rather than cruise phase calls or feeding buzzes (McKenzie et al. 2002)
- Recordings containing less than three pulses were not analysed and these sequences were labeled as short (Law et al. 1999)
- Four categories of confidence in species identification were used (Mills et al. 1996):
    - definite – identity not in doubt
    - probable – low probability of confusion with species of similar calls
    - possible – medium to high probability of confusion with species with similar calls
    - low – calls made by bats which cannot be identified to even a species group.
- Nyctophilus spp. are difficult to identify confidently from their calls and no attempt was made to identify this genus to species level (Pennay et al. 2004)
- Sequences not attributed to microbat echolocation calls were labeled as junk or non-bat calls and don't represent microbat activity at the site
- Sequences labelled as low or short can be used as an indicator of microbat activity at the site

There were 1344 passes recorded from Anabat detectors placed at four sites within the study area at Rocglen Mine between 17 and 26 November 2014. Approximately 69% of passes submitted were able to be identified to genus or species with the remainder being too short or of low quality preventing positive identification.

Species

There were 16 species identified including up to **six vulnerable** species listed under the NSW TSC Act 1987 (**Tables C-1 – 4, Figures C-1 – 16**). Of the six threatened species ***Saccolaimus flaviventris*** **(Yellow-bellied Sheathtail Bat)** was particularly well represented by number of calls and occurrence at three of the four sites. ***Chalinolobus dwyeri*** **(Large-eared Pied Bat),** ***Chalinolobus picatus*** **(Little Pied Bat),** ***Miniopterus schreibersii oceanensis*** **(Eastern Bentwing Bat)** and ***Vespadelus troughtoni*** **(Eastern Cave Bat)** were represented by only a few calls each. In addition, it is possible that ***Nyctophilus corbeni*** **(South-eastern Long-eared Bat)** is present because its calls cannot be separated from other co-occurring Long-eared Bats.

The most commonly recorded species based upon number of recorded passes was *Chalinolobus gouldii* (Gould's Wattled Bat) followed by *Mormopterus (Ozimops) planiceps (species 4)* (South-eastern

Freetail Bat). Most species were recorded at all sites, except for *Chalinolobus morio* (Chocolate Wattled Bat), **Eastern Cave Bat**, **Large-eared Pied Bat** and *Tadarida australis* (White-striped Freetail Bat). There were long sequences and feeding buzzes recorded in the data set indicating that the study area is used as a foraging area for microbats of a range of species. There were a number of steep calls identified as *Scotorepens greyii* (Little Broad-nosed Bat) / *Scototrepens sp*. Central-eastern Broad-nosed Bat recorded just on dusk at site WC02 indicating that it is likely a roost was within range of the Anabat detector.

Sites

All sites recorded moderate microbat activity levels with calls recorded more often than every ten minutes but less often than every two minutes on average throughout each evening. Site WC02 was the most diverse with all 16 species recorded, followed by site WC01 with 15 species, WC03 with 14 and WR01 with 12 of the possible 16 microbat species recorded.

Notes

The calls of Gould's Wattled Bat, *Scotorepens balstoni* (Inland Broad-nosed Bat), *Mormopterus Ozimops petersi* (species 3) (Inland Freetail Bat) and South-eastern Freetail Bat can be difficult to separate, particularly in open areas such as the Rocglen study area. Calls were identified as Freetail Bats when the call shape was flat (OPS< 100), there was no alternation in frequency between pulses and the frequency was between 26 – 29.5kHz (South-eastern Freetail Bat) or 31 – 36kHz (Inland Freetail Bat). Gould's Wattled Bat was distinguished from Inland Broad-nosed Bat by alternation in call frequency between pulses.

The calls of the **Eastern Bentwing Bat** can often display very similar characteristics to other species such as *Vespadelus darlingtonii* (Large Forest Bat), *Vespadelus regulus* (Southern Forest Bat) and *Vespadelus vulturnus* (Little Forest Bat). Calls of **Eastern Bentwing Bat** were distinguished by the irregular pulse shape and time between calls, lack of an up-sweeping tail and drop in frequency of the pre-characteristic section of more than 2kHz.

The calls of the threatened ***Myotis macropus*** **(Large-footed Myotis)** are very similar to all Nyctophilus species and it is often difficult to separate these species. It is unlikely that the **Large-footed Myotis** occurs in this geographic region, particularly given the dry spring/summer of 2014. All near-vertical calls that were search phase calls were labelled as Nyctophilus sp.

Calls of the *Scotorepens orion* (Eastern Broad-nosed bat), *Scotorepens greyii* (Little broad-nosed bat*)* and *Scotorepens sp.* (Central-eastern Broad-nosed bat*)* are very similar to those of the threatened ***Falsistrellus tasmaniensis*** **(Eastern falsistrelle)** and ***Scoteanax rueppellii*** **(Greater broad-nosed bat*).* In this area it is unlikely that **Eastern Falsistrelles**, **Greater Broad-nosed Bats** or Eastern Broad-nosed Bats would be present given the known distribution of these species and the habitat preferences of the former. The calls of Little Broad-nosed Bats and Central-eastern Broad-nosed Bats are indistinguishable on recorded characteristics where they overlap in frequency (38 – 40 kHz). Little Broad-nosed Bats were identified when the frequency fell between 35 – 38 kHz and Central-eastern Broad-nosed Bats were identified at frequencies of 40 – 41 kHz.

There were numerous flat Freetail type calls at a frequency of 23 – 25 kHz (**Figure C-14**). These calls have been assigned to *Unknown species 23-25 kHz* in the absence of any similar shaped reference calls from NSW within this frequency range. It is possible that these calls belong to the threatened ***Mormopterus Setirostris eleryi (species 6)*** **(Hairy-nosed Freetail Bat)** whose call is unknown. It has been suggested that this species may produce calls similar to Inland Freetail Bat and South-eastern

Freetail Bat, although this species is not known from the area surrounding Rocglen. The other potential species is *Mormopterus beccarii* (Northern Freetail Bat) which is known to produce a similar call but not known from south of Murwillumbah in far NE NSW. Similar calls have been gathered from other sites in surrounding localities (eg Werris Creek, Lake Keepit), so it is not an anomaly of this particular data set.

The calls of the **Eastern Cave Bat,** *Vespadelus vulturnus* (Little Forest Bat) and Chocolate Wattled Bat can be difficult to separate in the range 49 – 51 kHz in this geographic region. Calls were identified as Chocolate Wattled Bat when there was a down-sweeping tail. Calls above 50 kHz were generally identified as **Eastern Cave Bat**.

Table C-1: Site WC01 results from two Anabat nights 17 - 18 November 2014, Rocglen Mine

Scientific name	Common name	Definite	Probable	Possible	Total^
Chalinolobus gouldii	Gould's Wattled Bat	30	9	32	71
Chalinolobus gouldii / Mormopterus Ozimops petersi (species 3)	Gould's Wattled Bat / Inland Freetail Bat				2
Chalinolobus gouldii / Mormopterus Ozimops planiceps (species 4)	Gould's Wattled Bat / South-eastern Freetail Bat				4
Chalinolobus gouldii / Scotorepens balstoni	Gould's Wattled Bat / Inland Broad-nosed Bat				5
Chalinolobus morio	Chocolate Wattled Bat	2	1	5	8
***Chalinolobus picatus** * / Scotorepens species*	**Little Pied Bat** / Central-eastern Broad-nosed Bat				2
Miniopterus schreibersii oceanensis*	**Eastern Bentwing Bat**			1	1
Miniopterus schreibersii oceanensis* / *Vespadelus vulturnus*	**Eastern Bentwing Bat** / Little Forest Bat				25
Mormopterus Ozimops petersi (species 3)	Inland Freetail Bat	4	3		7
Mormopterus Ozimops petersi (species 3) / Mormopterus Ozimops planiceps (species 4)	Inland Freetail Bat / South-eastern Freetail Bat				34
Mormopterus Ozimops petersi (species 3) / Scotorepens greyii	Inland Freetail Bat / Little Broad-nosed Bat				2
Mormopterus Ozimops planiceps (species 4)	South-eastern Freetail Bat	7	4	2	13
Nyctophilus sp.	Long-eared Bats				4
Saccolaimus flaviventris*	**Yellow-bellied Sheathtail Bat**	19		2	21

Scientific name	Common name	Definite	Probable	Possible	Total^
Scotorepens balstoni	Inland Broad-nosed Bat		1		1
Scotorepens greyii	Little Broad-nosed Bat	10	3	7	20
Scotorepens species	Central-eastern Broad-nosed Bat			1	1
Tadarida australis	White-striped Freetail Bat			1	1
Unknown 23 -25kHz					6
Vespadelus troughtoni*	**Eastern Cave Bat**			1	1
Vespadelus vulturnus	Little Forest Bat	10	7	10	27
Low					28
Short					125
TOTAL		82	28	62	409

* Indicates threatened species;

^ Where a total is recorded, but there is no definite, probable or possible results this indicates uncertainty between two species

Table C-2: Site WC02 results from two Anabat nights 19 and 25 November 2014, Rocglen Mine

Scientific name	Common name	Definite	Probable	Possible	Total^
Chalinolobus dwyeri*	**Large-eared Pied Bat**			1	1
Chalinolobus gouldii	Gould's Wattled Bat	27	6	6	39
Chalinolobus morio	Chocolate Wattled Bat			1	1
***Chalinolobus picatus **	**Little Pied Bat**			1	1
***Chalinolobus picatus ** / *Scotorepens species*	**Little Pied Bat** / Central-eastern Broad-nosed Bat				1
Miniopterus schreibersii oceanensis* / *Vespadelus vulturnus*	**Eastern Bentwing Bat** / Little Forest Bat				2
Mormopterus Ozimops petersi (species 3)	Inland Freetail Bat	4	1	6	11
Mormopterus Ozimops petersi (species 3) / *Mormopterus Ozimops planiceps (species 4)*	Inland Freetail Bat / South-eastern Freetail Bat				1
Mormopterus Ozimops planiceps (species 4)	South-eastern Freetail Bat	26	1	2	29
Nyctophilus sp.	Long-eared Bats	10	1		11
Saccolaimus flaviventris*	**Yellow-bellied Sheathtail Bat**	41		2	43
Scotorepens balstoni	Inland Broad-nosed Bat			1	1
Scotorepens greyii	Little Broad-nosed Bat	3	1		4

Scientific name	Common name	Definite	Probable	Possible	Total^
Scotorepens greyii / Scotorepens species	Little Broad-nosed Bat / Central-eastern Broad-nosed Bat				20
Scotorepens species	Central-eastern Broad-nosed Bat		3	2	5
Tadarida australis	White-striped Freetail Bat	3			3
Unknown 23 -25kHz					4
Vespadelus troughtoni*	**Eastern Cave Bat**			1	1
Vespadelus vulturnus	Little Forest Bat	4	2	3	9
Low					14
Short					121
TOTAL		118	15	26	322

* Indicates threatened species;

^ Where a total is recorded, but there is no definite, probable or possible results this indicates uncertainty between two species

Table C-3: Site WC03 results from Anabat nights 19 and 26 November 2014, Rocglen Mine

Scientific name	Common name	Definite	Probable	Possible	Total^
Chalinolobus dwyeri*	**Large-eared Pied Bat**			1	1
Chalinolobus gouldii	Gould's Wattled Bat	36		31	67
Chalinolobus gouldii / Mormopterus Ozimops planiceps (species 4)	Gould's Wattled Bat / South-eastern Freetail Bat				4
Chalinolobus gouldii / Scotorepens balstoni	Gould's Wattled Bat / Inland Broad-nosed Bat				1
Chalinolobus morio	Chocolate Wattled Bat	2	1		3
Chalinolobus picatus *	**Little Pied Bat**		1		1
Miniopterus schreibersii oceanensis*	**Eastern Bentwing Bat**	2		1	3
Miniopterus schreibersii oceanensis* / *Vespadelus vulturnus*	**Eastern Bentwing Bat** / Little Forest Bat				1
Mormopterus Ozimops petersi (species 3)	Inland Freetail Bat	3			3
Mormopterus Ozimops planiceps (species 4)	South-eastern Freetail Bat	82	3	6	91
Nyctophilus sp.	Long-eared Bats				27
Saccolaimus flaviventris*	**Yellow-bellied Sheathtail Bat**	10			10
Scotorepens balstoni	Inland Broad-nosed Bat	3	11	2	16
Scotorepens greyii	Little Broad-nosed Bat	55	5	3	63
Scotorepens species	Central-eastern Broad-nosed Bat		3		3

Scientific name	Common name	Definite	Probable	Possible	Total^
Unknown 23 -25kHz					12
Vespadelus vulturnus	Little Forest Bat	23	1		24
Low					14
Short					68
TOTAL		216	25	44	412

* Indicates threatened species;

^ Where a total is recorded, but there is no definite, probable or possible results this indicates uncertainty between two species

Table C-4: Site WR01 results from two Anabat nights 17 - 18 November 2014, Rocglen Mine

Scientific name	Common name	Definite	Probable	Possible	Total^
Chalinolobus dwyeri*	**Large-eared Pied Bat**			1	1
Chalinolobus gouldii	Gould's Wattled Bat	36		18	54
Chalinolobus gouldii / Mormopterus Ozimops planiceps (species 4)	Gould's Wattled Bat / South-eastern Freetail Bat				1
Chalinolobus gouldii / Scotorepens balstoni	Gould's Wattled Bat / Inland Broad-nosed Bat				2
Chalinolobus picatus *	**Little Pied Bat**			1	1
Miniopterus schreibersii oceanensis*	**Eastern Bentwing Bat**			1	1
Miniopterus schreibersii oceanensis* / *Vespadelus vulturnus*	**Eastern Bentwing Bat** / Little Forest Bat				3
Mormopterus Ozimops petersi (species 3)	Inland Freetail Bat			3	3
Mormopterus Ozimops petersi (species 3) / Mormopterus Ozimops planiceps (species 4)	Inland Freetail Bat / South-eastern Freetail Bat				28
Mormopterus Ozimops planiceps (species 4)	South-eastern Freetail Bat	7		1	8
Nyctophilus sp.	Long-eared Bats				3
Scotorepens balstoni	Inland Broad-nosed Bat		1		1
Scotorepens greyii	Little Broad-nosed Bat	7	1	2	10
Scotorepens greyii / Scotorepens species	Little Broad-nosed Bat / Central-eastern Broad-nosed Bat				1

Scientific name	Common name	Definite	Probable	Possible	Total^
Unknown 23- 25 kHz					4
Vespadelus troughtoni*	**Eastern Cave Bat**			1	1
Vespadelus vulturnus	Little Forest Bat	26		1	27
Low					7
Short					45
TOTAL					201

* Indicates threatened species;

^ Where a total is recorded, but there is no definite, probable or possible results this indicates uncertainty between two species

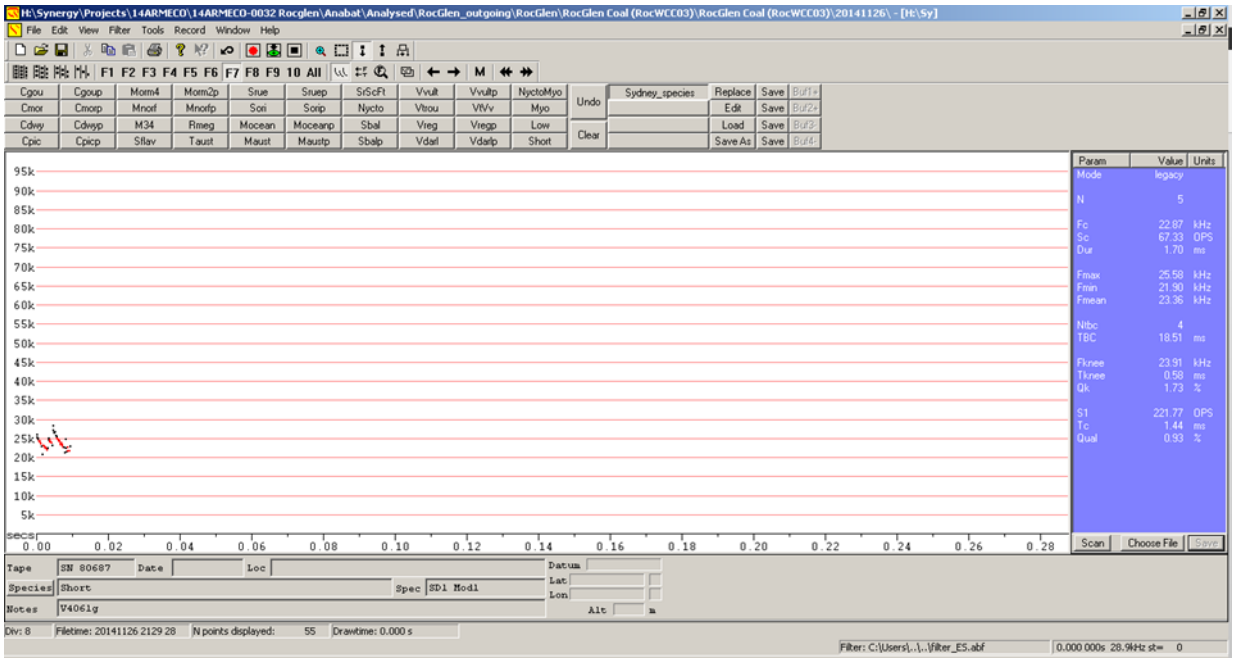

Figure C-1: Possible call profile for *Chalinolobus dwyeri* recorded at Rocglen, site WC03 at 20:57 on 26 November 2014.

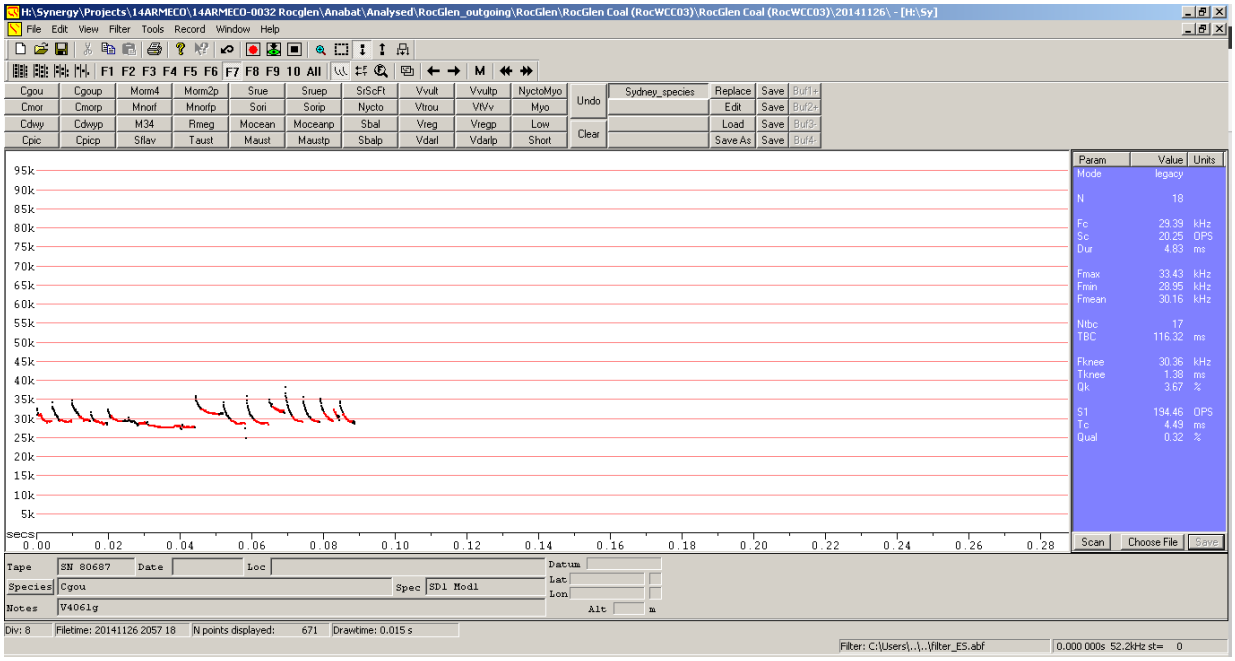

Figure C-2: Call profile for *Chalinolobus gouldii* recorded at Rocglen, site WC03 at 20:57 on 26 November 2014.

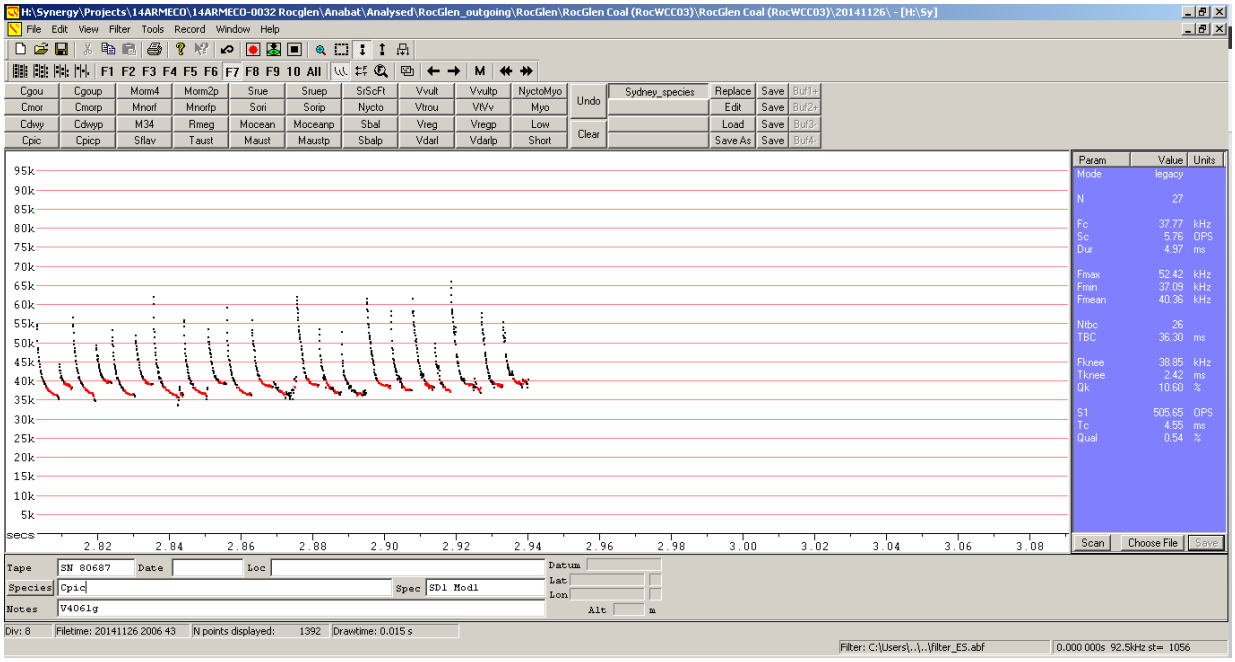

Figure C-3: Possible call profile for *Chalinolobus picatus* recorded at Rocglen, site WC03 at 20:06 on 26 November 2014.

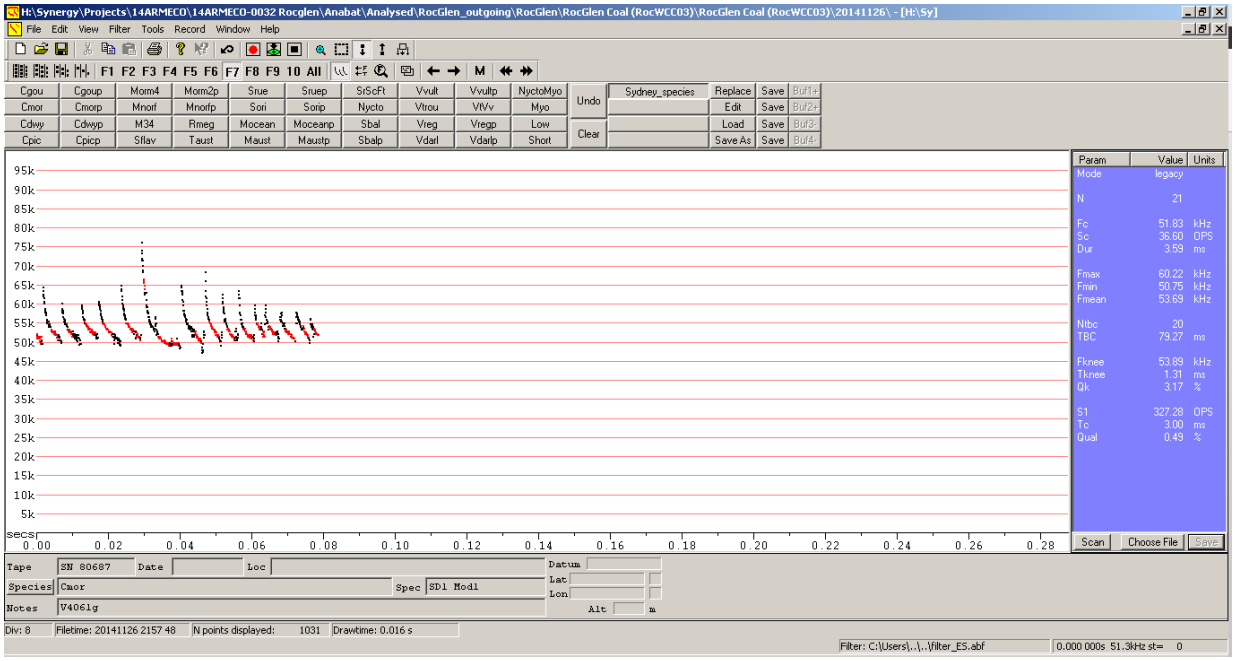

Figure C-4: Call profile for *Chalinolobus morio* recorded at Rocglen, site WC03 at 21:57 on 26 November 2014.

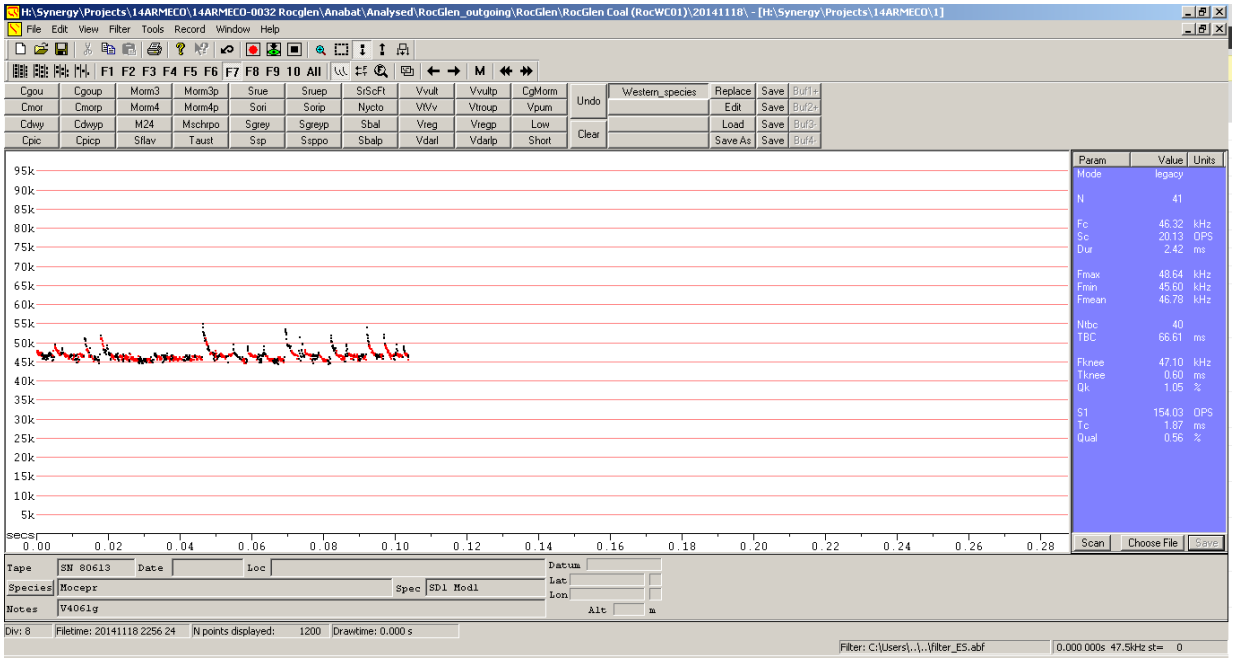

Figure C-5: Probable call profile for *Miniopterus schreibersii oceanensis* recorded at Rocglen, site WC01 at 22:56 on 18 November 2014.

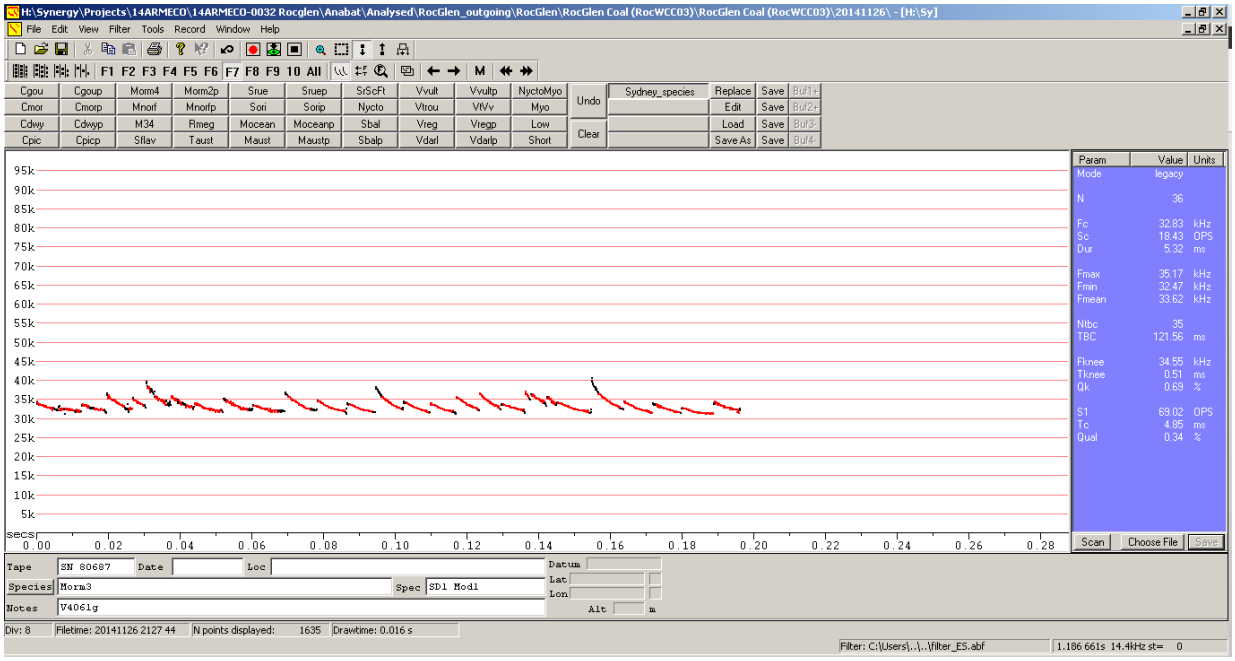

Figure C-6: Call profile for *Mormopterus* species 3 recorded at Rocglen, site WC03 at 21:27 on 26 November 2014.

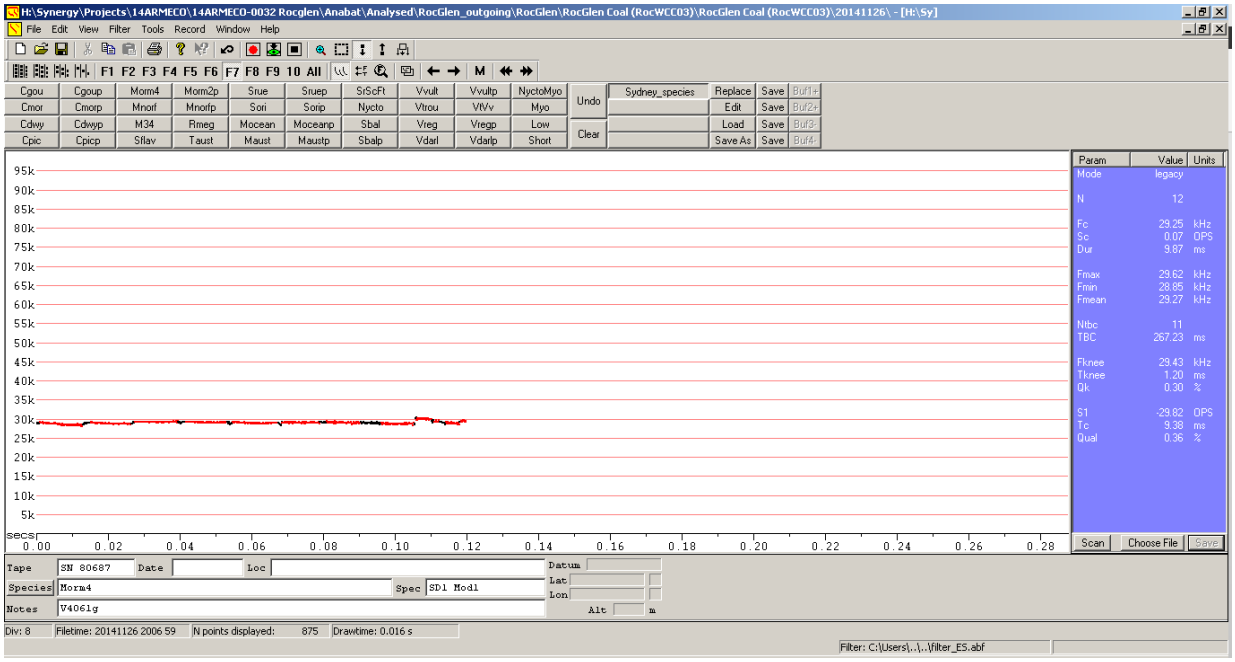

Figure C-7: Call profile for *Mormopterus* species 4 recorded at Rocglen, site WC03 at 20:06 on 26 November 2014.

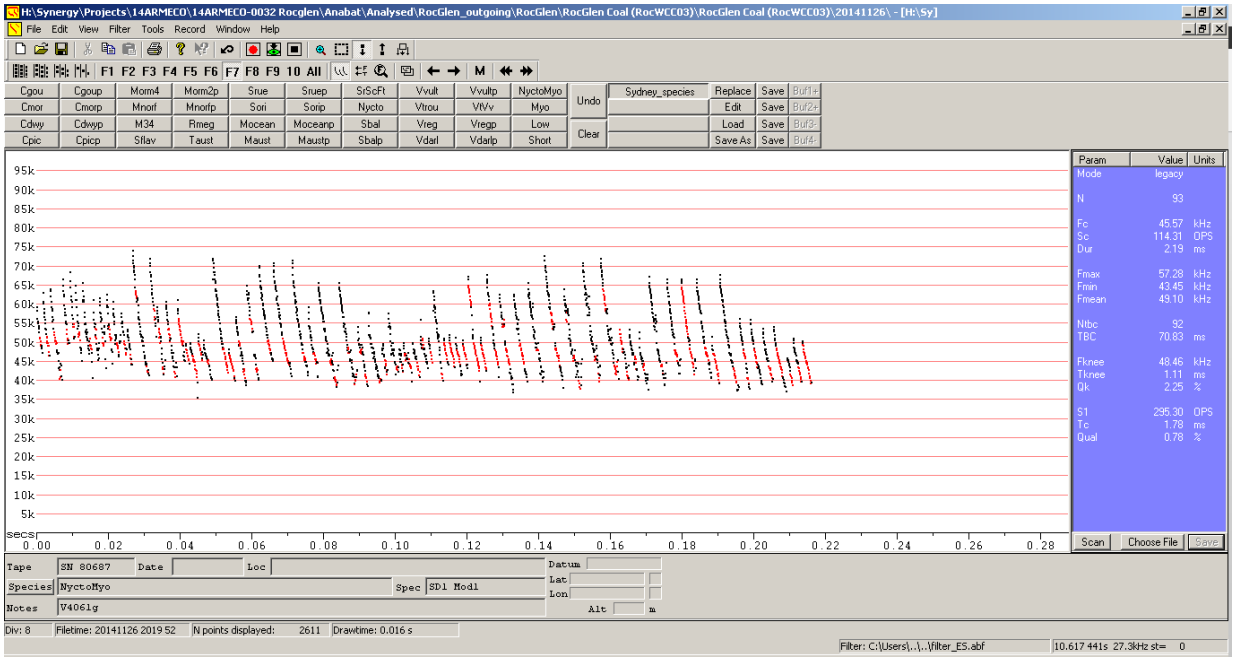

Figure C-8: Call profile for *Nyctophilus* sp. recorded at Rocglen, site WC03 at 20:19 on 26 November 2014.

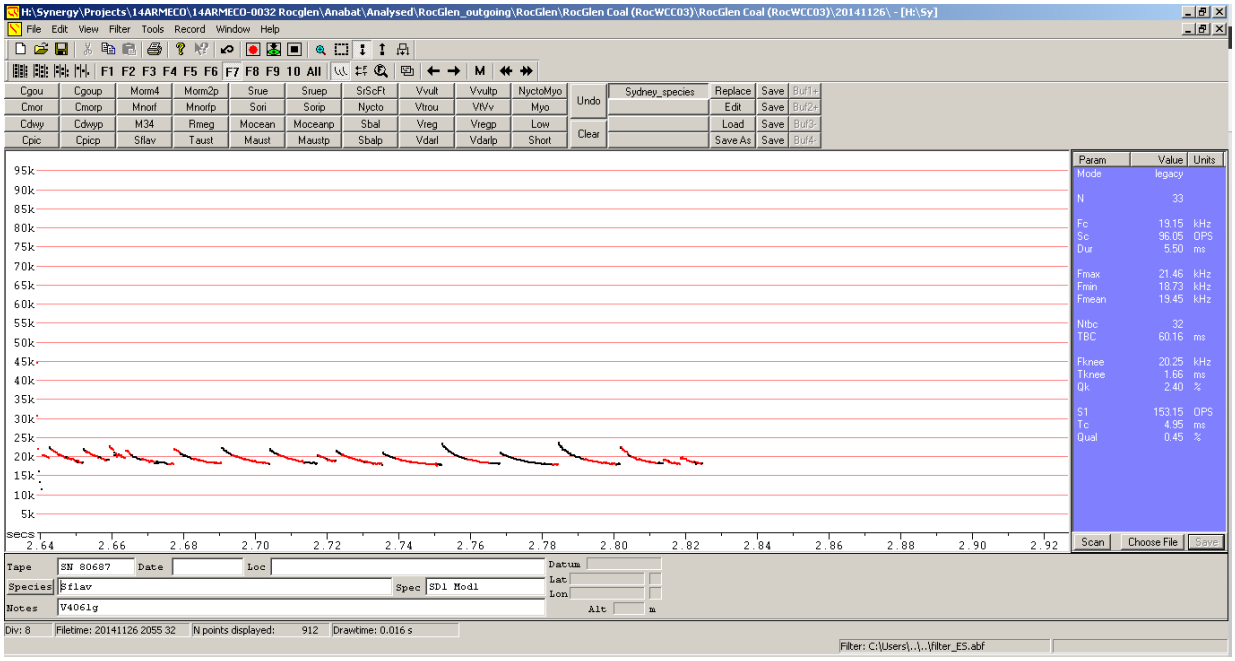

Figure C-9: Call profile for *Saccolaimus flaviventrus* recorded at Rocglen, site WC03 at 20:55 on 26 November 2014.

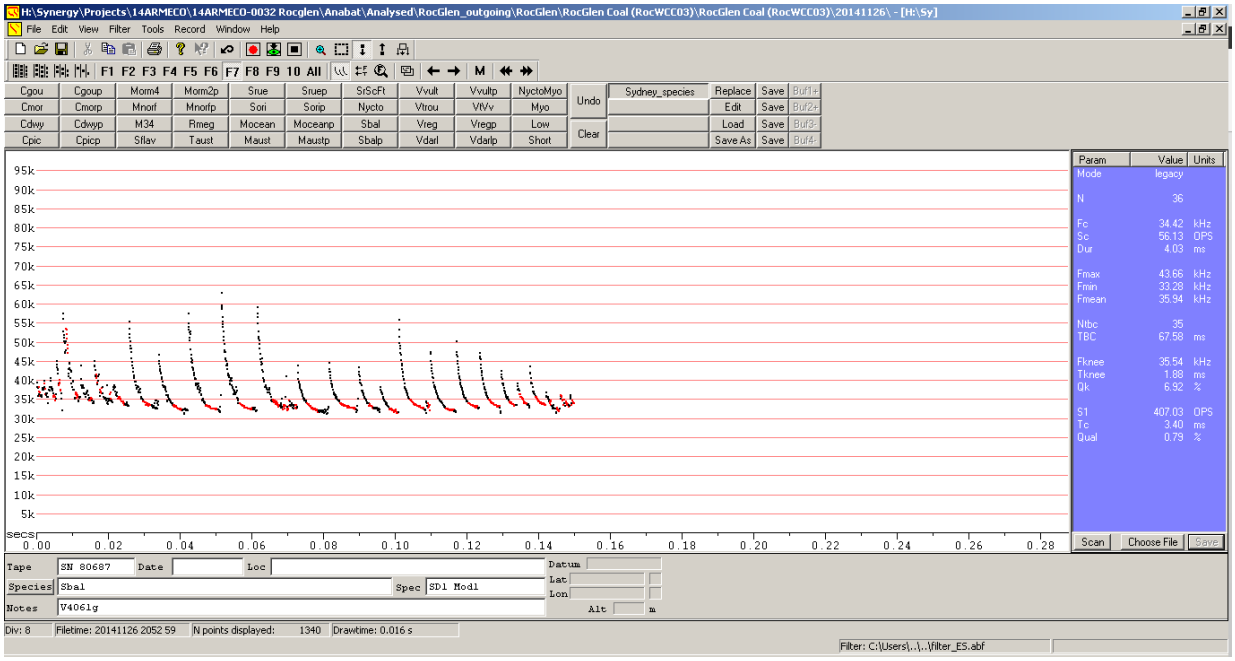

Figure C-10: Call profile for *Scotorepens balstoni* recorded at Rocglen, site WC03 at 20:52 on 26 November 2014.

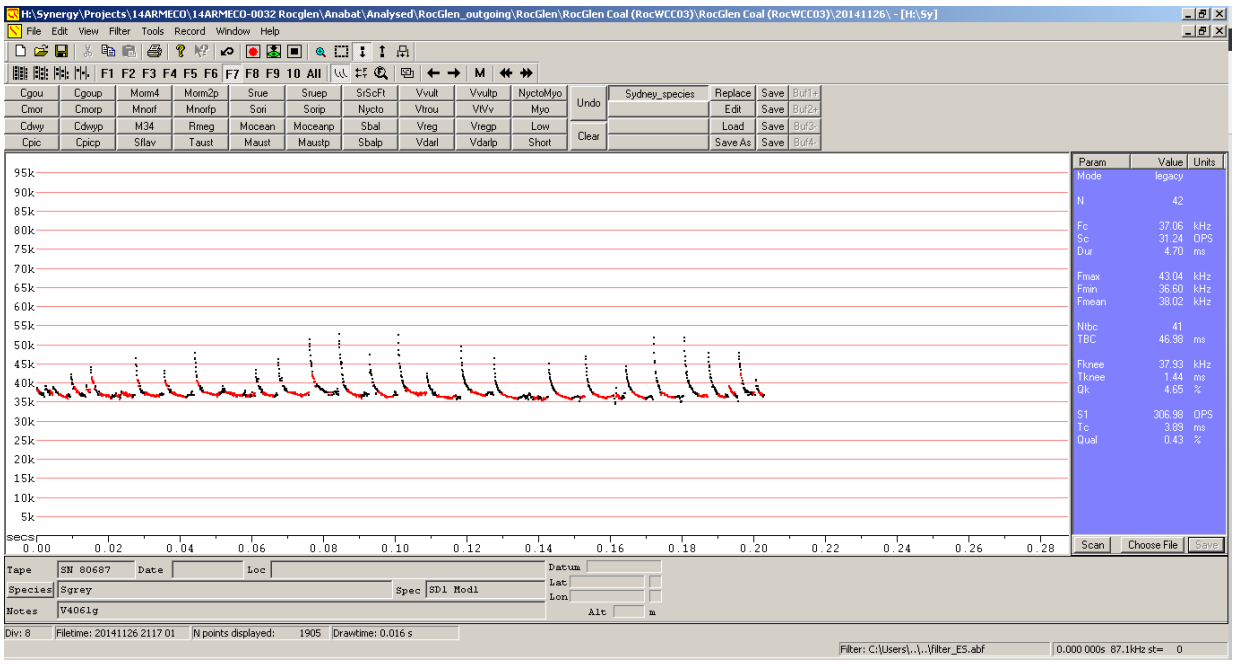

Figure C-11: Call profile for *Scotorepens greyii* recorded at Rocglen, site WC03 at 21:17 on 26 November 2014.

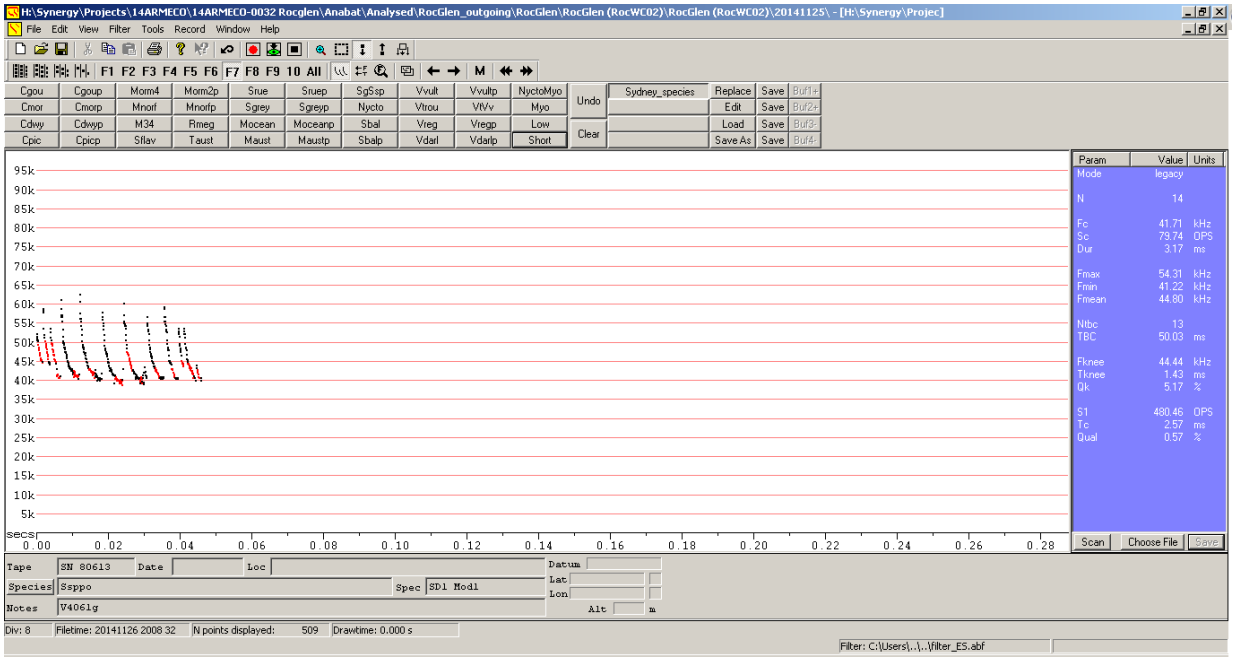

Figure C-12: Possible call profile for *Scotorepens* sp. recorded at Rocglen at 20:08 on 26 November 2014.

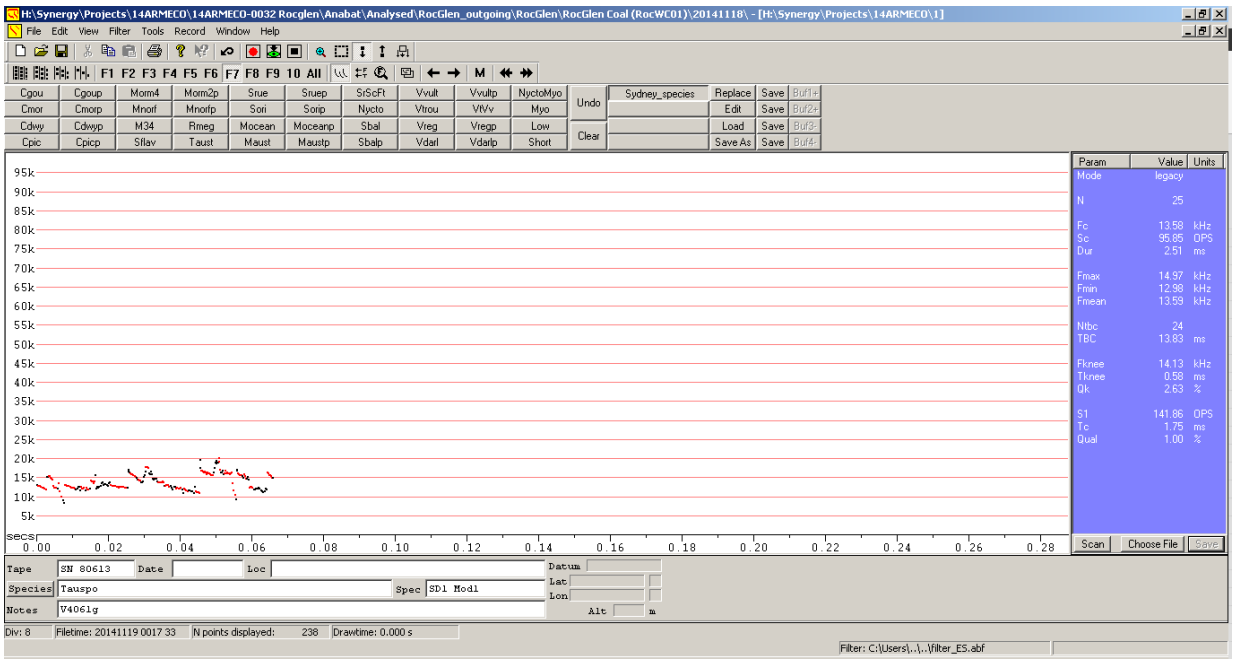

Figure C-13: Call profile for *Tadarida australis* recorded at Rocglen, site WC01 at 00:17 on 19 November 2014.

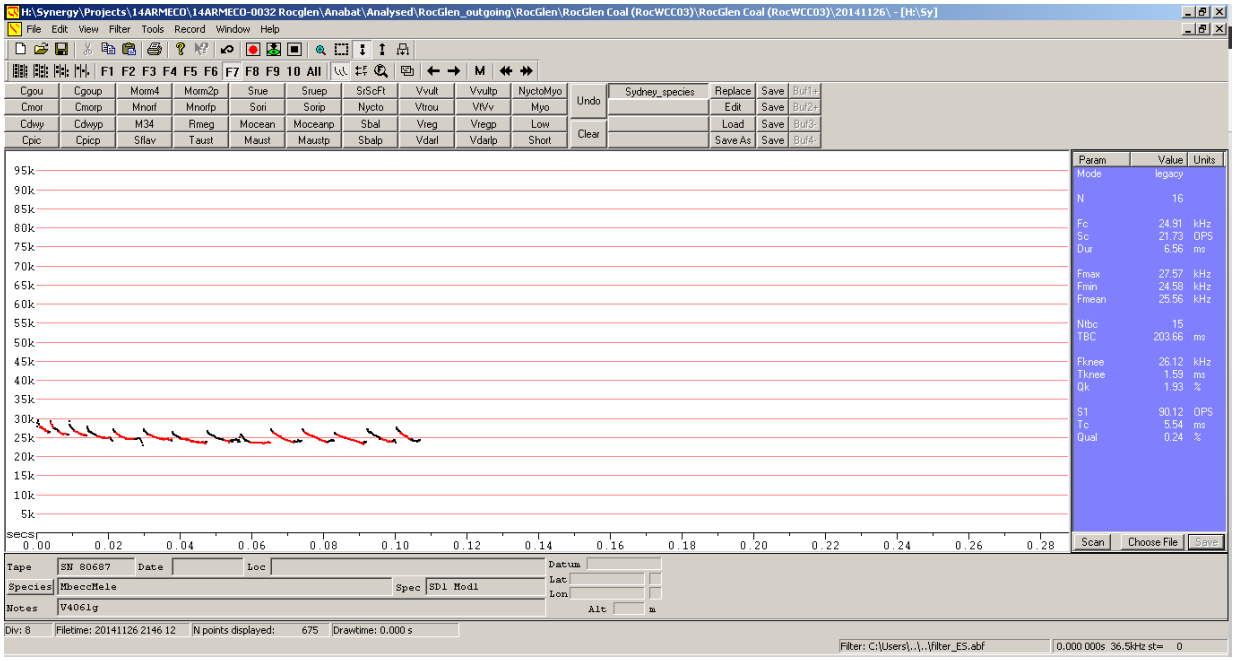

Figure C-14: Call profile for an unknown species recorded at Rocglen, at 21:46 on 26 November 2014.

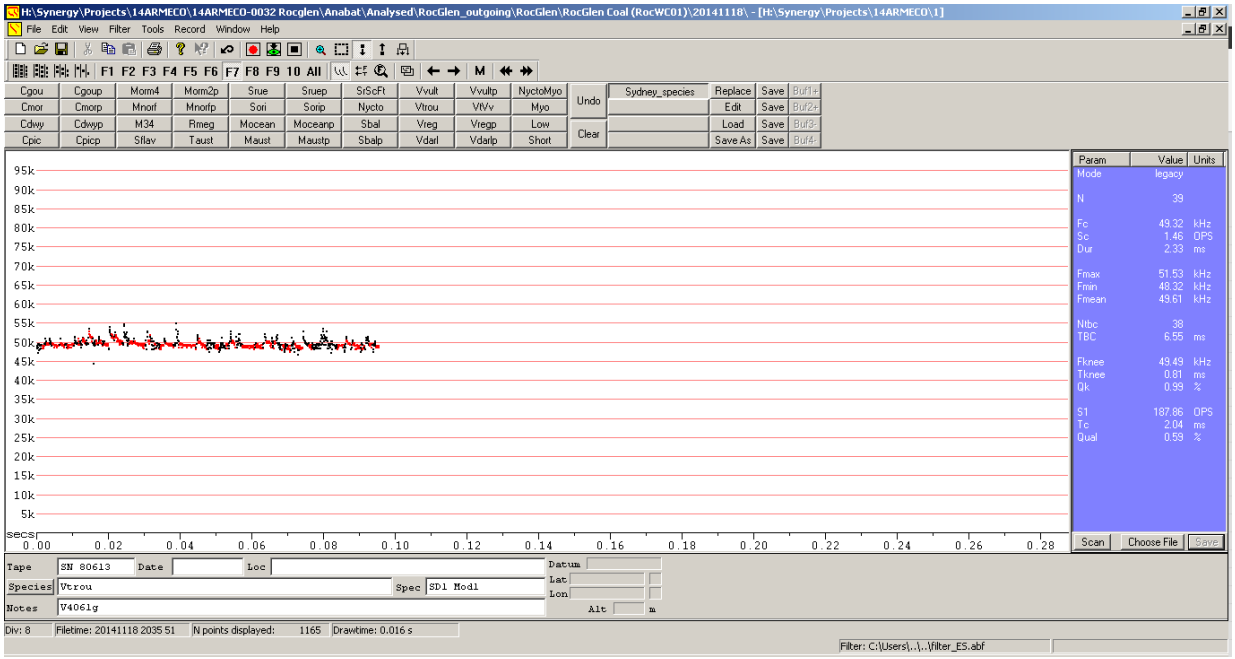

Figure C-15: Probable call profile for *Vespadelus troughtoni* recorded at Rocglen, site WC01 at 20:35 on 18 November 2014.

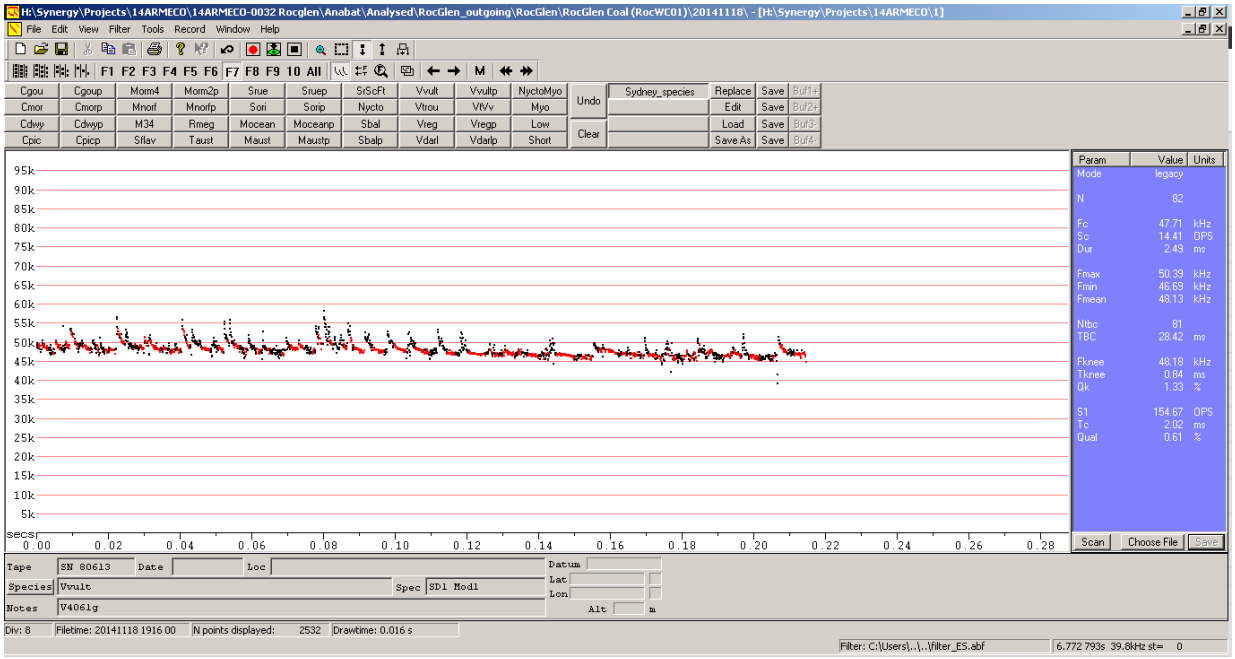

Figure C-16: Call profile for *Vespadelus vulturnus* recorded at Rocglen, site WC01 at 19:16 on 18 November 2014.

RESULTS FROM AUTUMN 2015 MONITORING

Bat calls were analysed using the program AnalookW (Version 3.8 25 October 2012, written by Chris Corben, www.hoarybat.com). Call identifications were made by Alicia Scanlon from Eco Logical Australia Pty Ltd using regional based guides to the echolocation calls of microbats in New South Wales (Pennay et al. 2004); and south-east Queensland and north-east New South Wales (Reinhold et al. 2001) and the accompanying reference library of over 200 calls from north-eastern NSW. Available: (http://www.forest.nsw.gov.au/research/bats/default.asp). Alicia has over six years of experience in the identification of ultrasonic call recordings.

Bat calls are analysed using species-specific parameters of the call profile such as call shape, characteristic frequency, initial slope and time between calls (Rinehold et al. 2001). To ensure reliable and accurate results the following protocols (adapted from Lloyd et. al. 2006) were followed:

- Search phase calls were used in the analysis, rather than cruise phase calls or feeding buzzes (McKenzie et al. 2002)
- Recordings containing less than three pulses were not analysed and these sequences were labeled as short (Law et al. 1999)
- Four categories of confidence in species identification were used (Mills et al. 1996):
    - definite – identity not in doubt
    - probable – low probability of confusion with species of similar calls
    - possible – medium to high probability of confusion with species with similar calls
    - low – calls made by bats which cannot be identified to even a species group.
- Nyctophilus spp. are difficult to identify confidently from their calls and no attempt was made to identify this genus to species level (Pennay et al. 2004)
- Sequences not attributed to microbat echolocation calls were labeled as junk or non-bat calls and don't represent microbat activity at the site
- Sequences labelled as low or short can be used as an indicator of microbat activity at the site

There were 787 passes recorded from Anabat detectors placed at four sites within the study area at Rocglen Mine between 13 and 15 April 2015. Approximately 28% of passes submitted were able to be identified to genus or species with the remainder being too short or of low quality preventing positive identification.

Species

There were at least 15 species identified including up to **five vulnerable** species listed under the NSW TSC Act 1987 (**Tables C5 – 8, Figures C17 – 31**). Of the five possible threatened species ***Miniopterus schreibersii oceanensis*** **(Eastern Bentwing Bat)** and ***Saccolaimus flaviventris*** **(Yellow-bellied Sheathtail Bat)** were well represented, both species occurring at all four sites. ***Chalinolobus picatus*** **(Little Pied Bat)** and ***Vespadelus troughtoni*** **(Eastern Cave Bat)** were represented by only a few calls each. In addition, it is possible that ***Nyctophilus corbeni*** **(South-eastern Long-eared Bat)** was present because its calls cannot be separated from other co-occurring Long-eared Bats.

The most commonly recorded species based upon number of recorded passes was *Mormopterus (Ozimops) planiceps (species 4)* (South-eastern Free-tailed Bat) followed by *Chalinolobus gouldii* (Gould's Wattled Bat) and *Chalinolobus morio* (Chocolate Wattled Bat). Most species were recorded at all sites, except for **Eastern Cave Bat**, **Little Pied Bat** and *Mormopterus (Ozimops) petersi (species 3)* (Inland Free-tailed Bat). There were long sequences and feeding buzzes recorded in the data set indicating that the study area is used as a foraging area for microbats of a range of species.

Sites

All sites recorded moderate microbat activity levels with calls recorded more often than every ten minutes but less often than every two minutes on average throughout each evening. In contrast to the spring surveys, Site WC02 was the least diverse with just 10 of a possible 15 species recorded. Site WR01, WC03 and WC01 recorded between 13 and 14 species each.

Notes

The calls of Gould's Wattled Bat, *Scotorepens balstoni* (Inland Broad-nosed Bat), Inland Freetail Bat and South-eastern Freetail Bat can be difficult to separate, particularly in open areas such as the Rocglen study area. Calls were identified as Freetail Bats when the call shape was flat (OPS< 100), there was no alternation in frequency between pulses and the frequency was between 26 – 29.5kHz (South-eastern Freetail Bat) or 31 – 36kHz (Inland Freetail Bat). Gould's Wattled Bat was distinguished from Inland Broad-nosed Bat by alternation in call frequency between pulses.

The calls of the **Eastern Bentwing Bat** can often display very similar characteristics to other species such as *Vespadelus darlingtonii* (Large Forest Bat), *Vespadelus regulus* (Southern Forest Bat) and *Vespadelus vulturnus* (Little Forest Bat). Calls of **Eastern Bentwing Bat** were distinguished by the irregular pulse shape and time between calls, lack of an up-sweeping tail and drop in frequency of the pre-characteristic section of more than 2kHz.

The calls of the threatened ***Myotis macropus*** **(Large-footed Myotis)** are very similar to all Nyctophilus species and it is often difficult to separate these species. It is unlikely that the **Large-footed Myotis** occurs in this geographic region, particularly given the dry spring/summer of 2014. All near-vertical calls that were search phase calls were labelled as Nyctophilus sp.

Calls of *Scotorepens orion* (Eastern Broad-nosed bat), *Scotorepens greyii* (Little broad-nosed bat*)* and *Scotorepens sp.* (Central-eastern Broad-nosed bat*)* are very similar to those of the threatened

Falsistrellus tasmaniensis **(Eastern falsistrelle)** and ***Scoteanax rueppellii*** **(Greater broad-nosed bat*).*** In this area it is unlikely that **Eastern Falsistrelles**, **Greater Broad-nosed Bats** or Eastern Broad-nosed Bats would be present given the known distribution of these species and the habitat preferences of the former. The calls of Little Broad-nosed Bats and Central-eastern Broad-nosed Bats are indistinguishable on recorded characteristics where they overlap in frequency (38 – 40 kHz). Little Broad-nosed Bats were identified when the frequency fell between 35 – 38 kHz and Central-eastern Broad-nosed Bats were identified at frequencies of 40 – 41 kHz.

There were numerous flat Freetail type calls at a frequency of 23 – 25 kHz (**Figure C-29**). These calls have been assigned to *Unknown species 23-25 kHz* in the absence of any similar shaped reference calls from NSW within this frequency range. It is possible that these calls belong to the threatened ***Mormopterus Setirostris eleryi (species 6)*** **(Hairy-nosed Freetail Bat)** whose call is unknown. It has been suggested that this species may produce calls similar to Inland Freetail Bat and South-eastern Freetail Bat, although this species is not known from the area surrounding Rocglen. The other potential species is *Mormopterus beccarii* (Northern Freetail Bat) which is known to produce a similar call but not known from south of Murwillumbah in far NE NSW. Similar calls have been gathered from other sites in surrounding localities (eg Werris Creek, Lake Keepit), so it is not an anomaly of this particular data set.

The calls of the **Eastern Cave Bat,** *Vespadelus vulturnus* (Little Forest Bat) and Chocolate Wattled Bat can be difficult to separate in the range 49 – 51 kHz in this geographic region. Calls were identified as Chocolate Wattled Bat when there was a down-sweeping tail. Calls above 50 kHz were generally identified as **Eastern Cave Bat**.

Table C-5: Site WC01 results from one Anabat night 13 – 14 April 2015 Rocglen Mine.

Scientific name	Common name	Definite	Probable	Possible	Total^
Chalinolobus gouldii	Gould's Wattled Bat	9	2	8	19
Chalinolobus morio	Chocolate Wattled Bat	4	1		5
Miniopterus schreibersii ocenanensis* / *Vespadelus vulturnus*	**Eastern Bentwing Bat** / Little Forest Bat				**2**
Mormopterus Ozimops petersi (species 3)	Inland Free-tailed Bat	5		2	7
Mormopterus Ozimops planiceps (species 4)	South-eastern Free-tailed Bat	18	4	6	28
Nyctophilus sp.	**Long-eared Bats**	**2**			**2**
Saccolaimus flaviventris*	**Yellow-bellied Sheathtail Bat**	**8**			**8**
Scotorepens balstoni	Inland Broad-nosed Bat			2	2
Scotorepens greyii	Little Broad-nosed Bat	14	2	8	24
Scotorepens sp.	Central-eastern Broad-nosed Bat			1	1
Tadarida australis	White-striped Free-tailed Bat	4			4
Unknown 23 -25kHz					3
Vespadelus troughtoni*	**Eastern Cave Bat**				**1**
Vespadelus vulturnus	Little Broad-nosed Bat				2
Low					18
Short					65
TOTAL					191

* Indicates threatened species;

^ Where a total is recorded, but there is no definite, probable or possible results this indicates uncertainty between two species

Table C-6: Site WC02 results from two Anabat nights 13 - 15 April 2015, Rocglen Mine.

Scientific name	Common name	Definite	Probable	Possible	Total^
Chalinolobus gouldii	Gould's Wattled Bat	1	1	5	7
Chalinolobus morio	Chocolate Wattled Bat	48	21	11	80
Chalinolobus gouldii / Mormopterus Ozimops planiceps (species 4)	Gould's Wattled Bat / South-eastern Free-tailed Bat				4
Miniopterus schreibersii ocenanensis*	**Eastern Bentwing Bat**			**1**	**1**

Scientific name	Common name	Definite	Probable	Possible	Total^
Mormopterus Ozimops planiceps (species 4)	South-eastern Free-tailed Bat	41	15	15	71
Nyctophilus sp.	**Long-eared Bats**	**7**	**1**	**1**	**9**
Saccolaimus flaviventris*	**Yellow-bellied Sheathtail Bat**	**8**			**8**
Scotorepens greyii	Little Broad-nosed Bat	1	1	1	3
Tadarida australis	White-striped Free-tailed Bat	2			2
Unknown 23 -25kHz					14
Vespadelus vulturnus	Little Broad-nosed Bat	1	1		2
Low					100
Short					182
TOTAL					483

* Indicates threatened species;

^ Where a total is recorded, but there is no definite, probable or possible results this indicates uncertainty between two species

Table C-7: Site WC03 results from two Anabat nights 13 – 15 April 2015, Rocglen Mine.

Scientific name	Common name	Definite	Probable	Possible	Total^
Chalinolobus gouldii	Gould's Wattled Bat	22	14	10	46
Chalinolobus morio	Chocolate Wattled Bat	18		3	21
Miniopterus schreibersii ocenanensis*	**Eastern Bentwing Bat**	**4**	**1**	**5**	**10**
Miniopterus schreibersii ocenanensis* / *Vespadelus vulturnus*	**Eastern Bentwing Bat** / Little Forest Bat				**4**
Mormopterus Ozimops petersi (species 3)	Inland Free-tailed Bat	3	2	7	12
Mormopterus Ozimops planiceps (species 4)	South-eastern Free-tailed Bat	6	5	7	18
Nyctophilus sp.	**Long-eared Bats**	**6**		**1**	**7**
Saccolaimus flaviventris*	**Yellow-bellied Sheathtail Bat**	**6**			**6**
Scotorepens greyii	Little Broad-nosed Bat		5	2	7
Scotorepens sp.	Central-eastern Broad-nosed Bat		1	4	5
Tadarida australis	White-striped Free-tailed Bat	4			4
Unknown 23 -25kHz					2
Vespadelus troughtoni*	**Eastern Cave Bat**	**1**		**2**	**3**

Scientific name	Common name	Definite	Probable	Possible	Total^
Vespadelus vulturnus	Little Broad-nosed Bat	7	5	2	14
Low					50
Short					95
TOTAL					304

* Indicates threatened species;

^ Where a total is recorded, but there is no definite, probable or possible results this indicates uncertainty between two species

Table C-8: Site WR01 results from two Anabat nights 13 – 15 April 2015, Rocglen Mine.

Scientific name	Common name	Definite	Probable	Possible	Total^
Chalinolobus gouldii	Gould's Wattled Bat	29	2	9	40
Chalinolobus morio	Chocolate Wattled Bat	3	1		4
Chalinolobus picatus*	**Little Pied Bat**			**1**	**1**
Miniopterus schreibersii ocenanensis*	**Eastern Bentwing Bat**	**1**			**1**
Miniopterus schreibersii ocenanensis* / *Vespadelus vulturnus*	**Eastern Bentwing Bat** / Little Forest Bat				2
Mormopterus Ozimops petersi (species 3)	Inland Free-tailed Bat	2			2
Mormopterus Ozimops planiceps (species 4)	South-eastern Free-tailed Bat	5		1	6
Nyctophilus sp.	**Long-eared Bats**	**1**		**1**	**2**
Saccolaimus flaviventris*	**Yellow-bellied Sheathtail Bat**	**7**			**7**
Scotorepens balstoni	Inland Broad-nosed Bat			1	1
Scotorepens greyii	Little Broad-nosed Bat	5	2	1	8
Scotorepens sp.	Central-eastern Broad-nosed Bat			1	1
Tadarida australis	White-striped Free-tailed Bat	3			3
Unknown 23 -25kHz					1
Vespadelus vulturnus	Little Broad-nosed Bat	4	4		8
Low					23
Short					34
TOTAL					144

* Indicates threatened species;

^ Where a total is recorded, but there is no definite, probable or possible results this indicates

uncertainty between two species

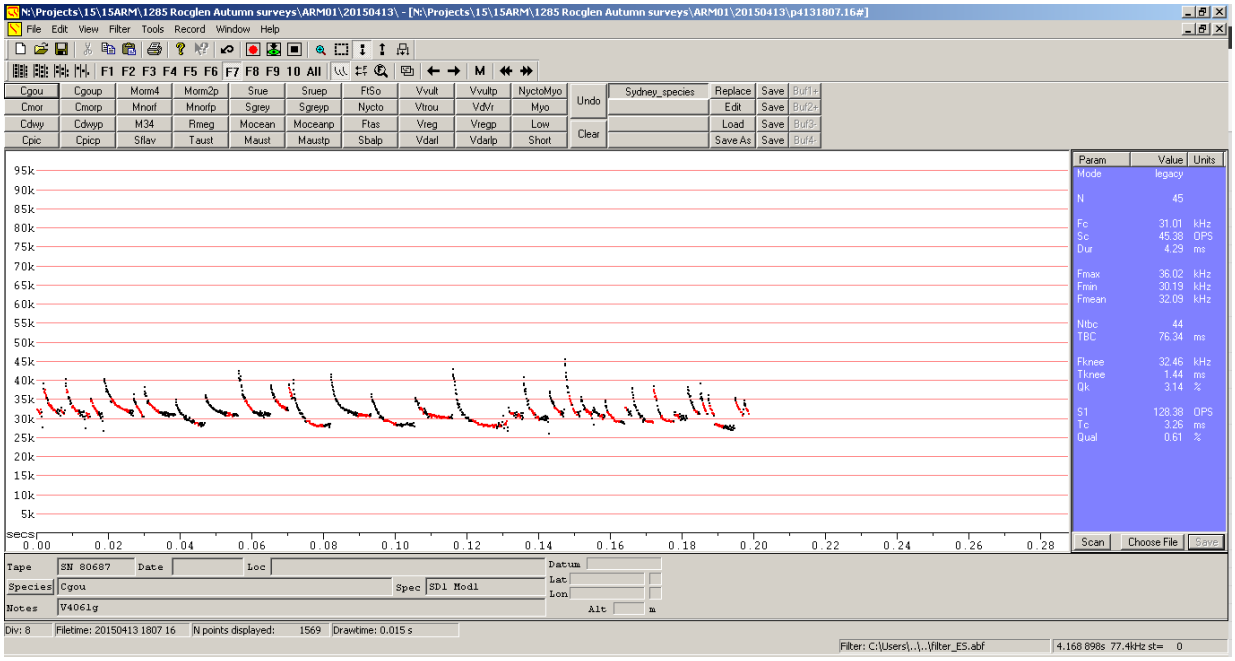

Figure C-17: Call profile for *Chalinolobus gouldii* recorded at Rocglen, site WC03 at 18:07 on 13 April 2015.

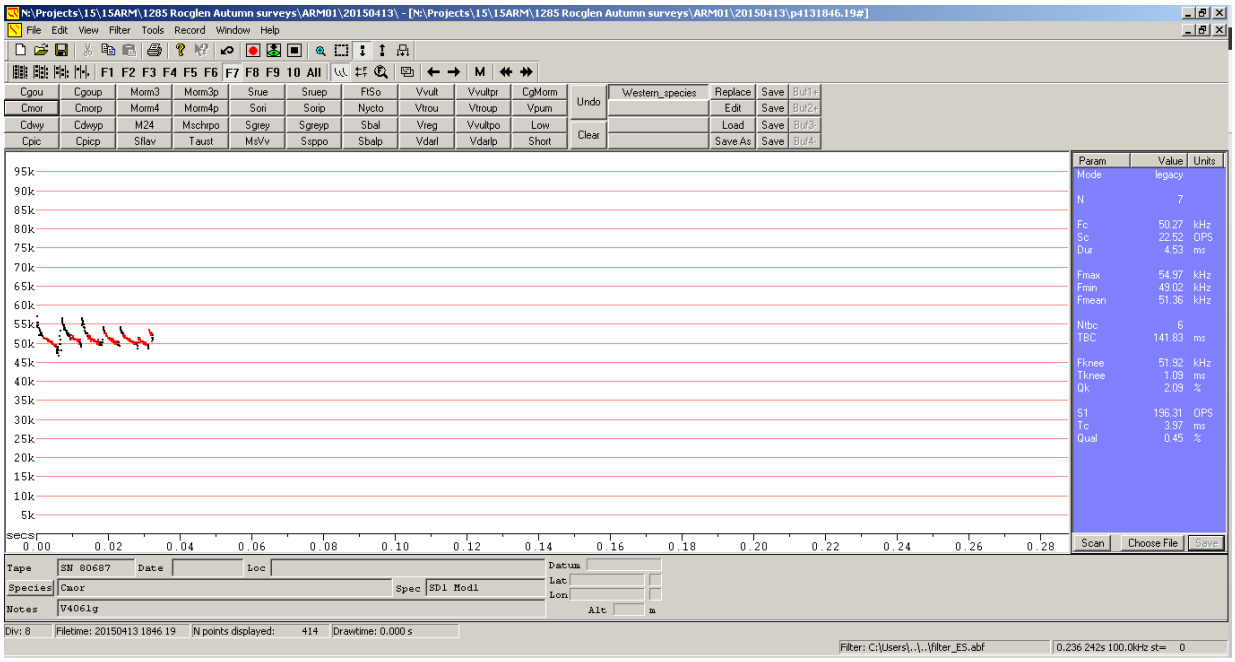

Figure C-18: Call profile for *Chalinolobus morio* recorded at Rocglen, site WC03 at 21:57 on 13 April 2015.

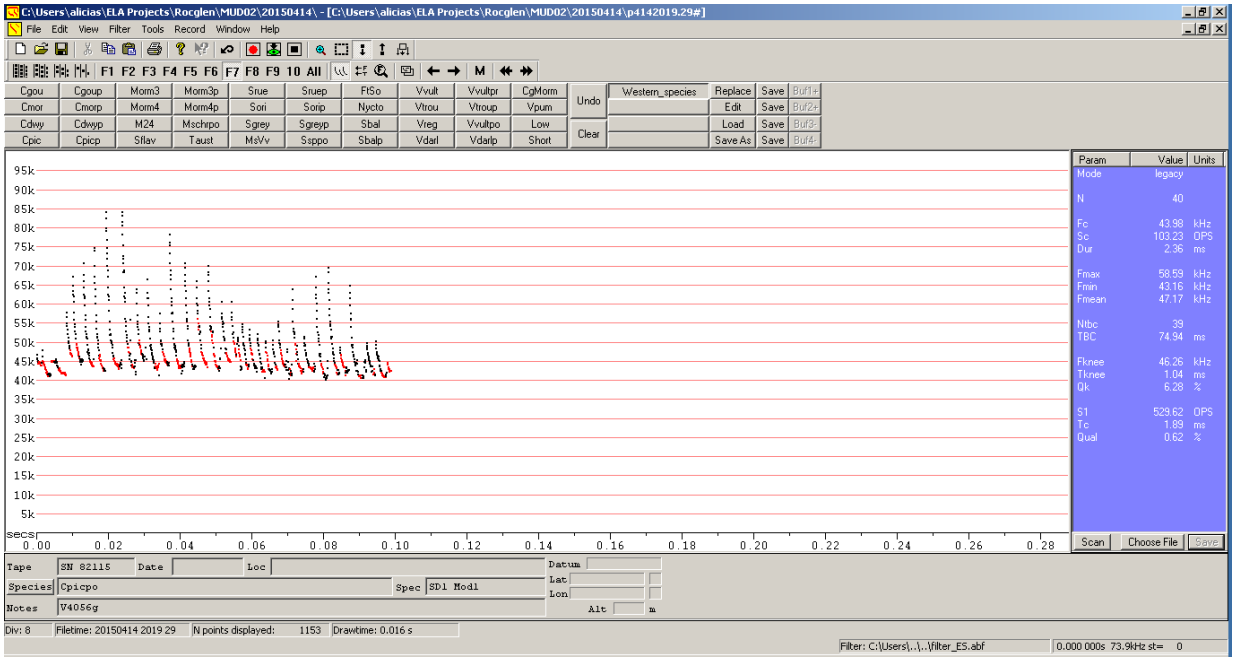

Figure C-19: Possible call profile for *Chalinolobus picatus* recorded at Rocglen, site WR01 at 20:19 on 14 April 2015.

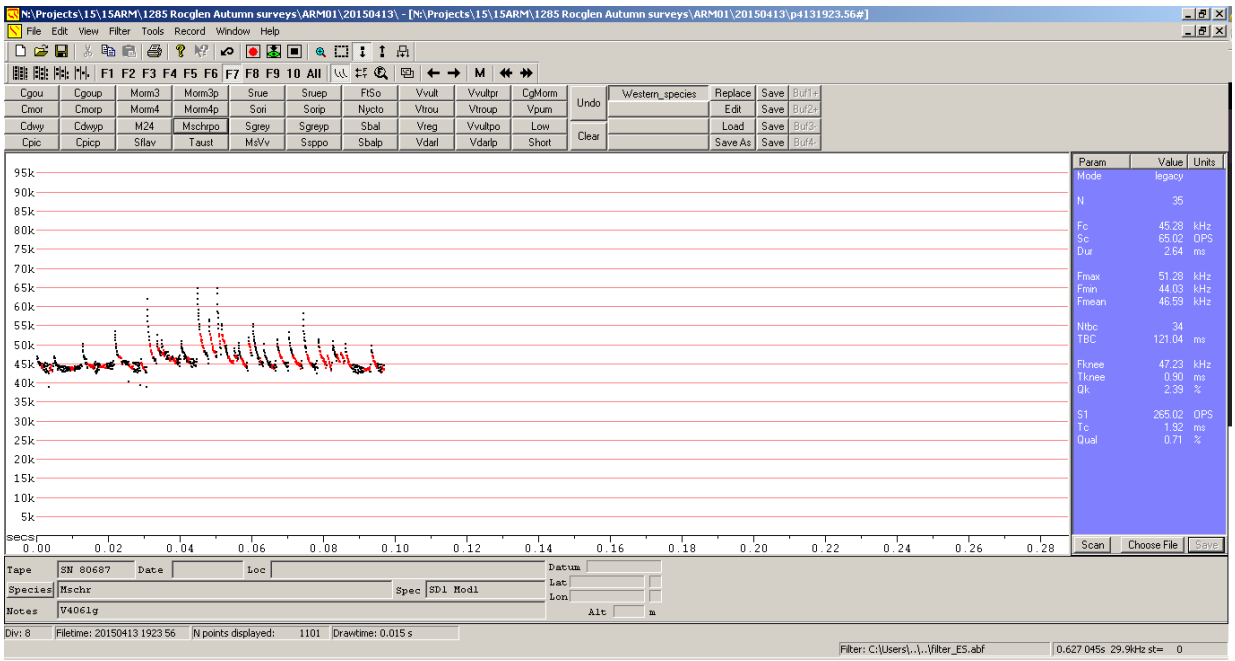

Figure C-20: Call profile for *Miniopterus schreibersii oceanensis* recorded at Rocglen, site WC03 at 19:23 on 13 April 2015.

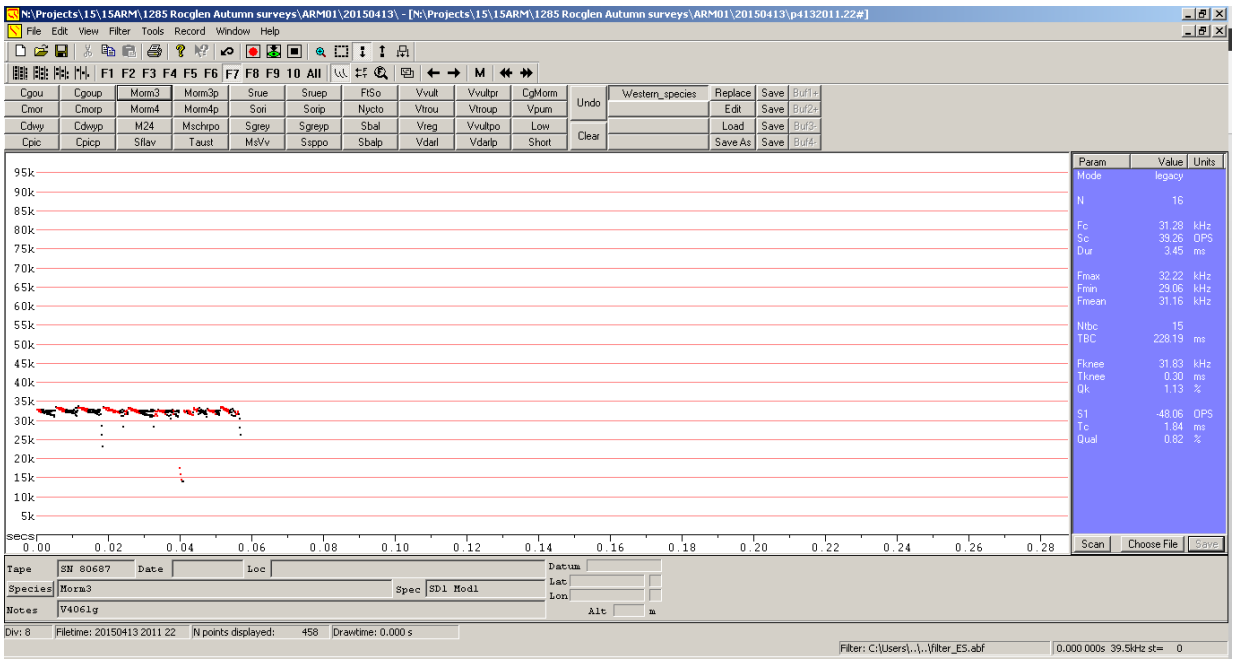

Figure C-21: Call profile for *Mormopterus* species 3 recorded at Rocglen, site WC03 at 20:11 on 13 April 2015.

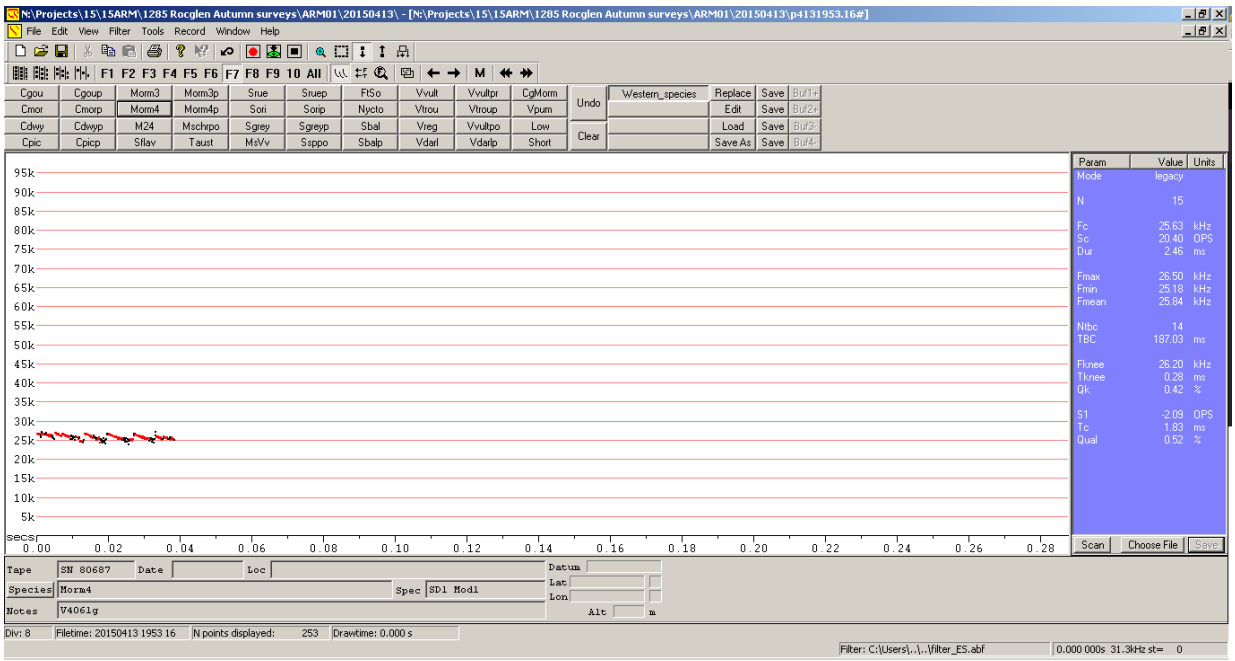

Figure C-22: Call profile for *Mormopterus* species 4 recorded at Rocglen, site WC03 at 19:53 on 13 April 2015.

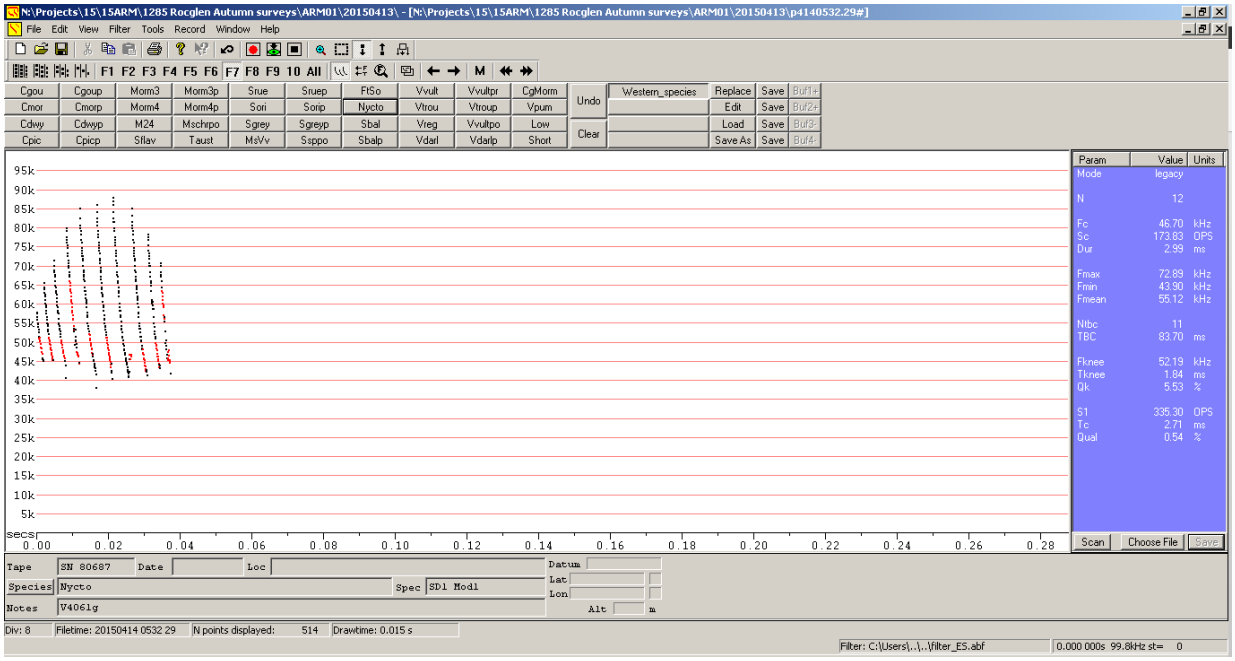

Figure C-23: Call profile for *Nyctophilus* sp. recorded at Rocglen, site WC03 at 05:32 on 14 April 2015.

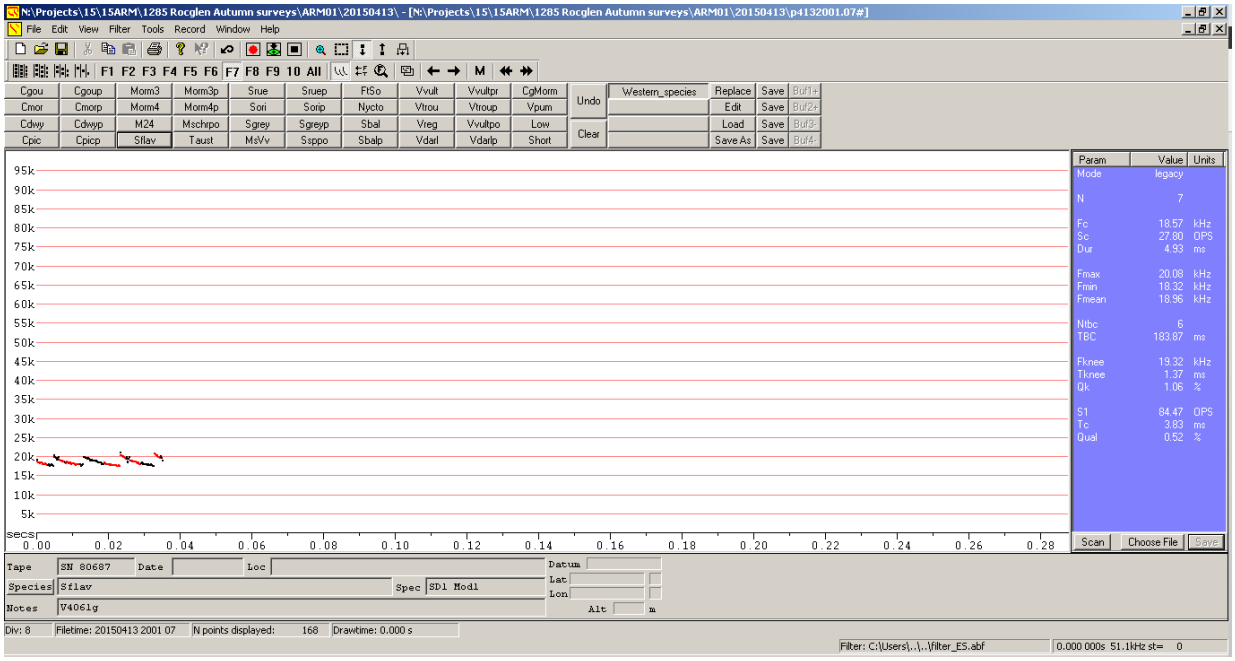

Figure C-24: Call profile for *Saccolaimus flaviventrus* recorded at Rocglen, site WC03 at 20:01 on 13 April 2015.

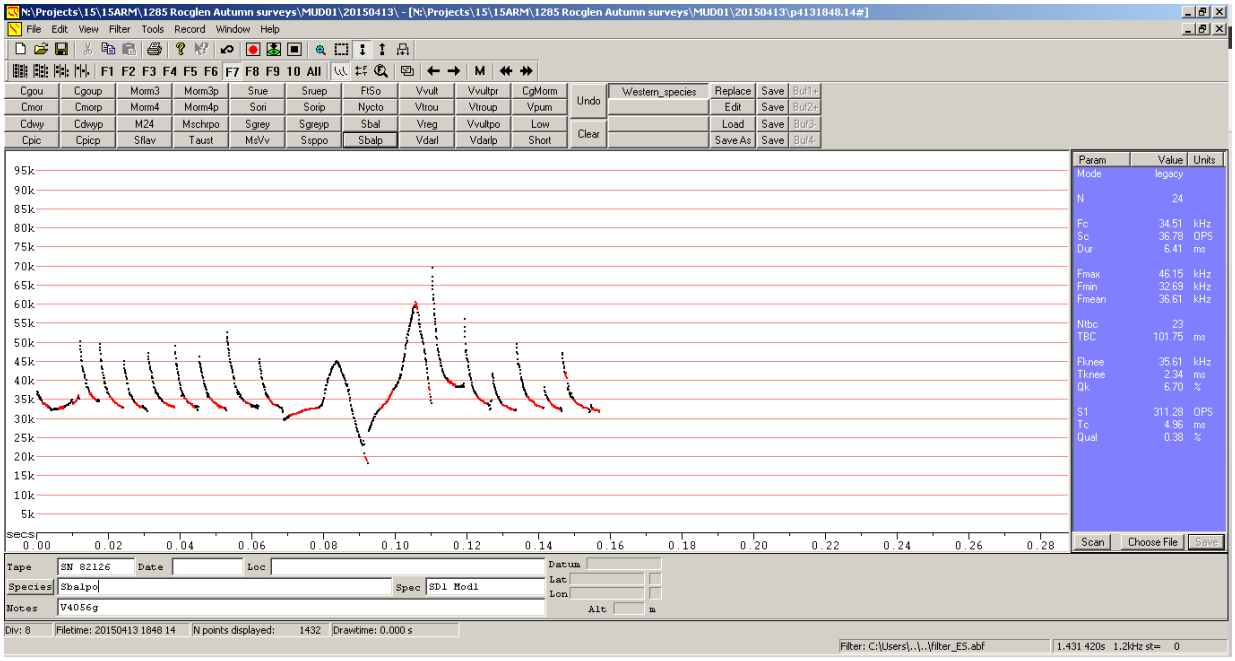

Figure C-25: Possible call profile for *Scotorepens balstoni* recorded at Rocglen, site WC01 at 18:48 on 13 April 2015.

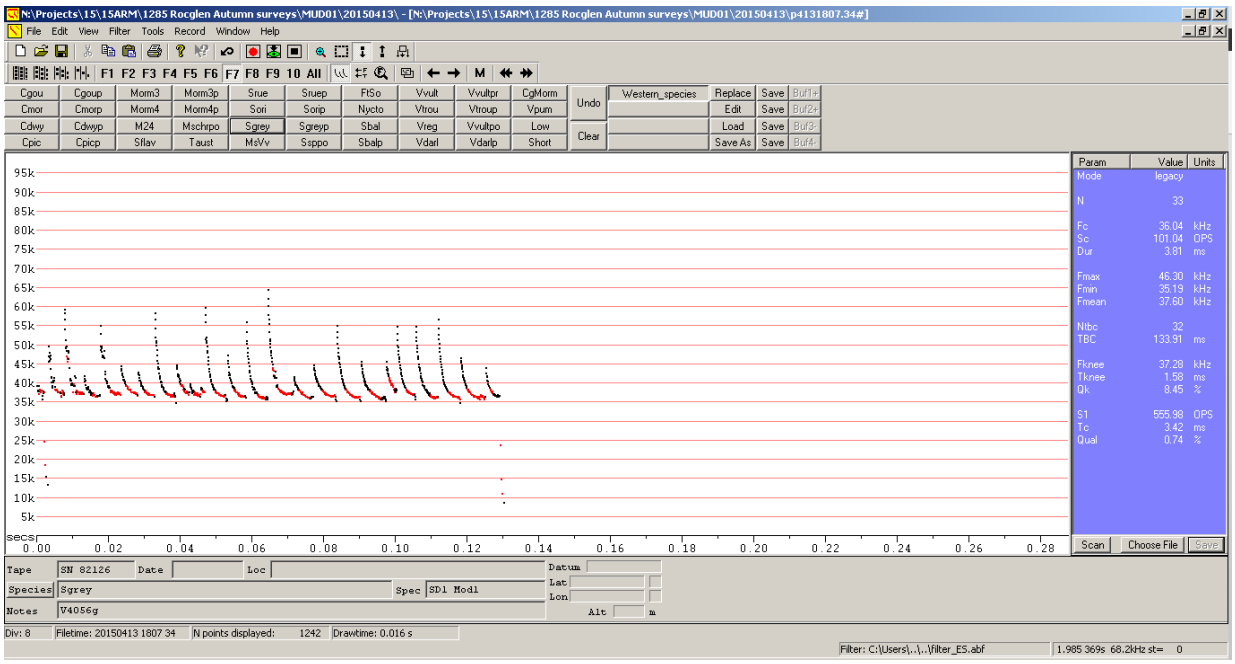

Figure C-26: Call profile for *Scotorepens greyii* recorded at Rocglen, site WC01 at 18:07 on 13 April 2015.

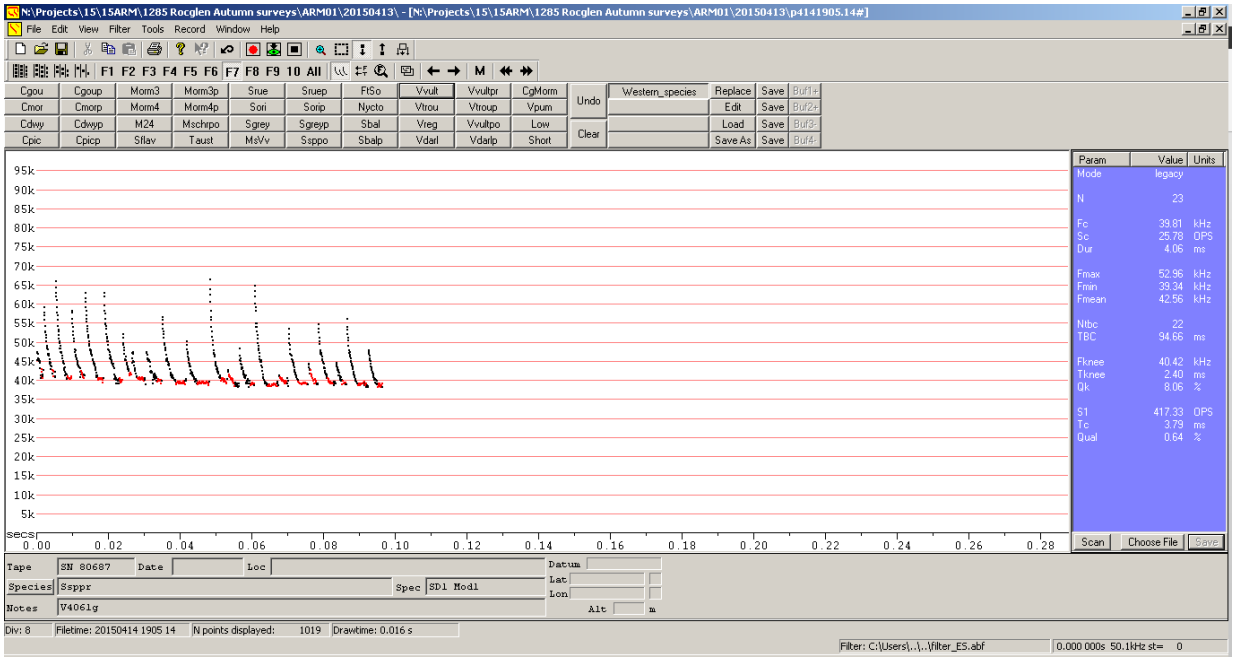

Figure C-27: Probable call profile for *Scotorepens* sp. recorded at Rocglen, site WC03 at 19:05 on 14 April 2015.

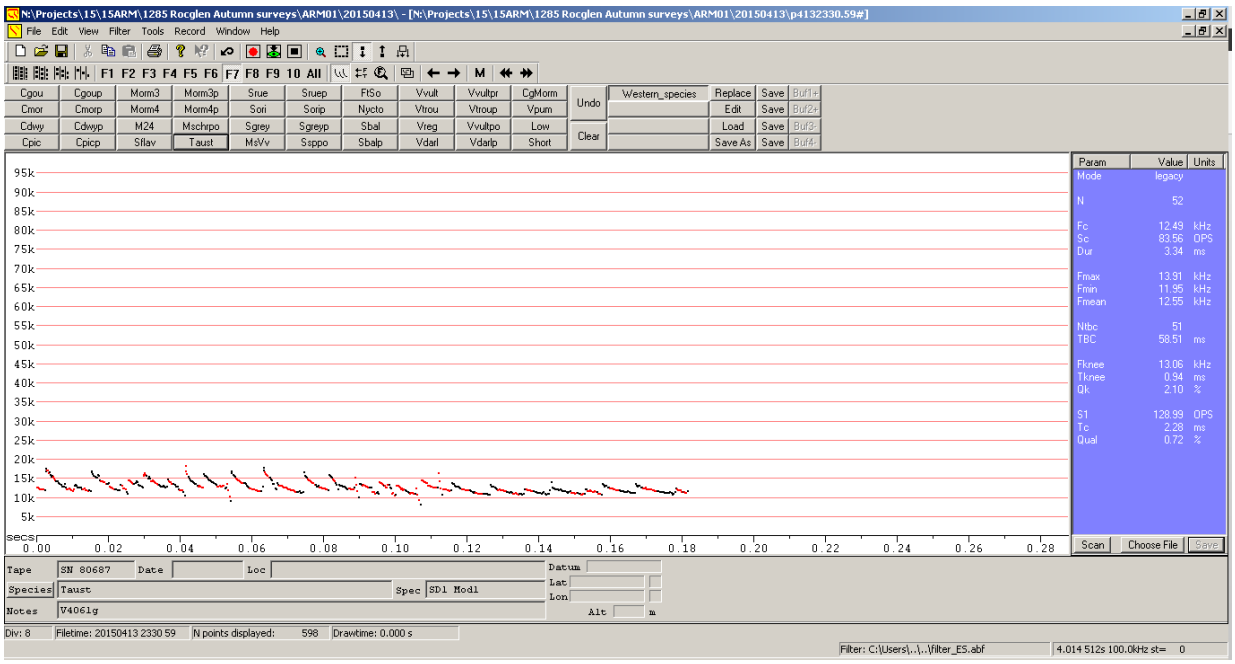

Figure C-28: Call profile for *Tadarida australis* recorded at Rocglen, site WC03 at 23:30 on 13 April 2015.

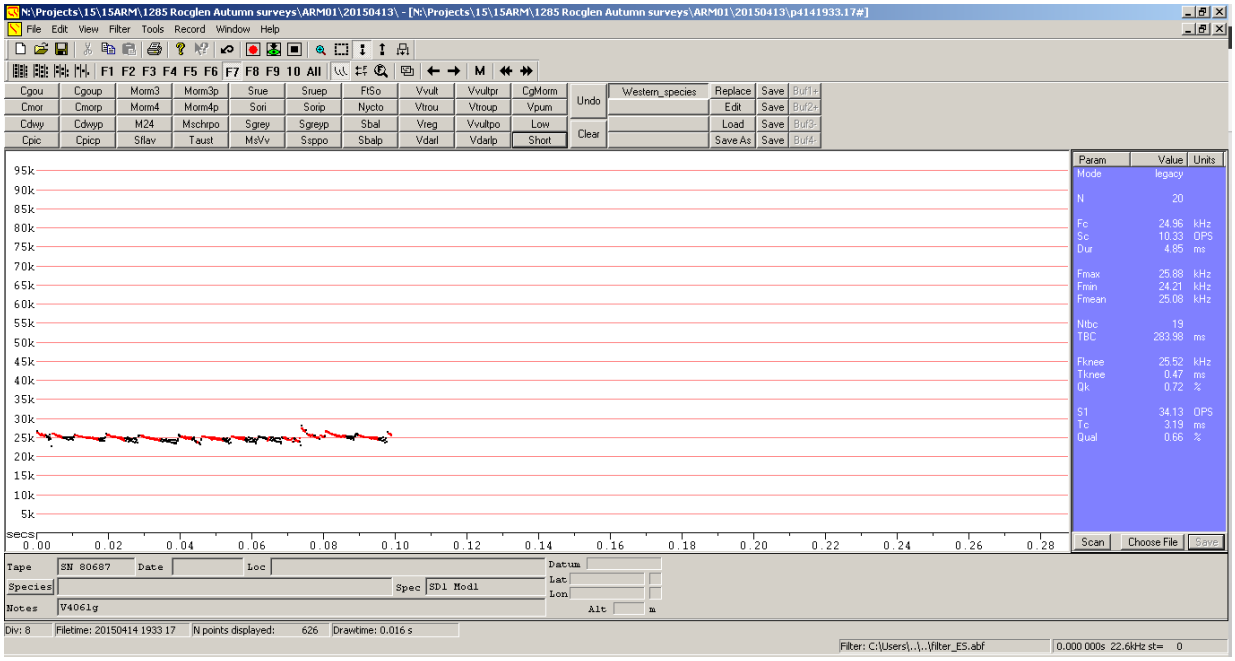

Figure C-29: Call profile for an unknown species (23 – 25kHz) recorded at Rocglen, site WC03 at 19:33 on 14 April 2015.

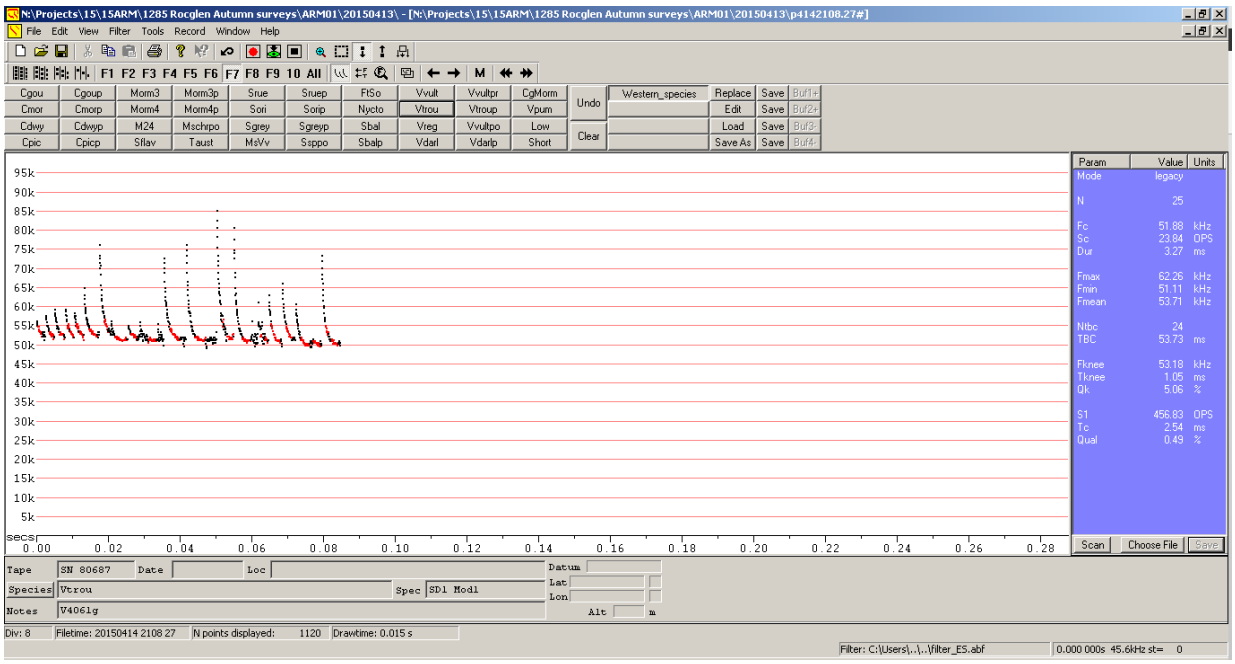

Figure C30: Call profile for *Vespadelus troughtoni* recorded at Rocglen, site WC03 at 21:08 on 14 April 2015.

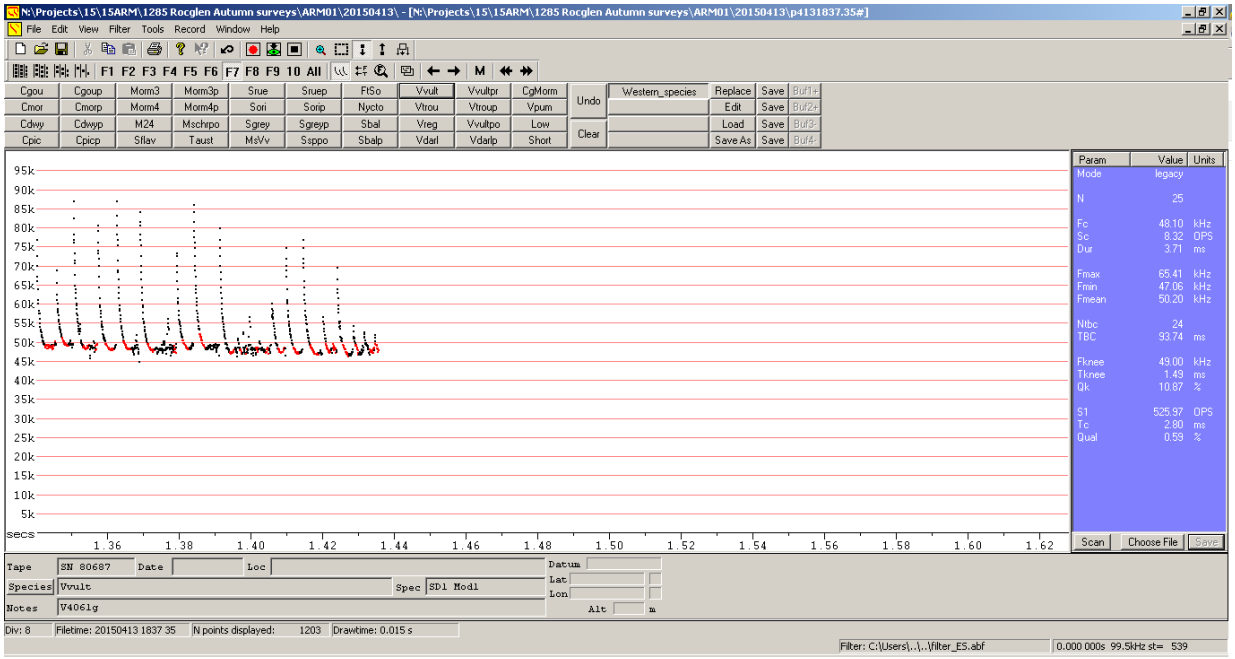

Figure C-31: Call profile for *Vespadelus vulturnus* recorded at Rocglen, site WC03 at 18:37 on 13 April 2015.

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McKenzie, N. L., Stuart, A. N., and Bullen, R. D. (2002). 'Foraging ecology and organisation of a desert bat fauna.' *Australian Journal of Zoology 50, 529-548.*

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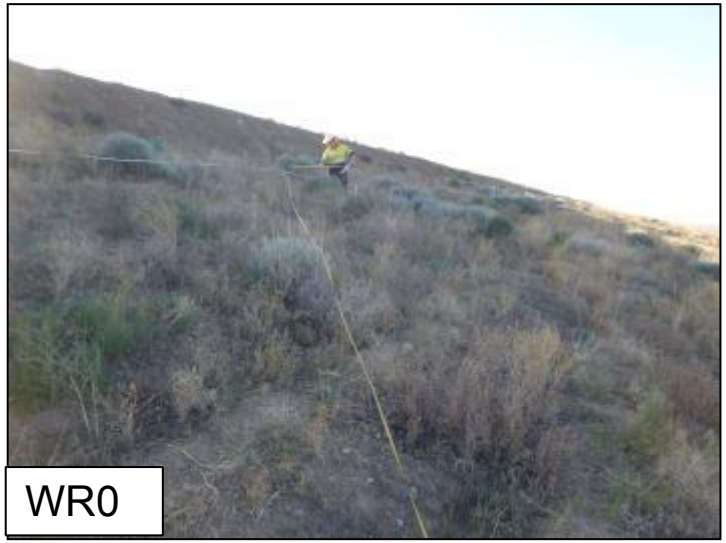
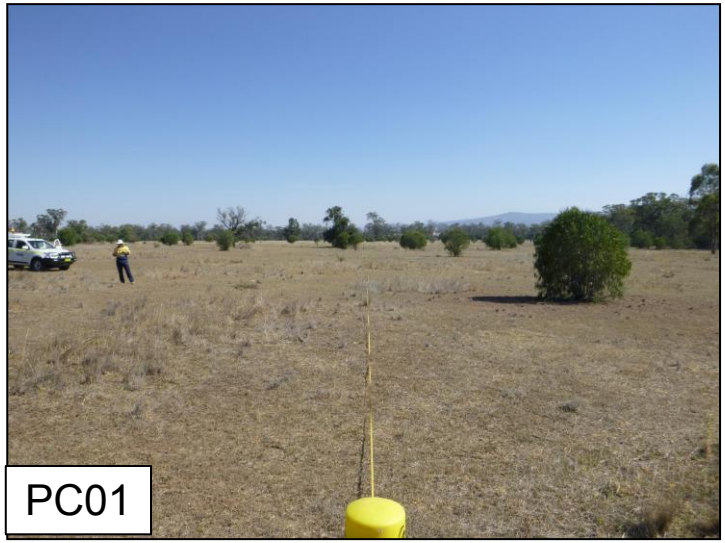
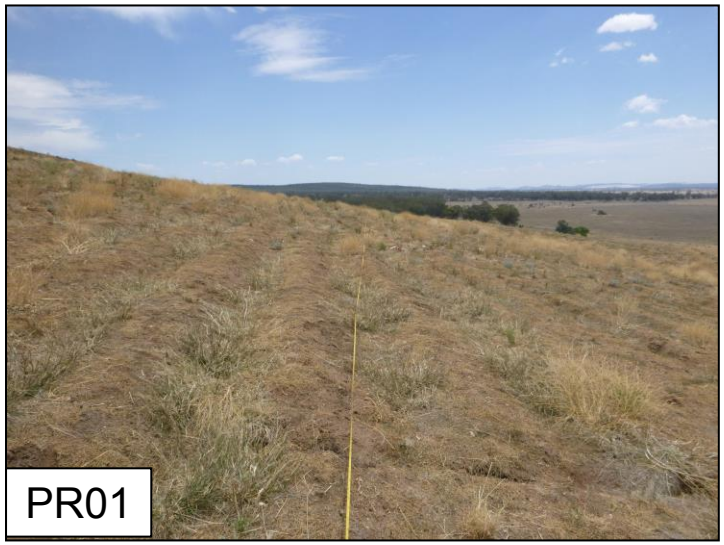
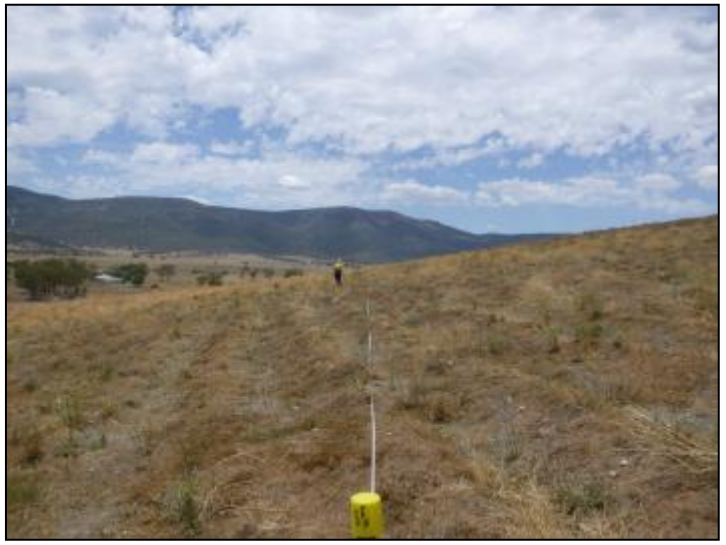
Appendix D Vegetation Transects – Site Photos









Appendix E Pasture

Table E-1: Groundcover composition for pasture monitoring plots 2014

Treatment	Site	Easting	Northing	Plot	Groundcover composition		
					Vegetation species (%)	Bare ground (%)	Litter (%)
Control	RocPC01	238300	6595324	1	12	88	0
				2	14	86	0
				3	9	91	0
				4	11	89	0
				5	19	81	0
	RocPC02	238156	6595898	1	7	78	15
				2	12	86	2
				3	21	69	10
				4	100	0	0
				5	18	32	50
Rehabilitation	RocPR01	239058	6595738	1	11	69	20
				2	18	72	10
				3	23	15	62
				4	20	15	65
				5	19	71	10
	Mean				21	63	16
	Min				7	0	0
	Max				100	91	65

Table E-2: Vegetation cover species recorded in pasture plots (2 x 2 m plots)

Scientific name Common name	PC01					PC02					PR01				
	1	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
Austrostipa scabra Speargrass	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
**Anagallis sp.*	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Austrostipa sp.	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0
Capsella bursa-pastoris Shepherd's Purse	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1
**Carthamus lanatus* Saffron Thistle	0	0	0	1	1	0	1	2	1	8	2	10	10	1	0
Convolvulus graminetinus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Einadia hastata Berry Saltbush	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
Einadia polygonoides	0	0	0	0	0	0	0	0	0	0	2	1	5	0	5
Enteropogon sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
**Exotic grass*	0	0	0	0	0	0	0	0	0	0	0	2	5	5	5
Goodenia fascicularis	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Ipomoea sp.	0	0	0	0	0	0	0	0	0	0	1	2	0	1	1
Juncus sp.	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0
**Lepidium bonariense* Pepper Cress	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Leucochrysum sp.	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
**Malva parviflora* Small-flowered Mallow	0	0	0	0	0	0	0	0	0	0	0	0	0	5	1
Native grass species unknown	5	7	2	0	5	5	2	15	85	8	0	0	0	0	0

Scientific name Common name	PC01					PC02					PR01				
	1	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
Salsola kali Prickly Saltwort	0	0	0	0	0	0	2	0	0	0	0	0	0	1	0
**Sclerolaena birchii* Galvanised Burr	0	0	1	0	0	0	0	0	0	0	0	0	1	5	0
Sclerolaena diacantha Cathead	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sedge unknown	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0
Sida corrugata Corrugated Sida	1	0	0	1	0	0	0	0	0	2	0	0	0	0	0
**Sida spinosa* Spiny Sida	1	2	1	2	1	0	0	1	0	0	2	2	2	0	5
Tribulus terrestris Bindii	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0
Trifolium fragiferum Strawberry Clover	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vittadinia cuneata Fuzzweed	5	5	5	5	1	2	2	1	0	0	2	0	0	0	0
Xerochrysum sp.	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Total vegetation cover	**12**	**14**	**9**	**11**	**18**	**7**	**13**	**21**	**101**	**18**	**11**	**18**	**23**	**20**	**19**

Table E-3: Record of large trees (>1.6 m tall) and DBH at Woodland sites

Site	Species	Tree health	Tree count (maximum 10 for any one species)																		Count of all trees for each species > 1.6 m tall
			1		2		3		4		5		6		7		8		9		10		
			Tag No.	DBH (mm)	Tag No.	DBH (mm)	Tag No.	DBH (mm)	Tag No.	DBH (mm)	Tag No.	DBH (mm)	Tag No.	DBH (mm)	Tag No.	DBH (mm)	Tag No.	DBH (mm)	Tag No.	DBH (mm)	Tag No.	DBH (mm)	
WC01	*Eremophila mitchellii* False Sandalwood	5	1	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
WC02	*Geijera parviflora* Wilga	5	6	65	2	15	1	40															3
	Eucalyptus crebra Narrow-leaved Ironbark	5	4	390	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
	Callitris endlicheri Black Cypress Pine	4	5	45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
	Notelaea sp.	4	3	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
WC03	*Callitris endlicheri* Black Cypress Pine	4	2	25	1	95	3	90	7	80	15	100	16	100	17	75	18	70	19	55	12	70	10
	Eucalyptus crebra Narrow-leaved Ironbark	4	5	160	6	165	4	135	9	180	10	180	11	180	13	130	14	180	-	-	-	-	8
	Geijera parviflora Wilga	4	8	35	20	80	21	80	22	60	23	60	24	85	-	-	-	-	-	-	-	-	6
WR01	n/a	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Appendix F Woodland

Table F-1: Species recorded within 2 m x 2 m quadrats Spring 2014

Scientific name Common name	Site			
	WC01	WC02	WC03	WR01
Acacia deanei Green Wattle	0	0	7	0
Alectryon microcarpa subsp. microcarpa	0	0	1	0
Boerhavia spp.	4	0	0	0
Brachyscome sp.	5	0	1	0
Brunoniella australis Blue Trumpet	11	1	0	0
Callitris sp.	4	4	2	0
Calotis sp.	5	0	0	0
**Carthamus lanatus* Saffron Thistle	0	0	0	26
Cheilanthes sieberi	0	1	3	0
Convolvulus graminetinus	0	0	0	4
Desmodium brachypodum Large Tick-trefoil	0	13	0	0
Einadia hastata Berry Saltbush	1	0	0	0
Einadia polygonoides	2	1	11	1
Glycine tabacina	1	2	0	0
Maireana enchylaenoides Wingless Bluebush	0	0	2	0
**Malva parviflora* Small-flowered Mallow	0	0	0	6
Malvaceae sp.	0	0	1	0
**Misopates orontium* Lesser Snapdragon	0	300	0	0
Pimelea neo-anglica Poison Pimelea	0	0	1	0
Salsola australis	0	0	0	15
**Sclerolaena birchii* Galvinised Burr	0	0	0	3

Scientific name Common name	Site			
	WC01	WC02	WC03	WR01
**Sclerolaena muricata var. villosa* Black Roly-poly	0	0	0	1
Sida corrugata Corrugated Sida	10	3	0	0
**Sida spinosa* Spiny Sida	0	0	0	47
Solanum parvifolium	0	1	0	0
Vittadinia cuneata Fuzzweed	13	0	0	0
Total	56	326	29	103
Native	56	26	29	20
Exotic	0	300	0	83

* Denotes exotic species

Table F-2: Plant species recorded in 20 x 10 m plot (outside 2 x 2 m quadrats)

Scientific name Common name	WC01	WC02	WC03	WR01
Acacia deanei Dean's Wattle			X	
Acacia decora Western Silver Wattle		X		
Alphitonia excelsa Red ash			X	
**Anagallis arvensis* Scarlet Pimpernel			X	
Arthropodium sp. 'B'			X	
Aristida spp.		X	X	
Atalaya hemiglauca Whitewood	X			
Austrostipa ramosissima Stout Bamboo Grass	X			
Austrostipa scabra Speargrass	X	X	X	
Breynia oblongifolia Coffee Bush			X	
Bulbine spp.			X	

Scientific name Common name	WC01	WC02	WC03	WR01
Callitris spp.	X			
Cassinia laevis Cough Bush		X		
Chloris truncata Windmill Grass	X			
Desmodium brachypodum Large Tick-trefoil		X		
Dodonaea viscosa subsp. spatulata		X		
Einadia hastata Berry Saltbush		X	X	X
Einadia nutans Climbing Saltbush				X
Eragrostis lacunaria Purple Lovegrass		X		
Eremophila debilis (Myoporum debile) Winter Apple	X			
Eremophila mitchelli False Sandalwood	X			
Eucalyptus crebra Narrow-leaved Ironbark		X	X	
Eucalyptus microcarpa Grey Box				
Geijera parviflora Wilga	X	X		
Glycine tabacina	X			
Leiocarpa panaetioides Wooly Buttons	X			
Lomandra filiformis Wattle Mat-rush				
Maireana enchylaenoides Wingless Bluebush	X			
Maireana microphylla Small-leaf Bluebush	X			
Myoporum montanum Western Boobialla			X	
Notelaea microcarpa var. *microcarpa* Native Olive		X		

Scientific name Common name	WC01	WC02	WC03	WR01
**Opuntia stricta* Prickly Pear				X
Paspalidium sp.	X	X	X	
Rytidosperma sp.	X			
Sclerolaena birchii Galvanised Burr	X			
Sida subspicata Spiked Sida				X
Solanum esuriale Quena	X			
Solanum parvifolium	X			
**Spergularia spp.*	X			
Xerochrysum spp.			X	

* Denotes exotic species

Appendix G Fauna Surveys

Table G-1: Bird species recorded at Woodland fauna monitoring sites Spring 2014

Common name *Scientific name*	Site					
	WC01	WC02	W03	WR01	Opportunistic Vickery State Forest	Opportunistic
Apostlebird *Struthidea cinerea*	10		10		X	
Australian King-Parrot *Alisterus scapularis*		2			X	X
Australian Magpie *Cracticus tibicen*	2			2	X	
Australian Owlet-nightjar *Aegotheles cristatus*		1	1			
Australian Raven *Corvus coronoides*	2	1		3		
Australian Ringneck *Barnardius zonarius*	4		3		X	
Bar-shouldered Dove *Geopelia humeralis*		1	1		X	
Black-faced Cuckoo-shrike *Coracina novaehollandiae*	1					
Black-shouldered Kite *Elanus axillaris*				1		
Blue-faced Honeyeater *Entomyzon cyanotis*					X	X
*Brown Treecreeper *Climacteris picumnus*		**2**			**X**	
Brown-headed Honeyeater *Melithreptus brevirostris*	10					
Channel-billed Cuckoo *Scythrops novaehollandiae*	1					
Chestnut-rumped Thornbill *Acanthiza uropygialis*		2	4			
Cicadabird *Coracina tenuirostris*			3			
Cockatiel *Nymphicus hollandicus*	7				X	
Common Bronzewing *Phaps chalcoptera*	3	1	1		X	
Common Myna *Sturnus tristis*			1			X

Common name *Scientific name*	Site					
	WC01	WC02	W03	WR01	Opportunistic Vickery State Forest	Opportunistic
Common Starling *Sturnus vulgaris*			5			X
Crested Pigeon *Ocyphaps lophotes*	3			1		
Double-barred Finch *Taeniopygia bichenovii*			4		X	
Dusky Woodswallow *Artamus cyanopterus*					X	
Eastern Koel *Eudynamys orientalis*	1		1			
Eastern Rosella *Platycercus eximius*	4				X	
Eastern Yellow Robin *Eopsaltria australis*	1	1	1		X	
Fuscous Honeyeater *Lichenostomus fuscus*			5			
Galah *Eolophus roseicapillus*	7	1	2	2	X	
Grey Butcherbird *Cracticus torquatus*	2	1				
Grey Fantail *Rhipidura albiscapa*		1	1		X	
Grey Shrike-thrush *Colluricincla harmonica*		1				
Grey Teal *Anas gracilis*					X	
*Grey-crowned Babbler *Pomatostomus temporalis*	**10**	**5**				
Inland Thornbill *Acanthiza apicalis*		1	2			
Jacky Winter *Microeca fascinans*	1					
Laughing Kookaburra *Dacelo novaeguineae*					X	
Leaden Flycatcher *Myiagra rubecula*	1	1	1			
Masked Lapwing *Vanellus miles*						X
Masked Woodswallow *Artamus personatus*					X	

Common name *Scientific name*	Site					
	WC01	WC02	W03	WR01	Opportunistic Vickery State Forest	Opportunistic
Mistletoebird *Dicaeum hirundinaceum*	1		1			
Nankeen Kestrel *Falco cenchroides*				1		
Noisy Friarbird *Philemon corniculatus*		1			X	
Noisy Miner *Manorina melanocephala*	15		2		X	
Olive-backed Oriole *Oriolus sagittatus*			1			
Peaceful Dove *Geopelia striata*	1				X	
Pied Butcherbird *Cracticus nigrogularis*	2		1	1	X	
Pied Currawong *Strepera graculina*		1			X	
Red-rumped Parrot *Psephotus haematonotus*					X	
Restless Flycatcher *Myiagra inquieta*			1	1	X	
Rufous Whistler *Pachycephala rufiventris*	1	5	3		X	
Silvereye *Zosterops lateralis*	6	3	3			
Singing Honeyeater *Lichenostomus virescens*	1					
Southern Boobook *Ninox novaeseelandiae*		1				
*Speckled Warbler *Chthonicola sagittata*		**2**	**4**			
Spiny-cheeked Honeyeater *Acanthagenys rufogularis*	1	1	2			
Straw-necked Ibis *Threskiornis spinicollis*						X
Striated Pardalote *Pardalotus striatus*	2	1	1			
Striped Honeyeater *Plectorhyncha lanceolata*	2	1	2		X	
Sulphur-crested Cockatoo *Cacatua galerita*	1				X	X

Common name *Scientific name*	Site					
	WC01	WC02	W03	WR01	Opportunistic Vickery State Forest	Opportunistic
Superb Fairy-wren *Malurus cyaneus*	2	4	5			
*Turquoise Parrot *Neophema pulchella*					**X**	
Weebill *Smicrornis brevirostris*	4	4	6			
Welcome Swallow *Hirundo neoxena*						X
Western Gerygone *Gerygone fusca*		1	1			
White-browed Woodswallow *Artamus superciliosus*	6	10			X	
White-faced Heron *Egretta novaehollandiae*					X	
White-plumed Honeyeater *Lichenostomus penicillatus*	2	1	2		X	
White-throated Treecreeper *Cormobates leucophaea*		2	1			
White-winged Chough *Corcorax melanoramphos*	5		6		X	
White-winged Fairy-wren *Malurus leucopterus*				8		
White-winged Triller *Lalage sueurii*	1		2			
Willie Wagtail *Rhipidura leucophrys*	2	2			X	
Yellow Thornbill *Acanthiza nana*	4	4	4			
Yellow-faced Honeyeater *Lichenostomus chrysops*			1			
Yellow-rumped Thornbill *Acanthiza chrysorrhoa*	2		5		X	
Total species	38	32	36	9	35	8
Abundance	131	66	94	20	n/a	n/a

***** Indicates species listed as Vulnerable under the TSC Act.

Table G-2: Bird species recorded at Woodland fauna monitoring sites Autumn 2015

Common name *Scientific name*	Site					
	WC01	WC02	WC03	WR01	Opportunistic Vickery State Forest	Opportunistic
Apostlebird *Struthidea cinerea*					X	
Australasian Pipit *Anthus novaeseelandiae*				1		
Australian Magpie *Cracticus tibicen*	3	2		2	X	
Australian Owlet-nightjar *Aegotheles cristatus*		2				
Australian Raven *Corvus coronoides*	2		3	3	X	
Australian Ringneck *Barnardius zonarius*	3	2	2		X	
Australian Wood Duck *Chenonetta jubata*	5					
Bar-shouldered Dove *Geopelia humeralis*	1	2	2		X	
Black-faced Cuckoo-shrike *Coracina novaehollandiae*	1	1	2		X	
*Black Falcon *Falco subniger*				**1**		
*Brown Treecreeper *Climacteris picumnus*		**1**			**X**	
Chestnut-rumped Thornbill *Acanthiza uropygialis*			3			
Cockatiel *Nymphicus hollandicus*					X	X
Common Bronzewing *Phaps chalcoptera*	4	2			X	
Common Myna *Sturnus tristis*						X
Common Starling *Sturnus vulgaris*					X	
Crested Pigeon *Ocyphaps lophotes*	5		1		X	
Double-barred Finch *Taeniopygia bichenovii*	4		3	11	X	
Eastern Rosella *Platycercus eximius*	3	4	2		X	
Eastern Yellow Robin *Eopsaltria australis*	1	3	2		X	

Common name *Scientific name*	Site					
	WC01	WC02	WC03	WR01	Opportunistic Vickery State Forest	Opportunistic
Fork-tailed Swift *Apus pacificus*	5					
Galah *Eolophus roseicapillus*	6	3	4		X	
Golden Whistler *Pachycephala pectoralis*			1			
Grey Butcherbird *Cracticus torquatus*	2	2	2		X	
Grey Fantail *Rhipidura albiscapa*	1	1	3		X	
Grey Shrike-thrush *Colluricincla harmonica*		1			X	
*Grey-crowned Babbler *Pomatostomus temporalis*	**10**	**2**			**X**	
Inland Thornbill *Acanthiza apicalis*		1	1		X	
Jacky Winter *Microeca fascinans*			1			
Laughing Kookaburra *Dacelo novaeguineae*	1					
*Little Lorikeet *Glossopsitta pusilla*			**6**			
Magpie-lark *Grallina cyanoleuca*	1		2		X	
Mistletoebird *Dicaeum hirundinaceum*		2	1		X	
Musk Lorikeet *Glossopsitta concinna*	4					
Nankeen Kestrel *Falco cenchroides*	1			1		
Noisy Friarbird *Philemon corniculatus*			1		X	
Noisy Miner *Manorina melanocephala*	15		2		X	
Pacific Black Duck *Anas superciliosa*				2		
Pallid Cuckoo *Cacomantis pallidus*			1			
Peaceful Dove *Geopelia striata*	1				X	

Common name *Scientific name*	Site					
	WC01	WC02	WC03	WR01	Opportunistic Vickery State Forest	Opportunistic
Pied Butcherbird *Cracticus nigrogularis*	1		2	2	X	
Pied Currawong *Strepera graculina*		1			X	
Rainbow Bee-eater *Merops ornatus*			1			
Red-capped Robin *Petroica goodenovii*			2			
Red-rumped Parrot *Psephotus haematonotus*					X	
Red-winged Parrot *Aprosmictus erythropterus*			5			
Restless Flycatcher *Myiagra inquieta*			1			
Rufous Whistler *Pachycephala rufiventris*	1	3	2		X	
Silvereye *Zosterops lateralis*	5	10	30		X	
*Speckled Warbler *Chthonicola sagittata*	**1**		**4**			
Spiny-cheeked Honeyeater *Acanthagenys rufogularis*	1	2	1		X	
Striated Pardalote *Pardalotus striatus*	2	3	4		X	
Striped Honeyeater *Plectorhyncha lanceolata*	2	1	2		X	
Superb Fairy-wren *Malurus cyaneus*	2	2	4		X	
Tawny Frogmouth *Podargus strigoides*						X
Torresian Crow *Corvus orru*						X
Tree Martin *Petrochelidon nigricans*				20	X	
Weebill *Smicrornis brevirostris*	2	4	4		X	
Welcome Swallow *Hirundo neoxena*	2			6		
Western Gerygone *Gerygone fusca*	1		2			

Common name *Scientific name*	Site					
	WC01	WC02	WC03	WR01	Opportunistic Vickery State Forest	Opportunistic
White-faced Heron *Egretta novaehollandiae*					X	
White-plumed Honeyeater *Lichenostomus penicillatus*	3	2	5		X	
White-throated Treecreeper *Cormobates leucophaea*		2	1		X	
White-winged Chough *Corcorax melanoramphos*	6		11		X	
White-winged Fairy-wren *Malurus leucopterus*				9		
Willie Wagtail *Rhipidura leucophrys*	2	1	3	2	X	
Yellow Thornbill *Acanthiza nana*	3	2	6			
Yellow-faced Honeyeater *Lichenostomus chrysops*		1	1			
Yellow-rumped Thornbill *Acanthiza chrysorrhoa*	2		2		X	
Total species	38	29	42	12	42	4
Abundance	115	65	138	60	n/a	n/a

Table G-3: Terrestrial fauna species recorded at Woodland monitoring sites Spring 2014

Common name *Scientific name*	Site				
	WC01	WC02	WC03	WR01	Opportunistic Vickery State Forest
Mammals					
Common Brushtail Possum *Trichosurus vulpecula*	X				
Common Wallaroo *Macropus robustus*	X		X	X	X
Eastern Grey Kangaroo *Macropus giganteus*	X	X	X	X	X
Red-necked Wallaby *Macropus rufogriseus*			X		
Swamp Wallaby *Wallabia bicolor*	X				X
Total species	4	1	3	2	3
Amphibians					
Broad-palmed Frog *Litoria latopalmata*					X
Peron's Tree-Frog *Litoria peronii*					X
Red Tree-Frog *Litoria rubella*				X	
Total species	0	0	0	1	2
Reptiles					
Nobbi Dragon *Amphibolurus nobbi*	X				
Total species	1	0	0	0	0

Table G-4: Terrestrial fauna species recorded at Woodland monitoring sites Autumn 2015

Common name *Scientific name*	Site				
	WC01	WC02	WC03	WR01	Opportunistic Vickery State Forest
Mammals					
Common Brushtail Possum *Trichosurus vulpecula*	2				
Eastern Grey Kangaroo *Macropus giganteus*	X		5	4	X
Common Wallaroo *Macropus robustus*	X	X	X	X	X
Swamp Wallaby			X		X

Common name *Scientific name*	Site				
	WC01	WC02	WC03	WR01	Opportunistic Vickery State Forest
Wallabia bicolor					
Total species	3	1	3	2	3
Amphibians					
Peron's Tree-Frog *Litoria peronii*		1			
Spotted Grass-Frog *Limnodynastes tasmaniensis*	1		1	1	
Burns' Dragon *Amphibolurus burnsi*	1				
Total species	2	1	1	1	0

Table G-5: Pest species recorded at Woodland monitoring sites Spring 2014

Common name *Scientific name*	Site				
	WC01	WC02	WR01	WC03	Opportunistic Vickery State Forest
Hare *Lepus capensis*				X	X
Rabbit *Oryctolagus cuniculus*		X			
Fox *Vulpes vulpes*			X		
Feral Pig *Sus scrofa*					X
Total	0	1	1	1	2

Table G-6: Pest species recorded at Woodland monitoring sites Autumn 2015

Common name *Scientific name*	Site				
	WR01	WC01	WC02	WC03	Opportunistic Vickery State Forest
Hare *Lepus capensis*				1	X
Fox *Vulpes vulpes*					
Feral Pig *Sus scrofa*				X	X
Total species	0	0	0	2	2

Appendix H Soil Data

Table H-1: Soil test results for bulked samples from each monitoring site

Test Parameter	Method Description	Method Reference*	Units	Limit of Reporting	PC01	PC02	PR01	WC01	WC02	WC03	WR01
pH (1:5 in CaCl2)	Electrode	R&L4B2	pH units	na	5.96	5.81	7.73	4.93	6.00	5.50	7.26
Chloride Soluble	Electrode	R&L 5A2	mg/kg	5	14.8	11.3	27.0	9.6	8.3	18.4	11.3
Moisture	Air-Dry content	R&L 2A1	%	0.5	2.1	1.8	6.9	3.4	2.4	3.2	3.0
Electrical Conductivity	Electrode	R&L 3A1	dS/m	0.01	0.06	0.05	0.22	0.04	0.05	0.07	0.52
Total N (LECO)	LECO	R&L 7A5	mg/kg	10	1383	728	604	1207	865	1538	513
Extractable Nitrate-N	H20/UV-Vis	PMS-08	mg/kg	0.5	5.3	0.8	12.9	0.7	4.1	3.9	6.7
Total Phosphorus	HNO3/HCLO4 ICP	ICP-03	mg/kg	25	353	294	146	376	306	467	276
Organic Carbon (LECO)	LECO	R&L 6B3	%	0.1	1.77	0.90	0.79	1.89	1.45	2.89	0.63
Extractable Phosphorus (Colwell)	Bicarb/UV-Vis	R&L 9B1	mg/kg	5	8.4	6.6	7.7	14.0	13.4	5.8	20.7
Sulfate - S (KCl40)	KCl40/ICP	R&L 10D1	mg/kg	2	4.9	3.7	6.0	4.9	4.0	5.2	192
Extractable Copper	DTPA/ICP	R&L 12A1	mg/kg	0.25	1.26	1.05	0.71	1.07	0.35	0.91	0.93
Extractable Zinc	DTPA/ICP	R&L 12A1	mg/kg	0.25	1.38	0.91	0.49	1.59	1.49	2.79	1.46
Extractable Manganese	DTPA/ICP	R&L 12A1	mg/kg	5	187	203	35.3	149	242	112	114
Extractable Iron	DTPA/ICP	R&L 12A1	mg/kg	5	211	261	15.5	166	265	44.0	120
Exchangeable Potassium	NH4Cl/ICP	R&L 15A1	mg/kg	10	672	359	405	482	238	469	544
Exchangeable Calcium	NH4Cl/ICP	R&L 15A1	mg/kg	10	1423	1226	6312	1105	1241	1116	3145
Exchangeable Magnesium	NH4Cl/ICP	R&L 15A1	mg/kg	10	384	290	1186	368	137	313	492
Exchangeable Sodium	NH4Cl/ICP	R&L 15A1	mg/kg	10	56.2	99.6	402	59.1	21.0	29.1	77.5
Gravel > 2.36	Sieve/Hydro	ASTM D422	%	0.1	23.1	21.7	3.4	10.1	35.3	7.8	19.9

Test Parameter	Method Description	Method Reference*	Units	Limit of Reporting	PC01	PC02	PR01	WC01	WC02	WC03	WR01
Course Sand 0.3-2.36	Sieve/Hydro	ASTM D422	%	0.1	17.8	23.8	10.8	18.0	30.0	6.6	18.1
Fine Sand 0.02-0.3	Sieve/Hydro	ASTM D422	%	0.1	38.2	36.1	29.1	39.6	21.8	44.0	33.1
Silt 0.002-0.02	Sieve/Hydro	ASTM D422	%	0.1	6.2	6.3	10.1	12.3	4.0	19.5	6.5
Clay <0.002	Sieve/Hydro	ASTM D422	%	0.1	14.7	12.1	46.6	19.9	8.9	22.1	22.3
Water Retention	30cm tension	ASTM F1815-97	%	0.1	19.7	15.6	28.3	21.7	22.4	29.1	23.5
Exchangeable Potassium %	Calculation	R&L 15J1	%	na	14.0	9.3	2.35	12.3	7.58	12.6	6.47
Exchangeable Calcium %	Calculation	R&L 15J1	%	na	57.9	61.9	71.4	54.8	77.1	58.6	72.9
Exchangeable Magnesium %	Calculation	R&L 15J1	%	na	26.1	24.4	22.3	30.4	14.2	27.4	19.0
Exchangeable Sodium %	Calculation	R&L 15J1	%	na	1.99	4.37	3.95	2.55	1.13	1.33	1.56
Exchangeable Potassium	Calculation	R&L 15J1	Cmol/kg	na	1.72	0.92	1.04	1.24	0.61	1.20	1.39
Exchangeable Calcium	Calculation	R&L 15J1	Cmol/kg	na	7.12	6.13	31.6	5.53	6.21	5.58	15.7
Exchangeable Magnesium	Calculation	R&L 15J1	Cmol/kg	na	3.20	2.42	9.88	3.07	1.14	2.61	4.10
Exchangeable Sodium	Calculation	R&L 15J1	Cmol/kg	na	0.24	0.43	1.75	0.26	0.09	0.13	0.34
ECEC	Calculation	R&L 15J1	Cmol/kg	na	12.3	9.90	44.2	10.1	8.05	9.52	21.6
Ca/Mg Ratio	Calculation	R&L 15J1	Cmol/kg	na	2.22	2.54	3.19	1.80	5.44	2.14	3.84
Dispersion Index	Field	Loveday-Pyle	Class	na	4	6	2	4	2	3	0

* East West Enviroag Pty Ltd 2014. *Chemical and physical soil test methods.*

Appendix I Erosion Data

Table I-1: Location of erosion transects at Woodland plots

Transect	Site							
	WC01		WC02		WC03		WR01	
	Easting	Northing	Easting	Northing	Easting	Northing	Easting	Northing
Start	238509	6594959	236293	6595299	237911	6594985	238243	6593236
End	238543	6594925	236308	6595348	237872	6595014	238239	6593187
Orientation	SE		N		NNW		S	

Table I-2: Recorded erosion at Woodland plots

Site	Easting	Northing	Erosion Pin	Dimensions (cm)
WC02	236293	6595305	Y	800
	236308	6595336	Y	1000
WR01	238245	6593226	Y	30
	238242	6593209	Y	50
	238239	6593188	Y	40

Table I-3: Erosion pin measurements from top of pin to ground (mm)

Points	Site			
	WC01	WC02	WC03	WR01
1	230	270	270	190
2	230	250	275	210
3	210	260	265	205
4	230	210	240	185
5	220	250	250	200
6	240	270	245	185
7	220	250	240	210
8	215	250	220	220
9	210	260	200	195
10	220	230	280	180
11	-	250	-	200
12	-	230	-	210
13	-	-	-	180

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SHOT NO	DATE	MONITOR LOCATION	PEAK GROUND PRESSURE mm/s	PEAK OVERPRESSURE dBL	TIME
1	14/Aug/08	Costa Vale	DNT	DNT	DNT
1	14/Aug/08	Brolga	DNT	DNT	DNT
1	14/Aug/08	Surrey	DNT	DNT	DNT
2	22/Aug/08	Costa Vale	DNT	DNT	DNT
2	22/Aug/08	Roadside	0.66	102.1	13:48:38
3	03/Sep/08	Costa Vale	0.10	110.2	9:08:16
3	03/Sep/08	Roadside	0.58	110.7	9:07:58
4	11/Sep/08	Costa Vale	DNT	DNT	DNT
4	11/Sep/08	Brolga	DNT	DNT	DNT
4	11/Sep/08	Surrey	DNT	DNT	DNT
5 (block 3)	25/Sep/08	Costa Vale	DNT	DNT	DNT
5 (block 3)	25/Sep/08	Brolga	DNT	DNT	DNT
5 (block 3)	25/Sep/08	Surrey	DNT	DNT	DNT
5 (block 4b)	26/Sep/08	Costa Vale	DNT	DNT	DNT
5 (block 4b)	26/Sep/08	Brolga	DNT	DNT	DNT
5 (block 4b)	26/Sep/08	Surrey	DNT	DNT	DNT
6	02/Oct/08	Costa Vale	0.65	102.3	12:08:53
6	02/Oct/08	Roseberry	0.66	102.1	12:08:38
7	21/Oct/08	Costa Vale	0.35	110.5	12:37:23
7	21/Oct/08	Roseberry	0.86	107.5	12:37:48
7	21/Oct/08	Roadside	0.86	107.5	12:37:48
8	31/Oct/08	Costa Vale	DNT	DNT	DNT
8	31/Oct/08	Surrey	DNT	DNT	DNT
8	31/Oct/08	Roseberry	DNT	DNT	DNT
9	28/Nov/08	Costa Vale	0.36	105.5	12:14:57
9	28/Nov/08	Surrey	DNT	DNT	DNT
9	28/Nov/08	Roseberry	1.04	103.2	12:14:04
10	12/Dec/08	Costa Vale	1.46	115	10:06:25
10	12/Dec/08	Roseberry	1.50	114.9	10:06:14
12	30/Jan/09	Roseberry	1.48	114.8	9:14:12
12	30/Jan/09	Costa Vale	1.46	114.9	9:14:25
13	10/Feb/09	Costa Vale	0.53	111.2	12:29:19
13	10/Feb/09	Roseberry	DNT	DNT	DNT
14	25/Feb/09	Costa Vale	0.51	107.2	12:13:59
14	25/Feb/09	Roseberry	0.33	102.2	12:14:15
15	27/Feb/09	Costa Vale	0.36	114.9	10:58:03
15	27/Feb/09	Roseberry	DNT	DNT	DNT
16	12/Mar/09	Costa Vale	0.56	113.2	12:10:42
16	12/Mar/09	Roseberry	1.22	114.6	12:10:26
17	25/Mar/09	Costa Vale	0.40	108.2	12:59:41
17	25/Mar/09	Roseberry	0.13	111.7	13:00:06
18	08/Apr/09	Costa Vale	0.71	107.2	12:05:38
18	08/Apr/09	Roseberry	0.30	114.8	12:05:55
19	24/Apr/09	Costa Vale	Monitors not set		
19	24/Apr/09	Roseberry	Monitors not set		
20	08/May/09	Costa Vale	0.43	103.3	11:59:57
20	08/May/09	Roseberry	DNT	DNT	DNT
21	25/May/09	Costa Vale	0.76	109.1	15:13:22
21	25/May/09	Roseberry	0.46	111.5	15:15:04
22	01/Jun/09	Costa Vale	0.48	87.4	12:03:17
22	01/Jun/09	Roseberry	DNT	DNT	DNT
23	04/Jun/09	Costa Vale	DNT	DNT	DNT
23	04/Jun/09	Roseberry	DNT	DNT	DNT
24	16/Jun/09	Costa Vale	DNT	DNT	DNT
24	16/Jun/09	Roseberry	DNT	DNT	DNT
25	26/Jun/09	Costa Vale	0.43	107.2	14:52:49
25	26/Jun/09	Roseberry	0.43	104.6	15:53:04
25	26/Jun/09	Brolga	0.71	104.5	14:52:34
26	07/Jul/09	Costa Vale	0.68	106.7	12:10:16
26	07/Jul/09	Roseberry	DNT	DNT	DNT
26	07/Jul/09	Brolga	DNT	DNT	DNT
27	27/Jul/09	Costa Vale	0.78	103.7	12:07:24
27	27/Jul/09	Roseberry	0.47	100.2	12:07:18
27	27/Jul/09	Brolga	DNT	DNT	DNT
28	06/Aug/09	Costa Vale	0.56	113.2	12:43:42
28	06/Aug/09	Roseberry	0.99	109.2	12:43:08
28	06/Aug/09	Brolga	DNT	DNT	DNT
29	24/Aug/09	Costa Vale	0.41	119.9	11:41:53
29	24/Aug/09	Roseberry	DNT	DNT	DNT

SHOT NO	DATE	MONITOR LOCATION	PEAK GROUND PRESSURE mm/s	PEAK OVERPRESSURE dBL	TIME
30	27/Aug/09	Costa Vale	0.38	116.9	12:02:45
30	27/Aug/09	Roseberry	DNT	DNT	DNT
31	16/Sep/09	Costa Vale	0.53	101.9	12:27:48
31	16/Sep/09	Roseberry	0.76	100	12:27:52
32	17/Sep/09	Costa Vale	0.43	99.3	12:09:22
32	17/Sep/09	Roseberry	DNT	DNT	DNT
33	08/Oct/09	Costa Vale	1.39	108.8	11:03:10
33	08/Oct/09	Roseberry	0.43	110.5	11:03:07
33	08/Oct/09	Brolga	0.25	109.7	11:02:50
34	23/Oct/09	Costa Vale	DNT	DNT	DNT
34	23/Oct/09	Roseberry	DNT	DNT	DNT
35	06/Nov/09	Costa Vale	DNT	DNT	DNT
35	06/Nov/09	Roseberry	DNT	DNT	DNT
36	19/Nov/09	Costa Vale	0.84	104	11:57:29
36	19/Nov/09	Roseberry	DNT	DNT	DNT
37	30/Nov/09	Costa Vale	0.68	103.6	12:21:03
37	30/Nov/09	Roseberry	0.69	106.9	12:21:09
38	16/Dec/09	Costa Vale	0.65	102.3	12:08:53
38	16/Dec/09	Roseberry	0.66	102.1	12:08:38
39	21/Jan/10	Costa Vale	0.58	110.2	13:00:56
39	21/Jan/10	Roseberry	DNT	DNT	DNT
40	28/Jan/10	Costa Vale	0.74	100.9	12:01:59
40	28/Oct/10	Roseberry	DNT	DNT	DNT
41	05/Feb/10	Costa Vale	DNT	DNT	DNT
41	05/Feb/10	Roseberry	0.13	111.2	11:09:02
42	02/Mar/10	Costa Vale	0.96	108.6	12:18:47
42	02/Mar/10	Roseberry	DNT	DNT	DNT
43	05/Mar/10	Costa Vale	0.84	104.3	10:33:29
43	05/Mar/10	Roseberry	0.13	113.5	10:33:59
44	16/Mar/10	Costa Vale	DNT	DNT	DNT
44	16/Mar/10	Roseberry	DNT	DNT	DNT
45	30/Mar/10	Costa Vale	0.13	109.4	12:16:37
45	30/Mar/10	Roseberry	DNT	DNT	DNT
46	24/Mar/10	Costa Vale	0.81	111.9	12:03:47
46	24/Mar/10	Roseberry	DNT	DNT	DNT
47	19/Apr/10	Costa Vale	DNT	DNT	DNT
47	19/Apr/10	Roseberry	DNT	DNT	DNT
48	28/Apr/10	Costa Vale	0.61	110.7	12:06:05
48	28/Apr/10	Roseberry	DNT	DNT	DNT
49	14/May/10	Costa Vale	DNT	DNT	DNT
49	14/May/10	Roseberry	DNT	DNT	DNT
50	25/May/10	Costa Vale	0.89	108.2	12:08:57
50	25/May/10	Roseberry	0.13	111.3	12:08:28
51	25/Jun/10	Costa Vale	0.99	104.2	10:13:36
51	25/Jun/10	Roseberry	DNT	DNT	DNT
52	09/Jul/10	Costa Vale	DNT	DNT	DNT
52	09/Jul/10	Roseberry	DNT	DNT	DNT
53	06/Aug/10	Costa Vale	0.42	104.4	9:59:28
53	06/Aug/10	Roseberry	DNT	DNT	DNT
54	26/Aug/10	Costa Vale	DNT	DNT	DNT
54	26/Aug/10	Roseberry	DNT	DNT	DNT
55	14/Sep/10	Costa Vale	DNT	DNT	DNT
55	14/Sep/10	Roseberry	DNT	DNT	DNT
56	23/Sep/10	Costa Vale	0.55	101.4	12:44:05
56	23/Sep/10	Roseberry	DNT	DNT	DNT
57	29/Sep/10	Costa Vale	0.46	103.2	10:03:18
57	29/Sep/10	Roseberry	DNT	DNT	DNT
58	14/Oct/10	Costa Vale	0.43	98.5	10:04:39
58	14/Oct/10	Roseberry	0.31	107.7	10:04:51
59	28/Oct/10	Costa Vale	DNT	DNT	DNT
59	28/Oct/10	Roseberry	DNT	DNT	DNT
60	28/Oct/10	Costa Vale	DNT	DNT	DNT
60	28/Oct/10	Roseberry	DNT	DNT	DNT
61	01/Nov/10	Costa Vale	DNT	DNT	DNT
61	01/Nov/10	Roseberry	DNT	DNT	DNT
62	11/Nov/10	Costa Vale	DNT	DNT	DNT
62	11/Nov/10	Roseberry	DNT	DNT	DNT
63	06/Dec/10	Costa Vale	0.70	88.7	12:04:48
63	06/Dec/10	Roseberry	0.36	92.8	12:04:32
64	21/Dec/10	Costa Vale	DNT	DNT	DNT
64	21/Dec/10	Roseberry	DNT	DNT	DNT

SHOT NO	DATE	MONITOR LOCATION	PEAK GROUND PRESSURE mm/s	PEAK OVERPRESSURE dBL	TIME
65	30/Dec/10	Costa Vale	DNT	DNT	DNT
65	30/Dec/10	Roseberry	DNT	DNT	DNT
66	15/Jan/11	Costa Vale	DNT	DNT	DNT
66	15/Jan/11	Roseberry	DNT	DNT	DNT
67	27/Jan/11	Costa Vale	0.27	107.2	12:06:52
67	27/Jan/11	Roseberry	DNT	DNT	DNT
68	10/Mar/11	Costa Vale	DNT	DNT	DNT
68	10/Mar/11	Roseberry	DNT	DNT	DNT
69	18/Mar/11	Costa Vale	DNT	DNT	DNT
69	18/Mar/11	Roseberry	DNT	DNT	DNT
70	25/Mar/11	Costa Vale	0.55	100.7	12:07:44
70	25/Mar/11	Roseberry	0.39	103.5	12:08:32
71	01/Apr/11	Costa Vale	DNT	DNT	DNT
71	01/Apr/11	Roseberry	0.39	101.4	10:09:27
72	12/Apr/11	Costa Vale	DNT	DNT	DNT
72	12/Apr/11	Roseberry	DNT	DNT	DNT
73	16/Apr/11	Costa Vale	0.14	113.4	10:09:01
73	16/Apr/11	Roseberry	0.47	109.3	10:09:15
74	13/May/11	Costa Vale	DNT	DNT	DNT
74	13/May/11	Roseberry	DNT	DNT	DNT
75	27/May/11	Costa Vale	0.43	102.4	10:13:05
75	27/May/11	Roseberry	DNT	DNT	DNT
76	03/Jun/11	Costa Vale	DNT	DNT	DNT
76	03/Jun/11	Roseberry	DNT	DNT	DNT
77	08/Jun/11	Costa Vale	DNT	DNT	DNT
77	08/Jun/11	Roseberry	DNT	DNT	DNT
78	22/Jun/11	Costa Vale	0.42	87.0	16:08:53
78	22/Jun/11	Roseberry	0.39	83.7	16:11:24
79	07/Jul/11	Costa Vale	DNT	DNT	DNT
79	07/Jul/11	Roseberry	DNT	DNT	DNT
80	21/Jul/11	Costa Vale	0.46	103.3	12:16:26
80	21/Jul/11	Roseberry	DNT	DNT	DNT
81	26/Jul/11	Costa Vale	DNT	DNT	DNT
81	26/Jul/11	Roseberry	0.58	101.9	14:10:57
82	28/Jul/11	Costa Vale	DNT	DNT	DNT
82	28/Jul/11	Roseberry	DNT	DNT	DNT
83	04/Aug/11	Costa Vale	DNT	DNT	DNT
83	04/Aug/11	Roseberry	0.41	104.3	10:22:42
84	15/Aug/11	Costa Vale	DNT	DNT	DNT
84	15/Aug/11	Roseberry	DNT	DNT	DNT
85	24/Aug/11	Costa Vale	DNT	DNT	DNT
85	24/Aug/11	Roseberry	DNT	DNT	DNT
86	02/Sep/11	Costa Vale	0.43	91.7	12:08:33
86	02/Sep/11	Roseberry	DNT	DNT	DNT
87	16/Sep/11	Costa Vale	DNT	DNT	DNT
87	16/Sep/11	Roseberry	DNT	DNT	DNT
88	14/Oct/11	Costa Vale	DNT	DNT	12:06:00
88	14/Oct/11	Roseberry	DNT	DNT	12:06:00
89	03/Nov/11	Costa Vale	DNT	DNT	12:12:00
89	03/Nov/11	Roseberry	DNT	DNT	12:12:00
90	04/Nov/11	Costa Vale	DNT	DNT	12:02:00
90	04/Nov/11	Roseberry	DNT	DNT	12:02:00
91	03/Dec/11	Costa Vale	DNT	DNT	DNT
91	03/Dec/11	Roseberry	DNT	DNT	DNT
92	22/Dec/11	Costa Vale	0.46	114.9	12:02:43
92	22/Dec/11	Roseberry	0.64	109	12:02:01
93	23/Dec/11	Costa Vale	Monitor malfunction	Monitor malfunction	10:59:00
93	23/Dec/11	Roseberry	0.36	101	10:59:02
94	17/Jan/12	Costa Vale	0.32	107.3	12:06:30
94	17/Jan/12	Roseberry	DNT	DNT	12:06:00
95	20/Jan/12	Costa Vale	0.47	106.5	12:03:11
95	20/Jan/12	Roseberry	0.47	99.2	12:03:09
96	18/Feb/12	Costa Vale	DNT	DNT	DNT
96	18/Feb/12	Roseberry	DNT	DNT	DNT
97	06/Mar/12	Costa Vale	0.52	108.5	11:57:09
97	06/Mar/12	Roseberry	0.48	103	11:57:10
98	15/Mar/12	Costa Vale	DNT	DNT	DNT
98	15/Mar/12	Roseberry	0.47	105.6	12:09:23
99	30/Mar/12	Costa Vale	0.41	92.6	12:09:00
99	30/Mar/12	Roseberry	DNT	DNT	DNT
100	27/Apr/12	Costa Vale	DNT	DNT	DNT

SHOT NO	*DATE*	*MONITOR LOCATION*	*PEAK GROUND PRESSURE mm/s*	*PEAK OVERPRESSURE dBL*	*TIME*
100	27/Apr/12	Roseberry	1.12	84.2	13:19:17
101	14/May/12	Costa Vale	0.77	113.6	12:50:15
101	14/May/12	Roseberry	DNT	DNT	12:50:00
102	30/May/12	Roseberry	0.44	96.7	12:07:49
102	30/May/12	Costa Vale	0.36	99.9	12:09:12
103	19/Jun/12	Costa Vale	0.50	104.2	12:06:08
103	19/Jun/12	Roseberry	0.17	99.7	12:05:20
104	06/Jul/12	Costa Vale	DNT	DNT	12:00:00
104	06/Jul/12	Roseberry	DNT	DNT	12:00:00
105	31/Jul/12	Costa Vale	0.37	107.3	12:20:02
105	31/Jul/12	Roseberry	DNT	DNT	12:20:00
106	10/Aug/12	Roseberry	DNT	DNT	12:11:00
106	10/Aug/12	Costa Vale	DNT	DNT	12:11:00
107	22/Aug/12	Roseberry	DNT	DNT	12:11:00
107	22/Aug/12	Retreat	DNT	DNT	12:11:00
108	07/Sep/12	Roseberry	DNT	DNT	11:51:00
108	07/Sep/12	Retreat	DNT	DNT	11:51:00
109	14/Sep/12	Roseberry	DNT	DNT	11:48:00
109	14/Sep/12	Retreat	DNT	DNT	11:48:00
110	25/Sep/12	Roseberry	DNT	DNT	12:04:00
110	25/Sep/12	Retreat	DNT	DNT	12:04:00
111	10/Oct/12	Roseberry	0.35	102	12:02:00
111	10/Oct/12	Retreat	0.24	97.5	12:02:00
112	17/Oct/12	Roseberry	DNT	DNT	12:27:00
112	17/Oct/12	Retreat	0.26	99	12:27:00
113	22/Oct/12	Roseberry	0.26	113	12:08:00
113	22/Oct/12	Retreat	0.27	102	12:08:00
114	23/Oct/12	Roseberry	DNT	DNT	12:00:00
114	23/Oct/12	Retreat	DNT	DNT	12:00:00
115	29/Oct/12	Roseberry	DNT	DNT	12:07:00
115	29/Oct/12	Retreat	DNT	DNT	12:07:00
116	30/Oct/12	Roseberry	DNT	DNT	12:42:00
116	30/Oct/12	Retreat	DNT	DNT	12:42:00
117	01/Nov/12	Roseberry	DNT	DNT	12:19:00
117	01/Nov/12	Retreat	0.25	106	12:19:00
118	05/Nov/12	Roseberry	NOT FIRED	NOT FIRED	
118	05/Nov/12	Retreat	NOT FIRED	NOT FIRED	
119	14/Nov/12	Roseberry	0.26	DNT	12:00:00
119	14/Nov/12	Retreat	0.26	110	12:00:00
120	16/Nov/12	Roseberry	DNT	DNT	12:28:00
120	16/Nov/12	Retreat	DNT	DNT	12:28:00
121	28/Nov/12	Roseberry	0.65	107	12:05:00
121	28/Nov/12	Retreat	0.26	99.5	12:05:00
122	30/Nov/12	Roseberry	DNT	DNT	12:10:00
122	30/Nov/12	Retreat	DNT	DNT	12:10:00
123	06/Dec/12	Roseberry	0.20	101	11:05:00
123	06/Dec/12	Retreat	0.16	98	11:05:00
124	11/Dec/12	Roseberry	DNT	DNT	11:59:00
124	11/Dec/12	Retreat	DNT	DNT	11:59:00
125	12/Dec/12	Roseberry	DNT	DNT	13:00:00
125	12/Dec/12	Retreat	DNT	DNT	13:00:00
126	14/Dec/12	Roseberry	DNT	DNT	12:00:00
126	14/Dec/12	Retreat	DNT	DNT	12:00:00
127	20/Dec/12	Roseberry	0.13	104	12:00:00
127	20/Dec/12	Retreat	0.12	99	12:00:00
128	03/Jan/13	Retreat	0.18	102	12:03:00
128	03/Jan/13	Roseberry	0.20	113.7	12:03:00
129	08/Jan/13	Roseberry	0.22	97.5	12:03:00
129	08/Jan/13	Retreat	0.10	97	12:03:00
129	08/Jan/13	Surrey	0.13	98.94	12:03:00
130	11/Jan/13	Retreat	0.11	97	12:03:00
130	11/Jan/13	Roseberry	DNT	DNT	12:03:00
130	11/Jan/13	Surrey	DNT	DNT	12:03:00
131	18/Jan/13	Roseberry	DNT	DNT	11:53:00
131	18/Jan/13	Surrey	DNT	DNT	11:53:00
131	18/Jan/13	Retreat	DNT	DNT	11:53:00
132	22/Jan/13	Roseberry	0.30	95.94	11:58:00
132	22/Jan/13	Surrey	DNT	DNT	11:58:00
132	22/Jan/13	Retreat	DNT	DNT	11:58:00
133	25/Jan/13	Roseberry	0.22	99.07	12:07:00
133	25/Jan/13	Surrey	DNT	DNT	12:07:00

SHOT NO	DATE	MONITOR LOCATION	PEAK GROUND PRESSURE mm/s	PEAK OVERPRESSURE dBL	TIME
133	25/Jan/13	Retreat	DNT	DNT	12:07:00
134	31/Jan/13	Roseberry	DNT	DNT	11:55:00
134	31/Jan/13	Surrey	DNT	DNT	11:55:00
134	31/Jan/13	Retreat	DNT	DNT	11:55:00
135	06/Feb/13	Roseberry	DNT	DNT	12:05:00
135	06/Feb/13	Surrey	DNT	DNT	12:05:00
135	06/Feb/13	Retreat	DNT	DNT	12:05:00
136	07/Feb/13	Roseberry	DNT	DNT	12:05:00
136	07/Feb/13	Surrey	DNT	DNT	12:05:00
136	07/Feb/13	Retreat	DNT	DNT	12:05:00
137	13/Feb/13	Roseberry	DNT	DNT	13:33:00
137	13/Feb/13	Surrey	0.11	97.45	13:33:00
137	13/Feb/13	Retreat	DNT	DNT	13:33:00
138	15/Feb/13	Roseberry	DNT	DNT	12:00:00
138	15/Feb/13	Surrey	DNT	DNT	12:00:00
138	15/Feb/13	Retreat	DNT	DNT	12:00:00
139	21/Feb/13	Roseberry	0.08	111.2	11:58:00
139	21/Feb/13	Surrey	1.64	102.4	11:58:00
139	21/Feb/13	Retreat	DNT	DNT	11:58:00
140	22/Feb/13	Roseberry	DNT	DNT	12:04:00
140	22/Feb/13	Surrey	DNT	DNT	12:04:00
140	22/Feb/13	Retreat	DNT	DNT	12:04:00
141	11/Mar/13	Roseberry	DNT	DNT	12:19:00
141	11/Mar/13	Surrey	0.16	101.1	12:19:00
141	11/Mar/13	Retreat	DNT	DNT	12:19:00
142	21/Mar/13	Roseberry	0.07	118.9	12:19:00
142	21/Mar/13	Surrey	0.19	117.1	12:19:00
142	21/Mar/13	Retreat	0.24	95.9	12:19:00
143	26/Mar/13	Roseberry	0.37	104.6	11:57:00
143	26/Mar/13	Surrey	DNT	DNT	11:57:00
143	26/Mar/13	Retreat	0.23	96.93	11:57:00
144	28/Mar/13	Roseberry	DNT	DNT	12:04:00
144	28/Mar/13	Surrey	0.06	111.3	12:19:00
144	28/Mar/13	Retreat	DNT	DNT	12:19:00
145	04/Apr/13	Roseberry	DNT	DNT	11:53:00
145	04/Apr/13	Surrey	DNT	DNT	11:53:00
145	04/Apr/13	Retreat	DNT	DNT	11:53:00
146	09/Apr/13	Roseberry	DNT	DNT	11:58:00
146	09/Apr/13	Surrey	DNT	DNT	11:58:00
146	09/Apr/13	Retreat	DNT	DNT	11:58:00
147	15/Apr/13	Roseberry	0.17	107.3	10:38:00
147	15/Apr/13	Surrey	DNT	DNT	10:38:00
147	15/Apr/13	Retreat	DNT	DNT	10:38:00
148	22/Apr/13	Roseberry	0.25	97.9	12:42:00
148	22/Apr/13	Surrey	DNT	DNT	12:42:00
148	22/Apr/13	Retreat	0.20	94.06	12:42:00
149	06/May/13	Roseberry	DNT	DNT	12:05:00
149	06/May/13	Surrey	DNT	DNT	12:05:00
149	06/May/13	Retreat	DNT	DNT	12:05:00
150	23/May/13	Roseberry	0.45	98.9	12:05:00
150	23/May/13	Surrey	DNT	DNT	12:05:00
150	23/May/13	Retreat	DNT	DNT	12:05:00
151	30/May/13	Roseberry	DNT	DNT	12:20:00
151	30/May/13	Surrey	DNT	DNT	12:20:00
151	30/May/13	Retreat	DNT	DNT	12:20:00
152	12/Jun/13	Roseberry	DNT	DNT	14:54:00
152	12/Jun/13	Retreat	DNT	DNT	14:54:00
153	14/Jun/13	Roseberry	DNT	DNT	11:05:00
153	14/Jun/13	Surrey	DNT	DNT	11:05:00
153	14/Jun/13	Retreat	0.16	95.1	11:05:00
154	27/Jun/13	Roseberry	DNT	DNT	12:29:00
154	27/Jun/13	Surrey	DNT	DNT	12:29:00
154	27/Jun/13	Retreat	DNT	DNT	12:29:00
155	05/Jul/13	Roseberry	DNT	DNT	12:11:00
155	05/Jul/13	Surrey	0.39	103.9	12:11:00
155	05/Jul/13	Retreat	0.26	104.5	12:11:00
156	15/Jul/13	Roseberry	0.24	90.1	12:06:00
156	15/Jul/13	Surrey	DNT	DNT	12:06:00
156	15/Jul/13	Retreat	0.39	85.8	12:06:00
157	05/Aug/13	Roseberry	DNT	DNT	12:26:00
157	05/Aug/13	Surrey	DNT	DNT	12:26:00

SHOT NO	DATE	MONITOR LOCATION	PEAK GROUND PRESSURE mm/s	PEAK OVERPRESSURE dBL	TIME
157	05/Aug/13	Retreat	DNT	DNT	12:26:00
158	06/Aug/13	Roseberry	0.33	109.8	12:23:00
158	06/Aug/13	Surrey	0.26	110.6	12:23:00
158	06/Aug/13	Retreat	0.21	94.1	12:23:00
159	07/Aug/13	Roseberry	DNT	DNT	11:57:00
159	07/Aug/13	Surrey	DNT	DNT	11:57:00
159	07/Aug/13	Retreat	DNT	DNT	11:57:00
160	12/Aug/13	Roseberry	DNT	DNT	12:03:00
160	12/Aug/13	Surrey	DNT	DNT	12:03:00
160	12/Aug/13	Retreat	DNT	DNT	12:03:00
161	14/Aug/13	Roseberry	DNT	DNT	11:57:00
161	14/Aug/13	Surrey	DNT	DNT	11:57:00
161	14/Aug/13	Retreat	DNT	DNT	11:57:00
162	21/Aug/13	Roseberry	DNT	DNT	11:59:00
162	21/Aug/13	Surrey	DNT	DNT	11:59:00
162	21/Aug/13	Retreat	DNT	DNT	11:59:00
163	29/Aug/13	Roseberry	0.26	96.9	12:06:00
163	29/Aug/13	Surrey	DNT	DNT	12:06:00
163	29/Aug/13	Retreat	DNT	DNT	12:06:00
164	04/Sep/13	Roseberry	0.18	100.1	11:52:00
164	04/Sep/13	Surrey	DNT	DNT	11:52:00
164	04/Sep/13	Retreat	DNT	DNT	11:52:00
165	11/Sep/13	Roseberry	DNT	DNT	13:58:00
165	11/Sep/13	Surrey	DNT	DNT	13:58:00
165	11/Sep/13	Retreat	DNT	DNT	13:58:00
166	20/Sep/13	Roseberry	DNT	DNT	12:10:00
166	20/Sep/13	Surrey	DNT	DNT	12:10:00
166	20/Sep/13	Retreat	DNT	DNT	12:10:00
167	02/Oct/13	Roseberry	0.69	104	11:54:00
167	02/Oct/13	Surrey	0.50	108.1	11:54:00
167	02/Oct/13	Retreat	0.43	95.2	11:54:00
168	04/Oct/13	Roseberry	DNT	DNT	12:08:00
168	04/Oct/13	Surrey	DNT	DNT	12:08:00
168	04/Oct/13	Retreat	DNT	DNT	12:08:00
169	18/Oct/13	Roseberry	0.47	104.3	11:58:00
169	18/Oct/13	Surrey	0.27	104.1	11:58:00
169	18/101/13	Retreat	DNT	DNT	11:58:00
170	25/Oct/13	Roseberry	DNT	DNT	14:04:00
170	25/Oct/13	Surrey	DNT	DNT	14:04:00
170	25/Oct/13	Retreat	DNT	DNT	14:04:00
171	30/Oct/13	Roseberry	0.21	102.1	12:09:00
171	30/Oct/13	Surrey	DNT	DNT	12:09:00
171	30/Oct/13	Retreat	DNT	DNT	12:09:00
172	14/Nov/13	Roseberry	0.21	105	12:04:00
172	14/Nov/13	Surrey	DNT	DNT	12:04:00
172	14/Nov/13	Retreat	DNT	DNT	12:04:00
173	19/Nov/13	Roseberry	0.34	101.2	11:57:00
173	19/Nov/13	Surrey	DNT	DNT	11:57:00
173	19/Nov/13	Retreat	DNT	DNT	11:57:00
174	21/Nov/13	Roseberry	DNT	DNT	12:08:00
174	21/Nov/13	Surrey	DNT	DNT	12:08:00
174	21/Nov/13	Retreat	DNT	DNT	12:08:00
175	26/Nov/13	Roseberry	0.34	93.6	12:01:00
175	26/Nov/13	Surrey	DNT	DNT	12:01:00
175	26/Nov/13	Retreat	0.26	101.6	12:01:00
176	11/Dec/13	Roseberry	0.33	101.5	12:05:00
176	11/Dec/13	Retreat	0.17	97.4	12:05:00
177	19/Dec/13	Roseberry	0.24	94.5	12:09:00
177	19/Dec/13	Retreat	0.22	105.6	12:09:00
178	31/Dec/13	Roseberry	0.45	99.5	10:07:00
178	31/Dec/13	Retreat	0.25	98.4	10:07:00
179	21/Jan/14	Roseberry	0.49	100.1	13:00:00
179	21/Jan/14	Retreat	0.22	100.9	13:00:00
180	04/Mar/14	Roseberry	0.93	105.1	12:11:00
180	04/Mar/14	Retreat	0.35	97.7	12:11:00
181	13/Mar/14	Roseberry	0.18	100	12:00:00
181	13/Mar/14	Retreat	0.09	100.8	12:00:00
182	21/Mar/14	Roseberry	0.15	97.5	10:38:39
182	21/Mar/14	Retreat	0.09	98.7	10:38:39
183	10/Apr/14	Roseberry	0.20	114.1	13:06:04
183	10/Apr/14	Retreat	0.09	96.6	13:06:04

SHOT NO	*DATE*	*MONITOR LOCATION*	*PEAK GROUND PRESSURE mm/s*	*PEAK OVERPRESSURE dBL*	*TIME*
184	02/May/14	Roseberry	0.37	100.6	11:35:58
184	02/May/14	Retreat	0.29	96.1	11:35:58
185	12/May/14	Roseberry	0.26	108	11:59:44
185	12/May/14	Retreat	0.14	99.5	11:59:44
186	26/May/14	Roseberry	0.43	96.6	13:12:14
186	26/May/14	Retreat	0.19	95.4	13:12:14
187	16/Jun/14	Roseberry	0.84	104.4	12:04:28
187	16/Jun/14	Retreat	0.38	106.1	12:04:28
188	19/Jun/14	Roseberry	0.17	112	12:00:18
188	19/Jun/14	Retreat	0.06	93.2	12:00:18
189	02/Jul/14	Roseberry	0.19	107.6	11:55:07
189	02/Jul/14	Retreat	0.07	97.8	11:55:07
190	08/Jul/14	Roseberry	0.60	99.5	11:49:46
190	08/Jul/14	Retreat	0.28	94.7	11:49:46
191	31/Jul/14	Roseberry	0.16	102.4	15:58:26
191	31/Jul/14	Retreat	0.07	103.9	15:58:26
192	06/Aug/14	Roseberry	0.29	95.6	11:47:40
192	06/Aug/14	Retreat	0.23	92.2	11:47:40
193	13/Aug/14	Roseberry	0.23	97.7	13:55:07
193	13/Aug/14	Retreat	0.07	93.5	13:55:07
194	20/Aug/14	Roseberry	0.11	99.2	11:59:47
194	20/Aug/14	Retreat	0.06	92.5	11:59:47
195	22/Aug/14	Roseberry	0.71	99.4	13:00:38
195	22/Aug/14	Retreat	0.35	97.1	13:00:38
196	29/Aug/14	Roseberry	1.15	97.4	11:59:02
196	29/Aug/14	Retreat	0.16	92.3	11:59:02
197	02/Sep/14	Roseberry	DNT	DNT	11:57:00
197	02/Sep/14	Retreat	DNT	DNT	11:57:00
198	05/Sep/14	Roseberry	0.38	116.1	13:00:03
198	05/Sep/14	Retreat	0.21	105.5	13:00:03
199	18/Sep/14	Roseberry	0.30	115.7	12:12:33
199	18/Sep/14	Retreat	0.16	101.9	12:12:33
200	03/Oct/14	Kahana	0.08	97.1	12:01:51
200	03/Oct/14	Roseberry	0.43	110.8	12:01:51
200	03/Oct/14	Retreat	0.32	99.4	12:01:51
201	10/Oct/14	Kahana	0.05	86.0	11:51:36
201	10/Oct/14	Roseberry	0.34	98.0	11:51:36
201	10/Oct/14	Retreat	0.10	96.4	11:51:36
202	15/Oct/14	Kahana	0.06	92.1	11:56:31
202	15/Oct/14	Roseberry	0.19	102.7	11:56:31
202	15/Oct/14	Retreat	0.10	93.7	11:56:31
203	29/Oct/14	Kahana	0.06	93.4	13:07:52
203	29/Oct/14	Roseberry	0.28	112.3	13:07:52
203	29/10/204	Retreat	0.12	101.5	13:07:52
204	31/Oct/14	Kahana	0.05	91.2	12:01:06
204	31/Oct/14	Roseberry	0.18	100.8	12:01:06
204	31/Oct/14	Retreat	0.10	90.7	12:01:06
205	04/Nov/14	Kahana	0.03	92.5	11:52:40
205	04/Nov/14	Roseberry	0.11	103.5	11:52:40
205	04/Nov/14	Retreat	0.09	94.5	11:52:40
206	07/Nov/14	Kahana	0.08	91.8	12:01:08
206	07/Nov/14	Roseberry	0.48	106.4	12:01:08
206	07/Nov/14	Retreat	0.18	100.4	12:01:08
207	12/Nov/14	Kahana	0.12	90.4	11:57:07
207	12/Nov/14	Roseberry	0.69	102.1	11:57:07
207	12/Nov/14	Retreat	0.26	98.6	11:57:07
208	19/Nov/14	Kahana	0.04	86.9	11:55:32
208	19/Nov/14	Roseberry	0.20	98.6	11:55:32
208	19/Nov/14	Retreat	0.13	101.0	11:55:32
209	02/Dec/14	Kahana	0.03	96.7	12:00:24
209	02/Dec/14	Roseberry	0.04	105.6	12:00:24
209	02/Dec/14	Retreat	0.00	100.8	12:00:24
210	03/Dec/14	Kahana	0.08	101.9	14:08:35
210	03/Dec/14	Roseberry	0.41	109.4	14:08:35
210	03/Dec/14	Retreat	0.13	96.5	14:08:35
211	09/Dec/14	Kahana	0.12	92.5	10:04:52
211	09/Dec/14	Roseberry	0.55	108.1	10:04:52
211	09/Dec/14	Retreat	0.40	95.2	10:04:52
212	19/Dec/14	Kahana	0.01	86.2	12:05:18
212	19/Dec/14	Roseberry	0.04	101.5	12:05:18
212	19/Dec/14	Retreat	0.01	108.0	12:05:18

SHOT NO	*DATE*	*MONITOR LOCATION*	*PEAK GROUND PRESSURE mm/s*	*PEAK OVERPRESSURE dBL*	*TIME*
213	06/Jan/15	Kahana	0.06	92.7	14:52:01
213	06/Jan/15	Roseberry	0.21	108.0	14:52:01
213	06/Jan/15	Retreat	0.14	100.1	14:52:01
214	14/Jan/15	Kahana	0.09	98.9	14:53:50
214	14/Jan/15	Roseberry	0.41	105.3	14:53:50
214	14/Jan/15	Retreat	0.25	105.3	14:53:50
215	03/Feb/15	Kahana	DNT	DNT	11:59:00
215	03/Feb/15	Roseberry	DNT	DNT	11:59:00
215	03/Feb/15	Retreat	DNT	DNT	11:59:00
216	12/Feb/15	Kahana	0.08	80.2	13:16:57
216	12/Feb/15	Roseberry	0.41	92.1	13:16:57
216	12/Feb/15	Retreat	0.15	95.4	13:16:57
217	13/Mar/15	Kahana	0.13	95.0	11:36:55
217	13/Mar/15	Roseberry	0.38	113.3	11:36:55
217	13/Mar/15	Retreat	0.23	111.2	11:36:55
218	10/Apr/15	Kahana	0.12	92.6	11:01:50
218	10/Apr/15	Roseberry	0.46	108.5	11:01:50
218	10/Apr/15	Retreat	0.21	104.1	11:01:50
219	28/Apr/15	Kahana	0.21	90.1	14:55:36
219	28/Apr/15	Roseberry	0.73	105.2	14:55:36
219	28/Apr/15	Retreat	0.50	91.7	14:55:36
220	12/Jun/15	Roseberry	0.63	104.5	14:51:09
220	12/Jun/15	Retreat	0.28	101.3	14:51:09
220	12/Jun/15	Roseberry Portable	0.01	100.8	14:51:09
221	20/Jul/15	Roseberry	0.38	105.1	11:51:50
221	20/Jul/15	Retreat	0.12	99.1	11:51:50
221	20/Jul/15	Roseberry Portable	0.01	102.4	11:51:50
222	14/Aug/15	Retreat	0.25	100	12:29:22
222	14/Aug/15	Roseberry	0.31	95.2	12:29:22

Project No: 06261

ATTENDED NOISE MONITORING – September 2014
Rocglen Coal Mine
Gunnedah, NSW

Prepared for:

Whitehaven Coal Pty Limited
PO Box 600
Gunnedah NSW 2380

Author:

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B.Sc., B. Math.(Hons), MAAS, MASA
Principal / Director

Review:

Ross Hodge
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September 2014

TABLE OF CONTENTS

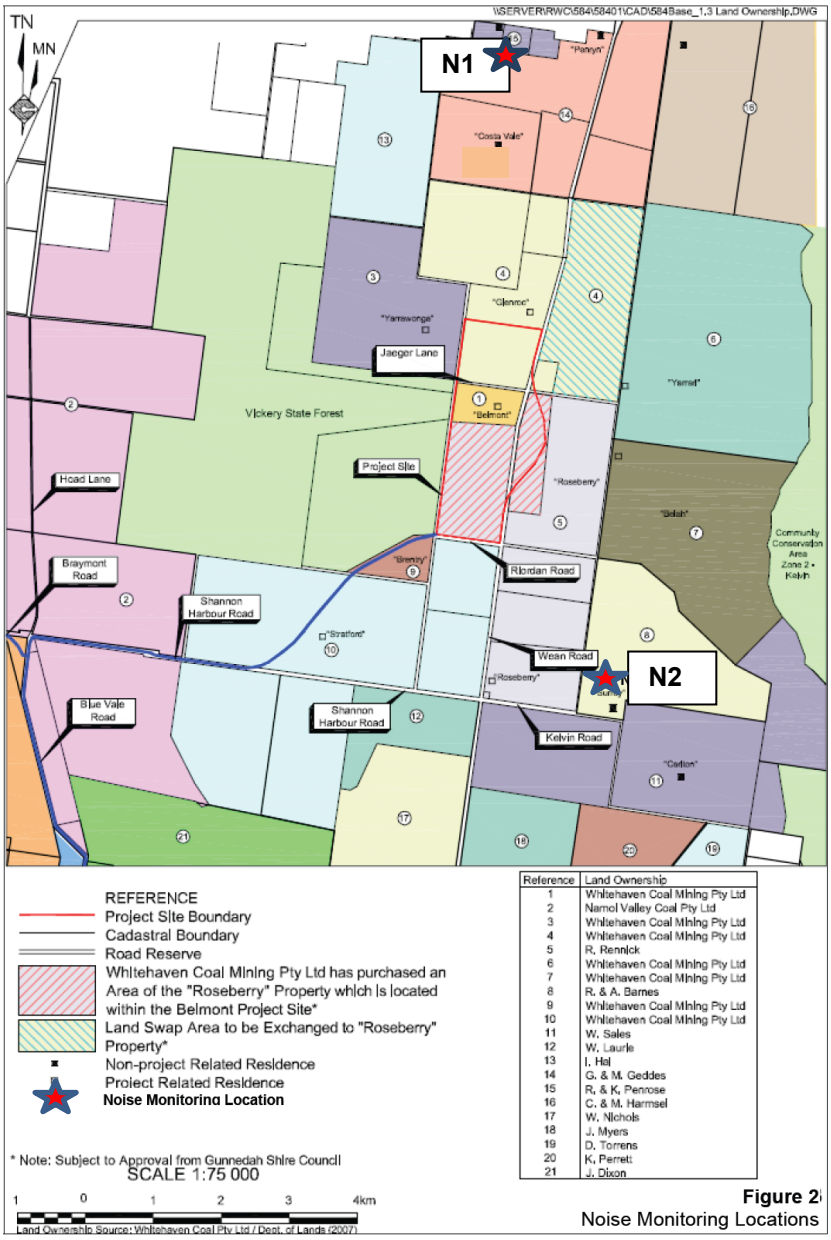
1.0 INTRODUCTION

This report presents the results of attended noise compliance monitoring and measurements conducted for the Rocglen Coal Mine (RCM) between 1st and 3rd September, 2014. The monitoring was carried out in accordance with the requirements of Environment Protection Licence (EPL 12870) and other relevant Australian Standards and guidelines.

1.1 Noise Monitoring Locations

Section M7.2 of EPL 12870 identifies that noise monitoring should be carried out at the residences listed below and shown in **Figure 1**:

N1 Retreat N2 Surrey



Whitehaven Coal Mining Pty Ltd

Figure 1 Noise Monitoring Locations

1.2 Monitoring Frequency and Duration

Section M8.2 of EPL 12870 indicates that the attended noise monitoring must be conducted;

a) at each of the locations detailed above.
b) quarterly in a reporting period.
c) during each day, evening and night period for a minimum of:
    - 1.5 hours during the day;
    - 30 minutes during the evening; and
    - 1 hour during the night.
d) occur for three consecutive operating days.

2.0 NOISE CRITERIA AND CONDITIONS

2.1 Noise Assessment Criteria

At all of the residences, the noise criterion is **35 dB(A) Leq (15 min)** (operational noise criterion) for each of the day, evening and night time periods, with "day" defined as 7am to 10pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays, "evening" being 6pm to 10pm and "night" being all other times.

In addition to the operational noise, the noise from RCM must not exceed **45 dB(A) L1 (1 min)** between the hours of 10 pm and 7 am. This is to minimise the potential for sleep disturbance as a result of individual loud noises from the mine. To determine compliance with the L1 (1 min) sleep disturbance noise criterion the noise measurement equipment must be located within 1m of a dwelling façade

2.2 Monitoring Location Definition

EPL 12870 states that to determine compliance with the Leq (15 min) operational noise criteria the noise measurement equipment must be located:

- Approximately on the property boundary, where any dwelling is situated 30m or less from the property boundary closest to the premises; or
- Within 30m of a dwelling façade, but not closer than 3m, where any dwelling on the property is situated more than 30m from the property boundary closest to the premises; or, where applicable
- Within 50m of the boundary of a National Park or Nature Reserve.

2.3 Applicable Meteorological Conditions

The noise limits apply under all meteorological conditions except for the following;

1. Wind speeds greater than 3m/s at 10m above ground level; or
2. Stability category F temperature inversion conditions and wind speeds greater than 2m/s at 10m above ground level; or
3. Stability category G temperature inversion conditions.

2.4 Other Conditions

To determine compliance with the Leq (15 min) operational noise criteria the modification factors detailed in Section 4 of the NSW industrial Noise policy must be applied, as appropriate, to the measured noise levels.

The noise limits do not apply where a current legally binding agreement exists between the licensee and the occupant of a residential property that:

a) Agrees to an alternative noise limit for that property: or

b) Provides an alternative means of compensation to address noise impacts from the premises.

3.0 NOISE MONITORING PROCEDURE

3.1 Monitoring Equipment

Attended noise monitoring was conducted with Brüel & Kjær Type 2260 Precision Sound Analysers. These instruments have Type 1 characteristics as defined in AS1259-1982 "Sound Level Meters" and have current NATA calibration. Field calibration is carried out at the start and end of each monitoring period.

A-weighted noise levels were measured over the appropriate monitoring periods (90 minutes/day, 30 minutes/evening and 60 minutes/night) with data acquired at 1 or 2 second statistical intervals and the meter set to "fast" response. Each 1 or 2 second measurement is accompanied by a third-octave band spectrum from 20 - 20k Hz which is required for analysing INP 'modifying factors'. Time based field notes allow for determination of the relative contributions to the overall noise level of all significant noise sources.

3.2 Measurement Analysis

The operational noise criteria for compliance with Section L3.1 of EPL 12870 are based on a 15 minute Leq noise level. The procedures detailed in Section M 8.2 of EPL 12870 require noise monitoring for significantly longer periods than that of the compliance criteria. To determine compliance with the EPL conditions the worst case 15 minute period, in relation to mine noise, was extracted from each measurement and compared to the criteria in Section L3.1.

This worst case 15 minute Leq noise level for each monitoring period is shown in the tables below. Where the noise from RCM was audible Bruel & Kjaer "*Evaluator*" analysis software was used to quantify the contributions of the mine and other significant noise sources to the overall noise level. Mine noise from RCM is shown in the tables in bold type.

When no mine noise was audible at a monitoring location, a representative 15 minute noise measurement was made with observations carried out for the remainder of the applicable time period. In these instances, the measured noise level for the representative 15 minute period is that shown in the tables below.

3.3 Meteorological Data

Meteorological data used in this report were taken partly from an automatic weather station located approximately 3km to the north of the RCM operations.

3.4 Special Conditions

Before the noise surveys, Spectrum Acoustics personnel were briefed on the current location(s) of activities.

4.0 RESULTS AND DISCUSSION

4.1 Measured Operational Noise Levels

Measured noise levels for each monitoring location and each day are summarised in **Tables 1 - 9**. In the tables, wind speed is in metres per second and wind direction is in degrees.

Table 1
RCM Operational Noise Monitoring Results – 1 September 2014 (day)

Location	Time	Total dB(A), Leq (15 min)	Wind speed/ direction	Identified Noise Sources
Surrey	1:47 pm	40	3.1 / 301	Birds (40), **RCM (27)**, traffic 25
Retreat	3:34 pm	51	3.3 / 310	Birds (51), traffic (25), **RCM inaudible**

Table 2
RCM Operational Noise Monitoring Results – 1 September 2014 (evening)

Location	Time	Total dB(A), Leq (15 min)	Wind speed/ direction	Identified Noise Sources
Surrey	8:22 pm	33	2.6 / 20	**RCM (32)**, frogs (25)
Retreat	9:10 pm	30	2.5 / 8	Frogs (26), birds (26), other mine (22), **RCM inaudible**

Table 3
RCM Operational Noise Monitoring Results – 1 September 2014 (night)

Location	Time	Total dB(A), Leq (15 min)	Wind speed/ direction	Identified Noise Sources
Surrey	10:00 pm	34	1.7 / 30	**RCM (34)**, frogs (22)
Retreat	11:16 pm	29	1.4 / 26	Cattle (29), frogs (22), other mine (20), **RCM inaudible**

Table 4
RCM Operational Noise Monitoring Results – 2 September 2014 (day)

Location	Time	Total dB(A), Leq (15 min)	Wind speed/ direction	Identified Noise Sources
Surrey	7:00 am	51	2.1 / 45	Birds (51), **RCM (26)**, traffic (21)
Retreat	8:47 am	45	2.2 / 273	Birds (45), other mine (28), **RCM (24)**

Table 5
RCM Operational Noise Monitoring Results – 2 September 2014 (evening)

Location	Time	Total dB(A), Leq (15 min)	Wind speed/ direction	Identified Noise Sources
Surrey	8:17 pm	31	0.8 / 203	Birds (30), traffic (21), frogs (20), **RCM inaudible**
Retreat	9:09 pm	31	1.1 / 8	**RCM (30)**, frogs (23)

Table 6 RCM Operational Noise Monitoring Results – 2 September 2014 (night)				
Location	**Time**	**Total dB(A), Leq (15 min)**	**Wind speed/ direction**	**Identified Noise Sources**
Surrey	10:00 pm	28	2.0 / 278	**RCM (23)**, frogs (23), cattle (23)
Retreat	11:15 pm	34	2.7 / 250	**RCM (32)**, wind in trees (28), frogs (25)

Table 7 RCM Operational Noise Monitoring Results – 3 September 2014 (day)				
Location	**Time**	**Total dB(A), Leq (15 min)**	**Wind speed/ direction**	**Identified Noise Sources**
Surrey	7:09 pm	45	1.2 / 2.8	Birds (45), traffic (27), **RCM (26)**
Retreat	8:58 pm	41	5.2 / 179	Birds (41), **RCM (26)**

Table 8 RCM Operational Noise Monitoring Results – 3 September 2014 (evening)				
Location	**Time**	**Total dB(A), Leq (15 min)**	**Wind speed/ direction**	**Identified Noise Sources**
Surrey	8:30 pm	27	4.7 / 211	**RCM (24)**, traffic (24)
Retreat	9:15 pm	33	2.9 / 202	**RCM (33)**

Table 9 RCM Operational Noise Monitoring Results – 3 September 2014 (night)				
Location	**Time**	**Total dB(A), Leq (15 min)**	**Wind speed/ direction**	**Identified Noise Sources**
Surrey	10:00 pm	36	1.4 / 146	Dogs (36), birds (23) **RCM inaudible**
Retreat	11:17 pm	33	1.5 / 30	**RCM (33)**, cattle (20)

4.2 Discussion of Results

The results in Tables 1 to 9 show that, under the operating and meteorological conditions at the times, for the worst case 15 minute compliance measurement periods, the mine noise did not exceed the operational noise criterion at any monitoring location during any of the monitoring periods.

Where the noise from RCM was audible at the Surrey and Retreat locations the most significant contributor was engine revs from scrapers. The remainder of the noise was as general mine hum.

4.2.1 Modifying Factor Corrections

Data from those times where RCM operations were audible were analysed using the *"Evaluator"* software. This analysis showed the noise did not contain any tonal, impulsive or low frequency components as per definitions of "modifying factor corrections" in the NSW Industrial Noise Policy.

4.3 Sleep Disturbance

Measured L1 (1 min) noise levels for each night time monitoring period are summarised in **Tables 10- 12**.

Table 10 RCM Sleep Disturbance Monitoring Results – 1 September 2014 (night)			
Location	**Time**	**dB(A),L1 (1 min)**	**Wind speed/ direction**
Surrey	10:00 pm	40	1.7 / 30
Retreat	11:16 pm	n/a	1.4 / 26

Table 11 RCM Sleep Disturbance Monitoring Results – 2 September 2014 (night)			
Location	**Time**	**dB(A),L1 (1 min)**	**Wind speed/ direction**
Surrey	10:00 pm	27	2.0 / 278
Retreat	11:15 pm	38	2.7 / 250

Table 12 RCM Sleep Disturbance Monitoring Results – 3 September 2014 (night)			
Location	**Time**	**dB(A),L1 (1 min)**	**Wind speed/ direction**
Surrey	10:01pm	n/a	1.4 / 146
Retreat	11:17 pm	38	1.5 / 30

The results in these tables show that, under the operating and meteorological conditions at the times, the maximum L1 (1 min) noise emission from RCM did not exceed the sleep disturbance criterion.

APPENDIX A

DESCRIPTION OF ACOUSTICAL TERMS

Table A1

Definition of acoustical terms

Term	Description
dB(A)	The quantitative measure of sound heard by the human ear, measured by the A-Scale Weighting Network of a sound level meter expressed in decibels (dB).
SPL	Sound Pressure Level. The incremental variation of sound pressure above and below atmospheric pressure and expressed in decibels. The human ear responds to pressure fluctuations, resulting in sound being heard.
STL	Sound Transmission Loss. The ability of a partition to attenuate sound, in dB.
Lw	Sound Power Level radiated by a noise source per unit time re 1pW.
Leq	Equivalent Continuous Noise Level - taking into account the fluctuations of noise over time. The time-varying level is computed to give an equivalent dB(A) level that is equal to the energy content and time period.
L1	Average Peak Noise Level - the level exceeded for 1% of the monitoring period.
L90	"Background" Noise Level - the level exceeded for 90% of the monitoring period.

Project No: 06261

ATTENDED NOISE MONITORING – DECEMBER 2014
Rocglen Coal Mine
Gunnedah, NSW

Prepared for:

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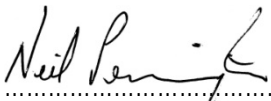
Author:



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Review:

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January 2015

TABLE OF CONTENTS

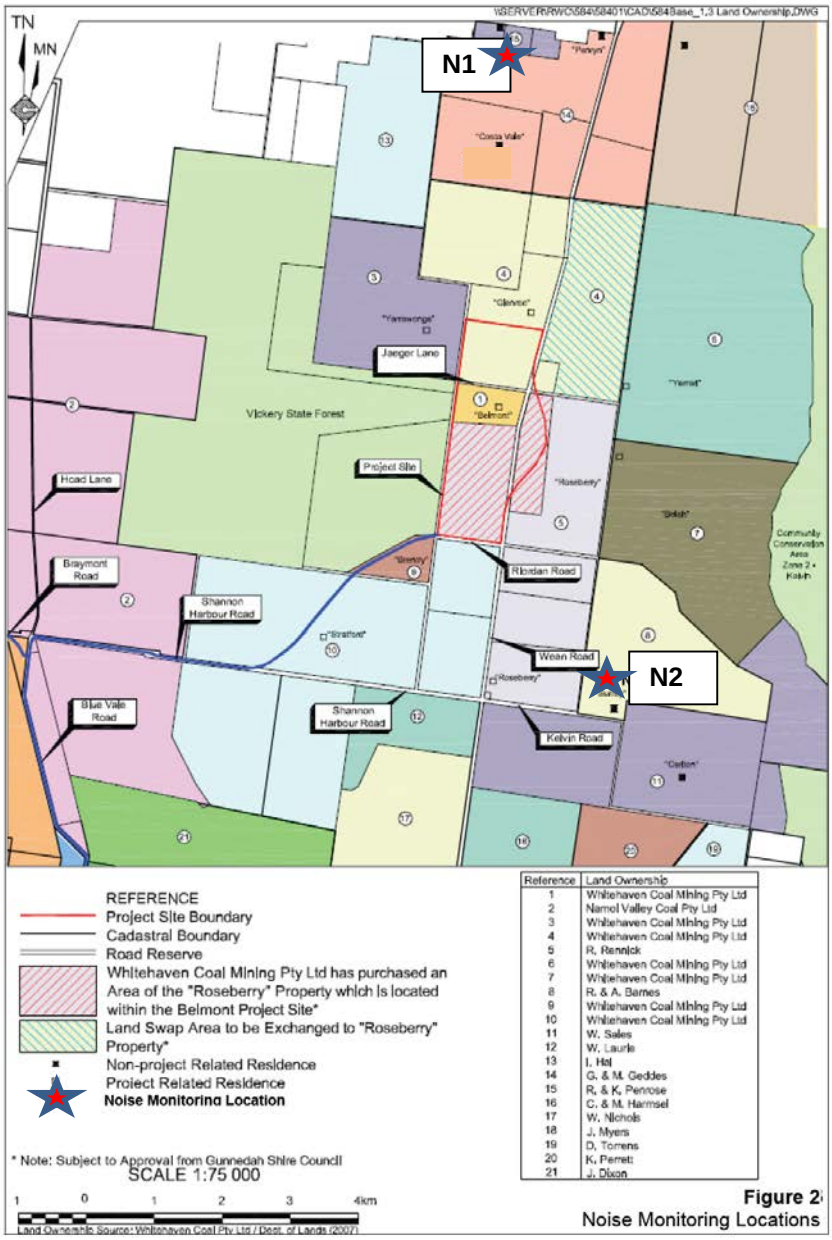
1.0 INTRODUCTION

This report presents the results of attended noise compliance monitoring and measurements conducted for the Rocglen Coal Mine (RCM) between 15th and 17th December, 2014. The monitoring was carried out in accordance with the requirements of Environment Protection Licence (EPL 12870) and other relevant Australian Standards and guidelines.

1.1 Noise Monitoring Locations

Section M7.2 of EPL 12870 identifies that noise monitoring should be carried out at the residences listed below and shown in **Figure 1**:

N1 Retreat N2 Surrey



Whitehaven Coal Mining Pty Ltd

Figure 1 Noise Monitoring Locations

1.2 Monitoring Frequency and Duration

Section M8.2 of EPL 12870 indicates that the attended noise monitoring must be conducted;

a) at each of the locations detailed above.
b) quarterly in a reporting period.
c) during each day, evening and night period for a minimum of:
    - 1.5 hours during the day;
    - 30 minutes during the evening; and
    - 1 hour during the night.
d) occur for three consecutive operating days.

2.0 NOISE CRITERIA AND CONDITIONS

2.1 Noise Assessment Criteria

At all of the residences, the noise criterion is **35 dB(A) Leq (15 min)** (operational noise criterion) for each of the day, evening and night time periods, with "day" defined as 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays, "evening" being 6pm to 10pm and "night" being all other times.

In addition to the operational noise, the noise from RCM must not exceed **45 dB(A) L1 (1 min)** between the hours of 10 pm and 7 am. This is to minimise the potential for sleep disturbance as a result of individual loud noises from the mine. To determine compliance with the L1 (1 min) sleep disturbance noise criterion the noise measurement equipment must be located within 1m of a dwelling façade

2.2 Monitoring Location Definition

EPL 12870 states that to determine compliance with the Leq (15 min) operational noise criteria the noise measurement equipment must be located:

- Approximately on the property boundary, where any dwelling is situated 30m or less from the property boundary closest to the premises; or
- Within 30m of a dwelling façade, but not closer than 3m, where any dwelling on the property is situated more than 30m from the property boundary closest to the premises; or, where applicable
- Within 50m of the boundary of a National Park or Nature Reserve.

2.3 Applicable Meteorological Conditions

The noise limits apply under all meteorological conditions except for the following;

1. Wind speeds greater than 3m/s at 10m above ground level; or
2. Stability category F temperature inversion conditions and wind speeds greater than 2m/s at 10m above ground level; or
3. Stability category G temperature inversion conditions.

2.4 Other Conditions

To determine compliance with the Leq (15 min) operational noise criteria the modification factors detailed in Section 4 of the NSW industrial Noise policy must be applied, as appropriate, to the measured noise levels.

The noise limits do not apply where a current legally binding agreement exists between the licensee and the occupant of a residential property that:

a) Agrees to an alternative noise limit for that property: or

b) Provides an alternative means of compensation to address noise impacts from the premises.

3.0 NOISE MONITORING PROCEDURE

3.1 Monitoring Equipment

Attended noise monitoring was conducted with Brüel & Kjær Type 2260 Precision Sound Analysers. These instruments have Type 1 characteristics as defined in AS1259-1982 "Sound Level Meters" and have current NATA calibration. Field calibration is carried out at the start and end of each monitoring period.

A-weighted noise levels were measured over the appropriate monitoring periods (90 minutes/day, 30 minutes/evening and 60 minutes/night) with data acquired at 1 or 2 second statistical intervals and the meter set to "fast" response. Each 1 or 2 second measurement is accompanied by a third-octave band spectrum from 20 - 20k Hz which is required for analysing INP 'modifying factors'. Time based field notes allow for determination of the relative contributions to the overall noise level of all significant noise sources.

3.2 Measurement Analysis

Noise levels were recorded for each of the Leq (15 min), Lmax, L1, L10, L90 and Lmin percentiles. The noise criteria for the operation of the mine are based on the Leq (15 min) noise level for all operating times and these levels are shown in the tables below.

Levels for the other percentiles are not shown as they have no compliance criteria for comparison but are available on request. The exception is the L1 (1 min) noise level (which is the standard measure of sleep disturbance) which is applicable to noise emissions at night (i.e. between 10 pm and 7 am).

As described, the operational noise criteria for compliance with Section L3.1 of EPL 12870 are based on a 15 minute Leq noise level. The procedures detailed in Section M 8.2 of EPL 12870 require noise monitoring for significantly longer periods than that of the compliance criteria. To determine compliance with the EPL conditions the worst case 15 minute period, in relation to mine noise, was extracted from each measurement and compared to the criteria in Section L3.1.

This worst case 15 minute Leq noise level for each monitoring period is shown in the tables below. Where the noise from RCM was audible Bruel & Kjaer "*Evaluator*" analysis software was used to quantify the contributions of the mine and other significant noise sources to the overall noise level. Mine noise from RCM is shown in the tables in bold type.

When no mine noise was audible at a monitoring location, a representative 15 minute noise measurement was made with observations carried out for the remainder of the applicable time period. In these instances, the measured noise level for the representative 15 minute period is that shown in the tables below.

3.3 Meteorological Data

Meteorological data used in this report was taken from the RCM operated weather station.

3.4 Special Conditions

Before the noise surveys, Spectrum Acoustics personnel were briefed on the current location(s) of activities.

4.0 RESULTS AND DISCUSSION

4.1 Measured Operational Noise Levels

Measured noise levels for each monitoring location and each day are summarised in **Tables 1 - 9**. In the tables, wind speed is in metres per second and wind direction is in degrees.

Table 1
RCM Operational Noise Monitoring Results – 15 December 2014 (day)

Location	Time	Total dB(A), Leq (15 min)	Wind speed/ direction	Identified Noise Sources
Surrey	4:26 pm	39	4.2 / SSE	Wind in trees (37), birds (35), RCM inaudible
Retreat	2:35 pm	34	4.0 / S	Wind in trees (31), birds (29), domestic (25), RCM inaudible

Table 2
RCM Operational Noise Monitoring Results – 15 December 2014 (evening)

Location	Time	Total dB(A), Leq (15 min)	Wind speed/ direction	Identified Noise Sources
Surrey	9:28 pm	28	2.2 / E	Wind in trees (26), insects (23), RCM inaudible
Retreat	8:44 pm	35	4.0 / E	Wind in trees (33), dogs (29), frogs & insects (26), RCM inaudible

Table 3
RCM Operational Noise Monitoring Results – 15 December 2014 (night)

Location	Time	Total dB(A), Leq (15 min)	Wind speed/ direction	Identified Noise Sources
Surrey	11:39 pm	34	3.7 / E	Wind in trees (33), insects (28), RCM inaudible
Retreat	10:17 pm	32	1.2 / E	Frogs & insects (31), dogs (24), traffic (23), RCM inaudible

Table 4 RCM Operational Noise Monitoring Results – 16 December 2014 (day)				
Location	Time	Total dB(A), Leq (15 min)	Wind speed/ direction	Identified Noise Sources
Surrey	11:14 am	40	4.3 / WNW	Birds (39), wind in trees (30), RCM (23)
Retreat	9:26 am	35	0.5 / S	Birds (34), RCM (26)

Table 5 RCM Operational Noise Monitoring Results – 16 December 2014 (evening)				
Location	Time	Total dB(A), Leq (15 min)	Wind speed/ direction	Identified Noise Sources
Surrey	9:15 pm	32	1.3 / E	RCM (28), insects (25), traffic (24), wind (24)
Retreat	8:33 pm	32	2.9 / E	Birds (29), wind (27), RCM (23)

Table 6 RCM Operational Noise Monitoring Results – 16 December 2014 (night)				
Location	Time	Total dB(A), Leq (15 min)	Wind speed/ direction	Identified Noise Sources
Surrey	11:33 pm	30	Calm	Insects (30), RCM faintly audible
Retreat	10:01 pm	29	1.3 / NE	Wind in trees (27), insects (25), RCM inaudible

Table 7 RCM Operational Noise Monitoring Results – 17 December 2014 (day)				
Location	Time	Total dB(A), Leq (15 min)	Wind speed/ direction	Identified Noise Sources
Surrey	1:17 pm	40	3.4 / E	Wind in trees (38), birds (36), RCM inaudible
Retreat	11:31 pm	46	5.9 / WNW	Wind in trees (46), birds (28), RCM inaudible

Table 8 RCM Operational Noise Monitoring Results – 17 December 2014 (evening)				
Location	Time	Total dB(A), Leq (15 min)	Wind speed/ direction	Identified Noise Sources
Surrey	9:27 pm	27	1.8 / E	Insects (29), sheep (26), RCM faintly audible
Retreat	8:39 pm	33	0.2 / ESE	Birds (30), dogs (30), RCM faintly audible

Table 9 RCM Operational Noise Monitoring Results – 17 December 2014 (night)				
Location	Time	Total dB(A), Leq (15 min)	Wind speed/ direction	Identified Noise Sources
Surrey	11:33 pm	27	0.5 / WNW	Insects (27), RCM faintly audible
Retreat	10:14 pm	31	1.1 / NW	RCM (27), insects (26), wind (24)

4.2 Discussion of Results

The results in Tables 1 to 9 show that, under the operating and meteorological conditions at the times, for the worst case 15 minute compliance measurement periods, the mine noise did not exceed the operational noise criterion at any monitoring location during any of the monitoring periods.

Where the noise from RCM was audible at the Surrey and Retreat locations the most significant contributor was general mine hum.

4.2.1 Modifying Factor Corrections

Data from those times where RCM operations were audible were analysed using the *"Evaluator"* software. This analysis showed the noise did not contain any tonal, impulsive or low frequency components as per definitions of "modifying factor corrections" in the NSW Industrial Noise Policy.

4.3 Sleep Disturbance

Measured L1 (1 min) noise levels for each night time monitoring period are summarised in **Tables 10- 12**.

Table 10
RCM Sleep Disturbance Monitoring Results – 15 December 2014 (night)

Location	Time	dB(A),L1 (1 min)	Wind speed/ direction
Surrey	11:39 pm	n/a	3.7 / E
Retreat	10:17 pm	n/a	1.2 / E

Table 11
RCM Sleep Disturbance Monitoring Results – 16 December 2014 (night)

Location	Time	dB(A),L1 (1 min)	Wind speed/ direction
Surrey	11:33 pm	22	Calm
Retreat	10:01 pm	n/a	1.3 / NE

Table 12
RCM Sleep Disturbance Monitoring Results – 17 December 2014 (night)

Location	Time	dB(A),L1 (1 min)	Wind speed/ direction
Surrey	11:33 pm	22	0.5 / WNW
Retreat	10:14 pm	31	1.1 / NW

The results in these tables show that, under the operating and meteorological conditions at the times, the maximum L1 (1 min) noise emission from RCM did not exceed the sleep disturbance criterion.

APPENDIX A

DESCRIPTION OF ACOUSTICAL TERMS

Table A1

Definition of acoustical terms

Term	Description
dB(A)	The quantitative measure of sound heard by the human ear, measured by the A-Scale Weighting Network of a sound level meter expressed in decibels (dB).
SPL	Sound Pressure Level. The incremental variation of sound pressure above and below atmospheric pressure and expressed in decibels. The human ear responds to pressure fluctuations, resulting in sound being heard.
STL	Sound Transmission Loss. The ability of a partition to attenuate sound, in dB.
Lw	Sound Power Level radiated by a noise source per unit time re 1pW.
Leq	Equivalent Continuous Noise Level - taking into account the fluctuations of noise over time. The time-varying level is computed to give an equivalent dB(A) level that is equal to the energy content and time period.
L1	Average Peak Noise Level - the level exceeded for 1% of the monitoring period.
L90	"Background" Noise Level - the level exceeded for 90% of the monitoring period.

Project No: 06261

ATTENDED NOISE MONITORING – MARCH 2015
Rocglen Coal Mine
Gunnedah, NSW

Prepared for:

Whitehaven Coal Pty Limited
PO Box 600
Gunnedah NSW 2380

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April 2015

TABLE OF CONTENTS

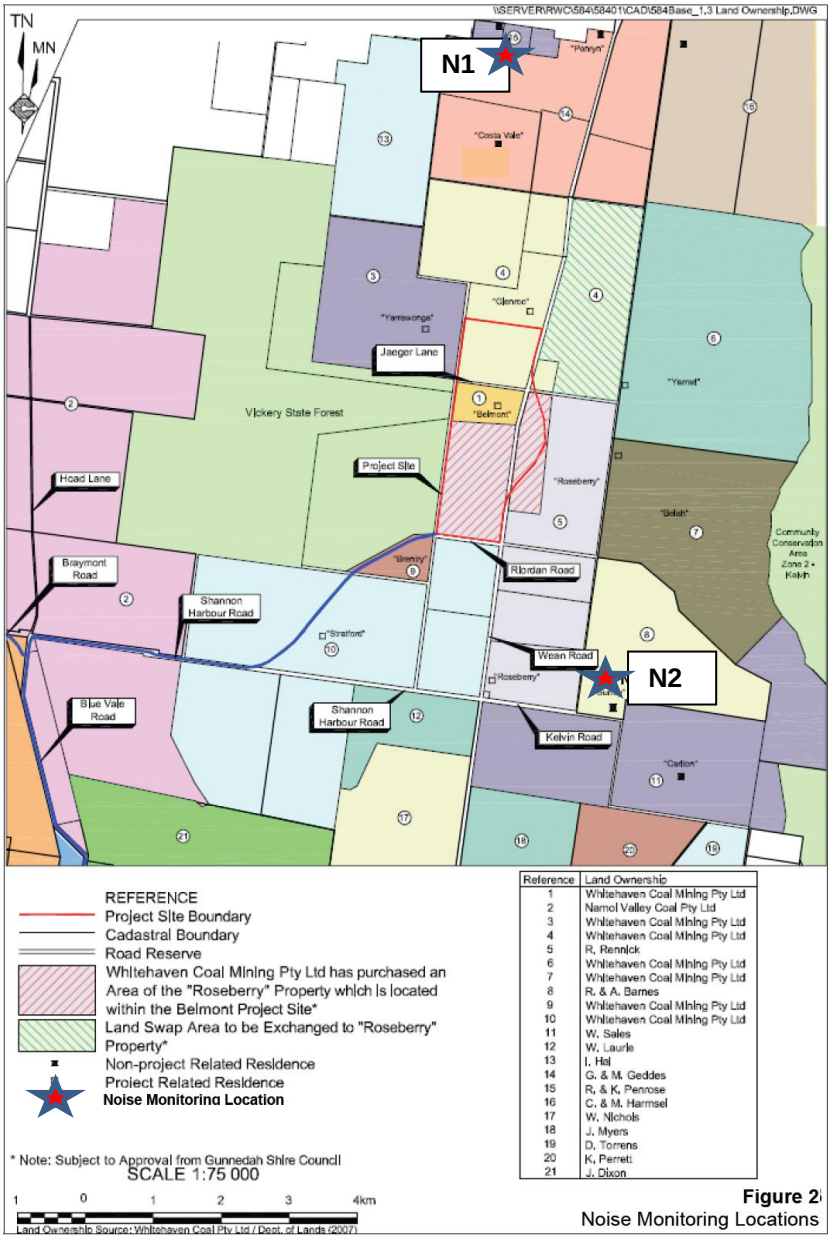
1.0 INTRODUCTION

This report presents the results of attended noise compliance monitoring and measurements conducted for the Rocglen Coal Mine (RCM) between 23rd and 26th March, 2015. The monitoring was carried out in accordance with the requirements of Environment Protection Licence (EPL 12870) and other relevant Australian Standards and guidelines.

1.1 Noise Monitoring Locations

Section M7.2 of EPL 12870 identifies that noise monitoring should be carried out at the residences listed below and shown in **Figure 1**:

N1 Retreat N2 Surrey



Whitehaven Coal Mining Pty Ltd

Figure 1 Noise Monitoring Locations

1.2 Monitoring Frequency and Duration

Section M8.2 of EPL 12870 indicates that the attended noise monitoring must be conducted;

a) at each of the locations detailed above.
b) quarterly in a reporting period.
c) during each day, evening and night period for a minimum of:
    - 1.5 hours during the day;
    - 30 minutes during the evening; and
    - 1 hour during the night.
d) occur for three consecutive operating days.

2.0 NOISE CRITERIA AND CONDITIONS

2.1 Noise Assessment Criteria

At all of the residences, the noise criterion is **35 dB(A) Leq (15 min)** (operational noise criterion) for each of the day, evening and night time periods, with "day" defined as 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays, "evening" being 6pm to 10pm and "night" being all other times.

In addition to the operational noise, the noise from RCM must not exceed **45 dB(A) L1 (1 min)** between the hours of 10 pm and 7 am. This is to minimise the potential for sleep disturbance as a result of individual loud noises from the mine. To determine compliance with the L1 (1 min) sleep disturbance noise criterion the noise measurement equipment must be located within 1m of a dwelling façade

2.2 Monitoring Location Definition

EPL 12870 states that to determine compliance with the Leq (15 min) operational noise criteria the noise measurement equipment must be located:

- Approximately on the property boundary, where any dwelling is situated 30m or less from the property boundary closest to the premises; or
- Within 30m of a dwelling façade, but not closer than 3m, where any dwelling on the property is situated more than 30m from the property boundary closest to the premises; or, where applicable
- Within 50m of the boundary of a National Park or Nature Reserve.

2.3 Applicable Meteorological Conditions

The noise limits apply under all meteorological conditions except for the following;

1. Wind speeds greater than 3m/s at 10m above ground level; or
2. Stability category F temperature inversion conditions and wind speeds greater than 2m/s at 10m above ground level; or
3. Stability category G temperature inversion conditions.

2.4 Other Conditions

To determine compliance with the Leq (15 min) operational noise criteria the modification factors detailed in Section 4 of the NSW Industrial Noise policy must be applied, as appropriate, to the measured noise levels.

The noise limits do not apply where a current legally binding agreement exists between the licensee and the occupant of a residential property that:

a) Agrees to an alternative noise limit for that property: or

b) Provides an alternative means of compensation to address noise impacts from the premises.

3.0 NOISE MONITORING PROCEDURE

3.1 Monitoring Equipment

Attended noise monitoring was conducted with Brüel & Kjær Type 2250 Precision Sound Analysers. These instruments have Type 1 characteristics as defined in AS1259-1982 "Sound Level Meters" and have current NATA calibration. Field calibration is carried out at the start and end of each monitoring period.

A-weighted noise levels were measured over the appropriate monitoring periods (90 minutes/day, 30 minutes/evening and 60 minutes/night) with data acquired at 1 or 2 second statistical intervals and the meter set to "fast" response. Each 1 or 2 second measurement is accompanied by a third-octave band spectrum from 20 - 20k Hz which is required for analysing INP 'modifying factors'. Time based field notes allow for determination of the relative contributions to the overall noise level of all significant noise sources.

3.2 Measurement Analysis

Noise levels were recorded for each of the Leq (15 min), Lmax, L1, L10, L90 and Lmin percentiles. The noise criteria for the operation of the mine are based on the Leq (15 min) noise level for all operating times and these levels are shown in the tables below.

Levels for the other percentiles are not shown as they have no compliance criteria for comparison but are available on request. The exception is the L1 (1 min) noise level (which is the standard measure of sleep disturbance) which is applicable to noise emissions at night (i.e. between 10 pm and 7 am).

As described, the operational noise criteria for compliance with Section L3.1 of EPL 12870 are based on a 15 minute Leq noise level. The procedures detailed in Section M 8.2 of EPL 12870 require noise monitoring for significantly longer periods than that of the compliance criteria. To determine compliance with the EPL conditions the worst case 15 minute period, in relation to mine noise, was extracted from each measurement and compared to the criteria in Section L3.1.

This worst case 15 minute Leq noise level for each monitoring period is shown in the tables below. Where the noise from RCM was audible Bruel & Kjaer "*Evaluator*" analysis software was used to quantify the contributions of the mine and other significant noise sources to the overall noise level. Mine noise from RCM is shown in the tables in bold type.

When no mine noise was audible at a monitoring location, a representative 15 minute noise measurement was made with observations carried out for the remainder of the applicable time period. In these instances, the measured noise level for the representative 15 minute period is that shown in the tables below.

3.3 Meteorological Data

Meteorological data used in this report was taken from the RCM operated weather station.

3.4 Special Conditions

Before the noise surveys, Spectrum Acoustics personnel were briefed on the current location(s) of activities.

4.0 RESULTS AND DISCUSSION

4.1 Measured Operational Noise Levels

Measured noise levels for each monitoring location and each day are summarised in **Tables 1 - 9**. In the tables, wind speed is in metres per second and wind direction is in the division of the nearest cardinal points.

Table 1
RCM Operational Noise Monitoring Results – 23 March 2015 (day)

Location	Time	Total dB(A), Leq (15 min)	Wind speed/ direction	Identified Noise Sources
Surrey	9:10 am	47	0.9 / N	Birds (47), **RCM inaudible**
Retreat	10:58 am	39	1.3 / W	Birds & insects (39), **RCM inaudible**

Table 2
RCM Operational Noise Monitoring Results – 23 March 2015 (evening)

Location	Time	Total dB(A), Leq (15 min)	Wind speed/ direction	Identified Noise Sources
Surrey	9:20 pm	33	Calm	Insects (32), **RCM (27)**
Retreat	8:29 pm	27	Calm	Insects (27), **RCM inaudible**

Table 3
RCM Operational Noise Monitoring Results – 23 March 2015 (night)

Location	Time	Total dB(A), Leq (15 min)	Wind speed/ direction	Identified Noise Sources
Surrey	11:41 pm	29	Calm	Insects (29), **RCM inaudible**
Retreat	10:25 pm	27	Calm	Insects (27), **RCM inaudible**

Table 4
RCM Operational Noise Monitoring Results – 24 March 2015 (day)

Location	Time	Total dB(A), Leq (15 min)	Wind speed/ direction	Identified Noise Sources
Surrey	7:20 am	46	0.4 / NE	Birds (46), **RCM (35)**
Retreat	9:08 am	49	1.4 / N	Birds (49), other mine (32), **RCM inaudible**

Table 5 RCM Operational Noise Monitoring Results – 24 March 2015 (evening)				
Location	**Time**	**Total dB(A), Leq (15 min)**	**Wind speed/ direction**	**Identified Noise Sources**
Surrey	7:44 pm	29	1.1 / E	**RCM (26)**, insects (26)
Retreat	8:32 pm	34	2.0 / E	Other mine (30), insects (29), wind (28), **RCM inaudible**

Table 6 RCM Operational Noise Monitoring Results – 24 March 2015 (night)				
Location	**Time**	**Total dB(A), Leq (15 min)**	**Wind speed/ direction**	**Identified Noise Sources**
Surrey	10:01 pm	35	0.4 / SW	Insects (35), **RCM (24)**
Retreat	11:16 pm	27	0.8 / SW	Insects (26), other mine (21), **RCM inaudible**

Table 7 RCM Operational Noise Monitoring Results – 25 March 2015 (day)				
Location	**Time**	**Total dB(A), Leq (15 min)**	**Wind speed/ direction**	**Identified Noise Sources**
Surrey	8:26 am	43	Calm	Birds (43), **RCM (27)**
Retreat	10:11 am	46	0.4 / SW	Birds (46), other mine (29), **RCM inaudible**

Table 8 RCM Operational Noise Monitoring Results – 25 March 2015 (evening)				
Location	**Time**	**Total dB(A), Leq (15 min)**	**Wind speed/ direction**	**Identified Noise Sources**
Surrey	8:15 pm	34	Calm	Insects (33), **RCM (27)**
Retreat	9:13 pm	28	Calm	Insects (27), **RCM (22)**

Table 9 RCM Operational Noise Monitoring Results – 25 March 2015 (night)				
Location	**Time**	**Total dB(A), Leq (15 min)**	**Wind speed/ direction**	**Identified Noise Sources**
Surrey	10:15 pm	25	0.3 / ESE	Insects (25), **RCM inaudible**
Retreat	11:31 pm	24	Calm	Insects (24), **RMC inaudible**

4.2 Discussion of Results

The results in Tables 1 to 9 show that, under the operating and meteorological conditions at the times, for the worst case 15 minute compliance measurement periods, the mine noise did not exceed the operational noise criterion at any monitoring location during any of the monitoring periods.

Noise from the direction of Tarrawonga Coal Mine and Boggabri Coal Mine were at times audible and measurable from the Retreat location and this has been reported as “other mine” in the results tables.

Where the noise from RCM was audible at the Surrey and Retreat locations the most significant contributor was general mine hum. On the morning of the 24th of March, however, dozer tracks and truck revs were clearly audible at the Surrey location.

4.2.1 Modifying Factor Corrections

Data from those times where RCM operations were audible were analysed using the *"Evaluator"* software. This analysis showed the noise did not contain any tonal, impulsive or low frequency components as per definitions of "modifying factor corrections" in the NSW Industrial Noise Policy.

4.3 Sleep Disturbance

Measured L1 (1 min) noise levels for each night time monitoring period are summarised in **Tables 10- 12**.

Table 10
RCM Sleep Disturbance Monitoring Results – 15 December 2014 (night)

Location	Time	dB(A),L1 (1 min)	Wind speed/ direction
Surrey	11:41 pm	n/a	Calm
Retreat	10:25 pm	n/a	Calm

Table 11
RCM Sleep Disturbance Monitoring Results – 16 December 2014 (night)

Location	Time	dB(A),L1 (1 min)	Wind speed/ direction
Surrey	10:01 pm	28	0.4 / SW
Retreat	11:16 pm	n/a	0.8 / SW

Table 12
RCM Sleep Disturbance Monitoring Results – 17 December 2014 (night)

Location	Time	dB(A),L1 (1 min)	Wind speed/ direction
Surrey	10:15 pm	n/a	0.3 / ESE
Retreat	11:31 pm	n/a	Calm

The results in these tables show that, under the operating and meteorological conditions at the times, the maximum L1 (1 min) noise emission from RCM did not exceed the sleep disturbance criterion.

APPENDIX A

DESCRIPTION OF ACOUSTICAL TERMS

Table A1

Definition of acoustical terms

Term	Description
dB(A)	The quantitative measure of sound heard by the human ear, measured by the A-Scale Weighting Network of a sound level meter expressed in decibels (dB).
SPL	Sound Pressure Level. The incremental variation of sound pressure above and below atmospheric pressure and expressed in decibels. The human ear responds to pressure fluctuations, resulting in sound being heard.
STL	Sound Transmission Loss. The ability of a partition to attenuate sound, in dB.
Lw	Sound Power Level radiated by a noise source per unit time re 1pW.
Leq	Equivalent Continuous Noise Level - taking into account the fluctuations of noise over time. The time-varying level is computed to give an equivalent dB(A) level that is equal to the energy content and time period.
L1	Average Peak Noise Level - the level exceeded for 1% of the monitoring period.
L90	"Background" Noise Level - the level exceeded for 90% of the monitoring period.

Project No: 06261

ATTENDED NOISE MONITORING – JUNE 2015
Rocglen Coal Mine
Gunnedah, NSW

Prepared for:

Whitehaven Coal Pty Limited
PO Box 600
Gunnedah NSW 2380

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Review:

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Ross Hodge
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June 2015

TABLE OF CONTENTS

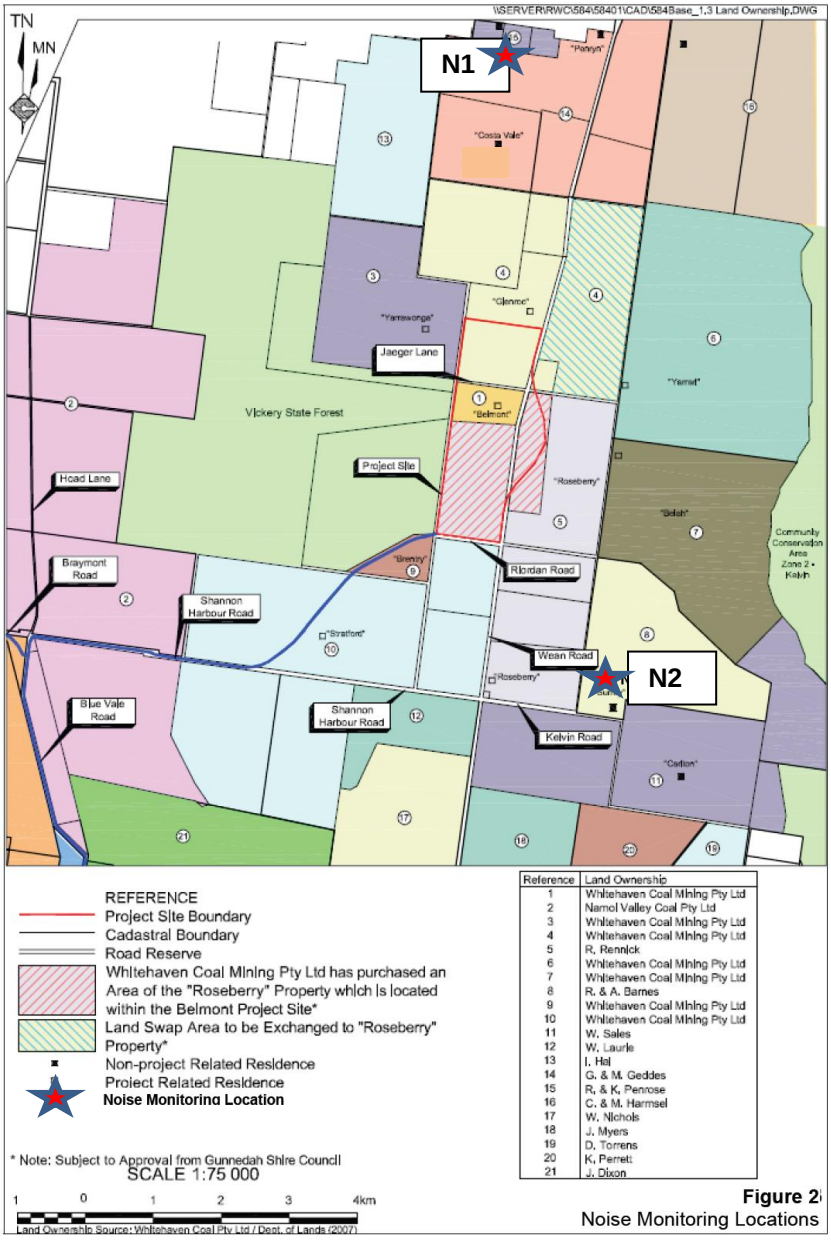
1.0 INTRODUCTION

This report presents the results of attended noise compliance monitoring and measurements conducted for the Rocglen Coal Mine (RCM) between 9th and 11th June, 2015. The monitoring was carried out in accordance with the requirements of Environment Protection Licence (EPL 12870) and other relevant Australian Standards and guidelines.

1.1 Noise Monitoring Locations

Section M7.2 of EPL 12870 identifies that noise monitoring should be carried out at the residences listed below and shown in **Figure 1**:

N1 Retreat N2 Surrey



Whitehaven Coal Mining Pty Ltd

Figure 1 Noise Monitoring Locations

1.2 Monitoring Frequency and Duration

Section M8.2 of EPL 12870 indicates that the attended noise monitoring must be conducted;

a) at each of the locations detailed above.
b) quarterly in a reporting period.
c) during each day, evening and night period for a minimum of:
    - 1.5 hours during the day;
    - 30 minutes during the evening; and
    - 1 hour during the night.
d) occur for three consecutive operating days.

2.0 NOISE CRITERIA AND CONDITIONS

2.1 Noise Assessment Criteria

At all of the residences, the noise criterion is **35 dB(A) Leq (15 min)** (operational noise criterion) for each of the day, evening and night time periods, with "day" defined as 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays, "evening" being 6pm to 10pm and "night" being all other times.

In addition to the operational noise, the noise from RCM must not exceed **45 dB(A) L1 (1 min)** between the hours of 10 pm and 7 am. This is to minimise the potential for sleep disturbance as a result of individual loud noises from the mine. To determine compliance with the L1 (1 min) sleep disturbance noise criterion the noise measurement equipment must be located within 1m of a dwelling façade

2.2 Monitoring Location Definition

EPL 12870 states that to determine compliance with the Leq (15 min) operational noise criteria the noise measurement equipment must be located:

- Approximately on the property boundary, where any dwelling is situated 30m or less from the property boundary closest to the premises; or
- Within 30m of a dwelling façade, but not closer than 3m, where any dwelling on the property is situated more than 30m from the property boundary closest to the premises; or, where applicable
- Within 50m of the boundary of a National Park or Nature Reserve.

2.3 Applicable Meteorological Conditions

The noise limits apply under all meteorological conditions except for the following;

1. Wind speeds greater than 3m/s at 10m above ground level; or
2. Stability category F temperature inversion conditions and wind speeds greater than 2m/s at 10m above ground level; or
3. Stability category G temperature inversion conditions.

2.4 Other Conditions

To determine compliance with the Leq (15 min) operational noise criteria the modification factors detailed in Section 4 of the NSW Industrial Noise policy must be applied, as appropriate, to the measured noise levels.

The noise limits do not apply where a current legally binding agreement exists between the licensee and the occupant of a residential property that:

a) Agrees to an alternative noise limit for that property: or

b) Provides an alternative means of compensation to address noise impacts from the premises.

3.0 NOISE MONITORING PROCEDURE

3.1 Monitoring Equipment

Attended noise monitoring was conducted with Brüel & Kjær Type 2250 Precision Sound Analysers. These instruments have Type 1 characteristics as defined in AS1259-1982 "Sound Level Meters" and have current NATA calibration. Field calibration is carried out at the start and end of each monitoring period.

A-weighted noise levels were measured over the appropriate monitoring periods (90 minutes/day, 30 minutes/evening and 60 minutes/night) with data acquired at 1 or 2 second statistical intervals and the meter set to "fast" response. Each 1 or 2 second measurement is accompanied by a third-octave band spectrum from 20 - 20k Hz which is required for analysing INP 'modifying factors'. Time based field notes allow for determination of the relative contributions to the overall noise level of all significant noise sources.

3.2 Measurement Analysis

Noise levels were recorded for each of the Leq (15 min), Lmax, L1, L10, L90 and Lmin percentiles. The noise criteria for the operation of the mine are based on the Leq (15 min) noise level for all operating times and these levels are shown in the tables below.

Levels for the other percentiles are not shown as they have no compliance criteria for comparison but are available on request. The exception is the L1 (1 min) noise level (which is the standard measure of sleep disturbance) which is applicable to noise emissions at night (i.e. between 10 pm and 7 am).

As described, the operational noise criteria for compliance with Section L3.1 of EPL 12870 are based on a 15 minute Leq noise level. The procedures detailed in Section M 8.2 of EPL 12870 require noise monitoring for significantly longer periods than that of the compliance criteria. To determine compliance with the EPL conditions the worst case 15 minute period, in relation to mine noise, was extracted from each measurement and compared to the criteria in Section L3.1.

This worst case 15 minute Leq noise level for each monitoring period is shown in the tables below. Where the noise from RCM was audible Bruel & Kjaer "*Evaluator*" analysis software was used to quantify the contributions of the mine and other significant noise sources to the overall noise level. Mine noise from RCM is shown in the tables in bold type.

When no mine noise was audible at a monitoring location, a representative 15 minute noise measurement was made with observations carried out for the remainder of the applicable time period. In these instances, the measured noise level for the representative 15 minute period is that shown in the tables below.

3.3 Meteorological Data

Meteorological data used in this report was taken from the RCM operated weather station.

3.4 Special Conditions

Before the noise surveys, Spectrum Acoustics personnel were briefed on the current location(s) of activities.

4.0 RESULTS AND DISCUSSION

4.1 Measured Operational Noise Levels

Measured noise levels for each monitoring location and each day are summarised in **Tables 1 - 9**. In the tables, wind speed is in metres per second and wind direction is in the division of the nearest cardinal points.

Table 1
RCM Operational Noise Monitoring Results – 9 June 2015 (day)

Location	Time	Total dB(A), Leq (15 min)	Wind speed/ direction	Identified Noise Sources
Surrey	1:15 pm	30	2.9 / W	Wind (29), **RCM (<20)**
Retreat	2:59 pm	29	1.0 / WNW	Birds (26), wind (26), **RCM (<20)**

Table 2
RCM Operational Noise Monitoring Results – 9 June 2015 (evening)

Location	Time	Total dB(A), Leq (15 min)	Wind speed/ direction	Identified Noise Sources
Surrey	8:22 pm	32	0.2 / NNE	**RCM (32)**
Retreat	9:05 pm	33	0.4 / ESE	**RCM (33)**

Table 3
RCM Operational Noise Monitoring Results – 9 June 2015 (night)

Location	Time	Total dB(A), Leq (15 min)	Wind speed/ direction	Identified Noise Sources
Surrey	10:00 pm	30	0.4 / ESE	**RCM (29)**, traffic (24)
Retreat	11:12 pm	25	0.4 / E	Traffic (23), **RCM (21)**

Table 4
RCM Operational Noise Monitoring Results – 10 June 2015 (day)

Location	Time	Total dB(A), Leq (15 min)	Wind speed/ direction	Identified Noise Sources
Surrey	7:06 am	40	0.2 / E	Birds (40), **RCM (27)**
Retreat	8:50 am	40	0.7 / SSE	Birds (39), **RCM (31)**, traffic (28)

Table 5 RCM Operational Noise Monitoring Results – 10 June 2015 (evening)				
Location	**Time**	**Total dB(A), Leq (15 min)**	**Wind speed/ direction**	**Identified Noise Sources**
Surrey	8:31 pm	31	3.8 / E	**RCM (31)**
Retreat	9:15 pm	32	4.0 / E	Wind (30), frogs (26), **RCM (22)**

Table 6 RCM Operational Noise Monitoring Results – 10 June 2015 (night)				
Location	**Time**	**Total dB(A), Leq (15 min)**	**Wind speed/ direction**	**Identified Noise Sources**
Surrey	10:00 pm	31	4.1 / E	**RCM (31)**
Retreat	11:14 pm	31	5.6 / ESE	Wind (31), **RCM (<20)**

Table 7 RCM Operational Noise Monitoring Results – 11 June 2015 (day)				
Location	**Time**	**Total dB(A), Leq (15 min)**	**Wind speed/ direction**	**Identified Noise Sources**
Surrey	7:04 am	43	1.3 / SE	Birds (43), wind (29), **RCM (<20)**
Retreat	10:34 am	39	4.3 / ESE	Wind (37), birds (35), **RCM (<20)**

Table 8 RCM Operational Noise Monitoring Results – 11 June 2015 (evening)				
Location	**Time**	**Total dB(A), Leq (15 min)**	**Wind speed/ direction**	**Identified Noise Sources**
Surrey	8:29 pm	29	3.4 / E	**RCM (27)**, wind (25)
Retreat	9:14 pm	32	3.6 / E	Wind (32), **RCM (<20)**

Table 9 RCM Operational Noise Monitoring Results – 11 June 2015 (night)				
Location	**Time**	**Total dB(A), Leq (15 min)**	**Wind speed/ direction**	**Identified Noise Sources**
Surrey	10:01 pm	31	3.9 / E	**RCM (31)**
Retreat	11:13 pm	30	3.5 / E	Wind (30), **RMC (<20)**

4.2 Discussion of Results

The results in Tables 1 to 9 show that, under the operating and meteorological conditions at the times, for the worst case 15 minute compliance measurement periods, the mine noise did not exceed the operational noise criterion at any monitoring location during any of the monitoring periods.

Where the noise from RCM was audible at the Surrey and Retreat locations the most significant contributor was general mine hum and truck revs.

4.2.1 Modifying Factor Corrections

Data from those times where RCM operations were audible were analysed using the *"Evaluator"* software. This analysis showed the noise did not contain any tonal, impulsive or low frequency components as per definitions of "modifying factor corrections" in the NSW Industrial Noise Policy.

4.3 Sleep Disturbance

Measured L1 (1 min) noise levels for each night time monitoring period are summarised in **Tables 10- 12**.

Table 10
RCM Sleep Disturbance Monitoring Results – 9 June 2015 (night)

Location	Time	dB(A),L1 (1 min)	Wind speed/ direction
Surrey	10:00 pm	28	0.4 / ESE
Retreat	11:12 pm	<20	0.4 / E

Table 11
RCM Sleep Disturbance Monitoring Results – 10 June 2015 (night)

Location	Time	dB(A),L1 (1 min)	Wind speed/ direction
Surrey	10:00 pm	36	4.1 / E
Retreat	11:14 pm	37	5.6 / ESE

Table 12
RCM Sleep Disturbance Monitoring Results – 11 June 2015 (night)

Location	Time	dB(A),L1 (1 min)	Wind speed/ direction
Surrey	10:01 pm	35	3.9 / E
Retreat	11:13 pm	<20	3.5 / E

The results in these tables show that, under the operating and meteorological conditions at the times, the maximum L1 (1 min) noise emission from RCM did not exceed the sleep disturbance criterion.

APPENDIX A

DESCRIPTION OF ACOUSTICAL TERMS

Table A1

Definition of acoustical terms

Term	Description
dB(A)	The quantitative measure of sound heard by the human ear, measured by the A-Scale Weighting Network of a sound level meter expressed in decibels (dB).
SPL	Sound Pressure Level. The incremental variation of sound pressure above and below atmospheric pressure and expressed in decibels. The human ear responds to pressure fluctuations, resulting in sound being heard.
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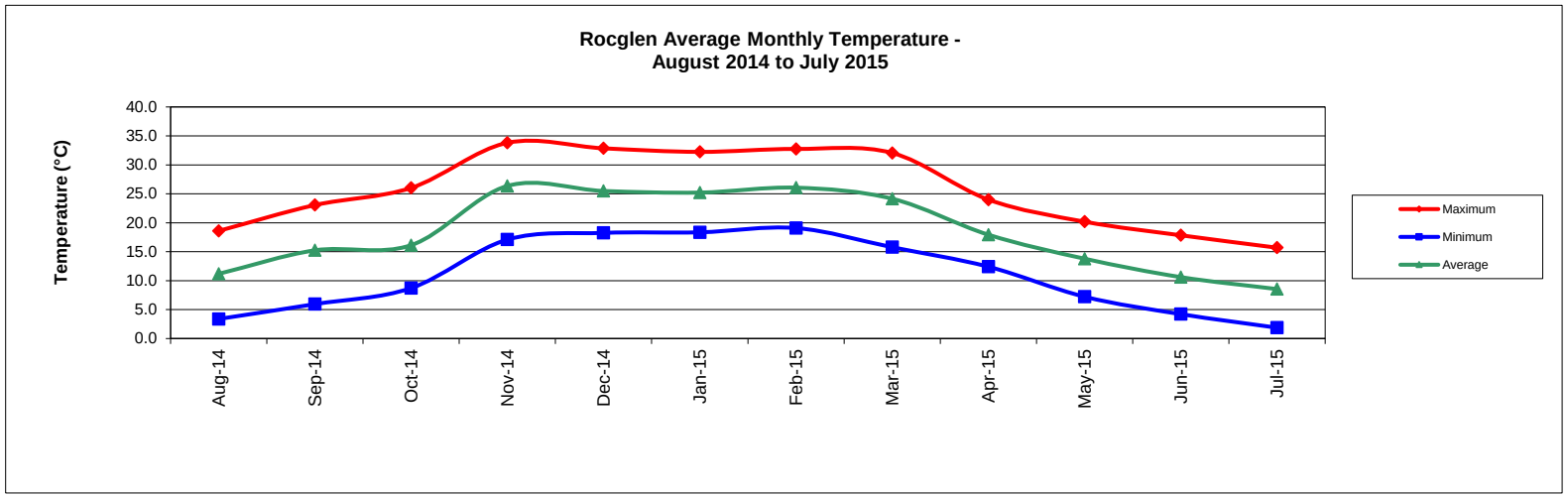
L1	Average Peak Noise Level - the level exceeded for 1% of the monitoring period.
L90	"Background" Noise Level - the level exceeded for 90% of the monitoring period.

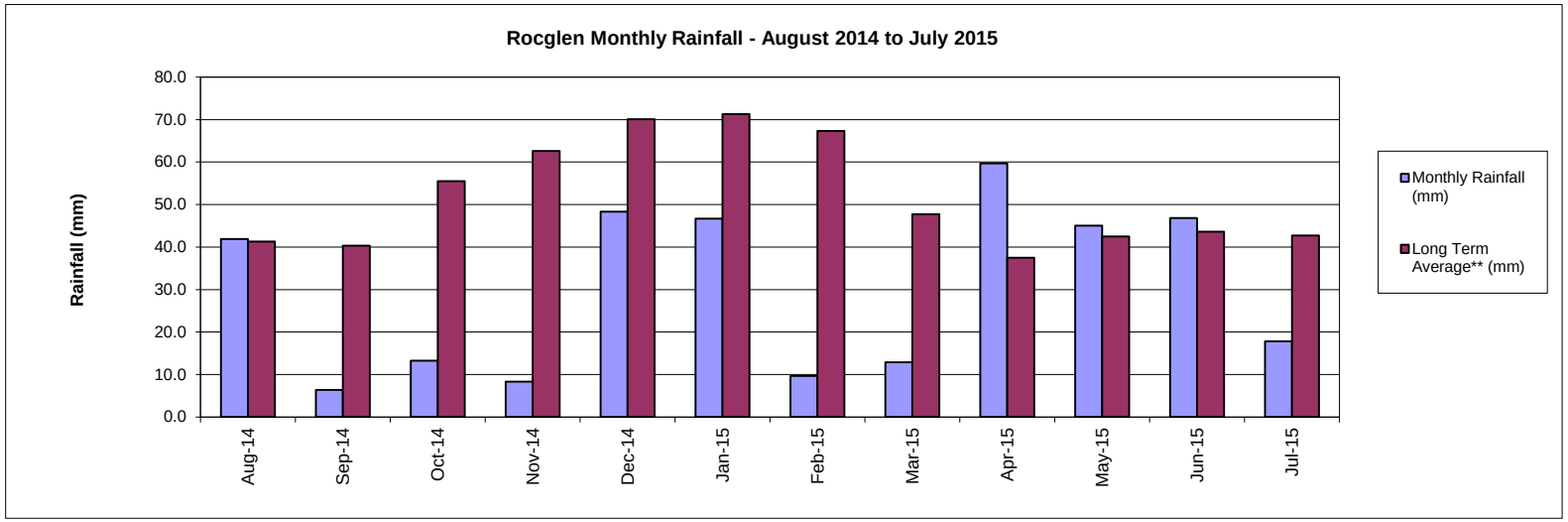
Rocglen Coal Mine Average Monthly Results

Month	Minimum Air Temp (°C)	Average Air Temp(°C)	Maximum Air Temp (°C)	Minimum Relative Humidity (%)	Average Relative Humidity(%)	Maximum Relative Humidity (%)	Minimum Wind Speed (m/s)	Average Wind Speed (m/s)	Maximum Wind Speed (m/s)
Aug-14	3.4	11.2	18.6	38.9	65.3	90.4	0.0	1.9	4.0
Sep-14	5.9	15.2	23.1	26.8	53.3	84.5	0.0	1.7	3.4
Oct-14	8.7	16.1	26.0	**15.5**	**37.0**	67.8	0.0	1.5	3.4
Nov-14	17.1	**26.4**	**33.8**	18.8	38.3	**67.7**	0.1	1.8	6.6
Dec-14	18.3	25.5	32.9	26.4	51.1	81.7	0.1	1.9	7.6
Jan-15	18.3	25.2	32.2	31.4	54.8	83.8	0.1	2.3	5.7
Feb-15	**19.1**	26.1	32.7	27.1	46.9	74.4	0.2	**2.9**	**9.4**
Mar-15	15.8	24.2	32.1	24.0	46.6	76.1	0.0	1.7	4.7
Apr-15	12.4	17.9	24.0	41.5	65.4	88.6	0.1	1.4	4.1
May-15	7.2	13.8	20.2	47.8	72.3	93.0	0.0	1.4	2.6
Jun-15	4.2	10.6	17.8	50.5	77.5	94.9	0.0	**1.1**	2.3
Jul-15	**1.9**	**8.5**	**15.7**	**52.1**	**78.0**	**95.5**	0.1	1.4	2.8
Average	**11.0**	**18.4**	**25.8**	**33.4**	**57.2**	**83.2**	**0.1**	**1.7**	**4.7**
Minimum	**1.9**	**8.5**	**15.7**	**15.5**	**37.0**	**67.7**	**0.0**	**1.1**	**2.3**
Maximum	**19.1**	**26.4**	**33.8**	**52.1**	**78.0**	**95.5**	**0.2**	**2.9**	**9.4**
Total									

Month	Monthly Rainfall (mm)	Long Term Average** (mm)	Cumulative Rainfall (mm)	Number of Rain Days***
Aug-14	41.9	41.3	41.9	7
Sep-14	6.4	40.3	48.3	1
Oct-14	13.3	55.5	61.6	1
Nov-14	8.3	62.6	69.9	2
Dec-14	48.3	70.1	118.2	11
Jan-15	46.7	71.3	164.9	6
Feb-15	9.7	67.3	174.6	3
Mar-15	12.9	47.7	187.5	4
Apr-15	59.7	37.5	247.2	5
May-15	45.0	42.5	292.2	6
Jun-15	46.8	43.6	339.0	3
Jul-15	17.8	42.7	356.8	4
Total	**356.8**	**622.4**	**356.8**	**53**

** Long term average is from Gunnedah Pool (Station 055023) 1877 - 2012
*** Rain day: >1.0mm


Rocglen Average Monthly Temperature -
August 2014 to July 2015
Temperature (°C)
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Aug-14
Sep-14
Oct-14
Nov-14
Dec-14
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Maximum
Minimum
Average


Rocglen Monthly Rainfall - August 2014 to July 2015
Rainfall (mm)
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Aug-14
Sep-14
Oct-14
Nov-14
Dec-14
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Monthly Rainfall (mm)
Long Term Average** (mm)

WHITEHAVEN COAL MINING PTY LTD

Meteorological Summary - August 2014

Daily Summary **August 2014**

Date	Min Temp (°C)	Ave Temp (°C)	Max Temp (°C)	Min RH (%)	Ave RH (%)	Max RH (%)	Rain (mm)	Min WS (m/s)	Ave WS (m/s)	Max WS (m/s)
01/08/14	0.6	11.5	19.5	26.8	47.8	80.5	0	0	2	2.7
02/08/14	**-4.2**	**5.2**	13.1	33.5	61.3	90.9	0	0	0.9	4
03/08/14	-1.4	9.8	17.7	34.4	56.4	83.7	0	0	2.3	9.9
04/08/14	7.2	13.1	19.8	35.4	56.3	79.5	0	0	1.4	1.3
05/08/14	3.8	10.6	19.8	38.6	70.1	92.5	0	0	**0.2**	0.9
06/08/14	-0.7	8.9	20.7	28.6	64.8	96	0	0	0.7	**0**
07/08/14	-3.9	7.2	19.8	25.4	60.8	86.8	0	0	0.4	1.1
08/08/14	-2	8.2	20.9	23.3	60.4	93.5	0	0	0.4	2.8
09/08/14	-2	9.2	**21.5**	28.2	59.8	90	0	0	0.9	0.7
10/08/14	-0.8	9.2	21.4	**21.5**	58.4	92	0	0	0.9	1
11/08/14	-1.1	7.4	17.5	24.9	57.2	86.6	0	0	0.7	**0**
12/08/14	-2	9.6	19	27.4	55	86.6	0	0	1.1	**10.7**
13/08/14	6.7	13	18.9	30	51	**72.5**	0	0	2.6	8.1
14/08/14	4	12.1	19.8	23	52.8	86	0	0	1.5	5.1
15/08/14	6.7	**15.5**	21	26.6	**46**	76.8	**12**	0	2.3	6.4
16/08/14	**10.8**	13.6	15.9	47.5	71	96.3	7.4	0	3.1	7.4
17/08/14	5.4	11.6	16.4	39.4	75	97.4	1.9	0	2.7	6.8
18/08/14	8.3	10.6	**13**	73.6	86.6	96.9	1.7	0	3	1.8
19/08/14	7.2	10.6	13.1	**79.5**	**88.9**	97.6	1.6	0	1	2.9
20/08/14	3.1	11.2	17.4	46.6	69.4	96.4	0.1	0	3.2	9
21/08/14	6.8	13.8	19.8	39.1	59.4	81.3	0	0	2.7	7
22/08/14	6.4	13.9	20.2	39.1	62.3	91.8	0	0	2.9	7
23/08/14	5.9	14.2	19.9	40.1	63.4	90.4	0	0	1.9	3.8
24/08/14	4.7	13.6	20.3	40.5	65.9	94.9	0	0	2	1
25/08/14	3.5	12.1	20.7	33.6	69.7	97	0	0	1.1	1.5
26/08/14	3.8	11.6	18.8	49.6	80.4	**97.7**	9.7	0	1	**0**
27/08/14	10.2	12.1	15.7	60.7	83.6	97.6	7.5	0	3.3	8.4
28/08/14	8.5	12.9	19.1	47.6	72.1	86.6	0	0	**5.1**	8.9
29/08/14	2.3	10.9	17.5	43.3	67.6	95.2	0	0	2.9	1.6
30/08/14	3	11.7	18.2	54.4	71.8	92.9	0	0	3.1	**0**
31/08/14	4.1	11.7	20	44.8	78	97.3	0	0	1.4	3.2
Average	**3.4**	**11.2**	**18.6**	**38.9**	**65.3**	**90.4**		**0.0**	**1.9**	**4.0**
Maximum	**10.8**	**15.5**	**21.5**	**79.5**	**88.9**	**97.7**	**12.0**	**0.0**	**5.1**	**10.7**
Minimum	**-4.2**	**5.2**	**13.0**	**21.5**	**46.0**	**72.5**	**0.0**	**0.0**	**0.2**	**0.0**
Total							**41.9**			

WHITEHAVEN COAL MINING PTY LTD

Meteorological Summary - September 2014

Daily Summary **September 2014**

Date	Min Temp (°C)	Ave Temp (°C)	Max Temp (°C)	Min RH (%)	Ave RH (%)	Max RH (%)	Rain (mm)	Min WS (m/s)	Ave WS (m/s)	Max WS (m/s)
01/09/14	3.7	13.4	22.5	32.3	65.9	96.9	0	0	1.5	0
02/09/14	5.1	11.3	17.2	38.3	64.9	85.4	0	0	2.5	0
03/09/14	0.8	9.5	16.8	21.8	55	91.3	0	0	2.5	1.4
04/09/14	-0.9	8.9	16.9	35.1	62.5	92.3	0	0	0.7	0
05/09/14	3.6	11.4	17.8	42.9	61.1	88.6	0	0	3.3	8.6
06/09/14	3.2	13.1	20.4	34.6	58.9	92.3	0	0	3.6	10.4
07/09/14	8.7	15.5	21.7	29.7	48.7	75.1	0	0.3	3.7	9.8
08/09/14	9.4	16.2	23	32.4	54.8	83.6	0	0	2.6	5.4
09/09/14	11.2	18.2	24.9	33.9	52.8	77.4	0	0.5	3.2	6.9
10/09/14	6.1	18	23.1	25.3	50.9	85	0	0	3.3	0
11/09/14	2.5	12.2	23.6	27.7	63.6	94.9	0	0	0.7	0
12/09/14	3.1	13.6	24.1	21.8	58.2	90.7	0	0	0.9	2.2
13/09/14	3.6	14.5	24.9	27.6	64.2	96.8	0	0	0.9	3.2
14/09/14	5.1	14.9	25.2	27.1	59.4	88.7	0	0	1	0
15/09/14	12.5	20.5	26.5	17.9	34.7	57.8	0	0	0	0.7
16/09/14	6.7	17.9	25	20.8	40.9	82.8	0	0	2.2	8
17/09/14	2.4	13	21.8	24.8	53.1	91.5	0	0	1.9	0.9
18/09/14	0.2	11.3	21.2	14.9	47.1	88.2	0	0	1.2	0.9
19/09/14	-2	9.9	20.6	10.3	47.3	85.8	0	0	0.4	2.5
20/09/14	0.4	13	22.3	12.4	40.1	78.4	0	0	2.1	9.5
21/09/14	7.8	16.2	22	21.9	42.9	76.1	0	0	2.5	9.2
22/09/14	9.1	17.7	24	25.3	43.2	73	0	0	2.4	5.7
23/09/14	8.9	19.5	26.5	15.8	34.7	60.2	0	0	0.6	1.3
24/09/14	9.9	19	26.2	25.4	44.6	67.9	0	0	1.4	5.6
25/09/14	14.4	17	20.7	47.9	78.6	97.7	6.4	0	1.2	2.2
26/09/14	9.4	16.6	23.2	32.9	64.2	86	0	0	2.1	1.1
27/09/14	5	14.8	22.3	33.7	59.4	95.2	0	0	1.4	5.3
28/09/14	6.3	16.6	26	25.1	56.8	90.8	0	0	0.3	0
29/09/14	11.9	22.1	29.4	22.2	43.3	79.4	0	0	0	0
30/09/14	10.3	21.4	31.8	21.8	47.4	84.3	0	0	1.1	1.4
Average	**5.9**	**15.2**	**23.1**	**26.8**	**53.3**	**84.5**		**0.0**	**1.7**	**3.4**
Maximum	**14.4**	**22.1**	**31.8**	**47.9**	**78.6**	**97.7**	**6.4**	**0.5**	**3.7**	**10.4**
Minimum	**-2.0**	**8.9**	**16.8**	**10.3**	**34.7**	**57.8**	**0.0**	**0.0**	**0.0**	**0.0**
Total							**6.4**			

WHITEHAVEN COAL MINING PTY LTD

Meteorological Summary - October 2014

Daily Summary **October 2014**

Date	Min Temp (°C)	Ave Temp (°C)	Max Temp (°C)	Min RH (%)	Ave RH (%)	Max RH (%)	Rain (mm)	Min WS (m/s)	Ave WS (m/s)	Max WS (m/s)
1/10/14	5.3	17.1	24.0	14.2	37.0	69.9	0.0	0.0	2.1	0.0
2/10/14	4.3	14.8	24.9	18.4	44.8	76.1	0.0	0.0	0.6	0.7
3/10/14	4.1	16.6	28.6	12.8	42.7	83.1	0.0	0.0	0.4	4.4
4/10/14	6.2	18.9	29.6	21.1	45.8	72.9	0.0	0.0	0.8	2.3
5/10/14	11.3	21.3	30.8	20.4	46.6	80.6	0.0	0.0	1.2	0.0
6/10/14	10.0	21.9	32.6	14.1	40.6	74.4	0.0	0.0	1.2	1.9
7/10/14	16.7	25.2	33.1	19.2	33.0	52.2	0.0	0.0	2.9	3.0
8/10/14	5.9	17.9	27.3	23.3	49.6	83.1	0.0	0.0	1.5	4.9
9/10/14	8.0	18.9	26.9	22.3	50.5	92.8	0.0	0.0	1.5	5.8
10/10/14	8.0	-39.7	22.1	0.1	0.2	44.5	0.0	0.0	1.8	1.5
11/10/14	0.0	0	0.0	0.1	0.2	7.8	0.0	0.0	2.4	0.0
12/10/14	0.0	0	0.0	0.1	0.1	0.4	0.0	0.0	2.9	5.1
13/10/14	0.0	0	0.0	0.1	1.7	45.3	13.1	0.0	5.0	2.6
14/10/14	0.0	0	0.0	0.7	54.5	80.7	0.0	0.0	0.0	0.8
15/10/14	7.6	13	20.7	29.0	64.8	88.1	0.0	0.0	0.0	0.0
16/10/14	4.0	14.6	24.6	16.3	52.3	92.2	0.0	0.0	1.5	0.0
17/10/14	4.8	15.9	24.4	19.2	49.2	88.3	0.0	0.0	3.2	10.7
18/10/14	9.3	18.3	25.8	18.8	44.6	79.6	0.0	0.0	1.6	2.2
19/10/14	9.2	19.1	28.9	20.9	50.7	83.9	0.0	0.0	0.6	0.0
20/10/14	10.0	21.2	31.9	18.7	48.4	83.5	0.0	0.0	2.3	10.4
21/10/14	12.9	21	27.9	29.6	48.1	78.0	0.0	0.4	2.1	9.1
22/10/14	12.9	21	29.5	27.6	47.3	69.0	0.0	0.0	1.0	1.1
23/10/14	14.6	23.4	32.3	23.8	44.0	73.2	0.0	0.0	0.3	7.5
24/10/14	14.8	25.5	34.5	18.9	36.3	75.1	0.0	0.0	1.3	1.7
25/10/14	15.7	27.1	36.4	12.8	31.1	62.0	0.0	0.0	0.7	9.2
26/10/14	18.6	30.4	39.4	9.0	22.0	43.4	0.0	0.0	0.9	0.0
27/10/14	15.4	26.6	36.9	12.7	27.8	50.0	0.0	0.0	2.6	4.6
28/10/14	8.7	21.9	31.4	9.7	28.9	67.7	0.0	0.0	1.9	6.3
29/10/14	7.5	20.3	31.9	16.2	32.9	60.8	0.0	0.0	0.9	0.0
30/10/14	10.5	22.5	33.8	15.6	34.2	60.5	0.0	0.0	0.9	1.7
31/10/14	10.5	25.2	36.6	15.0	37.1	82.6	0.2	0.0	0.7	8.3
Average	**8.7**	**16.1**	**26.0**	**15.5**	**37.0**	**67.8**		**0.0**	**1.5**	**3.4**
Maximum	**18.6**	**30.4**	**39.4**	**29.6**	**64.8**	**92.8**	**13.1**	**0.4**	**5.0**	**10.7**
Minimum	**0.0**	**-39.7**	**0.0**	**0.1**	**0.1**	**0.4**	**0.0**	**0.0**	**0.0**	**0.0**
Total							**13.3**			

Damaged cables resulted in inaccurate temperature recording for these days.

WHITEHAVEN COAL MINING PTY LTD

Meteorological Summary - November 2014

Daily Summary **November 2014**

Date	*Min Temp (°C)*	*Ave Temp (°C)*	*Max Temp (°C)*	*Min RH (%)*	*Ave RH (%)*	*Max RH (%)*	*Rain (mm)*	*Min WS (m/s)*	*Ave WS (m/s)*	*Max WS (m/s)*
01/11/14	19.8	26.1	34.1	26.4	49	75.2	0.2	0.4	3.8	11.5
02/11/14	12	20.3	26.4	8.4	17	31.7	0	0	0	2.4
03/11/14	15	23.6	28.6	14.4	29.7	57.1	0	0	1.5	10.7
04/11/14	16.8	23.7	29.1	24.2	39.1	61.5	0	0	0.9	2.2
05/11/14	14.1	22.5	32.2	23.6	48.8	97.7	6.1	0	1.7	16.7
06/11/14	12.3	20.8	30.5	23.7	59	95.6	0	0	1.1	2.3
07/11/14	11.3	24.1	30.6	16.5	41.9	92.4	0	0.6	3	10.5
08/11/14	16	25	33.1	17.4	41.9	78	0	0	1.6	1.3
09/11/14	14.8	25.7	35.4	18.3	38.4	68.3	0	0	0.3	3
10/11/14	21.8	31.6	36.8	16.2	29.8	66.8	0	0.6	0	7.3
11/11/14	16.1	25	35	19	52.1	85	0	0	3	11
12/11/14	15.5	27.8	33.9	19.1	36.7	77.2	0	0.2	1.5	9.2
13/11/14	18.9	27.7	35.6	16.2	38.6	68.3	0	0	0.9	1.5
14/11/14	21.7	30.6	38	15.5	34.3	58.7	0	0	1.7	7.8
15/11/14	23.2	33.5	42.3	11.8	24	48.4	0.1	0	2	9.2
16/11/14	18.7	19.2	19.9	45	48	50.2	0	1.3	0	2.9
17/11/14	11.1	24.5	32.4	14.2	29.8	76.1	0	0	1	2.2
18/11/14	10.5	25.1	32.1	8.7	20.8	57.8	0	0	2	6.3
19/11/14	15.3	26.1	35.3	12.7	33.6	66.7	0	0	1.6	11
20/11/14	21.6	29.5	37.4	17.3	37.3	61.9	0	0.8	2.4	8.4
21/11/14	22.8	31.8	39.2	8.8	32.5	57.1	0	0	3.7	0.6
22/11/14	17.1	30.6	41.1	11.8	24	48.8	0	0	1.1	2.5
23/11/14	20.6	32.4	42.3	13.9	29.4	47.5	0	0	1.8	15
24/11/14	21.8	30.7	40.5	21.1	45.1	93.6	1.8	0	2.7	1.8
25/11/14	21.2	26	28.7	29.2	48	63.3	0	0	2.6	0
26/11/14	18.7	27.6	31.9	30.3	44.4	62.1	0	0	2.3	1.7
27/11/14	11.4	23.8	33.3	18.6	44	70	0	0	3.2	14
28/11/14	16.4	25.3	33	16.2	39.4	69.9	0	0.1	2.7	12.3
29/11/14	19.4	24.2	33.1	20.9	49.5	73.5	0.1	0	1.2	11.5
30/11/14	16.8	25.9	32.4	23.9	42.1	69.9	0	0	1.5	2.2
Average	**17.1**	**26.4**	**33.8**	**18.8**	**38.3**	**67.7**		**0.1**	**1.8**	**6.6**
Maximum	**23.2**	**33.5**	**42.3**	**45.0**	**59.0**	**97.7**	**6.1**	**1.3**	**3.8**	**16.7**
Minimum	**10.5**	**19.2**	**19.9**	**8.4**	**17.0**	**31.7**	**0.0**	**0.0**	**0.0**	**0.0**
Total							**8.3**			

WHITEHAVEN COAL MINING PTY LTD

Meteorological Summary - December 2014

Daily Summary **December 2014**

Date	Min Temp (°C)	Ave Temp (°C)	Max Temp (°C)	Min RH (%)	Ave RH (%)	Max RH (%)	Rain (mm)	Min WS (m/s)	Ave WS (m/s)	Max WS (m/s)
01/12/14	19.1	26.6	31.7	28.9	43.1	73.3	0	0	1.4	6.2
02/12/14	18.8	28.1	35.8	21.5	37.8	65.7	0	0	1.4	6.4
03/12/14	22.0	30.2	36.9	21.5	35.6	60.5	0	0	0.7	11.4
04/12/14	18.0	25.7	33.2	31.5	58.7	98.2	6.1	0	0	5.1
05/12/14	18.7	25.3	33.7	29.6	62.2	94.7	2.6	0	0.3	10.5
06/12/14	18.1	23.1	29.5	39.5	65.9	98.0	5.3	0	2.1	8.5
07/12/14	17.1	24.0	34.4	26.8	69.3	95.3	1.1	0	0.6	0.7
08/12/14	21.1	26.9	33.6	24.6	53.9	87.7	0.1	0	2.2	1.2
09/12/14	20.0	27.2	34.6	22.2	50.7	87.1	1.7	0	1.6	12.0
10/12/14	21.9	28.8	38.2	18.5	47.0	75.0	0.4	0	0.9	13.5
11/12/14	18.3	24.9	31.8	30.5	63.5	98.1	15	0.3	2.3	12.3
12/12/14	16.0	20.5	26.0	37.9	53.5	73.6	0	2.2	6.6	12.3
13/12/14	14.7	21.4	27.6	27.5	45.8	72.4	0	0.2	4.1	9.3
14/12/14	15.9	23.2	30.3	22.0	39.7	63.7	0	0	1.6	7.8
15/12/14	14.0	25.6	33.7	15.8	35.2	78.5	0	0	2	7.8
16/12/14	21.0	27.7	36.0	14.3	36.7	68.9	0.3	0.3	2.1	10.3
17/12/14	18.5	29.5	38.5	10.5	36.6	75.5	0.1	0	1.8	8.0
18/12/14	18.3	26.9	34.6	15.8	39.2	71.0	0.6	0	1.9	2.5
19/12/14	15.1	24.3	33.3	10.2	33.0	70.2	0	0	1.9	2.5
20/12/14	12.8	24.6	33.9	15.2	41.9	84.6	0	0	1.4	11.7
21/12/14	21.5	27.8	35.5	18.7	43.5	64.3	0	0.6	3.4	10.4
22/12/14	22.6	28.9	34.9	24.2	41.6	63.4	0	0.2	2.3	7.6
23/12/14	18.8	24.3	29.0	46.0	62.9	97.8	3.2	0	1.4	5.8
24/12/14	19.0	26.8	35.8	28.1	58.2	91.8	1.1	0	1.5	13.5
25/12/14	20.1	25.8	33.0	37.2	65.3	97.0	1.6	0	1.1	0.7
26/12/14	21.2	25.1	32.5	23.6	64.3	94.1	2.2	0	1.4	8.4
27/12/14	18.5	21.8	25.5	54.1	67.0	83.4	0	0	2.9	9.2
28/12/14	16.8	19.3	21.0	62.4	79.5	94.3	6.7	0	3	6.6
29/12/14	18.4	23.9	32.4	32.8	66.9	93.9	0.2	0	0.7	0.0
30/12/14	16.9	26.9	36.2	13.4	44.4	81.4	0	0	2.8	2.5
31/12/14	12.6	25.0	35.4	13.0	39.7	80.0	0	0	1.1	10.3
Average	**18.3**	**25.5**	**32.9**	**26.4**	**51.1**	**81.7**		**0.1**	**1.9**	**7.6**
Maximum	**22.6**	**30.2**	**38.5**	**62.4**	**79.5**	**98.2**	**15.0**	**2.2**	**6.6**	**13.5**
Minimum	**12.6**	**19.3**	**21.0**	**10.2**	**33.0**	**60.5**	**0.0**	**0.0**	**0.0**	**0.0**
Total							**48.3**			

WHITEHAVEN COAL MINING PTY LTD

Meteorological Summary - January 2015

Daily Summary **January 2015**

Date	Min Temp (°C)	Ave Temp (°C)	Max Temp (°C)	Min RH (%)	Ave RH (%)	Max RH (%)	Rain (mm)	Min WS (m/s)	Ave WS (m/s)	Max WS (m/s)
01/01/15	23.3	29.9	37.7	19.9	41.6	65.6	0.0	0.5	2.1	9.4
02/01/15	17.3	22.2	28.2	40.1	72.0	98	19.5	0.0	3.1	0.0
03/01/15	20.1	27.0	34.8	27.3	54.8	86.8	0.0	0.0	1.9	3.7
04/01/15	21.1	26.5	32.3	39.9	58.3	83.1	1.6	0.0	1.1	0.7
05/01/15	20.1	25.0	29.5	46.3	66.3	88.7	0.1	0.0	1	2.7
06/01/15	19.0	26.8	32.3	31.1	51.8	84.9	0.0	0.0	3	8.3
07/01/15	21.2	26.8	31.9	30.3	45.0	65.2	0.0	1.0	3.6	8.4
08/01/15	21.2	26.6	32.6	30.1	47.5	65.9	0.0	0.0	2.4	0.9
09/01/15	20.0	27.5	34.7	27	48.2	74.8	0.0	0.0	1.1	4.8
10/01/15	24.5	28.0	33.7	33.8	50.2	71.8	0.0	0.0	1.7	4.5
11/01/15	22.8	25.2	27.7	53.6	66.1	85.7	0.0	0.0	2.7	7.9
12/01/15	20.9	23.7	28.0	57.5	73.1	91.5	0.3	0.0	2.7	6.0
13/01/15	22.4	26.5	30.6	48.2	59.9	70.3	0.0	0.0	1.4	4.7
14/01/15	21.5	27.8	34.4	31.3	60.4	94.3	1.0	0.0	2.8	8.0
15/01/15	14.5	23.8	32.7	25.6	56.9	93.4	0.0	0.0	1.4	1.8
16/01/15	13.3	24.1	33.3	13.8	42.5	82.9	0.0	0.0	1.9	0.0
17/01/15	11.5	24.6	35.7	15.6	37.9	74.2	0.0	0.0	1.7	1.3
18/01/15	12.4	25.5	35.2	10	32.8	75.6	0.0	0.0	1.8	6.5
19/01/15	15.6	25.4	34.7	22.8	44.7	70.7	0.0	0.0	3.5	13.5
20/01/15	18.6	24.7	34.8	22.3	54.3	97.3	5.0	0.6	3.9	12.8
21/01/15	20.0	25.2	31.1	35.8	53.9	75.7	0.0	0.0	2.8	8.2
22/01/15	19.2	26.5	33.1	32	52.4	77	0.0	0.0	2.8	9.0
23/01/15	20.9	25.4	28.4	47.9	61.2	97.4	3.4	0.0	2.6	2.3
24/01/15	17.6	26.7	35.8	19.9	55.7	93.8	1.0	0.0	0.3	7.0
25/01/15	20.9	29.0	37.1	22.1	52.2	91.3	1.0	0.0	1.9	5.7
26/01/15	19.2	26.7	37.1	18.8	56.6	84.6	1.5	0.0	2	11.9
27/01/15	18.4	21.8	30.6	45.7	75.3	96.3	12.3	0.0	3.4	15.9
28/01/15	16.6	19.9	23.4	57.3	68.6	89.2	0.0	0.0	3.5	9.0
29/01/15	12.8	19.9	26.6	31.2	60.8	91.5	0.0	0.0	2.4	0.0
30/01/15	10.8	20.9	30.1	21.1	54.3	92.7	0.0	0.0	1.8	1.5
31/01/15	11.1	21.9	31.3	13.6	43.7	87.7	0.0	0.0	1.6	0.7
Average	**18.3**	**25.2**	**32.2**	**31.4**	**54.8**	**83.8**		**0.1**	**2.3**	**5.7**
Maximum	**24.5**	**29.9**	**37.7**	**57.5**	**75.3**	**98.0**	**19.5**	**1.0**	**3.9**	**15.9**
Minimum	**10.8**	**19.9**	**23.4**	**10.0**	**32.8**	**65.2**	**0.0**	**0.0**	**0.3**	**0.0**
Total							**46.7**			

WHITEHAVEN COAL MINING PTY LTD

Meteorological Summary - February 2015

Daily Summary **February 2015**

Date	Min Temp (°C)	Ave Temp (°C)	Max Temp (°C)	Min RH (%)	Ave RH (%)	Max RH (%)	Rain (mm)	Min WS (m/s)	Ave WS (m/s)	Max WS (m/s)
01/02/15	11.2	23	32.9	18.0	43.2	82.0	0.0	0.0	0.6	7.2
02/02/15	20.4	24	31.1	27.9	52.7	85.9	2.9	0.5	3.6	11.3
03/02/15	16.8	21.8	26.7	36.3	54.3	81.0	0.0	1.4	4.0	12.2
04/02/15	12.3	22.5	29.6	25.8	47.6	88.8	0.0	0.0	3.5	9.0
05/02/15	20.3	26.2	30.4	28.1	40.4	60.2	0.0	0.5	4.8	11.5
06/02/15	17.3	24.1	30.3	21.6	44.5	70.0	0.0	0.2	3.6	10.4
07/02/15	18.2	25	32.4	23.3	40.4	61.0	0.0	0.3	2.1	6.4
08/02/15	15.2	26.7	35.9	18.8	39.6	75.2	0.0	0.0	0.6	5.1
09/02/15	19.6	29.5	37.0	18.0	33.0	59.2	0.0	0.0	3.3	10.0
10/02/15	20.8	27.4	34.1	26.2	43.2	65.2	0.0	0.0	4.2	11.6
11/02/15	19.2	26.6	33.0	25.7	44.6	70.2	0.0	0.5	4.2	11.7
12/02/15	20.5	27.4	33.9	21.9	40.4	61.4	0.0	0.2	2.5	9.0
13/02/15	22.2	26.9	33.0	14.4	39.3	55.5	0.0	0.9	3.7	9.9
14/02/15	20.1	26.8	33.2	22.1	37.4	54.3	0.0	0.1	2.0	7.4
15/02/15	18.3	25.1	33.6	26.9	49.3	97.7	2.7	0.0	2.1	13.7
16/02/15	20.9	29.1	32.9	27.0	37.0	73.5	0.0	0.0	1.4	7.5
17/02/15	20.6	27.1	33.9	22.2	42.4	69.4	0.0	0.6	3.8	9.8
18/02/15	19.1	26.9	34.1	20.3	35.9	54.9	0.0	0.1	4.6	10.7
19/02/15	22.1	27.2	34.9	26.8	43.1	56.4	0.0	0.3	4.4	11.0
20/02/15	20.8	23.9	28.3	47.0	63.9	91.7	0.9	0.2	2.6	6.7
21/02/15	20.4	24.9	29.7	45.4	64.0	91.3	0.0	1.1	3.9	9.1
22/02/15	20.6	26.9	34.2	33.4	55.2	79.0	0.0	0.0	3.0	7.4
23/02/15	18.6	28	35.1	26.7	50.1	84.1	0.0	0.0	2.0	9.0
24/02/15	20.0	27.8	34.6	26.7	47.8	76.1	0.0	0.0	2.3	10.6
25/02/15	18.5	26.6	34.3	22.9	50.5	79.2	0.0	0.0	2.2	12.2
26/02/15	19.0	25.7	32.4	37.6	61.0	96.9	3.0	0.0	1.2	11.2
27/02/15	18.8	24.9	31.7	33.2	63.2	93.1	0.2	0.0	1.7	9.1
28/02/15	22.6	27.6	33.7	33.5	50.5	69.0	0.0	0.0	2.3	2.0
Average	**19.1**	**26.1**	**32.7**	**27.1**	**46.9**	**74.4**		**0.2**	**2.9**	**9.4**
Maximum	**22.6**	**29.5**	**37.0**	**47.0**	**64.0**	**97.7**	**3.0**	**1.4**	**4.8**	**13.7**
Minimum	**11.2**	**21.8**	**26.7**	**14.4**	**33.0**	**54.3**	**0.0**	**0.0**	**0.6**	**2.0**
Total							**9.7**			

WHITEHAVEN COAL MINING PTY LTD

Meteorological Summary - March 2015

Daily Summary **March 2015**

Date	Min Temp (°C)	Ave Temp (°C)	Max Temp (°C)	Min RH (%)	Ave RH (%)	Max RH (%)	Rain (mm)	Min WS (m/s)	Ave WS (m/s)	Max WS (m/s)
01/03/15	21.2	27.3	33.7	37.6	59.4	95.8	1.4	0.0	1.0	1.7
02/03/15	17.8	26.0	34.0	28.2	56.7	89.8	0.1	0.0	2.7	10.1
03/03/15	19.1	27.6	35.5	28.7	47.4	73.7	0.0	0.0	1.3	3.5
04/03/15	23.6	33.1	38.1	20.7	31.1	45.8	0.0	0.0	4.1	1.8
05/03/15	19.1	25.7	32.0	12.1	29.4	55.9	0.0	0.0	3.4	0.0
06/03/15	11.0	20.6	29.7	10.3	34.0	62.4	0.0	0.0	1.3	0.0
07/03/15	9.4	21.9	33.5	9.2	27.4	53.2	0.0	0.0	0.7	0.0
08/03/15	14.9	22.8	31.3	23.9	38.2	53.3	0.0	0.0	0.7	0.0
09/03/15	14.8	25.6	35.6	13.1	35.6	65.2	0.0	0.0	0.6	8.9
10/03/15	20.0	26.2	33.5	25.3	52.6	92.1	1.2	0.0	2.4	11.9
11/03/15	20.0	25.7	32.2	32.7	56.9	81.8	0.0	0.0	0.5	0.0
12/03/15	17.6	24.8	31.2	35.8	57.4	86.3	0.0	0.0	1.1	8.3
13/03/15	15.8	23.6	31.1	30.7	52.7	81.9	0.0	0.0	3.0	12.7
14/03/15	13.4	22.4	29.1	24.6	46.8	81.6	0.0	0.0	2.0	3.5
15/03/15	11.4	22.7	32.3	16.1	41.6	70.2	0.0	0.0	2.4	12.4
16/03/15	16.6	22.9	29.4	22.9	41.6	65.9	0.0	0.1	2.2	6.9
17/03/15	18.6	24.8	30.2	32.9	46.1	63.4	0.0	0.0	1.8	0.0
18/03/15	19.8	27.2	33.6	33.5	52.1	83.9	0.1	0.0	2.8	0.6
19/03/15	16.4	26.6	36.0	15.4	42.8	82.0	0.0	0.0	0.7	0.0
20/03/15	16.1	28.8	39.7	13.7	31.3	63.8	0.0	0.0	1.3	9.2
21/03/15	20.2	25.6	32.9	35.7	53.3	71.4	0.0	0.4	4.8	11.7
22/03/15	15.3	23.1	31.0	33.8	57.2	83.2	0.0	0.0	2.2	10.9
23/03/15	20.4	27.4	31.7	28.0	39.5	56.1	0.0	0.0	0.8	1.3
24/03/15	17.9	25.5	34.9	25.6	59.6	98.0	8.1	0.0	1.8	12.3
25/03/15	14.4	22.4	30.4	18.2	58.5	91.3	0.0	0.0	1.0	0.0
26/03/15	9.9	19.8	30.1	11.7	47.8	89.2	0.0	0.0	1.7	2.3
27/03/15	7.9	16.9	26.5	15.4	46.7	89.0	0.0	0.0	0.8	1.0
28/03/15	7.0	17.9	28.6	12.5	43.1	83.5	0.0	0.0	0.9	3.2
29/03/15	9.3	20.2	29.8	20.7	45.1	74.7	0.0	0.0	0.8	1.7
30/03/15	14.3	19.4	24.0	49.5	67.2	97.5	2.0	0.0	1.5	4.2
31/03/15										
Average	**15.8**	**24.2**	**32.1**	**24.0**	**46.6**	**76.1**		**0.0**	**1.7**	**4.7**
Maximum	**23.6**	**33.1**	**39.7**	**49.5**	**67.2**	**98.0**	**8.1**	**0.4**	**4.8**	**12.7**
Minimum	**7.0**	**16.9**	**24.0**	**9.2**	**27.4**	**45.8**	**0.0**	**0.0**	**0.5**	**0.0**
Total							**12.9**			

WHITEHAVEN COAL MINING PTY LTD

Meteorological Summary - April 2015

Daily Summary **April 2015**

Date	Min Temp (°C)	Ave Temp (°C)	Max Temp (°C)	Min RH (%)	Ave RH (%)	Max RH (%)	Rain (mm)	Min WS (m/s)	Ave WS (m/s)	Max WS (m/s)
01/04/15	21.5	25.6	29.2	31.2	43.5	55.9	0.0	0.3	2.8	7.8
02/04/15	15.6	23.1	30.0	24.1	44.8	74.6	0.0	0.0	1.2	2.1
03/04/15	15.7	20.7	27.3	41.1	64.2	97.9	11.7	0.0	1.2	10.4
04/04/15	16.5	19.1	25.6	56.3	84.5	97.3	7.3	0.0	2.4	4.0
05/04/15	15.0	18.3	24.8	53.6	80.7	95.1	0.1	0.0	1.0	1.0
06/04/15	13.6	19.1	28.3	31.2	75.4	98.0	14.4	0.0	0.9	13.5
07/04/15	9.7	16.7	22.3	37.8	66.3	96.9	0.0	0.0	2.3	0.9
08/04/15	8.1	13.0	18.1	54.5	71.0	90.9	0.0	0.0	1.7	0.0
09/04/15	7.4	15.1	22.6	41.3	70.1	95.6	0.0	0.0	1.2	7.0
10/04/15	11.3	18.6	24.1	25.4	51.2	81.9	0.0	0.4	1.5	9.2
11/04/15	12.6	19.0	26.4	28.4	57.0	86.2	0.0	0.0	0.5	2.1
12/04/15	9.9	17.9	25.6	36.5	63.2	91.8	0.0	0.0	0.9	1.8
13/04/15	12.0	19.3	26.5	25.6	53.5	85.7	0.0	0.0	1.4	4.1
14/04/15	11.8	19.3	26.5	38.3	61.0	86.2	0.0	0.0	0.7	0.8
15/04/15	13.1	20.2	28.3	37.2	63.7	86.9	0.0	0.0	0.3	1.4
16/04/15	13.3	21.0	29.6	30.6	63.8	91.8	0.0	0.0	0.4	0.6
17/04/15	14.1	21.5	30.1	38.5	64.6	89.5	0.0	0.0	0.3	2.0
18/04/15	18.9	22.7	26.8	42.2	56.3	88.0	0.8	0.0	2.9	6.8
19/04/15	13.9	17.6	22.6	60.5	85.4	97.9	8.8	0.0	0.4	3.9
20/04/15	12.2	14.1	16.3	73.0	82.4	92.1	0.1	0.0	0.9	4.2
21/04/15	8.8	11.1	12.7	81.9	91.5	98.1	16.4	0.0	1.4	2.0
22/04/15	11.7	14.6	18.7	62.6	78.2	95.2	0.1	0.0	1.2	1.6
23/04/15	9.7	16.4	23.9	46.8	78.7	96.9	0.0	0.0	0.2	0.0
24/04/15	13.5	18.1	24.5	38.6	70.5	95.0	0.0	0.0	1.3	0.0
25/04/15	10.3	17.0	23.9	32.6	62.3	92.7	0.0	0.0	2.0	7.1
26/04/15	9.2	12.8	16.9	49.9	69.6	88.4	0.0	0.0	2.9	1.1
27/04/15	6.3	12.9	19.1	31.2	57.8	87.6	0.0	0.0	0.0	0.0
28/04/15	10.6	16.3	22.4	30.9	50.2	74.5	0.0	0.4	0.0	8.5
29/04/15	15.1	19.1	23.5	24.4	43.9	67.7	0.0	0.6	3.7	10.4
30/04/15	10.8	17.7	23.2	38.1	55.3	80.8	0.0	0.0	3.7	8.1
Average	**12.4**	**17.9**	**24.0**	**41.5**	**65.4**	**88.6**		**0.1**	**1.4**	**4.1**
Maximum	**21.5**	**25.6**	**30.1**	**81.9**	**91.5**	**98.1**	**16.4**	**0.6**	**3.7**	**13.5**
Minimum	**6.3**	**11.1**	**12.7**	**24.1**	**43.5**	**55.9**	**0.0**	**0.0**	**0.0**	**0.0**
Total							**59.7**			

WHITEHAVEN COAL MINING PTY LTD

Meteorological Summary - May 2015

Daily Summary **May 2015**

Date	Min Temp (°C)	Ave Temp (°C)	Max Temp (°C)	Min RH (%)	Ave RH (%)	Max RH (%)	Rain (mm)	Min WS (m/s)	Ave WS (m/s)	Max WS (m/s)
01/05/15	14.1	15.5	18.0	60.8	78.0	88.4	0.6	0.7	4.3	8.8
02/05/15	14.7	19.4	24.4	54.7	72.7	88.2	0.0	0.0	4.2	1.4
03/05/15	13.9	18.1	23.6	61.1	86.3	97.8	1.4	0.0	0.9	2.0
04/05/15	13.1	19.6	24.0	54.4	73.2	93.6	0.2	0.0	1.3	1.8
05/05/15	10.2	17.6	25.6	37.3	69.2	97.5	0.0	0.0	1.6	0.0
06/05/15	5.2	13.4	20.5	31.0	60.0	89.2	0.0	0.0	0.5	0.7
07/05/15	5.4	14.3	19.4	34.6	50.8	83.5	0.0	0.0	2.1	3.3
08/05/15	1.6	9.6	19.1	30.9	66.1	92.5	0.0	0.0	0.2	1.1
09/05/15	2.0	9.8	18.8	38.0	68.2	94.1	0.0	0.0	1.1	1.3
10/05/15	2.3	11.5	19.3	33.6	61.3	93.1	0.0	0.0	1.9	0.7
11/05/15	7.9	14.6	21.3	37.4	56.7	80.0	0.0	0.0	1.4	0.6
12/05/15	5.7	12.4	20.6	42.7	70.4	92.8	0.0	0.0	1.0	0.0
13/05/15	1.6	10.3	15.8	36.0	62.8	90.1	0.0	0.0	2.6	2.0
14/05/15	-2.4	7.0	16.3	30.9	62.8	91.4	0.0	0.0	0.4	0.7
15/05/15	-0.3	11.2	20.6	41.4	63.3	92.3	0.0	0.0	2.6	6.4
16/05/15	6.5	14.3	21.7	42.6	67.9	91.0	0.0	0.0	3.4	8.5
17/05/15	6.1	15.5	22.7	39.2	66.0	97.2	0.0	0.0	1.4	7.2
18/05/15	11.8	17.5	24.7	38.5	62.4	84.2	0.0	0.0	0.8	5.7
19/05/15	9.3	16.0	22.5	46.7	69.0	91.1	0.0	0.0	0.7	0.7
20/05/15	10.4	18.1	26.3	37.7	71.2	95.4	2.6	0.0	1.5	1.3
21/05/15	11.4	13.9	16.4	70.7	89.2	97.4	9.0	0.0	0.6	3.5
22/05/15	9.2	12.4	15.7	66.5	80.3	94.0	0.8	0.0	1.8	8.6
23/05/15	5.3	11.7	17.4	56.2	77.7	94.1	0.0	0.0	2.5	1.6
24/05/15	3.6	11.0	19.1	41.5	73.5	96.4	0.2	0.0	1.3	1.1
25/05/15	4.2	11.4	20.5	40.6	76.0	96.7	0.0	0.0	0.7	1.3
26/05/15	4.6	10.9	18.0	55.2	83.2	96.8	0.0	0.0	0.2	0.9
27/05/15	3.0	11.8	20.8	45.1	77.2	98.3	0.0	0.0	0.3	0.0
28/05/15	11.8	15.7	21.7	46.8	76.6	96.6	2.8	0.0	0.3	1.5
29/05/15	12.2	14.9	17.4	74.2	85.8	94.5	0.2	0.0	1.0	5.1
30/05/15	11.1	14.3	17.7	76.0	90.9	97.4	4.4	0.0	0.2	2.3
31/05/15	8.4	13.8	15.7	79.6	93.9	97.3	22.8	0.0	0.8	0.0
Average	**7.2**	**13.8**	**20.2**	**47.8**	**72.3**	**93.0**		**0.0**	**1.4**	**2.6**
Maximum	**14.7**	**19.6**	**26.3**	**79.6**	**93.9**	**98.3**	**22.8**	**0.7**	**4.3**	**8.8**
Minimum	**-2.4**	**7.0**	**15.7**	**30.9**	**50.8**	**80.0**	**0.0**	**0.0**	**0.2**	**0.0**
Total							**45.0**			

WHITEHAVEN COAL MINING PTY LTD

Meteorological Summary - June 2015

Daily Summary **June 2015**

Date	Min Temp (°C)	Ave Temp (°C)	Max Temp (°C)	Min RH (%)	Ave RH (%)	Max RH (%)	Rain (mm)	Min WS (m/s)	Ave WS (m/s)	Max WS (m/s)
01/06/15	1.3	7.6	14.1	44.4	78.7	98.3	0.0	0.0	1.5	2.2
02/06/15	**-1.6**	**4.5**	**11.9**	43.9	77.8	97.1	0.2	0.0	0.8	0.0
03/06/15	**-1.6**	4.9	13.2	46.5	80.1	96.7	0.0	0.0	0.4	0.8
04/06/15	**-1.6**	5.6	15.0	41.2	77.8	97.5	0.2	0.0	0.4	0.7
05/06/15	1.8	7.9	12.7	60.8	80.3	93.6	0.4	0.0	0.7	1.9
06/06/15	0.1	7.8	16.5	58.3	83.0	96.6	0.2	0.0	1.1	1.1
07/06/15	2.2	10.2	21.0	48.6	81.3	98.4	0.0	0.0	0.6	2.5
08/06/15	2.7	10.9	21.5	45.0	80.6	98.2	0.0	0.0	0.3	0.6
09/06/15	4.3	12.1	**21.8**	47.3	79.0	96.7	0.2	0.0	0.9	2.0
10/06/15	2.7	11.8	20.5	41.3	73.1	98.0	0.0	0.0	1.8	6.6
11/06/15	9.1	14.5	19.3	46.1	61.5	83.6	0.0	0.3	2.7	6.2
12/06/15	8.3	14.2	19.0	48.7	**60.8**	**78.7**	0.0	0.4	**2.8**	**8.4**
13/06/15	9.1	14.2	19.8	48.5	68.3	89.1	0.0	0.0	2.3	1.5
14/06/15	5.4	13.0	21.0	48.1	75.3	95.9	0.0	0.0	0.5	1.7
15/06/15	10.2	**16.4**	21.0	52.5	66.9	90.2	0.0	0.0	1.4	5.0
16/06/15	**14.0**	15.3	16.6	61.6	80.7	97.2	20.4	0.0	**2.8**	4.6
17/06/15	8.5	13.2	17.0	**80.6**	**92.0**	97.3	**22.8**	0.0	1.3	1.7
18/06/15	7.6	11.5	17.2	61.8	86.2	95.6	1.4	0.0	0.5	0.7
19/06/15	8.0	11.2	15.5	57.8	84.8	97.1	0.0	0.0	0.7	1.2
20/06/15	5.9	10.1	14.3	55.1	77.6	95.3	0.0	0.0	1.7	0.7
21/06/15	1.8	8.6	15.7	48.9	76.1	92.3	0.0	0.0	0.9	2.1
22/06/15	0.8	8.8	19.2	38.0	75.7	97.2	0.0	0.0	0.5	3.3
23/06/15	3.4	11.1	19.6	49.1	77.5	95.4	0.0	0.0	0.4	4.4
24/06/15	9.9	14.4	18.9	55.3	71.5	89.7	0.2	0.0	1.1	1.6
25/06/15	5.9	12.1	19.5	49.4	81.0	95.3	0.0	0.0	0.8	0.8
26/06/15	4.6	10.9	17.8	55.0	77.3	98.0	0.2	0.0	1.5	2.6
27/06/15	1.6	9.8	19.9	42.2	77.6	96.6	0.0	0.0	**0.2**	0.8
28/06/15	0.1	8.2	20.1	**25.8**	77.4	**98.6**	0.0	0.0	**0.2**	0.0
29/06/15	-0.4	8.3	20.8	39.5	76.7	97.2	0.0	0.0	0.4	1.6
30/06/15	2.4	9.2	14.6	73.3	87.1	96.9	0.6	0.0	0.3	1.3
Average	**4.2**	**10.6**	**17.8**	**50.5**	**77.5**	**94.9**		**0.0**	**1.1**	**2.3**
Maximum	**14.0**	**16.4**	**21.8**	**80.6**	**92.0**	**98.6**	**22.8**	**0.4**	**2.8**	**8.4**
Minimum	**-1.6**	**4.5**	**11.9**	**25.8**	**60.8**	**78.7**	**0.0**	**0.0**	**0.2**	**0.0**
Total							**46.8**			

WHITEHAVEN COAL MINING PTY LTD

Meteorological Summary - July 2015

Daily Summary **July 2015**

Date	Min Temp (°C)	Ave Temp (°C)	Max Temp (°C)	Min RH (%)	Ave RH (%)	Max RH (%)	Rain (mm)	Min WS (m/s)	Ave WS (m/s)	Max WS (m/s)
1/07/15	1.9	11.2	17.9	61.1	83.9	97.1	0.0	0.0	0.4	1.4
2/07/15	-1.5	5.2	12.3	55.2	81.9	98.0	0.0	0.0	0.8	2.9
3/07/15	-2.7	4.8	13.4	53.8	81.1	97.4	0.2	0.0	1.4	1.4
4/07/15	-1.4	7.0	16.6	43.4	79.8	98.7	0.0	0.0	0.5	1.5
5/07/15	2.1	7.9	17.0	47.2	80.5	96.5	0.0	0.0	0.6	0.0
6/07/15	-0.4	6.4	15.9	46.4	79.3	98.4	0.0	0.0	1.1	0.0
7/07/15	-1.7	5.6	14.2	51.9	78.4	96.4	0.0	0.0	1.0	0.0
8/07/15	-0.2	8.9	16.1	51.7	71.1	95.5	0.0	0.0	1.5	5.8
9/07/15	1.9	10.4	18.9	41.8	70.5	94.5	0.0	0.0	0.5	1.5
10/07/15	4.7	11.1	19.5	43.7	77.0	96.4	4.0	0.0	0.7	1.3
11/07/15	3.6	11.0	19.4	51.0	80.2	97.9	0.6	0.0	1.2	10.6
12/07/15	5.6	7.5	11.0	57.3	72.8	86.3	1.4	2.0	4.7	9.1
13/07/15	5.3	8.0	12.0	66.2	83.0	93.5	0.2	1.5	4.4	9.0
14/07/15	3.1	8.6	13.1	60.3	76.3	91.6	0.0	0.0	1.8	2.7
15/07/15	0.6	9.0	14.3	43.6	69.7	94.9	0.0	0.0	1.2	4.5
16/07/15	3.5	6.4	9.1	67.1	85.7	95.3	3.0	0.0	1.6	2.1
17/07/15	1.2	6.3	11.3	66.7	82.8	94.2	1.0	0.0	2.6	1.7
18/07/15	-2.0	5.1	12.8	55.2	79.8	96.7	0.0	0.0	1.8	3.1
19/07/15	-1.2	7.4	15.2	51.8	77.6	96.0	0.0	0.0	2.0	1.5
20/07/15	2.1	10.6	17.3	49.9	71.6	94.6	0.2	0.0	1.3	6.5
21/07/15	2.6	10.9	19.5	39.4	71.0	95.7	0.0	0.0	1.1	6.4
22/07/15	7.4	13.0	17.7	48.7	69.1	89.2	0.0	0.0	1.7	3.3
23/07/15	8.9	12.5	18.8	65.0	88.4	97.0	0.6	0.0	0.6	0.9
24/07/15	8.7	12.4	16.2	86.4	93.2	97.9	6.6	0.0	0.7	1.5
25/07/15	7.4	12.3	17.9	65.1	87.1	97.4	0.0	0.0	0.8	0.0
26/07/15	6.9	12.2	18.5	43.3	75.4	96.2	0.0	0.0	1.1	2.6
27/07/15	-1.3	6.6	12.1	48.4	73.7	96.7	0.0	0.0	2.0	1.6
28/07/15	-3.7	3.3	13.0	45.5	78.6	95.1	0.0	0.0	1.3	0.4
29/07/15	-2.9	6.0	17.8	32.2	72.6	93.9	0.0	0.0	0.5	1.6
30/07/15	-1.3	7.7	18.1	40.7	74.6	95.1	0.0	0.0	0.6	0.6
31/07/15	0.8	9.6	19.5	35.8	71.7	96.2	0.0	0.0	0.6	0.8
Average	**1.9**	**8.5**	**15.7**	**52.1**	**78.0**	**95.5**		**0.1**	**1.4**	**2.8**
Maximum	**8.9**	**13.0**	**19.5**	**86.4**	**93.2**	**98.7**	**6.6**	**2.0**	**4.7**	**10.6**
Minimum	**-3.7**	**3.3**	**9.1**	**32.2**	**69.1**	**86.3**	**0.0**	**0.0**	**0.4**	**0.0**
Total							**17.8**			